2013 AAPT Winter Meeting

New Orleans, LA
January 5–9, 2013

Hyatt Regency New Orleans

American Association of Physics Teachers
One Physics Ellipse
College Park, MD 20740
301-209-3333
www.aapt.org

Welcome to New Orleans!

Once again it is time for our AAPT Winter Meeting! The site is New Orleans and the theme is *"And All That Jazz"*. The many attractions awaiting us reflect the rich heritage of the major United States port located at the mouth of the Mississippi River. Twice a day the authentic steamboat, the Natchez, provides cruises on the river for the length of the city. Some items on your "must see" list include the world-renowned French Quarter, the historic Pontchartrain hotel along with the city's many historic homes, the Magazine St. lined with boutique stores and antique shops, and the Audubon Nature Institute. You cannot leave New Orleans, "the Big Easy", without sampling some of its world famous food with that distinctive Louisiana flavor. Specialties include beignets, Italian Muffuletta sandwiches, Gulf oysters on the half shell, boiled crawfish, and those delicious Creole dishes etouffe, jambalaya, and gumbo.

The rich musical heritage of New Orleans began during its pre-American and early American days. The unique blend of European instruments with African rhythms gave way to the birth of jazz and later to a brand of music known as rhythm and blues. You will have ample opportunity to hear live jazz performances at the Hyatt Regency New Orleans conference hotel and on Tuesday night AAPT will host a live performance by one of the Preservation Hall's jazz bands. Taking the cue from New Orleans' reputation as "home of jazz," some area committees have organized sessions and workshops focusing on music and sound themes.

Of course technology has a high visibility throughout our meeting. Presentations range from Best Practices in Educational Technology to Online Tools and to Online Physics Courses. Some sessions report on the use of tablets, smart phones, and the use of video games such as Angry Birds. You may even see some of our members setting up equipment for an experimental trial providing alternative access of two sessions to AAPT members who are unable to attend the meeting.

A special AIP exhibit will be on display throughout our meeting: Exhibition on Historically Black Colleges and Universities. Our physics education community is significantly underrepresented in number by ethnic minorities and women. Some paper sessions and one panel provide us a forum to hear and discuss current and future efforts to reduce this achievement gap.

We will hear from three speakers during the annual Physics Education Public Policy Symposium on Tuesday as they report on issues concerned with K-12 physics and STEM Education. The speakers are Jim Gates, Univ. of Maryland and a member of PCAST, Ramon Lopez, Univ. of Texas, Arlington and co-Director of UTEACH Arlington, and Richard Steinberg, City College of New York and author of *An Inquiry into Science Education: Where the Rubber Meets the Road.*

You do not want to miss the plenary presentation by Dr. Mark Whittle, Univ. of Virginia, on Monday night, which is entitled "The Universe's First Million Years: Primordial Light and Sound." On Wednesday morning, Dr. Robert Twilley, LSU, will speak on "The Mississippi River Delta Restoration as Science and Policy Issues of Public Concern: Opportunities in Science Education." Our AAPT award recipients will deliver their special presentations during our Ceremonial Sessions. Edward "Joe" Redish, Univ. of Maryland, recipient of the Oersted Award, will speak on "The Implications of a Theoretical Framework for PER," and David Pines, Univ. of California, Davis, recipient of the John David Jackson Award for Excellence in Graduate Physics Education will talk to us about "What We Don't Know, We Teach One Another."

Though this is a very busy week, I am excited about the meeting. I have only given you a sample of the activities we have lined up for you. If you have not already done so, please study your meeting program so you won't miss that particularly relevant talk or event. And when you have a little free time, I encourage you to experience the charm of New Orleans.

Mary Beth Monroe,
Southwest Texas Junior College, Uvalde, Texas

2013 Program Chair

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The American Association of Physics Teachers is extremely grateful to the following companies who have generously supported AAPT over the years:

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Facebook/Twitter at Meeting

We will be posting updates to Facebook and Twitter prior to and during the meeting to keep you in the know! Participate in the conversation on Twitter by following us at **twitter.com/AAPTHQ** or search the hashtag **#aaptwm13**. We will also be posting any changes to the schedule, cancellations, and other announcements during the meeting via both Twitter and Facebook. Visit our Pinterest page for suggestions of places to go and things to do in New Orleans. We look forward to connecting with you!

Facebook: facebook.com/AAPTHQ
Twitter: twitter.com/AAPTHQ
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Special Thanks

AAPT wishes to thank the following persons for their dedication in organizing the Winter Meeting:

Paper Sorters: Gerald Feldman, Committee on Physics in Undergraduate Education
Robert V. Steiner, Committee on Educational Technologies
Kathleen A. Harper, Research in Physics Education (PER) representative

Local Organizer: Mostafa Elaasar, Professor of Physics, Chair, Natural Sciences Department, Southern University at New Orleans

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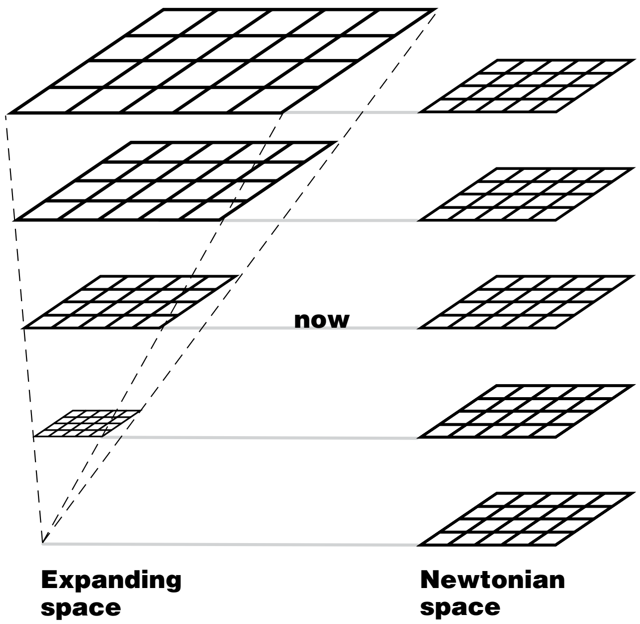
First time at an AAPT meeting?

Welcome to the 2013 AAPT Winter Meeting in New Orleans! Everyone at AAPT hopes you fulfill all the goals you have for attending this meeting. To help you plan your meeting activities, the following information and suggestions have been developed.

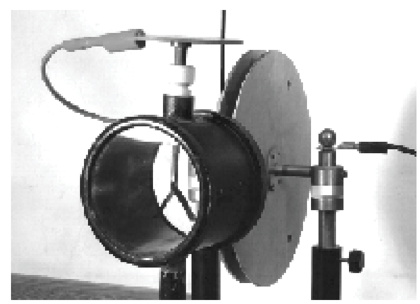
- Being at your first National Meeting can be a lonely experience if you don't know anyone. AAPT members are friendly people, so do not hesitate to introduce yourself to others in sessions and in the hallways. It is fun and rewarding to establish a network of other physics teachers with whom you can talk and share experiences. This is especially true during lunch and dinner.
- Area Committee meetings are not only for members of the committee, but also for friends of the committee. You are welcome to attend any Area Committee meeting. You should be able to find one or two committees that match your interests. Their meeting times are listed on page 17 in this guide. Area Committee meetings are often relatively small and are a great place to meet other people with interests similar to yours.
- Be sure to attend the First Timers' Gathering from **7–8 a.m. Monday in Imperial II**. It is a wonderful way to learn more about the meeting and about AAPT.
- Awards and other plenary sessions have distinguished speakers and are especially recommended. Invited speakers are experts in their fields and will have half an hour or more to discuss their subjects in some depth. Posters will be up all day and presenters will be available during the times indicated in the schedule. Contributed papers summarize work the presenters have been doing. You are encouraged to talk to presenters at the poster sessions or after the contributed paper sessions to gain more information about topics of interest to you. Informal discussion among those interested in the announced topic typically will follow a panel presentation, and crackerbarrels are entirely devoted to such discussions.
- Be sure to make time to visit the exhibits in the Exhibit Hall. This is a great place to learn what textbooks and equipment are available in physics education.



Since the 1998 discovery of the increasing expansion of the universe, astronomers have developed a standard model cosmology. In this model, the age of the universe is 13.7 billion years, not somewhere between 10 and 20 billion years as in our pre-1998 picture. The energy density in the universe provides a precisely flat universe. And most of the energy in the universe (74%) is in the form of dark energy (vacuum energy) which has negative pressure that causes the acceleration of the expansion.

Can we explain these results in our introductory physics courses? Not unless we take seriously a basic feature of physics —that space itself can expand or contract, even much faster than the speed of light (while preserving the principle of relativity).

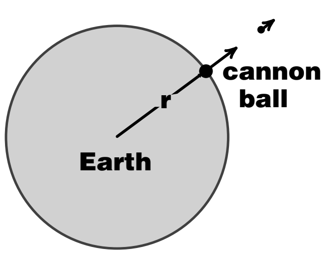
Tuesday, Jan 8
12:15-1:15 p.m.
Eagle Room



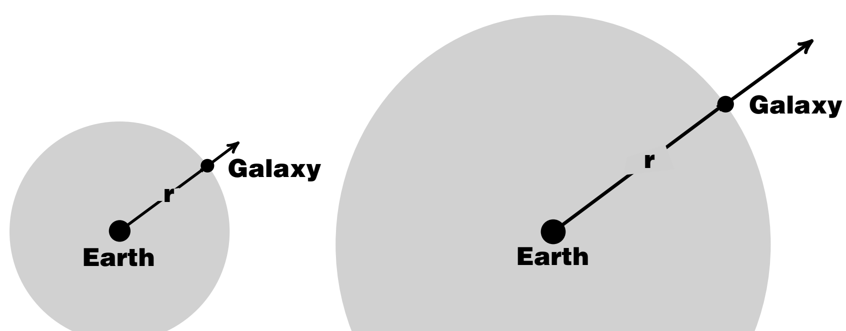
If we neglect fringing fields, the energy stored in a parallel plate capacitor is proportional to the volume of space (between the plates) and has a negative pressure. These are the properties of vacuum energy and Einstein's cosmological constant.

Free Workshop Physics2000.com

This workshop will be on how to introduce vacuum energy (dark energy) and inflation in an introductory physics course.

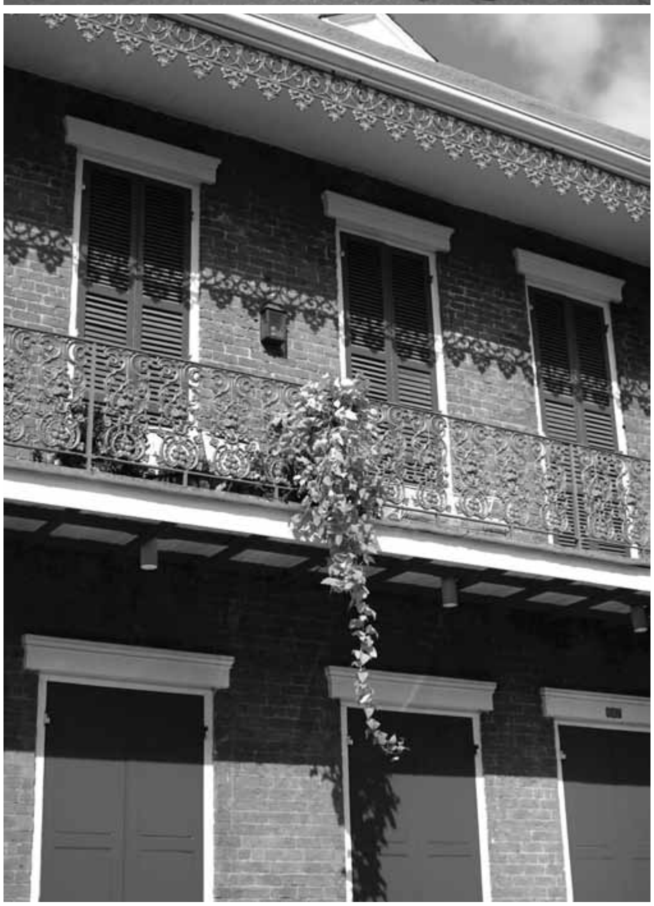


Newtonian gravity slows an escaping cannon ball.



In a ***vacuum energy universe***, Newtonian gravity causes an escaping galaxy to speed up. This results in an accelerated Hubble expansion.

New Orleans – "The Big Easy"



New Orleans, founded in 1718, is a major seaport and a colorful city in the state of Louisiana. Sitting on the Mississippi River and the Gulf of Mexico, it is often called the Big Easy or the Crescent City. And it is known for its food, jazz, and Mardi Gras, along with plenty of other celebrations.

History

The city was founded by the French Mississippi Company, under the direction of Jean-Baptiste Le Moyne de Bienville. It was named after Philippe d'Orléans, Duke of Orléans, who was Regent of France at the time. After the French-Indian war from 1754-1763, the French lost the territory east of the Mississippi to the British and the rest of what is now the state of Louisiana went to the Spanish. The city of New Orleans remained under Spanish control for the next 40 years. The French Quarter was actually developed under Spanish control.

Another famous event in Louisiana history occurred during the Spanish rule, when refugees from Acadia (now known as Nova Scotia), after being expelled by the British, came down the Mississippi, were welcomed by the Spanish, and settled in the Southwestern part of Louisiana. This area is now known as Acadiana, or as their modern-day ancestors call themselves, Cajuns. The culture of this diverse group created some of the best food in the world.

On November 29, 1803, the United States raised its flag in the port city of New Orleans and took control of the entire Louisiana territory. New Orleans history was again influenced by trade, but during the 1800s, primarily by the growing slave trade. The boom in this port's activities moving slaves from Africa and the Caribbean boosted it to become one of the richest cities in the Union. Eventually the Union Army captured New Orleans during the American Civil War. Today, the state of Louisiana has a population of around 4,500,000 and still remains a powerful center of American culture and life.

Education

The following colleges and universities call New Orleans home:

Tulane University; *Loyola University New Orleans,* a Jesuit university founded in 1912; *University of New Orleans*; *Xavier University of Louisiana*, the only historically black Catholic university in the United States; *Southern University at New Orleans,* an historically black university in the Southern University System; *Dillard University,* a private, historically black liberal arts college founded in 1869; *Louisiana State University Health Sciences Center*; *Our Lady of Holy Cross College*, a Catholic liberal arts college founded in 1916; *Notre Dame Seminary; New Orleans Baptist Theological Seminary*; *Delgado Community College*, founded in 1921; *William Carey College School of Nursing*; *Herzing College*; and *New Orleans Culinary Institute.*

Things to do in New Orleans:

◆ **French Quarter and Jazz:** From the beautiful architecture to art galleries, museums, restaurants, and bars, the French Quarter has something for everyone. Join a tour and learn more about the history of the area, or spend the entire day exploring and shopping, ending with a meal in a world-famous restaurant and some live music. The city is the birthplace of jazz and a mecca for gospel, R&B. There is an original spirit of creativity and musical magic is alive on the streets and in the clubs of New Orleans.

◆ **New Orleans Area Plantations:** Once the mainstays of a regional agrarian economy, now these beautiful homes are major tourist attractions offering windows into a bygone past. In southern Louisiana there are a good number within easy driving distance of New Orleans. See *www.neworleansonline.com/neworleans/attractions/plantations.html* for a full listing.

◆ **New Orleans Cemeteries:** With their unique, ornate tombs, some dating back to the late 1700s, it's no wonder that visitors are usually eager to explore New Orleans' famous cemeteries. There are dozens of cemeteries throughout the city, but most organized tours will take you through St. Louis Cemetery #1, home to Voodoo Queen Marie Laveau's grave, and Lafayette Cemetery—a popular location for movies shot in New Orleans. Find a list of cemeteries or sign up for a tour at *www.neworleansonline.com/neworleans/attractions/cemeteries.html.*

◆ **New Orleans Street Cars:** Getting around New Orleans by street car is a great way to see the city. There are three different lines: St. Charles, Canal St., and the Riverfront, each of which originates downtown but takes you to different parts of the city. One-way fares are $1.25 and are to be paid with exact change when you board. You can also purchase 1, 3, or 5-day unlimited ride passes. See the Regional Transit Authority (RTA)'s website, *www.norta.com.*

◆ **Historic Homes:** Visit some of the nation's oldest, still-standing examples of original French, Spanish, and American architecture. Learn the difference between a Creole cottage and a shotgun house. See ***The 1850 House,*** 523 St. Ann St., near Jackson Square for a fully refurbished historic site. *www.neworleansonline.com/neworleans/arts/museums/historichomes.html.*

◆ **Audubon Zoo:** Audubon Zoo is a New Orleans landmark and a living museum filled with some of the rarest and most beautiful creatures of nature. There have been animals at this site since the 1884 World Exposition in Audubon Park. **The Audubon Aquarium of the Americas** houses 15,000 sea life creatures, representing nearly 600 species, living in a state-of-the-art facility. Also check out **Audubon Butterfly Garden** and Insectarium at 423 Canal St.

(Compiled from www. neworleansonline.com and www.neworleanscvb.com)

PRESERVATION HALL JAZZ BAND of New Orleans, La.

New Orleans Jazz Night Fundraiser

Tuesday, January 8 from 9:00 p.m. to 10:00 p.m.

Join us for an elegant evening of traditional New Orleans jazz by The Preservation Hall Jazz Band. The net proceeds of this event will benefit AAPT's Annual Giving Fund.

The Preservation Hall Jazz Band has traveled worldwide spreading their mission to nurture and perpetuate the art form of New Orleans Jazz. Whether performing at Carnegie Hall or Lincoln Center, for British Royalty or the King of Thailand, this music embodies a joyful, timeless spirit.

Regular tickets are $20 with wine and beer available for purchase. VIP tickets at $75 provide you with priority seating and complimentary wine and beer. Only regular $20 tickets will be sold at the door.

New Orleans AAPT2013 And All That Jazz

Register Today!

www.aapt.org/Conferences/wm2013

Meeting-at-a-Glance

Meeting-at-a-Glance includes sessions, workshops, committee meetings and other events, including luncheons, Exhibit Hall hours and snacks, plenary sessions, and receptions. All rooms will be in the Hyatt Regency New Orleans. Workshops on Saturday and Sunday will be at the Southern University at New Orleans.

FRIDAY, January 4

4–7 p.m.		**REGISTRATION**	**Celestin Foyer**

SATURDAY, January 5

7 a.m.–4 p.m.		**REGISTRATION**	**Celestin Foyer**
8 a.m.–12 p.m.	W06	New RTP and ILD Tools and Curricula: Video Analysis, Clickers, and E&M Labs	BRN 201
8 a.m.–12 p.m.	W08	String and Sticky Tape Lecture Demonstrations	BRN 205
8 a.m.–12 p.m.	W09	TIPERs in the High School Classroom	BRN 209
8 a.m.–5 p.m.	W01	Arduino Micro-Controllers and Underwater ROVs	NSC 329
8 a.m.–5 p.m.	W03	Physics and Astronomy by Design	BRN 311
8 a.m.–5 p.m.	W04	Reformed Teacher Observation Protocol (RTOP)	NSC 327
1–5 p.m.	W07	Centripetal Force and Dark Matter	BRN 201
1–5 p.m.	W11	Demonstration Management	BRN 205
1–5 p.m.	W12	Reducing the Achievement Gap Using Invention Instruction	NSC 316
1–5 p.m.	W13	Stars: Their Lives and Our Cosmic Connection	NSC 322
1–2:30 p.m.		New Board Member Orientation	Black Eagle
3–4:30 p.m.		Area Chairs Orientation	Jackson
3–4:30 p.m.		Investment Advisory Committee	Excelsior
5–10 p.m.		Executive Board I	Black Eagle
7:30–10 p.m.		French Quarter Walking Tour	Offsite

SUNDAY, January 6

7 a.m.–4 p.m.		**REGISTRATION**	**Celestin Foyer**
8–10:30 a.m.		Publications Committee	Onward
8–10:30 a.m.		Meetings Committee	Excelsior
8 a.m.–12 p.m.	W19	Low-Budget Instructional Labs	NSC 322
8 a.m.–12 p.m.	W20	A Kaleidoscope of Great Online Tools for Teaching Physics	BRN 202
8 a.m.–12 p.m.	W21	iPhone and iPad App Development	NSC 316
8 a.m.–12 p.m.	W22	VPython-based Video Games to Teach Physics	NSC 329
8 a.m.–5 p.m.	W15	Research-based Alternatives to Traditional Physics Problems	BRN 205
8 a.m.–5 p.m.	W17	How Old Is Your Universe?	BRN 201
8 a.m.–5 p.m.	W18	Introduction to Modeling Instruction	NSC 327
10:30 a.m.–4 p.m.		Houmas House Plantation and Gardens Tour	Offsite
11 a.m.–3 p.m.		Executive Board II	Black Eagle
11:30 a.m.–2:30 p.m.		Resource Letters Committee	Excelsior
12–2 p.m.		Nominating Committee (closed)	Onward
1–5 p.m.	W25	Leadership Roles and Models in Academia and Beyond	BRN 209
1–5 p.m.	W26	Sketch and Etch	NSC 327
1–5 p.m.	W27	Sound and Music: Ways to Teach It (Free Kit!)	NSC 329
3–4 p.m.		Section Officers Exchange	Jackson
4–5 p.m.		Fredrick and Florence M. Bauder Endowment Committee	Excelsior
4–6 p.m.		Programs Committee I	Imperial III
4–6 p.m.		High School Share-a-Thon	Foster
6–8 p.m.		Section Representatives	Jackson
6:30–8 p.m.		Awards Committee (closed)	Excelsior
7:30–9 p.m.		**REGISTRATION**	**Celestin Foyer**
8–10 p.m.		SPS Undergraduate Research and Outreach Poster Reception	Storyville Hall
8–10 p.m.		**Exhibit Hall Opening / Welcome Reception**	Storyville Hall

MONDAY, January 7

7 a.m.–5 p.m.		**REGISTRATION**	**Celestin Foyer**
7–8 a.m.		First Timers' Gathering	Imperial II
8–9:30 a.m.		Review Board	Onward
8–10 a.m.	AA	The Jazz of Physics Teaching	Johnson
8–9:20 a.m.	AB	Upper Division/Graduate Courses	Foster
8–9:20 a.m.	AC	Effective Practices in Educational Technology	Bechet

8–9:40 a.m.	AD	PER: Investigating Classroom Strategies	Bucktown I
8–10 a.m.	AE	Overview of High School Physics in the U.S.	Jackson
8–10 a.m.	AF	Reforming the Introductory Physics Course for Life Science Majors VIII	Bucktown II
8–10 a.m.	AG	History and Strengthening of Physics Departments at HBCUs	Bolden
8–10 a.m.	AH	Implementation and Assessment of Physics by Inquiry	Oliver
8–9:50 a.m.	AI	Models of Lab Instruction/Curricula from Around the World	Ory
10 a.m.–6 p.m.		**Exhibit Hall Open (coffee break, 10 a.m.)**	Storyville Hall
10 a.m.–12:30 p.m.		Spouse and Guest New Orleans Cooking Demonstration and Lunch	Offsite
10:15 a.m.		Kindle Raffle Drawing in Exhibit Hall	Storyville Hall
10:30 a.m.–12:30 p.m.	**Awards**	**Oersted Medal, DSC Citations, SPS Award**	**Celestin I-III**
12:30–1:30 p.m.	**CW01**	**Using Online Homework to Achieve Your Pedagogical Goals**	**Pickwick**
12:30–1:30 p.m.		Early Career Professionals Speed Networking Event	Irish Channel
12:30–1:30 p.m.		Reunion of New Faculty Workshop	Imperial I
12:30–1:30 p.m.		Retired Physicists Luncheon	Imperial II
12:30_1:30 p.m.		Membership & Benefits Committee	Onward
12:30–2 p.m.		Committee on Science Education for the Public	Excelsior
12:30–2 p.m.		Committee on Educational Technologies	Jackson
12:30–2 p.m.		Committee on Teacher Preparation	Bolden
12:30–2 p.m.		Committee on Minorities in Physics	Black Eagle
12:30–2 p.m.		Committee on Physics in Undergraduate Education	Firehouse Five
2–3 p.m.	BA	Teaching in High Schools of Districts with Limited Resources	Bucktown I
2–3:30 p.m.	BB	Outreach Conducted by SPS and SPS Undergraduate Research and Outreach	Bucktown II
2–3 p.m.	BC	Cultural Perspectives on Physics Education	Jackson
2–3:30 p.m.	BD	Astronomy and Earth Science as a Context for Education Research	Foster
2–3 p.m.	BE	Integrating Math & Science to Prepare Pre-College Teachers	Bechet
2–2:50 p.m.	BG	Recruiting and Retaining Physics Students	Johnson
2–3:40 p.m.	BH	Preparing Teachers for Technology Needed in Teaching Physics	Oliver
3:15–3:30 p.m.		**Exhibit Hall** Amazon Gift Card Drawing	Storyville Hall
3:30–4 p.m.		Afternoon Break in **Exhibit Hall**	Storyville Hall
4–5 p.m.	**Plenary:**	The Universe's First Million Years: Primordial Light and Sound, **Dr. Mark Whittle**	**Celestin I-III**
5–6:30 p.m.		Committee on Laboratories	Imperial I
5–6:30 p.m.		Committee on International Physics Education	Firehouse Five
5–6:30 p.m.		Committee on Physics in High Schools	Jackson
5–6:30 p.m.		Committee on the Interests of Senior Physicists	Onward
5:30–6:30 p.m.		SPS Undergraduate Awards Reception	Imperial II
6:30–7:30 p.m.	CRK01	Physics and Society Crackerbarrel	Bucktown II
6:30–7:30 p.m.	CRK02	Crackerbarrel on What Physics Means – Philosophy	Bucktown I
7:45–9:15 p.m.	PST1	Poster Session I	Storyville Hall
8:30–10 p.m.		AAPT Council Meeting	Celestin V

TUESDAY, January 8

7 a.m.–4:30 p.m.		**REGISTRATION**	**Celestin Foyer**
7–8 a.m.		AAPT Fun Run/Walk	Offsite
7–8 a.m.		Physics Bowl Advisory Committee	Black Eagle
7–8 a.m.		Two-Year College Breakfast	Imperial II
7–8:30 a.m.		PTRA Oversight Committee	Onward
7–8:30 a.m.		Committee on Graduate Education in Physics	Rhythm Kings
7–8:30 a.m.		Committee on Apparatus	Pickwick
7–8:30 a.m.		Committee on Physics in Pre-High School Education	Olympia Orchestra
7–8:30 a.m.		Committee on Professional Concerns	Firehouse Five
7:30–8:30 a.m.		SI Units and Metric Education Committee	Original Zenith
7:30–8:30 a.m.		Audit Committee	Excelsior
8:30–10 a.m.	CA	Physics and Society	Bucktown II
8:30–9:20 a.m.	CB	PER: Topical Understanding and Attitudes	Bucktown I
8:30–10 a.m.	CC	Modern Physics in the High Schools	Bolden
8:30–9:30 a.m.	CD	Implementations of Physics for Future Presidents	Oliver
8:30–9:50 a.m.	CE	Tracker: Video Analysis	Bechet
8:30–9:40 a.m.	CF	Pre-High School	Foster
8:30–10 a.m.	CG	Panel: Reports from the Conference for Undergraduate Women in Physics	Jackson
8:30–10 a.m.	CH	Sustainability in the 21st Century	Johnson
10 a.m.–4 p.m.		**Exhibit Hall Open (coffee break, 10–10:30 a.m.)**	Storyville Hall
10:15–10:30 a.m.		Exhibit Hall Kindle Drawing	Storyville Hall
10:30 a.m.–12:15 p.m.	**Awards**	**J. D. Jackson Award: *David Pines,* Retiring President's Address,**	**Celestin I-III**
12:15–1:15 p.m.	CRK03	Crackerbarrel on Prerequisite Issues in Introductory Courses	Bucktown I
12:15–1:15 p.m.	CRK04	Crackerbarrel on Program Guidelines and Learning Objectives	Bucktown II

12:15–1:15 p.m.	**CW02**	**Physics2000.com – Commercial Workshop**	Eagle
12:15–1:15 p.m.	**CW03**	**Enhanced WebAssign for Physics – Increase Student Engagement & Improve Outcomes**	Pickwick
12:15–1:15 p.m.	**CW04**	**Expert TA – Commercial Workshop**	Laine
12:15–1:15 p.m.		Multicultural Luncheon	Imperial II
1:30–2:30 p.m.		Committee on Governance Structure (COGS)	Original Zenith
1:30–3 p.m.	DA	Bridge and Dual Enrollment Programs with HBCUs and MSIs	Foster
1:30–2:20 p.m.	DB	Twentieth Century Physics in the First Year	Bechet
1:30–3 p.m.	DC	Teacher Training/Enhancement	Oliver
1:30–3 p.m.	DD	Policy & Advocacy for Physics Education and PER	Bucktown I
1:30–2:30 p.m.	DE	Introductory Labs/Apparatus	Bucktown II
1:30–3 p.m.	DF	Panel: Where's the Pedagogy In Lab?	Jackson
1:30–3:10 p.m.	DG	How to Gear an Introductory Physics Course Toward Allied Health Majors	Bolden
1:30–3:20 p.m.	DH	Interactive Lecture Demonstrations: What's New? ILDs Using Clickers and Video Analysis	Johnson
3:15–3:30 p.m.		Exhibit Hall Amazon Gift Card Drawing	Storyville Hall
3:15–3:45 p.m.		**Exhibit Hall Afternoon Break**	**Storyville Hall**
3:30–5 p.m.	**Plenary**	**AAPT Symposium on Physics Education and Public Policy**	**Celestin I-III**
5:10–6:40 p.m.		Committee on Research in Physics Education	Jackson
5:10–6:40 p.m.		Committee on Space Science and Astronomy	Onward
5:10–6:40 p.m.		Committee on History & Philosophy in Physics	Original Zenith
5:10–6:40 p.m.		Committee on Women in Physics	Olympia Orchestra
5:10–6:40 p.m.		Committee on Physics in Two-Year Colleges	Pickwick
6:50–8:40 p.m.	EA	Introductory Courses	Bucktown II
6:50–8:50 p.m.	EB	Best Practices in Educational Technology	Bechet
6:50–8:30 p.m.	EC	Apparatus Gumbo	Oliver
6:50–8:50 p.m.	ED	Panel: Online Homework Services and Issues	Jackson
6:50–8:50 p.m.	EE	Research Paradigms in PER	Bucktown I
6:50–8:50 p.m.	EF	Panel: AP Physics 1&2 Curriculum Frameworks	Foster
6:50–8:50 p.m.	EG	Instructional Labs that Use Sound or Music	Ory
6:50–8:50 p.m.	EH	Just Labs	Storyville
6:50–8:50 p.m.	EI	Physics Preparation for Preservice Elementary Teachers	Bucktown I
9–10 p.m.		**Preservation Hall Jazz Band Event**	Celestin V

WEDNESDAY, January 9

7:30–9 a.m.		Programs Committee II	Imperial II
8–9 a.m.		Nominating Committee II (closed)	Black Eagle
8 a.m.–3 p.m.		**REGISTRATION**	**Celestin Foyer**
9–10 a.m.	**Plenary**	Mississippi River Delta Restoration as Science ..., **Dr. Robert Twilley, LSU**	**Celestin I-III**
9 a.m.–12 p.m.		Students Exploring Engineering and Science (SEES) Program	Celestin V
10:15–11:45 a.m.	PST2	Poster Session II	Storyville Hall
11:50 a.m.–12:50 p.m.		PERTG Town Hall Meeting	Johnson
1–2:30 p.m.		ALPHA	Onward
1–3 p.m.		Executive Board III	Black Eagle
1–2:50 p.m.	FB	PER: Student Reasoning	Bucktown II
1–2:10 p.m.	FC	History and Practice in Musical Acoustics	Foster
1–3 p.m.	FD	Broader Perspectives: Technology in the Classroom	Bechet
1–2:50 p.m.	FE	Upper Division Undergraduate Courses	Oliver
1–3 p.m.	FF	Panel: Confessions of First-Year Faculty	Jackson
1–3 p.m.	FG	The Role of Integrated Lab Activities in Introductory Courses	Bolden
1–3 p.m.	FH	LA Programs as Vehicles for Course Transformation & Recruitment of Future Teachers	Ory
1–2:30 p.m.	FI	Post-Deadline Abstracts	Bucktown I
3:15–4 p.m.		Great Book Giveaway	Celestin Foyer
3:30–4:30 p.m.	GA	Careers in Physics: Alternatives to Academia	Bucktown I
3:30–5 p.m.	GB	Online Physics Courses	Bucktown II
3:30–5 p.m.	GC	Insights and Benefits from Framing a Class as a Discourse Community	Foster
3:30–4:30 p.m.	GD	Pedagogical Content Knowledge for Preservice Teachers	Bechet
3:30–5 p.m.	GE	Panel: Opportunities for High School Teachers Abroad	Jackson
3:30–5 p.m.	GF	Mentoring Minority Graduate Students	Johnson

Special Events at AAPT 2013 Winter Meeting

Saturday, January 5

▲ French Quarter Walking Tour
7:30–10 p.m.

The New Orleans French Quarter Walking Tour takes you on a walk through the Quarter and shows you sights and tells you stories that many visitors miss. Let your own "local expert" unravel the mysteries of America's oldest and most unique living neighborhood! Follow in the footsteps of historic figures as you stroll along the Mighty Mississippi, through the French Market and Jackson Square. *Fee: $21*

Sunday, January 6

▲ Houmas House Plantation and Gardens Tour
10:30 a.m.–4 p.m.

The Houmas House Plantation and Gardens Guided Tour is so much more than just a tour of a grand antebellum estate. Experience the southern splendor of "The Sugar Palace" when you step into 16 rooms filled with period antiques and Louisiana artwork. Enjoy 38 lush acres of gardens, ponds, and a majestic live oak alley. Relax with a refreshing mint julep. Round trip transportation is provided from hotel and lunch is on your own. *Fee: $45*

▲ Grand Opening of Exhibit Hall and Welcome Reception
Storyville Hall
8–10 p.m.

Monday, January 7

▲ First Timers' Gathering
7–8 a.m. Monday
Imperial II

Learn more about AAPT and the Winter Meeting. Meet and greet new friends.

▲ Spouse & Guest New Orleans Cooking Demonstration and Lunch
10 a.m.–12:30 p.m. Monday offsite

Visit the New Orleans School of Cooking for demonstrations of Cajun and Creole cuisine. You will be treated to a wide range of local classics such as Jambalaya, Gumbo, Corn Crab Bisque, and Pralines. Lunch included. *Fee: $25*

▲ Exhibit Hall Kindle Drawing
– 10:15 a.m. Monday

▲ Exhibit Hall Amazon $75 Gift Card Drawing
– 3:15 p.m. Monday

Tickets $1; buy at Registration. Must be present to win!

▲ Early Career Professionals Speed Networking Event
12:30–1:30 p.m. Monday
Irish Channel (2nd floor)

Speed-networking provides the opportunity to discuss career goals and challenges with a new contact for five minutes, exchange information, and then move on to the next person.

▲ Retired Physicists' Luncheon
12:30–1:30 p.m. Monday
Imperial II

Renew and create alliances by networking and exchanging ideas with our long-served and deserving supporters of AAPT. *Fee: $48*

Tuesday, January 8

▲ AAPT Fun Run / Walk
7–8 a.m. Tuesday

Join us for the 5th Annual AAPT Fun Run/Walk. Water will be provided. (Location offsite, please meet in Registration area.)

▲ Two-Year College Breakfast
7–8 a.m. Tuesday
Imperial II

Pre-register and enjoy your time and breakfast with like-minded attendees. *Fee: $30*

▲ Multicultural Luncheon
12:15–1:15 p.m. Tuesday
Imperial II

Increase awareness and understanding while sharing and celebrating unique perspectives.. *Ticket required. Fee: $48*

▲ Exhibit Hall Kindle Drawing
– 10:15 a.m. Tuesday

▲ Exhibit Hall Amazon $75 Gift Card Drawing
– 3:15 p.m. Tuesday

Tickets $1 apiece, buy at Registration. You must be present to win!

▲ New Orleans Jazz Night Fundraiser
9–10 p.m. Tuesday
Celestin Ballroom V

Join us for an elegant evening of traditional New Orleans jazz by The Preservation Hall Jazz Band. The net proceeds of this event will benefit AAPT's Annual Giving Fund. The Preservation Hall Jazz band has traveled worldwide spreading their mission to nurture and perpetuate the art form of New Orleans Jazz. Your support of this event will include *luxurious VIP seating with a complimentary drink. Fee: $75*

▲ Great Book Giveaway
3:15–4 p.m. Wednesday
Celestin Foyer

Get your raffle ticket from the AAPT booth and attend this popular event to claim your book.

Committee Meetings

All interested attendees are invited and encouraged to attend the Committee meetings with asterisks (*).

Saturday, January 5

New Board Member Orientation	1–2:30 p.m.	Black Eagle
Investment Advisory Committee	3–4:30 p.m.	Excelsior
Area Chairs Orientation	3–4:30 p.m.	Jackson
AAPT Executive Board I	5–10 p.m.	Black Eagle

Sunday, January 6

Meetings Committee	8–10:30 a.m.	Excelsior
Publications Committee	8–10:30 a.m.	Onward
AAPT Executive Board II	11 a.m.–3 p.m.	Black Eagle
Resource Letters Committee	11:30 a.m.–2:30 p.m.	Excelsior
Nominating Committee (closed)	12–2 p.m.	Onward
Section Officers Exchange	3–4 p.m.	Jackson
Bauder Endowment	4–5 p.m.	Excelsior
Programs Committee I	4–6 p.m.	Imperial III
Section Representatives	6–8 p.m.	Jackson
Awards Committee (closed)	6:30–8 p.m.	Excelsior

Monday, January 7

Review Board	8–9:30 a.m.	Onward
Membership & Benefits	12:30–1:30 p.m.	Onward
Science Education for the Public*	12:30–2 p.m.	Excelsior
Educational Technologies*	12:30–2 p.m.	Jackson
Teacher Preparation*	12:30–2 p.m.	Bolden
Minorities in Physics*	12:30–2 p.m.	Black Eagle
Physics in Undergraduate Education*	12:30–2 p.m.	Firehouse Five
Laboratories*	5–6:30 p.m.	Imperial I
International Physics Education*	5–6:30 p.m.	Firehouse Five
Physics in High Schools*	5–6:30 p.m.	Jackson
Interests of Senior Physicists*	5–6:30 p.m.	Onward
AAPT Council Meeting	8:30–10 p.m.	Celestin V

Tuesday, January 8

Physics Bowl Advisory Committee	7–8 a.m.	Black Eagle
PTRA Oversight Committee	7–8:30 a.m.	Onward
Apparatus*	7–8:30 a.m.	Pickwick
Graduate Education in Physics*	7–8:30 a.m.	Rhythm Kings
Physics in Pre-H.S. Education*	7–8:30 a.m.	Olympia Orchestra
Professional Concerns*	7–8:30 a.m.	Firehouse Five
Audit Committee	7:30–8:30 a.m.	Excelsior
SI Units and Metric Education*	7:30–8:30 a.m.	Original Zenith
Committee on Governance (COGS)	1:30–2:30 p.m.	Original Zenith
Research in Physics Education*	5:10–6:40 p.m.	Jackson
Space Science and Astronomy*	5:10–6:40 p.m.	Onward
History & Philosophy in Physics*	5:10–6:40 p.m.	Original Zenith
Women in Physics*	5:10–6:40 p.m.	Olympia Orchestra
Physics in Two-Year Colleges*	5:10–6:40 p.m.	Pickwick

Wednesday, January 9

Programs Committee II	7:30–9 a.m.	Imperial II
Nominating Committee II (closed)	8–9 a.m.	Black Eagle
Executive Board III	1–3 p.m.	Black Eagle
PERTG Town Hall Meeting	11:50 a.m.–12:50 p.m.	Johnson
ALPHA*	1–2:30 p.m.	Onward

Joe Redish
University of Maryland
Department of Physics

The Implications of a Theoretical Framework for Physics Education Research (PER)

Monday, January 7

10:30 a.m.–12:30 p.m.

Celestin Ballroom I-III

Oersted Medal

The Oersted Medal for 2013 is presented to **Edward F. (Joe) Redish** for his outstanding, widespread, and lasting impact on the teaching of physics. Joe Redish is a Professor of Physics at the University of Maryland in College Park. He received his undergraduate degree Magna Cum Laude from Princeton University and his PhD in theoretical nuclear physics from M.I.T. in 1968. He has been at the University of Maryland ever since, and served as Chairman of the Department of Physics and Astronomy there from 1982-1985. His research in nuclear theory emphasized the theory of reactions and the quantum few-body problem. As a nuclear theorist he served on the national Nuclear Science Advisory Committee and served as Chair of the Program Committee for the Indiana University Cyclotron. Since 1982 he has been actively involved in the subject of physics education. His current research effort is devoted entirely to physics education.

In the 1980s he collaborated with AAPT Executive Officer Jack Wilson and other physics colleagues on early projects using computers in education. For the past 20 years his research has focused on physics education with an emphasis on the role of student expectations and understanding the kinds of difficulties physics students have with problem solving from introductory to upper division physics. Redish has been a major factor in bringing the ideas of physics education research to the community of STEM education researchers. His book *Teaching Physics* describes research-based curriculum developments and methods, and was distributed to thousands of physics faculty free by John Wiley & Sons. He is in great demand as a speaker on the topic of physics education research and, since 2000, he has given more than 150 invited talks at conferences and universities around the world.

He has been a mentor to a large number of physics education researchers and has supervised more than 30 graduate students and postdoctoral fellows in physics education research and nuclear physics.

Prof. Redish is a fellow of the American Physical Society, the AAAS, and the Washington Academy of Science. He has received awards for his work in education from the Washington Academy of Science, the Maryland Association for Higher Education, Dickinson College, Vanderbilt University, and the Robert A. Millikan Medal from AAPT. In 2005, he received the NSF Director's award as a Distinguished Teaching Scholar. In the summer of 2012, Joe received the medal of the International Commission of Physics Education (ICPE) at the World Physics Conference in Istanbul.

The Oersted Medal is named for Hans Christian Oersted (1777-1851), a Danish physicist who, in the course of creating a demonstration for teaching his class, discovered that electric currents caused a magnetic field. This was a crucial step in establishing the theory of electromagnetism, so important in building modern technology and modern physics. The award was established by AAPT in 1936.

David Pines
UC–Davis, ICAM, and UIUC

What We Don't Know, We Teach One Another

Tuesday, January 8

10:30 a.m. –12:15 p.m.

Celestin Ballroom I-III

John David Jackson Award for Excellence in Graduate Physics Education

The David Jackson Excellence in Graduate Physics Education Award for 2013 is presented to **David Pines** in recognition of his authorship of *The Many Body-Problem* and *Elementary Excitations in Solids* and the two-volume text/monograph, *The Theory of Quantum Liquids*, written with Philippe Nozieres.

These publications served to define and describe significant sub-fields of physics. Additionally, he is recognized as the founder of the innovative series, *Frontiers in Physics*, containing over 100 volumes, for which he has served as Editor since its inception in 1961. The series has been a significant source of knowledge and inspiration for graduate students in all fields of physics. To quote from the Editor's Foreword: "The series has made it possible for leading physicists to communicate in coherent fashion their views of recent developments in the most exciting and active fields of physics—without having to devote the time and energy required to prepare a formal review or monograph."

In accepting the award, Pines noted, "I am most pleased to receive this quite unexpected honor and recognition, and very much look forward to attending the AAPT Winter, 2013, meeting in New Orleans and giving the Award lecture, not least because David Jackson is a former colleague and friend of long standing."

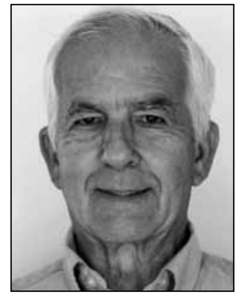
Pines is Distinguished Research Professor at UC Davis, Research Professor of Physics and Professor Emeritus of Physics and Electrical and Computer Engineering in the Center for Advanced Study, University of Illinois at Urbana-Champaign, and retired last year as the Founding Director of the Institute for Complex Adaptive Matter, a global partnership connecting scientists who study emergent behavior in matter in its 71 branches representing 111 institutions.

Named in honor of outstanding physicist and teacher, John David Jackson, this award recognizes physicists and physics educators who, like John David Jackson, have made outstanding contributions to curriculum development, mentorship, or classroom teaching in graduate physics education. This award recognizes that great teaching CAN be done and should be expected of great scientists at leading institutions.

Homer L. Dodge Citations for Distinguished Service to AAPT

Monday, January 7, 10:30 a.m.–12:30 p.m. • Celestin Ballroom I-III

A. James Mallmann


A. James Mallmann

A. James (Jim) Mallmann is Professor of Physics and the R.D. Peters Professor of Materials Science and is Director of the Photonics and Applied Optics Center at the Milwaukee School of Engineering. He earned his BS and MS in physics at the University of Wisconsin–Milwaukee. His PhD from Marquette University is in materials science.

He has served as Wisconsin Section Representative for many years and has twice served as the president of the Wisconsin Section of AAPT. His service to AAPT has also included the Committee on Apparatus, which runs the Apparatus Competition, chairing the committee in 2002. He has also served as chair of the Committee on Laboratories. A member of AAPT since 1978, he has presented a paper at every summer AAPT meeting since 1981.

Wisconsin activities include the development of a course titled "A Hands-On Introduction to Electronics" that was taken over four semesters by 96 high school and middle school science teachers in southeastern Wisconsin. Funds for those courses were provided by NSF and by the Dwight D. Eisenhower Mathematics and Science Education Program.

Mallmann co-authored, with Norman C. Harris and Edwin M. Hemmerling, *Physics: Principles and Applications* and *Experiments in Physics* with Norman C. Harris which were published in 1990 by McGraw-Hill Companies.

Sarah "Sam" McKagan

Sarah "Sam" McKagan

Sarah "Sam" McKagan is the creator and author of the "PER User's Guide," a web resource to help physics educators learn about the results of PER and apply them in the classroom. This resource has been invaluable in building a bridge between the communities of research and practice in physics education. Not only has she done the work of developing and maintaining the Per User's Guide since 2008, she has also taken the lead in seeking funding support for these efforts, serving as the PI on a grant through the NSF NSDL program to develop a pilot site. Most recently she is the PI on a proposal to the NSF WIDER program to develop PER resources for Physics Department Chairs.

McKagan has also been a key participant in the University of Colorado PhET Project (Physics Education Technology), possibly the most widespread resource for physics education simulations. She has consulted with Seattle Pacific University to conduct research on embodied cognition, create, and analyze videotapes of teacher development workshops, and worked with Augsburg College to assist with development and assessment of modern physics laboratories.

She plays a significant role in the Energy Project, a complex PER effort on the learning and teaching of energy at Seattle Pacific University. Additionally, she co-created and co-organizes an annual regional PER meeting in the Pacific Northwest.

McKagan has synthesized the work of the PER community and made it relevant to the AAPT community at large. A member of the Committee on Research in Physics Education and of the Physics Education Research (PER) Topical Group, she is passionate about translating the multiple research-based approaches into tools that practitioners can actually use. Her commitment and her contributions to the organization promote the very mission of AAPT.

Stanley Micklavzina


Stanley Micklavzina

Stanley Micklavzina is a faculty instructor at the University of Oregon Physics Department. Micklavzina has served a very active role in AAPT for many years, organizing sessions, presenting workshops and demonstrations that support his love for physics education. A member since 1984, he is one of the founders and a past president of PIRA and has authored several articles for *The Physics Teacher*. He has served on the Committee on Science Education for the Public, chairing the committee from 2008-09, and has also served on the Bauder Fund Committee and is again currently serving on both committees. Notably, he produced and directed the Demonstration shows at the 2008 AAPT Summer Meeting in Edmonton, Alberta, and the 2010 AAPT Summer Meeting in Portland, Oregon.

Micklavzina is publicly known as the engineer of "Science Circus," an annual event that promotes science to the public. Designed to entertain and educate community members of all ages, physics concepts are presented and entwined with performance styles that open the audience's minds up for a new level of understanding.

His efforts to advance physics education at all pedagogic levels have earned him national and international recognition. International activities include a recent sabbatical leave where he designed community and school outreach activities for MAX IV, the National Synchrotron Radiation Laboratory located in Lund, Sweden, and he is also an International Advisor for the *Physics Education* journal, published by the IOP in the United Kingdom.


Homer L. Dodge

AAPT's Distinguished Service Citation program was established in 1953 and in 2012 it was renamed the Homer L. Dodge Citation for Distinguished Service to AAPT to recognize the foundational service and contributions of Homer Levi Dodge, AAPT's first president. The Homer L. Dodge Citation for Distinguished Service to AAPT recognizes AAPT members for their exceptional contributions to the association at the national, section, or local level.

Mark Whittle
University of Virginia

The Universe's First Million Years: Primordial Light and Sound, *by Mark Whittle*

Monday, January 7 • 4–5 p.m. • Celestin Ballroom I–III

Professor **Mark Whittle** obtained his BA and MA in Physics from Oxford and his PhD in Astronomy from Cambridge. Following postdoctoral fellowships at the University of Arizona and Jesus College Cambridge, in 1986 he joined the faculty of the Astronomy Department at the University of Virginia. His research concerns optical and radio observations of active galactic nuclei, and he teaches both undergraduate and graduate astronomy courses. He recently produced a course for the Teaching Company called "Cosmology: The History and Nature of Our Universe."

Robert R. Twilley
Louisiana State University

The Mississippi River Delta Restoration as Science and Policy Issues of Public Concern: Opportunities in Science Education, *by Robert R. Twilley*

Wednesday, January 9 • 9–10 a.m. • Celestin Ballroom I–III

Robert R. Twilley is Executive Director of Louisiana Sea Grant College and professor in the Department of Oceanography and Coastal Science at LSU. He has been a Distinguished Professor in Louisiana Environmental Studies at LSU in 2005, and served in several administrative capacities including Associate Vice Chancellor of Research and Economic Development from 2007 to 2010, and Director of the Wetland Biogeochemistry Institute from 2004 to 2007. In 2010, Dr. Twilley served for two years as Vice President of Research at University of Louisiana at Lafayette, which manages the UL Research Park and $70 million research enterprise. He earned the UL Lafayette Foundation's Distinguished Professor Award in 2000, where he was a professor in biology from 1986 to 2004. He is the founder of the Coastal Sustainability Studio at LSU (in 2009), and also he founded the Center for Ecology and Environmental Technology (CEET) at UL Lafayette in 1999. Most of his research has focused on coastal wetlands both in the Gulf of Mexico, throughout Latin America, and in the Pacific Islands. Dr. Twilley has published extensively on wetland ecology, global climate change, and has been involved in developing ecosystem models coupled with engineering designs to forecast the rehabilitation of coastal and wetland ecosystems.

AAPT Symposium on Physics Education and Public Policy

SYMPOSIUM on Physics Education

Tuesday, January 8, 3:30–5 p.m. • Celestin Ballroom I–III

Policymakers formulate decisions everyday that impact curriculum, standards, funding, and many other aspects of physics education at all levels. AAPT works with a number of partners to keep policymakers informed on the views of physics educators and to suggest appropriate policy options within the Association's sphere of influence. This session brings together individuals who play pivotal roles in helping to shape policies and who provide information to policymakers. We hope to provide a look at the process of policy making as well as actions you might make to contribute to decisions about policies affecting physics and STEM education.

Facilitator: *Noah Finkelstein, Professor of Physics at University of Colorado at Boulder*

Speakers:

- *S. James Gates, John S. Toll Professor & Director of Center for String & Particle Theory, University of Maryland*

– Member of PCAST which recently released two reports on STEM education ("Prepare and Inspire" to generate 100,000 highly qualified K-12 STEM teachers in 10 years and "Engage to Excel" to reform undergraduate STEM education particularly in the first two years). Gates received BScs in Mathematics and Physics and a PhD in Physics from the Massachusetts Institute of Technology.) More information about Gates is available at http://umdphysics.umd.edu/people/faculty/135-gates.html.

S. James Gates

- *Ramon E. Lopez, Professor of Physics, University of Texas, Arlington*

–Ramon E Lopez's research is both in space plasma physics and physics education, and he is the author of over 100 peer-reviewed papers. Ramon is a Fellow of the American Physical Society (APS) and of the American Association for the Advancement of Science (AAAS). In 2002 he was awarded the APS Nicholson Medal for his extensive work in education, and he has received other awards for his work both in space physics and education from organizations including NASA, APS, and SACNAS (Society for the Advancement of Chicanos and Native Americans in Science). Ramon has also been very active in precollege science education. He was a member of the design and writing team for Active Physics, a High School curriculum project, and he was one of the authors of the College Board's Standards for College Success. Currently he is part of the Leadership Team for the development of the Next Generation Science Standards. He has also served as a science education consultant for numerous school districts, state departments of education, and other organizations including the Discovery Channel. Ramon earned a BS in physics in 1980 from the University of Illinois at Urbana-Champaign, and PhD in space physics in 1986 from Rice University.

Ramon E. Lopez

- *Richard Steinberg, Professor of Physics and Secondary Education, City College of New York*

– Director of the physics teacher preparation program at CCNY, scholar in physics education research, and recently published a book *An Inquiry into Science Education: Where the Rubber Meets the Road* about his experience becoming certified to teach high school physics and then teaching in inner city New York. He received a PhD in Applied Physics and a secondary teaching certificate from the Teacher Preparation Program from Yale University. More information about Steinberg is available at http://www.sci.ccny.cuny.edu/~rstein/

Richard Steinberg

Free Commercial Workshops

CW01: Using Online Homework to Achieve Your Pedagogical Goals

Location: Pickwick
Date: Monday, January 7
Time: 12:30–1:30 p.m.
Sponsor: WebAssign

Leader: Matt Kohlmyer

Since 1977, WebAssign has been the online homework system of choice for the introductory physics lecture courses. Through our partnerships with every major publisher, WebAssign supports over 160 introductory physics textbooks with precoded, assignable questions, and advance learning tools. In addition to textbook-specific question and resources, WebAssign has question collections authored by experienced physics educators, designed to strengthen student skills and conceptual understanding. Learn about research-based additional resources collection (free to WebAssign adopters) that stress physics education research principles. We will also introduce a new question collection that features both feedback designed to address student misconceptions; tutorials designed to step students through complex problems and concepts; and a personal study plan designed to improve student's perquisite math skills.

CW02: Physics2000.com Commercial Workshop

Location: Eagle
Date: Tuesday, January 8
Time: 12:15–1:15 p.m.
Sponsor: Physics2000.com

Leader: Lish Huggins

In the Physics2000 textbooks, we thought that we did a good job of including modern physics in comfortably paced, somewhat standard, introductory texts. We started with special relativity in the first week, which allowed us to include modern topics as we went along. But the discovery in 1998 that the expansion of the universe is accelerating, fundamentally changes our perspective of what modern physics is. Our workshop will be devoted to discussing how concepts, particularly of dark energy and inflation, can meaningfully be incorporated into introductory physics texts. We have already done this for the new calculus-based edition *Physics2013* and have submitted related papers to *The Physics Teacher.*

CW03: Using Enhanced WebAssign for Physics – Increase Student Engagement and Improve Outcomes

Location: Pickwick
Date: Tuesday, January 8
Time: 12:15–1:15 p.m.
Sponsor: Brooks/Cole Cengage Learning

Leaders: Charles Hartford, Mark Santee

Engage students and help them develop a deeper understanding of key concepts with rich tutorial content, automatically graded online homework, immediate feedback, and interactive, fully customizable ebook. Enhanced WebAssign combines exceptional Physics content from Cengage Learning with the most powerful online homework solution, WebAssign. Online assignments are easily built by selecting from thousand of text-specific problems or supplemented with problems from any Cengage Learning textbook. Unique, book-specific Analysis Model Tutorials by text author John Jewett guide students through the problem-solving process and provide meaningful feedback at each step. A critical component of these tutorials is the selection of an appropriate model to describe what is going on in the problem. Join us to learn about this time-saving, easy-to-use solution that motivates students and improves their performance.

CW04: Expert TA Commercial Workshop

Location: Laine
Date: Tuesday, January 8
Time: 12:15–1:15 p.m.
Sponsor: Expert TA

Leader: Jeremy Morton

Expert TA is a commercial online homework and tutorial system for introductory-level physics courses. It was designed to grade problems the way instructors do; considering more than just a student's final answer. Solving physics problems involves numerous steps such as applying equations, drawing free-body diagrams, etc; to solve for numeric answers. Expert TA's problems are all multi-step and involve these aspects of problem solving. With a sophisticated math engine, Expert TA is able to grade student equations in detail, in a manner similar to how you or your TA would. It identifies detailed mistakes within equations, deducts points, and provides specific feedback. Expert TA has partnered with talented professors, leaders in physics education, to develop a rich library of original problems. Users of Expert TA have discovered the power of detailed/sophisticated grading over simple right vs. wrong grading. Instructors are provided with a much more accurate assessment of students' work, and students are provided with the feedback required to help them master concepts. Join us and learn how Expert TA can help you and your students.

Contact Congress and be Part of the Budget Conversation

Science societies, including the American Association of Physics Teachers, can influence legislation in the U.S. Congress — legislation that will impact science education and research funding and policy. AAPT members will have the opportunity to ask questions and get more information about the federal science budget, science education issues, and initiatives that will be addressed when the new Congress convenes in January 2013. Come learn effective ways to contact your Representative or Senator, learn about the advocacy efforts at AAPT, learn how to set up a meeting with and ask questions to your Members of Congress. Information will be provided at the AAPT Symposium on Physics Education and Public Policy for those who want to be more involved in discussions about issues that affect the physics education community.

AAPT Symposium on Physics Education and Public Policy
Tuesday, January 8
3:30–5 p.m.
Celestin Ballroom I-III

American Association of Physics Teachers

Booths #304, 306, 308
One Physics Ellipse
College Park, MD 20740
301-209-3300
rrosier@aapt.org
www.aapt.org

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American Physical Society

Booths #106, 108
One Physics Ellipse
College Park, MD 20740
301-209-3297
khatib@aps.org
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LIGO, The Laser Interferometer Gravitational wave Observatory in Livingston, LA, and Hanford, WA, searches for gravitational waves caused by massive objects undergoing incredible acceleration—such as colliding neutron stars. The LIGO Science Education and Outreach seeks to connect this scientific research to teachers and students through field trips and teacher workshops.

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The SAO/NASA Astrophysics Data System (ADS) is a Digital Library portal for researchers and educators operated by the Smithsonian Astrophysical Observatory under a NASA Grant. ADS maintains three bibliographic databases containing 10 million records, providing access to a wealth of external resources. Find us online at http://adslabs.org.

Society of Physics Students

Booth #305
One Physics Ellipse
College Park, MD 20740
301-209-3008
lydia@aip.org
www.spsnational.org

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Take a look at the books exhibited near the AAPT booth.

Dearborn Resources

- *What Einstein Did Not See: Redefining Time to Understand Space,* Thomas W. Sills

Princeton University Press

- *The Physics of Neutrinos, Vernon Barger,* Danny Marfatia & Kerry Whisnant
- *Biophysics: Searching for Principles,* William Bialek
- *The Ultimate Book of Saturday Science: The Very Best Backyard Science Experiments You Can Do Yourself,* Neil A. Downie
- *Classical Electromagnetism in a Nutshell,* Anupam Garg
- *Why Cats Land on Their Feet: And 76 Other Physical Paradoxes and Puzzles,* Mark Levi
- *Guesstimation: Solving the World's Problems on the Back of a Cocktail Napkin,* Lawrence Weinstein & John A. Adam
- *Why You Hear What You Hear: An Experiential Approach to Sound, Music, and Psychoacoustics,* Eric J. Heller

Rutgers University Press

- *Physics: The First Science,* Peter Lindenfeld and Suzanne White Brahmia

Monday, January 7, 2013 – Session Schedule

Poster Session I is in Storyville Hall, 7:45 to 9:15 p.m.

	JOHNSON	FOSTER	BECHET	BUCK-TOWN I	JACKSON	BUCK-TOWN II	BOLDEN	OLIVER	ORY	CELESTIN I-iii
8:00 a.m.	**AA** The Jazz of Physics Teaching	**AB** Upper Division/ Graduate Courses	**AC** Effective Practices in Educational Technology	**AD** PER: Investigating Classroom Strategies	**AE** Overview of High School Physics in the U.S.	**AF** Reforming the Introductory Physics Course for Life Science Majors VIII	**AG** History and Strengthening of Physics Departments at HBCUs	**AH** Implementation and Assessment of Physics by Inquiry	**AI** Models of Lab Instruction/Curricula from Around the World	
8:30 a.m.										
9:00 a.m.										
9:30 a.m.										
10:00 a.m.										
10:30 a.m.										**Ceremonial Session:** Welcome to New Orleans, Oersted Award, DSC Awards
11:00 a.m.										
11:30 p.m.										
12:00 p.m.										
12:30 p.m.										
1:00 p.m.										
2:00 p.m.	**BG** Recruiting and Retaining Physics Students	**BD** Astronomy and Earth Science as a Context for Education Research	**BE** Integrating Math and Science to Prepare Precollege Teachers	**BA** Teaching in H.S. of Districts with Limited Resources	**BC** Cultural Perspectives on Physics Education	**BB** Outreach Conducted by SPS and SPS Undergraduate Research and Outreach		**BH** Preparing Teachers for Technology Needed in Teaching Physics		
2:15 p.m.										
2:30 p.m.										
2:45 p.m.										
3:00 p.m.										
3:30 p.m.										
4:00 p.m.										**PLENARY:** Dr. Mark Whittle
4:30 p.m.										
5:00 p.m.										
6:30 p.m.				**CRK02** What Physics Means – Philosophy		**CRK01** Physics and Society Crackerbarrel				
7:15 p.m.										
7:30 p.m.										

Tuesday, January 8, 2013– Session Schedule

	JOHNSON	FOSTER	BECHET	BUCK-TOWN I	JACKSON	BUCK-TOWN II	BOLDEN	OLIVER	ORY	STORY-VILLE	CELESTIN I-III
8:30 a.m.	**CH** Sustainability in the 21st Century	**CF** Pre-High School	**CE** Tracker: Video Analysis	**CB** PER: Topical Understanding and Attitudes	**CG** *Panel:* Reports from the Conference for Undergraduate Women in Physics	**CA** Physics and Society	**CC** Modern Physics in the High Schools	**CD** Implementations of Physics for Future Presidents			
8:45 a.m.											
9:00 a.m.											
9:30 a.m.											
10:00 a.m.											
10:30 a.m.											**Ceremonial Session:** Retiring President's Address; J.D. Jackson Award Presentation
11:00 a.m.											
11:30 p.m.											
12:00 p.m.											
12:15 p.m.				**CRK03** Prerequisite Issues in Introductory Courses		**CRK04** Program Guidelines and Learning Objectives					
1:00 p.m.											
1:15 p.m.											
1:30 p.m.	**DH** Interactive Lecture Demonstrations: What's New? ILDs Using Clickers and Video Analysis	**DA** Bridge and Dual Enrollment Programs with HBCUs and MSIs	**DB** 20th Century Physics in 1st Year	**DD** Policy & Advocacy for Physics Education and PER	**DF** *Panel:* Where's the Pedagogy in Lab?	**DE** Introductory Labs/Apparatus	**DG** How to Gear an Introductory Physics Course Toward Allied Health Majors	**DC** Teacher Training/ Enhancement			
2:15 p.m.											
2:30 p.m.											
3:00 p.m.											
3:30 p.m.											**AAPT Symposium:** Physics Policy
4:30 p.m.											
5:00 p.m.											
6:50 p.m.	**EI** Physics Preparation for Preservice Elementary Teachers	**EF** *Panel:* AP Physics 1&2 Curriculum Frameworks	**EB** Best Practices in Educational Technology	**EE** Research Paradigms in PER	**ED** *Panel:* Online Homework Services and Issues	**EA** Introductory Courses		**EC** Apparatus Gumbo	**EG** Instructional Labs that Use Sound or Music	**EH** Just Labs	
7:30 p.m.											
8:00 p.m.											
8:50 p.m.											

Wednesday, January 9, 2013– Session Schedule

Poster Session II is in Storyville Hall, 10:15 to 11:45 a.m.

	JOHNSON	FOSTER	BECHET	BUCK-TOWN I	JACKSON	BUCK-TOWN II	BOLDEN	OLIVER	ORY	IMPERIAL II	CELESTIN I-III
9:00 a.m.											**PLENARY:** Dr. Robert Twilley
9:30 a.m.											
10:00 a.m.											
10:30 a.m.											
11:00 a.m.											
11:30 a.m.											
12:00 p.m.											
12:30 p.m.											
12:45 p.m.											
1:00 p.m.		**FC** History and Practice in Musical Acoustics	**FD** Broader Perspectives: Technology in the Classroom	**Fi** Post-Deadline	**FF** *Panel:* Confes-sions of First-Year Faculty	**FB** PER: Student Reasoning	**FG** The Role of Integrated Lab Activities in Introductory Courses	**FE** Upper Division Undergraduate	**FH** Learning Assistant Programs as Ve-hicles for Course Transformation and Recruitment of Future Physics Teachers		
1:30 p.m.											
2:00 p.m.											
2:30 p.m.											
3:00 p.m.											
3:30 p.m.	**GF** Mentoring Minority Gradu-ate Students	**GC** Insights and Benefits from Framing a Class as a Discourse Community	**GD** Pedagogical Content Knowl-edge	**GA** Careers in Phys-ics: Alternatives to Academia	**GE** *Panel:* Opportu-nities for High School Teachers Abroad	**GB** Online Physics Courses					
4:00 p.m.											
4:30 p.m.											
5:00 p.m.											

Workshops – Saturday, January 5

All workshops are held at Southern University at New Orleans, 6895 Press Drive, New Orleans, LA 70126

W01: Arduino Micro-Controllers and Underwater ROVs

Sponsor: Committee Physics in Two-Year Colleges
Time: 8 a.m.–5 p.m. Saturday
Member Price: $215 **Non-Member Price:** $240
Location: NSC 329

Greg Mulder, Parker Swanson, and Pat Keefe, Linn-Benton Community College, 6500 Pacific Blvd., SW, Albany, OR 97321; mulderg@linnbenton.edu

Arduino Microcontrollers are relatively inexpensive devices that you can program to collect data from a variety of sensor types and control external devices such as motors and actuators. Microcontrollers can be used in a variety of classroom activities and student projects. We will focus our workshop on using an Arduino Microcontroller to construct a mini-underwater vehicle that will seek out to hover at a desired programmed depth. We will also discuss how our students use Arduinos for fun, research, underwater ROVs, and general exploration. An optional pool-test of your mini-underwater vehicle will occur after the workshop at a nearby hotel pool. No previous microcontroller, programming, or electronics experience is required. You need to bring your own Windows, Mac, or Linux computer.

W03: Physics and Astronomy by Design

Sponsor: Committee on Space Science and Astronomy
Co-sponsor: Committee on Physics in Pre-High School Education
Time: 8 a.m.–5 p.m. Saturday
Member Price: $120 **Non-Member Price:** $145
Location: BRN 311

Julia Olsen, College of Education, MASTER-IP Program, 1430 E. Second St., Tucson, AZ 85721; jkolsen@u.arizona.edu

What is understanding? What is the relationship between knowledge and understanding? What does “teaching for understanding” look like in the physics and/or astronomy classroom? How can we implement reformed teaching along with new standards? These and other important questions will be explored as participants design, develop, and refine a cohesive unit plan based on the principles found in Understanding by Design (UbD). In the UbD classroom, there are high expectations and incentives for all students while exploration of big ideas and essential questions is differentiated, so students who are able delve more deeply into the subject matter than others. This workshop is appropriate for instructors from pre-high school through college levels. Participants will receive a copy of UbD, 2nd *Ed. Note*: participants are strongly encouraged to bring their own laptops to the workshop.

W04: Reformed Teacher Observation Protocol (RTOP)

Sponsor: Committee on Physics in Pre-High School Education
Time: 8 a.m.–5 p.m. Saturday
Member Price: $90 **Non-Member Price:** $115
Location: NSC 327

Kathleen Falconer, Department of Elementary Education and Reading, Buffalo State College, Buffalo, NY 14222; falconka@buffalostate.edu

Daniel MacIsaac

The Reformed Teaching Observation Protocol (RTOP) is a 25-item rubric that provides a percentile measure of the degree and type of student-centered, constructivist, inquiry-based engagement in an instructional situation. RTOP scores correlate very highly with student conceptual gains. In this workshop, we will score video vignettes of teaching to learn how to use RTOP for guiding personal reflection and improvement and change of our own teaching; for mentoring peers, novice teachers, and student teachers; and to establish a vocabulary for discussing reformed teaching practices. If you wish, you may bring a DVD of your own teaching to score.

W06: New RTP and ILD Tools and Curricula: Video Analysis, Clickers and E&M Labs

Sponsor: Committee on Research in Physics Education
Co-sponsor: Committee on Educational Technologies
Time: 8 a.m.–12 p.m. Saturday
Member Price: $85 **Non-Member Price:** $110
Location: BRN 201

David Sokoloff, Department of Physics, University of Oregon, Eugene, OR 97403-1274; sokoloff@uoregon.edu

Ronald Thornton, Tufts University; Priscilla Laws, Dickinson College

RealTime Physics (RTP) and Interactive Lecture Demonstrations (ILDs) have been available for over 15 years—so what's new? The recently released Third Edition of RTP includes five new labs on basic electricity and magnetism in Module 3 as well a new approach to projectile motion in Module 1. Some of these new labs make use of video analysis. Also new are clicker-based ILDs. This hands-on workshop is designed for those who want to make effective use of active learning with computer-based tools in their introductory courses. These active learning approaches for lectures, labs, and recitations (tutorials) are based on physics education research (PER). Participants will work with new activities as well as original ones. The following will be distributed: Modules from the Third Edition of RTP, the ILD book, the Physics with Video Analysis book and CD, and Teaching Physics with the Physics Suite by E.F. Redish.

W07: Centripetal Force and Dark Matter

Sponsor: Committee on Physics in High Schools
Time: 1–5 p.m. Saturday
Member Price: $90 **Non-Member Price:** $115
Location: BRN 201

Jim Nelson, 6871 SW 89th Way, Gainesville, FL 32608; nelsonjh@ix.netcom.com

Damian Pope, Perimeter Institute (PI) for Theoretical Physics

During this PI-PTRA workshop participants will do a simulation and an actual laboratory activity to develop the equation for centripetal force. This information will be used to develop an explanation for the discovery and characteristics of dark matter. Several Perimeter Institute activities will be completed, and the Perimeter Institute Dark Matter DVD will be shown. Participants will receive a PI Mystery of Dark Matter Resource Kit including DVD and activities masters as well as a CD with notes and masters of each PTRA activity. Some Advanced Placement problems on centripetal force will also be discussed. Participants are encouraged to bring a calculator or computer with graphing software.

W08: String and Sticky Tape Lecture Demonstrations

Sponsor: Committee on Apparatus
Co-sponsor: Committee on Science Education for the Public
Time: 8 a.m.–12 p.m. Saturday
Member Price: $80 **Non-Member Price:** $105
Location: BRN 205

Tom Senior, Loyola University Chicago, Cudahy Hall 1032, W. Sheridan Rd., Chicago, IL 60660; tomseniorphysics@yahoo.com

David Maiuillo, David Sturm

Lecture demonstrations using inexpensive apparatus, mostly homemade. Topics from both semesters of physics will be shown.

W09: TIPERs in the High School Classroom

Sponsor: Committee on Physics in High Schools
Time: 8 a.m.–12 p.m. Saturday
Member Price: $75 **Non-Member Price:** $100
Location: BRN 209

Martha Lietz, Niles West High School, 5701 Oakton St., Skokie, IL 60077; marlie@d219.org

TIPERs are Tasks Inspired by Physics Education Research. These tasks are not like traditional physics textbook problems, but rather, require the students to think conceptually about a particular physical situation. They include ranking tasks, working backwards tasks, conflicting contentions tasks, linked multiple choice tasks and others. In this workshop, we will work with different kinds of tasks, discuss how they might be effectively used in the physics classroom, and learn how to write some of our own tasks.

W11: Demonstration Management

Sponsor: Committee on Apparatus
Time: 1–5 p.m. Saturday
Member Price: $70 **Non-Member Price:** $95
Location: BRN 205

Dale Stille and David Sturm, Instructional Resource Specialist, Department of Physics and Astronomy, University of Iowa, Iowa City, IA 52242-1479; dale-stille@uiowa.edu, sturmde@maine.edu

A how-to session on managing the many facets of modern demonstration and outreach facilities. Starting from an overview of Physics Instructional Resource Association (PIRA) resources and materials, workshop participants can consider either how to take an existing demonstration room, or construct a new facility, using the experiences and knowledge of fellow demonstration specialists. This workshop will include categorizing and sorting existing demonstrations, methods of delivery, and focus on issues such as what to order and what to build, where to find raw material, vendor resources, and much more. This session will be different from the summer workshops that perform the top 200 demonstrations: instead we focus on managing those resources. Participants will go home with checklists, references, and a to-do list geared towards their facility!

W12: Reducing the Achievement Gap Using Invention Instruction

Sponsor: Committee on Research in Physics Education
Co-sponsor: Committee on Minorities in Physics
Time: 1–5 p.m. Saturday
Member Price: $75 **Non-Member Price:** $100
Location: NSC 316

Suzanne Brahmia, Department of Physics and Astronomy, Rutgers State University of New Jersey, Piscataway, NJ 08854-8019; brahmia@physics.rutgers.edu

Andrew Boudreaux, Stephen Kanim

When we introduce new quantities in physics, we usually explain mathematically how they are related to other quantities. Too often students simply memorize the equations, approaching physics as a pattern-matching activity. Schwartz et. al. have developed invention instruction as a means to prepare students for future learning. Based on this work, physics invention tasks present students with open-ended situations in which they create mathematical characterizations of physical situations, thus priming students to make sense of subsequent formal instruction rather than just memorizing the associated equations. A collaboration between Rutgers, WWU, and NMSU has developed sequences of invention tasks designed to promote mathematical reasoning skills that are often lacking in introductory physics students. These materials have been used in physics courses with large numbers of underrepresented minority students, and contribute to reducing achievement gaps. This workshop will engage participants in invention tasks, discuss classroom applications, and present preliminary results.

W13: Stars: Their Lives and Our Cosmic Connection

Sponsor: Committee on Space Science and Astronomy
Time: 1–5 p.m. Saturday
Member Price: $74 **Non-Member Price:** $99
Location: NSC 322

Mandy Frantti, 108 W. Chocolay St., Munising, MI 49862; mpfrantti@hotmail.com

How are you related to the cosmos? In this workshop, participants will review the life cycle of stars (especially those whose lives end in Black Holes). Participants will engage in activities including sorting impressive photos taken by Hubble Space Telescope, looking at how heavier elements are formed in supernova explosions, representing the spectra of elements with music, and more. The topic includes applications that are great for physics, chemistry, or astronomy classrooms that excite students (and teachers). Multiple intelligences are addressed. Astronomy background not necessary. Participants will receive NASA materials to use in the classroom.

Workshops – Sunday, January 6

All workshops are held at Southern University at New Orleans, 6895 Press Drive, New Orleans, LA 70126

W15: Research-based Alternatives to Traditional Physics Problems

Sponsor: Committee on Research in Physics Education
Co-sponsor: Committee on Physics in Two-Year Colleges
Time: 8 a.m.–5 p.m. Sunday
Member Price: $95 **Non-Member Price:** $120
Location: BRN 205

Kathy Harper, Engineering Education Innovation Center, 244 Hitchcock Hall, Columbus, OH 43210; harper.217@osu.edu

Thomas M. Foster, David P. Maloney

Accumulating research on problem solving in physics clearly indicates that traditional, end-of-chapter exercises in physics texts are not useful and may actually hinder students' learning of important physics concepts. The research also raises questions about the efficacy of such tasks for helping students develop "problem solving skills." In light of these results the question is: What alternative tasks can we use to help students develop problem solving skills and a conceptual understanding? This workshop will review the research and then provide examples of several alternative tasks and their use. Participants will also get practice writing alternative problems in a variety of formats for use in their own classrooms.

W17: How Old Is Your Universe?

Sponsor: Committee on Space Science and Astronomy
Time: 8 a.m.–5 p.m. Sunday
Member Price: $97 **Non-Member Price:** $122
Location: BRN 201

Richard Gelderman, Department of Physics and Astronomy, Western Kentucky University, 1906 College Heights Blvd., Bowling Green, KY 42101-1077; richard.gelderman@wku.edu

Help your students understand the evidence that supports conclusions that our solar system is 4.6 billion years old and the entire universe is 13.7 billion years old. Participants will receive clear, easy to implement classroom-proven curriculum materials and inquiry-based, hands-on activities designed to integrate science content and focus on the reasons for our belief in an ancient and evolving cosmos. These ready-to-implement, student-centered investigations encourage students to take responsibility for their own learning and to formulate and ask their own questions. This full-day workshop is a condensed summary of a successful series of four-day workshops held in Kentucky for middle grades science teachers.

W18: Introduction to Modeling Instruction

Sponsor: Committee on Physics in High Schools
Time: 8 a.m.–5 p.m. Sunday
Member Price: $105 **Non-Member Price:** $130
Location: NSC 327

Lee Trampleasure, 690 Athens St., San Francisco, CA 94112; lee@trampleasure.net

Modeling Instruction (MI) uses guided inquiry and model-centered units to correct many weaknesses of the traditional lecture-demonstration method—including fragmentation of knowledge, student passivity, and persistence of naive beliefs about the physical world. While MI is mostly used at the high school level, it has been implemented at both the middle school and college level. In this workshop, participants will work through a typical unit to develop a sense of this unique instructional approach. While MI curriculum resources include essential teacher notes and student readings, worksheets, tests and quizzes, it is flexible enough to allow teachers to use much of the equipment they already have. This workshop is intended as an introduction to the normal two-to-three week summer MI workshop. It should provide educators with a sense of the approach so they can decide if they wish to attend a full workshop in the future. See modeling instruction.org

W19: Low-Budget Instructional Labs

Sponsor: Committee on Laboratories
Time: 8 a.m.–12 p.m. Sunday
Member Price: $70 **Non-Member Price:** $95
Location: NSC 322

Steve Lindaas and Linda Barton, IPFW, Physics Department, 2101 E. Coliseum Blvd., Fort Wayne, IN 46805; lindaas@mnstate.edu, lsbsps@rit.edu

Mark F. Masters

This workshop is designed for people teaching physics courses at the high school and collegiate level. Attendees will learn how to construct various versatile, low-cost, easily assembled devices. These devices can then be used in labs, interactive demonstrations, and many other ways.

W20: A Kaleidoscope of Great Online Tools for Teaching Physics

Sponsor: Committee on Educational Technologies
Time: 8 a.m.–12 p.m. Sunday
Member Price: $72 **Non-Member Price:** $97
Location: BRN 202

Cathy Ezrailson, University of South Dakota, 414 E. Clark St., Vermillion, SD 57069; cathy.ezrailson@usd.edu

Educators have more opportunities than ever to begin teaching in today's "smart environments" through e-texts, simulations, and today's emerging and "customizable" web-tools. Especially since web-based tools can also be pressed into service in order to organize, design, and assess learning. This workshop is one opportunity to access, investigate, and begin to apply a few of these resources in your courses. Most of these tools and applications are free on the web, easy to grasp and implement. Coupled with a course redesign, implementation could markedly enhance your course and communication with students. This workshop aims to help you to model, create and gain experience with some of these free tools.

W21: iPhone and iPad App Development

Sponsor: Committee on Educational Technologies
Time: 8 a.m.–12 p.m. Sunday
Member Price: $80 **Non-Member Price:** $105
Location: NSC 316

Andrew Duffy; Department of Physics, Boston University, Boston, MA 02215; aduffy@bu.edu

This workshop is a basic introduction to creating apps for the iPhone, the iPod Touch, and the iPad. No prior knowledge is assumed. We will cover the basics of drawing and animating; learn a little Objective-C; become familiar with the XCode environment in which apps are created on the Mac; and get an introduction to Interface Builder, where we lay out various buttons and sliders, etc. Workshop attendees must bring their own Mac computers, with Apple's latest version of XCode already downloaded and installed.

W22: VPython-based Video Games to Teach Physics

Sponsor: Committee on Educational Technologies
Time: 8 a.m.–12 p.m. Sunday
Member Price: $75 **Non-Member Price:** $100
Location: NSC 329

Danny Caballero, UCB, 390 2000 Colorado Ave., Boulder, CO 80309; danny.caballero@colorado.edu

In this workshop, we will work with a newly developed suite of activities to develop computational models of physical systems. These activities use classic videos games (e.g., Asteroids and Missile Command) to teach physics, mathematics, and computational modeling. We will use VPython (vpython.org) to develop these programs. Participants are asked to bring a laptop to the workshop.

W25: Leadership Roles and Models in Academia and Beyond

Sponsor: Committee on Physics in Undergraduate Education
Time: 1–5 p.m. Sunday
Member Price: $70 **Non-Member Price:** $95
Location: BRN 209

Juan Burciaga, Department of Physics, Mount Holyoke College, 50 College St., South Hadley, MA 01075; jburciag@mtholkyoke.edu

As we adopt a more peer-oriented environment for our courses, faculty begin losing their traditional role as leaders in the classroom. In addition, more and more we are asked to participate in bringing about change in our classes and beyond—changes in pedagogy, changes in diversity and inclusion, and even to initiate/participate in research or teaching groups. How do we share the authority of learning in our classes without ceding the final responsibility for that learning? What models of leadership and participation exist that can help us adapt to the changing demands? And how do we model these roles so that students can effectively develop these leadership skills as well? Using discussions, readings, and case studies, we will explore these questions as we attempt to characterize effective leadership and our most appropriate response to the challenges and opportunities of leadership demands from our professional lives.

W26: Sketch and Etch

Sponsor: Committee on Apparatus
Co-Sponsor: Committee on Laboratories
Time: 1–5 p.m. Sunday
Member Price: $88 **Non-Member Price:** $113
Location: NSC 327

Eric Ayars, Department of Physics, UC-Chico, Campus Box 202, Chico, CA 95929-0202; ayars@mailaps.org

Steve Lindaas

Make your own circuit boards! This workshop will offer hands-on experience in the physical process of creating your own circuit board from scratch. Participants will print, etch, and solder a really cool electronic gizmo they can wear on their badge for the rest of the meeting, making them the envy of all the other nerds. (Additionally, the skills gained may be useful in building experimental apparatus for physics labs.)

W27: Ways to Teach Sound and Music

Sponsor: Committee on Teacher Preparation
Co-sponsor: Committee on Physics in Pre-High School Education
Time: 1–5 p.m. Sunday
Member Price: $70 **Non-Member Price:** $95
Location: NSC 329

Wendy Adams, University of Northern Colorado, CB 127, Greeley, CO 80639; Wendy.Adams@colorado.edu

The Acoustical Society of America is proud to offer a "Sound and Music Activity Kit" free to K-12 teachers. The kit includes 10 high-quality tuning forks (frequencies chosen to address a range of learning goals), a sound level meter, four laminated posters of the inner ear and hair cells (healthy and damaged), additional items for hands on demos and 32 research-based, interactive, student-tested lessons, laboratory exercises and two assessments. These lessons have been reviewed by the AAPT PTRAs (Physics Teacher Resource Agents). There are lessons that are appropriate for a range of levels K-14. Topics include basic learning goals for teaching the physics of sound with examples and applications relating to medical imaging, animal bioacoustics, physical and psychological acoustics, speech, audiology, and architectural acoustics. In this workshop the introductory lesson will be demonstrated and we will work with several of the hands-on portions of additional lessons.

SHUTTLE BUS SCHEDULE FOR WORKSHOPS

Saturday, January 5

Buses departing Hyatt Regency Hotel to Southern University at New Orleans
- **7:20 a.m.**
- **7:35 a.m.**
- **12:20 p.m.**

Buses departing Southern University at New Orleans, returning to Hyatt Regency Hotel
- **12:15 p.m.**
- **12:40 p.m.**
- **5:15 p.m.**
- **5:30 p.m.**

Sunday, January 6

Buses departing Hyatt Regency Hotel to Southern University at New Orleans
- **7:20 a.m.**
- **7:35 a.m.**
- **12:20 p.m.**

Buses departing Southern University at New Orleans, returning to Hyatt Regency Hotel
- **12:15 p.m.**
- **12:40 p.m.**
- **5:15 p.m.**
- **5:30 p.m.**

Buses from the hotel will depart from the first level behind the front desk – take a right at the bottom of the escalators.

Session Sponsors List

AAPT Committees

Apparatus: W08, W11, W26, DE, EC, EG

Educational Technologies: AC, DH, BH. CE, EB, GB

Graduate Education: DA, FF, GF

High Schools: W07, W09, W18, AE, CC, EF, GB, GE

History & Philosophy of Physics: AG, CRK02

Interests of Senior Physicists: FB, CH, FC

International Physics Education: AI, BC, FD

Laboratories: W19, W26, AI, DE, DF, EG, EH, FG

Minorities: W12, AG, BA, DA, GF

Pre-High School Education: W03, W04, W27, BE, CF

Professional Concerns: FF, GA

Research in Physics Education: W06, W15, AD, DH, CB, DD, DF, EE, FD, GC

Science Education for the Public: W08, CA, CH, CRK01

Space Science and Astronomy: W03, W12, W13, W17, BD

Teacher Preparation: W27, AH, BH, DC, DD, FA, GD

Two-Year Colleges: W01, W15, AA, CH, CRK03, DG, ED

Undergraduate Education: W25, AF, BB, BG, CD, CRK04, DB, FG, FH

Women in Physics: BG, CG

Session SPS: SPS Undergraduate Research and Outreach Poster Reception

Location: Storyville Hall
Sponsor: Committee on Research in Physics Education
Date: Sunday, January 6
Time: 8–10 p.m.

Presider: Toni Sauncy

SPS01: 8-10 p.m. Computational Modeling and Video Analysis of a Kicked Football

Poster – Kevin Sanders, High Point University, High Point, NC 27262; sandek10@highpoint.edu

The motion of a football is not characterized by ideal projectile motion because it is significantly affected by drag and spin. In this experiment, a regulation football was kicked end-over-end in a vertical plane, and high-speed video was used to analyze its motion. The video was analyzed with Tracker software to determine the effect of drag on the path of the football. It was found that the drag force and gravitational force were not sufficient to describe its motion. The path of the football also showed something of a lift force, likely due to the Magnus effect. A numerical model was developed using a classroom cluster of Macs to approximate the solution using a brute force method. The results of this and a comparison to a possible analytic solution will be presented.

SPS02: 8-10 p.m. Determining DNA Breaks Due to Neutron Radiation

Poster – Linda J. Poplawski, High Point University, Department of Chemistry and Physics, High Point, NC 27262; poplal09@highpoint.edu

The amount of radiation that a human being is safely allowed to receive is determined from a linear curve extrapolated from unfortunate events in which large doses were delivered, such as atomic accidents. In order to determine if the body reacts to neutron radiation in a different way, such as with a threshold, DNA breaks were examined. Large doses of neutron radiation, from a neutron generator, were given to plasmid DNA placed in a copper holding block to determine if there are any damages in the DNA specifically due to radiation. The irradiated DNA was then analyzed using gel electrophoresis and measurements were taken from those images. Assumptions have been used in order to create a simpler calculation of the radiation given and to determine an approximated dose received by the plasmid DNA.

SPS03: 8-10 p.m. Simulation Studies of the Helium and Lead Observatory (HALO)

Poster – Nikki L. Sanford, High Point University, High Point, NC 27262; sanfon09@highpoint.edu

Kate Scholberg, Duke University

Simulation studies were conducted for the Helium and Lead Observatory (HALO), the supernova neutrino detector at SNOLAB, Sudbury, Ontario. HALO consists of 79 tons of lead, with 128 3He counters that detect the scattered lead neutrons resulting from incoming neutrinos. Improvements were made to the Geant4 Monte Carlo simulation's geometry by the addition of water boxes and plastic baseboards, which serve to reflect scattered neutrons back towards counters, and shield against outside neutrons and gammas. Several box designs were created, and the resulting event detection efficiencies and labeling of 1n and 2n events were studied. It was found that these additions cause a 2% efficiency increase, a slight improvement of correctly labeled events, and are a significant improvement to the HALO simulation.

SPS04: 8-10 p.m. Spin-Orientation Calculations for a Generalized Dipolar System

Poster – Justin S. Leighty, Coastal Carolina University, Conway, SC 29526, jsleight@coastal.edu

Teresa Burns, Coastal Carolina University

The 2D dielectric phases and phase transitions of adsorbed dipolar molecules are modeled using a spin-1 Ising model in the mean-field approximation. The model includes electric dipole interactions between a central unit cell and its first 100 nearest neighbors. Mathematica was used to program iterations through sets of indices, to calculate the net spin orientation for a given coverage, temperature, and for a range of input parameters. Graphs were also produced to show how the interaction parameters (J, H, and L) change as the number of nearest neighbors range from 1 to 100.

Sunday, January 6 Highlights

AAPT Workshops – Morning, Afternoon, All Day

REGISTRATION	7 a.m.–4 p.m.	Celestin Foyer
Publications Committee	8–10:30 a.m.	Onward
Meetings Committee	8–10:30 a.m.	Excelsior
Houmas House Plantation Tour	10:30–4	Offsite
Resource Letters Com.	11:30–2:30	Excelsior
Section Off. Exchange	3–4 p.m.	Jackson
Programs Committee I	4–6 p.m.	Imperial III
H.S. Share-a-Thon	4–6 p.m.	Foster
Section Representatives	6–8 p.m.	Jackson
REGISTRATION	7:30–9 p.m.	Celestin Foyer

SPS Undergraduate Research and Outreach Poster Reception

8–10 p.m. Storyville Hall

Exhibit Hall Opens / Welcome Reception

8–10 p.m. Storyville Hall

Session AA: The Jazz of Physics Teaching

Location: Johnson
Sponsor: Committee on Physics in Two-Year Colleges
Date: Monday, January 7, 2013
Time: 8–10 a.m.

Presider: Tom O'Kuma **Alternative Access Session**

AA01: 8-8:30 a.m. The Use of Woodwinds in Jazz

Invited – Gordon P. Ramsey, Loyola University Chicago, 6460 N. Kenmore, Chicago, IL 60626 gpr@hep.anl.gov

Since the early 20th century, woodwinds have been used extensively in jazz. Clarinets, being higher pitched and having a smoother sound, are perfect for the high accompaniment of Dixieland Jazz. Saxophones, with their rich, "almost human" timbre provide an excellent voice for many kinds of jazz. The combination of saxes and brass supply a perfect point-counterpoint discussion in Big Band or other forms of jazz. What are the technical features of the woodwinds that make them perfect for these roles? This talk covers the timbre and physical quantities of woodwinds that answer this question and how they can be taught. Many live demonstrations will emphasize these points.

AA02: 8:30-9 a.m. The Drumbeat of Jazz in Physics

Invited – Harvey S. Leff, Reed College; California State Polytechnic University, Pomona; Drummer, Out-Laws of Physics, 12705 SE River Rd. Apt 501S; Portland, OR 97222; hsleff@csupomona.edu

Rhythms are a fundamental part of human life and especially of music. We lock onto repetitive beats, tap our toes, and shake our heads to rhythmic pulsations. The backbone of the music we hear is often the beat of drums, from the dynamic timpani rolls of symphony orchestras to the triplets of jazz and blues. I focus here primarily on the modern drum kit used in jazz (snare, tom-tom, bass drum, high-hat, ride and crash cymbals) and the remarkable kettledrum. I'll elaborate on some of the physics involved with each, and play audio and video clips illustrating their use in jazz. For more in-depth, extended examples, you might visit one of the many jazz clubs in New Orleans!

AA03: 9-9:30 a.m. Painting the Clouds with Sunshine – The History of Jazz Banjo

Invited – Bob Swanson, Itawamba Community College, 602 West Hill St., Fulton, MS 38804; rsswanson@iccms.edu

The banjo's use in jazz has waxed and waned. In the Dixieland jazz style of the early 20th century, both the 4-string and tenor banjo were widely used, albeit primarily for rhythmic support. By mid-century, as jazz gained a solid footing as a uniquely American art form, the banjo largely disappeared from jazz music, at the same time becoming synonymous with another form of American music — bluegrass. In recent years, banjoists such as Bela Fleck have mined the melodic possibilities of the 5-string banjo to make it again a featured instrument in jazz. This talk will highlight the history of the instrument in jazz music, the interesting acoustics that make the instrument so versatile, as well as performances of some examples of jazz pieces on both 4- and 5-string banjo.

AA04: 9:30–10 a.m. Vocal Technique in Jazz

Invited – Ingo R. Titze, University of Utah and University of Iowa, 136 South Main St., Suite 320, Salt Lake City, UT 84101-1623; ingo.titze@ncvs2.org

Elizabeth Johnson, Blair School of Music, Vanderbilt University

Vocalists are able to adjust their technique to adapt to instrumental accompaniment, use of electronic amplification, and varied emphasis on rhythm versus melody. Vocal timbre mimics that of brass and woodwind instruments used in jazz. Vibrato is variable, as opposed to continuous in operatic singing. Pitch is kept at low to medium high to preserve verbal intelligibility. Occasional roughness is used to mirror the blaring of wind instruments. Scatting allows the singer to become a pure instrumentalist, not being inhibited by phonemic rules of spoken language.

Monday, January 7 Highlights

REGISTRATION	7 a.m.–5 p.m.	Celestin Foyer
First Timers' Gathering	7–8 a.m.	Imperial II
H.S. Physics Teachers Day Breakfast	7–8 a.m.	Imperial III
Spouse & Guest Cooking Demo and Lunch	10 a.m.–12:30 p.m.	offsite
Early Career Professionals Speed Networking	12:30–1:30 p.m.	Irish Channel
Kindle Raffle	10:15 a.m.	Storyville Hall
OERSTED MEDAL, DSCs	**10:30–12:30**	**Celestin I-III**

COMMITTEE MEETINGS, 12:30–2 p.m.

–Sci. Educ. for the Public	Excelsior
–Educational Technologies	Jackson
–Teacher Preparation	Bolden
–Minorities in Physics	Black Eagle
–Phys. in Undergrad. Education	Firehouse Five

COMMERCIAL WORKSHOP, 12:30–1:30 p.m.

–CW01: WebAssign	Pickwick

PLENARY 4–5 p.m. Celestin I-III

–Dr. Mark Whittle on "The Universe's First Million Years"

Afternoon Break Exhibits	3:30 p.m.	Storyville Hall
Amazon Raffle	3:15 p.m.	Storyville Hall

COMMITTEE MEETINGS, 5-6:30 p.m.

–Laboratories	Imperial I
–International Physics Educ.	Firehouse Five
–Physics in High Schools	Jackson
–Interests of Senior Physicists	Onward

CRACKERBARRELS, 6:30–7:30 p.m.

–CRK01 Physics and Society	Bucktown I
–CKR02 What Physics Means	Bucktown II

POSTER SESSION I	7:45–9:15 p.m.	Storyville
AAPT Council Meeting	8:30–10 p.m.	Celestin V

Session AB: Upper Division/Graduate Courses

Location: Foster
Sponsor: Committee on Educational Technologies
Date: Monday, January 7
Time: 8–9:30 a.m.

Presider: Lynn Aldrich

AB01: 8-8:10 a.m. Using Modeling to Emphasize Quantitative Thinking in the Laboratory

Contributed – Benjamin M. Zwickl, Physics Department, University of Colorado Boulder, 390 UCB Boulder, CO 80309; benjamin.zwickl@colorado.edu

Noah Finkelstein, H. J. Lewandowski, University of Colorado Boulder

Modeling, the practice of developing, testing, and refining models of physical systems, is gaining support as a key scientific practice, and is included in the new Framework for K-12 Science Education released by the National Research Council. Modeling has already been integrated into introductory courses such as RealTime Physics, Modeling Instruction, and Matter & Interaction. However, there have been limited attempts to integrate modeling in the upper-division. We present modeling as a holistic approach for emphasizing quantitative thinking in the upper-division laboratory, which is accomplished by focusing on the relationships between fundamental principles, quantitative predictions, limitations of the model, data, and the physical apparatus. Practical examples (drawn from optics experiments) and tips for incorporating modeling into your existing labs will be included.

AB02: 8:10-8:20 a.m. Student Connections Between Multiplicity and Macroscopic Entropy*

Contributed – Michael E. Loverude, California State University Fullerton, Department of Physics, Fullerton, CA 92834; mloverude@fullerton.edu

Sissi L. Li, Catalyst Center, California State University Fullerton

As part of an ongoing project involving research and curriculum development in upper-division thermal physics, we have investigated student understanding of the concept of entropy and the approach to thermal equilibrium. In the thermal physics approach, the second law of thermodynamics is motivated by an extended examination of statistical properties and entropy is first introduced in terms of multiplicity. In the current talk, we present data from written problems in which students are asked about entropy and multiplicity in the context of interacting bodies. In particular, we will show responses that suggest that the link between multiplicity and entropy can be more challenging for students than might be expected.

*Supported in part by NSF grant DUE 0817335.

AB03: 8:20-8:30 a.m. Examining Graduate Student Understanding of Rotating Reference Frames

Contributed – David P. Cassidy, Mallinson Institute of Science Education, Western Michigan University, Kalamazoo, MI 49008-5444; david.p.cassidy@wmich.edu

David G. Schuster, Mallinson Institute of Science Education

Understanding noninertial frames of reference and the genesis of the force-like effects perceived within them has long been an obstacle for students of both upper-division undergraduate and graduate mechanics. To elucidate why this may be, a characterization was required of student conceptual and formalistic understanding of rotating and inertial reference frames. We conducted think-aloud problem-solving sessions with post-mechanics graduate students who were tasked with comparing several situations from both the fixed and rotating frames. From these comparisons and subsequent open-ended recall interviews, several alternate conceptions emerged to a saturation. Among other things, these conceptions involved the existence and genesis of force-like effects in both frames of reference, and the existence and conservation of momentum. These emergent characteristics may suggest a pedagogical solution to these problems, and the limitations and successes of traditional instruction.

AB04: 8:30-8:40 a.m. p-adic q-integral and Some Family of L-functions and their Applications

Contributed – Yilmaz Simsek, Akdeniz University, Faculty of Science, Department of Mathematics, Antalya - 07058 Turkey; ysimsek63@gmail.com

p-adic q-integral and some family of L-functions and their applications
In this paper we construct a p-adic q-L functions using p-adic q-integral which interpolate Bernoulli and Euler numbers. We will give some application in Mathematical Physics.

AB05: 8:40-8:50 a.m. The Advanced Lab: Modern Techniques in a Research-Type Environment

Contributed – Andra Troncalli, Austin College, Department of Physics, 900 N. Grand Ave., Suite 61556; Sherman, TX 75090; atroncalli@austincollege.edu

Our advanced lab is a junior-level elective whose purpose is to strengthen our students' experimental research skills. In order to achieve this goal, students are introduced to modern techniques: phase sensitive detection, temperature measurement and control, and instrument interfacing through LabVIEW. Once trained in using the equipment, students design their own experiments in order to investigate the relevant properties of the materials under study. Specific topics include high temperature superconductivity, diode laser, and Faraday rotation. The approach is more similar to that used in a research setting, rather than in a traditional classroom.

AB06: 8:50-9 a.m. An Advanced Laboratory in Beta Spectroscopy Utilizing a Solenoid-type Magnetic Spectrometer*

Contributed – Fred Becchetti, University of Michigan, Department of Physics, Ann Arbor, MI 48109; fdb@umich.edu

Ramon Torres-Isea, Michael Febbraro, Matthew Bales, Univ.of Michigan

As part of a planned upgrade to our advanced physics teaching laboratories covering topics in modern physics, we have developed a beta-spectroscopy laboratory that utilizes a high-acceptance permanent-magnet solenoid-type magnetic spectrometer. The apparatus can be constructed at modest cost, permitting multiple setups as required in the new laboratory planned. In addition, the high collection efficiency (typically x10 or more relative to a dipole-based spectrometer) greatly facilitates a complete set of measurements during typical laboratory periods using exempt quantities of radioactive materials. The data obtained illustrate the important features of beta decay, including determination of an upper limit for the neutrino mass as well as the need for a relativistic treatment for the beta particle energy and momentum spectra.

*This work supported in part by the National Science Foundation.

AB07: 9-9:10 a.m. Complementary Nuclear and Optical Scattering Experiments as a Capstone Laboratory

Contributed – Jessie A. Petricka, Gustavus Adolphus College, 800 W College Ave., St. Peter, MN 56082; jpetrick@gustavus.edu

A series of scattering experiments has been developed to serve as the capstone experiments in an upper-division undergraduate laboratory. We have combined a measurement of Compton scattering and of Mie scattering to reinforce common ideas using complementary approaches and the appropriate apparatus. The traditional Compton lab introduces nuclear measurement techniques to verify the simple angular and energy distribution, whereas the Mie scattering lab presents a complex optical scattering phenomenon that is visible to the eye yet computationally tractable. Skills in these labs focus on precision measurement, automated data collection, background suppression and instrumental calibration. In the capstone portion of the lab, students are asked to revisit the analysis and theoretical fitting of one of the two labs to better fit the accepted model. This task includes techniques in nonlinear chi-squared fitting, experimental optimization to recollect data at critical points, and computer modeling of extended geometry effects.

AB08: 9:10-9:20 a.m. Estimating the Boltzmann Constant from Simulations of Settling Brownian Particles

Contributed – Jeffrey R. Groff, Shepherd University, PO Box 5000, Shepherdstown, WV 25443; jgroff@shepherd.edu

Brownian motion can be studied by observing micron-sized polystyrene spheres in aqueous solution using a microscope. The size of these particles is such that the rate of diffusion is similar to the rate of advection due to gravity. This work focuses on using a theoretical model of the gravitational settling of Brownian particles to analyze experimental data that consists of the concentration of one-micron diameter polystyrene spheres at specific vertical positions in a depression slide as a function of time. The theoretical model simulates the experiment using a one-dimensional advection-diffusion equation. Using a simulated annealing algorithm, simulations are used to estimate the Boltzmann constant by fitting the experimental data. This experiment is suitable for undergraduates in an upper-level advanced physics laboratory or biophysics laboratory.

Session AC: Effective Practices in Educational Technology

Location: Bechet
Sponsor: Committee on Educational Technologies
Date: Monday, January 7
Time: 8–9:30 a.m.

Presider: Danny Caballero

AC01: 8-8:10 a.m. Dynamic Timeline for High School Physics Courses

Contributed – Mrinal Bali, The Meadows School, 8601 Scholar Lane, Las Vegas, NV 89128; mbali@themeadowsschool.org

An essential part of a teacher's planning for a course is a timeline – what is taught when. An ideal timeline lists every task — lectures, labs, assessments, field trips — by date throughout an academic year; links tasks to clearly show what follows what or what is in parallel to what; makes dates not constant but variable if a planned lesson slips; automatically calculates new dates for subsequent tasks but according to the school's holiday calendar and the timetable of a class so that no date is assigned when teacher and class don't meet; flags clashes for lab resources shared between teachers; and also tracks secondary tasks such as scheduling a bus for a field trip. Such a dynamic timeline is possible with software that the engineering industry has been using for decades. This paper details the author's experience in adapting this industrial tool to planning his high school physics courses.

AC02: 8:10-8:20 a.m. Effective Use of the Slide Rule In the Physics Class

Contributed – W. Ronald McCloskey, Western Area Career & Technology Center, Canonsburg, PA 15317; rmccloskey@wactc.net

In our facility the students are vocational students and there is an immediate need to be skilled at reading scales of all kinds: tapes, steel rules, micrometers, calipers, meters of all kinds, etc. They arrive in physics class unable to quickly adjust to various scale divisions. Using electronic calculators, students tend to NOT take responsibility for their answers. They often respond, "That's what the calculator read!" They often give no thought to the order of magnitude of their answer. Most of the physics students have little skill in estimating anything. They have not had to practice estimating. The slide rule addresses much of what the student needs to succeed. 1) Reading varying scales is required and the physics student must think about that many times per class. 2) Estimating their expected answer is required since the slide rule does not provide anything but significant figures. 3) Physics students must take responsibility for their answers since they must place the decimal point (not having an electronic calculator do it for them). 4) The power of tens eventually becomes second nature to the slide rule user.

AC03: 8:20-8:30 a.m. Cosmology for Nonscience Majors by Using Web-based Apps

Contributed – Daniel M. Smith Jr., South Carolina State University, 300 College St., NE, Orangeburg, SC 29115; dsmith@scsu.edu

Cosmology needs demonstrations and simulations for teaching just as other sciences because almost everyone is curious about the origin, contents, structure, and fate of the universe. Such instructional aids should partly lift the veil from a scientific process that seems mysterious enough that many people believe discoveries in cosmology to be arbitrary pronouncements. To help explain the discoveries of dark matter, dark energy, and inflation, several apps have been developed that run in a browser with the free Mathematica plug-in.

http://physics.scsu.edu/~dms/cosmology/home2.html NSF PAARE/POCA Grant AST-0750814

AC04: 8:30-8:40 a.m. A College-Wide iPad Pilot Group: Learning From Other Departments

Contributed – Kendra J. Sibbernsen, 287 Concord Circle, Papillion, NE 68046 kjsibbernsen@mccneb.edu

A group of faculty members was invited to participate in a pilot project to use iPads in classes at Metropolitan Community College in Omaha, NE. Through monthly meetings, classroom results with varying degrees of success were shared among members of the group. Some of the best ideas for using the technology in the classroom came from unexpected places, such as the automotive department and culinary arts. Some of these apps and techniques for using tablets in innovative ways in the physics or physical science classroom will be presented in this talk.

AC05: 8:40-8:50 a.m. One Decade of Evolution in Introductory Calculus-based Physics at UW

Contributed – R. Daryl Pedigo, University of Washington, Physics Department, Seattle, WA 98195; rdp3@uw.edu

Large introductory physics lectures have become the norm at many universities, despite evidence that traditional lectures are ineffective for conceptual learning. Various sessions outside the lecture hall, such as innovative labs and tutorials, are widely employed to supplement lectures, and innovative lecture methods are slowly replacing traditional lectures. But resources for such efforts, and for aiding, assessing and grading students, have remained fixed or diminished in the face of increased enrollments. Is it possible to deliver a quality learning experience to hundreds of students taught in different lecture sections by different faculty despite today's financial climate? I report on the evolution of the introductory physics sequence at UW from 2002-2012, including: extensive use of online materials and technology for lecture, lab and tutorial; common midterm exams; and pooled grading across lecture sections.

AC06: 8:50-9 a.m. Central Force Model and Oscillating Particle Model through Halo Video Game

Contributed – Igor V. Proleiko, McKinley Classical Leadership Academy, 2156 Russell, St. Louis, MO 63104; igor.proleiko@slps.org

Julian K. Proleiko School of Independent Thought

This paper follows a paper presented at the Summer meeting, further exploring Modeling methodology through data collected within the Halo video game universe. Particular attention is given to the Central Force Model and Ocsillating particle Model, the topics of future study are being discussed. The longer term goal is to support the entire Modeling curriculum through video games universe.

AC07: 9-9:10 a.m. A Course in Physics for Video Games

Contributed – Aaron Titus, High Point University, 833 Montlieu Ave., High Point, NC 27262; atitus@highpoint.edu

In 2012, I created a physics course for nonscience majors called "Physics for Video Games." The course combines experiments, theory, and video game development using VPython. Physics content includes a subset of topics in classical mechanics, such as kinematics, reference frames and relative motion, Newton's laws, inelastic and elastic collisions, and conservation of momentum. For each topic, there is an experiment and programming activity. Many of the resulting programs resemble classic arcade-style games like Pong, Breakout, Space Invaders, Frogger, Lunar Lander, and Asteroids, for example. An outline of physics topics and examples of experiments and programming activities will be presented.

AC08: 9:10-9:20 a.m. Our Students Love Tests

Contributed – Stephen T. Collins, Lusher Charter School, 5624 Freret St., New Orleans, LA 70115; stephen_collins@lusherschool.org

Matt Owen, Lusher Charter School

Highly positive student reactions to their course and assessment structure have encouraged Stephen Collins (author of socraticbrain.com) and Matt Owen (author of "Just tell me the answer" blog) to describe their integrated algebra and physics course for Freshmen at Lusher Charter School (New Orleans). Their unique approach fuses modeling and student centered dialog with technology-enabled Standards-Based Assessment and Reporting. Students take charge of their own learning through online practice and video instruction and complete assessments at their own pace.

Session AD: PER: Investigating Classroom Strategies

Location: Bucktown I
Date: Monday, January 7
Time: 8–10 a.m.

Presider: Sherry Savrda

AD01: 8-8:10 a.m. Autonomous Choices and the Student Experience in Introductory Physics

Contributed – Nicholas Hall, University of California - Davis, Department of Physics, Davis, CA 95616; nicholasronhall@gmail.com

David J. Webb, University of California - Davis

The effects of autonomous choices on the student experience in a large-enrollment undergraduate introductory physics course were investigated from a self-determination theory perspective. A controlled study tested how restructuring the course to allow more autonomous choices by the students changed certain aspects of the student experience. This was done by comparing two sets of classes, one in which students were given significantly more opportunities for autonomous choice than the other. It was found that more autonomous choices led to large differences between women and men in interest/enjoyment in learning physics, with women becoming less interested than men. Additionally, only in the set of classes with more autonomous choices did the change over time in students' reasons for taking physics correlate with performance, where coming to study physics more because they wanted to (less because they had to) correlated with higher performance.

AD02: 8:10-8:20 a.m. Fostering Future Members of the Physics Community

Contributed – Sissi L. Li, California State University, Fullerton, 800 North State College Blvd., Fullerton, CA 92831; sili@fullerton.edu

Michael E. Loverude, California State University Fullerton

Physics teachers do more than help students understand and apply physics concepts — they also show students what it means to be a physicist in a community. As recognized members of the academic and disciplinary communities, teachers and other mentors can be in positions to help students understand the communities they are joining by pursuing their major. The choice of practices established in the classroom, the language used to discuss physics, and attitudes about other sciences serve both to inform students about the communities they are joining and also shape the role they might play. We report a case study of a thermal physics course as a community where ideas about what it means to join the physics community as a physicist are supported throughout the instruction interactions. We will showcase how students interpret the subtle and sometimes unintentional cues from the instructor to shape their ideas about becoming a physicist.

AD03: 8:20-8:30 a.m. Increases in Problem Solving and Conceptual Understanding Without Sacrificing Content

Contributed – David J. Webb, University of California, Davis, Department of Physics, Davis, CA 95616; webb@physics.ucdavis.edu

Four large sections of intro-physics for physical scientists are compared. One section (treatment) was organized so that students worked to learn the classical ideas connecting forces and motion over the first six weeks of the 10-week quarter and then used the final four weeks to apply those principles to algebraically complicated physical problems. The other three (control) sections learned ideas at essentially the same time as calculations. The treatment group and one of the control sections were taught by the same instructor, had identical curricular materials, and this instructor was blind to the comparison measure, the final exam. After controlling for GPA as well as for incoming conceptual understanding, the treatment group was found to perform significantly better on the final exam than the control group taught by the same instructor and, by a similar measure, the treatment group performed significantly better than any other section.

AD04: 8:30-8:40 a.m. Eye Movements While Interpreting Graphical Representations of Motion

Contributed – Jennifer L. Docktor, University of Wisconsin - La Crosse, Department of Physics, La Crosse, WI 54601; jdocktor@uwlax.edu

Jose Mestre, University of Illinois at Urbana-Champaign

Elizabeth Gire, University of Memphis

N.Sanjay Rebello, Kansas State University

Adrian Madsen, Kansas State University

An important skill for proficient problem solving is the fluent use of multiple representations of information (e.g. text, equations, pictures, diagrams, and graphs). In this study, introductory physics students and graduate students viewed several kinematics graphs on a computer screen and were asked to match a region of the graph with a text description of motion. The graphs were carefully designed to elicit common student difficulties with graph interpretation. We compare subjects' performance on the items, their reasoning criteria, and eye movements recorded using an eye tracker.

AD05: 8:40-8:50 a.m. Initial Assessment of a Curriculum on the Physics of Biomedicine

Contributed – Warren M. Christensen, North Dakota State University, Fargo, ND 58102; warnpeace1414@hotmail.com

James K. Johnson, Grace R. Van Ness, Elliot Mylott, Ralf Widenhorn, Portland State University

Undergraduate educational settings often struggle to provide students with authentic biologically or medically relevant situations and problems that simultaneously improve their understanding of physics. Through exercises and laboratory activities developed in an elective Physics in Biomedicine course for upper-level biology or pre-health majors at Portland State University we aim to teach fundamental physical concepts such as light absorption and emission, and atomic energy levels through analysis of biological systems and medical devices. We report on the effect engaging students in tasks with real medical applications has had on their conceptual understanding of light and spectroscopy through analysis of their responses to open-ended questions. The nature of the activities gives students opportunities to use the medical apparatus and unpack the underlying physical concepts. Additionally, we use the Colorado Learning Attitudes toward Science Survey to determine the extent to which student attitudes toward learning science are changing through the course.

AD07: 8:50-9 a.m. Assessment of Effectiveness of Studio-Mode Instruction in Algebra-based Physics Courses

Contributed – Archana Dubey, University of Central Florida, Orlando, FL 32816-2385; Archana.Dubey@ucf.edu

Jacquelyn Chini, University of Central Florida

While the success of the studio mode of instruction in calculus-based physics courses is now well demonstrated, the same cannot be said for algebra-based courses. Keeping this in mind, a study has been conducted on algebra-based electricity and magnetism courses in which studio and lecture sections were taught by the same instructor, using the same text book. Students' understanding of the magnetic forces has been assessed using common quiz questions. This presentation will highlight students' performance when the problem is asked in a condensed versus divided form. In an effort to assess the relative effectiveness of the two modes of instruction, results of the Survey of Electricity, Magnetism, Circuits and Optics (SEMCO) will also be presented.

AD08: 9-9:10 a.m. Research-based Active-Learning Instruction in Physics*

Contributed – David E. Meltzer, Arizona State University, Mesa, AZ 85212; david.meltzer@asu.edu

Ronald K. Thornton,Tufts University

The development of research-based active-learning instructional methods in physics can serve as a model for creation of evidence-based instructional practices in all science fields. Based on a recent review,[1] we define these methods as those (1) explicitly based on research in the learning and teaching of physics, (2) that incorporate classroom and/or laboratory activities that require students to express their thinking through speaking, writing, or other actions that go beyond listening and the copying of notes, or execution of prescribed procedures, and (3) that have been tested repeatedly in actual classroom settings and have yielded objective evidence of improved student learning. We describe some key features common to methods in current use. These features focus on (a) recognizing and addressing students' physics ideas, and (b) guiding students to solve problems in realistic physical settings, in novel and diverse contexts, and to justify or explain the reasoning they have used.

*Supported in part by NSF DUE #1256333

1. D.E. Meltzer and R.K. Thornton, *Am. J. Phys.* **80**, 478 (2012).

AD09: 9:10-9:20 a.m. Longitudinal Standing Wave Tutorial for a Physics of Music Class

Contributed – Jack Dostal, Wake Forest University, PO Box 7507, Winston-Salem, NC 27109; dostalja@wfu.edu

The Longitudinal Standing Wave (LSW) Tutorial is a PER-based curriculum that helps students to develop their understanding of sound waves using marked springs, tuning forks, pipes, and plenty of discussion. Though originally designed for the two-semester introductory college physics class, I have recently used this tutorial as a laboratory exercise in a general education Physics of Music class. The group discussions in these two classes of students have interesting similarities and differences. Some of these are a result of students' prior knowledge about sound, while others are affected by the course material covered prior to the tutorial. Observations from my Physics of Music class and comparisons to a standard introductory physics class will be presented. Some subtle apparatus issues will also be addressed.

AD10: 9:20-9:30 a.m. Reflection on Problem Solving: Application to Life Science Majors

Contributed – Andrew J. Mason, University of Central Arkansas, Lewis Science Center, Conway, AR 72035; ajmason@uca.edu

Recent studies have shown that reflection upon physics problem solving remains a difficult task for physics majors to learn how to do properly. The PER community has recently begun an intense effort to address reform in introductory physics courses for the life sciences. Given that the majors frequently chosen by students in this course involve a different domain of content knowledge, it is of interest to probe ability to reflect on problem solving for these students. Plans for a study, based on recent research on self-diagnosis exercises with calculus-based physics students,[1] will be discussed for a second-semester algebra-based physics course, for which the student population consists of mainly life science majors and also computer science majors.

1. E. Yerushalmi, E. Cohen, A. Mason, and C. Singh, *Phys. Rev. ST-PER* **8**, 020109 and 020110, 2012.

AD11: 9:30-9:40 a.m. Testing Problem Solving through Multiple Choice

Contributed – Jessica Graber, Xavier University of Louisiana, New Orleans, LA 70125; jgraber@xula.edu

Large lecture courses and grading time constraints force many instructors to use multiple-choice exams, and many students will encounter multiple-choice exams determining entrance into post-secondary education or career paths. However, research shows that student test preparation does not occur at a deep knowledge level for multiple-choice tests compared to hand-graded exams using worked out problems. Most instructors prefer worked out problems on exams for pedagogical reasons even if it is practically not possible. To increase the efficacy of multiple-choice problems in assessing actual problem-solving skills, I compare the two types of questions on the same test to determine what features of the problem solving skill set best predict overall problem solving capabilities.

Session AE: Overview of High School Physics in the U.S.

Location: Jackson
Sponsor: Committee on Physics in High Schools
Date: Monday, January 7
Time: 8–10 a.m.

Presider: Larry Escalada

AE01: 8-8:30 a.m. Overview of High School Physics in U.S.

Invited – Eric R. Banilower, Horizon Research, Inc., 326 Cloister Ct., Chapel Hill, NC 27514; erb@horizon-research.com*

Horizon Research Inc. conducted the 2012 National Survey of Science and Mathematics Education (NSSME), the fifth in a series of surveys dating back to 1977. These surveys provide valuable insights on the status of high school physics on a national level. Results from the 2012 NSSME will be shared in this session, focusing on the background of high school physics teachers, their perceptions of content and pedagogical preparedness, and their classroom practices. Changes over time from previous surveys will also be shared as appropriate.

*Sponsor: Larry Escalada

AE02: 8:30-9:00 a.m. Modeling Instruction Workshops: A Robust Framework for Science Teacher Professional Development

Invited – Kathleen A. Harper, Engineering Education Innovation Center, The Ohio State University, Columbus, OH 43210; harper.217@osu.edu

Jane Jackson Arizona State University

A collaboration between a high school physics teacher and a university physicist led to the creation of Modeling Instruction in the early 1990s. A grant from NSF-funded multiple national workshops in the mid to late '90s, and from there, Modeling has spread through grass-roots efforts, directly impacting approximately 5500 teachers through workshops all around the country. This includes nearly 10% of the nation's physics teachers. These workshops have been shown to have strong positive impacts on teacher content knowledge, classroom pedagogy, and student learning. In addition, they have created strong and supportive professional networks, both at the local level and nationally. This talk will give a brief synopsis of the program's history, an overview of the Modeling framework, a description of a typical workshop, and data on the current state of Modeling Instruction in the U. S. and planned future directions.

AE03: 9-9:30 a.m. Training In-Service High School Physics Teachers in Iowa

Invited – Jeffrey T. Morgan, University of Northern Iowa, Cedar Falls, IA 50614-0150; jeff.morgan@uni.edu

Lawrence T. Escalada University of Northern Iowa

Many schools in our state are small, with one to two teachers tasked with teaching all science courses. We're frequently contacted by school districts throughout the state seeking physics teachers, or science teachers with a physics endorsement. To address this shortage and the need for teachers who can teach multiple sciences, the University of Northern Iowa Physics Department has conducted several multi-year programs designed to train science teachers in other disciplines to be physics teachers, and strengthen the pedagogical content knowledge of existing physics teachers. Participants work through content using both Modeling Instruction[1] and PRISMS Plus,[2] then discuss and practice pedagogy. In addition, they are provided with various teaching resources, including access to probeware and laptop computers. We will discuss our most recent program, Iowa Physics Teacher Instruction and Resources (ITPIR), describing the design and delivery in the program, participant feedback, and results from our research into teacher and student learning.

1. http://modelinginstruction.org
2. http://www.uni.edu/prisms/prisms/prisms-plus

AE04: 9:30-9:40 a.m. An Analysis of the Current State of High School Physics in Texas

Contributed – Jess Dowdy, Abilene Christian University, Abilene, TX 79699; jess.dowdy@acu.edu

Krisitn Holz Abilene, Christian University

Presentation includes an overview of the instructional patterns originating from the 2007 Texas requirement to include physics in the graduation requirements for virtually all high school students. The research presented centers on analysis of state certification data, state overview reports, and various statistical methodologies. Patterns are emerging, so that predictions may be made for the future of physics teaching in Texas. This talk may be of interest to those from other states, as the push for physics in Texas, may lead other states to consider similar strategies in high school science requirements.

AE05: 9:40-9:50 a.m. Physics Yesterday, Today and Tomorrow at HPHS Texas

Contributed – Beverly Trina Cannon, Highland Park High School, Dallas, TX 75205; cannonb@hpisd.org

HP is rated high by the Department of Education in Texas. It is centered in a suburb that is surrounded by the city of Dallas. The community is economically wealthy and the parents have achieved high levels of academic success. The students receive unlimited encouragement from their families for success and often have their own expectations for high achievement. So physics as a course completed in their 11th grade year has received the bumps and bruises in this environment. Hear the saga of its past, the present situation, and the prediction for the future which will respond to the state's end-of-course exams.

AE06: 9:50-10 a.m. Understanding Career Paths: Tracking Physics Teachers in Texas

Contributed – Jennifer D. Mount, Texas State University, San Marcos, TX 78666; jm229@txstate.edu

Jill Marshall, University of Texas at Austin

Many states are experiencing a shortage of qualified physics teachers, due in part to attrition (teachers leaving the field). The problem, however, becomes more complicated, when shortages are examined by school type, e.g., by the socioeconomic status (SES) of the school community. Even if there is no shortage overall, there may be shortages in specific areas. I examined a statewide dataset of Texas secondary science teachers from 2003-2008. I analyzed the data to identify attrition and migration (moving school to school) of physics teachers vs. the SES of the schools where they taught, using vector maps to represent the flow of teachers into and out of schools. I found a strong migration pattern toward schools with higher (but not the highest) SES, meaning that lower SES students were more likely to have novice teachers. My results have implications for the equitable distribution of teachers.

Session AF: Reforming the Introductory Physics Course for Life Science Majors VIII

Location: Bucktown II
Sponsor: Committee on Physics in Undergraduate Education
Date: Monday, January 7
Time: 8:30–10 a.m.

Presider: Juan Burciaga

AF01: 8-8:20 a.m. Physics of Medicine (POM)

Invited – Nancy L. Donaldson, Rockhurst University, Kansas City, MO 64110; nancy.donaldson@rockhurst.edu

Mary Lowe, Loyola Maryland University

In 2009, Rockhurst University established a Physics of Medicine Program designed to deepen students' understanding of physics as it is applied to medicine. Through a focus designed to build upon introductory physics principles to an application of physics to medicine, Rockhurst's POM Program has been successful in attracting students from different disciplines into upper-division physics courses. In POM, students study the physics principles involved in analyzing human physiological and anatomical function, the detection/diagnosis of disease and the subsequent treatment plan. Active-learning courses include a mixture of hands-on work, experimentation, research and project design, lectures, problem solving, guest speakers from the medical community and field trips to view medical imaging equipment and nuclear medicine facilities. Rockhurst University and Loyola Maryland University received a collaborative NSF TUES grant in May 2012 to develop three upper-division active learning modules in fiber optics in medicine, pressure in the human body and nuclear medicine.

AF02: 8:20-8:40 a.m. How Can Biologists Learn to Love Physics?

Invited – Jay Nadeau, McGill University, Montreal, QC H3A2B4 Canada; jay.nadeau@mcgill.ca*

Many biologists see introductory physics as a "weed-out" class to be endured, and do not make the connection between the fundamental principles of physics and many common biological problems and techniques. At the same time, these evolving quantitative techniques make it more and more necessary for biologists to have a firm grasp of physical principles and of quantitative methods such as dimensional analysis and statistics. One of the biggest conceptual hurdles occurs during the introduction of electricity and magnetism (E&M) and wave optics. Students who have readily mastered elementary mechanics are often overwhelmed by the abstract and "invisible" nature of E&M. This situation is not aided by engineering-specific test questions that appear to have little to do with biology. In my talk, I present some basic biological systems that can be used to illustrate principles of optics and E&M in a rigorous way.

*Sponsor: Juan Burciaga

AF03: 8:40-9 a.m. Physics for the Life Sciences at the University of Michigan

Invited – Timothy A. McKay, University of Michigan, Ann Arbor, Mi 48109-1120; tamckay@umich.edu

In 2006 the University of Michigan Department of Physics began reforming our Introductory Physics sequence for life science and pre-professional students. The new course we have created, Physics for the Life Sciences, is a two-semester sequence focusing on the physical principles that are most important for living systems. This sequence, with its accompanying labs, has now replaced our traditional algebra-based track, and enrolls around 900 students per term. Rather than a traditional textbook, the course utilizes a coursepack of original material created at Michigan, all of which is available to those interested in seeing what we've done. In this presentation I will describe the organizing goals of our new course, provide an outline of its general content, and present a summary of student and faculty responses to this new approach.

AF04: 9-10 a.m. Introductory Physics for the Pre-Physical Therapist

Poster – Nancy Beverly, Mercy College, Dobbs Ferry, NY 10522; nbeverly@mercy.edu

Students preparing for Physical Therapy graduate programs typically are required to take the same two semesters, with laboratory, algebra-based introductory physics sequence that many pre-med students take. Although both student populations benefit from a focus on human functioning and biological processes, these student populations often have different academic preparation as well as different curricular needs. Comparative examples and curriculum modifications will be shown.

AF05: 9-10 a.m. Physics in Biomedicine: An Elective Course for Pre-Health Majors

Poster – Grace R. Van Ness, Portland State University, Department of Physics, Portland, OR 97201, vanness@pdx.edu

Ralf Widenhorn, Portland State University Department of Physics

We describe the curriculum development of the Physics in Biomedicine course at Portland State University. This course addresses a gap in the number of intermediate-level algebra-based physics courses for pre-health majors in the United States. The curriculum was developed by a physicist though the community engagement of students, physicians, clinical and basic science researchers. Course activities include a combination of regular and guest lectures, hands-on exercises, web-based activities, discussions, and a poster information session highlighting an aspect of physics in medicine at a local science museum. Demographic data revealed that the majority of students were biology majors, followed by science and physics majors. Approximately two-thirds of students were pursuing a career in medicine, while a smaller proportion of students were pursuing a career in scientific research. Furthermore, this course sparked motivation for continued self-study by engaging students into biomedical physics-related educational research projects.

Session AG: History and Strengthening of Physics Departments at HBCUs

Location: Bolden
Sponsor: Committee on Minorities in Physics
Co-Sponsor: Committee on History and Philosophy in Physics
Date: Monday, January 7
Time: 8–10 a.m.

Presiders: Ntungwa Maasha and James Lincoln

AG01: 8-8:30 a.m. Targeted Infusion and Enhancement of the Physics Program at Howard University

Invited – Prabhakar Misra, Howard University, Department of Physics & Astronomy, Washington, DC 20059; pmisra@howard.edu

The presentation will provide an overview of the programs and innovations currently under way to increase student retention and enrollment in the Department of Physics & Astronomy at Howard University. The targeted infusion effort involves upgrading of instructional facilities, offering peer student stipends for tutorial programs, and making available student-centered recruitment scholarships. The expected outcome will be better-prepared students completing courses in a timely manner and an enhanced learning experience within the department. Such targeted initiatives will help address both retention and enrollment of physics majors and also help expand the department's outreach efforts.

AG02: 8:30-9 a.m. The Development of Physics at Spelman College

Invited – Derrick J. Hylton, Spelman College, Atlanta, GA 30314; dhylton@spelman.edu

Sharah Yasharahla, Spelman College, Physics Department

Spelman College is an HBCU for women with approximately 2100 students. This talk will highlight the history of the Physics Department at Spelman College from its beginning in 1991 to the present. We focus on the increase from one to five faculty members, the growth of physics research, and the creation of curricula based on physics education research, as well as some of the plans for the future. We will also discuss the building of an environment that serves our students well and lessons learned in our development that will be useful to others in attracting and retaining students that are members of under-represented groups.

AG03: 9-9:30 a.m. Physics at the Mico University College – Jamaica's Oldest HBCU

Invited – Patrick D. Stephens, Mico University College, Kingston, 00006 Jamaica; amadeusorama@gmail.com

This presentation gives a brief history of the Mico University College, often described as the oldest teacher training institution in the Western Hemisphere. It then seeks to locate the Teaching of Physics at this institution within that historical context including a review of the physics curriculum changes over time. The present physics curriculum is discussed and its structure, emphases, and objectives are highlighted along with some of the major problems encountered in its delivery. Plans for the future development of Physics Teaching at the institution are also presented.

AG04: 9:30-10 a.m. Physics at Xavier

Invited – Frank R. Wesselmann, Xavier University of Louisiana, New Orleans, LA 70125; fwesselm@xula.edu

Dean Richardson, Xavier University of Louisiana

Xavier University of Louisiana is the only Catholic HBCU in the country, and it is a private institution. This creates a very unique campus environment and comes with a similarly unique set of challenges. Yet, Xavier routinely ranks highest in the nation in the number of African Americans earning Bachelor degrees in physics. I will present an overview of our programs, our department, and the university to illustrate our approach and methods.

Session AH: Implementation and Assessment of Physics by Inquiry

Location: Oliver
Sponsor: Committee on Teacher Preparation
Date: Monday, January 7
Time: 8–10 a.m.

Presider: Paula Heron

AH01: 8-8:30 a.m. The Effectiveness of Physics by Inquiry to Teach the Cause of Moon Phases

Invited – Kathy C. Trundle, The Ohio State University, Columbus, OH 43210; trundle.1@osu.edu

This investigation compared the effectiveness of the Physics by Inquiry Astronomy by Sight instruction at achieving desired conceptual change among early childhood preservice teachers (n = 157). Three different treatments employed the Physics by Inquiry instruction on moon phases and used data students collected from: (1) a planetarium software program, Starry Night, (2) nature observations and Starry Night, or (3) nature observations alone. Data sources included drawings and intensive interviews. Non-parametric tests of significance revealed that pre- to post-instruction gains were significant for all three treatments across all concepts. The Starry Night-Only treatment demonstrated statistically greater gains for sequencing moon phases than the other two treatments. However, there were no significant differences among the three treatments in regard to participants' abilities to draw scientific moon shapes or in their conceptions of the causes of moon phases. Thus, the three treatments were equally effective in facilitating desired conceptual change.

AH02: 8:30-9 a.m. PbI as a First-Year Experience for Underprepared Physics Majors

Invited – James C. Moore, Coastal Carolina University, Conway, SC 29528-6054 moorejc@coastal.edu

Louis J. Rubbo, Coastal Carolina University

A large percentage of freshman physics majors at Coastal Carolina University (CCU) enter underprepared in mathematics and scientific abilities. These students are otherwise talented, though lacking in preparation, and it is exactly these types of students that we should strive to retain within the STEM pipeline. In this talk, we will discuss the implementation and assessment of Physics by Inquiry (PbI) as a freshman first-year experience for our majors. We present an adaptation of the PbI curriculum that includes an explicit approach to scientific abilities and reasoning. Specifically, we discuss the implementation of pre-class micro-lectures, lab notebooks, and authentic research experiences at the end of major learning units. The combination of PbI with simulated cognitive apprenticeship experiences results in significant gains on the Lawson's Classroom Test of Scientific Reasoning, greater retention, and increased success in the subsequent calculus-based introductory course.

AH03: 9-9:30 a.m. Effects of Inquiry-based Pedagogical Approaches on Student Learning

Invited – Jennifer Esswein, Tennessee Department of Education, 710 James Robertson Pkwy, Nashville, TN 37243; jennifer.esswein@tn.gov

Bruce Patton, The Ohio State University

Physics by Inquiry has been evolving at The Ohio State University for over two decades, starting from the University of Washington framework. The changing of national-level standards, equipment options, staff involvement, online possibilities, and experimental innovations have all played a role in the format of the current series of courses offered as a key part of K-12 teacher preparation. In addition, increased focus on relevant research in cognitive science and the development of higher order conceptual thinking has been used to optimize the impact on student reasoning, as well as the learning of core science concepts through various pedagogical approaches. Findings from multiple studies concerning various aspects of the inquiry-based instruction are presented showing impacts not only on students' content knowledge gain, but also changes in students' ability to reason scientifically.

AH04: 9:30-10 a.m. Using PbI to Teach Science as a Process

Invited – Karen Cummings, Southern Connecticut State University, New Haven, CT 06511; cummingsk2@southernct.edu

Jeffrey Marx, McDaniel College

Over the past decade I have used parts of the Physics by Inquiry curriculum (PbI) in a wide range of introductory physics courses. I consider the PbI introduction to electric circuits to be one of the most worthwhile and versatile piece of science curriculum available. From nonscience majors in a general education course to physics majors in a calculus-based course, students are shown to gain a firm conceptual understanding of the material. Equally important is that the PbI activities engage students at all levels in tasks directly related to critical thinking and the development of scientific models. In this talk I will present conceptual learning and attitudinal assessment results for a range of populations and justify the statements that I make above. I will call on our community to begin a more explicit and sustained dialog about appropriate goals for the science courses we offer to nonscience majors.

Session AI: Models of Lab Instruction/Curricula from Around the World

Location: Ory
Sponsor: Committee on Laboratories
Co-Sponsor: Committee on International Physics Education
Date: Monday, January 7
Time: 8–9:50 a.m.

Presider: Gabe Spalding

AI01: 8-8:30 a.m. Physics Laboratory Curriculum and Teaching Practice at Fudan

Invited – Yongkang Le, Department of Physics, Fudan University, Shanghai 200433 China; yongkangle@gmail.com

In comparison, the graduates from Chinese universities are often considered to be well-prepared in theory and computation, but poorly trained in laboratory practice. It is the unshirkable resposibility of the faculties in charge of laboratory courses to change the situation. With the increasing support from the authority, we undertook changes during the past decade: including optimizing the laboratory curriculum, establishing new teaching laboratories, improving the teaching method, etc. This talk will cover the following topics: 1. Brief introduction of the physics undergraduate program and physics education related conferences in China. 2. Physics laboratory courses offered at the physics teaching lab of Fudan Univeristy and our consideration on students' ability development in a physics teaching lab. 3. Our transform on the laboratory curriculum and teaching practice at Fudan aiming to integrate as much research element into teaching.

AI02: 8:30-9 a.m. Particle Traps in Modern Physics Education

Invited – Klaus D.A. Wendt, University of Mainz, Mainz, D 55122 Germany; klaus.wendt@uni-mainz.de

Techniques to trap charged and neutral species, i.e. ions, atoms, and elementary particles, are essential tools for the tremendous progress in quantum physics and state-of-the-art applications. In particular electrically charged particles are easily confined by overlaying ac and dc electric fields in "Paul Traps." This technique can be impressively demonstrated by constructing and analyzing simple traps for macroscopic particles, i.e. lycopodium seeds, which is possible in the classroom — even as hands-on experiments. In this way, stimulating tutorials on various aspects of modern physics, including quantum optics and quantum computing, accelerator physics or antimatter handling according to Dan Brown's *Illuminati*, can be significantly enriched. We discuss educational versions of "Paul Traps" with different geometries, constructed for the purpose of education, visualization and as exhibits — mostly with commercially available parts, and present a particle accelerator model and the antimatter trap model of the permanent exhibition "Univers de particules" at CERN, Geneva.

AI03: 9-9:30 a.m. Low-Cost Hands-on Research in the Developing World

Invited – Mark D. Shattuck, The City College of New York, New York, NY 10031; shattuck@ccny.cuny.edu

The Hands-On Research in Complex Systems Schools[1] are designed to introduce graduate students and young faculty from developing countries to table-top scientific research on problems at the frontiers of science. Experiments on physical, chemical, and biological systems are conducted with modern yet inexpensive digital instrumentation, and the laboratory work is complemented by mathematical modeling and data analysis using Matlab. The two-week-long schools provide an interactive experience with hands-on research involving experiments with real-time computer data acquisition and associated computational modeling. Lectures and hands-on experiences focus on complex systems in the physical and life sciences. This research is inherently interdisciplinary, and topics range from biological networks to spatial patterns in fluids to laser chaos.

1. Sponsored by The Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste, Italy) and the National Science Foundation.

AI04: 9:30-9:40 a.m. International Comparison of an Online Medical Physics Laboratory

Contributed – Ralf Widenhorn, Portland State University SRTC, Portland, OR 97201; ralfw@pdx.edu

Heike Theyßen, Sarah Struzyna, Universität Duisburg-Essen, Germany

Christin Heinze, Heinrich-Heine-Universität Düsseldorf, Germany

Elliot Mylott, Portland State University

We will describe the results of a comparative study conducted at the Heinrich-Heine University (HHU) in Düsseldorf, Germany and Portland State University (PSU). The physics practicum for medical students at the HHU has used online laboratories since 2003. Students have the choice of attending the regular laboratory or to conduct the experiment using the multimedia online learning environment. On average 30 percent of the students take at least one of the online learning modules during the course of the practicum. In 2012, we transferred the learning module on geometrical optics and the human eye to Portland State University, where it was used for a laboratory for pre-health majors. During a pilot study in 2012 we compared the results of 45 students at HHU and 34 students at PSU. The assessment includes: pre- and post-tests, demographic information, and students' opinion and use of the online learning module.

AI05: 9:40-9:50 a.m. Science Teaching Program for Students of Low Socioeconomic Status

Contributed – Jiyeon Park, Seoul National University, Gwanak-gu Seoul, Seoul 151-748 Korea; pjy13638@snu.ac.kr

Dongryul Jeon, Seoul National University

Helping students with socioeconomic disadvantage is important not just for the individuals but also for the society because the society can have a larger talent pool. We have been running a program to help middle school students of low socioeconomic status with mathematics, science, and writing. We selected students based on their school teacher's recommendation just before they graduated from the elementary school. In addition to teaching subject contents, we also have mentors who are in charge of free classes that are designed to help students with all kinds of questions from school subjects to personal matters. We plan to have students stay in the program for two years during their first and second grade, with exceptions for a few top students who will enter the third year when we will help them to apply to science high schools. We want to share and discuss our experience at the meeting.

Ceremonial Session I: Oersted Medal, Edward F. Redish
DSC Awards
SPS Award

Location: Celestin Ballroom I-III
Date: Monday, January 7
Time: 10:30 a.m.–12:30 p.m.

Presider: Jill Marshall *Presenter: David Sokoloff*

Joe Redish

Oersted Medal Presented to Edward F. (Joe) Redish

Edward F. (Joe) Redish, University of Maryland, Department of Physics, College Park, MD 20742-4111; redish@umd.edu

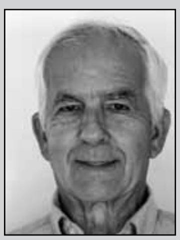
The Implications of a Theoretical Framework for Physics Education Research (PER)

Much of PER focuses on how to teach physics more successfully. But for many of us, our interest in PER is "curiosity driven." PER lets us apply our scientific skills to a new field, one that plays a pivotal role in the construction and evolution of our profession. It permits us to study such intellectually engaging questions as, "What does it mean to understand something in physics?" and, "What skills and competencies do we want our students to learn from our physics classes?" To address questions like these we need to do more than observe student difficulties and build curriculum. We need a theoretical framework — a structure for talking about, making sense of, and modeling how one thinks about, learns, and understands physics. This necessarily involves us in the complex and subtle issues of mind and society. In this talk I will outline the *Resources Framework*, a way of creating a phenomenology of physics learning that ties closely to modern developments about how people think and learn from research in neuroscience, psychology, and linguistics.

Homer L. Dodge Citations for Distinguished Service to AAPT

presented to:

A. James Mallman, Sarah (Sam) McKagan, and Stanley Micklavzina



A. James Mallmann

Sam McKagan

Stan Micklavzina

Ajay Narayanan

SPS 2012 Outsanding Chapter Advisor Award

presented to: Dr. Ajay Narayanan, Green River Community College

The Society of Physics Students Outstanding Chapter Advisor Award 2012 goes to Dr. Ajay Narayanan from Green River Community College Department of Physics & Astronomy, Auburn, WA. This award is the highest recognition of an SPS chapter advisor who has made exceptional contributions toward promoting student leadership, developing and inspiring a broad spectrum of activities, and inspiring enthusiastic student participation. Ajay received his PhD in physics from University of Arizona in 1997 in experimental particle physics. After finishing his PhD, he turned his attention to full time teaching. After serving for one year as an adjunct instructor at the University of Arizona, he joined the GRCC Physics and Astronomy department in 2000. Ajay has been involved with the SPS since his graduate school days. He has been the chapter advisor at Green River Community College since 2003 and has served two terms as Zone Councilor on the SPS National Council. Having an SPS chapter at a two-year college presents significant challenges, but despite this, the GRCC chapter has been named an Outstanding SPS Chapter for the last 8 years, and has received multiple Marsh White Outreach Awards and SPS Student Leadership Scholarships. Several GRCC students have served on the SPS National Council as Associate Zone Councilors. Among the words written on behalf of Ajay, we find evidence of his effectiveness in his role as teacher and advisor: "*Ajay is a caring leader, who encourages students to step outside of their boundaries and construct a strong foundation for leadership, not only for GRCC students but future college students.*"

Session BA: Teaching in High Schools of Districts with Limited Resources

Location: Bucktown I
Sponsor: Committee on Minorities in Physics
Date: Monday, January 7
Time: 2–3 p.m.

Presider: Peter Muhoro

BA01: 2-2:30 p.m. Lending a Helping Hand: Making Learning Possible in Resource-Poor Schools

Invited – Anderson Sunda-Meya, Xavier University of Louisiana, New Orleans, LA 70125; asundame@xula.edu

We describe the four-year collaboration and partnership between the Physics Department at Xavier University of Louisiana and some local high schools. In the 2011-12 school year, 90 percent of public school students in New Orleans were African American and 85 percent were eligible for the federal free or reduced-price lunch program. This project is a service learning undertaken by students in the Introductory General Physics class. Teams of three to six students work with one teacher for the entire semester to tutor students, or run experiments in science classes. These service-learning activities are designed to integrate science, education, research, and civic engagement. We will highlight the results and the challenges faced in this service-learning project.

BA02: 2:30-3 p.m. Engaging Secondary Students in Physics Understanding Using Local Hardware Stores

Invited – Duane B. Merrell, Brigham Young University, Provo, UT 84602; duane_merrell@byu.edu

Ideas for engaging secondary physics student with low cost, to no cost equipment that is available to everyone. We will see the equipment in use through video of students and teachers using the equipment. Motion labs with paper drag racers Newtons Laws with paper and pop bottle rockets Impulse momentum with pumpkins and clay pigeons, eggs Waves with a variable speed drill and more.

Session BB: Outreach Conducted by SPS and SPS Undergraduate Research and Outreach

Location: Bucktown II
Sponsor: Committee on Physics in Undergraduate Education
Date: Monday, January 7
Time: 2–3:30 p.m.

Presider: Toni Sauncy

BB01: 2-2:30 p.m. Science Outreach Through SPS Chapters at Two-Year Colleges

Invited – Ajay Narayanan, Green River Community College, Auburn, WA 98092-3622; anarayanan@greenriver.edu

Two-year colleges are well positioned to communicate the opportunities provided by higher education to the local community. Students, staff, and faculty at the Green River Community College physics and astronomy department have been involved in outreach for many years. Our SPS chapter in particular has excelled at conveying the excitement of science to elementary school children. This presentation will touch upon some details of our experience in taking science to the community.

BB02: 2:30-3 p.m. SPS Science Outreach Catalyst Kits

Invited – Melissa M. Hoffman, Society of Physics Students, 86 Brookview Dr., Woodland Park, NJ 07424; mhoffman1@drew.edu*

Meredith Woy, Society of Physics Students

Every year the Society of Physics Students (SPS) produces a Science Outreach Catalyst Kit (SOCK) to be used by SPS chapters throughout the country to start up or stimulate community engagement. This year the theme of the SOCK is "Fabric of the Cosmos," inspired by the Brian Greene book and NOVA documentary of the same name. The Fabric of the Cosmos Kit explores the "Cosmic" invisible fields of gravity and magnetism. To explore systems and phenomenon related to gravity, the SOCK includes a large piece of Spandex and various spheres of different sizes and densities. To explore magnetic fields and forces, the SOCK includes several different types of magnets such as bar magnets and multi-pole magnets. An added bonus, ferrofluid is also included in the kit for further explanation. The prepared lessons are geared to accommodate a range of grade levels, from third grade to college level.

*Sponsor: Toni Sauncy

BB03: 3-3:10 p.m. A Model of Transient Response and Persistent-Photoconductivity in Al:ZnO:Al Planar Structures

Contributed – Laura R. Covington, Coastal Carolina University, Conway, SC 29528-6054; lrcoving@g.coastal.edu*

James C. Moore, Coastal Carolina University

We have investigated the photoconductivity and transient response of polycrystalline thin films grown via thermal oxidation of dc sputter deposited Zinc metal films. Ultraviolet photodetectors of a metal-semiconductor-metal planar structure were fabricated via sputter deposition of aluminum contacts. When exposed to ultraviolet light, ZnO photodetectors respond by a primary sharp increase in photoconductivity, followed by a more gradual rise to the point of saturation. When the photodetectors are removed from electromagnetic radiation, typical relaxation times for decreasing photocurrent are observed to be in the range from hours to several days, in a phenomenon known as persistent photoconductivity. By isolating specific growth characteristics, we were able to determine several critical factors that may be controlled in an effort to manipulate the occurrence of persistent photoconductivity. Additionally, we present a phenomenological model of photoconductivity transients, in which transient recoveries are fitted with a linear combination of two exponential decay functions.

*Sponsor: James C. Moore.

BB04: 3:10-3:20 p.m. Adverse Effects of Malathion on Brine Shrimp

Contributed – Sarthak Garg, Little Rock Central High School, Little Rock, AR 72211; gargsarthak@yahoo.com

Malathion is the most widely used insecticide in the United States. Once introduced into the ecosystem, it bio-accumulates through the food chain. Artemia salina, brine shrimp is a common bio-indicator, used in this study to evaluate the effects of malathion. The shrimp exposed to the 24h-LC50 of malathion (140ppm) and a sublethal dose (25ppm) for different durations showed a time- and dose-dependent decrease in proteins. The proteins separated by SDS-PAGE showed that some proteins were over-expressed as a reaction to malathion. SEM studies showed that malathion adversely affected morphology. Elemental analyses revealed a time-dependent increase of oxygen and sulfur suggesting that malathion accumulated in the brine shrimp. The bio-accumulation of malathion in brine shrimp can lead to bio-magnification and seriously affect the food chain. These results can be used to increase public awareness and help the USDA and U.S. Environmental Protection Agency (EPA) decide on new pesticide regulations and uses.

BB05: 3:20-3:30 p.m. Is Big Time "Wraslin" Real or Choreographed?

Contributed – Thomas F. Haff, Issaquah High School, 700 2nd Ave. SE, Issaquah, WA 98027-4319; Hafft@issaquah.wednet.edu

Is Big Time "Wraslin" real? This activity/demo with students uses pork blade steaks and Vernier Motion Detectors to indirectly measure accelerations and thus forces when one steak collides with another. As the students file into class I make sure that they do not step on my "dinner." Their curiosity is stimulated wondering what is going to happen with the steaks. By using data, the students calculate the force required to stop the steak when one free falls to a collision with another steak on the ground. This is modeled and extrapolated to a "wrasler" jumping off a corner turnbuckle and doing a deep-knee drop onto an opponent's spine. Slow motion "wraslin" is viewed and analyzed. It is a fun and motivating way to get the students to measure velocities, accelerations, and forces to determine whether the sport is choreographed or not.

Session BC: Cultural Perspectives on Physics Education

Location: Jackson
Sponsor: Committee on International Physics Education
Date: Monday, January 7
Time: 2–3 p.m.

Presider: Kenneth Cecire

BC01: 2-2:30 p.m. Italian IBL Cultural Perspective Designed Vertical Path on Electromagnetism

Invited – Stefano Vercellati, Research Unit in Physics Education, Dept. of Chemistry, Physics and Environmen, University of Udine via delle scienze, 208 Udine, UD 33100 Italy; stefano.vercellati@uniud.it

Marisa Michelini, Lorenzo G. Santi, Research Unit in Physics Education, Dept. of Chemistry, Physics and Environment, University of Udine

A research-based educational path on electromagnetism was experimented in different contexts (formal / informal) with students of different school levels (from primary to secondary school). In the framework of design-based research the learning path was developed as a corridor in vertical perspective, starting from an analysis of the theoretical framework of the classical electromagnetism and its historical foundation. This cultural perspective was implemented in IBL paths in which the experimental exploration takes an epistemic role in giving experience and meaning of what is an experiment in the physical culture, focusing on building the formal thinking and on the methodological aspects. Empirical research results of the intervention experiments carried out in Italy offer guidelines for teaching at different levels and in particular in secondary school.

BC02: 2:30-2:40 p.m. Comparing U.S. and Chinese High School Physics Teaching in Terms of the Use of Inquiry

Contributed – Sachiko Tosa, Wright State University, Dayton, OH 45435; sachiko.tosa@wright.edu

Lingbo Qian, Cambridge International Centre of Eton School

Inquiry-based teaching has been emphasized in the United States as well as in China. This study examines the extent to which inquiry-based teaching is practiced in Chinese high school physics in comparison with U.S. high schools. Data were collected through lesson observations and a teacher survey (N=19). Results show that both U.S. and Chinese teachers are well aware of the importance of inquiry-based teaching. However, in practice, little inquiry-based teaching was observed in the two countries by different reasons. U.S. physics lessons often lacked developing student understanding of physics concepts through thought-provoking questions, while many of the Chinese lessons failed to include opportunities for students to present and test their own ideas. Implications of the findings to improve teacher education in both countries are discussed.

BC03: 2:40-2:50 p.m. A Young Chinese Adult Non-Scientist's Epistemologies and Understandings of Speed

Contributed – Ying Cao, Tufts University, Medford, MA 02155; ying.cao@tufts.edu*

In science education studies, researchers have thoroughly investigated the epistemologies held by students who are learning science (e.g., Hammer, 1994; Hammer, Elby, Scherr, & Redish, 2005). The research findings, however, have yet to be applied to individuals who are not currently enrolled in science classes. Additionally, these studies have primarily focused on individuals from Western cultures and who are native English speakers. In this paper I examine an individual with different characteristics to see whether the research claims in relation to students' epistemologies still apply. The findings show that previous theoretical frameworks can be used to explain the epistemologies of the individual examined in this study. The case suggests that the explanatory power of the theories may be extended to individuals regardless of the learner's science background, language, education experience, and cultural background. Tentative educational suggestions are proposed at the end of this paper.

*Sponsor: David Hammer

BC04: 2:50-3 p.m. Helping Teachers Learn to Frame Classroom Discourse for Optimal Learning

Contributed – Colleen Megowan-Romanowicz, Arizona State University, Tempe, AZ 85282; megowan@asu.edu

In negotiating a classroom culture that values thinking over answer-getting, teachers must engage in "expectancy violation" with their students early and often in order to bring about new socio-scientific norms in their classroom. If they do not deliberately attend to culture building, the default culture (that values right answers, points, and A's) will certainly prevail. School is a game that students know how to play; to get them to play it a different way, we must change the game. Teachers enrolled in a content-intensive, sustainability-themed Middle School STEM Master of Natural Science program examine the cognitive science literature as they come to grips with the inherent challenges and opportunities that characterize the learning game in a discourse-intensive learning environment. They are learning to play a different game — the "Modeling Game" and in the process learning to negotiate a new cultural paradigm that moves students toward taking responsibility for collective sense-making.

Session BD: Astronomy and Earth Science as a Context for Education Research

Location: Foster
Sponsor: Committee on Space Science and Astronomy
Date: Monday, January 7
Time: 2–3:30 p.m.

Presider: Joe Heafner

BD01: 2-2:30 p.m. Teaching Astronomy Inspired by Education Research

Invited – Janelle M. Bailey, University of Nevada, Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154-3005; janelle.bailey@unlv.edu

You've heard about astronomy education research (AER). You think something about this might be able to inform your own teaching. But how can you learn about this field without being overwhelmed? What critical background information do you need to know to be able to use research results in your own classroom? Perhaps you want to conduct your own research and contribute to this growing area but don't know where to begin. Focusing on the astronomy or earth science instructor who isn't doing AER but wants to understand the field as a way of improving your teaching, this talk will present an overview of these questions (and their answers!), enlighten you about helpful resources, and prepare you for some of the ideas discussed in the next two papers in the session.

BD02: 2:30-3 p.m. Teaching Astronomy as Knowledge Construction

Invited – Doug Lombardi, Temple University, Philadelphia, PA 19122; doug.lombardu@temple.edu

You have probably heard about it: constructivism — or more simply student knowledge construction. Although there are many variants of constructivism, a basic tenant is that students are active (e.g., cognitively active) learners seeking to make meaning. Constructivist instructional practices are often thought of as "student-centered." Active student knowledge construction is often pitted against the more traditional didactic — or "teacher-centered"— instruction. Despite the call from educational research for instructors to incorporate learner-centered strategies into the classroom, didactic methods persist, perhaps due the perceived efficiency of direct information transmission. This presentation will discuss some research-based examples of effective instructional strategies that promote knowledge construction and deep learning about astronomy topics. You do not need to fear constructivism anymore!

BD03: 3-3:30 p.m. Teaching Problem-Solving and Reasoning in Astro101

Invited – Thomas Foster, Southern Illinois University, Edwardsville, Department of Physics, Edwardsville, IL 62026-1654; tfoster@siue.edu

Astronomy is a captivating science, and to be a science it must be taught as more than pretty pictures. For example, the color of the "leading" edges of spiral arms is blue, but why? And for how long? Do you ask these probing questions? Do the students know what is expected for an answer? Science demands evidence-based reasoning, solving problems from basic principles, and the use of mathematics. As an astronomy teacher, you might be imagining your course enrollment plummeting with each of those words. What percentage of students will drop the course because I said "math"? Ironically, it is exactly that type of thinking students should be getting out of their science classes, but don't. This presentation will give a few suggestions on how to teach your students principle-driven, evidence-supported answers. Given that astronomy is captivating, perhaps it is the perfect class to slip in some scientific thinking.

Session BE: Integrating Math & Science to Prepare Pre-College Teachers

Location: Bechet
Sponsor: Committee on Physics in Pre-High School Education
Date: Monday, January 7
Time: 2–3 p.m.

Presider: Patricia Seivert

BE01: 2-2:30 p.m. Physics and Geometry Activities for Preservice Middle School Teachers

Invited – Paul J. Dolan, Jr., Northeastern Illinois University, 5500 N. St. Louis Ave., Chicago, IL 60625; p-dolan@neiu.edu

Panagos Papageorgiu, Wright College

Heather Patay, Wayne Landerholm Northeastern Illinois University

Where's the Geometry in Physics? What happens when both are taught together? The MSTQE Program at NEIU is an integrated Math-Science program for preparing middle school math and science teachers. The program is especially aimed at the urban environment (Chicago Public Schools) and for inclusion of under-represented groups. The program is a collaboration between NEIU and two of the City Colleges of Chicago (Wright & Truman Colleges). Graduates receive an endorsement in Middle School Math and Science. Physics and Geometry are taught together; physics uses traditional and nontraditional labs and activities. Each core content course consists of a linked course-pair, the science taken concurrently with a pertinent math course, emphasizing the math-science and interdisciplinary connections, and using inquiry activities. This talk will focus on this link, from the point of view of a physicist; the companion talk will focus on this link from the point of view of a mathematician.

BE02: 2:30-3 p.m. Geometry and Physics Activities for Preservice Middle School Teachers

Invited – Panagos Papageorgiu, Wright College, 430 N. Narragansett Ave., Chicago, IL 60634; panagospap@comcast.net

Paul J. Dolan, Jr., Heather Patay, Wayne Landerholm, Northeastern Illinois University

Where's the Physics in Geometry? What happens when both are constructed together? The MSTQE Program at NEIU is an integrated Math-Science program for preparing middle school math and science teachers. The program is especially aimed at the urban environment (Chicago Public Schools) and for inclusion of under-represented groups. The program is a collaboration between NEIU and two of the City Colleges of Chicago (Wright & Truman Colleges). Graduates receive an endorsement in Middle School Math and Science. Geometry and physics are taught together; geometry is taught using classical Euclidean constructions. Each core content course consists of a linked course-pair, the math taken concurrently with a pertinent science course, emphasizing the math-science and interdisciplinary connections, and using inquiry activities. This talk will focus on this link, from the point of view of a mathematician; the companion talk will focus on this link from the point of view of a physicist.

Session BG: Recruiting and Retaining Physics Students

Location: Johnson
Sponsor: Committee on Women in Physicsn
Co-Sponsor: Committee on Physics in Undergraduate Education
Date: Monday, January 7
Time: 2–2:50 p.m.

Presider: Kathleen Falconer

BG01: 2-2:10 p.m. Networking Nights: A Tool to Improve the Retention of Women

Contributed – Jolene L Johnson, University of St. Catherine, 2004 Randolph Ave., St. Paul, MN 55105; jljohnsonarmstrong@stkate.edu

For the past five years Women in Physics and Astronomy (WiPA) at the University of Minnesota has organized a women in physics undergraduate event that brings together students from up to 15 different institutions to network and learn about opportunities in physics and related fields. Many small colleges in the area have small physics departments with only a handful of female majors. This can lead to female students feeling isolated within their departments. We developed this annual event to both overcome some of this isolation and allow students to explore future education and career options in physics and engineering. In this talk I will present the most effective format we have discovered for these events, and well as outcomes and feedback.

BG02: 2:10-2:20 p.m. Project W.I.S.E. – Recruiting Students into S.T.E.M.-Fields by Community Service

Contributed – Gregory A. DiLisi, John Carroll University, University Heights, OH 44118; gdilisi@jcu.edu

We describe the design and implementation of our Project W.I.S.E. partnership, a multi-institutional collaboration that assembles interdisciplinary teams of high school students charged with developing S.T.E.M.-focused community youth-programs. Our goal is to promote young women's interest in S.T.E.M. through an early, positive exposure to informal science education. The project serves as a model of how high schools can collaborate with universities and informal learning centers to build strong, successful youth-program partnerships that serve the local community. Our project is innovative in its youth-development strategies, the targeting plan for diverse audiences, and the focus on women's contributions to aviation and space flight. The project also gives high school students rare but powerful opportunities to contribute directly to the quality of life in their community and to work in multi-disciplinary, multi-generational teams.

BG03: 2:20-2:30 p.m. Using Invention Sequences to Narrow the Achievement Gap in Introductory Physics

Contributed – Suzanne White Brahmia, Rutgers University, Serin Physics Laboratory, Piscataway, NJ 08850; brahmia@physics.rutgers.edu

Andrew Boudreaux, Western Washington University

Stephen Kanim, New Mexico State University

Physics instruction typically emphasizes mathematical formalism, often at the expense of sensemaking. Too many students resort to memorization strategies, approaching physics as a match-the-equation activity. Invention tasks, originally developed by Schwartz et. al. and adapted to physics contexts, present students with open-ended situations in which they must work in groups to devise ways to mathematically characterize physical situations. These tasks provide a bridge between the mathematical procedures ubiquitous in physics and a conceptual understanding of the principles that underlie them. A collaboration between Rutgers, WWU, and NMSU has developed sequences of invention tasks designed to develop mathematical reasoning skills that are expected and often lacking in introductory physics students. Because socioeconomically disadvantaged districts often have weak mathematics programs in the middle and high school levels, these tasks seem to be particularly beneficial to students from underrepresented groups. We present early results on this work with mathematically underprepared and female students.

BG04: 2:30-2:40 p.m. Teaching and Organizing for Success

Contributed – Daryao S Khatri, The University of the District of Columbia, Washington, DC 200008, dkhatri@udc.edu

Anne O. Hughes, Gateway Academic Program, Inc.

In teaching College Physics I and II and several other advanced courses, we have discovered that three strategies are critical to maximize students' success and retention. The first is the inductive method of teaching that includes engaging students with professors continuously during lectures and/or presentations. The second one is the physical organization of the content by both professors and students in a 3-D-ring binder. The third one is the organization of teaching and students' assessment into eight categories: (1) review of critical math skills; (2) review of course skills; (3) list of topics to be taught for a given topic or chapter; (4) classroom problems; (5) points to remember; (6) exit questions; (7) practice homework; and (8) priming homework. The first five topics are included on a daily and/or chapter agenda, and the last three are included on a separate student handout. We will share data that have been collected over a period of five years for students' evaluations and their successes and retention.

BG05: 2:40-2:50 p.m. Introductory Calculus-based Physics for Underprepared Students

Contributed – Dean Richardson, Xavier University of Louisiana, 1 Drexel Drive, New Oleans, LA 70125; drichar7@xula.edu

Part of the mission of Xavier University of Louisiana is to admit some students who are not fully prepared for the rigors of college-level courses. A different approach is needed in order for these students to reach the necessary level of competency by the time they graduate. Some of the methods used in our introductory physics sequence for physics majors will be discussed. These include specific implementations of in-class problem solving, detailed lab reports and homework.

Session BH: Preparing Teachers for Technology Needed in Teaching Physics

Location: Oliver
Sponsor: Committee on Teacher Preparation
Co-Sponsor: Committee on Educational Technologies
Date: Monday, January 7
Time: 2–3:40 p.m.

Presider: Connie Wells

BH01: 2-2:30 p.m. Technology Integration as a Means to Enhance Teaching and Learning

Invited – Howard M. Glasser, Knowles Science Teaching Foundation, 1000 N Church St., Moorestown, NJ 08057; glasserh@gmail.com

Technology changes rapidly and it can be challenging for physics teachers and teacher preparation programs to keep pace. It is especially difficult to find ways to meaningfully incorporate digital resources into instruction in ways that enhance teaching and learning. This talk will focus on how teachers and teacher preparation programs can address this issue. I will share ways they can integrate digital resources into their classes in ways that will further develop students' skills in broad areas that transcend specific science content. These skills can include things like collaborating, communicating, and demonstrating understanding. Teachers will be able to better enhance and assess students' content knowledge using various digital resources if they can learn how technology can be used to develop these broader skills.

BH02: 2:30-3 P.M. Physics Teaching 2.Uh-Oh

Invited – Frank Noschese, John Jay High School, 60 North Salem Rd., Cross River, NY 10518; fpn1@cornell.edu

Physics teachers have always been ahead of the curve when teaching with technology. But are we using technology the best way possible? How can we help prepare new physics teachers to effectively incorporate technology in their instruction? We'll take a critical look at popular tech tools like YouTube, probeware, interactive whiteboards, video games, etc. in the classroom and beyond.

BH03: 3-3:30 p.m. Preparing Our Future High School Physics Teachers for Their Physics Classrooms

Invited – David S. Jones, Florida International University, 11200 SW 8th St., Miami, Fl 33199; djones@fiu.edu

My own personal physics teaching journey has given me many teaching experiences that have informed my views on teaching physics and informed my views on the use of technology in the high school physics classroom. I will discuss some of the following questions and ideas in my talk. What does "technology" look like in a high school classroom? What are appropriate uses for "Hi Tech" or "Low Tech" teaching activities for the high school classroom? How to enhance already established good physics teaching ideas with a little technological tweak. I will also provide some input on how to better prepare future teachers on the challenges that they will face in a high school teaching environment and comment on the skills needed in order to negotiate their new world of the physics classroom and the physics lab stockroom.

BH04: 3:30-3:40 p.m. TYC-New Faculty Experience: Professional Development with Technology Applications*

Contributed – Todd R. Leif, Cloud County Community College, Concordia, KS 66901; tleif@cloud.edu

Scott R. Schultz, Delta College, University City, MI

The American Association of Physics Teachers has developed an 18-month experience to transform undergraduate physics programs at two-year colleges by developing newly hired physics instructors. The program seeks to equip these new faculty members with the tools, skills, and theory of active engagement techniques that have been developed based on Physics Education Research and successfully implemented at Two-Year Colleges. This talk will discuss the professional development delivered to the participants specifically targeted at the inclusion of the technology applications that were demonstrated during the program experience.

*Funding supported by NSF grant # 0940857

PLENARY

The Universe's First Million Years: Primordial Light and Sound

Professor
Mark Whittle

Location: Celestin Ballroom I-III
Date: Monday, January 7
Time: 4–5 p.m.

Presider: Richard Gelderman

Mark Whittle, University of Virginia, Department of Astronomy, Charlottesville, VA 22904; dmw8f@virginia.edi

The Universe's first million years, compared to the Universe's current age, is equivalent to the first day in the life of a human. As you might expect, conditions in the embryonic Universe were radically different from those we find around us today. The matter was spread about almost uniformly; there was a brilliant omnidirectional glow of light; and vast sound waves surged through the foggy gas. Perhaps surprisingly, we know about these conditions in great detail thanks to the famous cosmic microwave background whose feeble radiation comes to us directly from that time. My lecture aims to take us back to the Universe's first million years so that we can "experience", or at least imagine, the conditions at that time. In particular, it has been possible to reconstruct the primordial sound waves and transpose them up in pitch by 50 octaves into the human audible range. Remarkably the primordial sound contains a fundamental tone, and a set of harmonics, reminiscent of a musical instrument. So, is the sound of creation beautiful and harmonious? Come to the lecture and decide for yourself.

CRK01: Physics and Society

Location: Bucktown II
Sponsor: Committee on Science Education for the Public
Date: Monday, January 7
Time: 6:30–7:30 p.m.

Presider: Steve Lindaas

Join your colleagues for an informal discussion of how AAPT members can contribute to the teaching of such physics-related societal issues as energy use, global warming, nuclear power, resource extraction, and pseudoscience.

CRK02: What Physics Means – Philosophy

Location: Bucktown I
Sponsor: Committee on History and Philosophy in Physics
Date: Monday, January 7
Time: 6:30–7:30 p.m.

Presider: Shawn Reeves

What physics means to instructors and what it means to students can be questions of philosophy, and we instructors may make the theoretical framework of physics more explicit in our instruction. This crackerbarrel is an open discussion of not only the philosophy of physics but philosophizing as part of learning and research. Everyone seeking or providing ideas on strengthening that learning should come, whether it be through habits of mind, eradicating pseudo-science, seeking principles or unification, expanding the scope of physics curriculum, practicing political or economic models, addressing cultural needs, or questioning the relationship between physics and other sciences.

PST1: Poster Session I

Location: Storyville Hall
Date: Monday, January 7
Time: 7:45–9:15 p.m.

Odd number poster authors should be present ***7:45-8:30 p.m.***
Even number poster authors should be present ***8:30-9:15 p.m.***
(Posters should be set up by 9 a.m. Monday and then taken down by 9:30 p.m. Monday)

A – Astronomy

PST1A01: 7:45-8:30 p.m. The Big Ideas in Cosmology

Poster– Kimberly Coble, Chicago State University, Department of Chemistry and Physics, Chicago, IL 60628; kcoble@csu.edu

Janelle M. Bailey, University of Nevada, Las Vegas

Laura E. Trouille, Northwestern University

Geraldine L. Cochran, Florida International University

Carmelita T. Camarillo, Melissa D. Nickerson, Donna Larrieu, K'Maja Bell, Chicago State University

Anne J. Metevier, Kevin M. McLin, Lynn R. Cominsky, Sonoma State University

Powerful new observations and advances in computation and visualization have led to a revolution in our understanding of the structure, composition, and evolution of the universe. These gains have been vast, but their impact on education has been limited. Determining the range and frequency of "alternative conceptions" is an important first step to improving instructional effectiveness. Through analysis of pre-instructional open-ended surveys (N = 1270), follow-up interviews (N = 15), and other assessments (N ~ 60), our research group has been classifying students' ideas about concepts important to modern cosmology, including the distances, structure, composition, age, expansion, and evolution of the universe. Informed by our research on student learning, we have created a series of web-based cosmology learning modules in which students master the scientific concepts and reasoning processes that lead to our current understanding of the universe, through interactive tasks, prediction and reflection, experimentation, and model building.

PST1A02: 8:30-9:15 p.m. Cosmology for Nonscience Majors by Using Web-based Apps

Poster – Daniel M. Smith, Jr., South Carolina State University, Orangeburg, SC 29115; dsmith@scsu.edu

Cosmology needs demonstrations and simulations for teaching just as other sciences because almost everyone is curious about the origin, contents, structure, and fate of the universe. Such instructional aids should partly lift the veil from a scientific process that seems mysterious enough that many people believe discoveries in cosmology to be arbitrary pronouncements. To help explain the discoveries of dark matter, dark energy, and inflation, several apps have been developed that run in a browser with the free Mathematica plug-in.
http://physics.scsu.edu/~dms/cosmology/home2.html
NSF PAARE/POCA Grant AST-0750814

PST1A03: 7:45-8:30 p.m. Modeling the History of Astronomy: Ptolemy, Copernicus, and Tycho

Poster – Todd K. Timberlake, Berry College, PO Box 5004, Mount Berry, GA 30149-5004; ttimberlake@berry.edu

The Copernican Revolution is an astronomy course for non-science majors at Berry College. The course begins with simulated observations of the night sky and then proceeds to an examination of several historical models that were proposed to explain these observations. This poster describes how students actively engage with computer simulations to gain a deep understanding of the Ptolemaic and Copernican models of our solar system. Sudents then have the opportunity to model their own unique planetary system. Each student receives a personalized Easy Java Simulations program depicting the motion of a "Sun" and several planets against background stars. Students make the measurements they need and then construct both Ptolemaic and Copernican models for their system. Students also investigate the relationships between the Ptolemaic, Copernican, and Tychonic models and evaluate these models in the context of early 17th cntury knowledge of astronomy and physics. More information is available at http://facultyweb.berry.edu/ttimberlake/copernican/.

PST1A04: 8:30-9:15 p.m. Introducing the Newtonian Gravity Concept Inventory

Poster – Shannon Willoughby, Montana State University, Bozeman, MT 59717; willoughby@physics.montana.edu

Kathryn Williamson, Montana State University

Ed Prather, University of Arizona

Multiple-choice Concept Inventories have become important tools in Astronomy Education Research for assessing student learning and the effects of instructional interventions. We introduce for the Newtonian Gravity Concept Inventory (NGCI), a 26-item research validated instrument to quickly and effectively assess introductory college astronomy students' understanding of gravity. The conceptual focus of the NGCI covers four conceptual domains: (1) Independence of gravity from other factors, (2) Application of the force law (including mass and distance proportionality relationships, (3) Behavior at certain thresholds (such as low mass and high distance limits, as well as atmospheric boundaries), and (4) Directionality, including superposition. After three iterations of testing and refining, the NGCI has proven to be both a reliable and valid instrument. As evidence, we present a full statistical analysis of overall instrument reliability, item difficulty and discriminatory power, supplemented with qualitative information from think-aloud student interviews and expert review.

B – Upper Division and Graduate

PST1B01: 7:45-8:30 p.m. What Should You and Your Students Know About Advanced Writing in Physics and Astronomy?

Poster – Jean-Francois S. Van Huele, Brigham Young University, Provo, UT 84601-4681; vanhuele@byu.edu

J. Ward Moody, Brigham Young University

Every year in Physics and Astronomy at Brigham Young University (BYU) we administer a pre- and post-test in an advanced writing course in the discipline, taught by physics and astronomy faculty to majors writing their senior thesis. The test, just like the course, is inspired in part by the AIP style manual http://www.aip.org/pubservs/style/4thed/toc.html and by actual examples taken from theses drafts from previous editions of the course. Here we present the latest version of the test and give the audience an opportunity to take it, compare their answers and scores with those of typical BYU seniors, and give feedback on the experience. What does one really need to know to write well in physics?

PST1B02: 8:30-9:15 p.m. Exploring Expert Navigation of a Thermodynamics Maze

Poster – Mary Bridget Kustusch, Oregon State University, Physics Department, Corvallis, OR 97331-6507; mary.bridget@oregonstate.edu

David Roundy, Tevian Dray, Corinne Manogue Oregon State University

Several studies in recent years have demonstrated that upper-division students struggle with partial derivatives and the complicated chain rules ubiquitous in thermodynamics problems. In order to better understand what is necessary to successfully navigate these problems, we conducted interviews with experts (faculty and graduate students), asking them to solve a challenging thermodynamics problem. This poster presents the physical and mathematical sense-making employed by these experts as they attempted to solve this problem. Particular emphasis is given to the questions asked, tools used, warrants employed, and the value placed on different conclusions.

PST1B03: 7:45-8:30 p.m. Molecular Dynamics Simulation of Small Biomolecules in Water

Poster – Hye-Young Kim, Southeastern Louisiana University, Department of Chemistry and Physics, Hammond, LA 70402; hye-young.kim@selu.edu

Caleb Delaune, Daniel Daigle, Southeastern Louisiana University

Vecar is a newly synthesized amphiphilic antioxidant biomolecule.[1] Vecar molecules are composed of vitamin E and Carnosine which are linked via a carbon chain of varying lengths. The number of carbon atoms in the chain can vary from 0 to 18. We have preformed molecular dynamics simulations to study the micellization of these amphiphilic molecules, Vecar, in water. Our research mainly focuses on the dependence of micelle formation on the chain length. The findings and their possible application for drug delivery will be discussed. This research is supported by Louisiana BOR grant (LEQSF(2012-15)-RD-A-19) and by the Louisiana Optical Network Institute (LONI).

1. C. Astete, D. S. Meador, D. Spivak, and C. Sabliov, Synthetic Communications, DOI: 10.1080/00397911.2011.632829 (published online in 20 April 2012).

C – Lecture/Classroom

PST1C01: 7:45-8:30 p.m. Color-Coded Algebra

Poster – Bradley McCoy, Azusa Pacific University, Glendora, CA 91740; bmccoy@apu.edu

One challenge during problem solving is distinguishing between known and unknown variables in algebraic equations. A color coding system helps reduce cognitive load, clarifies algebra strategy, and serves as a useful tool for identifying needed equations.

PST1C02: 8:30-9:15 p.m. Advance Pseudoscience

Poster – Sadri Hassani, Illinois State University, Physics Department, Normal, IL 61790-4560 hassani@phy.ilstu.edu

This poster describes advanced pseudoscience, gives examples of it--including college disciplines teaching it—and presents ways of using it to make our students more scientifically aware.

PST1C03: 7:45-8:30 p.m. Hands-on Activities in Large Enrollment Courses

Poster – Edward Price, CSU San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA 92096; eprice@csusm.edu

Fred Goldberg, Michael McKean, San Diego State University

Stephen Robinson, Tennessee Technological Institute

We are developing a new conceptual physics curriculum, called Learning Physics (LEP), that is suitable for large-enrollment classes. LEP is based on the small enrollment, discussion, and lab-based Physics and Everyday Thinking (PET) curriculum. LEP students spend approximately 50% of the class time working in small groups, conducting simple hands-on experiments, using computer simulations, and periodically sharing their predictions, observations and conclusions via clicker questions or by emailing diagrams to the instructor. We have implemented LEP in classes of 80-100 students. This poster will present some of the activities included in LEP, and the management and pedagogical challenges (and solutions) of including hands-on activities in large enrollment settings.

PST1C04: 8:30-9:15 p.m. Novel (Extra Credit) Project for the Physics Classroom

Poster – Sytil K. Murphy, Shepherd University, P.O. Box 5000 ,Shepherdstown, WV 25443; smurphy@shepherd.edu

During the fall 2011 semester, I adapted the H.S. photo contest as an extra credit project in my physics courses. As a follow-up to this, in the spring 2012 semester, I asked students to somehow depict physics that cannot be photographed. Students were allowed to use any media they chose. Submissions were initially sorted by me and then the final winners of the contest were decided by a class vote. Submissions will be shown as well as discussion on the process.

PST1C05: 7:45-8:30 p.m. Development of Science Learning Strategy for Serious Games

Poster – Youngseok Jhun, Seoul National University of Education, 2801 Chancellorsville Dr., Tallahassee, FL 32312; youngseok.jhun@gmail.com

Kapsu Kim, Donghoon Shin, Seoul National University of Education

We have developed a series of science learning strategies that can be applied in serious Internet games. As a first step, we examined the attractions that catch the gamers' eyes and make them immerse in the game. Then the strategies were set up that relate the attractions to the learning of core ideas difficult for students to accept. Informal science education theory was an important part of the research. Induced strategies of learning core concepts are repeated exposure, visualization, making slow motion pictures, relating to everyday experiences, and showing various examples, etc. In addition, the games can take parts as fields of inquiry where gamers can find out a bundle of science knowledge related to their own life. So they can make their unique meanings. A game on force and movement for middle school students has been developed by way of showing examples of applying the strategies.

PST1C06: 8:30-9:15 p.m. Enhancing Learning Through Research in Introductory Physics

Poster – Natalia Schkolnikov, Hampton University, Department of Physics, Hampton, VA 23668; natalia.schkolnikov@hamptonu.edu

Transition of Hampton University to a research-intensive institution requires from faculty and students more engagement in research than they had in the past. Students from underrepresented groups in science and engineering often have a hard time mastering the necessary mathematics and physical laws required by these courses. In an attempt to increase student success in the physical sciences, we have implemented "Learning through Research" in introductory physics classes. Our students are engaged in research through carefully crafted presentations whose topics are assigned at the beginning of each semester. The choice of a research presentation topic for each biology, pharmacy, architecture, or music engineering student depends on his/her major. The students enhance their learning through these presentations since they are required to present the results of their research on relations between physical laws and contemporary principles of their disciplines.

Acknowledgement: This work was supported by the National Science Foundation (NSF HRD-1137747).

PST1C07: 7:45-8:30 p.m. Helping Students Understand the Work-Kinetic Energy Theorem

Poster – Jacob Millspaw, Indiana Purdue University Fort Wayne, IN 46805; millspaj@ipfw.edu

Mark F. Masters, Indiana Purdue University Fort Wayne

Eric Ayars, California State University - Chico

We present a simple investigation using a modified "fan cart" that allows students to explore and discover the relationship between work and kinetic energy. The fan cart is modified so that it can be turned on at one location and turned off at a second location. Launching the cart along a track so that it has an almost constant speed, and then triggering the fan for a known distance while monitoring its position using a sonic position sensor allows us to determine a relationship between the force exerted by the fan, the distance traveled, and the final speed of the cart (after the fan has been turned off).

PST1C08: 8:30-9:15 p.m. Lessons From Educators Before and After All that Jazz

Poster – Alice M. Hawthorne, Allen Concord University, Athens, WV 24712; amhallen@concord.edu

Independent of the PER research encouraging a trend away from "traditionally taught lectures," many of us must utilize traditional lecture and lab teaching slots or formats. Some current pedagogy can be modified successfully for lecture use. Other pedagogy from the past, like that of M. Montessori and C. Mason, can still be utilized in highly effective ways. As has also been noted, the type of assessment used makes a difference in the student outcomes. Simple suggestions that have made a significant difference in my lecture and lab style classes and notable outcomes will be presented.

PST1C09: 7:45-8:30 p.m. Science and Literature: An Integrated Learning Environment

Poster – Kristi D. Concannon, King's College, Wilkes-Barre, PA 18711; kristiconcannon@kings.edu

A Learning Community is a common educational experience, with the benefits of enhanced academic and social opportunities. It is often easier to integrate subjects like art and history or theology and philosophy, but what about science? To what other disciplines does it readily speak? In Fall 2011, a Learning Community on the theme "Visions of the Future" was created at King's College that allowed students to satisfy their Core Science and Core Literature requirements. The courses were scheduled back-to-back, in the same classroom, for maximum course integration. Students were assigned common readings from works of science fiction, and the science behind the science fiction was examined. Physics topics included space travel via warp drives and wormholes, futuristic weapons, flying cars, and teleportation. This poster will present an overview of the integration of the two courses, a sample of course readings and assignments and an assessment of the integrated course objectives.

PST1C10: 8:30-9:15 P.M. Using Context-Rich Problems to Elicit Group Work Outside the Classroom

Poster – Frances A. Mateycik, Penn State Altoona, 3000 Ivyside Dr., Altoona, PA 16602; fam13@psu.edu

Timothy D. Hooper, Penn State Altoona

Problems designated as "context rich" are ill-structured, real-world relevant, and often challenging enough that it is very difficult for students to complete the problem singularly. Forty calculus-based physics students were asked to complete these collaborative activities once per week, with their group, primarily outside of the classroom. They were given 30 minutes of laboratory time to work together, where clarification questions may be asked of the instructor, but finalized solutions were to be generated outside the class time. Emphasis was placed on continuing this task as a group, and further questions to the instructor were only to be posed face-to-face with all group members present. This poster will present any observable performance changes between sections that do and do not offer context-rich problem solving tasks. The goal is to determine whether this task may be less class-time intensive, and yet maintain its effectiveness as a collaborative problem solving exercise.

PST1C11: 7:45-8:30 p.m. Writing Narratives to Enhance Problem Solving Skills

Poster – Bill Schmidt, Meredith College, Raleigh, NC 27607-5298; schmidtw@meredith.edu

One of the biggest challenges students encounter while learning physics is demonstrating mastery of problem solving. In order to enhance student self-confidence and aptitude in problem solving, our general physics students are required to write reflective narratives that describe how they think and reason through a problem. The goal is to make the learning process explicit through the use of written narratives. In order to provide peer feedback and interaction, students review other student narratives for clarity. The narratives are used in conjunction with pre- and post-Force Concept Inventory scores to assess critical thinking and metacognition skills. At the end of the semester, students describe how the extent and quality of their narratives have changed over time. Results will be presented and discussed.

PST1C12: 8:30-9:15 p.m. Reciprocal Influences of Iron Bar Magnets According to the Alignments

Poster – Chaewook Jhun, Chiles High School, 2801 Chancellorsville Dr., 536 Tallahassee, FA 32312; youngseok.jhun@gmail.com*

It is known that the magnetization in iron is so vulnerable that it can be easily changed by external magnetic field. However, we seldom are able to find the data about the procedure of the variation of magnetization due to the time. So experiments were done to find out the co-relation of bar magnets according to their alignments. The experiments consisted of four parts: align two ion bar magnets in parallel, meeting same poles and opposite poles, make two iron bar magnets form a shape of capital T, and approach a neodymium magnet to a iron bar magnet. The variations of magnetization were measured by folded thin films filled with magnetic material called magnetic viewer. If a normal iron bar magnet is seen through the magnetic viewer, the boundary of two poles can be seen with white band perpendicular to the magnet. But the boundary bands can be shifted parallel to break the symmetry, can be tilted to make a diagonal lines. In certain circumstances, more than three boundary bands appeared in the magnet, and it means that more than two north or south poles appeared. These deviations could be related to the magnets' alignment condition.

*Sponsor: Youngseok Jhun

D – Physics Education Research

PST1D01: 7:45-8:30 p.m. Cognitive Acceleration Using PER

Poster – John M. Clement, 1222 Howard Lane, Bellaire, TX 77401; clement@hal-pc.org

Using the ideas of Shayer & Adey in their design of a cognitve acceleration program, and PER curricula gain has been observed in general thinking in both high school and college courses. But it would seem that just using PER alone may not be enough. Students first have to be convinced that they can improve their thinking. Then the thinking skills have to be explicitly set aside from just the physics curricula. It is possible to get gain on FCI or FMCE without any gain in overall thinking, but it is not possible to get high gain on these tests without high scores on the Lawson published Piagetian test. References: Lawson, "Science Teaching and the Development of Thinking"; Shayer & Adey "Really Raising standards"

PST1D02: 8:30-9:15 p.m. Force Concept Inventory for a Fully Online Physics Class

Poster – Erik L. Jensen, Chemeketa Community College, 4000 Lancaster Dr. NE, Salem, OR 97309; erik.jensen@chemeketa.edu

Chemeketa Community College administered the Force Concept Inventory (FCI) as a pre-test and post-test to three classes of introductory physics students in fall term of 2011. The classes consisted of algebra-based physics in both campus-based and fully online formats as well as a calculus-based physics class on campus. All three classes were taught by the same instructor, though the students were not randomly assigned. Normalized gains in algebra-based physics were slightly higher in the online class (36% versus 28%). This suggests that online classes can be at least as effective at teaching concepts, despite considerable skepticism in the physics education community. Gains for calculus-based physics were much higher (68%), which supports the contention by Coletta and others that student characteristics are an important independent variable. Results of a repetition of this experiment in fall term of 2012 and a description of the online class will also be provided.

PST1D03: 7:45-8:30 p.m. General Physics Enterprise Impact on Expert Identity Development

Poster – Idaykis Rodriguez, Florida International University, 11200 SW 8th St., Miami, FL 33199; irodr020@fiu.edu

Renee Michelle Goertzen, Eric Brewe, Laird H. Kramer, Florida International University

Specific expertise in a topic of physics is inevitably influenced by the general enterprise of physics. Using the theoretical framework of Communities of Practice and more specifically the concept of boundaries between local communities and the larger enterprise, we show how changes in paradigms of the larger biophysics field influence a physics research group and the individual expert identities constructed. Data were collected from an ethnographic case study of a biophysics research group weekly research meeting. Focusing on boundary interactions between the biophysics research group and visiting experts from other communities that share a common analytical software, we show how such exchange across community boundaries influence a shift in research of the group and of its individual members as well.

PST1D04: 8:30-9:15 p.m. Measuring Information Presentation in a Physics Class

Poster – John Stewart, University of Arkansas, Physics Building, Fayetteville, AR 72701; johns@uark.edu

At some level, the performance of students in a science class must depend on what is taught, the information content of the materials, and assignments of the course. The introductory calculus-based electricity and magnetism class at the University of Arkansas is examined using a catalog of the basic reasoning steps involved in the solution of problems assigned in the class. These fundamental steps are used to quantify the distribution of informational content within the different elements of the course: laboratory, lecture, reading, and homework. This distribution of content is compared with the instructional outcomes measured by the Conceptual Survey of Electricity and Magnetism and by course exams to determine the relative efficacies of the various mechanism of presenting the information. Using this characterization technique, an exceptionally detailed picture of the information flow and the information structure of the class can be produced. Variation of the types and the amount of information presented is analyzed over multiple semesters.

PST1D05: 7:45-8:30 p.m. U.S. Schools vs. Asian Schools: Cultural Differences and Physics Education

Poster – Boris Korsunsky, Weston High School, 444 Wellesley St., Weston, MA 02493; korsunbo@post.harvard.edu

Zhanna Glazenburg, Croton-Harmon High School

The authors discuss the differences between the Asian and the U.S. high school cultures and realities and the effect these differences have on physics education in the two systems. The authors draw on the results of an extended visit to China by Glazenburg and the survey of the students from Asia currently studying in the U.S. conducted by Korsunsky.

PST1D06: 8:30-9:15 p.m. Symbolic Forms for Infinitesimal and Finite Quantities in Introductory Physics

Poster – Joshua S. Von Korff, Georgia State University, Science Annex, Atlanta, GA 30303; jvonkorff@gsu.edu

N. Sanjay Rebello; Kansas State University

Most integrals in physics involve the product of a finite and an infinitesimal quantity. For instance, x is the integral of $v\ dt$, where "v" is finite and "dt" is infinitesimal. We classify these finite and infinitesimal quantities using symbolic forms, a concept developed by Sherin. Infinitesimal quantities such as dt can be viewed as a difference, in this case a difference between two times, $t_2 - t_1$. However, infinitesimal quantities such as dM, a small amount of mass, cannot be viewed as a difference. Likewise, a finite quantity such as "v" is easy to view as a ratio, dx/dt, whereas a finite quantity such as "F"is not. We analyze examples of our own instructional methods and our students' responses to them using this framework. We suggest that instructors should consciously select and discuss the symbolic forms that they wish their students to be familiar with. This work supported in part by NSF grant 0816207.

PST1D07: 7:45-8:30 p.m. Students' Difficulty in Distribution of Charged Insulators

Poster – Min ju Kim, Korea National University of Education, chungbuk 363-791, The Republic Of Korea; only22k@hotmail.com

Jung bog Kim, Korea National University of Education

Students consider electrostatics is easy to understand because they often experience it in everyday life. But according to previous studies, they have difficulties after completing the electromagnetic section in an introductory physics class. That is why the electrical phenomena contained in introductory physics is something mostly about metal after first section of electromagnetic and the charge that causes electrostatic is invisible. In this paper we investigated concretely what difficulties are in many various situations where charged insulators and metal are involved. These persisted even after classes.

PST1D08: 8:30-9:15 p.m. Reconciling "Energy" and "Free Energy"*

Poster – Benjamin D. Geller, University of Maryland, College Park, MD 20742; vashti.sawtelle@gmail.com

Abigail R. Daane, Seattle Pacific University

Vashti Sawtelle, University of Maryland

Biology and pre-health science students encounter a disconnect between "energy" as described in introductory physics courses and "free energy" as described in their biology and chemistry classes. The relationship between these two concepts is made visible when students are asked to reason about the energy of a thermally isolated ideal gas that is allowed to freely expand to twice its original volume. While the gas has the same energy before and after expansion, it does not have the same free energy or the same capacity to do work on its surroundings. In this presentation, we discuss student data that calls for the design of an interdisciplinary task that asks students to reconcile these two notions of energy. Issues of energy degradation and entropy naturally arise in any such reconciliation, making the scenario well-suited for broader discussions about the connection between energy and the Second Law of Thermodynamics.

*Poster will be presented by Joe Redish or Vashti Sawtelle. Mr. Geller is unable to attend.

PST1D09: 7:45-8:30 p.m. Physics for Ninth Graders: Pitfalls and Discoveries

Poster – Boris Korsunsky, Weston High School, 444 Wellesley St., Weston, MA 02493; korsunbo@post.harvard.edu

Drawing on more than a decade of experience in teaching a ninth-grade honors physics course in an affluent suburban high school, I will present the curricular and policy changes introduced as the results of the ongoing effort to survey the students and their parents about their perceptions of the course. The results of some of the recent surveys and their possible implications will be discussed as well.

PST1D10: 8:30-9:15 p.m. Modeling Hidden Circuits: an Authentic Research Experience in Two Hours

Poster – James C. Moore, Coastal Carolina University, Conway, SC 29528-6054; moorejc@coastal.edu

Two wires exit a black box that has three exposed light bulbs connected together in an unknown configuration. The task is to determine the actual circuit configuration without opening the box. In this two-hour authentic research experience, we adopt the Investigative Science Learning Environment (ISLE) method of instruction to navigate students through the process of making models, developing and conducting testing experiments that can support or falsify models, and confronting ways of distinguishing between two different models that make similar predictions. We present examples from student-generated notebooks, where teams of students can be seen doing authentic science process to solve a research question. We also describe a twist that requires students to confront new phenomena, requiring revision of their model and incorporation of new ideas never previously explored in the coursework.

PST1D11: 7:45-8:30 p.m. Introducing Research Experiences in a Community College

Poster – Chitra G. Solomonson, Green River Community College, Auburn, WA 98092-3622; csolomonson@greenriver.edu

Andrew H. Rice, University of Washington

Christine K. Luscombe, University of Washington

Keith A. Clay, Green River Community College

As more students seek to gain admission to universities, fewer seats are becoming available to them due to increasing budget cuts. Thus admission is becoming increasingly competitive. At the same time, more and more students are relying on community colleges to serve as a stepping stone to college. Introducing research experiences early on has short and long-term benefits. Experience in research is becoming an important component of STEM undergraduate programs in four year schools. Introducing them in a two-year college will enable our students to transfer successfully to a four-year university. Research experiences have also been shown to deepen students' resolve in persisting in STEM fields especially for underrepresented populations.[1] In this project (funded by NSF DUE-1141339), faculty members at Green River Community College are collaborating with faculty members at the University of Washington to develop and implement research-like lab modules in the cutting edge fields of Organic Photovoltaics (OPVs) and Organic Light Emitting Devices (OLEDs).

1. S.H. Russell, M.P.Hancock, J. McCullough, "Benefits of undergraduate research experiences," *Science* **316**(5,824) 548–549 (2007).

Christine Luscombe and Andrew Rice sponsored by Chitra Solomonson

PST1D12: 8:30-9:15 p.m. Peer Influence on Student Physics Learning: In Class And Beyond

Poster – Sissi L. Li, California State University, Fullerton, 800 North State College Blvd., Fullerton, CA 92831; sili@fullerton.edu

Michael E. Loverude. California State University Fullerton

Active engagement learning environments are built on the ideas that learning is a social activity and that students learn better by directly developing understanding instead of passively receiving knowledge. In asking our students to work in groups during class, we allow them opportunities to be influenced by their peers; additionally, we communicate implicitly that learning from and with peers is valuable. In a series of interviews with physics majors in a thermal physics course, we explore the classroom social relationships by asking students about a student in the course who has been most influential to their physics learning. The findings indicate that while some of the relationships were established prior to the course, the group learning setting strengthened both old and new relationships. Additionally, the students' perception of how their learning is influenced by their peers is varied and significantly supported by interactions and circumstances outside the classroom.

PST1D13: 7:45-8:30 p.m. Initial Characterizations of Transformative Experiences in Undergraduate Physics

Poster – Brian W. Frank, Middle Tennessee State University, Murfreesboro, TN 37132; bfrank@mtsu.edu

Leslie J. Atkins, California State University Chico

Transformative experience (TE) is a theoretical construct intended to capture and assess the extent to which science concepts learned in the classroom shape everyday meaning-making and engagement with science outside of the classroom. We are investigating TE in a range undergraduate physics courses using a mixed-methods approach, including survey development to measure depth and prevalence of TE, case studies to better understand the nature of TE as embedded in individual students' lives, and video ethnography to refine hypotheses about how TE is fostered in different settings. We present our initial attempts to characterize the nature and range of TE in two science courses for future elementary school teachers. Through these characterizations, we explore questions of how science content, family relationships, classroom agency, and technology help to shape the boundary between science classrooms and everyday life.

PST1D14: 8:30-9:15 p.m. Evidence Supporting Cycles of Pedagogical Change Through Cogenerative Localized Reform*

Poster – Natan Samuels, Florida International University, 11200 SW 8th St., Miami, FL 33199; nsamu002@fiu.edu

Renee Michelle Goertzen, Eric Brewe, Laird Kramer, Florida International University

We present evidence of a high school physics teacher adapting to, and expanding her understanding of her students' confidence, attitudes toward their physics problem-solving ability, and whiteboard presentations. Pedagogical changes were observed through classroom videos, artifacts, and teacher interviews recorded during the instructor's semester-long use of the Cogenerative Mediation Process for Learning Environments (CMPLE) formative intervention. In CMPLE, students and instructors act as a discourse community to negotiate, develop, and implement changes to their classroom structure, based on their collective learning preferences. We use Activity Theory to identify the teacher's cyclical change process as 1) the questioning of her past actions and behavior patterns, 2) analyzing the current situation, 3) constructing a new model of behavior, 4) implementing the model, and 5) reflecting on her changes. Implications include reconceptualizing a physics teacher's increased agency as based in her participation in a shared localized reform effort with her students.

*Research supported by NSF Award #0802184.

PST1D15: 7:45-8:30 p.m. Research into Student Understanding of Architectural Structures Principles

Poster – Deborah J. Oakley, School of Architecture, University of Nevada, Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154; deborah.oakley@unlv.edu*

Janelle M. Bailey, University of Nevada, Las Vegas

The field of architecture requires practitioners to be conversant in numerous subjects, including the physical structure of a building and the underlying principles of structural engineering/material historically challenging for students. These are concepts first encountered in introductory physics classes, specifically in mechanics. Physics education research, among other fields, demonstrates that learning may be improved if students' prior knowledge is taken into account; however, similar research in architecture is presently lacking. This poster will present results from two components of an ongoing study to identify students' knowledge of, and subsequently improve instruction in, the subject of architectural structures. First, 163 students in 100-level architecture courses responded to open-ended surveys prior to instruction. Second, 36 students in a 300-level structures course completed multiple-choice surveys both pre-and post-instruction. Preliminary results indicate that many students enter the courses with an incomplete understanding of mechanical principles that must be considered for effective instruction.

*Sponsor: Janelle Bailey

PST1D16: 8:30-9:15 p.m. Do Proportional Reasoning Skills Affect Student Performance in Intro. Astronomy?

Poster – April J. Hankins, California State University, Fullerton, 3028 E. Los Cerillos Drive, West Covina, CA 91791; ajhankins7@csu.fullerton.edu

Gabriela Serna, Michael Loverude, Joshua Smith, Sissi Li, California State University, Fullerton

At California State University Fullerton, we are in the process of applying research-based reformed instruction in introductory astronomy, including use of lecture tutorials and think-pair-share activities. In order to assess the effectiveness of the reformed instruction, we have collected assessment data about students' conceptual understanding. As part of our analysis, we assessed students' understanding of proportional reasoning using items developed by Boudreaux, Brahmia, and Kanim. The purpose of this poster is to investigate the relationship between students' proportional reasoning skills and their score on the LSCI (Light and Spectroscopy Concept Inventory, Bardar 2007). Students were given free response items on proportional reasoning in which they had to answer mathematically and then explain their answer. Responses on this survey were compared with the pre- and post-tests of the LSCI with their total gain. We will analyze and present data to show the extent to which a student's performance on the proportional reasoning assessment relate to the student performance and gain on the LSCI.

PST1D17: 7:45-8:30 p.m. Consequences of Attempted Clarifications of Force Concept Inventory Questions

Poster – Wendy K. Adams, University of Northern Colorado, Greeley, CO 80631; wendy.adams@unco.edu

Richard D. Dietz, Matthew R. Semak, Courtney W. Willis, University of Northern Colorado

We have conducted think-aloud interviews with students as they grappled with questions on the Force Concept Inventory (FCI). Doing so has shown us that the difficulties they have with some questions have nothing to do with their understanding of physics. These difficulties involve diagrams, notations, and vocabulary that make perfect sense to physics teachers but can easily confuse beginning students. We modified several of the FCI questions to improve clarity and administered it to two sections of introductory physics students. Here we report on the results of that experiment and compare them with several years of archival data generated with the canonical FCI.

PST1D18: 8:30-9:15 p.m. Computer Coaches for Problem Solving: Application to High School Physics

Poster – Andrew J. Mason, University of Central Arkansas, Lewis Science Center 171, Conway, AR 72035; ajmason@uca.edu

Mishal Benson, University of Central Arkansas

Qing Xu, Leon Hsu, Kenneth Heller, University of Minnesota, Twin Cities

Computer modules are currently being developed in conjunction with the University of Minnesota[1] to train students in a calculus-based introductory physics course in an expert-like physics problem-solving framework. One of our research goals is to be able to implement the modules in different class settings. To this end, we discuss an ongoing study in which Arkansas teachers are interviewed as they use a subset of the Minnesota modules adapted for an algebra-based physics course. Discussion revolves around the feasibility and adaptability of the coaches as described by the teachers in the case study. Future plans include using this information to adapt the coaches as necessary for trial among volunteers in local high school physics courses.

1. L. Hsu and K. Heller, *Proceedings of the 82nd NARST Annual International Conference,* Garden Grove, CA, 2009; Q. Xu et al., AAPT 2012 Summer Meeting, Philadelphia, PA.

PST1D19: 7:45-8:30 p.m. Characterizing Student Metacognition: A Case Study Approach

Poster – Andrew Boudreaux, Western Washington University, Bellingham, WA 98225-9164; andrew.boudreaux@wwu.edu

Sepideh P. Rishel, Western Washington University

At Western Washington University, efforts are under way to create an environment conducive to building student ability to engage in metacognitive thinking, that is knowing and thinking about their own learning. While most educators agree that this ability is important, it is not usually explicitly taught and research has shown that traditional teaching methods can actually push students away from this kind of thinking. We scaffold this ability in our guided-inquiry lab curriculum through structured reflection on predictions and observations. To build concrete vision of what metacognition looks like in student work and behavior, this poster exemplifies low, emerging, and high-level metacognition through the development of student case studies that rely on classroom video and interview transcripts, survey responses, and students' reflective writing. We hope these case studies can be used by faculty and students to qualitatively gauge metacognitive ability.

PST1D20: 8:30-9:15 p.m. Learning Objectives Based Assessment and Student Study Habits

Poster – Todd A. Zimmerman, University of Wisconsin - Stout, Menomonie, WI 54751; zimmermant@uwstout.edu

Learning Objectives Based Assessment (LOBA) is a different grading paradigm from the traditional points-based grading system. A key component of LOBA, which is based on Standards Based Grading, is allowing students to make mistakes and learn from them and it focuses students on mastering concepts rather than accumulating points. This poster will discuss the results of a study of how students' study habits for assessments change under LOBA in introductory calculus-based and algebra-based physics courses.

PST1D21: 7:45-8:30 p.m. Autonomy and the Student Experience in Introductory Physics

Poster – Nicholas Hall, University of California - Davis, Department of Physics, Davis, CA 95616; nicholasronhall@gmail.com

David J. Webb, University of California - Davis

The role of autonomy in the student experience in a large-enrollment undergraduate introductory physics course was investigated from a self-determination theory perspective. A correlational study tested whether certain aspects of the student experience correlated with how autonomy supportive (vs. controlling) students perceived their instructors to be (e.g., the instructor listened to how the student would like to do things). Students who perceived their instructors as more autonomy supportive tended to become more interested in learning physics, become less anxious about taking physics, come to study physics more because they wanted to (less because they had to), and perform better (for a subset of students). A controlled study tested how restructuring the course to allow more autonomous choices by students changed the student experience. More autonomous choices led to large differences between men and women in interest/enjoyment in learning physics, with women becoming less interested than men.

PST1D22: 8:30-9:15 p.m. Practices in Physics and Technology (PP&T) Grade 10

Poster – James L. Redmond, University of Hawaii, Manoa-College of Ed., Honolulu, HI 96822; jredmond@hawaii.edu

Practices in Physics and Technology (PP&T) is a laboratory- and algebra-based physics curriculum for 10th grade, designed and tested at the Curriculum Research & Development Group (CRDG) of the University of Hawaii. PP&T developers recognize that physics is a necessary intellectual base for modern chemistry and biology. Distinguishing features of the PP&T program: –Materials cover basic physics and engineering and technology practices. –Is aligned with the NRC Framework. –Concepts and skills developed are accessible to all students in a normal heterogeneous high school classroom. –Concept development is initiated in the laboratory and refined in the dynamics of student group interaction. –Mental modeling is approached through problem description, prediction, and experimentation followed by argumentation and search for generalizations recorded mathematically, pictorially, and written. –Experiments use standard laboratory and digital equipment. –Assessment of student progress is tied to a concept-and-skill inventory that keeps a detailed log of student development.

PST1D23: 7:45-8:30 p.m. Influences on Student Reasoning Due to a Provided Outcome

Poster – Jeffrey M. Hawkins, The University of Maine, Orono, ME 04469; jeffrey.hawkins@maine.edu

Michael C. Wittmann, John R. Thompson, The University of Maine

Many instructional physics practices, such as some traditional lecture demonstrations, provide students with an outcome and ask them to think of reasons that outcome occurred. Other practices, such as Interactive Learning Demonstrations[1] ask students to predict and explain what outcome will occur before demonstrating the outcome. We have been investigating the impact of providing students with the outcome, rather than asking them what they think will happen, on the reasoning students use to explain what will occur. We administered written questions to introductory calculus-based students via an online pre-test system. We find that providing students with the outcome often causes them to express different reasoning than students who are asked to select which outcome they think will occur. We also find that the different reasoning elicited by providing students with the outcome can be productive reasoning (e.g. reasoning based on definition), or unproductive reasoning(e.g. compensation reasoning[2]).

1. D.R. Sokoloff and R.K. Thornton, *Phys. Teach.* **35**, 340-347 (1997).
2. R.A. Lawson and L.C. McDermott, *Am. J. of Phys.* **55**, 811-817 (1987).

PST1D24: 8:30-9:15 p.m. Analyzing Perspectives and Learning Motivation on Peer Instruction Processes

Poster – Jung Bog Kim, Korea National University of Education, cheongwon, CB 363-791, S. Korea; jbkim@knue.ac.kr

Hyundeok Park, Korea National University of Education

This research will show how Peer Instruction (PI) has influence on students through analyzing the responses to PI processes. Data was collected by the survey that is composed of questions of Lickertis scale and open ended questions. The survey has been done with university students who are taking introductory physics courses and major physics courses. Students are asked their opinion to each step in PI processes which are pre-vote, peer discussion, re-vote, and explanation of answer. The pre-vote causes thinking and an interest. The discussion gives a chance to share, examine, and apply thinking. The re-vote checks on a reaction and gives an opportunity for feedback. The explanation of answers helps to solve curiosity and confirm the concept. PI activates not only students' cognition and meta-cognition strategy, but also helps to raise motivation in participating actively to class.

PST1D25: 7:45-8:30 p.m. Thinking Process of Science Teachers in a Scientific Contradictory Situation

Poster – Ji Won Lee, Korea National University of Education, Science Building 411-e, Gangnaemyon Chungju, Chung-Buk 363-791, South Korea; ljiwony@naver.com

Jung Bog Kim, Korea National University of Education

We hypothesize the thinking process of 18 science teachers in explaining the contradictory situation. They observed the Experiment I and II which are contradictory to each other, but the two experimental results are scientifically correct; thus, none of these results can be ignored. We let them explain personally by writing and drawing, and then we ask the 2nd explanation after peer discussion. However, there is no progress. After seeing another hint using a charge sensor, they were in disarray because their fundamental concept was shaken. There was only one teacher reminding the correct answer, even though other teachers also knew about it. It is necessary to have the essential expertise, abundant contextual knowledge related to specific concept to solve the problem creatively rather than interrupting by specialty of expert.

PST1D26: 8:30-9:15 p.m. Ten Results of PER that Every Physics Instructor Should Know

Poster – Sarah B. McKagan, Seattle Pacific University, 3307 3rd Ave. West, Seattle, WA 98119; sam.mckagan@gmail.com

Over the last few decades, researchers in Physics Education Research (PER) have made enormous advances in understanding how students learn physics most effectively and in developing teaching methods that dramatically improve student learning. The PER User's Guide (http://perusersguide.org) is a growing web resource that translates, summarizes, and organizes the results of PER in an accessible and useful way for busy educators. This poster summarizes the results of PER that are most important for practicing physics educators to know and apply in their classrooms, and solicits feedback for an article detailing these results on the PER User's Guide. The goals of this article are to explain the research behind each result in enough detail that readers can easily understand why we believe each result to be true, and to offer suggestions for how to incorporate each result into their teaching.

PST1D27: 7:45-8:30 p.m. Categorizations of Energy: Forms, Carriers, Types, and Transfers

Poster– Sarah B. McKagan, Seattle Pacific University, 3307 3rd Ave. West, Seattle, WA 98119; sam.mckagan@gmail.com

Benedikt W. Harrer, University of Maine

Rachel E. Scherr, Seattle Pacific University

Energy is ultimately unified, but manifests in a variety of ways. Most national and state standards, textbooks, and other instructional materials emphasize forms of energy as an important tool for categorizing the manifestations of energy. However, the new Framework for K-12 Science Education, the basis for the Next Generation Science Standards, cautions against talking about forms of energy as "misleading." This caution aligns with recommendations from some science educators, who support the use of "energy carriers" as an alternative to energy forms. We discuss the distinctions between the multiplicity of alternatives to energy forms, and the advantages and disadvantages of these different methods of categorizing energy. Depending on how we teach them, students may use any of these categorizations of energy as meaningless and superficial lists to be memorized, or as important tools for making sense of the properties of systems and the mechanisms by which these properties change.

PST1D28: 8:30-9:15 p.m. Physics Energy Is Not Chemistry Energy Is Not Biology Energy

Poster – Vashti Sawtelle, University of Maryland, College Park, MD 20707; vashti.sawtelle@gmail.com

Chandra Turpen, Benjamin W. Dreyfus, University of Maryland

At the University of Maryland, we are engaged in redesigning an introductory physics course to be more relevant for life science majors. In doing so, we must consider the many representations and languages these students may bring with them for considering energy from not only everyday life experiences, but also from their other science courses. This presentation will examine the differences in the way energy is discussed and represented in the disciplines of physics, chemistry, and biology. We argue that simply being exposed to these different languages and representations does not help students move between or coordinate these different languages. We examine student data from first semester discussions of energy in kinematics scenarios and contrast that with students struggling to connect ideas about energy in thermodynamic contexts. We will show how an example of our curricula that is being developed helps supports students in building these connections.

PST1D29: 7:45-8:30 p.m. Assessment of the Effectiveness of an Interactive Engagement Approach

Poster – Michi Ishimoto, Kochi University of Technology, Tosayamada-cho Kami-shi, 782-8502 Japan; ishimoto.michi@kochi-tech.ac.jp

The Force Concept Inventory (FCI) and the Force and Motion Conceptual Evaluation (FMCE) were used to examine the effectiveness of students' conceptual learning in terms of teaching strategies and students' preexisting knowledge in Japan. The 663 students were divided into groups based on teaching approaches: Two groups were taught with a traditional approach, and one group was taught with IE strategies. The pre-test and the post-test scores were analyzed based on the following information about students: (1) the type of instruction strategies employed in an introductory mechanics class, (2) the university mathematics placement test score, (3) the type of high school physics curriculum taught, (4) the type of university entrance examination written (some students are admitted to university based on the recommendation of their high school without having to write an academic aptitude test), and (5) the national aptitude examination score.

Tuesday, January 8 Highlights

REGISTRATION 7 a.m–4:30 p.m. Celestin Foyer
Fun Run/Walk 7–8 a.m. Offsite

Exhibit Hall Opens 10 a.m.–4 p.m. Storyville Hall
Kindle Raffle 10:15 a.m. Storyville Hall

Multicultural Luncheon 12:15–1:15 p.m. Imperial II

AWARDS 10:30 a.m.–12:15 p.m. Celestin I-III
J. D. Jackson Award — David Pines

SYMPOSIUM 3:30–5 p.m. Celestin I-III
Symposium on Physics Education and Public Policy

COMMERCIAL WORKSHOPS, 12:15–1:15 p.m.

CW02: Physics2000.com Eagle
CW03: Brooks/Cole Cengage Pickwick
CW04: Expert TA Laine

COMMITTEE MEETINGS, 7–8:30 a.m.

–Graduate Educ. in Physics Rythm Kings
–Apparatus Pickwick
–Pre-High School Educ. Olympia Orchestra
–Professional Concerns Firehouse Five
–SI Units and Metric Educ. (7:30) Original Zenith

Afternoon Break 3–3:30 p.m. Storyville Hall
Amazon Card Raffle 3:15 p.m. Storyville Hall

COMMITTEE MEETINGS, 5:10–6:40 p.m.

–Research in Physics Educ. Jackson
–Space Science and Astronomy Onward
–History and Philosophy Original Zenith
–Women in Physics Olympia Orchestra
–Two-Year Colleges Pickwick

PRESERVATION HALL JAZZ BAND, 9–10 p.m.
Celestin Ballroom

Session CA: Physics and Society

Location: Bucktown II
Sponsor: Committee on Science Education for the Public
Date: Tuesday, January 8
Time: 8:30–10 a.m.

Presider: Bill Reitz

CA01: 8:30-9 a.m. Emptiness and the Nature of Knowledge in Physics

Invited – Dewey I. Dykstra, Boise State University, Physics Department, Boise, ID 83725-1570; ddykstra@boisestate.edu

In the Buddhist philosophy known as the Middle Way[1] knowledge has certain similarities to the nature of knowledge in Physics. Buddhism is a religion without a supreme being. Buddhists are left to work things out for themselves. The four fundamental beliefs that identify Buddhism contain no specific directions as to how to behave in order to pursue this basic set of beliefs. Buddhism is an empirical belief system. While some might object, Physics is also an empirical belief system. In Physics we are also left to work out our explanation of the physical world. It is not unreasonable that similar understandings of the nature of knowledge might occur in these two empirical belief systems both based in human cognition. Emptiness, the central concept in the Buddhist Middle Way, will be described and linked to an understanding of the nature of knowledge from 20th–21st century Physics.

1. Nagarjuna & J.L. Garfield, *The Fundamental Wisdom of the Middle Way,* Oxford University Press, USA (1995).

CA02: 9-10 a.m. A Quasi-Qualitative Analysis of Time-Compressed STEM Course Pedagogy

Poster – Gerardo Giordano, King's College, 133 N River Str., Wilkes-Barre, PA 18711; gerardogiordano@kings.edu

The number of time-compressed, or length-shortened, college courses continues to rise. The appeal of these courses began with the desire to accelerate learning, but has grown to include making use of typical university and college down time, including weekends. Research has demonstrated that there are best-practice pedagogical techniques designed specifically for this type of course that lead to good learning experiences. The science, technology, engineering, and mathematics community has also begun to utilize courses that are shorter than traditional length courses. Best practice pedagogy for these courses is still a contested topic and much research remains to be done. Using a literature review of time compressed and science course pedagogy, a series of suggested pedagogical practices are discussed. Their application to two time-compressed summer physics courses is qualitatively examined and found to be in agreement with previous reported results in terms of learning outcomes, and instructor and student satisfaction.

CA03: 9-10 a.m. Photovoltaics at Davidson College – A Community-based Learning Project*

Poster – Tim Gfroerer, Davidson College, Physics Department, Davidson, NC 28035, tigfroerer@davidson.edu

In the fall of 2012, our junior-level electronics class conducted an investigation of photovoltaics at Davidson College. We started by touring the new 100 KW installation on the campus sports complex. Then we employed a solar cart (built by the physical plant using a spare 300 W panel) to study the circuitry required to store and utilize solar energy. The cart facilitated an in-depth examination of the practical, electrical, environmental, and thermal issues inherent in photovoltaic energy conversion. We concluded the study with a public exhibit at the local (Town of Davidson) farmer's market.

*This project was supported by a curriculum development grant from the Center for Civic Engagement at Davidson College.

CA04: 9-10 a.m. The Fluid Mechanics Lessons of Hurricane Katrina

Poster – Peggy A. Bertrand, University of Tennessee, 103 Greve Hall, Knoxville, TN 37830; pbertran@utkl.edu

Physics B fluid mechanics can be taught successfully using the catastrophe of Hurricane Katrina as the unit theme. Some of the devastating effects of the storm are examined at a basic level using concepts such as hydrostatic pressure, buoyant force, fluid flow continuity, and the Bernoulli effect. The emphasis, beyond just physics, is the interrelated impact of natural physical phenomena and human engineering upon both the coastal environment and human population. Ways to use information about hurricanes, especially Katrina, as a theme for a fluids unit are suggested, and sample qualitative and semi-quantitative problems are presented. A culminating activity, in which students develop presentations describing aspects of fluid mechanics within a social context, is suggested. The author is a native of St. Bernard Parish, Louisiana, taught the unit for several years, and published it in a feature article in *The Science Teacher* in 2009.

CA05: 9-10 a.m. Vision of Teachers in Physics Programs in Mexico About Skills in Physics

Poster – Mario Ramirez, CICATA-IPN Av. Legaria 694, Col. Irrigación. Mexico, DF 11500, Mexico; mramirezd@ipn.mx

Eduardo Chavez, ESCOM-IPN

The Latin American Tuning project was developed in 2004 and studies the competence in different programs. In particular, the physics programs were studied in 12 countries including Mexico. However, Mexico participation was low (just 16 people¡), and so the results are not totally valid for the country. This research shows the results of asking teachers in physics programs in Mexico their opinion about what are the most important and most carried out skills in physics programs, based on the 22 competences proposed in the Tuning Project. The skills were divided into four categories: 1) More Important and more made it, 2) Less important and more made it, 3) Less important and less made, and 4) More important and less made. With this analysis we found that skills like capacity to pose, analyze, and solve physical problems, both theoretical and experimental, through the use of numerical, analytical, or experimental methods are very good values for the teachers, while capacity to participate in advising and drawing up science and technology proposals in subjects of national economics and/or social impact are not considered important or made in the physics programs in Mexico.

CA06: 9-10 a.m. What Science Should Liberal Arts Students Know?

Poster – Kristi D. Concannon, King's College, 133 North River St., Wilkes-Barre, PA 18711; kristiconcannon@kings.edu

There is an increasing level of accountability in higher education to justify student experiences and outcomes. At King's College, students must complete two natural science courses in our Core Curriculum. Traditionally, the first of these requirements has been a course introducing science's "Greatest Hits": genetics and evolution, conservation laws, and simple chemistry. Recently, the course was redesigned to remove emphasis from science content and to place it, instead, on science context. In this course, students cover the process of doing science: establishing a testable hypothesis, designing an ethical and meaningful experiment, analyzing data, drawing conclusions and undergoing peer review. More importantly, students learn what distinguishes science from other disciplines and learn critical thinking skills for evaluating pseudoscientific claims, with the ultimate goal of preparing them to become better consumers of science. This poster will outline the course objectives and content, the embedded course assessments and an analysis of course outcomes.

Session CB: PER: Topical Understanding and Attitudes

Location: Bucktown I
Sponsor: Committee on Physics Education Research
Date: Tuesday, January 8
Time: 8:30–9:20 a.m.

Presider: Sytil Murphy

CB01: 8:30-8:40 a.m. A Comparison Between Ninth Grade Modeling Instruction Physics Students and Ninth Grade Biology Students'

Contributed – Kathy L. Malone, Albert Einstein Fellow, 4103 11th Place North Arlington, VA 22102; Malonek@einsteinfellows.org

The scientific reasoning skills and mathematical ability of ninth-grade students taking a freshman biology and a freshman physics classes were compared. The biology class was inquiry oriented and used the BSCS curriculum. The physics class was taught using the Modeling Instruction pedagogy and did not use a textbook. The scientific reasoning skills were assessed using Lawson's Classroom Test for Scientific Reasoning while the mathematical abilities were assessed using a test designed for the project. The Modeling Instruction physics students outperformed the BSCS students at a satistically significant level.

CB02: 8:40-8:50 a.m. Categorizations of Energy: Forms, Carriers, Types, and Transfers

Contributed – Sarah B. McKagan, Seattle Pacific University, 3307 3rd Ave. West, Seattle, WA 98119; sam.mckagan@gmail.com

Benedikt W. Harrer, University of Maine

Rachel E. Scherr, Seattle Pacific University

Energy is ultimately unified, but manifests in a variety of ways. Most national and state standards, textbooks, and other instructional materials emphasize forms of energy as an important tool for categorizing the manifestations of energy. However, the new Framework for K-12 Science Education, the basis for the Next Generation Science Standards, cautions against talking about forms of energy as "misleading." This caution aligns with recommendations from some science educators, who support the use of "energy carriers" as an alternative to energy forms. We discuss the distinctions between the multiplicity of alternatives to energy forms, and the advantages and disadvantages of these different methods of categorizing energy. Depending on how we teach them, students may use any of these categorizations of energy as meaningless and superficial lists to be memorized, or as important tools for making sense of the properties of systems and the mechanisms by which these properties change.

CB03: 8:50-9 a.m. Winter Break Effect in General Education CLASS Results

Contributed – David Donnelly, Texas State University-San Marcos, 601 University Dr., San Marcos, TX 78666; donnelly@txstate.edu

Hunter G. Close, Eleanor Close, Texas State University-San Marcos

The Winter Break Effect is a shift in student attitudes toward more expert-like during the break between the first semester and second semester of a course. We have CLASS data from a two semester general education course that seems to demonstrate a Winter Break Effect. However, more detailed analysis of matched responses between the end of the first semester and the beginning of the second semester indicates that no significant shift in overall favorable percentage occurred between the first and second semester. We do however observe a statistically significant decrease in the overall unfavorable percentage. This shift persists throughout the second semester of the course.

CB04: 9-9:10 a.m. Testing Student Misconceptions in Energy, Momentum and Rotational Dynamics

Contributed – Andrew W. Dougherty, The Ohio State University, 191 West Woodruff Ave., Columbus, OH 43210; andrew@physics.osu.edu*

Jennifer L Esswein, The Ohio State University

Alex Chediak, California Baptist University

For over 20 years, David Hestenes' diagnostic, the Force Concept Inventory (FCI), has been used in college physics courses to gauge student understanding of Newtonian concepts. This multiple-choice test was developed to aid in designing courses that help students overcome erroneous beliefs. While the FCI has proven invaluable for this purpose, courses oftentimes cover topics that go beyond the scope of the test. In order to broaden coverage, items addressing energy, momentum, and rotational dynamics have been created to fit seamlessly with the FCI. This study reveals the development of these questions, starting with administering open-ended questions to reveal misconceptions, which were then analyzed to produce optimal multiple-choice items. Item Response Theory (IRT) was used as an aid in developing the questions and distractors, as well as to determine item difficulty with respect to existing FCI items.
*Sponsor: Alex Chediak

CB05: 9:10-9:20 a.m. General Physics Enterprise Impact on Expert Identity Development

Contributed – Idaykis Rodriguez, Florida International University, 11200 SW 8th St., Miami, FL 3199; irodr020@fiu.edu

Renee Michelle Goertzen, Eric Brewe, Laird H. Kramer, Florida International University

Specific expertise in a topic of physics is inevitably influenced by the general enterprise of physics. Using the theoretical framework of Communities of Practice and more specifically the concept of boundaries between local communities and the larger enterprise, we show how changes in paradigms of the larger biophysics field influence a physics research group and the individual expert identities constructed. Data were collected from an ethnographic case study of a biophysics research group weekly research meeting. Focusing on boundary interactions between the biophysics research group and visiting experts from other communities that share a common analytical software, we show how such exchange across community boundaries influence a shift in research of the group and of its individual members as well.

Session CC: Modern Physics in the High Schools

Location: Bolden
Sponsor: Committee on Physics in High Schools
Date: Tuesday, January 8
Time: 8:30–10 a.m.

Presider: Deborah Roudebush

CC01: 8:30-9:00 a.m LIGO's Resources for Educational Engagements with Distant Locations

Invited – Dale Ingram, LIGO Laboratory, LIGO Hanford Observatory, Richland, WA 99352; ingram_d@ligo-wa.caltech.edu

LIGO, the Laser Interferometer Gravitational-wave Observatory, operates active outreach programs at detector sites in Louisiana and Washington that connect students and teachers to gravitational wave physics. LIGO also makes available a number of resources for K-12 personnel whose locations are distant from the detectors. This session will explore these distance-learning opportunities and offer ways for teachers from across the U.S. and in international locations to connect to the search for gravitational waves. Some of the primary distance-based strategies that LIGO has utilized to date include the Web-based LIGO Electronic Laboratory (e-Lab — one of the I2U2 project's set of e-Labs), videoconferences, virtual observatory tours, and web-based resources to accompany the classroom use of the movie "Einstein's Messengers." K-12 personnel whose locations are not close to LIGO's detector facilities might be situated near a research group from the LIGO Scientific Collaboration, a circumstance that might offer a different route to face-to-face interactions.

CC02: 9-9:30 a.m. LIGO Science Education Through Immersion in a Working Observatory

Invited – Amber L. Stuver, LIGO Livingston Observatory, 1003 E. Tom Stokes Ct ., Baton Rouge, LA 70810; stuver@ligo-la.caltech.edu

The Laser Interferometer Gravitational-wave Observatory (LIGO) in Livingston, LA and Hanford, WA searches for gravitational waves, which are ripples in a gravitational field, or ripples in space-time, caused by massive objects, like colliding black holes and supernovae, undergoing incredible accelerations. The direct detection of gravitational waves will open a new field of astronomy by allowing humans to "see: the Universe in a new way. The LIGO Science Education Center (SEC), a 5,000 square-foot facility co-located at the Livingston Observatory, seeks to connect this active scientific research to students and teachers through immersion in inquiry activities and interactions with scientists illustrating the process of science at the observatory. This presentation will focus on LIGO's science and the resulting SEC programs for high school students and teachers. Scientific programming is an increasingly valuable skill for physicists, whether they're writing simulations, exploring theoretical models, or analyzing complex data. How and when should this training be incorporated into the curriculum? Can it help students understand physics better?

Session CD: Implementations of Physics for Future Presidents

Location: Oliver
Sponsor: Committee on Physics in Undergraduate Education
Date: Tuesday, January 8
Time: 8:30–9:30 a.m.

Presider: Raluca Teodorescu

CD01: 8:30-8:40 a.m. Advanced Pseudoscience

Contributed – Sadri Hassani, Illinois State University, Physics Department, Normal, IL 61790-4560; hassani@phy.ilstu.edu

Pseudoscience such as the landing of aliens and Big Foot have their origins in the population at large. Advanced pseudoscience are purveyed by intellectuals and even taught at colleges and universities. In this talk, I look at some examples of advanced pseudoscience and discuss how to make our students aware of it as a way of making them more scientifically aware.

CD02: 8:40-8:50 a.m. Future Physics at Princeton University

Contributed – Carolyn D. Sealfon, Princeton University, 328 Frist Campus Center, Princeton, NJ 08544; csealfon@princeton.edu

Peter D. Meyers, Paul J. Steinhardt, Princeton University

Since 2005, Physics 115: Future Physics has been offered as a science course for nonscientists who aspire to become influential citizens and decision-makers. Through a nontraditional organization of physics content inspired by Richard Muller's course, Physics for Future Presidents, we strive to challenge all students equally regardless of their high school physics backgrounds. Lectures, labs, problem sets, and a final project are designed to develop students' confidence and skills when applying quantitative and scientific reasoning to real-life situations. We have recently introduced interactive teaching methods, including pre-class assignments for Just-in-Time Teaching, ConcepTests, interactive lecture demonstrations, and group worksheets (tutorials) to practice quantitative skills. Assignments and discussions about the nature of science help us assess the criteria students use to evaluate the credibility of scientific claims, beyond relying on the authority of the source.

CD03: 8:50-9 a.m. Teaching Future Leaders to Ask the Right Questions

Contributed – Gerald Feldman, George Washington University, Department of Physics, Washington, DC 20052; feldman@gwu.edu

Physics for Future Presidents (PffP) provides a good motivational framework to introduce non-science students to some basic physics knowledge and to develop analytical and problem-solving skills. We have offered PffP in the fall semesters of 2011 and 2012, and the course has attracted primarily political science and international affairs majors. We have built the course on three main pillars — energy, nuclear and climate — which covers about half of the chapters in the Muller textbook. The format of the course involves much interactive discussion, interspersed with simple calculations, as well as several writing assignments. Guest speakers visit the class for expert presentations on a variety of topics. The course also has a weekly lab/recitation session incorporating simple measurements. The primary objective of the course is to develop critical thinking skills and the ability to analyze situations semi-quantitatively. Ultimately, we want the students to cultivate a healthy skepticism and to know what questions to ask when confronted with a problem.

CD04: 9-9:10 a.m. Philosophy of Science in Introductory Lab

Contributed – James K. Simmons, Shawnee State University, Portsmouth, OH 45662; jsimmons@shawnee.edu

Often, a goal of college-level introductory science courses is to help students develop a more sophisticated understanding of the nature of science, and of scientific methods appropriate to that discipline. Explicit instruction in these subjects is necessary to develop a better understanding of these topics, but time is limited in an introductory course. This talk describes how careful reflection on aspects of scientific methods and on related issues from the philosophy of science can be integrated into common laboratory exercises.

CD05: 9:10-9:20 a.m. Basic Science Behind the Headlines

Contributed – Sean J. Bentley, Adelphi University, Garden City, NY 11530; bentley@adelphi.edu

I will discuss my course "Basic Science Behind the Headlines." Designed not only to generate future presidents, but also more generally (and perhaps more importantly) to generate an electorate with a knowledge of science, the course alternates between learning about science from discussions based on readings in Muller's text to then discussing related issues that are found by the students in news articles. Each student is responsible for finding and posting a link on the class website to at least one article for every topic, with these articles being the basis for in-depth discussion. The class emphasizes the wide-reaching impacts of science and technology on our modern world, and how the issues of science, economics, culture, and politics are difficult to separate when exploring complex questions. The goal is to generate students who will become informed and critical thinkers in their actions related to technological issues throughout their lives.

CD06: 9:20-9:30 a.m. Best NYTimes Web-based Physics Applications

Contributed – John P. Cise, Austin Community College, 1212 Rio Grande St., Austin, TX 78701; jpcise@aol.com

For the past four years I have found over four hundred NYTimes articles with excellent applications of physics. They are located at: http://CisePhysics.homestead.com/files/NYT.htm. Articles are edited to fit on a one page word document. Good graphics are enhanced with my added graphics. Each page can serve as a stand alone: Introduction to a physics concept in class, quiz question, or used as student extra credit. Webpages contain: Edited NYTimes article containing a physics application, graphics, introduction, short questions for student solutions and answers to questions. Newer webpages are in PDF format and thus friendly to pc or apple computers.
I will present my best NYTimes web physics applications rich in physics variables confirming physics concepts. http://CisePhysics.homestead.com/files/NYT.htm Students in high minority schools are less likely to have access to high-quality physics instruction. This session will explore issues, needs, challenges, and successes in preparing physics teachers to serve diverse communities.

Session CE: Tracker: Video Analysis

Location: Bechet
Sponsor: Committee on Educational Technologies
Date: Tuesday, January 8
Time: 8:30–9:50 a.m.

Presider: Wolfgang Christian

CE01: 8:30-9:00 a.m. Sharing Video Experiments with Tracker Digital Libraries*

Invited – Douglas Brown, Cabrillo College, 945 Pine Tree Lane, Aptos, CA 95003; dobrown@cabrillo.edu

Sharing is an important component of learning. This talk will show how to access and create shared collections of videos and video experiments using the free Tracker video analysis and modeling tool. Tracker's Digital Library (DL) browser makes it easy to browse and open high-quality videos and experiments in online collections from ComPADRE, LivePhoto, physics departments and teacher workshops. And your students can now share their own experiments with their peers, instructors, or the world by zipping and cataloging them for the DL browser using Tracker itself. Tracker is available for the Windows, Mac and Linux platforms from Cabrillo College at http://www.cabrillo.edu/~dbrown/tracker/ or from the ComPADRE Open Source Physics collection at http://www.compadre.org/OSP/.

*Partial funding was provided by NSF grant DUE-0442581.

CE02: 9-9:30 a.m. Interesting Projects Using Tracker Video Analysis

Invited – Rhett J. Allain, Southeastern Louisiana University, Hammond, LA LA 70402; rallain@selu.edu

Video analysis makes any project more exciting and interesting. In this talk, I will go over my favorite examples of video analysis including (but not limited to): video analysis of Angry Birds, using video analysis to spot faked videos, determining the height of a space balloon, and examining the download progress bar on your computer.

CE03: 9:30-9:40 a.m. The Physics of Angry Birds

Contributed – Rebecca Howell, Alpharetta High School, 3595 Webb Ridge Road, Alpharetta, GA 30005; howellr@fultonschools.org

Want to make exploring mechanics fun? Angry Birds is a popular smart phone app that was recently released as an online game through Google Chrome. Using free software, students and instructors can capture the computer screen as a video file. Using the amazing and free Tracker program, the motion of the birds can be analyzed. Once the motion of a bird is tracked, the projectile motion, kinetic energy, potential energy, and momentum can be calculated. Most students are familiar with the game and enjoy having an opportunity to explore the physics of the gaming world. Additionally, this application teaches students how to use Tracker, which many will use in the future to analyze other video clips.

CE04: 9:40-9:50 a.m. Tracking the Coriolis Force

Contributed – Anne J. Cox, Eckerd College, St Petersburg, FL 33711; coxaj@eckerd.edu

This talk presents a ready-to-use laboratory activity using Tracker for both video analysis and video modeling of the "fictional" Coriolis force. Students use video analysis to track the motion of a ball in a rotating reference frame. Then they build a model of the motion using Tracker's modeling tools and compare experiment to theory. Resources are available on Compadre (http://www.compadre.org/osp/items/detail.cfm?ID=12042).

Session CF: Pre-High School

Location: Foster
Sponsor Committee on Physics in Pre-High School Education
Date: Tuesday, January 8
Time: 8:30–9:40 a.m.

Presider: Peggy Norris

CF01: 8:30-9:00 a.m. LIGO Science Education Center and the Middle School Student

Invited – William Katzman, LIGO Science Education Center, 19100 LIGO Lane, Livingston, LA 70754; wkatzman@ligo-la.caltech.edu

The Laser Interferometer Gravitational-wave Observatory (LIGO) in Livingston, LA, and Hanford, WA, search for gravitational waves, which are ripples in a gravitational field, or ripples in space-time, caused by massive objects, such as colliding black holes and supernovae, undergoing incredible accelerations. We expect the direct detection of gravitational waves to open a new field of astronomy by allowing humans to "see" the universe in a new way. The LIGO Science Education Center (SEC), a 5000-square-foot facility co-located at the Livingston Observatory, seeks to leverage the resources of LIGO in order to inspire the next generation of scientists. This presentation will focus on LIGO Science Education Center's inquiry-laden outreach to younger audiences (grades 5-8), which comprises almost half of LIGO-SEC's on-site school visitors.

CF02: 9-9:30 a.m. Outreach in Rural Native American Communities

Invited – Julie M. Callahan, Telescope Array – University of Utah, Salt Lake City, UT 84109; cosmic.callahan@gmail.com

The challenge of providing outreach to K-12 science communities poses interesting problems under the best of conditions. Serving our underrepresented groups in the most rural of areas presents a unique set of issues that can be supported using novel approaches. ASPIRE has partnered with schools in Browning, MT, to provide outreach to some of their K-12 students. Providing support and opportunity to rural and underrepresented groups is a challenging and rewarding problem to address. Learn how we have implemented a semi-formal program to engage and support students from these unique populations by sharing information about cosmic ray research from Telescope Array.

CF03: 9:30-9:40 a.m. Physics of Atomic Nuclei for Middle and Elementary Classrooms

Contributed – Lynn Arnold, Rapid City School District, Rapid Valley Elementary, 2601 Covington St., Rapid City, SD 57703; Lynn.Arnold@k12.sd.us

Ann Hast, Rapid City School District - West Middle School

Margaret Norris, BHSU/Sanford Underground Research Facility

The Sanford Underground Research Facility in Lead, SD, is providing infrastructure and support to scientists installing large detectors a mile underground that will advance our understanding of the structure, history, and fate of the universe. Regional educators at all levels and in all disciplines are exploring ways to excite and inspire students about STEM careers through the science happening in their backyard. In the summer of 2012, a one-week teacher professional development workshop, "Physics of Atomic Nuclei in the 21st Century Classroom," explored online resources for delivering modern physics contents to K-12 students. The workshop was a follow-up to an earlier workshop that used a more traditional lecture and hands-on activity format. In this joint presentation, the instructor of the course plus two participants will present lesson plans and follow up lessons learned for introducing modern physics to 5th and 8th grade classrooms.

CF04: 9:40-9:50 a.m. "Science Is Fun" Field Trip for Elementary School Graduates

Contributed – Michael Ponnambalam, University of the West Indies, Physics Department, Kingston, 7 Jamaica; michael.ponnambalam@uwimona.edu.jm

In May 2011, we launched the "Science Is Fun" Field Trip for our Elementary School Graduates. We gave the little ones an opportunity to discover, experience, and enjoy the beauty and fun in science, through the use of lively and interactive demonstrations, experiments and computer simulations. They were given a chance to enjoy science for two hours, and discover for themselves that i) Science is fun, ii) Science is cool, and iii) Science is good for them. The program was extremely successful, and has become a popular annual event.

Session CG: *Panel:* Reports from the Conference for Undergraduate Women in Physics

Location: Jackson
Sponsor Committee on Women in Physicsn
Date: Tuesday, January 8
Time: 8:30–10 a.m.

Presider: Dedra Demaree

The annual Conference for Undergraduate Women in Physics began at USC in January 2006 with 29 undergraduate women from 12 universities. But the conference has grown and the 2013 conference will take place in six regional conferences bringing together hundreds of women undergraduates in a unique environment to highlight the study of physics. The panel will consist of organizers, speakers, and undergraduate women who will speak on the goals, how the conferences are organized, and what the attendees learned at the meetings.

CG01: 8:30-10 a.m. Goals and Reflections: The Northeast Conference for Undergraduate Women in Physics

Panel – Ariel Ekblaw, Yale University, New Haven, CT; 06520 ariel.ekblaw@yale.edu

The Northeast Conference for Undergraduate Women in Physics (NCUWP) provides a supportive and empowering atmosphere for young physicists to connect with peers and with female role-models in the field. We hope the event inspires attendees to pursue careers in physics and to embrace an invigorated vision for the future of women in science. From talking to participants and analyzing our surveys over the past four years, we have accomplished these goals and we strive to continue achieving them in the future. Throughout the conference and program activities, we encourage a dialogue on the challenges and opportunities for women in physics and engineering fields. At Yale, the conference has inspired the Women in Physics organization, dedicated to connecting undergraduates to career and educational resources and developing a community on campus. Inspired by the NCUWP at MIT in 2011, Ariel Ekblaw served as a principal organizer of NCUWP 2012 at Yale University.

CG02: 8:30-10 a.m. Overview and Initial Insights into the Impact of the Conferences

Panel – Gayle Buck, Indiana University, 201 North Rose Ave., Bloomington, IN; 47404 gabuck@indiana.edu

Mary Mills, Indiana University

The first Conference for Undergraduate Women in Physics occurred in 2006, with the number of locations growing from one in that year to six in 2012. Accordingly, the number of participants grew from 29 that first year, to 672 in 2012. In 2013, the number is expected to grow again to approximately 700 participants across six different host institutions. Over the years, the conferences have been evaluated on a site-by-site basis, with the results suggesting very positive impacts. Beginning with the 2012 conferences, a large-scale evaluation was implemented. The initial findings provided us with a better understanding of the summative impact of the conference in regards to the established goals. More importantly, the findings provided new understandings in regards to the impact of the various conference components that supported or hindered progress toward those goals. These best practices, and their value for future conferences, will be shared and discussed.

CG03: 8:30-10 a.m. Two Year Experience with the Conference for Undergraduate Women in Physics

Panel – K. Renee Horton, NASA MSFC, Huntsville, AL 35712; renee.horton@nasa.gov

This talk represents a two year experience attending the Conference for Undergraduate Women in Physics as an invited speaker. It reviews the positive impact associated with attending, presenting and interacting with undergraduates and some graduates at different stages of their academic career. Each year provided a different outlet to share my experiences, first as a graduate student and the last time as a new PhD. The conference has served as a very positive impact on myself and the other attendees.

CG04: 8:30-10 a.m. Women's College Meets Women's Conference

Panel – Amelia A. Plunk, Northwestern University, 2220 Campus Drive, Evanston, IL 60208; amelia.plunk@u.northwestern.edu

For many women who attended the Conference for Undergraduate Women in Physics the weekend was refreshing, empowering, and inspiring. For me, it was eye-opening. Having a background at a women's college meant that I had an awareness of the struggles of women in physics, while having experienced few myself. Being given the opportunity to attend the Northeast CUWiP allowed me to hear the stories and experiences of my peers and to adapt and apply them to my own trajectory. In this informal talk I will bring to the table my unique experience as a student from a women's college at the CUWiP. I will discuss some of the viewpoints I brought with me, and many more of those with which I walked away. Finally I will present sage advice straight from the conference, and will develop on this idea a plan for expanding the scope of the CUWiP.

Session CH: Sustainability in the 21st Century

Location: Johnson
Sponsor Committee on Physics in Two-Year Colleges
Co-Sponsor: Committee on Science Education for the Public
Date: Tuesday, January 8
Time: 8:30–10 a.m.

Presider: Keith Clay

CH01: 8:30-9 a.m. Constructing a Sustainable Foundation for Thinking and Learning About Energy in the 21st Century*

Invited – Stamatis Vokos, Seattle Pacific University, Physics Department, Seattle, WA 98119-1957; vokos@spu.edu

Lane H. Seeley, Seattle Pacific University

Sustainability is the capacity to endure and continue flourishing. Intellectual sustainability involves the construction of ideas, strategies, and beliefs that will support ongoing intellectual engagement throughout a learner's lifetime. The Energy Project at Seattle Pacific University works with K-12 teachers to help them build an energy understanding that is both personal and intellectually sustainable. We will describe instructional strategies that promote the construction, negotiation and representation of foundational energy ideas. These strategies help teachers engage in subtle, rigorous, and productive discourse about energy with their colleagues and with their students. In this way, the Energy Project is working with teachers to lay the intellectually sustainable groundwork that will be critical for addressing the energy challenges of today and tomorrow.

*Supported in part by NSF grant DRL-0822342.

CH02: 9-9:30 a.m. Sustainable Energy Degree Programs in New Jersey's Two-Year Colleges

Invited – Brian Holton, Passaic County Community College, Science Department, Paterson, NJ 07505; bholton@pccc.edu

For the last few years, a consortium of two-year colleges along with a few four-year institutions have been working together to develop degree programs for students wishing to pursue careers in sustainable energy in the state of New Jersey. Our state is diverse in population in terms of race, socio-economic status, and population density. While a relatively small state, New Jersey encompasses urban, suburban, and rural areas with colleges in all of these. Does one size fit all and can very different colleges offer similar programs? Armed with a two-year degree in sustainable energy, what do our students do with these? We will describe how our colleges are working together in sharing resources and in developing successful sustainable energy degree programs to meet the country's growing energy needs.

Ceremonial Session II: J.D. Jackson Award, David Pines

Retiring President's Address,

Jill Marshall, University of Texas, Austin

Location: Celestin Ballroom I-III
Date: Tuesday, January 8
Time: 10:30 a.m.–12:15 p.m.

Presider: David Sokoloff

J.D. Jackson Award Presented to David Pines

David Pines

What We Don't Know, We Teach One Another

David Pines, UC Davis, ICAM, and UIUC

This was Robert Oppenheimer's 1946 description of theoretical physics as a profession, but because his evocative phrase is equally applicable to teaching and learning about physics, and indeed all of science, and because he was my first mentor, it seemed the right title for this talk. I first describe how my early experiences as a student, teacher, and researcher led to my inventing and editing "Frontiers in Physics"and writing "The Theory of Quantum Liquids" for a graduate student audience. I then fast forward to another kind of teaching—a description of some of my ICAM-based experiments in engagement during the past decade: using the web to convey the importance of emergence in general [http://emergentuniverse.org], and research on emergent behavior in quantum matter in particular[http://physics.digitalgizmo.com/courses/physics/unit/text.html?unit=8&secNum=0] to a broad audience that begins with high school teachers and undergraduates; founding a new global partnership, GSEE [http://icami2cam.org/index.php/outreach/gsee/], that is designed to connect and expand the global community of engaged scientists and make their work more effective; and working with colleagues to take the first steps toward creating a science of engagement.

Pines is Distinguished Research Professor at UC Davis, Research Professor of Physics and Professor Emeritus of Physics and Electrical and Computer Engineering in the Center for Advanced Study, University of Illinois at Urbana-Champaign, and retired last year as the Founding Director of the Institute for Complex Adaptive Matter, a global partnership connecting scientists who study emergent behavior in matter in its 71 branches representing 111 institutions.

CRK03: Prerequisite Issues in Introductory Courses

Location: Bucktown I
Sponsor: Committee on Physics in Two-Year Colleges
Date: Tuesday, January 8
Time: 12:15–1:15 p.m.

Presider: John Cise

Prerequisites are essential for success in Introductory Physics courses. This crackerbarrel session will discuss prerequisite issues ....especially prerequisite checking by Colleges.

CRK04: Crackerbarrel on Program Guidelines and Learning Objectives

Location: Bucktown II
Sponsor: Committee on Physics in Undergraduate Education
Date: Tuesday, January 8
Time: 12:15–1:15 p.m.

Presider: Aaron Titus

In this crackerbarrel, participants will have an open, guided discussion on the value and need for professionally recommended college-level program guidelines, learning objectives, and course and program assessment. Physics departments are being asked to articulate learning objectives and measure student learning, and they are looking to professional organizations like AAPT and APS for guidance.

Session DA: Bridge and Dual Enrollment Programs with HBCUs and MSIs

Location: Foster
Sponsor Committee on Minorities in Physics
Co-Sponsor: Committee on Graduate Education in Physics
Date: Tuesday, January 8
Time: 1:30–3 p.m.

Presider: Geraldine Cochran

DA01: 1:30-2 p.m. A New Way of Enhancing Diversity in Applied Physics

Invited – Cagliyan Kurdak, University of Michigan, Applied Physics, Ann Arbor, MI 48109; kurdak@umich.edu

In 2010, the University of Michigan Applied Physics Program launched a Master's degree bridge program designed to prepare students from underrepresented groups for doctoral studies in interdisciplinary research in applied physics, physical sciences, and engineering. The program currently has a cohort of seven graduate students and is fully integrated without PhD program. In this talk, I will share some of our best practices that can be used by other programs that are interested in enhancing diversity.

DA02: 2-2:30 p.m. Building Partnerships to Increase the Success of Underrepresented Minorities in Physics

Invited – Vivian Incera, University of Texas at El Paso, 500 West University Ave., El Paso, TX 79968; vincera@utep.edu

I will describe the coordinated efforts between UTEP and several Degree Granting Institutions (DGIs) to develop a model of partnerships between Underrepresented Minority Institutions and DGIs to increase the number of underrepresented minority students finishing with a master or doctorate degree in physics. The main idea is to develop a well-structured mentoring and supporting model between the participating institutions that can be suitable for partnerships between institutions that are not necessarily geographically close and that has the potential to be institutionalized for sustainable impact.

DA03: 2:30-3 p.m. Mentoring and Networking in the Fisk/Vanderbilt Masters-to-PhD Bridge Program

Invited – Arnold Burger, Fisk University, Vanderbilt University, Nashville, TN 37208; aburger@fisk.edu

Keivan Stassun, Dina Myers Stroud, David J. Ernst, Kelly Holley-Bockelmann, Vanderbilt University, Fisk University

We briefly review the current status of underrepresented minorities in the physical sciences: The underrepresentation of Black-, Hispanic-, and Native-Americans is an order of magnitude problem. We then describe the Fisk-Vanderbilt Masters-to-PhD Bridge program as a successful model for effective partnerships with minority-serving institutions toward addressing this problem. Since 2004 the program has admitted 60 students, 54 of them underrepresented minorities (60% female), with a retention rate of 92%. The program has become the nation's top producer of underrepresented minority PhDs in physics, astronomy, and materials science. Moreover the program leads the nation in master's degrees in physics for African Americans, and is one of the top 10 producers of physics master's degrees among all U.S. citizens in general. We summarize the main features of the program including two of its core strategies: (1) partnering a minority-serving institution and a major research university through collaborative research, and (2) using the master's degree as a deliberate stepping stone to the PhD. We also specifically discuss the emerging core theories of the program, including (a) the concept of selecting students with high "performance character," and (b) monitoring the "second derivative" of performance. We discuss our methods to recognize and select for high performance character during the admissions process, and how we cultivate that unrealized potential toward development of successful scientists and leaders.

Session DB: Twentieth Century Physics in the First Year

Location: Bechet
Sponsor: Committee on Physics in Undergraduate Education
Date: Tuesday, January 8
Time: 1:30–2:20 p.m.

Presider: Dwain Desbien

DB01: 1:30-1:40 p.m. A Journey of Discovery: Teaching Particle Physics First

Contributed – Donald A. Smith, Guilford College, Greensboro, NC 27410; dsmith4@guilford.edu

I will present a description of our calculus-based introductory physics class that begins with modern physics. We confront the students with surprising data that force them to revise their intuitive models of the world. We have sometimes begun with particle physics, using a quasi-historical approach to guide the students to develop the standard model themselves. The process also works with optics, as the students must embrace and abandon the ray, wave, and photon models of light in turn. We finish the semester with a treatment of Special Relativity. I will present the advantages and challenges inherent to this approach in a small liberal arts college setting.

In our experience, bringing 20th-century physics in at the beginning lets students see right away that physics is an active field filled with mysteries while also giving them the thinking skills to develop as scientists.

DB02: 1:40-1:50 p.m. 1900-Planck's Miraculous Year

Contributed – Aleksandr Goltsiker, Loyola University Chicago, 1032 W. Sheridan Road, Chicago, IL 60660; agoltsi@luc.edu

Asim Gangopadhyaya, Joseph Hlevyac, Thomas T. Ruubel, Loyola University Chicago

The concept of quanta was introduced by Planck through three ground breaking papers during the miraculous year of 1900. We will describe his introduction of the h constant, the development of the formula describing the black-body radiation and, finally the derivation of the formula that introduced, for the first time, the discreteness of energy.

DB03: 1:50-2 p.m. Spandex Models for General Relativity: Folklore, Facts, and Fun

Contributed – Gary D. White, NSF and AIP National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230; gwhite@nsf.gov

Many texts tout the use of taut rubber sheets with heavy spheres on top as a useful way to visualize aspects of general relativity. In this talk, after summarizing some results discovered by my students and me regarding the shape of stretched Spandex when attached to a circular boundary with a heavy mass suspended from the center, I'll indicate how this shape dictates what kinds of orbits will be observed when viewing marbles rolling on the surface.[1] After discussing the limitations of this Spandex model of Newtonian gravity, I'll move to discuss how the Spandex can be used to model Einstein's view of gravity, exploring in a semi-quantitative way Wheeler's oft-cited quote: "Matter tells space how to curve. Space tells matter how to move."

1. Rolling marbles on stretched Spandex is a great way to engage students in the subtleties of celestial orbital phenomena, everything from precession to escape velocity to the Roche limit to tides to planetary rings. See "The shape of 'The Spandex' and orbits upon its surface," Gary D. White and Michael Walker, *Am. J. Phys.* **70,** 48-52 (Jan. 2002), and the comment by Don S. Lemons and T. C. Lipscombe, *Am. J. Phys.* **70** 1056-1058 (Oct. 2002).

DB04: 2-2:10 p.m. Undergraduate Student Investigations in Modern Physics*

Contributed – Kenneth Cecire, University of Notre Dame, 225 Nieuwland Science Hall, Notre Dame, IN 46556; kcecire@nd.edu

QuarkNet has developed student investigations centered on particle and cosmic ray physics and the use of data from experiments. These have potential for use in undergraduate physics to bring in new content that helps students learn how physics research works. We will introduce investigations and examine online resources.

*This work is sponsored in part by the National Science Foundation, the U.S. Department of Energy Office of Science, and the University of Notre Dame.

DB05: 2:10-2:20 p.m. Using Astronomy to Teach Physics at Gustavus Adolphus College

Contributed – Charles F. Niederriter, Gustavus Adolphus College, Saint Peter, MN 56082; chuck@gustavus.edu

Steven H. Mellema, James Miller, Gustavus Adolphus College

In an effort to improve retention in introductory physics courses for physics majors and pre-engineers, the faculty at Gustavus Adolphus College have begun teaching the first physics course differently. As many students struggled with the use of calculus, particularly integral calculus, in that course, we decided to avoid significant amounts by careful choice of topics. As it turned out, the topics chosen for that course could easily be fit into a theme of astrophysics. So, in the fall of 2011, we began teaching "The Cosmic Universe" as the first course in our four-course introductory sequence. In this talk, we will report on the contents of this new course and its associated lab. With results from only two classes available, only preliminary assessment data are available. But, we will discuss the impressions of the students and faculty involved.

Session DC: Teacher Training/ Enhancement

Location: Oliver
Date: Tuesday, January 8
Time: 1:30–3 p.m.

Presider: Todd Leif

DC01: 1:30-1:40 p.m. Alabama Professional Development Project, Alliance for Physics EXcellence (APEX)

Contributed – Jim Nelson, Alabama A&M University, Gainesville, FL 32608; nelsonjh@ix.netcom.com

Mostafa Dokhanian, Alabama A&M University

The National Science Foundation has awarded a physics educational enhancement grant to Alabama A&M University and its partners: AAPT/PTRA Program, Huntsville City School System, University of Alabama, Drake State Technical College (DSTC), and Alabama Science In Motion (ASIM) to conduct a five-year project addressing the secondary physics needs of Alabama. This project, entitled "Alliance for Physics Excellence" (APEX), will increase the number of undergraduates in physics who plan to become teachers, the professional development of in-service physics teachers, and the number of underrepresented individuals who study and teach physics at all levels of the Alabama educational system. APEX envisions transforming physics education in Alabama by enabling physics teachers to acquire a deeper knowledge of physics content and employ more effective pedagogical strategies based on physics educational research, thus enabling students to achieve higher knowledge gains. Come meet APEX leaders who will share their vision and details of the project.

DC02: 1:40-1:50 p.m. PhysicsTeachersNYC – A New, Local, Modeling-Focused Learning Community

Contributed – Fernand Brunschwig, Columbia University Teachers College, Math, Science & Tech Dept., New York, NY 10027; fbrunsch@gmail.com

Mark Schober, Trinity School

Colleen Megowan-Romanowicz, American Modeling Teachers Association

Zhanna Glazenburg, Croton-Harmon High School

PhysicsTeachersNYC,[1] a year-old affiliate of the American Modeling Teachers Association (ModelingInstruction.org), has over 100 teacher-members in NYC, communicating via a lively Google Group and website (PhysicsTeachersNYC.org). PhysicsTeachersNYC meets at Columbia Teachers College and has conducted 11 highly successful teacher-led three-hour weekend workshops and one three-week summer Modeling Mechanics Workshop. We will document the process by which PhysicsTeachersNYC began and the high level of activity and interaction. Reasons for success lead back to the fact that the group is locally-originated, classroom-oriented, and modeling-focused, with teachers determining the topics and leading the workshops. The workshops are intense, "hands-on" sessions: teachers work through Modeling Instruction lessons including experiments in "student mode" and then discuss the pedagogy in "teacher mode." We will spell out the implications and possibilities for teachers elsewhere interested in generating additional locally oriented initiatives from the grassroots, whether focused on Modeling Instruction or other interactive-engagement approaches.

1. PhysicsTeachersNYC.org;

DC03: 1:50-2 p.m. UCA STEMteach: Transforming a Teacher Education Program

Contributed – Stephen R. Addison, University of Central Arkansas, 201 Donaghey Ave., Conway, AR 72035; saddison@uca.edu

Gary O. Bunn, University of Central Arkansas

The University of Central Arkansas is a cohort 4 UTeach replication site. The effort was driven by state needs to increase the numbers of teachers being produced in the STEM disciplines. The productivity of physics programs across the state has been particularly low. Lessons learned and strategies developed to implement a UTeach replication site on a compressed schedule will be presented. Strategies to attract more physics students into high school classrooms will be included.

DC04: 2-2:10 p.m. Helping High School Teachers Teach Atoms*

Contributed – Gordon Aubrecht, Ohio State University at Marion, 1465 Mt. Vernon Ave., Marion, OH 43302; aubrecht@mps.ohio-state.edu

As a university professor interacting with high school teachers, I have tried to help teachers with accessing content without dictating how teachers should teach. In observing ninth-grade physical science classes, it was clear to me as an outside observer that attempts to teach atoms and the periodic table were not reaching students. This did not seem clear to the teachers themselves. We used grant funding to help teachers learn about their students' thinking through use of formative assessments the teachers analyzed. The assessments were developed with teacher assistance. The physical science assessments were not focused at the subject of atoms but addressed parts of the subject. After teachers had analyzed the students' assessments, they spontaneously expressed dissatisfaction with what students learned about atoms and asked us for assistance in making changes. We present some details of the process in this talk.

*Research supported in part by by grants from the Ohio Department of Education C1457-OSCI-09-49 (2008-2009), C1667-MSP-10-410 (2009-2010), EDU01-0000006141 (2010-2011), EDU01-0000007902 (2011-2012) and GRT00029161 (2012-2013).

DC05: 2:10-2:20 p.m. New Instructor Training Program at West Point

Contributed – Pete R. Exline, United States Military Academy, West Point, NY 10996; pete.exline@usma.edu*

Pete Chapman, United States Military Academy at West Point

In the Department of Physics and Nuclear Engineering (D/PANE) at the United States Military Academy (USMA), the junior faculty consists largely of active duty U.S. Army officers sent to graduate school for a two-year Master's Degree program in Physics or Nuclear Engineering and then to West Point for a thre-year tour as an instructor. While this model is great for bringing current military experience into the classroom, it creates almost 30% turnover in the department's faculty each year. With only six weeks from new instructor arrival to the start of classes, D/PANE has developed a "New Instructor Training" (NIT) Program to rapidly equip them with the pedagogical concepts and practical experience to successfully lead a classroom. This presentation describes the structure of the NIT Program and discusses the continuing faculty development efforts throughout the academic year.

*Sponsor: Tom Lainis, USMA

DC06: 2:20-2:30 p.m. The Role of Reflection in a Content-based Professional Development Program*

Contributed – Donna L. Messina, University of Washington, Seattle, WA 98195-1560; messina@phys.washington.edu

Paula R.L. Heron, Peter S. Shaffer, Lillian C. McDermott, Univ. of Washington

Effective science education reform requires bringing inquiry teaching and learning to the forefront in K-12 schools. To successfully do so, teachers need the opportunity to participate in meaningful professional development that develops their content and pedagogical content knowledge. During the Physics Education Group's five-week Summer Institute in Physics and Physical Science, teachers work through modules of Physics by Inquiry[1] relevant to the grades they teach to develop these understandings. In addition, they are prompted by specific instructional strategies to reflect on their own teaching practice and ways in which they can creatively affect their students' learning experiences. This talk will explore these strategies and provide insight into the ways in which the teachers' practice and their students' learning is affected.

*This work has been supported in part by the National Science Foundation.

1. L.C. McDermott and the Physics Education Group at the University of Washington, *Physics by Inquiry* (Wiley, 1996).

DC07: 2:30-2:40 p.m. Understanding Physics Learning Assistants' Perspectives on Teaching, Reflection, and Expertise*

Contributed – Geraldine L.. Cochran, Florida International University, 11200 S.W. 8th Street, Miami, FL 33199; gcoch001@fiu.edu

David T. Brookes, Eric Brewe, Laird H. Kramer, Florida International University

At Florida International University we have implemented a learning assistant (LA) program based on the Colorado Learning Assistant Model (Otero, Pollock, Finkelstein, 2010), designed to help prospective and preservice science and mathematics teachers to develop pedagogical content knowledge, develop as reflective practitioners, and gain experience in teaching early in their academic careers. As a part of the program, LAs are helped to develop reflective practice. We believe that reflective practice is a kind of deliberate practice that helps novice teachers to hone their teaching skills as they strive toward expertise in teaching. To better understand the needs of our LAs in this development, we interviewed a number of them to better understand their perspectives in regard to teaching, reflection, and expertise.

*Work supported by NSF Grant #0802184.

DC08: 2:40-2:50 p.m. Learning Assistants at the University of Alabama

Contributed – Stan Jones, The University of Alabama, Tuscaloosa, AL 35487; stjones@bama.ua.edu

Dennis W. Sunal, Penni Wallace, The University of Alabama

We describe the transition from undergraduate teaching assistants to learning assistants at the University of Alabama. A key component of the program is early exposure to physics teaching in the department as well as in local high schools. Our program integrates activities with the Alabama Science in Motion program, which makes lab equipment available to all interested high schools statewide. LAs demonstrate a greater interest in high school teaching than was found with the traditional TA program. LAs were found to be more enthusiastic in participating in courses where reformed teaching was present.

Session DD: Policy & Advocacy for Physics Education and PER

Location: Bucktown I
Sponsor: Committee on Research in Physics Education
Co-Sponsor: Committee on Teacher Preparation
Date: Tuesday, January 8
Time: 1:30–3 p.m.

Presider: Tyler Glembo

DD01: 1:30-2 p.m. Why Leaders in Physics Education Must Communicate the Right Message to Students

Invited – John Rice, 1118 Camelia Ave.,Baton Rouge, LA 70806; spindoc62@msn.com

In spring 2009, the University of Texas had 192 physics majors. Now there are 442. John Rice, owner of CommonSense Communications — a Baton Rouge marketing, public relations and advertising firm, and Sacha Kopp, physics professor and senior associate dean for the College of Natural Sciences at the University of Texas, based a campaign on what students said drew them to the major, would keep them in the major, and what repelled them from it. This data was collected through focus groups of both physics majors and science and math majors who said they would not major in physics if you held a gun to their head. Rice went on to conduct focus groups, write marketing plans, and create campaigns for four more university physics departments. He has also conducted focus groups at community colleges and high schools. In part, the data collected revealed: 1. Though high school students taking advanced science classes rate their high school physics highly, less than five percent will choose to major in physics. 2. 80 percent of senior physics majors cannot name three careers that can be pursued with a physics background other than teaching at a university and conducting research 3. At California State University San Marcos, 60 percent of STEM majors said they did not feel like they were aware of all the careers associated with their majors; 53 percent said if they knew about other careers associated with math and science majors they would consider something other than their current major and 84 percent said seeing research first hand would affect their choice of major to some degree. This presentation will provide specific suggestions and strategies to high school and college physics educators about how to communicate messages that will help students ensure that they get what they want from physics and everything the academic pursuit has to offer. Rice believes that if more physics education decision makers do this effectively it will result in more majors. If you have seen this presentation before, you should consider seeing it again since it will focus more on the specifics of what you can do as an educator and how to do it.

DD02: 2-2:30 p.m. The Faculty Role in Advocacy: What, Why, And How

Invited – Scott Franklin, Rochester Institute of Technology, Department of Physics/RIT, Rochester, NY 14623; svfsps@rit.edu

The Capitol Hill environment is completely unlike that in the halls of academia, and advocating for science policy requires a style of communication quite different from scientific discourse. Nevertheless, the experience, while challenging, can be extremely rewarding, and change how one approaches changing our educational system. Fortunately, there are a growing number of resources that faculty can draw upon to make the process easier and more effective. I will discuss my first trip to Capitol Hill, including the details of setting up and managing appointments with congressional aides, and the resources I found useful during my visit. I'll also describe the initial culture shock and how I quickly came to appreciate the intensity and clarity of the visits. In addition to providing a roadmap for other faculty wishing to advocate for science policy, I'll describe additional resources that are in development.

DD03: 2:30-3 p.m. Teacher-Centered Systemic Change in the Maine Physical Sciences Partnership

Invited – Michael C. Wittmann, University of Maine, 5709 Bennett Hall, Orono, ME 04469-5709; mwittmann@maine.edu

William N. Zoellick, SERC Institute

As part of the Maine Physical Sciences Partnership (MainePSP, an NSF-funded MSP project*), members of the University of Maine and several non-profits are working with school districts to enact change in middle-school physical science instruction. The setting is rural, with schools separated by long distances, and often only one or two science teachers per school. The MainePSP uses a "bottom-up" change mechanism to support a community of teachers who are implementing a vertically integrated science curriculum. The beliefs and practices of the teachers impact school administrative decisions that support the curriculum reform. We provide evidence of a strong teacher community, our model of systemic change, and conjectures about how the teacher community might be influencing district-level decisions about physical science instruction.

* NSF DUE-0962805

Session DE: Introductory Labs/ Apparatus

Location: Bucktown II
Sponsor: Committee on Apparatus
Date: Tuesday, January 8
Time: 1:30–2:30 p.m.

Presider: Amber Stuver

DE01: 1:30-1:40 p.m. iLabs: Hands on Investigations with iPads In Introductory Physics Labs

Contributed – Jacob Millspaw, Indiana Purdue University Fort Wayne, 2101 E. Coliseum Blvd., Fort Wayne, IN 46805; millspaj@ipfw.edu

Sally Mikhail, Indiana Purdue University Fort Wayne

Computers and data collection devices are an expensive part of introductory labs. What if students could use their own smart phones or tablets? We have run a set of mechanics-based physics labs using iPads for data collection and analysis. Using motion capture software the iPads function as a versatile replacement for frustrating sonic detectors. The data can be analyzed with a variety of simple apps that can be easily inserted into a document for electronic submission. ilabs are paperless eLabs!

DE02: 1:40-1:50 p.m. Measuring the Impulse of a Popper

Contributed – Sytil K. Murphy, Shepherd University, Shepherdstown, WV 25443; smurphy@shepherd.edu

Jeffrey R. Groff. Shepherd University

Many schools have labs that use conservation of energy to determine the amount of energy stored in a toy popper. However, there is much more physics involved in the "pop" portion. Thus, we extended our analysis of the popper's motion to include looking at the impulse between the popper and the surface it sits upon. To do so, we used a lever connected to a Vernier force probe in order to obtain a graph of the force vs. time while the popper was launching and video analysis to more accurately use conservation of energy to determine the initial velocity. Results will be shown.

DE03: 1:50-2 p.m. Progressive Lab Textbook for Algebra-based Introductory Physics

Contributed – Melanie R. Brady, University of Southern Mississippi, Hattiesburg, MS 39406; melanie.brady@eagles.usm.edu

Hironori Shimoyama, University of Southern Mississippi

At the University of Southern Mississippi, the physics lab education team started a new type of textbook for algebra-based introductory physics labs. It is challenging to teach physics to non-physics major students due to their low math ability and negatively motivated mind setting. Laboratory education highly involves equipment features, student backgrounds, and teaching capacity of the lab instructor. Traditional textbooks do not integrate such factors. One of our strategies is a progressively revisable textbook to improve laboratory education. In-depth discussions resulting in a variety of feedback have been essential for maintaining this innovative textbook.

DE04: 2-2:10 p.m. Promoting Scientific Reasoning Abilities in the Introductory Physics Lab Course*

Contributed – Kathleen M. Koenig, University of Cincinnati, 400 Geo Phys Building, Cincinnati, OH 45221; kathy.koenig@uc.edu

Larry Bortner, Carol Fabby, University of Cincinnati

Lei Bao, The Ohio State University

Students enter college with wide variations in scientific reasoning abilities. Research indicates that students with formal reasoning patterns are more proficient learners, but unfortunately the typical college course does not significantly impact these abilities. Rather, it is through explicit and targeted instruction in scientific reasoning that students have been observed to make significant shifts. In an effort to better target our students' development of scientific reasoning, we have revised the structure and topics of the activities in our introductory physics lab courses. Students are more involved in the actual design of the experiments and more emphasis is placed on student use of evidence-based reasoning in lab report writing. Online homework and quizzes between lab sessions provide further targeted support. This presentation will describe the new lab curriculum as well as gains made in student development of scientific reasoning.

*Partially supported by the National Institutes of Health 1RC1RR028402-01

DE05: 2:10-2:20 p.m. Two Lab Activities Related to High Altitude Balloon Launches

Contributed – Seiji A. Takemae, University of Minnesota at Morris, Physics Department, Morris, MN 56267; stakemae@umn.edu*

We are developing two lab activities to support high altitude balloon launches. These activities will help students understand the forces involved in the balloon ascent and descent. In one activity, weight is added to a hydrogen balloon until it attains equilibrium. We calculate an expected value of the buoyancy force and compare to the total weight of the balloon in equilibrium. In another activity, the mass of an air-filled balloon is measured and then the balloon is dropped. The terminal velocity is then measured with techniques that will be described. We use the equations for drag force, balloon weight, and buoyancy force to calculate the expected value of the terminal velocity and then compare the calculated and measured value.

*Sponsor: Gordon McIntosh

DE06: 2:20-2:30 p.m. Benefits of Thought Provoking Discussion in Introductory Physics Lab

Contributed – Amanda M. Palchak, University of Southern Mississippi, 610 Sarazen Drive, Gulfport, MS 39507; amanda.palchak@eagles.usm.edu

Hironori Shimoyama, University of Southern Mississippi

College-level students in algebra-based introductory physics labs consistently have similar weak and strong points each semester. Upon completion of my first year as a teaching assistant for these labs at the University of Southern Mississippi, I was able to pinpoint and address the needs of these students successfully. The targeted students lack the ability to intuitively complete their assignments. In order to address this issue I began to administer detailed explanations of the laboratory procedure, followed by "pop questions" that allow for thought-provoking group discussion of the subject matter. These implemented methods have not only enhanced the students' cognitive engagement while performing the laboratory activity, but have considerably improved weekly quiz grades. It is important that teaching assistants at this level do not overestimate a student's understanding of basic concepts. In doing so, students should excel in basic laboratory activities and answer weekly quiz questions with ease.

Session DF: *Panel:* Where's the Pedagogy in Lab?

Location: Jackson
Sponsor: Committee on Laboratories
Co-Sponsor: Committee on Research in Physics Education
Date: Tuesday, January 8
Time: 1:30–3 p.m.

Presider: Dean Hudek

Instructional labs have been an integral part of physics education for a very long time; arguably since the creation of the discipline. However, to date there is no clear, concise agreement on what knowledge the students should take away from their time in the lab or what pedagogical approach is most effective. Not knowing the answers to these questions makes it difficult to justify the significant expense – lab equipment, lab rooms, lab staff – and time commitment – time students spend in lab and writing reports. Does this ambiguity make our instructional labs vulnerable to budget cuts? Are we providing the best learning environment to our students? In this session, four members will have 10-15 min to express their views on this topic. The remaining time will be spent on audience questions and open discussion. I hope you can join us. Note: *This is a continuation of the panel held at the AAPT Winter 2012 Meeting in Ontario, California —"What is the point of the instructional lab?"*

SPEAKERS:

- *Eric Ayars, California State University, Chico; eayars@csuchico.edu*
- *Nina Abramzon, California Polytechnic University Pomona; nabramzon@csupomona.edu*
- *Sean P. Robinson, MIT, Cambridge, MA; spatric@mit.edu*
- *Benjamin Zwicki, University of Colorado, Boulder; benjamin.zwickl@colorado.edu*

Session DG: How to Gear an Introductory Physics Course Toward Allied Health Majors

Location: Bolden
Sponsor: Committee on Physics in Two-Year Colleges
Date: Tuesday, January 8
Time: 1:30–3:10 p.m.

Presider: Sherry Savrda

DG01: 1:30-2 p.m. Teaching Physics for Allied Health Science Students

Invited – Rod Milbrandt, Rochester Community and Technical College, 851 30th Ave. SE, Rochester, MN 55904; rod.milbrandt@roch.edu

Many allied health sciences including radiology require a general physics course as a prerequisite or as part of the program of study. Designing such a course means taking into account the sometimes conflicting requests from the program leaders while keeping the class coherent. As a two-year college in the same town as the Mayo Clinic, this course is an important one on our campus. The way we've approached this class will be discussed along with some of the challenges and opportunities involved. In addition I'll try to look at the question of "what do they need" from a medical physicist perspective; I was trained in medical physics and have kept a toehold in that world.

DG02: 2-2:30 p.m. Teaching Nuclear Physics to Health Professions Students

Invited – Jeff C. Bryan, University of Wisconsin - La Crosse, 1725 State St., La Crosse, WI 54601; jbryan@uwlax.edu*

Teaching nuclear physics at a four-year comprehensive university to students with minimal background in physical science and math can be challenging. Two health professions majors dominate student populations in our nuclear science classes: nuclear medicine technology and radiation therapy. Their degree programs only require college algebra and introductory science before the students take nuclear science courses. This presentation will discuss ways of overcoming these challenges while enhancing student learning. Teaching methods and tools, as well as assessment results, will be presented. Specifically, the development of a textbook[1] for teaching nuclear science at the sophomore level and the evolution of our teaching laboratories will be discussed.

*Sponsor: Sherry L. Savrda

1. Jeff C. Bryan, *Introduction to Nuclear Science*, 2nd ed. (CRC Press; Boca Raton, FL).

DG03: 2:30-2:40 p.m. Sonography and Physics Classroom Crossover Part II

Contributed – Erick Agrimson, St. Catherine University, St. Paul, MN 55105; epagrimson@stkate.edu

Susan Hummel, St. Catherine University

The Physics Department at St. Catherine University has been offering Physics for the Health Sciences for over 10 years. Of the students who have taken the course, well over 60% were, or are, involved in an Allied Health emphasis. One of the many ways we have adapted the course is to include ultrasound physics. Not only do we talk about waves, but also about phenomena in the optics section that have ultrasonic similarities, i.e., refraction, edge artifact and wave interference. We also make connections between electrical resistance and hemodynamics in the course. Since I teach the physics course that the students in the ultrasound sequence take, I will talk about the advantages of the physics and ultrasound physics crossover and how it benefits all of our Allied Health majors.

DG04: 2:40-2:50 p.m. Two Levels of Introductory Physics for Allied Health

Contributed – Nancy Beverly, Mercy College, 555 Broadway, Dobbs Ferry, NY 10522; nbeverly@mercy.edu

Students preparing for Allied Health graduate programs, such as physical therapy, typically are required to take a two-semester, with laboratory, algebra-based introductory physics sequence. The Allied Health professions requiring an associate degree, such as occupational therapy assistant, typically require a one-semester, no lab, conceptual, introductory physics course. The curricular content of each of these courses, developed at Mercy College, focuses on human functioning appropriate to their respective student populations. Comparative examples will be presented.

DG05: 2:50-3 p.m. Integrated Labs in Conceptual Physics

Contributed – Dyan L.. Jones, Mercyhurst University, Erie, PA 16546; djones3@mercyhurst.edu

Our Conceptual Physics course is currently structured as a three-credit course with no associated lab time and primarily serves students from the sports medicine department. This combination provides a unique opportunity to integrate a series of lab activities into the traditional lecture, and to create a biology-inspired set of experiences to help students see the connections of the physics content to their discipline. This talk will highlight the ways in which we go about integrating the labs and the result it has on the pedagogy of the class, including student surveys and observations on how class time is used.

DG06: 3-3:10 p.m. Measuring RF Radiation in Introductory Labs

Contributed – Wathiq Abdul-Razzaq, West Virginia University, Physics Department, Morgantown, WV 26506; wabdulra@wvu.edu

Pre-health students are required to take physics courses at West Virginia University. Many of these students pass physics courses without making the connections between health and physics. We have developed a lab

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SYMPOSIUM on Physics Education

AAPT Symposium on Physics Education and Public Policy

S. James Gates

Tuesday, January 8, 3:30–5 p.m. • Celestin Ballroom I–III

Policymakers formulate decisions everyday that impact curriculum, standards, funding, and many other aspects of physics education at all levels. AAPT works with a number of partners to keep policymakers informed on the views of physics educators and to suggest appropriate policy options within the Association's sphere of influence. This session brings together individuals who play pivotal roles in helping to shape policies and who provide information to policymakers. We hope to provide a look at the process of policy making as well as actions you might make to contribute to decisions about policies affecting physics and STEM education.

Facilitator: *Noah Finkelstein, Professor of Physics at University of Colorado at Boulder*

Speakers:

- *S. James Gates, John S. Toll Professor & Director of Center for String & Particle Theory, University of Maryland*
- *Ramon E. Lopez, Professor of Physics, University of Texas, Arlington*
- *Richard Steinberg, Professor of Physics and Secondary Education, City College of New York*

Ramon E. Lopez

Richard Steinberg

experiment that takes this issue into consideration. Students measure the intensity of RF waves generated by cell phones and leaked by microwave ovens. Then the student compares the intensity data that is obtained to the national standards as to relate the field of physics and health. Our pre-health students spend 110 min in the lab versus 150 min in the lecture. The significant percentage of time that a student spends in the lab provides sufficient reason dedicate a substantial effort toward improving the lab curriculum.

Session DH: Interactive Lecture Demonstrations: What's New? ILDs Using Clickers and Video Analysis

Location: Johnson
Sponsor: Committee on Research in Physics Education
Co-Sponsor: Committee on Educational Technologies
Date: Tuesday, January 8
Time: 2–3:20 p.m.

Presider: Priscilla Laws **Alternative Access Session**

DH01: 2-2:30 p.m. Interactive Lecture Demonstrations: Active Learning in Lecture Including Clickers & Video Analysis

Invited – David R. Sokoloff, University of Oregon, Department of Physics, Eugene, OR 97403-1274; sokoloff@uoregon.edu

Ronald K. Thornton, Center for Science and Math Teaching, Tufts University

The results of physics education research and the availability of microcomputer-based tools have led to the development of the Activity Based Physics Suite.[1] Most of the Suite materials are designed for hands-on learning, for example student-oriented laboratory curricula such as RealTime Physics. One reason for the success of these materials is that they encourage students to take an active part in their learning. This interactive session will demonstrate "through active audience participation" Suite materials designed to promote active learning in lecture — Interactive Lecture Demonstrations (ILDs),[2] including those using clickers and video analysis.

1. E.F. Redish, *Teaching Physics with the Physics Suite* (Wiley, Hoboken, NJ, 2004). 2. David R. Sokoloff and Ronald K. Thornton, *Interactive Lecture Demonstrations* (Wiley, Hoboken, NJ, 2004).

DH02: 2:30-3 p.m. Interactive Lecture Demonstrations: Effectiveness in Teaching Concepts

Invited – Ronald K. Thornton, Center for Science and Math Teaching, Tufts University, Medford, MA 02155; csmt@tufts.edu

David R. Sokoloff, University of Oregon

The effectiveness of Interactive Lecture Demonstrations (ILDs) in teaching physics concepts has been studied using physics education research based, multiple-choice conceptual evaluations.[1] Results of such studies will be presented, including studies with clicker ILDs. These results should be encouraging to those who wish to improve conceptual learning in their introductory physics course.

1. David R. Sokoloff and Ronald K. Thornton, "Using Interactive Lecture Demonstrations to Create an Active Learning Environment," *Phys. Teach.* **35**, 340 (1997).

DH03: 3-3:10 p.m. Peer Instruction for Interactive Lecture Demonstrations

Contributed – Tetyana Antimirova, Ryerson University, 350 Victoria St., Toronto, ON M5B 2K3, Canada; antimiro@ryerson.ca

Experienced educators know that merely showing the demonstrations does very little to combat common student misconceptions. Research data confirm that demonstrations have very little, if any, effect on student learning. In order to make a difference, the demonstration needs to be embedded into students' activities, such as Interactive Lecture Demonstrations (ILDs). However, a common complaint about ILDs is that they require written predictions from students that need to be marked or at least recorded for credits. We find that asking clickers questions related to the demonstration is a reasonable alternative to the standard ILD procedure. Our approach combines Peer Instruction (PI) pedagogy, where the clicker questions themselves are built to collect the predictions about the experiment to be performed. If the real-time data acquisition or recorded video is used, follow-up homework activities could be added. We will provide the examples of activities built around popular experiments in introductory mechanics.

DH04: 3:10-3:20 p.m. Clicker-based IDL Approach for Introductory E&M, Waves, and Optics

Contributed – Richard Gelderman, Western Kentucky University, Bowling Green, KY 42101-1077; richard.gelderman@wku.edu

We discuss use of clicker response systems, instead of written worksheets, to implement a variation on Interactive Lecture Demonstrations. Each student is to use a response system to individually predict the outcomes for a demonstration. Students then collaborate within a group of three to discuss their prediction, using the response system to enter the group's consensus prediction. After observing the demonstration, students in the group compare their predictions to the results, and attempt to explain the phenomena. The response system records the student feedback without requiring time from the solo instructor to mark the responses and enter the data in a gradebook. We will provide the examples of activities built around demonstrations for introductory E&M, waves, and optics content.

Session EA: Introductory Courses

Location: Bucktown II
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Greg Puskar

EA01: 6:50-7 p.m. Decreasing Costs, Increasing Gains: Initial Data from a Flipped Class

Contributed – Nathan W. Erickson, The University of Texas at Austin, 1 University Station, G2500, Austin, TX 78712; nathanwerickson@cns.utexas.edu

William J. Corrigan, Sacha E. Kopp, The University of Texas at Austin

Flipping a class can have many benefits such as increase in student knowledge and satisfaction. One positive side effect of this design that is often overlooked, however, is the potential for combating a growing issue at many universities around the country: the rising student costs of college. I will discuss the design of a flipped class reaching 130 students in lecture and covering non-calculus based physics at The University of Texas at Austin. In this class, we were able to eliminate the cost of a textbook and collected some initial data showing no significant loss of student performance. I will also discuss some the anecdotal evidence we received indicating that the students were more than willing to accept this pedagogical change.

EA02: 7-7:10 p.m. Humor as a Physics Teaching Strategy

Contributed – Carlos H. Worner, Pontificia Universidad Catolica de Valparaiso, Av. Brasil 2950, Valparaiso, 02 Chile; cworner@ucv.cl

Angel Romero, Pontificia Universidad Catolica de Valparaiso

Humor is a well founded instrument to the teaching/learning process. Several authors have noted its beneficial influence on the classroom atmosphere and in promoting divergent learning. In this note, we will expose our experience on using this idea as a starting point to teach physics for a general college audience. Previous work on the fundamentals of this approach had already been communicated (see, i.e., *Phys. Ed.* **45**(5) 539-543 (2010)) and now we intend to show some new results in our current work.

EA03: 7:10-7:20 p.m. Implementing Studio Physics at Boston University

Contributed – Andrew Duffy, Boston University, Physics Department, Boston, MA 02215; aduffy@bu.edu

Bennett Goldberg, Manher Jariwala, Mark Greenman, Boston University

At Boston University, we are in the second year of a pilot studio physics implementation embedded within the large algebra-based introductory physics class, in preparation for expanding to large-scale studio implementation starting Fall 2013. Our design incorporates the traditional studio elements of active-learning with pre-class quizzes, worksheets, interactive clicker questions, directed peer learning, and experiential activities. We also are building infrastructure to engage a wider array of physics faculty. In fall 2012, we had a 35-student studio section, and we were able to compare the performance of those students against the other 385 students in the course, from three different lecture sections. All students did the same pre- and post-tests (FMCE and CLASS), homework, quizzes and the same midterm tests and final exam. We will report on the outcomes, and compare them to the outcomes in 2011-2012.

EA04: 7:20-7:30 p.m. Inquiry Learning in the Introductory Course and the AP-B Redesign

Contributed – Peter Sheldon, Randolph College, Lynchburg, VA 24503; psheldon@randolphcollege.edu

The College Board has undertaken a redesign of the AP Physics B curriculum to better reflect today's understanding of how students should learn science and physics in particular. The new AP courses, Physics 1 and Physics 2, are based on a curriculum framework that has undergone extensive higher-ed review, and that is meant to build a greater conceptual understanding of the physics rather than a breadth of knowledge. The new framework will be better supported by inquiry-based learning. In order to best train our future scientists, students should engage in the same sorts of inquiry methods and activities that scientists do. In this presentation, the author will discuss the importance of inquiry-based learning and how inquiry-based learning will support the goals of the introductory physics courses.

EA05: 7:30-7:40 p.m. James Clerk Maxwell as an Educator

Contributed – Genrikh M. Golin, Touro College, New York, NY 11224; genrikhgolin@yahoo.com

In many works dedicated to Maxwell's life, we can find that his direct teaching accomplishments were much less significant than the scientific achievements of this great Scottish physicist. Maxwell was never an excellent classroom lecturer. However, we obtain a very different perspective on Maxwell as an educator if we step away from the biographical details of his classroom teaching. We can thus try to analyze Maxwell's pedagogical ideas and overall educational approaches, which are reflected in his published documents and books. We then see that, in terms of his ideas on physics education, Maxwell was much ahead of his time and in agreement with today's educational views on teaching physics. We obtain a picture of a professor who is wise and kind and who also has developed an excellent perspective on teaching. This allowed him to present easily and clearly abstract and often hard-to-comprehend material. Furthermore, when he gave his inaugural lecture at Cambridge University in October 1871, Maxwell presented concrete and concise concepts as a part of his methodical plan to prepare students for their future professional development. Modern professors, and even secondary school teachers, can find in Maxwell's writings very good pedagogical advice and a number of useful approaches related to teaching physics.

EA06: 7:40-7:50 p.m. An Integrated Lab-Lecture Approach to Increasing Student Engagement

Contributed – Doug Bradley-Hutchison, Sinclair Community College, Dayton, OH 45402; douglas.bradley-hutc@sinclair.edu

Lalitha Locker, Sinclair Community College

For approximately the past five years we have scheduled several sections of calculus-based physics courses each term so that lab and lecture are integrated. The class is then taught using a mixture of lecture/discussion, activity work (which often is hands on) and labs. Topics are frequently introduced through exploratory activities, or lab so that students can develop a phenomenological sense of the material prior to the development of any formal theory. Lab handouts are written in an open- ended manner so that students draw conclusions without reference to any overriding theory and serve the purpose of setting the stage for material developed through lecture/discussion. Thus students engage in dynamic experimental learning exercises as opposed to being passive listeners. We will present the specifics of several topic scenarios and discuss our conclusions regarding the overall effectiveness of this approach.

EA07: 7:50-8:00 p.m. Teaching Introductory Physics Using Integrated Lecture and Laboratory: Lessons Learned

Contributed – Ntungwa Maasha, College of Coastal Georgia, Brunswick, GA 31520; nmaasha@ccga.edu

Over the last three years the introductory calculus-based physics course sequence at the College of Coastal Georgia has been taught through integrated lecture and laboratory sessions. I shall outline our experience with the pedagogy and discuss the lessons learned from its use including the apparent advantages and drawbacks associated with the pedagogy. In particular I shall highlight the unique challenges encountered in serving the students during the first course of the sequence.

EA08: 8-8:10 p.m. Active Learning in Calculus-Physics and Physics for Elementary Teachers

Contributed – Timmy L. Ross, Chattanooga State Community College, Chattanooga, TN 37421; tim.ross@chattanoogastate.edu

Theresa Underwood-Lemons, Michael Pugh, Chattanooga State Community College

Active Learning in General Physics and Physics for Elementary Teachers: Chattanooga State Community College is changing our traditional lecture courses to active learning courses. General Physics (Physics with Calculus for Science Majors and Engineers) now integrates laboratory exercises, active learning, class discussion, and nominal lecture into three classes of two hours each. The students do lab activities and problem solving as teams. We are also part of a Tennessee-wide consortium exploring a new way to expose elementary teachers to physics. It is designed to be completely active learning for the students. We use a workbook/activity book, software and sensors for data capturing, online simulations, and some traditional physics equipment. The students work in teams. Teams present findings to the class as a whole. Both courses are evaluated using pre- post-tests.

EA09: 8:10-8:20 p.m. Measuring Information Presentation in a Physics Class

Contributed – John Stewart, University of Arkansas, Physics Building, Fayetteville, AR 72701; johns@uark.edu

At some level, the performance of students in a science class must depend on what is taught, the information content of the materials and assignments of the course. The introductory calculus-based electricity and magnetism class at the University of Arkansas is examined using a catalog of the basic reasoning steps involved in the solution of problems assigned in the class. These fundamental steps are used to quantify the distribution of informational content within the different elements of the course: laboratory, lecture, reading, and homework. This distribution of content is compared with the instructional outcomes measured by the Conceptual Survey of Electricity and Magnetism and by course exams to determine the relative efficacies of the various mechanism of presenting the information. Using this characterization technique, an exceptionally detailed picture of the information flow and the information structure of the class can be produced. Variation of the types and the amount of information presented is analyzed over multiple semesters.

EA10: 8:20-8:30 p.m. Elements to Enhance Conceptual Understanding in Intro Physics Classes

Contributed – Abaz Kryemadhi, Messiah College, Department of Mathematical & Info. Sciences, Mechanicsburg, PA 17055; akryemadhi@messiah.edu

Niklas Hellgren, Messiah College

We report on some elements we introduced to enhance conceptual understanding of physics in introductory classes. The emphasis has been on interactive methods such as Interactive Lecture Demonstration and peer instructions infused in traditional classrooms. We also report on a screening algebra and trigonometry pre-test in helping us be aware of students who might experience difficulties in these introductory physics classes.

EA11: 8:30-8:40 p.m. The Application of Play Theory to Textbook Design

Contributed – Juan R. Burciaga, Mount Holyoke College, Department of Physics, South Hadley, MA 01075; jburciag@mtholyoke.edu

Though play theory can be an effective paradigm to apply to course design, its application to a static textbook provides many challenges. What are the aspects of play theory that apply to textbook design? How can these aspects be evaluated? What do we gain by applying play theory to textbook structure? An earlier paper ("Textbook Design: An Exploration of Pedagogical Properties of Textbooks", PERC 2012) proposed seven properties that can be used to evaluate textbooks. This paper will present an update of how well those properties are being used in evaluating three physics books that each have distinctly different goals. The perspectives of play theory that can be applied to textbook design are discussed and illustrated with examples from the textbooks being evaluated.

Session EB: Best Practices in Educational Technology

Location: Bechet
Sponsor: Committee on Educational Technologies
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Anne Cox

EB01: 6:50-7:20 p.m. Using Open Source Physics, Moodle and iPads to Teach Astronomy

Invited – Mario Belloni, Davidson College, Physics Department, Davidson, NC 28035-6910; mabelloni@davidson.edu

Wolfgang Christian, Davidson College

Todd Timberlake, Berry College

At Davidson College we have redesigned our introductory astronomy course to include a wider variety of media and a laboratory for the fall of 2012. This talk will focus on three innovations: Open Source Physics (OSP) programs and tools, Moodle, and iPads. Specifically, we have created simulations and curricular material to aide in the teaching of astronomy from a historical perspective and have organized them within ComPADRE and Moodle. We also use Moodle to deliver Just-in-Time Teaching and in-class peer instruction questions as well as content for blended learning. New computer-based laboratories that use Tracker video analysis to measure angular speed to determine the sidereal day and the solar rotation rate are presented. In this talk we show how to obtain and use our material and propose possible future improvements. The Open Source Physics Project is supported by the National Science Foundation (DUE-0442581).

EB02: 7:20-7:50 p.m. iPods and iPads in the Laboratory and Classroom

Invited – Ian G. Bearden, Niels Bohr Institute, University of Copenhagen, Blegdamsvej 17, Copenhagen, 2100, Denmark; bearden@nbi.dk

In the past two years, we have been experimenting with the use of iPods and iPads in both our introductory mechanics and our advanced laboratory courses. This talk will present some of the experiments our students have done as well as a discussion of the efficacy of using such devices. At present, we are producing a custom "teaching app" that aims to increase student understanding of gravitation through hands on "experimentation" with Lagrange points in the Earth Sun system. The app, together with preliminary results of its efficacy in the classroom, will be presented. Finally, we will show other potentially novel uses of these devices in teaching and communicating physics.

EB03: 7:50-8:20 p.m. Tweak Your Labs with Arduino Microcontrollers

Invited – Eric Ayars, California State University, Chico, Campus Box 202, Chico, CA 95929-0202; ayars@mailaps.org

The development of new easily programmed microcontroller systems such as the Arduino has opened a whole new world of opportunity in the area of educational physics lab equipment. Now teachers can build new lab equipment, and modify existing lab equipment, so that it does exactly what they want it to do for their class. I'll present several examples of the versatility and power of Arduinos in the teaching lab, with applications to courses ranging from first-semester physics to senior lab.

EB04: 8:20-8:50 p.m. Easy Java Simulations Meets Moodle, Arduino, and (Walks Towards) the iPad

Invited – Francisco Esquembre, Universidad de Murcia, Facultad de Matemáticas, Campus de Espinardo Murcia, Murcia 30071, Spain; fem@um.es*

Luis de la Torre, Ruben Heradio, UNED, Spain

Andres Mejias, Marco A. Marquez, Universidad de Huelva, Spain

Easy Java Simulations (EJS) is a modeling and authoring tool that helps teachers and students create interactive simulations of physics processes. We show in this talk some new additions to EJS that help integrate EJS applets with online courses and laboratory activities. In particular, we show how to embed EJS generated applets into Moodle courses, including communication of the applet with the Moodle file repository and collaborative learning. We also show how EJS simulations can send and receive data to/from a number of laboratory equipment such as Arduino and Phidgets (and others to come). Finally, we show work in progress that reuses EJS architecture for tablets. This work will eventually help us quickly port existing EJS simulations at ComPADRE into tablets supporting Javascript and HTML5, such as the iPad and Android tablets.

*Sponsor: Anne J. Cox

Session EC: Apparatus Gumbo

Location: Oliver
Sponsor: Committee on Committee on Apparatus
Date: Tuesday, January 8
Time: 6:50–8:30 p.m.

Presider: David Sturm

EC01: 6:50-7 p.m. A Common "Cents" Lab Activity

Contributed – Duane L. Deardorff, University of North Carolina at Chapel Hill, CB 3255, Chapel Hill, NC 27599; duane.deardorff@unc.edu

This simple laboratory activity provides a basic introduction to measurements and their uncertainties while challenging students to use critical thinking and reasoning skills. By taking measurements of mass, diameter, and the thickness of pennies, students calculate the average density of these coins and often find that their results do not agree with other students or the theoretical value based on the metal composition. These discrepancies motivate students to reconsider the accuracy and precision of their measurements along with their "common sense" assumptions.

EC02: 7-7:10 p.m. The Massometer: Measuring Mass and Understanding Inertia

Contributed – Tucker Hiatt, Stanford University & Wonderfest 47, Alta Way Corte, Madera, CA 94925; thiatt@stanford.edu

Dan Burns, Los Gatos High School

Mass lies at the heart of mechanics, and mechanics lies at the heart of physics. Inertia, and its quantitative measure as mass, is often the first truly novel and important idea encountered by students in introductory physics. Despite the importance of mass, no classroom tool exists to measure it directly. Such a tool would certainly NOT measure weight. It would measure the inertia of a test object by systematically accelerating that object. A MASSOMETER is a newly proposed device that measures mass by means of the "wiggle test." It uses simple harmonic motion to calculate an object's mass from the measured period of oscillation. A well-made massometer is gravity independent: it will work in any orientation, on any planet, and in deep space. Of course, what's most important is the massometer's ability to measure mass directly while demonstrating to students precisely what inertia really means.

EC03: 7:10-7:20 p.m. An Inexpensive Rotary Motion Sensor Students Can Build Themselves

Contributed – Vadas Gintautas, Chatham University, Pittsburgh, PA 15206; United States vgintautas@chatham.edu

Lessons and homework problems involving a pendulum are often a big part of introductory physics classes and laboratory courses from high school to undergraduate levels. Although laboratory equipment for pendulum experiments is commercially available, it is often expensive and may not be affordable for teachers on fixed budgets, particularly in developing countries. We present a low-cost, easy-to-build rotary motion sensor pendulum using the existing hardware in a ball-type computer mouse. The design is simple enough for students to build one at the start of a lab and use it to collect data the same day. We demonstrate how this apparatus may be used to measure both the frequency and coefficient of damping of a simple physical pendulum. This easily constructed laboratory equipment makes it possible for all students to have hands-on experience with one of the most important simple physical systems. Furthermore, this apparatus provides a unique experience of building a measurement instrument as part of the lesson.

EC04: 7:20-7:30 p.m. Charles Grafton Page and His Shocking Coil

Contributed – Thomas B. Greenslade, Jr., Kenyon College, Department of Physics, Gambier, OH 43022; Greenslade@kenyon.edu

Charles Grafton Page (1812-1865) was the first American who worked as a full-time electrical experimenter and inventor. Among the instruments that he developed in the late 1830s was the ancestor of the induction coil. This consisted of what we would now call a step-up transformer, with an interrupter in series with the primary coil to produce the necessary pulsating voltage signal. The example in my collection dates from the 1860s and was listed as a "vibrating shocker" in the 1860 catalogue of E.S. Ritchie of Boston. The 1842 edition of Daniel Davis's "Manual of Magnetism" includes it in the section on medical electricity. Devices like this are the precursors of the induction coil whose use led to the discovery of the electron and x rays.

EC05: 7:30-7:40 p.m. Faraday Rotation as a Lecture Demonstration

Contributed – Dale Stille, University of Iowa, Department of Physics and Astronomy, Iowa City, IA 52242; dale-stille@uiowa.edu

Michael Flatte,University of Iowa

Faraday rotation experiments, plane-polarized light through a sample being rotated by some angle when a magnetic field is applied, have long been a staple of most advanced physics laboratory curriculums but have been plagued by high costs, size, fragility, or operating difficulties of the components used. Technological advances in the areas of diode laser pointers, high strength permanent magnets, and readily available metal doped glass samples, combined with dramatic price decreases for these components now make this experiment easy and suitable for not only any advanced laboratory but also as a lecture demonstration. We will describe the apparatus that we made here at the University of Iowa and how we use it during lectures.

EC06: 7:40-7:50 p.m. Series and Parallel: No Longer Just for Resistors

Contributed –Tibi Dragoiu-Luca, Hillsborough High School, 466 Raider Blvd., Hillsborough, NJ 08844; tdragouiuluca@hillsborough.k12.nj.us

John Lewis, Glenbrook South High School

What happens to the length of time that batteries are useful when placed in series and parallel? This question can be asked, and answered, IN THE LAB! This talk will discuss the series of labs that gives students a working knowledge of the benefits and shortcomings of placing batteries in series and parallel within a working device like a calculator or flashlight. Taking an energy perspective when answering this question allows for understanding that is less theoretical, and more enduring, than traditional methods of instruction.

EC07: 7:50-8 p.m. What's The Difference? A New Look at Electricity From a Battery's Perspective

Contributed – John Lewis, Glenbrook South High School, 4000 W. Lake Ave., Glenview, IL 60026; jlewis@glenbrook225.org

Tibi Dragouiu-Luca, Hillsborough High School

Let's face it, our students will purchase and use many more batteries than resistors in their lifetime and yet traditional studies in electricity have an inordinate focus on resistors in series and parallel. This Lab Sequence focuses on the energy provided by C, D, AA, and AAA cells, the current and potential difference provided to the circuit, the power of each cell, the amount of energy each can deliver, and the cost of energy provided by such devices.

EC08: 8-8:10 p.m. Who's at Fault?

Contributed – Michelle Strand, West Fargo High School, 9 Prairiewood Dr. S, Fargo, ND 58103; shelhusk@gmail.com

Becca Howell, Fulton County Board of Education

Students know all about car crashes, but aren't always aware how physics can be used to reconstruct the accident. In this lab, students take measurements at a simulated crash, talk to witnesses, and use their physics knowledge in teams to determine who was at fault in the accident.

EC09: 8:10-8:20 p.m. Writing a Graphite Variable Resistor

Contributed – David Venne, 3735 Burr Oak Drive, Racine, WI 53406; ddvenne@gmail.com

Graphene, a single layer of carbon atoms, is an exotic new material that has been shown to be stronger than diamond and conduct electricity better than copper. Andre Geim and Konstantin Novoselov won the 2010 Nobel Prize in Physics for being the first to obtain single layer graphene. Students in a middle or high school classroom can repeat this groundbreaking experiment without a million- dollar lab facility. The "scotch tape" experiment can be expanded upon by constructing a variable resistor on a CD disc by connecting two Cu electrodes with a battery and a light emitting diode (LED). The CD circuit is used to demonstrate the concept of variable resistance by scribing a pencil between two Cu leads. The LED is turned on once the transferred graphite pieces complete the circuit. The light emission dims as the graphite layers are erased.

EC10: 8:20-8:30 p.m. A Low-cost Method To Measure the Speed of Sound

Contributed – David Kardelis, Utah State University, Eastern 451 E. 400 N, Price, UT 84526; david.kardelis@usu.edu

The science equipment suppliers offer a nice apparatus to measure the speed of sound using a water column. While this is a nice device, it is relatively expensive, difficult to store, and the students usually make a mess in the classroom. A low-cost alternative to this device will be shown. The device, made out of readily available PVC pipe, has several advantages. Both open and closed pipe resonances can be used. The pipe can be easily expanded to use lower frequency waves and several of the setups can be stored in a small space.

Session ED: *Panel:* Online Homework Services and Issues

Location: Jackson
Sponsor: Committee on Physics in Two-Year Colleges
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Keith Clay

Basic features of current online homework systems. Panelists will talk about the advantages and disadvantages of online homework systems. We hope to have a conversation about our experiences with online homework systems: the good, the bad and the ugly. me panelists will talk about why they do not use online homework systems.

SPEAKERS:

- *Aaron Titus, High Point University, High Point, NC; atitus@highpoint.edu*
- *Brooke Haag, Hartnell College, Slians, CA; bhaag@hartnell.edu*

Session EE: Research Paradigms in PER

Location: Bucktown I
Sponsor: Committee on Research in Physics Education
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Amy Robertson

EE01: 6:50-7:20 p.m. Piagetian and Ethnographic Influences in Physics Education Research*

Invited – Rachel Scherr, Seattle Pacific University, 3307 Third Avenue West, Seattle, WA 98119; rescherr@spu.edu

My present theoretical framework combines constructivist learning theory, ethnography, and perspectives from embodied cognition. Its Piagetian roots are evident in a focus on the logic and structure of learners' existing knowledge about concepts and a commitment to learners' ideas always having some seed of correctness. Meanwhile, because of the ease of video recording in classrooms, the available evidence shows knowledge as an interactional practice, in which knowledge and understanding are evident in what people do to learn together. My interactionist perspective includes theories of embodied cognition, in which the body is a site for the dynamic production of meaning and actions, and the interpretive tradition in ethnography, in which the phenomena of interest for learning are the meaning of activities for the participants. These theoretical perspectives combine in a research methodology that can include pre- and post-testing, but is centered on detailed video analysis of learner interactions in semi-natural settings.

*This material is based upon work supported by the National Science Foundation under Grant No. 0822342.

EE02: 7:20-7:50 p.m. Once Upon a Data Set: Telling Stories through Data Representation

Invited – Danielle B. Harlow, University of California - Santa Barbara, Department of Education, Santa Barbara, CA 93106-9490: dharlow@education.ucsb.edu

Paradigms and professional visions are often invisible — even to the researcher. Here, I discuss how choices across multiple research projects make visible a professional vision and theories of cause. We focus on understanding how children and teachers develop and engage in creative and improvisational thinking while teaching and learning science. Expecting learners to develop and present unanticipated ideas presents numerous challenges for how to collect data and how to find and tell the stories in the data. Representing data in multiple ways allows different aspects of a classroom context to be seen. In this presentation, I show how multiple ways of representing qualitative and quantitative data result in different things to see.

EE03: 7:50-8:20 p.m. How Do Researchers Decide What to Study and How to Study It?

Invited – Paula R.L. Heron, University of Washington, Department of Physics Box 351560, Seattle, WA 98195-1560; pheron@uw.edu

The Physics Education Group at the University of Washington typically investigates student learning in an iterative cycle in which basic research, classroom instruction, and the development of instructional materials are inextricably linked. Research articles sometimes portray the cyclic nature of the process but rarely in enough detail for readers to understand the many decisions that were made at each point. Explicit discussion of guiding principles is usually sacrificed in favor of descriptions of results. Thus the conceptual framework in which this research takes place is usually implicit. In this talk I will attempt to make this framework explicit by discussing the principles, preferences, values and beliefs that motivate my research and guide its progress.

EE04: 8:20-8:50 p.m. The Study of Student Responses to Questions: Assumptions and Inferences

Invited – Andrew F. Heckler, Ohio State University, Columbus, OH 43210; heckler.6@osu.edu

In our lab we analyze large numbers of student responses to questions commonly found in classroom assessments. From our perspective, it is necessary to collect relatively large data samples in controlled studies in order to isolate effects of one or two factors of interest from a relatively large number of potential factors that may affect student responses. In addition to our own assumptions underlying our research, I will discuss the often overlooked assumptions needed to claim the existence of patterns in student answers, the problematic inferences about "concepts" or other high-order mental structures hypothesized to cause patterns in answers, and the ripening need to unpack and specify the manifold meanings subsumed by the term "understanding" so that these meanings may be consistently used in research and practice. For better or worse, these issues are often an artifact of the use of conventional tests and the interpretation of their results.

Session EF: *Panel:* AP Physics 1&2 Curriculum Frameworks

Location: Foster
Sponsor: Committee on Physics in High Schools
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Martha Lietz

A panel presentation and discussion of the curriculum frameworks for the new AP Physics exams. Members of the AP Physics 1 and 2 Curriculum Development and Assessment Committees (CDACs) will present information about the newly released curriculum frameworks for those courses. There will also be time for a question and answer session. Panel members will include Connie Wells, Deborah Roudebush, Gay Stewart, Scott Beutlich and other members of the CDACs who may be present at the meeting.

SPEAKERS:

- *Connie Wells, Pembroke Hill High School, Kansas City, MO; cwells@pembrokehill.org*
- *Deborah Roudebush, Oakton High School, Vienna, VA; droudebush@cox.net*
- *Scott Beutlich, Crystal Lake South High School, Crystal Lake, IL; scottbeutlich@rocketmail.com*

Session EG: Instructional Labs that Use Sound or Music

Location: Ory
Sponsor: Committee on Laboratories
Co-Sponsor: Committee on Apparatus
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Andy Morrison

EG01: 6:50-7:20 p.m. Light as a Model for Fourier Analysis of Complex Sound Waves

Invited – Heather Whitney, 501 College Ave., Wheaton, IL 60187; heather.whitney@wheaton.edu

The Fourier transform is a powerful mathematical tool for analysis of complex waves. When applied to sound waves, it can be used to quantitatively analyze the amplitude and frequency of the different components. Comprehending that sound waves can be made of several components is an important learning goal for students in a physics of music course, as this helps students understand why notes that have the same fundamental frequency can have a different timbre when played by different instruments, but we have found that understanding the Fourier transform is very difficult for non-science majors taking the course. We used the example of light, observed with prisms and emission spectroscopy, as a model for Fourier analysis to help our students better understand the function of the transform, while avoiding reference to advanced mathematics that was beyond their preparation, and report on our experience.

EG02: 7:20-7:50 p.m. Visualizing the Doppler Effect

Invited – Tom Bauer, Wellesley College, 106 Central St ., Wellesley, MA 02481; tbauer@wellesley.edu

Video recordings of moving objects from digital cameras or cell phones are converted into *.wav type sound files. These recordings are turned into false color plots of frequency as a function of time by using fast Fourier transforms. The frequency shifts seen in these plots allow the velocity of the object to be determined. The trade offs between sampling frequency, sample time, and resolution will be discussed. The velocity of the object can be found from video analysis of the object and compared to the velocity determined from the sound analysis. Examples of student projects will include analysis of a campus police car, a flying model airplane, a rotating buzzer, and a singing rod. A link to working Matlab code that analyzes a *.wav sound file will be provided as well as an outline of the process needed to write your own code.

EG03: 7:50-8:20 p.m. Using Guitars and Loudspeakers to Explain Acoustics

Invited – Davin Huston, Purdue University, West Lafayette, IN 47907; dhhuston@purdue.edu

Mark French, Purdue University

Acoustics is hard for students to understand due to its invisible nature. Familiar explanations of acoustic phenomena can employ abstract concepts and high-level math, which can be difficult for students to grasp at a beginning level. An approach to help overcome these issues is to use intuitive examples based upon common experiences. From starting with using a simple pop bottle to demonstrate a Helmholtz resonator to building guitars and loudspeakers that demonstrate absorption, diffraction, and reflections in a hands-on fashion. These small-scale examples can be expanded to room acoustics for concert halls, or other large rooms, with little effort. These examples both supply the students with foundational understanding and knowledge about acoustics, but provide them with lasting information that can prove valuable to an audio/video systems designer, an acoustician, a musician, or simply a person who appreciates music.

EG04: 8:20-8:30 p.m. Elasticity and Sound Propagation; From the Kitchen to the Lab

Contributed – Kenneth A. Pestka II, Rollins College, 1000 Holt Ave., Winter Park, FL 32789; kpestka@rollins.edu

This work presents several simple, fun, and engaging introductory laboratories activities that explore the properties of elastic media and are suitable for physics and engineering students. These activities utilize household items such as plastic flatware (spoons, forks, etc.), marshmallows and other commonly found kitchen items in order to explore Hooke's law, Young's Modulus and shear modulus. In addition, sound speed and sound wave propagation, which are governed by the object's elastic properties, will also be discussed.

EG05: 8:30-8:40 p.m. Generalizing Musical Instruments

Contributed – Wendy K. Adams, University of Northern Colorado, Campus Box 127, Greeley, CO 80631; wendy.adams@unco.edu

During the past two years we have developed and tested an exploratory lab entitled "How Music is Made" as part of the educational outreach efforts of the Acoustical Society of America. In this lab students make their own straw trombone and cup instrument. They use these instruments along with water bottles, their voices, and both an electric and acoustic guitar to investigate how music is made. Specifically they investigate the source of the sound, how to change the pitch, and how the sound is amplified. The objectives of the lab include understanding the difference between resonance and sympathetic vibration as well as participating in the scientific process with explicit discussion of what it means to do science.

EG06: 8:40-8:50 p.m. Visualization of Standing Sound Wave Using Electronic Speckle Pattern Interferometer

Contributed – Junehee Yoo, Department of Physics Education,Seoul National University, Seoul, 151-742, Republic of Korea; yoo@snu.ac.kr

Jeongwoo Park, Dong Uk Lee, Doh-Ook Han, Seoul National University

A low-cost electronics speckle pattern interferometer was built to visualize standing waves in a pipe. Since Moore (2004) reported the way to build a simple design for an electronic speckle pattern interferometer, many interferograms of vibrating solid bodies have been reported. But interferograms of standing sound waves are rare. A rectangular pipe with 35.5 cm, 4.5cm, 4.5 cm with transparent acryl was made and up to the 5th mode were observed by the built ESPI.

Session EH: Just Labs

Location: Storyville
Sponsor: Committee on Laboratories
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Mark Masters

EH01: 6:50-8:50 p.m. A Mechanical Analog of NMR

Poster – Gregory Adams, IPFW, Department of Physics, Fort Wayne, IN 46805; masters@ipfw.edu*

Srikanth Dasari, Jacob Millspaw, Mark Masters

There are a number of different forms of Nuclear Magnetic Resonance (NMR) - scanning magnetic field, scanning rf frequency, and pulsed rf. The trouble is that the NMR is a black box system in which it is difficult to visualize what is physically happening. What is resonance in NMR? Using plastic spheres with embedded Nd Magnets rotating in an air-bearing, two large plate magnets to set the guide magnetic field and a pair of Helmholtz coils to the "rf" excitation fields we are able to mechanically simulate each of the different types of NMR so that the students can gain insight into how NMR works.

*Sponsor: Mark Masters

EH02: 6:50-8:50 p.m. Experiments from Nanocamp

Poster – Joseph Kozminski, Lewis University, Department of Physics, Romeoville, IL 60615; kozminjo@lewisu.edu

Jason Keleher, Lewis University, Department of Chemistry

The Lewis University Nanotechnology Experience introduces students entering thier junior or senior year of high school to nanotechnology through a hands-on summer camp. The students explore the nano-scale and applications of nanotechnology through various lab activities such as synthesizing and studying quantum dots and using nanoparticles to make stained glass. They learn about the nano-world through macro-scale analogs like studying non-Newtonian fluids (e.g. corn-starch and water) as analogs to nanofluids. They also run experiments in light and optics in order to better understand how nanomaterials can be studied and characterized. We will present several of the experiments conducted in the Nanotechnology Experience. These experiments are accessible to high school and college students at all levels and can be adapted for use throughout Physics and Chemistry curricula.

EH03: 6:50-8:50 p.m. Instructional Labs in Modern/Materials Physics

Poster – Gabriel C. Spalding, Illinois Wesleyan University, Bloomington, IL 61701; gspaldin@iwu.edu

We will discuss a course where students take on six of the following: LabVIEW programming for GPIB control of instrumentation; DC measurement of milli-ohm samples (2-probe vs. 4-probe); Lock-in measurement of resistivity; Elastic moduli measurements (uniform vs non-uniform strain); Diffraction of light by 1D, 2D and 3D crystalline arrays (with microwaves); Wave Nature of Matter: Quantized Conductance of gold wire nanocontacts (Mechanical Break Junctions); Particle-like Behavior of Localized Electrons: Coulomb Blockade with gold nanoparticles; Modes of coupled oscillators; Detecting Phonon Modes in Si Tunnel Diodes at Low-Temperature; Temperature dependence of Hall Effect; Extracting Boltzmann statistics from sedimenting colloid; Measurement of 1/f noise; Examination of Johnson noise; Blinking Quantum Dots; Examination of ordering: g(r) and S(k); Curie Temperature of Gadolinium (and thermoelectric temperature control).

EH04: 6:50-8:50 p.m. Laser Spectroscopy of Play-Doh

Poster – Mark F. Masters, IPFW, Department of Physics, Fort Wayne, IN 46805; masters@ipfw.edu

Timothy T. Grove, Jacob Millspaw, IPFW

Using readily available 635nm, 532nm and 405nm laser pointers, we examine the fluorescence spectra of various color Play-Doh samples. The spectra are analyzed using a simple spectrometer made of a web-cam and a section of DVD. We present the spectrometer, and the laser induced fluorescence of the Play-Doh as an activity that helps students understand color, spectra, laser spectroscopy, and the energy of light.

EH05: 6:50-8:50 p.m. Measuring Dielectric Constants in a Parallel Plate Capacitor

Poster – Mark Masters, IPFW, Department of Physics, Fort Wayne, IN 46805; masters@ipfw.edu

Jacob Millspaw, Timothy Grove, IPFW

One common and seemingly simple laboratory investigation of capacitance consists of inserting multiple sheets of paper (or other thin dielectric materials) between two conductive plates and measuring the capacitance of the system. The separation of the two plates is nominally determined by the number and thickness of the individual dielectric sheets. The end result of this investigation is to determine the dielectric constant of the sheet dielectric. Unfortunately, this is seriously flawed because of air trapped between the dielectric sheets. The calculated dielectric constant is too low because it is of a composite material or air and the dielectric sheet. We present a simple method of performing these measurements that does not have these shortcomings and provides more accurate values for the dielectric constant. Better yet, the described investigation is even simpler for students to perform.

EH06: 6:50-8:50 p.m. Modified Experiments in the Introductory Laboratory

Poster – Joel C. Berlinghieri, The Citadel, Physics Department, Charleston, SC 29409; berlinghieri@citadel.edu

Rene G. Hurka, The Citadel

As part of a comprehensive four-year laboratory experience the introductory physics courses use experiments designed around PASCO sensors to capture measurements and Data Studio® and Excel® to analyze these data. We will review four experiments that use modified equipment and sensors and we will show sample data and results from each. 1) A simple pendulum experiment uses a modified rotation sensor for measuring time period as a function of oscillator amplitude. 2) A moment of inertia experiment accounts for friction in the rotation bearing. 3) A buoyancy experiment handles objects with densities more and less than the buoyant fluid. 4) A thermal expansion experiment uses a temperature sensor and rotation sensor mounted on a modified expansion apparatus. More information can be found in the department's laboratory manual[1] and on the department's website, http://physics.citadel.edu/

1. Joel C. Berlinghieri, *Physics Laboratory Manual for Scientists and Engineers* (Tavenner Publishing Co., 2009); ISBN 978-1-930208-35-3 #

EH07: 6:50-8:50 p.m. Study of Magnetic Force in the Faraday's Law Experiment

Poster – Tatiana A. Krivosheev, Clayton State University, Morrow, GA 30260; TatianaKrivosheev@mail.clayton.edu

Kanesha Smiley, Clayton State University

We present a quantitative study of the magnetic force between a falling magnet and a solenoid in a classic Faraday's law experiment. It is customary to refer to this effect as negligible, and we will show if this is indeed the case. Two approaches are utilized: direct measurements performed by using PASCO photo gates and graphic analysis.

Tuesday afternoon

EH08: 6:50-8:50 p.m. Teaching Fourier Optics Through Inquiry with Spatial Light Modulators

Poster – Jerome Fung, Harvard University, Cambridge, MA 02138; fung@physics.harvard.edu*

Markus Greiner, Vinothan N. Manoharan, Joseph Peidle, Harvard University

Rachael A. Lancor, Edgewood College

We describe an apparatus based on a transmissive spatial light modulator (SLM) for performing experiments on wave optics. Using a computer, the students generate and display arbitrary arrangements of slits on the SLM and can discover for themselves the fundamentals of interference and diffraction phenomena. Moreover, the students can explore the connections between Fraunhofer diffraction and Fourier transforms. Additionally, using a 4f setup, the students can perform optical filtering on images of their choice. We also illustrate how students can use the SLMs to explore the fundamental principles of holography.

*Sponsor: Robert Hart

EH09: 6:50-8:50 p.m. Using Modeling to Emphasize Quantitative Thinking in the Laboratory

Poster – Benjamin M. Zwickl, University of Colorado Boulder, Department of Physics, Boulder, CO 80309; benjamin.zwickl@colorado.edu

Noah Finkelstein, University of Colorado Boulder

H. J. Lewandowski, JILA, University of Colorado Boulder

Modeling, the practice of developing, testing, and refining models of physical systems, is gaining support as a key scientific practice, and is included in the new Framework for K-12 Science Education released by the National Research Council. Modeling has already been integrated into introductory courses such as RealTime Physics, Modeling Instruction, and Matter & Interaction. However, there have been limited attempts to integrate modeling in the upper-division. We present modeling as a holistic approach for emphasizing quantitative thinking in the upper-division laboratory, which is accomplished by focusing on the relationships between fundamental principles, quantitative predictions, limitations of the model, data, and the physical apparatus. Practical examples (drawn from optics experiments) and tips for incorporating modeling into your existing labs will be included.

EH10: 6:50-8:50 p.m Verifying the Wiedemann-Franz Law in the Undergraduate Lab

Poster – Patrick Polley, Beloit College, 700 College Ave., Beloit, WI 53511; polleyp@beloit.edu

Andrea Clark, Logan Jacobson, Beloit College

The Wiedemann-Franz law ties together the disparate phenomena of electrical and thermal conduction in metals. In our work we develop two inexpensive and robust methods for measuring the electrical resistivity and thermal conductivity of three metals; aluminum, copper, and zinc. We measure the thermal conductivities using a transient method in which the temperature of a metal rod is measured after one end is immersed in a water bath. The electrical resistivity is measured in the steady state by determining the resistance of various lengths of wire. The variation in electrical resistivity from a low value of 18 n?.m for copper to a high value of 59 n?.m for zinc covers a range that is followed by their thermal conductivities of 385 W/m.K for copper to 110 W/m.K for zinc. The values we obtain verify the Wiedemann-Franz law and demonstrate the central role of electrons in these two processes.

Session EI: Physics Preparation for Preservice Elementary Teachers

Location: Johnson
Sponsor: Committee on Teacher Preparation
Date: Tuesday, January 8
Time: 6:50–8:50 p.m.

Presider: Wendy Adams

EI01: 6:50-7:20 p.m. Elementary Program Re-design I: Creating a New Major for Teachers

Invited – Eleanor W. Close, Texas State University-San Marcos, Department of Physics, San Marcos, TX 78666; eclose@txstate.edu

Lezlie S. DeWater, Seattle Pacific University

In 2007, a group of faculty at Seattle Pacific University set out to design a major that would prepare future elementary teachers in all six core content areas they would be required to teach, and in particular to increase their relevant preparation in science and mathematics. The process of creating the new major was a two-year collaboration between multiple departments within the College of Arts and Sciences, the School of Education, and the School of Psychology, and included the development of six major concentrations corresponding to the six core elementary school content areas. The creation of the new major more than doubled the number of required mathematics and science courses for elementary certification candidates. Results from the first few years of the new major show a dramatic increase in the number of students choosing to focus on science and mathematics.

EI02: 7:20-7:50 p.m. Elementary Program Re-design II: Integrating Physics Content and Methods

Invited – Lezlie S. DeWater, Seattle Pacific University, Seattle, WA 98119-1997; dewater@spu.eud

Eleanor W. Close, Texas State University-San Marcos

As part of the re-designed elementary teacher preparation program at Seattle Pacific University, students are required to take a sequence of two program-specific physical science courses, usually in their first year, and a science methods course also taught by physics faculty, usually in their fourth year. In addition, students who choose the Natural Sciences concentration are required to take at least two credits of science teaching practicum, which typically consists of serving as a Learning Assistant in the physical science courses during their second or third year. This sequence of experiences has been transformative for a number of students; we will describe the sequence through the lens of student stories.

EI03: 7:50-8:20 p.m. Hands-On-Science: Integrated, Inquiry-based Science for Preservice Elementary Teachers

Invited – Sacha Kopp, The University of Texas at Austin, 1 University Station C 1600, Austin, TX 78712-0264; kopp@hep.utexas.edu

Much has been discussed about the need for better science curriculum and training for teachers of elementary school classrooms. Future elementary school teachers at UT Austin gain their degree from the College of Education, with significant credits earned in math and science. I will discuss a new inquiry-based curriculum in integrated natural sciences (physics, chemistry, geology, biology, and astronomy) introduced for these teachers. I will discuss transitioning curriculum over to an inquiry class, the challenges of student mastery given the required broad curriculum, and in tailoring a curriculum and assessment to achieve goals of greater teacher self-efficacy in science instruction. Data on preservice teacher content mastery will be presented, as well as data on self-efficicacy.

EI04: 8:20-8:50 p.m. An Inquiry-based Course in Chemistry and Physics for Preservice Teachers

Invited – Michael Loverude, California State University Fullerton, Department of Physics, Fullerton, CA 92834; mloverude@fullerton.edu

Physics/Chemistry 102, “Physical Science for Future Elementary Teachers” is one of three courses that were developed at California State University Fullerton as part of an NSF-funded initiative to enhance the science content understanding of prospective teachers; the other courses cover geology and biology. Phys/Chem 102 is taught in a weekly six-hour lab format, with enrollment limited to 26 students per section and little or no lecture instruction. The course emphasizes learning science in context and a strong focus on conceptual understanding. The intention is that prospective teachers will see science as an interconnected discipline with real-world implications, rather than a collection of facts and equations. In this talk, we describe the course and its development, present research on student understanding for students in this course and similar-level lecture courses, and examine the present and future prospects for the course.

Plenary: Robert R. Twilley

Location: Celestin Ballroom I-III
Date: Wednesday, January 9
Time: 9–10 a.m.

Presider: Mary Lowe

Robert R. Twilley

The Mississippi River Delta Restoration as Science and Policy Issues of Public Concern: Opportunities in Science Education

Robert Twilley, Louisiana State University, Department of Oceanography and Coastal Sciences, Baton Rouge, LA 70803

Catchment environments share a level of complexity in that they are linked over large scales by a river network, so that problems in downstream locations may be the result of decisions made thousands of kilometers upstream. Coastal landscapes represent some of the most altered ecosystems worldwide and often integrate the effects of processes over their entire catchment, requiring systemic solutions to achieve restoration goals. One example of such large-scale watershed and coastal restoration efforts is the Mississippi River catchment and its deltaic coasts. Extensive flooding including a major event in 1927 resulted in major public work projects that drastically altered regional hydrology. In addition, major agricultural development in the floodplains of the Mississippi River basin over the last four decades has increased levels of inorganic nutrients, leading to problems with eutrophication. The urgent need for wetland rehabilitation at landscape scales has been initiated through major hydrologic diversions to reconnect the catchment with coastal processes. But the constraints of sediment delivery and nutrient enrichment represent some critical conflicts in earth surface processes that limit the ability to design 'self sustaining' public work projects; particularly with the challenges of accelerated sea level rise. The science and engineering challenges to 'restore' some of the self-sustaining processes represent the type of challenges to teach 'systems level' approaches to present environmental problems. The integration of physical, biological, and social sciences to reshape deltaic coasts will require interdisciplinary teaching frameworks in education. The Mississippi River Delta will be used as an example of approaches that are necessary to respond to such challenges to the physical sciences.

Poster Session II

Location: Storyville Hall
Date: Wednesday, January 9
Time: 10:15–11:45 a.m.

Odd number poster authors should be present ***10:15-11 a.m.***
Even number poster authors should be present ***11-11:45 a.m.***
(Posters should be set up by 10 a.m. Wednesday and then taken down by 4 p.m. Wednesday)

A – Labs/Apparatus

PST2A01: 10:15-11 a.m. Acoustic Analog to Level-Splitting Route to Band Gaps

Poster – Timothy A. Canalichio, Texas Lutheran University, Seguin, TX 78155; tacanalichio@tlu.edu

Tyler T. Bull, Shawn A. Hilbert, Texas Lutheran University

Demonstrations of quantum phenomena are difficult to attain for underfunded departments or with advanced lab budgets. To visualize such phenomena, analogies are beneficial. Acoustics is cost-beneficial, and the acoustic wave equation is equivalent to the Schrödinger equation in time-independent situations. This led us to attempt an acoustic analogy to the infinite square well with delta well perturbations. We mimic the level splitting route to band gaps, as demonstrated by Cohen-Tannoudji, by us-

Wednesday, January 9 Highlights

REGISTRATION 8 a.m.–3 p.m. Celestin Foyer

PLENARY 9 a.m.–10 a.m. Celestin I-III
Dr. Robert R. Twilley – "The Mississippi River Delta Restoration as Science and Policy Issues of Public Concern: Opportunities in Science Education"

POSTER SESSION II, 10:15–11:45 a.m. Storyville Hall

ing sound waves in an array of PVC tube sections separated by metal diaphragms. We demonstrate congruence between the acoustic and quantum systems and demonstrate the formation of acoustic band gaps.

PST2A02: 11-11:45 a.m. Recurrent Studies: Bringing Flavor into Physics Labs

Poster – Mikhail M. Agrest, 87 Droos Way, Charleston, SC 29414; agrestm@cofc.edu

Further development of the methodology of recurrent studies[1] in the practice of teaching introductory physics labs and in studio-style teaching that was first proposed in 2001 will be demonstrated. Bringing flavor into the learning process it became very popular among the author's students and colleagues after numerous presentations at SC Academy of Science, SACS AAPT, SC Science Counsel, AAPT, and other forums. It came to the apogee in 2009 when the publication[2] was named number one among the top 10 most read articles of *TPT* in May 2009[3] and led to the next publication in *TPT*[4] in 2011 with the following firing of the author from the College of Charleston as "not an exemplary teacher" in 2011. The audience will have a chance to receive recommendations on how to convert the lab of their suggested topic into recurrent study format. Hard copies of lab descriptions will be available.

1. M.Agrest, "Physics Lab with Flavor," SACSAAPT Annual Meeting. Coastal Georgia Community College, Brunswick, GA. Oct. 12-13, 2001. http://sacs-aapt.org/Meetings/Meeting_Programs/AbstractsF01.pdf.
2. Mikhail M. Agrest, "Physics Labs with Flavor," *Phys. Teach.* **47**(5) 297–301, 2009. http://tpt.aapt.org/resource/1/phteah/v47/i5/p297_s1?bypassSSO=1.
3. *Top 10 Most Read Articles of TPT*, May 2009; http://tpt.aapt.org/most_downloaded?month=5&year=2009.
4. Mikhail M. Agrest, "Physics Labs with Flavor II," *Phys. Teach.* **49**, 295–297 (May 2011); http://tpt.aapt.org/resource/1/phteah/v49/i5/p295_s1

PST2A03: 10:15-11 a.m. ilabs' Hands on Investigations with ipads In Introductory Physics Labs

Poster – Jacob Millspaw, Indiana Purdue University Fort Wayne, 2101 E. Coliseum Blvd., Fort Wayne, IN 46805; millspaj@ipfw.edu

Sally Mikhail, Indiana Purdue Univesristy Fort Wayne

Computers and data collection devices are an expensive part of introductory labs. What if students could use their own smart phones or tablets? We have run a set of mechanics-based physics labs using iPads for data collection and analysis. Using motion capture software the iPads function as a versatile replacement for frustrating sonic detectors. The data can be analyzed with a variety of simple apps that can be easily inserted into a document for electronic submission. ilabs are paperless eLabs!

PST2A04: 11-11:45 a.m There Might be Giants?

Poster – Jacob Millspaw, Indiana Purdue University Fort Wayne, 2101 E. Coliseum Blvd., Fort Wayne, IN 46805; millspaj@ipfw.edu

Mark F. Masters, Indiana Purdue Univesristy Fort Wayne

Ever ask a student about giants? What happens as people get extraordinarily tall? Is there a limit to a person's maximum height? Sure, we developed a simple experiment for students to do using some lab weights and lots of spaghetti. The spaghetti is used as a model for bones and the students can examine the strength of the bones varying the length and the cross section. This simple lab allows students to explore the question of giants (...the limitations on human growth). While exploring this question, the students are introduced to a variety of lab-related skills: measurement, data taking, uncertainty, and graphical data analysis.

PST2A05: 10:15-11:45 a.m. Workshops for the Education of the Concept of Light Reflection

Poster – Juan C. Tapia, Universidad Autónoma de Baja California, Carretera Tijuana, Ensenada km 103 Baja, CA 22800, México; juan@uabc.edu.mx

Alma R. Cabazos, Jesús R. Lerma, Universidad Autónoma de Baja California

In this work we show the didactic experiences of the achievement of workshops for the education of the concept of light reflection directed to primary and middle school students. The target of the workshop is the securing of significant learning of a playful way. Realizing experimental demonstrations and by means of the exchange of questions and answers the student is capable of forming for himself the real concept of the phenomenon in question, eliminating the intuitive and incorrect ideas on the above mentioned phenomenon. Finally, using homemade materials the student carries out an experiment with which it reinforces the acquired knowledge.

B – Teacher Training/Enhancement

PST2B01: 10:15-11 a.m. Alliance for Physics EXcellence (APEX), NSF funded Professional Development Project

Poster – Mostafa Dokhanian, Alabama A&M University, Department of Physics, Huntsville, AL 35762; mdokhanian@gmail.com

Dennis Sunal, J.W. Harrell, University of Alabama

Barbara Cady, Alabama A&M University

John Reutter, Drake Technical State College

NSF has awarded a five-year MSP grant to the Physics Department at Alabama A&M University entitled "Alliance for Physics Excellence (APEX)." APEX is led by AAMU and includes partners consisting of the University of Alabama at Tuscaloosa, Drake State Technical College, the American Association of Physics Teachers/Physics Teaching Resource Agents, Huntsville City School system, supporting partners from the 11 Alabama Math Science and Technology Initiative (AMSTI) regional in-service centers, and the Alabama State Department of Education. The vision of APEX is to promote significant gains in student learning by revamping secondary physics education in Alabama. APEX will be an agent of holistic, systemic transformation of physics pedagogy from traditional, didactic methods to an active intellectual engagement of students in the learning process. Integration of cutting edge teaching methodologies to participating in-service teachers will assist them in gaining deep content knowledge of physics and effective strategies based on physics education research.

PST2B02: 11-11:45 a.m. Preparing Teachers for Next Generation Science Standards with "A LOT of Science"

Poster – Jennifer Docktor, University of Wisconsin - La Crosse, Department of Physics, La Crosse, WI 54601; jdocktor@uwlax.edu

Gubbi Sudhakaran, University of Wisconsin - La Crosse

The "A LOT of Science" project at the University of Wisconsin-La Crosse involves 30 in-service elementary and middle school teachers in summer institutes and ongoing professional development (PD) weekend workshops on topics in physical science. The project is funded by a U.S. Department of Education Math Science Partnerships Program grant through the Wisconsin Department of Public Instruction. Year one of the PD was designed to integrate the Framework for K-12 Science Education and draft Next Generation Science Standards into activities, specifically for topics of Matter, Force and Motion, and Energy. Teacher feedback and assessment results for the first year of the project are presented.

PST2B03: 10:15-11 a.m. PhysicsTeachersNYC – A New, Local, Modeling-Focused Learning Community

Poster – Fernand Brunschwig, Columbia University Teachers College, Math, Science & Tech Department, New York, NY 10027; fbrunsch@gmail.com

Mark Schober, Trinity School

Colleen Megowan-Romanowicz, American Modeling Teachers Association (

Zhanna Glazenburg, Croton-Harmon High School

PhysicsTeachersNYC, a year-old affiliate of the American Modeling Teachers Association (ModelingInstruction.org), has over 100 teacher-members in NYC, communicating via a lively Google Group and website (PhysicsTeachersNYC.org). PhysicsTeachersNYC meets at Columbia

Teachers College and has conducted 11 highly successful teacher-led three-hour weekend workshops and one three-week summer Modeling Mechanics Workshop. We will document the process by which PhysicsTeachersNYC began and the high level of activity and interaction. Reasons for success lead back to the fact that the group is locally originated, classroom-oriented, and modeling-focused, with teachers determining the topics and leading the workshops. The workshops are intense, "hands-on" sessions: teachers work through Modeling Instruction lessons including experiments in "student mode" and then discuss the pedagogy in "teacher mode." We will spell out the implications and possibilities for teachers elsewhere interested in generating additional locally oriented initiatives from the grassroots, whether focused on Modeling Instruction or other interactive-engagement approaches.

PST2B04: 11-11:45 a.m. Overview: New Faculty Experience for Two-Year College Physics Instructors*

Poster – Todd R. Leif, Cloud County Community College, Concordia, KS 66901; tleif@cloud.edu

Scott F. Schultz, Delta College

The American Association of Physics Teachers has developed an 18-month experience to transform undergraduate physics programs at two-year colleges by developing newly hired physics instructors. The program seeks to equip these new faculty members with the tools, skills, and theory of active engagement techniques that have been developed based on Physics Education Research and successfully implemented at Two-Year Colleges. The lead presenters of the experience are all master two-year college faculty that also serve as mentors for the participants as the new faculty work to implement novel techniques and strategies in the classroom. The culmination of the experience is the commencement conference held in tandem with this national meeting. This poster will discuss the professional development delivered to the participants, the diversity of the group, and the lessons we as leaders have learned from the experience.

*Funding supported by NSF grant # 0940857.

PST2B05: 10:15-11 a.m. Improving Teaching of College Physics Courses Through Lesson Study

Poster – Sachiko Tosa, Wright State University, Dayton, OH 45435; sachiko.tosa@wright.edu

A number of instructional strategies to improve college-level physics courses have been developed and implemented over the decades. However, sustaining an effective use of innovative teaching techniques would not be easy because physics faculty members are often isolated and would not have opportunities to analyze their teaching. This study examines the use of the Lesson Study professional development model for improving physics teaching at a state college. Members of the group co-plan, observe, and discuss large-lecture physics classes at the introductory-level. The focus was on the use of clickers and Peer Instruction. Faculty's attitudes toward collaboration and inquiry-based teaching were measured by pre-/post-program responses to a survey instrument (N=14). The preliminary results indicate the process helped faculty members feel more comfortable asking their colleagues questions about their teaching. It also helped them see teaching in a more student-centered way. The need for collaborative effort like this is strongly advocated.

PST2B06: 11-11:45 a.m. Evaluation of Physics by Inquiry Programs for K-12 Teachers*

Poster – Robert J. Endorf, University of Cincinnati, Department of Physics, Cincinnati, OH 45221-0011, robert.endorf@uc.edu

Don Axe, Amy Girkin, Kathleen M. Koenig, Jeffrey Radloff, University of Cincinnati

We report on our continuing evaluation of the effectiveness of the Physics by Inquiry[1] professional development programs for K-12 teachers conducted at the University of Cincinnati. The study is based on data acquired from over 500 teachers that have completed either the 13 quarter-credit-hour graduate course in Physics by Inquiry for teachers in grades 5-12 or a separate 7 quarter-credit-hour course for teachers in grades K-5. Both programs have been effective in increasing the teachers' science content knowledge and their understanding of scientific inquiry. The teachers also gained significantly more confidence in their ability to teach inquiry-based science lessons. An important consequence of the programs was the teachers' evaluation that their students had performed better after they had implemented inquiry-based science activities in their classrooms.

* Supported by The Improving Teacher Quality Program administered by the Ohio Board of Regents.

1. L.C. McDermott and the Physics Education Group at the University of Washington, *Physics by Inquiry,* (John Wiley & Sons, 1996).

PST2B07: 10:15-11 a.m. Perception of Physics Teachers in Mexico About Competences Model

Poster – Mario Ramirez, CICATA-IPN, Av. Legaria 694, Col. Irrigacion, Mexico, DF 11500, Mexico; mramirezd@ipn.mx

Guadalupe Angel, Gonzalez Chavez, UPIITA-IPN

The teachers in physics programs are one of the most reticent groups to adopt the competence model. In particular, the Physic and Mathematics Superior School of the National Polytechnic Institute in Mexico (ESFM-IPN) has a mission forming teachers in physics and mathematics to the institute, being a contradiction to reject the educational institutional model (based on competence) in their own programs. The reasons to reject the competences model are varied, since unknowledge until absence of capacitation about the model. In curious that the teachers did not identify clear what is a competence? Before to reject only the term, because when the word was changed of "competence" to "skill" the attitude was totally different. On the other aspects the teachers shows reserved about the success of model while will not made a evaluation after some generation of students working this kind of model

PST2B08: 11-11:45 a.m. Dimensions of a Funded PhysTEC Project: California State University's PHYSICS AT THE BEACH

Poster – Chuhee Kwon, California State University, Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840; chuhee.kwon@csulb.edu

Laura Henriques, Galen Pickett, Kevin Dwyer, California State University Long Beach

The California State University Long Beach (CSULB) Physics Teacher Education Coalition (PhysTEC) project is in the last-year of the PhysTEC funding. We have built a successful model for a Physics Teacher Network involving physics majors, preservice teachers, in-service teachers, and university faculty in a comprehensive urban minority-serving university. The PhysTEC project was a catalyst that transformed the culture of the department. We will present various dimensions of the CSULB PhysTEC project and specific activities, e.g., recruitment, outreach to area high school teachers, and connecting with other projects and programs. Also the sustainability plan beyond the PhysTEC funding will be discussed.

PST2B09: 10:15-11:00 a.m. Conceptual Learning in a Training of Trainers Workshop on Active Learning of Thermodynamics and Fluids

Poster – Genaro Zavala, Tecnologico de Monterrey, Garza Sada 2501, Monterrey, NL 64849 Mexico; genaro.zavala@itesm.mx

Julio Benegas, CONICET/UNSL

Silvia Tecpan, Tecnologico de Monterrey

In this paper we report the results of the evaluation of conceptual knowledge showed by participants at a workshop for training of trainers on Active Learning of Thermodynamics and Fluids (AATyF-2011). The evaluation was carried out by a multiple-choice conceptual test of 35 questions administered at the beginning and the end of the workshop. These pre- and post- workshop data revealed that these physics teachers' content knowledge improved at the end of workshop but still showed they had some conceptual difficulties. During this workshop the participants reflected individually and in small groups on the preconceptions of their own students on the topics of the workshop. These participants were able to describe some of the most common student preconceptions on subjects of Flotation and hydrostatic pressure, but not in gases. We describe the main results and their possible implications on student learning.

PST2B10: 11-11:45 a.m. The Impact of Learning Assistants on Student Learning and Engagement

Poster – Sarah Garcia, Cal Poly Pomona, 3801 W. Temple Ave,. Pomona, CA 91768; sarahcgarcia@csupomona.edu

April Hankins, Cal State Fullerton

Homeyra Sadaghiani, Josh Zeeman, Cal Poly Pomona

The Learning Assistant Program at Cal Poly Pomona Department of Physics & Astronomy recruits students with interests in teaching to work with physics instructors in freshman and sophomore level courses. The Learning Assistants (LAs) lead small group discussions in lecture, labs, and recitation courses. On this poster, we will explain the existing the LA program and report on its impact on enhancing students" engagement in reformed courses. Furthermore, we will discuss the benefits of the program on LAs' own content knowledge and their overall preparation as prospective future teachers.

PST2B11: 10:15-11 a.m. Lessons from a Summer PET Course for In-service K-12 Teachers

Poster – Justin L. Snook, Buffalo State College, Buffalo, NY 14222; snookj01@buffalostate.edu

David S. Abbott, Dan L. MacIsaac, Brad Gearhart, Kathleen A. Falconer, Buffalo State College

In summer 2012, 15K-12 teachers from struggling, low-income schools in an urban school district attended a two week, credit bearing course at SUNY Buffalo State College using the Physics for Everyday Thinking (PET) curriculum by Goldberg et al. The course featured whiteboard driven discourse and significant use of technology and hands-on activities, all of which were unfamiliar to the participants. We report on pre- and post-PET diagnostic data and student learning journals. Additional course characterization from video and instructors' comments will be included, and self-reported classroom impacts will be presented. Findings and lessons learned will be presented for this and similar courses.

C – Technologies

PST2C01: 10:15-11 a.m. Effect of Online Pre-tests on Performance in Inquiry-based Physics

Poster – Andrew W. Dougherty, The Ohio State University, Columbus, OH 43210; andrew@physics.osu.edu*

Jennifer L. Esswein, Bruce R. Patton, The Ohio State University

The addition of online pre-tests as a primer for learning is studied in an introductory inquiry based physics course designed for preservice K-12 teachers. The questions are designed to address misconceptions, elicit thinking about the material covered in the upcoming week, and to alert students to the physical principles essential to the class material. The pre-tests are paired with an online post-test component to both measure student gains as well as reinforce student learning. The pre-tests are completed and machine-graded at the beginning of the week during which the content is covered in class, while the post-tests are short answer corrections to the pre-tests completed at the end of the week. The relationships between online tests and the learning of course content are investigated to determine a model for predicting success in the course.

Sponsor: Bruce Patton

PST2C02: 11-11:45 a.m. Screencasting in College Physics

Poster – Chadwick Young, Nicholls State University, Thibodaux, LA 70310; chad.young@nicholls.edu

Students today face a barrage of online videos, but their capacity to view and consume these are phenomenal. The use of video tutorials, screencasts, and video logs in an introductory physics course can be immensely useful and effective for the students' learning experience. I will present the use of screencasting and video-logs in a physics course. I will provide information about free resources that make screencasting and vlogs easy for the teacher and student.

PST2C03: 10:15-11 a.m. Parallel Computing in the Upper Division

Poster – Steve J. Spicklemire, USAF Academy/University of Indianapolis, USAF Academy, CO 80840; spicklemire@uindy.edu

Introducing parallel computing in an undergraduate curriculum not directly related to computer science has multiple challenges. Students often have limited computing experience and essentially no knowledge of concepts like parallelism or object oriented programming. During the second semester of the regular quantum mechanics sequence we've employed a novel approach to parallel programing that permitted undergraduate physics majors to write non-trivial parallel codes that performed efficiently on distributed memory cluster computers using the python programming language. A brief description of the strategies involved and the results of student projects will be discussed.

PST2C04: 11-11:45 a.m. Karplus "Physics Textbook on Web" One Semester's Progress and Pitfalls

Poster – Fernand Brunschwig, Columbia University Teachers College, Math, Science & Tech Department, New York, NY 10027; fbrunsch@gmail.com

Introductory Physics by Karplus went on the web as a free e-book in preliminary form August 2012 (fernwig.org, "guest" login and password). It is readable with laptops, tablets, and smartphones. A unique method of publication integrates the features of printed textbooks (equations, tables, graphics, sidebars . . .) and opens door to multimedia (live web links, videos, simulations, . . .). The publication method limits clutter and allows individual authors to publish and revise on the web. A survey (tinyurl.com/karplussurvey) of teachers and students reveals the potential and issues particular to physics e-textbooks. The current state of the book will be demonstrated, including features in development: 1) Teachers adding material, omitting/rewriting sections and publishing their "remix"; 2) Teachers sharing added/rewritten materials; 3) Teachers and students rating elements of the book; 4) Teachers sharing "recipes" for deployment; 5) Producing PDFs and e-books in "native" format for Kindles, Nooks, and other readers.

D – Pre-college/Informal and Outreach

PST2D01: 10:15-11 a.m. How to Start a Science Festival

Poster – Peter Sheldon, Randolph College 2500 Rivermont Avenue Lynchburg, VA 24503 psheldon@randolphcollege.edu

In 2009, the Randolph College Society of Physics Students started the Randolph College Science Festival with a $700 donation from a local company and a few departmental dollars. The Festival is a weekend of science-based activities, and all events are free and open to the public. Randolph College is in central Virginia, in a city of 70,000. In three years, the Festival has grown to an event with 1500 attendees and contest submissions from 800 K-12 students. The Randolph College SPS Chapter runs the event with the help of 105 college student volunteers. We would like to share our success and ideas, and would also like to learn ideas from others about festival-type activities and fundraising.

PST2D02: 11-11:45 a.m. Bauder Endowment Outreach Projects

Poster – Paul W. Zitzewitz, University of Michigan-Dearborn (retired), 16229 Country Knoll Drive, Northville, MI 48168; pwz@umich.edu

The Frederick and Florence Bauder Endowment provides grants for the development and distribution of innovative apparatus for physics teaching, funds to obtain and/or build and support traveling exhibits of apparatus, or funds for local workshops. Up to approximately $500 is available to fund local workshops for teachers who spread the use of demonstration and laboratory equipment. This poster will exhibit the work of prior grant recipients who are unable to attend the meeting to present the results themselves. Come and see what small grants can do and explore ideas you might have for projects.*

* Other members of the Bauder Committee will be present during the poster session.

of basic science aspects (such as certainty, predictive vs. reactive, Occam's razor) are probed.

PST2D03: 10:15-11 a.m. AAPT's PhysicsBowl – A Contest for High Schools

Poster – Michael C. Faleski, Delta College, University Center, MI 48710; michaelfaleski@delta.edu

The PhysicsBowl is an annual contest for high school students. The contest itself is 40 multiple-choice questions in length to be answered in no more than 45 minutes In 2012, there were more than 5000 students participating from approximately 260 schools across the world. In the past few years, schools have competed from the United States, Canada, China, Taiwan, Japan, the Republic of Korea, and Italy. Prizes are awarded to both the students and schools for high performers. This poster is to give high school teachers more information about the contest.

PST2D04: 11-11:45 a.m. Radical Physics: A Novel Online Introductory Course

Poster –Tucker Hiatt, Stanford University & Wonderfest, 47 Alta Way Corte, Madera, CA 94925; thiatt@stanford.edu

According to the AIP, two-thirds of U.S. students never take a year-long physics course. Radical Physics is a novel online introductory course that will appeal to a sizable portion of the un-physicsed two-thirds. It will also help full-year students who have inexperienced teachers or who just want a second view of essential material. Radical Physics, created by the the nonprofit "Wonderfest," offers several improvements over the Khan Academy model: (1) its principal instructor has 35 years of experience; (2) it promotes use of the PhET laboratory simulations; (3) it has a look-you-in-the-eye "talking head" format that draws the viewer in — as television news has been able to do for over 50 years. Radical Physics also benefits from occasional interviews with Stanford and UC Berkeley experts, and from critical analysis of compelling action movie scenes.

E – Other

PST2E01: 10:15-11 a.m. An Undergraduate Experiment Testing a Platform Concept for Atmospheric Re-entry

Poster – Cynthia Galovich, Univ. of Northern Colorado, Department of Physics, Greeley, CO 80639 rawalch@unco.edu

Robert Walch, Matt Semak, Univ. of Northern Colorado

Maurice Woods, RoadNarrows Robotics

An undergraduate experiment was designed, modeled, and tested to investigate the process of atmospheric re-entry of a small probe. One of the important considerations for space exploration involves the structural challenges experienced by spacecraft upon returning to Earth. The experiment was launched on a suborbital Improved Terrier Orion sounding rocket from NASA's Wallops Flight Facility in Virginia and successfully deployed a small aluminum capsule at apogee (about 120 km). The experiment was funded by the Colorado Space Grant Consortium as part of an ongoing undergraduate research program in space physics. The flight served as a proof-of-concept test for the capsule design with the hope of it being an effective platform that could be used for future undergraduate research.

PST2E02: 11-11:45 a.m. Using Plumbdads-Quarkles to Examine Student Understanding of Scientific Practice

Poster – Timothy T. Grove, Indiana University Purdue University Fort Wayne, 2101 East Coliseum Blvd., Fort Wayne, IN 46805; grovet@ipfw.edu

Many of my colleagues have lamented students' inability to examine, analyze, and gain meaning from measured data. To examine student thinking, a hypothetical set of data was given to students relating the fictional quantities of plumbdads and quarkles. These two quantities were used rather than physically observable parameters so that students could not "gain insight" through Internet searches (Wikipedia, Google search, etc.) or through the index of a book. The developed exercise, which will be presented here, asks students a series of questions regarding the "collected data" and two researchers opinions about the same data. One researcher behaves much like a scientist while the other researcher reacts more like a pseudo-scientist with an unwavering and unshakable preconception. Student understanding

PST2E03: 10:15-11 a.m. Recruiting and Retaining Women in Physics in Central Arkansas

Poster – Stephen R. Addison, University of Central Arkansas, Conway, AR 72035; saddison@uca.edu

Over the last 10 years the Department of Physics and Astronomy at the University of Central Arkansas has experienced considerable growth. The number of women physics graduates had been notable, and has often represented half of each graduating class. Strategies developed to recruit and retain these students will be presented with a particular emphasis on strategies that were successfully deployed to increase the number of women physics graduates.

PST2E04: 11-11:45 a.m. Musical Instruments on the Cheap!

Poster – Wendy K. Adams, 1914 18th Ave., Greeley, CO 80631 wendy.adams@unco.edu

Come make a straw trombone and a multi-functional cup instrument with me! You may have seen these instruments before but have you used them to teach the Nature of Science? As part of the educational outreach efforts of the Acoustical Society of America, interactive lessons on resonance, sympathetic vibration and some aspects of the nature of science have been created around these instruments. Stop by and check them out or share your ideas for teaching with these fun make and takes.

PST2E05: 10:15-11 a.m. Supporting PER as a Physics Department Chair

Poster – Laura McCullough, University of Wisconsin - Stout, Physics Department, Menomonie, WI 54751; McCulloughL@uwstout.edu

With the growth of PER and the hiring of PER faculty in many physics departments, there is a need for discussion of how a department chair can support PER faculty and research. With this poster, I will share some strategies I have found helpful as a department chair in supporting PER in a department that includes both traditional and educational physics research. I encourage discussion and sharing of best practices, as well as examples of non-supportive environments, during the poster presentation.

F – Post-Deadline Posters

PST2F01: 10:15-11 a.m. Analyzing the Motion of Coupled Oscillators Using the WiiMotion Plus

Poster – Romulo Ochoa, The College of New Jersey, Ewing, NJ 08628; ochoa@tcnh.edu

Cris R. Ochoa, Michael Erickson, The College of New Jersey

The Wii console utilizes a very powerful controller for game-playing. The Wii Motion Plus was introduced in May of 2010. In addition to the accelerometers and Bluetooth interface found in regular Wiimotes, it contains gyroscopes that measure the rate of rotation along 3-axes, X (pitch), Y (roll), and Z (yaw), up to ±2,000°/s. Open source code, such as GlovePie, allows PCs with Bluetooth capability to detect the information sent out by the controller. We have designed several experiments that make use of this device. Up to three Wiimotes are used simultaneously to measure the motion of a compound pendulum and of coupled pendulums. Normal modes have been determined where appropriate. Results of our experiments compare well with those predicted by Newtonian mechanics.

PST2F02: 11-11:45 a.m. Creating Experiments for Physics Teachers Education

Poster – Anna Solomey, Wichita State University, Wichita, KS 67260; anna.solomey@wichita.edu

We created physics experiments designed for physics teachers to help bring understanding to the physics problems that we are studying. Part of it was made for physics education teachers, faculty demos and a help room. This includes: motion, forces, energy, rotation, thermodynamics, electricity and optics experiments. The goal is to facilitate their education through hands on experiences.

PST2F03: 10:15-11:15 a.m. Early Teaching Experiences Builds Future Physics Teachers at Virginia Tech

Poster – Alma Robinson, Virginia Polytechnic Institute and State University, Robeson Hall 0435, Blacksburg, VA 24061; alma.robinson@vt.edu

John Simonetti, Leo Piilonen, George Glasson, Brenda Brand, Catherine Amelink, Sam Rosenkrantz, Chris Martin, Brandon Bear, Seth Guldin, Virginia Tech

The need for more physics majors and improved K-12 physics education is clear. Through the PhysTEC project, a national program to recruit and train future high school physics teachers, the Virginia Tech Physics Department and School of Education have partnered together to encourage physics students to participate in a multitude of early teaching experiences at both the K-12 and collegiate levels. This poster will outline the programs offered at Virginia Tech and describe how early teaching experiences have encouraged physics students to consider teaching as a career, improved their own content understanding as well as pedagogical content knowledge, and reformed both university and K-12 classrooms to be more student-centered and engaging. Students earn course credit by taking the Physics Teaching and Learning class and/or by participating in our Learning Assistant, Physics Outreach, Enriched Physics Outreach, and Robotics programs.

PST2F04: 11-11:45 a.m. Using Video Analysis to Classify Student Discussions During Peer Instruction

Poster – Laura Tucker, Harvard University, Cambridge, MA 02138; ltucker@seas.harvard.edu

Rachel Scherr, Seattle Pacific University

Eric Mazur, Harvard University

Numerous studies show courses taught using Peer Instruction have higher learning gains on standardized assessments. Yet we have very few measurements of what happens during the peer discussion component of this pedagogy. When students are told to discuss a physics question with a neighbor, do they do so? If so, do they have a substantive conversation about the physics, or just a brief exchange of answers? To address these questions, we recorded every student discussion in nearly every lecture of an introductory physics course at a major research university. Through both large-scale manual coding efforts and smaller-scale qualitative analysis, we have identified common interactional patterns and measured the frequency of each interaction type. In addition, we have measured the proportion of time students spend in on- and off-task discussions. We will discuss these results and implications for the classroom.

PST2F05: 10:15-11 a.m. Using Instructional Videos in Introductory Physics

Poster – Vasudeva R. Aravind, Clarion University, 840 Wood St., Clarion, PA 16214; varavind@clarion.edu

I used screencast instructional videos in the introductory physics class. These videos were made with Camtasia software and uploaded on the Internet using sites such as youtube and Vimeo. Data Analytics performed on these video views show that these videos were useful not only to students in my classroom, but also to many others in different parts of the world.

PST2F06: 11-11:45 a.m. The Next Generation Science Standards: To What Extent are Modern Physics Concepts Included?

Poster – Tugba Yuksel, Purdue University, West Lafayette, IN 47906; tyuksel@purdue.edu

Lynn Bryan Purdue University

Developments in nanotechnology and their applications to daily life have canalized people?s attention to subatomic-level particles and their behaviors. Different features of such particles are used in many fields from medical treatments to manufacturing. Concerning the need for understanding subatomic-world, physics educators have recently argued that some quantum physics concepts (QPCs) should be introduced to students starting from high school (Ireson, 2000). Based on these arguments, we focused on current state-level standards and the first draft of the Next Generation Science Standards (NGSS) to examine the extent to which they address QPCs. The NGSS essentially define the minimum of what all students should learn by the time they finish high school. In this study, we (a) compared how QPCs are addressed in state-level standards versus NGSS; and (b) analyzed the alignment of QPCs in NGSS and state-level standards with current secondary physics textbooks. We conclude with implications for secondary physics.

PST2F07: 10:15-11:15 a.m. Early Exposure to Major Physics Topics: Introductory Physics Re-Ordered

Poster – Jill M. Randall. University of New England, Biddeford, ME 04005; jrandall5@une.edu

James Vesenka, Bradley Moser, Dean Meggison, Paul Bilotta, University of New England

The University of New England uses a studio approach to teaching introductory physics based on "Modeling Instruction." The approach has shown promising results in increasing student retention (currently at 90%) and academic success. We rearranged the order in which introductory physics concepts were presented to further the students' understanding of "the big picture." For example, previously we followed a traditional order of kinematics, dynamics, etc. Unfortunately many students would latch on to and memorize formulas, such as the equations of kinematics, covered early in the semester. Later on, superior solutions employing energy and momentum conservation would be ignored in favor of the aforementioned equations, even when inappropriate to do so. We are trying to break this cycle through early exposure of major physics concepts followed by spiraling back, in order to help students better organize their physics framework and to systematically review earlier developed ideas in slightly new contexts

PST2F08: 10:15-11 a.m. Promoting Physics Teaching Through PoCOM (Practical On-site Cooperation Model)

Poster – Jongwon Park, Chonnam National University, 500-757, Korea (South); jwpark94@jnu.ac.kr

Youngmin Kim, Pusan National University

Jin-Su Jeong, Daegu University

Youngshin Park, Chosun University

Jongseok Park, Kyungpook National University

This study described how physics educators cooperated with physics teachers with the aim of enhancing physics teaching. To do this, we developed PoCOM (Practical On-site Cooperation Model). In this model, we used 'Bottom-up' approach where physics teachers themselves figured out what to improve for their teaching. Then physics educators and physics teachers developed 'alliance' to consult and prescribe each other with the purpose of improving physics teaching through cooperation. This cooperation does happen practically onsite where physics teachers reflect on what they wanted to improve, what they improved, and what they would improve in the next class through realistic approach. For this study, we developed K-TOP (Korean Teacher Observational Protocol) to make profiles of physics teachers' teaching in a naturalistic situation. In this presentation, we will introduce how physics teaching was actually improved, various characteristics found in the process of improvement, and also the reasons why sometimes the improvement failed..

Session FB: PER: Student Reasoning

Location: Bucktown II
Date: Wednesday, January 9
Time: 1–2:50 p.m.

Presider: Jeff Grott

FB01: 1-1:10 p.m. A Taxonomy of Infinitesimals in First-Semester Introductory Physics

Contributed – Joshua S. Von Korff, Georgia State University, Science Annex 400, Atlanta, GA 30303; jvonkorff@gsu.edu

N. Sanjay Rebello, Kansas State University

Physicists use infinitesimals (dx, dV, dM) in a variety of ways. In first-semester introductory physics, the "d" can refer to at least two types of infinitesimals: first, a change in a physical quantity over time or space; second, a small quantity associated with a small amount of space. Students who receive instruction about only one type of "d" will still be unfamiliar with other types. We develop the change vs. amount distinction by providing examples of student representations for both types. Students may use diagrammatic, graphical, and symbolic representations differently to depict changes vs. amounts. Diagrams that portray changes show time, space, and matter differently than diagrams that portray amounts. We conclude by suggesting that calculus-based physics courses should either explicitly distinguish the different types or attempt to eliminate all references to amounts. This work supported in part by NSF grant 0816207.

FB02: 1:10-1:20 p.m. An Instructional Strategy Arising from the Resources Framework

Contributed – Andrew Elby, University of Maryland, College Park, MD 20742; elby@umd.edu

The Misconceptions framework for describing students' intuitive knowledge[1] has been criticized on multiple grounds,[2] but it has one clear advantage: it connects closely to an instructional strategy of eliciting, unsettling, and displacing students' incorrect ideas.[3] The Resources (Knowledge-in-Pieces) framework,[4] by contrast, connects to vague instructional suggestions such as "help students refine and restructure their intuitive ideas," which provides limited help to tutorial writers, other curriculum developers, and instructors. In this talk, I will present what I hope to be a clear, generative strategy for curriculum writers and instructors, a strategy that corresponds to one particular cognitive mechanism of conceptual change within the Resources framework. I illustrate this instructional strategy with examples from tutorials that have contributed to documented conceptual gains.

1. J. Eaton, C. Anderson, and E. Smith (1984), *The Elementary School Journal* **84**(4), 365-379. R. Thornton (1995), *Conceptual dynamics: Changing student views of force and motion.* In C. Tarsitani, C. Bernardini, & M. Vincentini (Eds.), *Thinking Physics for Teaching,* London: Plenum Publishing.
2. J. Smith, J., A. diSessa, and J. Roschelle (1993), *J. of the Learning Sciences* **3**(2), 115-163.
3. G. Posner, K. Strike, P. Hewson, and W. Gertzog (1982), *Sci. Educ.* **66**(2), 211-227.
4. A. diSessa (1993), *Cognition and Instruction* **10**(2-3), 105-225. D. Hammer (2000), *Am. J. Phys.* 68(S1), S52-59.

FB03: 1:20-1:30 p.m. Conceptual Understanding Relies on Reasoning Ability

Contributed – Brian A. Pyper, BYU-Idaho, Rexburg, ID 83460-0520; pyperb@byui.edu

Even interactive classrooms sometimes give short shrift to the importance of reasoning in conceptual change. We often assume our students are high-level reasoners and teach accordingly, when research shows many of our students are not post- or even formal-operational. My data show the use of teaching techniques and materials to encourage reasoning results in improved conceptual understanding.

FB04: 1:30-1:40 p.m. Effectiveness of a 3D Interactive Demonstration of EM Plane Waves*

Contributed – Ximena C. Cid, University of Washington, Department of Physics, Seattle, WA 98195-1560; xcid@uw.edu

Paula R.L. Heron, Lillian C. McDermott, University of Washington

Ramon E. Lopez, University of Texas, Arlington

Electromagnetic (EM) plane waves are arguably one of the most difficult and abstract ideas taught in an introductory physics course. Instruction on this topic typically involves the use of both three-dimensional diagrams (shown in two dimensions) and mathematical representations. Both of these representations rely heavily on the ability of students to visualize electric and magnetic fields in space and to visualize how they change over time. This presentation will focus on an investigation of an EM plane wave in free space that was used in conjunction with Tutorials in Introductory Physics[1] at the University of Washington.

*This work has been supported in part by the National Science Foundation under Grant No. DUE-0733276.

1. *Tutorials in Introductory Physics,* 1st Edition (Prentice Hall, Upper Saddle River, NJ, 2002).

FB05: 1:40-1:50 p.m. Electric Field Lines and the Superposition Principle of Electric Field

Contributed – Genaro Zavala, Tecnologico de Monterrey, NL 64890 Mexico; genaro.zavala@itesm.mx

Esmeralda Campos, Tecnologico de Monterrey

The electric field and the superposition principle play key roles in the understanding of physical phenomena in Electricity and Magnetism. A very common representation of the electric field is with electric field lines. We conducted an experiment with the objectives of identifying the effect that electric field lines have over the superposition principle, and analyzing the different diagrams that students use to represent the electric field. The experiment consisted in the administration of three versions of a test with open-ended questions about the electric field on a particular case. The tests were administered in a private Mexican university in the spring semester 2012 to 288 students taking the course of Electricity and Magnetism upon completion of the topic of Electrostatics. Students presented only one version in a random way to be able to compare results. Results showed evidence that electric field lines have a negative effect on some students' comprehension of the superposition principle, that many students do not have a coherent framework when arguing the superposition principle using electric field lines, and that students who used vector representation instead of electric field lines representation have a higher tendency toward applying correctly the superposition principle.

FB06: 1:50-2 p.m. Examining Students' Reservations About Forces

Contributed – Jennifer Blue, Miami University, Department of Physics, Oxford, OH 45056; bluejm@miamiOH.edu

This is an investigation of the consistencies, or lack thereof, in how students apply their knowledge about Newtonian forces after instruction. Students were asked to draw all the forces on both an accelerating car and on a passenger riding in that car. Then they were asked to identify why the car accelerated. They sometimes invent forces, or labeled things as forces that are not actually forces (i.e. "motion", "momentum", "inertia"), giving up on the idea of real forces so that they could make Newton's Second Law work. In addition, students were given the Force Concept Inventory.[1] I will see how student performance on the Force Concept Inventory, particularly the items about the nature of forces and about Newton's second law, relates to their performance on the car and passenger problem.

1. Hestenes, Wells, & Swackhamer, *Phys Teach.* **30**, 141–158, (1992).

FB07: 2-2:10 p.m. Exploring Cognitive Acceleration Through Physics

Contributed – John M. Clement, Lonestar College, Bellaire, TX 77401; clement@hal-pc.org

Using the published Lawson test I pre- and post-tested students to determine if they improved their thinking skills. This was done both at a private high school and at a two-year college. All classes were taught using PER methods, primarily Modeling. ILDs and some other PER materials were also used. Some very small gain was sometimes seen in high school, but not reliably. Using some of the ideas of Shayer and Adey in 2YC courses produced improved results. Students first have to be convinced that they can improve their thinking. Then the various thinking skills need to be brought out explicitly. The thinking skills also should be separated from just the physics thinking. In other words there needs to be explicit bridging. Beyond the increase in general thinking skills, physics gain was observed to be in the IE range, but is limited by the achieved thinking skills among other factors.

FB08: 2:10-2:20 p.m. Influences on Student Reasoning Due to a Provided Outcome

Contributed – Jeffrey M. Hawkins, The University of Maine, Orono, ME 04469; jeffrey.hawkins@maine.edu

John R. Thompson, Michael C. Wittmann, The University of Maine

Many instructional physics practices, such as some traditional lecture demonstrations, provide students with an outcome and ask them to think of reasons that outcome occurred. Other practices, such as Interactive Learning Demonstrations[1] ask students to predict and explain what outcome will occur before demonstrating the outcome. We have been investigating the impact of providing students with the outcome, rather than asking them what they think will happen, on the reasoning students use to explain what will occur. We administered written questions to introductory calculus-based students via an online pre-test system. We find that providing students with the outcome often causes them to express different reasoning than students who are asked to select which outcome they think will occur. We also find that the different reasoning elicited by providing students with the outcome can be productive reasoning (e.g. reasoning based on definition), or unproductive reasoning(e.g. compensation reasoning).[2]

1. D.R. Sokoloff and R.K. Thornton, *Phys. Teach.* **35**, 340–347 (1997).
2. R.A. Lawson and L.C. McDermott, *Am. J. Phys.* **55**, 811–817 (1987).

FB09: 2:20-2:30 p.m. Student Gestures About Complex Wave Functions for One-Dimensional Potentials

Contributed – Catherine C. Schiber, Texas State University-San Marcos, 601 University Dr., San Marcos, TX 78666; cs1706@txstate.edu

Hunter G. Close, David Donnelly, Eleanor W. Close, Texas State University-San Marcos

A quantum wave function for a particle in a one-dimensional potential may be purely real at some instant, or there may be no such instant, depending on the potential. When the time dependence of the wave function is factored in, any function will surely have both real and imaginary parts. The complex nature of the wave function in these cases is perhaps best shown using three dimensions rather than with a two-dimensional drawing. We asked upper-division quantum mechanics students in an oral exam to show with their hands what the shape of wave functions for various potentials would look like, and how these functions would evolve in time. We analyze the students' gestures to understand their thinking; in particular, we investigate the difference between gestures that trace static structures and those that represent dynamic evolution, and how students extend mathematical knowledge from two-dimensional contexts into three.

FB10: 2:30-2:40 p.m. When Does a Group Ignore their Own Question?*

Contributed – Alex M. Barr, University of Texas at Austin, 1 University Station C1600, Austin, TX 78712; ambarr@physics.utexas.edu

Amy D. Robertson, Seattle Pacific University

The growth of tutorial- and discussion-style recitation sections has made group work an integral part of many physics classrooms. Goals for group work often include increasing student agency and encouraging students to ask their own questions. Once asked, these questions can either be taken up or be disregarded by the group as a whole. What factors influence this decision? We analyze an interaction between three teachers in the Energy Project at Seattle Pacific University in which the question of what makes a material magnetic is first disregarded and then later taken up for an extended discussion. We examine the teachers' framing of their activity to help understand when and why this question is taken up by the group.

*Supported in part by NSF 0822342.

FB11: 2:40-2:50 p.m. Student Understanding of Foundational Ideas in Quantum Mechanics

Contributed – Paul J. Emigh, University of Washington, Seattle, WA 98115; pemigh@u.washington.edu

Peter Shaffer, Gina Passante, University of Washington

Quantum mechanics requires a conceptual framework substantially different from the classical picture students develop in introductory physics courses. We are examining student thinking on several foundational topics in quantum mechanics, including black-body radiation, wave-particle duality, and the Stern-Gerlach effect. Excerpts from interviews, pre-tests, and post-tests will be used to illustrate some of the conceptual and reasoning difficulties we have identified among both introductory and upper-division students.

Session FC: History and Practice in Musical Acoustics

Location: Foster
Sponsor: Committee on the Interests of Senior Physicists
Date: Wednesday, January 9
Time: 1–2:10 p.m.

Presider: Gordon P. Ramsey

FC01: 1-1:30 p.m. The Physics of the Piano and How We Study It

Invited – Thomas Moore, Rollins College, Department of Physics, Winter Park, FL 32789; tmoore@rollins.edu*

It has now been over 300 years since the invention of the piano, however, we are still investigating the details of the physics involved in producing its characteristic sound. This presentation will focus on the physics of the piano as well as the techniques used to study it, and will highlight both well-established and more recent developments. Although early studies relied almost exclusively on analysis of the sound, recently electronic speckle pattern interferograms of the sound board, laser Doppler vibrometry of the bridge motion, and high-speed photography of the hammer motion have lent considerable insight into the underlying physics. Both the techniques and the insight they provide will be discussed.

*Sponsor: Gordon Ramsey

FC02: 1:30-2:00 p.m. The Progression of Percussion Research: From Chladni to the Present

Invited – Andrew Morrison, Joliet Junior College, Joliet, IL 60431; amorrison@jjc.edu

Drums are among the most ancient of all musical instruments and have been found in nearly all cultures across the world. This presentation will cover a selection of major investigations of the acoustics of percussion instruments by a variety of scientists throughout history. Ernst Chladni's efforts to characterize the vibration of plates is well known to the physics teacher and often replicated by physics students in the laboratory. Other scientists who made early contributions to the understanding of percussion instruments include Lord Rayleigh and C. V. Raman. Rayleigh's observations of the acoustics of the kettledrum and bells represented only a fraction of his contributions to acoustics. Raman, who was better known for his work in spectroscopy, made detailed studies of the traditional Indian drum, the tabla. Modal analysis techniques have evolved significantly in recent years. This presentation will include an overview of modern techniques for studying percussion instruments.

FC03: 2-2:10 p.m. Ultrasound Imaging of Vocal Tract Configuration in Clarinet Playing

Contributed – Joshua T. Gardner, Arizona State University, School of Music, Tempe, AZ 85287-0405; joshua.t.gardner@asu.edu*

Richard J. Jacob, Emeritus, Arizona State University

Vocal tract configuration is an integral, acoustically coupled component of successful clarinet performance. The exact mechanics are however difficult to describe or visualize due to the concealed nature of the system during performance. Music teachers have used vowels to help shape the tongue, yet vowel shapes only approximate the correct tongue shapes as required by different airflow conditions. Ultrasound imaging offers a non-invasive method for imaging the tongue during performance, allowing the examination of performance tongue shape and motion in real-time. Since ultrasound images a single slice of tissue approximately 2 mm thick and the transducer can be stabilized relative to the cranium, measurements of the tongue surface can be taken for quantitative analysis. This presentation includes a live demonstration of ultrasound as a viable means for investigating performance tongue shapes, while revealing key shapes in real-time.

*Sponsor: Richard J. Jacob

Session FD: Broader Perspectives: Technology in the Classroom

Location: Bechet
Sponsor: Committee on Research in Physics Education
Co-Sponsor: Committee on International Physics Education
Date: Wednesday, January 9
Time: 1–3 p.m.

Presider: Genaro Zavala

FD01: 1-1:30 p.m. Technology in the Classroom: A 5,000-Year-Old Tradition

Invited – Noah D. Finkelstein, University of Colorado Boulder, Department of Physics, Boulder, CO 80304; noah.finkelstein@colorado.edu

Noah Podolefsky, University of Colorado Boulder

We present a broad framing of technology in the classroom beginning with a theoretical framework for understanding the social and cognitive aspects of student learning that are supported by technology. This framework delineates essential characteristics of technology as a tool: its role in mediating (inter)action, its embedded affordances and constraints, and the roles of context and recursive interaction in social practice. This framework is applied and demonstrated in the examination of one of the most widespread science education tools, interactive PhET simulations, which boasts roughly 50M uses across the globe this year. We examine the creation and application of technology in the classroom, focusing on research-based outcomes resulting from both intentional (a priori) and emergent approaches to technology design and use. With the audience, we explore the application of this framework for emerging technologies in education, such as MOOCs and flipped classrooms.

FD02: 1:30-2 p.m. Design-based Research in Classroom and University with Mobile Devices

Invited – André Bresges, University of Cologne, Institute of Physics Education, Gronewaldstr. 2, Cologne, NRW 50931 Germany; andre.bresges@uni-koeln.de*

University of Cologne encourages learning in small workgroups, but is sensitive to meet standards for expected outcome. Solution is a Learning Management System to prepare workgroups and provide data-driven feedback. Prior and following workgroup meetings, students perform mandatory electronic quizzes. The results are discussed in tutor preparation courses, identifying both students' misunderstandings and weaknesses of the lecture. This guides the planning of the groupwork. Process of individual groups is weekly discussed based on results and on supervision. Thus, teacher education students are encouraged to view evaluation not as device for grading, but as a key to develop better lessons. This experience is anchor to follow-up project learning courses. In the Design Based Research project "Planetary Research with iPads" quizzes, supporting material and activities are aggregated into an iBook. Teacher education students design the iBook, guide and evaluate student's activities, and adapt the iBook to meet the design targets.

*Website of the author: http://www.physikdidaktik.uni-koeln.de

FD03: 2-2:10 p.m. Evaluation of SLOOH Space Telescope for Educational Merit

Contributed – Daniel Gershun, University of Wyoming, Laramie, WY 82072; dgershun@uwyo.edu*

Katie Berryhill, Tim Slater, University of Wyoming

Current literature on Internet-controlled telescopes illustrates a technology showing great promise for providing a student-centered, inquiry-based learning environment. To further investigate this emerging technology, we developed a study to determine the academic feasibility of using SLOOH in formal education. This mixed-methods study looks at nine in-service teachers who used SLOOH Telescope (www.slooh.com) during two weeks of an eight-week summer online course on observational astronomy. Inductive analysis of interviews and surveys reveals five categories which describe the most important aspects of the SLOOH experience according to participants: "Images," "Interface," "Classroom Application," "Instructor Impact," and "Logistical Issues." While there are both positive and negative aspects of this particular internet-telescope, analysis suggests that the limiting factor for successful implementation in any classroom pertains to how the technology is incorporated. When properly addressed, SLOOH Telescope can have the potential to capture student interests and engage them in the learning process.

*Sponsor: Tim Slater

FD04: 2:10-2:20 p.m. Interactive Peer Assessment and the Online CPR System

Contributed – Jeff Funkhouser, Greenhill School, 4141 Spring Valley Road, Addison, TX 75001; funkhouserj@greenhill.org

This talk will describe an interactive student peer assessment process conducted within an AP Physics course using released AP Physics materials from AP Central[1] and how that same experience translates to the UCLA Calibrated Peer Review[2] system. Students are introduced to the idea of rubric creation and rubric use in evaluating student free response questions on unit tests and then undertake an exercise to score their peers' papers anonymously. Students determine final scores for all papers through a negotiation process relating student work to the accepted rubric. Reliability of student outcomes to teacher scoring is presented. Students then undertake a similar process using the CPR system which uses an independent calibration process to rate scorer effectiveness before students randomly score each other's papers and then their own original submissions using the entered rubric. Again, teacher scoring of student submissions is compared to student scoring to evaluate accuracy.

1. http://apcentral.collegeboard.com/apc/members/exam/exam_information/8039.html .
2. http://cpr.molsci.ucla.edu/Home.aspx.

FD05: 2:20-2:30 p.m Interactive Video Vignettes in Introductory Physics*

Contributed – David P. Jackson, Dickinson College, Department of Physics, Carlisle, PA 17013; jacksond@dickinson.edu

Priscilla W. Laws, Dickinson College

Robert Teese, Rochester Institute of Technology

Interactive Video Vignettes are short, single-topic video expositions that incorporate narration, real-world experiments, and video-analysis activities. A series of these web-delivered vignettes are currently being developed by the LivePhoto Physics Group and are designed to supplement textbook readings as pre-lecture or pre-laboratory activities. Each vignette is under 10 minutes in length and focuses on a single concept to help students overcome common misconceptions and gain mastery of the topic. So far, three vignettes have been produced and tested in introductory physics courses at several colleges and universities. Details of these vignettes will be discussed along with our plans to develop additional vignettes and to determine their impact on student learning.

*Supported by the National Science Foundation (DUE #1123118 & #1122828).

FD06: 2:30-2:40 p.m. Online Social Homework Forum, Incubating Innovative Educational Technology

Contributed – Chuhee Kwon, California State University Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840; chuhee.kwon@csulb.edu

Zvonko Hlousek, Thomas Gredig, James Kisiel, California State University Long Beach

The Social Homework (SHW) is an online, Facebook-style forum where students collaborate in small groups to solve problems with timely feedback provided by peers and instructors. A team of faculty in Physics & Astronomy and Science Education at California State University Long Beach began the project in fall 2011. Starting with an open source forum software, a number of modifications and customizations were made, incorporating formative evaluation, to facilitate student groups and provide participation statistics. The SHW interface (for both students and instructor) will be discussed, as well as an account of the incubation and development of this innovative educational technology.

FD07: 2:40-2:50 p.m. Physics Learning Enhanced by Student Creation of MATLAB GUI Tools

Contributed – Thomas F. Finke, Trinity School at Greenlawn,107 S. Greenlawn Ave., South Bend, IN 46617; tfinke@trinityschools.org

Craig S. Lent, University of Notre Dame

For the past seven years Trinity School has been teaching all high school juniors and seniors on three campuses to program in MATLAB. Students write their own code which helps make mathematical manipulations and conceptual ideas concrete. Our approach focuses on the construction of GUI tools-student created computational models of physical phenomena which include a graphical user interface (GUI).[1] This allows students to easily vary values using sliders and text boxes and thereby explore the behavior of the physical system being modeled. This in turn helps in shaping and refining physical intuition. Student-written computational models can also be integrated with laboratory data. We introduce basic numerical techniques that enable the GUI Tools to include nonideal effects like aerodynamic drag, which are often difficult to model analytically. We will describe the structure of our pedagogical approach and show examples of student work.

1. http://www.learningmatlab.com.

FD08: 2:50-3 p.m. Understanding the Electronic Passport: Introducing RFID Tech. to German Physics Education

Contributed – William Lindlahr, Johannes Gutenberg University Mainz, Staudingerweg 7 Mainz, RLP 55128 Germany; wlindlahr@uni-mainz.de

Klaus Wendt, Johannes Gutenberg University Mainz

The "Radio Frequency Identification" (RFID) technology is increasingly being used in almost all areas of our modern life. It enables unique identification not only of objects and animals, but even of people — often without us being aware of it. The applications range from the electronic immobilizer in cars to the recognition of people using smart cards or electronic passports. Development is extremely fast and many novel applications are in preparation, for example as replacement for barcodes. We developed an interdisciplinary physics education project for teaching the functionality and relevance of RFID technology by using data and energy transmission via electromagnetic induction and resonant circuits. After a short presentation on the physics principles of RFID technology, the students construct their own RFID chip cards. By using and analyzing these, they understand how the technology works. In addition, they get to know current applications and reflect on threads of RFID systems.

*Sponsor: Timothy Grove

Session FE: Upper Division Undergraduate Courses

Location: Oliver
Date: Wednesday, January 9
Time: 1–2:50 p.m.

Presider: Elizabeth Gire

FE01: 1-1:10 p.m. Assessing "Thinking Like a Physicist"

Contributed – Eleanor C. Sayre, Kansas State University, Manhattan, KS 66506 esayre@ksu.edu

A major goal of undergraduate education in physics is fostering "thinking like a physicist" among physics majors. Precise definitions and observational markers have been elusive, especially at the upper-division level. I present some elements of what "thinking like a physicist" entails, and some discourse markers for identifying when students are more likely to be physicist-like. The markers are applicable across contexts. I suggest instructional strategies to promote students thinking like physicists, and promote a specific assessment strategy — oral exams — for measuring it.

FE02: 1:10-1:20 p.m. Active Learning Course Materials for Upper-Division Electrodynamics (E&M 2)*

Contributed – Charles Baily, University of Colorado Boulder, Department of Physics, Boulder, CO 80309-0390; Charles.Baily@Colorado.EDU

Michael Dubson, Steven J. Pollock, University of Colorado Boulder

Favorable outcomes from ongoing research at the University of Colorado Boulder on student learning in junior-level electrostatics (E&M 1) have led us to extend this work to upper-division electrodynamics (E&M 2). We describe our development of a set of research-based instructional materials designed to actively engage students during lecture (including clicker questions and other in-class activities); and an instrument for assessing whether our faculty-consensus learning goals are being met. We also discuss preliminary results from several recent implementations of our transformed curriculum, and offer some insights into student difficulties in advanced undergraduate electromagnetism.

*Course materials available at: http://per.colorado.edu/Electrodynamics

FE03: 1:20-1:30 p.m. Interviews and Assignment Analysis of Undergraduate Students Entering Quantum Mechanics

Contributed – Brian D. Thoms, Georgia State University, Science Annex, Atlanta, GA 30303; bthoms@gsu.edu

Christopher A. Oakley, John M. Aiken, Georgia State University

Characterizing faculty expectations is important to produce a comprehensive understanding of what knowledge and skills students should acquire before and during a quantum mechanics course (QMC). We describe interviews conducted with both faculty members and students entering a QMC in the Physics & Astronomy Department of Georgia State University. Faculty interviews probe expectations of senior undergraduate students' background in mathematics, physics, and quantum mechanics concepts before entering a QMC. The interviews with students examine student preparation for the course, expected material, and impressions of the faculty expectations. The interviews we conducted may provide students with a "map" for areas that will help strengthen the knowledge and skills obtained in their QMC. The Quantum Mechanics Conceptual Survey was offered and assignments were collected and analyzed. We will report on interview data and its comparison to assignment analysis and diagnostic results in an effort to highlight predictors for success in the QMC.

FE04: 1:30-1:40 p.m. Let's Talk About the Senior Thesis!

Contributed – Jean-Francois S. Van Huele, Brigham Young University, Provo, UT 84601-4681; vanhuele@byu.edu

Eric Hintz, Brigham Young University

Is the senior thesis the most significant learning experience physics and astronomy (P&A) departments can offer their majors? Or is it a most time-consuming imposition on P&A faculty? Should the thesis research experience be limited to those who are contemplating graduate work in P&A? Is undergraduate research a drain on a department's graduate efforts? What are the key components of a successful thesis experience? And how do students feel about the thesis requirement? As we keep searching for answers after more than 20 years of senior theses in P&A at Brigham Young University, we reaffirm our commitment to the program, and invite reactions from the audience.

FE05: 1:40-1:50 p.m. Magnet Falling Through Conducting Pipe: An Improved Analytical Approach

Contributed – Matthew R. Kemnetz, Loyola University Chicago, 5846 North Kirby Ave., Chicago, IL 60646; mkemnetz@luc.edu

Benjamin Irvine, Asim Gangopadhyaya, Thomas Ruubel, Loyola University Chicago

We present an analytical study of magnetic damping. In particular, we investigate the dynamics of a cylindrical neodymium magnet as it moves through a conducting tube. Owing to the very high degree of uniformity of the magnetization for neodymium magnets, we are able to provide completely analytical results for the EMF generated in the pipe and the consequent retarding force. Our analytical expressions are shown to have excellent agreement with experimental observations.

FE06: 1:50-2 p.m. Parallel Computing in the Upper Division

Contributed – Steve J. Spicklemire, USAF Academy/University of Indianapolis, USAF Academy, CO 80840; spicklemire@uindy.edu

Introducing parallel computing in an undergraduate curriculum not directly related to computer science has multiple challenges. Students often have limited computing experience and essentially no knowledge of concepts like parallelism or object oriented programming. During the second semester of the regular quantum mechanics sequence, we've employed a novel approach to parallel programing that permitted undergraduate physics majors to write non-trivial parallel codes that performed efficiently on distributed memory cluster computers using the python programming language. A brief description of the strategies involved and the results of student projects will be discussed.

FE07: 2-2:10 p.m. Proton, Electron, Sun, Earth

Contributed – David Keeports, Mills College, Oakland, CA 94613; dave@mills.edu

Despite vast differences in scale, the Earth-Sun system is a quantum mechanical system highly analogous to that electron-proton system that is the hydrogen atom. The Schrödinger wave equations for the two systems are identical except for the identity of constants. Thus, hydrogen's quantum numbers n, l, and ml, its energy and orbital angular momentum formulas, and its wavefunctions also apply to Earth following the modification of a few constants. Orbiting Earth well illustrates the correspondence principle: Its truly quantum mechanical behavior appears classical because its quantum numbers are very large. It will be demonstrated that Earth's three quantum numbers collapse to a common very large quantum number, and that this common quantum number implies hydrogen-like wavefunctions consistent with Earth's spatial probability distribution.

FE08: 2:10-2:20 p.m. Simulating the Conference Experience in Upper Division Theory Courses

Contributed – Hunter G. Close, Texas State University-San Marcos, 601 University Dr., San Marcos, TX 78666; hgclose@txstate.edu

David Donnelly, Texas State University-San Marcos

How can undergraduate students get more involved in AAPT and APS meetings at the regional and national levels? The barrier to participation can seem impossibly high to many students: They need to find a faculty member to work with, establish an appropriate project, generate original research, and present their work to an audience of experts in a potentially terrifying oral presentation format. We are trying a format for upper-division theory classes, in which we conduct weekly "conference sessions" to simulate conference conditions and help lower the barrier between students and conference participation. In order to support these conference sessions as preparation for real conferences, we developed a coherent framework involving many components (with detailed policy decisions): group problem sets on a small number of hard problems, condensed oral presentation with questions, and opportunities for extension of solutions to include original insight.

FE09: 2:20-2:30 p.m. Undergraduate Research and Identity Development

Contributed – Paul W. Irving, Kansas State University, Manhattan, KS 66502; paul.w.irving@gmail.com

Eleanor C. Sayre, Kansas State University

As part of an ongoing research project that is primarily investigating upper-level physics student identity development with physics, we examine the case of a single student's journey toward the development of a physics identity. During the initial stages of analysis of a longitudinal study of several upper-level physics students, we identified the interesting case of "Sally" whom at the beginning of the study had identified herself as a chemist but then as the study progressed began to develop a greater sense of identity and awareness of the position she occupied in the physics community. In a subsequent interview Sally wrestles with herself about the community that she primarily identifies with. This indicates the struggle of upper-level students to build a concrete identity and also the role that participating in undergraduate research can have on identity development.

FE10: 2:30-2:40 p.m. Use of an STM/AFM in the Undergraduate Physics Curriculum

Contributed – Walter S. Jaronski, Radford University, Department of Physics, Radford, VA 24142; wjaronsk@radford.edu

We recently obtained a high-quality scanning probe microscope, with both scanning tunneling microscopy (STM) and atomic force microscopy (AFM) modes. We are primarily interested in the pedagogical uses of this machine, to complement coursework and for use in undergraduate projects. Although the operation of the machine in the two modes is similar, STM and ATM are based on different physical principles, and experimentation with both modes helps to elucidate and differentiate these principles. Of course, these differences also affect the choice of technique for a given surface. There are also many subsidiary lessons to be learned, in areas such as piezoelectricity, feedback electronics, and image processing. Finally, there is the end result: the images themselves. These images assist students in visualizing atomic-scale structures and allow them to study nanoscale surface features of materials. We will share some of our ideas and experiences with incorporating this technology into our curriculum.

FE11: 2:40-2:50 p.m. Using Expert Solutions to Map a Thermodynamics Maze

Contributed – Mary Bridget Kustusch, Oregon State University, Physics Department, Corvallis, OR 97331-6507; mary.bridget@physics.oregonstate.edu

David Roundy, Tevian Dray, Corinne A. Manogue, Oregon State University

One of the challenges that upper-division students face in dealing with thermodynamics is the multitude of ways one can deal with the sea of partial derivatives. We conducted interviews with experts (faculty and graduate students), asking them to solve a challenging thermodynamics problem in order to better understand what is required to successfully solve these problems. This presentation discusses a procedural task analysis that uses these expert solutions to identify three choices that must be addressed in order to solve the problem: (1) what mathematical formalism to use, (2) which energy equation(s) to employ, and (3) how to deal with variables that are held constant (entropy, in this case). Any successful route through the problem must address these decision points and could be categorized in terms of these choices. The physical and mathematical sense-making surrounding these decisions will be addressed in a separate presentation.

Session FF: *Panel:* Confessions of First-Year Faculty

Location: Jackson
Sponsor: Committee on Graduate Education in Physics
Co-Sponsor: Committee on Professional Concerns
Date: Wednesday, January 9
Time: 1–3 p.m.

Presider: Sytil Murphy

Being a first-year physics faculty poses many challenges for which applicants are frequently not prepared when applying for a faculty position. We present a panel of recently hired junior faculty for discussion of this topic for the benefit of current graduate students, postdoctoral researchers, and early-career faculty. The panelists will discuss their respective hiring processes, as well as items for which they would have liked to have been more informed and/or better prepared in retrospect. A diverse range of academic institutions and backgrounds are represented on the panel, with the intent to address a wide range of academic career plans. Faculty members who anticipate being involved in upcoming hiring searches are also strongly encouraged to attend.

SPEAKERS:

- *Wendy K. Adams, University of Northern Colorado, Greeley, CO; Wendy.Adams@unco.edu*
- *Jennifer Docktor, University of Wisconsin - La Crosse, La Crosse, WI; jdocktor@uwlax.edu*
- *Jack Dostal, Wake Forest University, Winston-Salem, NC; dostalja@wfu.edu*
- *Brian W. Frank, Middle Tennessee State University, Murfreesboro, TN; bfrank@mtsu.edu*
- *Elizabeth Gire, University of Memphis, Memphis, TN; egire@memphis.edu*
- *Dyan L. Jones, Mercyhurst University, Erie, PA; djones3@mercyhurst.edu*
- *Shawn Weatherford, Saint Leo University, Saint Leo, FL; shawn.weatherford@saintleo.edu*
- *Evan Richards, Lee College, Baytown, TX; erichards@Lee.Edu*

Session FG: The Role of Integrated Lab Activities in Introductory Courses

Location: Bolden
Sponsor: Committee on Laboratories
Co-Sponsor: Committee on Physics in Undergraduate Education
Date: Wednesday, January 9
Time: 1–3 p.m.

Presider: Nancy Beverly

FG01: 1-1:30 p.m. Physics Without Lectures: Workshop Physics and Explorations in Physics

Invited – David P. Jackson, Dickinson College, Department of Physics, Carlisle, PA 17013; jacksond@dickinson.edu

Priscilla W. Laws, Dickinson College

Workshop Physics is an innovative, introductory physics curriculum in which lectures and laboratory activities are combined into three two-hour sessions per week. I will provide an overview of this curriculum from the perspective of a long-time user and present some results of student learning gains that have been taken over the years. I will also discuss how this curriculum model has been extended to an introductory course for nonscience majors called Explorations in Physics. Explorations in Physics extends the Workshop method to include extensive student-directed projects, placing students in the role a scientist to give them an in-depth experience with the process of science.

FG02: 1:30-2 p.m. Reconstructing Authentic Science Through Modeling Labs*

Invited – Eric Brewe, Florida International University, Miami, FL 33137; ebrewe@fiu.edu

Laird H. Kramer, Florida International University

Model building, validation, deployment, and revision are fundamental processes of science according to the Modeling Theory of Science. An overarching goal of science is to identify patterns — either through theoretical or experimental investigation. The Modeling Theory of Instruction avers that students should reconstruct these authentic scientific practices in the classroom. Accordingly, the role of the laboratory in University Modeling Instruction is twofold. The primary role is to promote the search for patterns, either by introducing phenomena that are the basis for new models or by motivating revisions in existing models. A secondary role is to validate the conceptual models built in the introductory course. We argue that these roles necessitate flexible use of classroom space and time which is provided by a studio-format class.

*Work supported by NSF 0802184.

FG03: 2-2:30 p.m. Integrating ISLE Labs into a Studio Physics Classroom: Opportunities and Challenges

Invited – David T. Brookes, Florida International University, Miami, FL 33199; dbrookes@fiu.edu

At Florida International University we have successfully implemented the Investigative Science Learning Environment (ISLE) in a studio classroom for three years. Experimentation is the core of the ISLE philosophy, but integrating labs into a student-centered studio classroom was a challenging task. The goal of ISLE is to help students develop scientific habits of mind. For students to value and appreciate this goal, we decided that experimentation could not be separate from other class activities, but must become an integral part of every aspect of the class. I will discuss some of the design principles that I believe made our implementation successful, focusing particularly on a) ways in which we tried to capitalize on the collaborative nature of the studio classroom, and b) how we integrated experimentation into our assessments. I will present results that show that students are displaying behavior that suggests they are starting to think and act in ways that are analogous to those of practicing physicists.

FG04: 2:30-3 p.m. Integrating Lab Activities in SCALE-UP – No Single Best Way

Invited – Jon D. H. Gaffney, Eastern Kentucky University, New Science Building 3140; Richmond, KY 40475; jon.gaffney@eku.edu

SCALE-UP (Student-Centered Active Learning Environment with Upside-down Pedagogies) utilizes specially designed classroom spaces to enhance student learning. Although specific classroom designs vary, they typically share many of the following features: multiple large circular tables that seat students in small groups, advanced technology including computers and multiple projectors, abundant whiteboard space, and no front to the classroom. In SCALE-UP courses, instructors typically "flip" the class by focusing on student activities including problem-solving exercises and laboratories. Each adaptation of SCALE-UP is unique; there is no single "best way" to integrate labs; indeed, due to the configuration of the room, it can be challenging to use traditional laboratories in the SCALE-UP class. In this talk, we will see multiple different approaches for including labs in introductory physics courses taught with the SCALE-UP method. We will explore some of the challenges and offer some suggestions for using labs in your own SCALE-UP style class.

Session FH: Learning Assistant Programs as Vehicles for Course Transformation and Recruitment of Future Physics Teachers

Location: Ory
Sponsor: Committee on Physics in Undergraduate Education
Co-Sponsor: Committee on Teacher Preparation
Date: Wednesday, January 9
Time: 1–3 p.m.

Presider: Monica Plisch

FH01: 1-1:30 p.m. Learning Assistant Model as a Model for Institutional Change

Invited – Valerie K. Otero, University of Colorado Boulder, 249 UCB, Boulder, CO 80309; valerie.otero@colorado.edu

The Colorado Learning Assistant (LA) model was launched at CU Boulder 10 years ago in efforts of increasing research faculty members' awareness and involvement in evidence-based reforms and in the recruitment and preparation of K-12 teachers. Since then the program has been adopted by over 30 physics departments throughout the nation and has demonstrated positive learning outcomes in university physics, increased K-12 teacher recruitment, and increased research-based teaching practices among university faculty as well as among LAs who become K-12 teachers. The LA program has catalyzed the development of a Discipline-Based Educational Research group at CU Boulder and has garnered full financial support from the university. In this presentation, the Colorado LA model is framed as a model for institutional change. Seven components of institutional change will be discussed as they align with the LA model and with current research findings. Future plans for a national-scale research project will be discussed.

FH02: 1:30-2 p.m. Designing LA Program Instruction and Assessment that Aligns with Our Values: Challenges and New Directions*

Invited – Amy D. Robertson, Seattle Pacific University, Seattle, WA 98119-1997; robertsona2@spu.edu

What we choose to emphasize and assess in Learning Assistant Programs communicates to our students, our research community, and funding agencies what it is that we value. We face a challenge when values emerge that are not only difficult to articulate and assess but that are also hidden by the emphases and assessments currently in place. In addition to valuing teacher recruitment and retention, programmatic growth, and student learning — all outcomes that we hope for and have documented over the past decade — Seattle Pacific University values outcomes of our LA Program that we do not yet know how to measure, such as the formation of science teacher identity, the development of proximal formative assessment skills that lead to productive shifts in practice, and participation in a community with shared early teaching experiences. I will discuss how we are working to translate all of the outcomes we value — those that we already document and those that we want to — into new research directions and instructional choices at Seattle Pacific University, as well as share some of the challenges we are facing.

*This material is based upon work supported by the National Science Foundation under Grant No. 0822342.

FH03: 2-2:10 p.m. Development of a Learning Assistant Program at Cal Poly Pomona

Contributed – Homeyra R. Sadaghiani, California State Polytechnic University, Pomona, 3801 West Temple Ave., Pomona, CA 91768; hrsadaghiani@csupomona.edu

Steve Mccauley, Alex Rudolph, Cal Poly Pomona

The Cal Poly Pomona Department of Physics & Astronomy has adopted the University of Boulder Colorado Learning Assistant (LA) Model since 2011. We recruit physics and engineering majors with a strong physics background to serve as LAs in introductory physics courses to further promote their interest in a teaching career. In order to support the LAs in their exploration of teaching, the faculty mentors provide training and supporting structures. We will report on our challenges and achievements.

FH04: 2:10-2:20 p.m. Implementing a Peer Instructor (Learning Assistant) Course at Louisiana State University

Contributed – Michael L. Cherry, Louisiana State University, Department of Physics & Astronomy, Baton Rouge, LA 70803; cherry@lsu.edu

The introductory first year non-calculus-based physics course at Louisiana State University currently has approximately 750 students in three large lecture sections. In order to supplement the large lectures, small (20-25 students) recitation sections have been added. Following the Learning Assistant model at Colorado, these recitation sections emphasize concepts and are managed by undergraduate Peer Instructors. The experience and lessons learned during the initial two semesters of the program are described.

FH05: 2:20-2:30 p.m. Operation Watchtower: The Learning Assistant Program at SDSU

Contributed – Joel Rauber, South Dakota State University, Department of Physics, Brookings, SD 57007; joel.rauber@sdstate.edu

Larry Browning, South Dakota State University

The learning assistant program in physics at South Dakota State University began in spring 2010 and just completed its sixth semester of operation impacting 26 LAs. The program will be presented as a case study of an implementation significantly constrained by resource and bureaucratic factors. The impacts on students involved in the LA program will be discussed.

FH06: 2:30-2:40 p.m. The Role of Learning Assistants in Sustaining Course Innovations*

Contributed – Charles J. De Leone, California State University-San Marcos, 333 S. Twin Oaks Valley Rd., San Marcos, CA 92096-0001; cdeleone@csusm.edu

Edward Price, California State University-San Marcos

Learning Assistant (LA) programs are often described as catalysts for course transformation. This talk describes an LA program's role in sustaining an existing non-traditional course. The CSUSM Physics Department's introductory physics course for life science majors features non-traditional content sequences and pedagogy; a model-based approach introduces energy before force, and most class time is spent on small group work and whole class discussions. This course was established prior to the CSUSM LA program, but its continued implementation relied on a select set of instructors. In this talk we will discuss the role that Learning Assistants can play in sustaining such course innovations by facilitating the transition to a broader set of faculty who are new to the course.

*Supported in part by National Science Foundation STEP Grant #1068477

FH07: 2:40-2:50 p.m. Building Institutional Connections with a Learning Assistants Program*

Contributed – Edward Price, California State University-San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA 92096; eprice@csusm.edu

Charles J. De Leone, California State University-San Marcos

Learning Assistants (LA) programs are catalysts for course transformation and teacher recruiting. While these goals are also important at two-year colleges, most LA programs are at four-year institutions. We are extending the CSU San Marcos LA program to nearby Palomar Community College, in order to advance course transformation and teacher recruiting at both institutions while building connections between them. This talk will describe the program and early outcomes from this effort.

*Supported in part by National Science Foundation STEP Grant #1068477 and PhysTEC.

FH08: 2:50-3 p.m. Students' Perceptions of Learning Assistants' Contributions to Physics Course Success

Contributed – Manher Jariwala, Boston University, 590 Commonwealth Ave., Boston, MA 02215; manher@bu.edu

Meredith Knight, Andrew Duffy, Bennett Goldberg, Boston University

The Learning Assistant program is one of many different active learning strategies we have integrated into our physics courses at Boston University. We explored students' perceptions of the effectiveness of different active learning strategies in the classroom, including the use of Learning Assistants, Teaching Fellows, worksheets, and the textbook, through a large-scale self-report survey of students in the spring of 2012. Using a dependent variable of students' "perceived ability for course success," we found that demographic variables such as gender, ethnicity, and language spoken at home did not have an effect on perceived success. However, the physics course the student was in, and the specific activities of the Teaching Fellow and Learning Assistant, did have a significant effect on students' perceived success. The multiple concurrent strategies used in college courses create a challenging environment for measuring the effectiveness of any one program. We will share our strategies going forward.

Session FI: Post-Deadline Talks

Location: Bucktown I
Sponsor: Committee on Graduate Education in Physics
Date: Wednesday, January 9
Time: 1–3 p.m.

Presider: Lila Adari

FI01: 1-1:10 p.m. Using Video Analysis to Classify Student Discussions During Peer Instruction

Contributed – Laura Tucker, Harvard University, Cambridge, MA 02138; ltucker@seas.harvard.edu

Rachel Scherr, Seattle Pacific University

Eric Mazur, Harvard University

Numerous studies show courses taught using Peer Instruction have higher learning gains on standardized assessments. Yet we have very few measurements of what happens during the peer discussion component of this pedagogy. When students are told to discuss a physics question with a neighbor, do they do so? If so, do they have a substantive conversation about the physics, or just a brief exchange of answers? To address these questions, we recorded every student discussion in nearly every lecture of an introductory physics course at a major research university. Through both large-scale manual coding efforts and smaller-scale qualitative analysis, we have identified common interactional patterns and measured the frequency of each interaction type. In addition, we have measured the proportion of time students spend in on- and off-task discussions. We will discuss these results and implications for the classroom.

FI02: 1:10-1:20 p.m. p adic q Integral and Some Family of L Functions and Their Applications*

Contributed – Yilmaz Simsek, Akdeniz University, Faculty of Science, Department of Mathematics, Antalya, 07058 Turkey; ysimsek63@gmail.com

In this paper we present a study on a p adic q L functions using p adic q integral which interpolate Bernoulli and Euler numbers at negative integers. We will give some applications related to these functions and numbers in Mathematical Physics.

*The present investigation was supported by the Scientific Research Project Administration of Akdeniz University.

FI03: 1:20-1:30 p.m. Creating their Own Learning Experiences: EMPACTS and Physical Science

Contributed – Capitola D. Phillips, Northwest Arkansas Community College, Bentonville, AR 72712; dphillips@nwacc.edu

Non-science majors in an Introductory Physical Science course learn basic science concepts through project based, self directed learning experiences. The EMPACTS (Educationally Managed Projects Advancing Technology/Teamwork and Service) model of engagement provides a collaborative learning environment, where students use technology to research and apply science concepts within the framework of a college level physical science course. Diverse teams of students (no more than 4) create science activities and models that are used in peer instruction activities and presentations as well as shared with area K-6 science, math and GT instructors. In addition, education (pre-service teachers) majors work with local school mentors as they adapt college level physical science content and activities to K-12 grade levels.

Session GA: Careers in Physics: Alternatives to Academia

Location: Bucktown I
Sponsor: Committee on Professional Concerns
Date: Wednesday, January 9
Time: 3:30–4:30 p.m.

Presider: Vince Kuo

GA01: 3:30-4 p.m. Do Physics, Be Anything: Informing and Preparing Physics Students for their Future Careers

Invited – Crystal Bailey, American Physical Society, One Physics Ellipse, College Park, MD 20740; bailey@aps.org

In our current era, society needs an increased representation of physicists in the workforce to help solve the growing number of societal and environment problems we collectively face. And even though a physics bachelor's degree opens the door to an incredible diversity of high-paying and rewarding careers, most physics students are only aware of academic career paths (having mostly encountered only physics professors during their lifetime). For most of these students, their path into physics begins in high school and undergraduate physics classes. Therefore, exposing students to solid career information at these early stages is essential for fostering a connection in students' minds between the abstract physics concepts they're learning and their real-world applications (which translate to job opportunities!). This talk will provide in-depth information about physics career paths outside of academia that are available to those with a bachelor's degree in physics, and will discuss how these options change as one moves through an advanced degree in physics. It will also provide information on resources for educators and mentors who are interested in sharing physics career information with those that they teach and advise.

GA02: 4-4:30 p.m. Careers and Curriculum: Lessons Learned from AIP's Career Pathways Project

Invited – Kendra Redmond, American Institute of Physics, One Physics Ellipse, College Park, MD 20740; kredmond@aip.org

Thomas Olsen, Roman Czujko, American Institute of Physics

Physics is often perceived as an academic major with no direct path to a job outside of academia, despite its high job placement rate and direct application to energy, medicine, computers, and many other high-tech areas. Since many physics bachelor's degree recipients look for jobs in their geographic region, departments that foster connections to the local STEM workforce and help students develop skills valued by that workforce may well increase their number of majors. The American Institute of Physics is in the midst of an NSF-funded research effort to visit departments that produce significant numbers of physics bachelor's degree recipients who successfully enter STEM employment within one year of graduation, in order to compile and disseminate effective practices for preparing physics students to enter the STEM workforce. This talk will present preliminary results from these site visits.

Session GB: Online Physics Courses

Location: Bucktown II
Sponsor: Committee on Educational Technologies
Co-Sponsor: Committee on Physics in High Schools
Date: Wednesday, January 9
Time: 3:30–5p.m.

Presider: Nina Abramzon

GB01: 3:30-4 p.m. Realization, Research, and Promise for Free Online Courses

Invited – David E. Pritchard, Massachusetts Institute of Technology, Cambridge, MA 02139; dpritch@mit.edu

RELATE's[1] Mechanics Online has been offered twice, the second time aimed at physics teachers. It will be described and compared with other online and blended courses. Key variables are target audience, registrants, attrition, improvements, student use of available resources, learning, and overall user satisfaction. We have successfully blended our online course with our on-campus course. Such blending relieves teachers of the need to prepare lectures on basic facts and procedures, leaving class time to concentrate on tutorial-style interactions with small student groups. Online courses offer opportunities for sophisticated research. Applying machine learning algorithms to data from the MITx MOOC on circuits and electronics (~8,000 students finished) has revealed 19 distinct skills that students need to solve problems. We validated its assignment of required skills for problems by correctly predicting 80% of the homework problems students actually consulted while doing the midterm based on the skills required for the midterm questions.

1. REsearch in Learning, Assessment, and Tutoring Effectively, is the speaker's educational research group, which is supported by NSF and MIT.

GB02: 4-4:30 p.m. Online Physics Courses: Exemplars, Trends, Opportunities and Challenges

Invited – Robert V. Steiner, American Museum of Natural History, Central Park West at 79th St., New York, NY 10024-7192; rsteiner@amnh.org

Online physics courses offer remarkable opportunities for student access as well as curricular and pedagogical innovation. However, such courses also raise fundamental questions, including questions about instructor roles and support for inquiry-based teaching methods. This session will provide an overview of the landscape of online physics courses, including examples of some current offerings. Various approaches to course design, development, implementation, and evaluation will be reviewed. Both opportunities and challenges of online courses will be explored within the context of some recent trends, including flipped classrooms, open source materials, massively open online courses and mobile computing. The presenter directs online and blended teacher education programs at the American Museum of Natural History and is a member of the adjunct faculty at the City University of New York's Queens College. He is the co-author of *Mathematics for Physics Students* and currently serves as the chair of the AAPT's Committee on Educational Technologies.

GB03: 4:30-4:40 p.m. Data-Driven Strategies for Student Success in Online Physics Courses

Contributed – Curtis M. Shoaf, Parkland College, 2400 W. Bradley Ave., Champaign, IL 61821; cshoaf@parkland.edu

Denice Hood, University of Illinois

Can students learn physics online? Do they learn differently? Are students that enroll in online courses different from students in the general population? Are there indicators of student success in online physics courses? What are students' attitudes toward online physics courses? I will answer these questions based upon data collected from a fully online algebra-based physics course. I have been teaching, and continually developing, a fully online college physics course at Parkland College for six years. More recently, I have been collecting targeted data to make future data-driven improvements to the course. I will share the results of my data and future plans for the courses based on the data collected.

GB04: 4:40-4:50 p.m. Peer Instruction for the Online Classroom

Contributed – Cynthia J. Sisson, LSU-Shreveport, 1 University Place, Shreveport, LA 71115; cynthia.sisson@lsus.edu

Samantha Morgan, LSU-Shreveport

One of the challenges of teaching online is in bringing effective aspects of face-to-face teaching to the online experience. In this talk we discuss the process of implementing a Peer Instruction cycle in an online conceptual physics course, and how (and why) that process has evolved over three semesters of teaching online.

GB05: 4:50-5 p.m. Radical Physics: A Novel Online Video Course

Contributed – Tucker Hiatt, Stanford University, & Wonderfest, 47 Alta Way Corte, Madera, CA 94925; thiatt@stanford.edu

According to the AIP, two-thirds of U.S. students never take a year-long physics course. Radical Physics is a novel online-video introductory course that will appeal to a sizable portion of the un-physicsed two-thirds. It will also help full-year students who have inexperienced teachers or who just want a second view of essential material. Radical Physics, created by the the nonprofit "Wonderfest," offers several improvements over the Khan Academy model: (1) its principal instructor has 35 years of experience; (2) it promotes use of the PhET online laboratory simulations; (3) it has a look-you-in-the-eye "talking head" format that draws the viewer in -- as television news has been able to do for over fifty years. Radical Physics also benefits from, on-screen demos with PASCO equipment, from occasional interviews with Stanford and UC Berkeley experts, and from critical analysis of compelling action movie scenes.

Session GC: Insights and Benefits from Framing a Class as a Discourse Community

Location: Foster
Sponsor: Committee on Research in Physics Education
Date: Wednesday, January 9
Time: 3:30–5 p.m.

Presider: Sissi Li

GC01: 3:30-4 p.m. Attending to the Development of a Physics Learning Community

Invited – Renee Michelle Goertzen, Florida International University, 11200 SW 8th St., VH 169, Miami, FL 33199; rgoertze@fiu.edu

Eric Brewe, Laird Kramer, Florida International University

Past research has demonstrated that students' sense of community is connected with their persistence, the rate at which they stay in college. We similarly expect that students' sense of community impacts whether they remain in their physics classes. We discuss the need to attend to students' sense of community and to the development of a physics learning community and we highlight the importance of both at Florida International University, a Hispanic serving institution. A goal of the reforms implemented by the Physics Education Research Group at FIU has been the establishment of multiple opportunities for entry into the physics learning community. These opportunities include classes using research-based curricula (Modeling Instruction and Investigative Science Learning Environment), a Learning Assistant program, and a growing cohort of physics majors.

GC02: 4-4:30 p.m. Progress Toward Disciplinary Pursuits in a Third-grade Class*

Invited – David Hammer, Tufts University, Paige Hall, Medford, MA 02155; david.hammer@tufts.edu

Jennifer Radoff, Tufts University

The PER community has come to recognize that learning physics is not only a matter of learning concepts. It is also a matter of taking up, understanding, and developing facility in the pursuits of the discipline, such as of replicable phenomena and of tangible explanations. In this alk we present video snippets from several weeks of children's inquiries about motion, in Sharon Fargason's third grade class, that show evidence of progress in these respects (Radoff, Goldberg, Hammer & Fargason, 2010; Hammer, Goldberg & Fargason, 2012).[1] We suggest that part of the dynamics of this progress was in Sharon's attending and responding to the substance of the students' work, not only to what they were thinking but to what they were trying to do and how they were engaging with each other.

*This work was supported by the National Science Foundation. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the Foundation.

1. D. Hammer, F. Goldberg, & S. Fargason, "Responsive teaching and the beginnings of energy in a third grade classroom," *Review of Science, Mathematics and ICT Education* **6**(1), 51-72 (2012). J. Radoff, F. Goldberg, D. Hammer, S. Fargason, *The Beginnings of Energy in Third Graders' Reasoning*, in C. Singh, M. Sabella & S. Rebello (Eds.), *2010 Physics Education Research Conference* (Vol. 1289, pp. 269-272).

GC03: 4:30-4:40 p.m. Evidence Supporting Cycles of Pedagogical Change Through Cogenerative Localized Reform*

Contributed – Natan Samuels, Florida International University, Miami, FL 33199; nsamu002@fiu.edu

Renee Michelle Goertzen, Eric Brewe, Laird Kramer, Florida International University

We present evidence of a high school physics teacher adapting to, and expanding her understanding of her students' confidence, attitudes toward their physics problem solving ability, and whiteboard presentations. Pedagogical changes were observed through classroom videos, artifacts, and teacher interviews recorded during the instructor's semester-long use of the Cogenerative Mediation Process for Learning Environments (CMPLE) formative intervention. In CMPLE, students and instructors act as a discourse community to negotiate, develop, and implement changes to their classroom structure, based on their collective learning preferences. We use Activity Theory to identify the teacher's cyclical change process as 1) the questioning of her past actions and behavior patterns, 2) analyzing the current situation, 3) constructing a new model of behavior, 4) implementing the model, and 5) reflecting on her changes. Implications include reconceptualizing a physics teacher's increased agency as based in her participation in a shared localized reform effort with her students.

*Research supported by NSF Award #0802184.

GC04: 4:40-4:50 p.m. To What Extent Are TAs Providing Opportunities for Students to Engage in Discourse?

Contributed – Cassandra Paul, San Jose State University, San Jose, CA 95112; cassandra.paul@sjsu.edu

Emily A. West, Wendell H. Potter, University of California - Davis

Students in large lecture courses of 100 or more students are often provided with an opportunity to engage in discourse in smaller break-out sections of discussion or lab. These sections are often facilitated by graduate student teaching assistants (TAs). In this talk we describe a method for investigating the interactions TAs engage in with students in the classroom, and use this method to discuss the extent to which TAs in a long-standing interactive engagement physics course allow for student-student interactions to place.

GC05: 4:50-5 p.m. Researching and Presenting a Scientific Article in Sophomore and Junior Level Classes

Contributed – Nina Abramzon, California Polytechnic University Pomona, 3801 W. Temple Ave., Pomona, CA 91768; nabramzon@csupomona.edu

Barbara M. Hoeling, University of Applied Sciences, Landshut, Germany

Because of the expense and amount of faculty time required, many undergraduate physics students will not have the opportunity to work under a mentor on original research. However, many of the key elements of undergraduate research can be incorporated into courses that are part of the standard undergraduate curriculum, making the benefits of research experience available to a broader audience of students. For example, in our modern physics and optics courses, we gave students the assignment to research and understand a scientific article from the *American Journal of Physics*, and finally critically discuss in a group presentation to their peers. We will describe this group research presentation experience and present results of student learning and attitude surveys from these courses.

Session GD: Pedagogical Content Knowledge for Preservice Teachers

Location: Bechet
Sponsor: Committee on Teacher Preparation
Date: Wednesday, January 9
Time: 3:30–4:30 p.m.

Presider: Duane Merrell

GD01: 3:30-4 p.m. Integrating Pedagogic Content Knowledge Across a Preservice Teacher Program*

Invited – Laird Kramer, Florida International University, Department of Physics, Miami, FL 33199; Laird.Kramer@fiu.edu

Eric Brewe, Leanne Wells, Florida International University

Pedagogic Content Knowledge (PCK) unites the content and pedagogy that are necessary for effective instruction in a specific subject area. Florida International University (FIU) has integrated PCK skill development into their restructured physics teacher preparation program. PCK development begins in the introductory physics course sequence, all of which include research-driven curricular reform. The development continues throughout the Learning Assistant (LA) program, developed at the University of Colorado Boulder, where preservice teachers and those considering teaching careers participate in authentic physics teaching experiences that provide rewarding experiences and develop teacher identity. PCK is explicitly developed across the physics teacher preparation program culminating in a modeling instruction pedagogy course. PCK is further strengthened by the nature of the programs that are collaborative across the Colleges of Arts & Science and Education and award physics bachelors' degrees plus teacher certification to future teachers. The program, along with its development, will be presented.

*Supported by NSF Award # PHY-0802184.

GD02: 4-4:30 p.m. PCK at Kennesaw State University

Invited – David Rosengrant, Kennesaw State University, 1000 Chastain Road, Kennesaw, GA 30144; drosengr@kennesaw.edu

Kennesaw State University is the third largest university in the state of Georgia. With the creation of our MAT program in physics five years ago, we have become the largest producer of physics teachers in the state of Georgia graduating nearly 20 teachers in the first five years. One of our strengths is our six-credit hour graduate course focusing specifically on physics pedagogical content knowledge. In this class time, we cover content labs, instructional strategies, designing assessments, lessons, units, technologies, issues in science, problem-based learning, nature of science, physics education research, and hands-on practicum teaching experiences. In this talk, we briefly talk about the MAT program and a detailed analysis and reflection of what this specific course entails.

Session GE: *Panel:* Opportunities for High School Teachers Abroad

Location: Jackson
Sponsor: Committee on Physics in High Schools
Date: Wednesday, January 9
Time: 3:30–5 p.m.

Presider: Tiberiu Dragoiu

Often physics teachers from the United States are recruited to teach in American Schools and International Schools throughout the world. A representative(s) from recruiting agency(ies) will discuss about the interviewing and hiring process, contract agreement, as well as other useful tips you need to know when considering teaching physics abroad.

GE01: 3:30-5 p.m. Physics Teachers Are Needed for International Schools Abroad

Panel – Ralph H. Jahr, Search Associates, 12 Exeter Ct., Princeton, NJ 08540-7046; ralph.jahr@gmail.com

Information about American and international schools in countries around the world will be presented. The type of curriculum, language of instruction, type of students, and the multinational communities they serve will be highlighted. Much of the session will be devoted to specific questions about international schools coming from the participants and more in-depth information can be presented based on the particular interests of the participants. There is high demand for excellent American / international schools for dependents of multinational businesses, the diplomatic corps, and residents of the host country who wish to have their children attend highly selective colleges and universities after graduation. Leadership opportunities present in American / international schools will also be discussed. Ralph Jahr was a physics teacher and an administrator in international schools for more than 20 years. He is currently working with Search Associates to staff international schools abroad.

Session GF: Mentoring Minority Graduate Students

Location: Johnson
Sponsor: Committee on Minorities in Physics
Co-Sponsor: Committee on Graduate Education in Physics
Date: Wednesday, January 9
Time: 3:30–5 p.m.

Presider: Ted Hodapp

GF01: 3:30-4 p.m. Simple Solutions for Advancing Diversity in Physics and Astronomy

Invited – Hakeem M. Oluseyi, Florida Institute of Technology, 2143 Merlin Drive, West Melbourne, FL 32904; holuseyi@fit.edu

The fields of physics and astronomy have long been criticized for possessing a lack of ethnic and gender diversity. This talk will present examples of successful programs and the strategies and techniques that have been used to produce the type of diversity long sought after. Recommendations for moving forward will also be presented.

GF02: 4-4:30 p.m. Walking the Walk: Mentoring for Success

Invited – Roy Clarke, University of Michigan, Department of Physics, 2477 Randall Laboratory, Ann Arbor, MI 48109; royc@umich.edu

The early years of graduate studies are often very stressful. The challenge of balancing difficult coursework with teaching duties, while making the transition from passive receptor to active creator of knowledge, is particularly difficult. These demands must be met against an often turbulent backdrop of personal relationships and family responsibilities. Given these competing priorities, success, or at the very least survival, requires an extraordinary degree of discipline and time-management skill on the part of the student, and a good deal of empathy and guidance from research advisors. All of this suggests that graduate programs must be active partners in the process of mentoring and advising graduate students, particularly in the early stages of graduate studies. In this presentation I outline the steps that the University of Michigan's Applied Physics Program has taken to help students over this difficult transition period and to improve retention and success at this critical stage.

GF03: 4:30-5 p.m. Key Elements in Mentoring Minority Graduate Students

Invited – Diola Bagayoko, Southern University and A&M College in Baton Rouge (SUBR), Baton Rouge, LA 70813; Diola_Bagayoko@subr.edu*

Based on a synthesis of experiences over the last 15 years, we have arrived at a few key elements which seem to be critical in successfully mentoring minority graduate students. One preliminary step is to make the distinction between intrinsic, intellectual abilities, practically limitless, and the actual knowledge and skills base. The determination and deliberate removal of possible shortfall in the latter constitute a key element. So dictates the hierarchical or taxonomic structure of knowledge in science, technology, engineering, and Mathematics (STEM). The adequacy of an assistantship or fellowship support to permit full time commitment to studying and to research is another key element. Academic, social (possibly including a critical mass of minority students), and professional integrations add to the previous elements to constitute a basic, pentagonal paradigm for success in mentoring minority graduate students. Questions, it is hoped, will help elucidate further some of these five key elements.

*We thank Theodore Hodapp for the invitation, and the National Science Foundation (NSF), the Louisiana Board of Regents, and NASA for funding our participation to this meeting and our undergraduate and graduate student mentoring through LASiGMA [EPS-1003897 & No. NSF (2010-15)-RII-SUBR], LS-LAMP [No. HRD-1002541], and LaSPACE [NNG05GH22H & SUBR-No. 37861].

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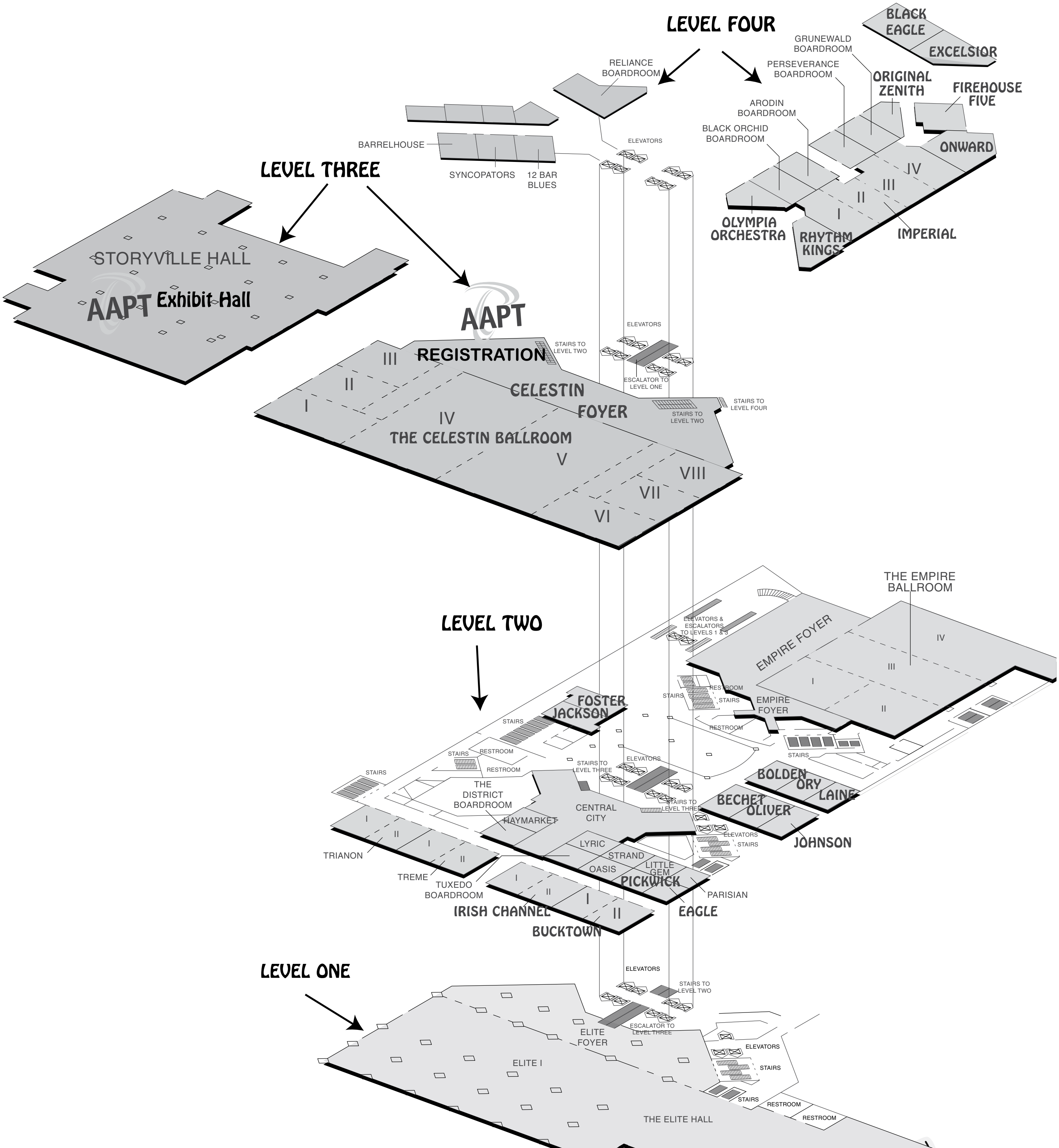

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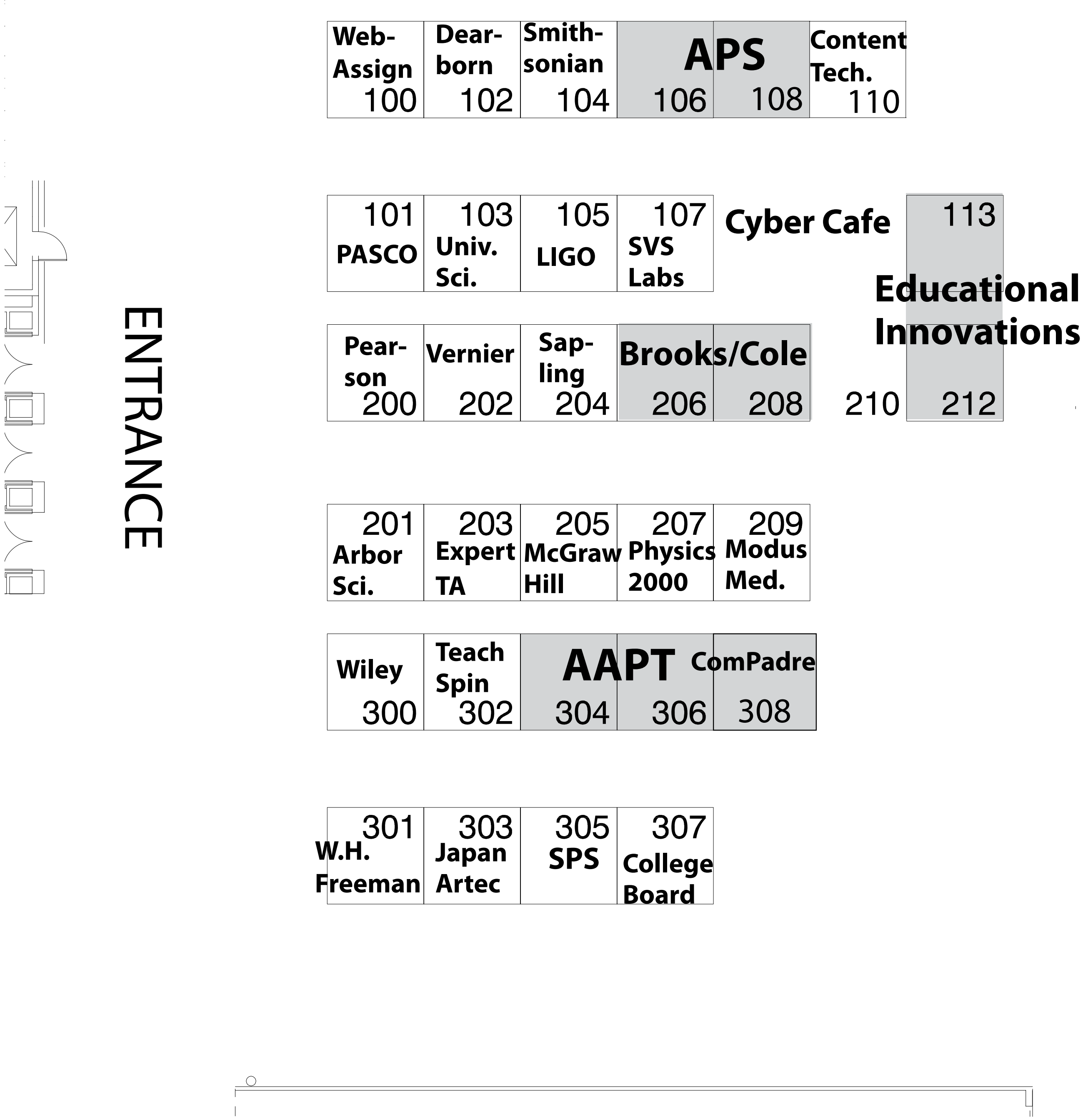

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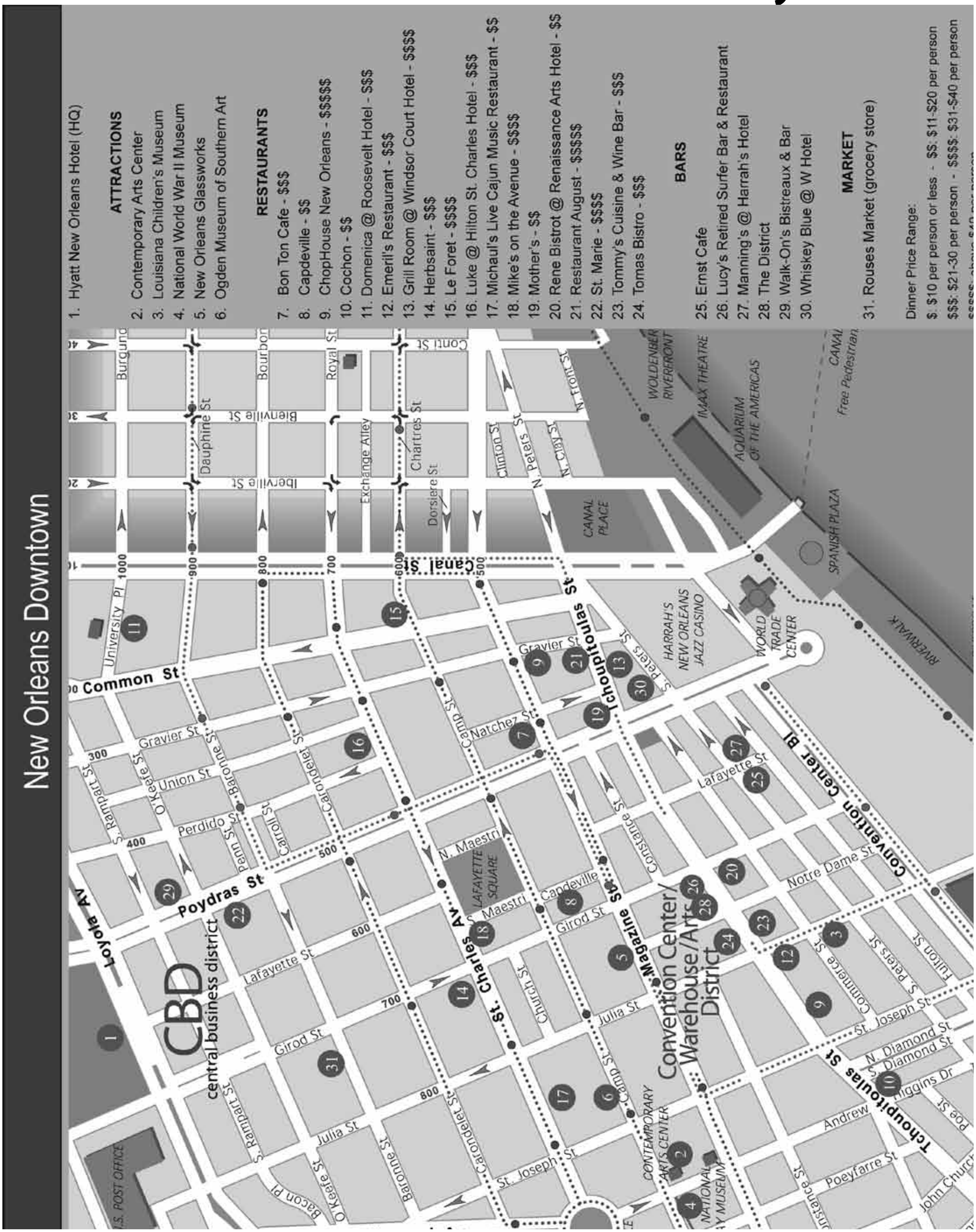

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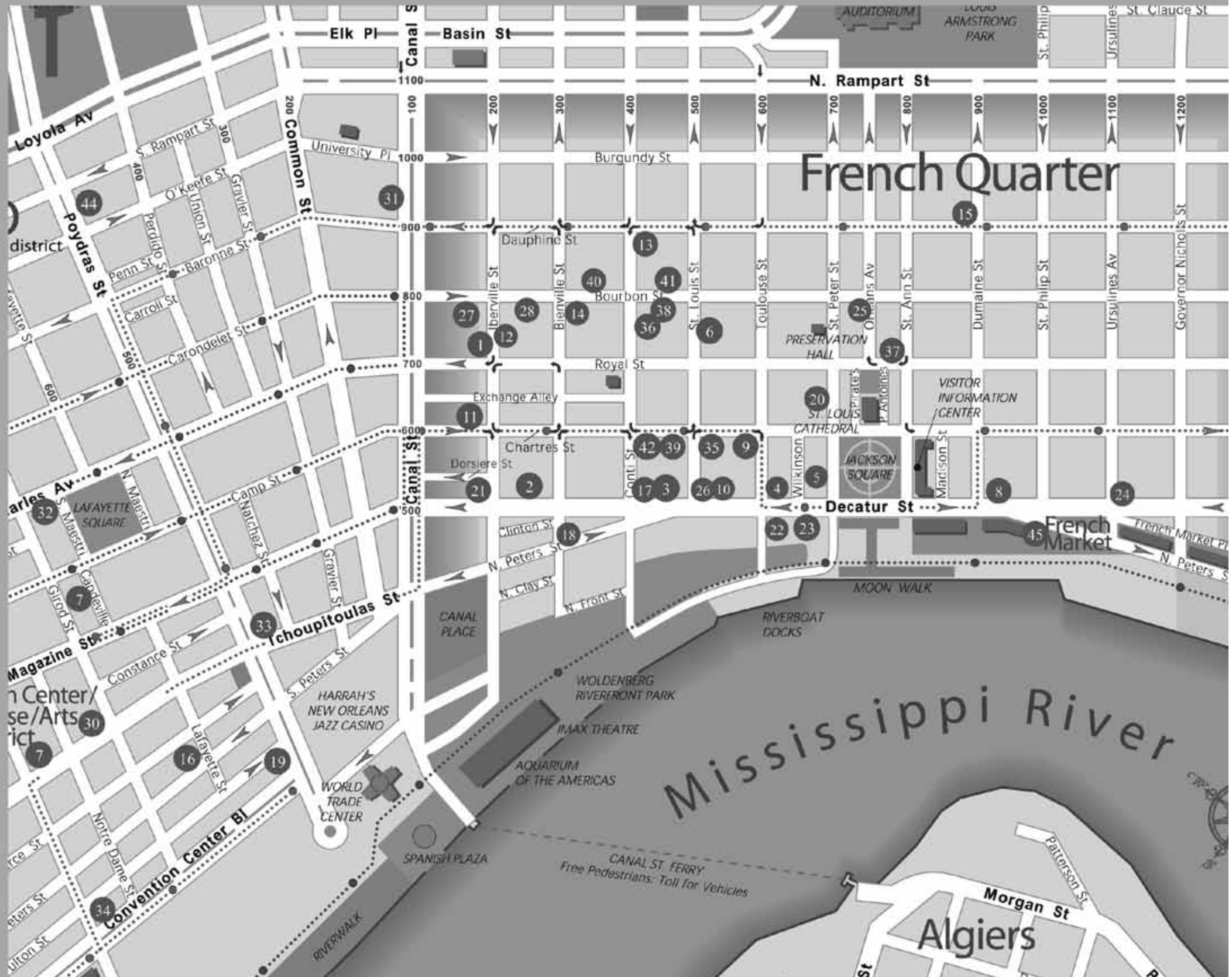
27. Krystal on Bourbon......$
28. Le Bayou......$$
29. Louisiana Pizza Kitchen......$$
30. Lucy's Retired Surfer Bar......$$
31. McDonald's......$
32. Mike's on the Avenue......$$
33. Mother's......$$
34. Mulate's......$$
35. Napoleon House......$$
36. Oceana......$$
37. Pere Antoine......$$
38. Pier 424......$$
39. Pierre Maspero's......$$
40. Remoulade......$$



41. Rita's Tequila House......$
42. Rotolo's Pizza......$$
43. Tomas Bistro......$$
44. Walk-On's Bistreaux......$$
45. World Famous N'awlins Cafe......$$

Price Range:
$: $10 or less per person
$$: $11-20 per person

PERC 2013

From Fearing Physics to Having Fun with Physics: Exploring the Affective Domain of Physics Learning from Multiple Perspectives

Portland, Oregon

July 17 - 18

ABOUT THIS YEAR'S THEME

Responses to learning physics are strongly emotional, for better or worse. While many students fear physics, an implicit goal that drives many PER researchers is the desire to cultivate in our students a love of the discipline. Nonetheless, affective issues are rarely explicitly addressed in our research or curricula. This may reveal a tacit assumption within our community that such "hot cognition" has little bearing on the "cold cognition" conceptual goals of physics. Recent research calls such assumptions into question, and the goal of this PERC is to highlight research across many disciplines that demonstrate the role of affect in science education. While affect was once seen as a hindrance to cognition, a wide array of research seems to be converging towards a common theme: *affect is fundamental to cognition*. As a community, attending to affective issues in the teaching and learning of physics is pivotal to our understanding of students' engagement, achievement, and retention in the discipline.

The central goal of PERC2013 is to consider affect in physics education from multiple disciplinary perspectives. We invite sessions that are designed to explicitly attend to affect in the teaching and learning of physics, in part by incorporating active engagement and experiential learning techniques. Since the best cross-pollination of ideas often happens outside a seminar room, we will incorporate a blending of social, academic, and online spaces utilizing local venues, social media, and crowd-sourcing technologies.

We look forward to seeing you there!

The 2013 PERC Organizing Committee,

Dedra Demaree — Oregon State University
Leslie Atkins — CSU, Chico
Luke Conlin — Tufts University
Sissi Li — CSU, Fullerton
Yuhfen Lin — Florida International University

Invited Speakers

Sian L. Beilock

Sian L. Beilock is a professor in the Department of Psychology at the University of Chicago. Her research program sits at the intersection of cognitive science and education. She explores the cognitive and neural substrates of skill learning, including embodied cognition of physics concepts, as well as the mechanisms by which performance breaks down in high-stress or high-pressure situations. Her work sheds light on the connections between affect and cognition in learning math and science, in part by exploring the mechanisms of stereotype threat and the effects of anxiety on achievement in math and science classrooms.

Noah Finkelstein

Noah Finkelstein is a professor of physics at the University of Colorado, Boulder. There, he co-directs the Physics Education Research group and directs the Integrating STEM Education program. Noah studies conditions that support students' interests and abilities in physics at multiple levels, with research projects ranging from the dynamics of classroom learning to the institutional level decisions that can support students' learning in the classroom and beyond. His theoretical work seeks to build models of learning that emphasize the critical and inextricable role of context in student learning of physics. His experimental work has revealed some of the affective dimensions of the contexts of physics learning, including the influence of stereotype threat on exam performance and the impact of faculty practices on students' comfort with discussing physics with peers and instructors.

Ayush Gupta

Ayush Gupta is a Research Assistant Professor at the Department of Physics, University of Maryland, College Park in the Physics Education Research Group. His research interests include cognitive modeling of student thinking and learning, the role of emotions in students' reasoning, and the use of mathematics in physics and engineering. His research aims to unpack the moment-to-moment entanglement of learners emotions, conceptual knowledge, epistemological stances, and identity. This work draws on the knowledge-in-pieces framework as well as interaction analysis methodologies, thus aiming to forge common ground between cognitivist and situated perspectives on learning.

Marja-Liisa Hassi

Marja-Liisa Hassi has a Master's degree in mathematics and a Ph.D. in education from the University of Helsinki, Finland. Her research interests include mathematics learning and problem solving, affective factors and learning, motivational processes, and self-regulated learning. She serves as an adjunct professor for the Faculty of Behavioral Sciences at the University of Helsinki, and has worked in the Ethnography and Evaluation Research group at the University of Colorado at Boulder. She has collaborated internationally with education and mathematics education researchers and contributes to faculty professional development and assessment of technical and vocational education initiatives in developing countries.

Kevin Pugh

Kevin Pugh is an associate professor of psychology at the University of Northern Colorado. His work focuses on investigating transformative experience -- experiences where students actively use curricular concepts to see and experience the world in a personally meaningful, new way. The primary goal of this work is to better address why school learning often fails to make a difference in students' everyday, out-of-school experience. Related to this work are investigations of influences on transformative experience, methods of teaching for transformative experience, and the relationship between transformative experience and enduring understanding in the context of science education. Research on motivation, transfer of learning, and Dewey's theory of aesthetic experience are important influences on his work.

Important Dates

May 1 — Abstract submission opens
June 7 — Invited abstracts due
June 14 — Contributed abstracts due

Further information will be available at:

www.compadre.org/per/conferences/2013/

U.S. Physics Team

Support the United States Physics Team Program

Organized by the American Association of Physics Teachers (AAPT) and funded by member societies of the American Institute of Physics and other generous donors, this physics community initiative encourages excellence in physics education while rewarding outstanding physics students.

www.aapt.org/physicsteam

2012 U.S. Physics Team traveling members (l-r) Kevin Zhou, Eric Schneider, Allan Sadun, Jeffrey Cai, and Jeffrey Yan.

Each year high school students compete in the F_{net}=ma exam contest in early January. Top scorers advance to the semi-final round. AAPT then uses the semi-final exam to recruit those students most qualified to compete in the Annual International Physics Olympiad (IPhO).

The U.S. Physics Team Program provides a once-in-a-lifetime opportunity for students to enhance their physics knowledge as well as their creativity, leadership and commitment to a goal.

Support the U.S. Physics Team at: **www.aapt.org/physicsteam/donate**

APS physics

American Astronomical Society

USA BIOlympiad 2013

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2013 Summer Meeting • July 13-17 • Portland, Oregon
National Meetings, held each winter and summer, provide opportunities for members, colleagues, and future physicists from around the world to participate in physics workshops; meet and greet other physics educators; form networks nationally and locally; engage exhibitors and learn about the latest physics resources; discuss innovations in teaching methods; and share the results of research about teaching and learning. In addition, we host or support smaller workshops, conferences and symposia throughout the year to provide opportunities for further professional development. Stay informed about future AAPT National Meetings at aapt.org

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