

Teaching Physics with Technology

Robert J. Beichner

AAPT New Faculty Conference
November 2003

NC STATE UNIVERSITY

Physics Education R & D Group

Faculty

Robert Beichner

Ruth Chabay

John Risley

Bruce Sherwood

+ David Haase

+ John Hubisz

+ John Park (Science Education)

Graduate Students

Lin Ding

Sejung Kim

Matt Kohlmyer

Jeanne Morse



Lessons from the Greeks...

τεχνολογία

Random House *Dictionary of the English Language*, Unabridged Edition
C.A.E. Luschnig's *An Introduction to Ancient Greek*, Scribner

Lessons from the Greeks...

ΤΕΧΝΟΛΟΓΙΑ

- ΤΕΧΝΗ: art or skill
technique: the body of specialized procedures and methods used in any specific field; method of performance; **method of accomplishing**

Random House *Dictionary of the English Language*, Unabridged Edition
C.A.E. Luschnig's *An Introduction to Ancient Greek*, Scribner

Lessons from the Greeks...

ΤΕΧΝΟΛΟΓΙΑ

- Λόγος: understanding or reasoning
logical: reasonable, **carefully considered**

Random House *Dictionary of the English Language*, Unabridged Edition
C.A.E. Luschnig's *An Introduction to Ancient Greek*, Scribner

What are we talking about ?

technology

a carefully considered
means of achieving a goal



R.J. Beichner's *Dictionary of My Language*, Greatly Abridged Edition.

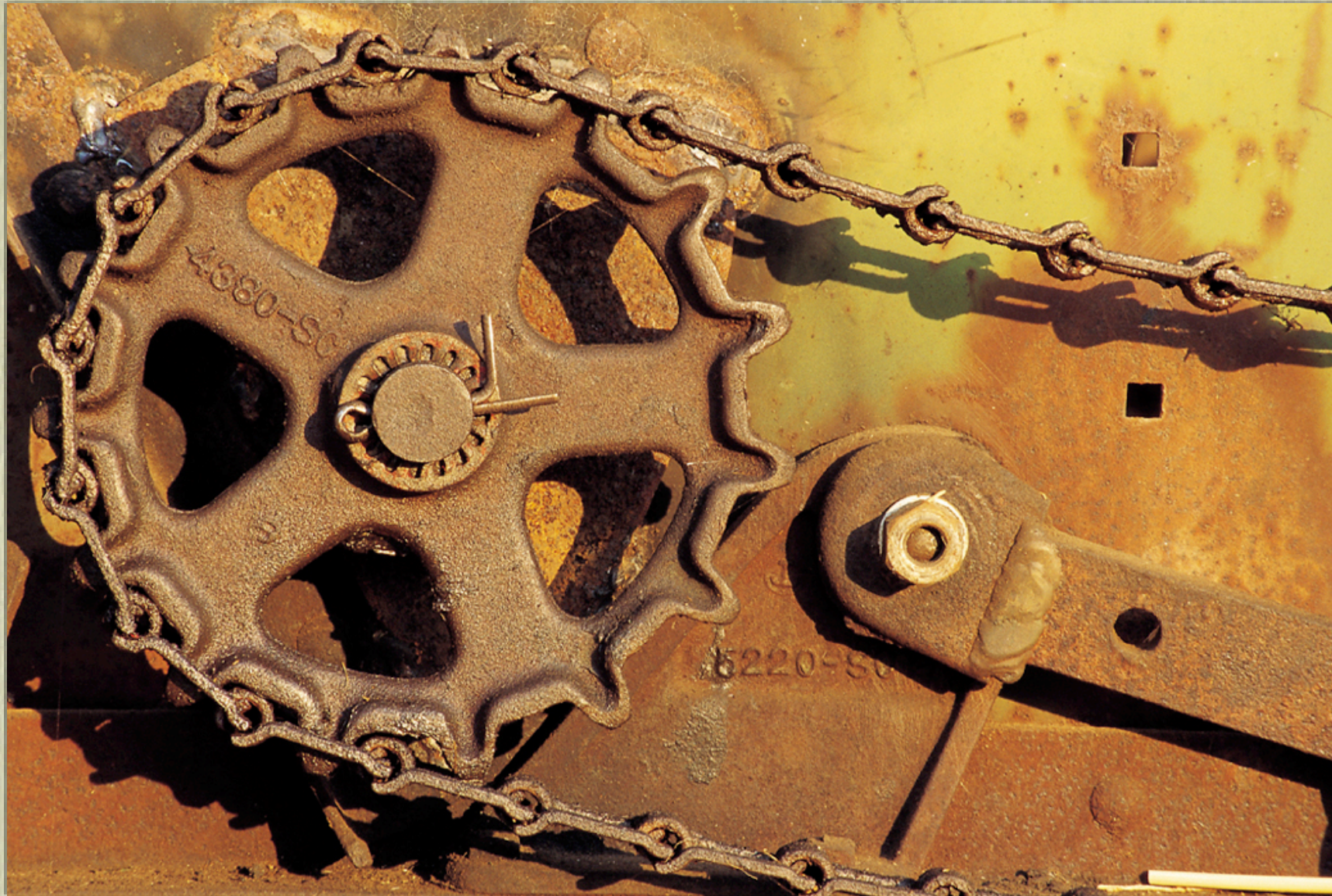


The Ancient Greeks

&

**Instructional
Technology**

Auditorium = Old Technology



Entertainment is fine in an auditorium.
Education is too important and has different goals.

Education in Ancient Greece

- Pythagoras (Samos & Croton, 580-500 BCE)



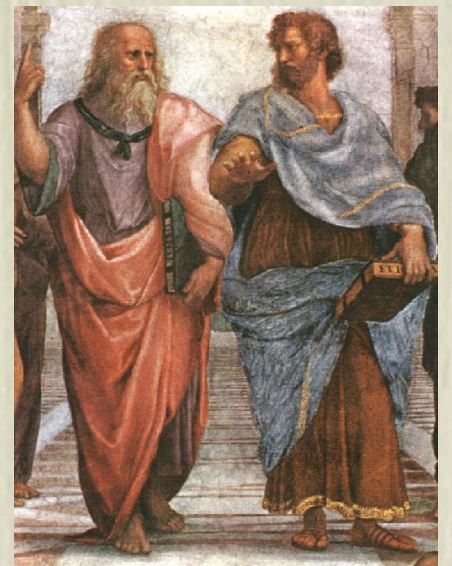
- Socrates (Athens, 469-399 BCE)



- Plato's Academy (Athens, 427-347 BCE)



- Aristotle's Lyceum (Athens, 384-322 BCE)



τεχνολογία
!

The Lecture Hall

- Pope Gregory VII called for clergy education in 1079
- Lecturers or “readers” stood in the front of an auditorium, dictating from their personally hand-written books.
- Students listened and made their own books.



Gutenberg's *Bible*
not till 1455

(Xerographic Method of Instruction)
“dry”



Modern Day Lecture Hall



Different *Technology*



for a Different Purpose

Where do you
want to go ?



What is the setting ?



What do you see happening here ?

What are your tools ?



Why should I use instructional technology?

- Actively involves the students
- Presents content in additional ways
- Relieves drudgery, gives higher quality results
- It is a professional tool students should use
- Provides you & students with access to effectively unlimited resources

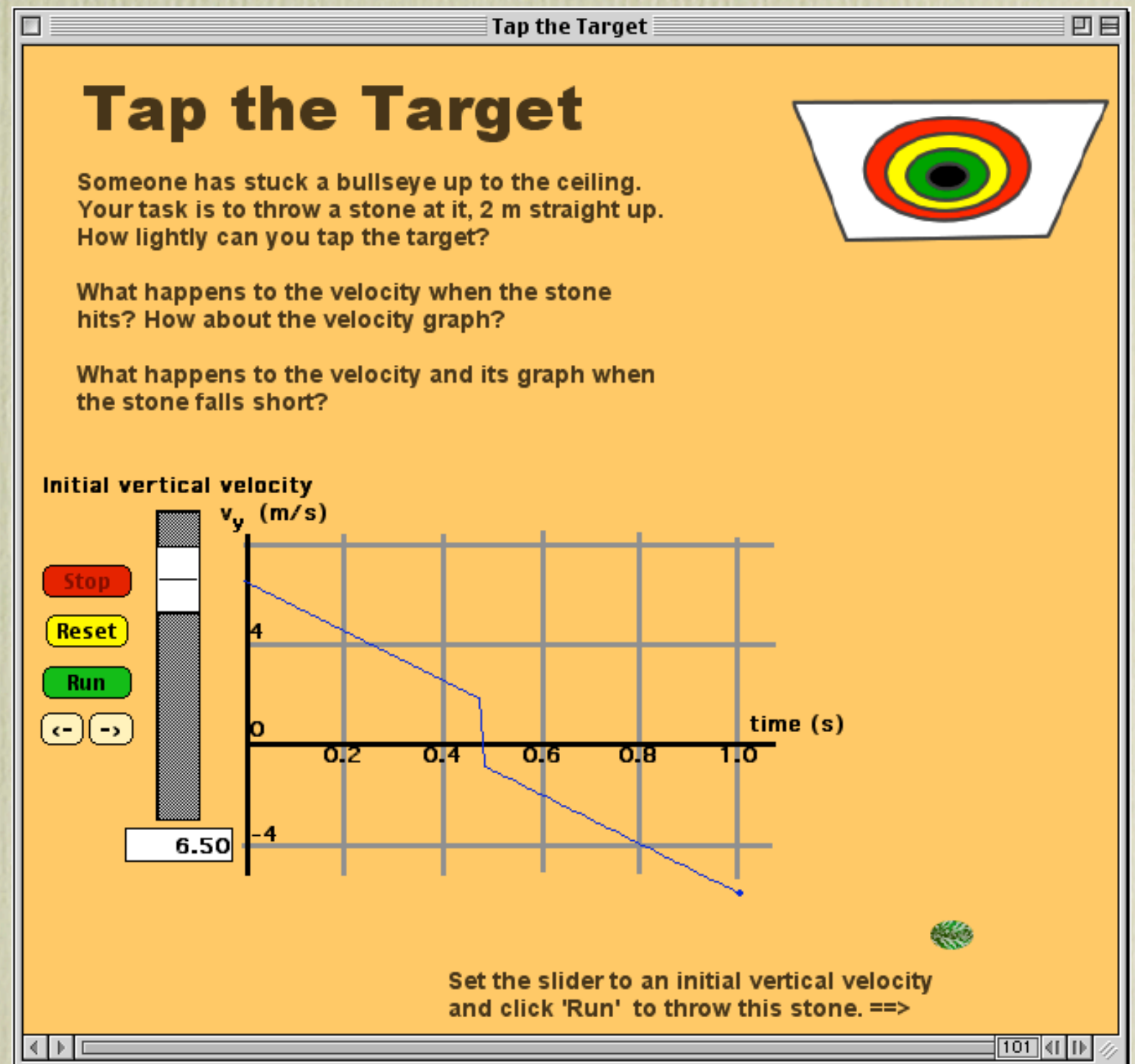
What can be done ?

- Present Content
- Simulation and Modeling
- Programming & Spreadsheets
- Symbolic Math
- Data Collection & Analysis
- Collect Homework

What can I do ?

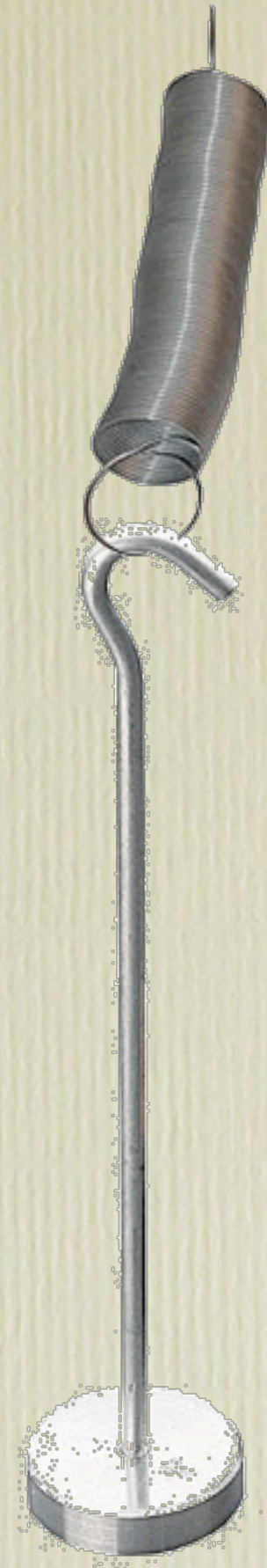
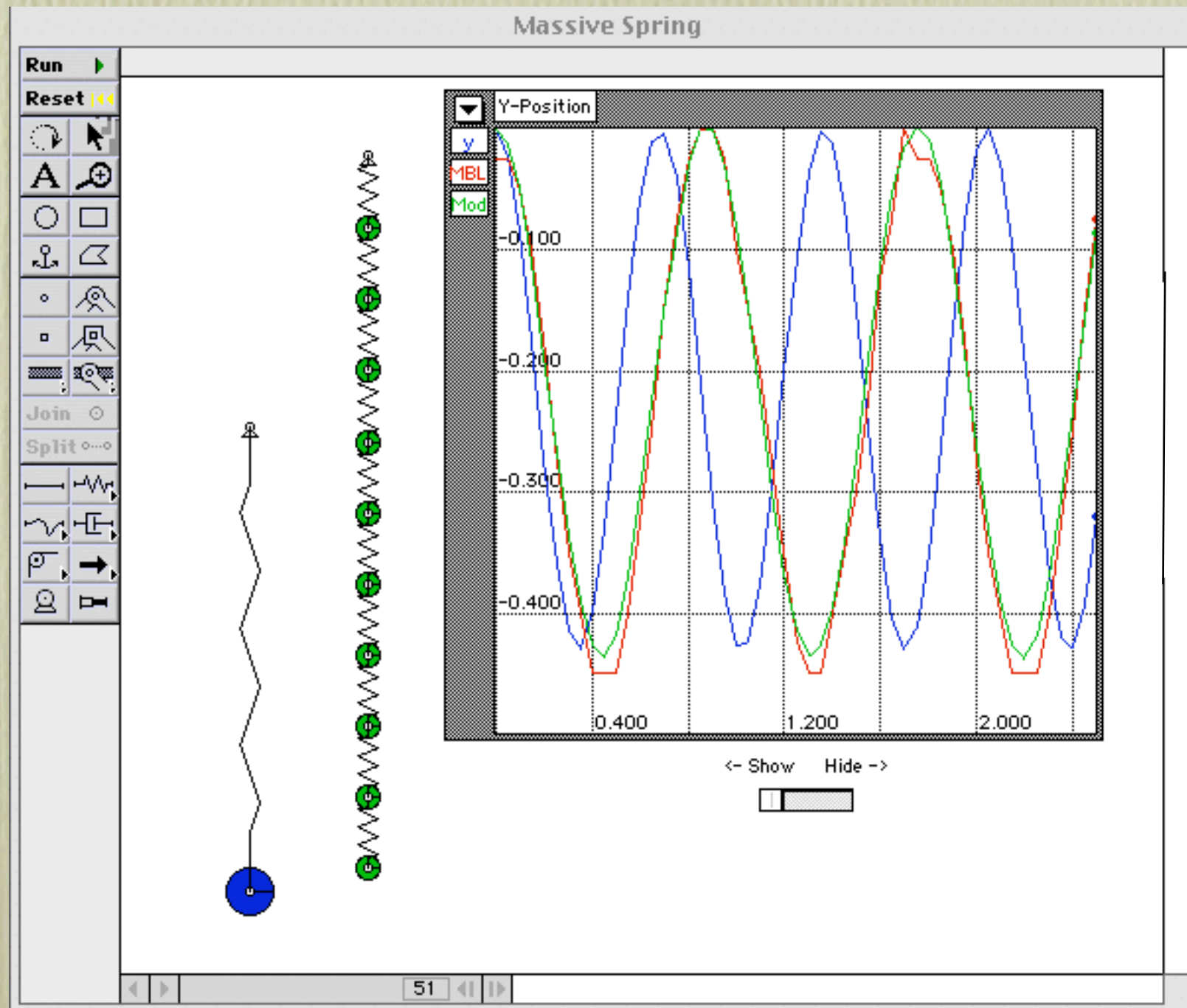
● Simulation and Modeling

Interactive Physics



What can I do ?

● Simulation and Modeling



What can be done ?

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- Simulation and Modeling
- Programming & Spreadsheets
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What can I do ?

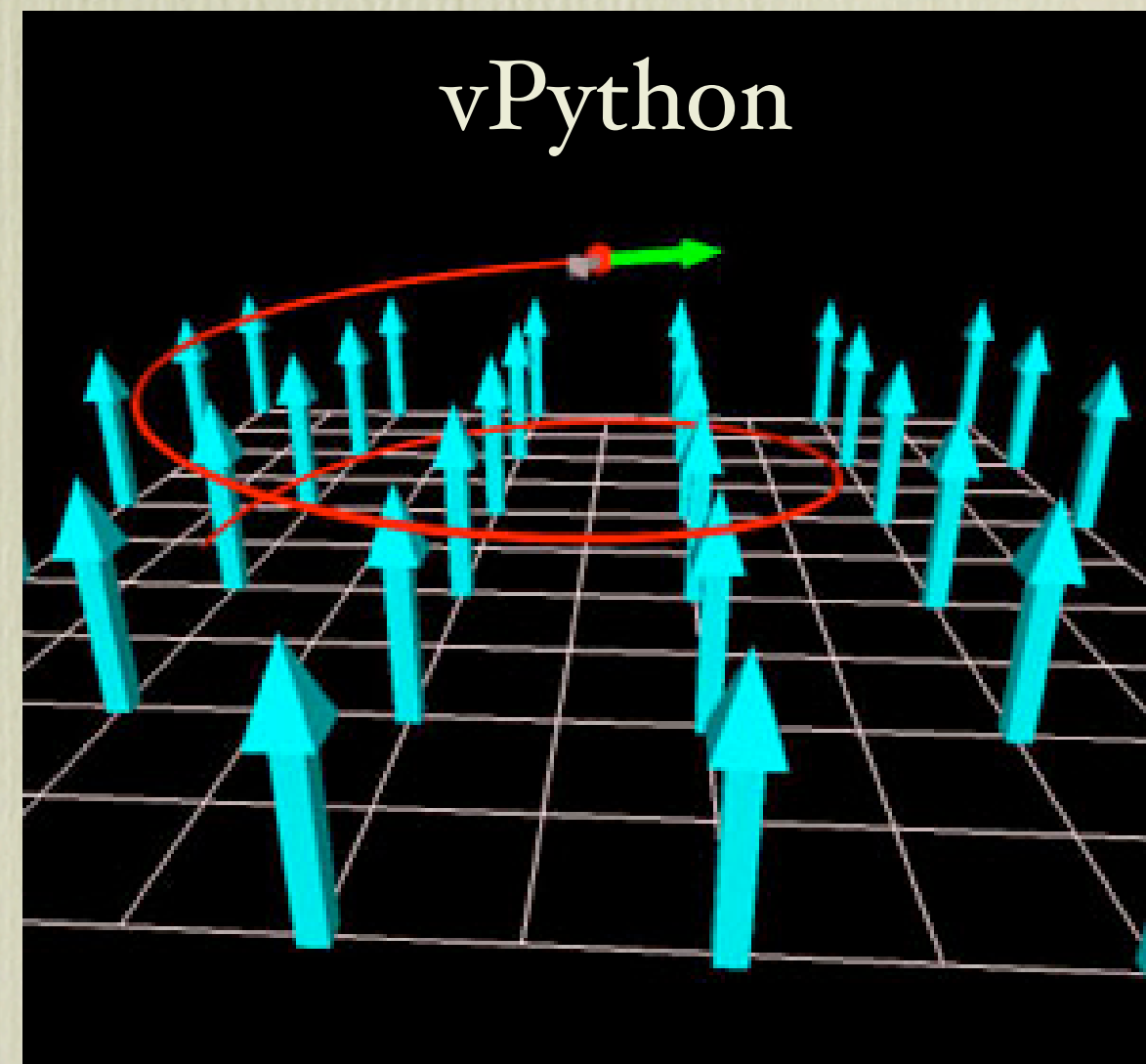
● Programming

Leming, *Computer Problems for Classical Dynamics and Modern Physics*, Brooks-Cole

Press, e. al. *Numerical Recipes*,
Cambridge

Koonin, *Computational Physics*,
Addison-Wesley

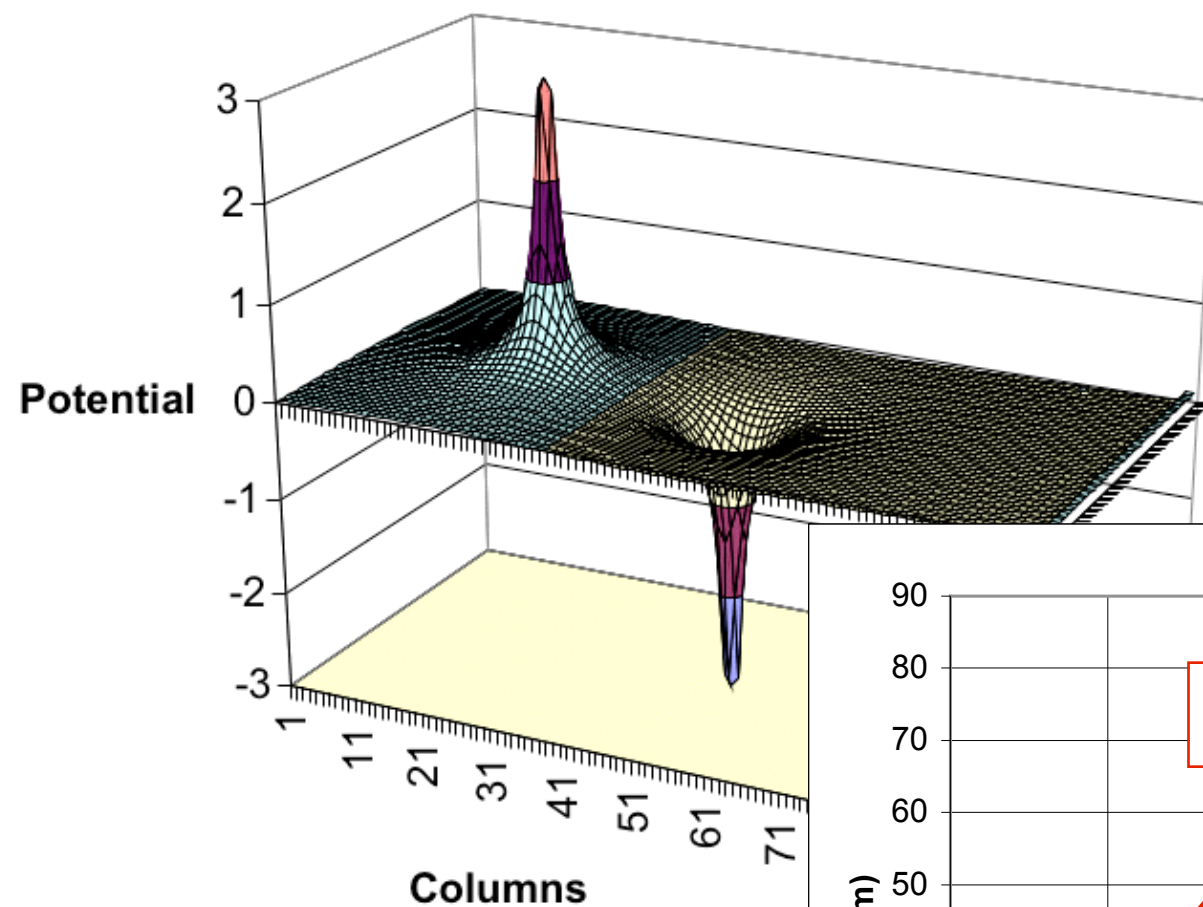
Christian & Belloni, *Physlets*,
Prentice Hall



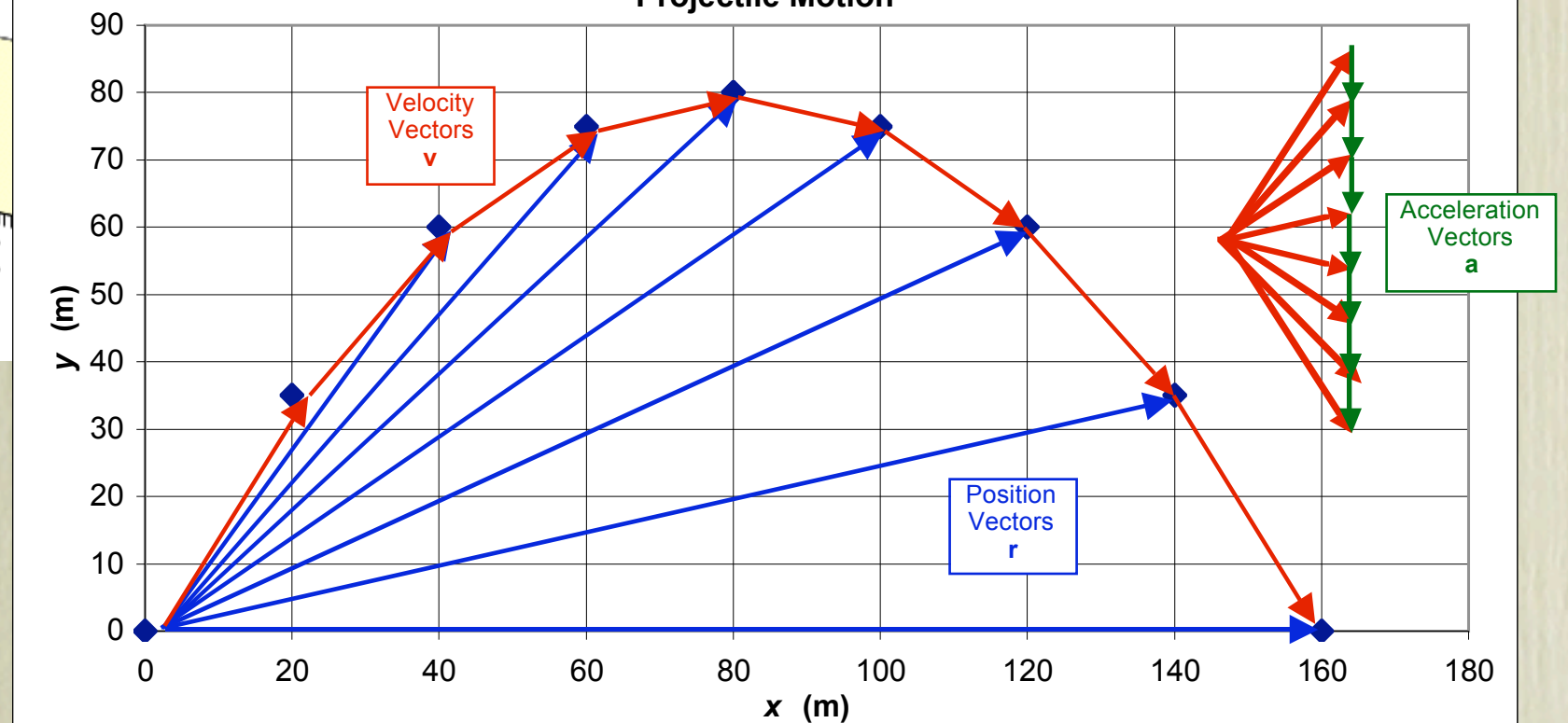
What can I do ?

● Spreadsheets

Potential Around Dipole



Projectile Motion



What can be done ?

- Present Content
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What can I do ?

- Symbolic Mathematics

- Maple (Scientific Notebook)

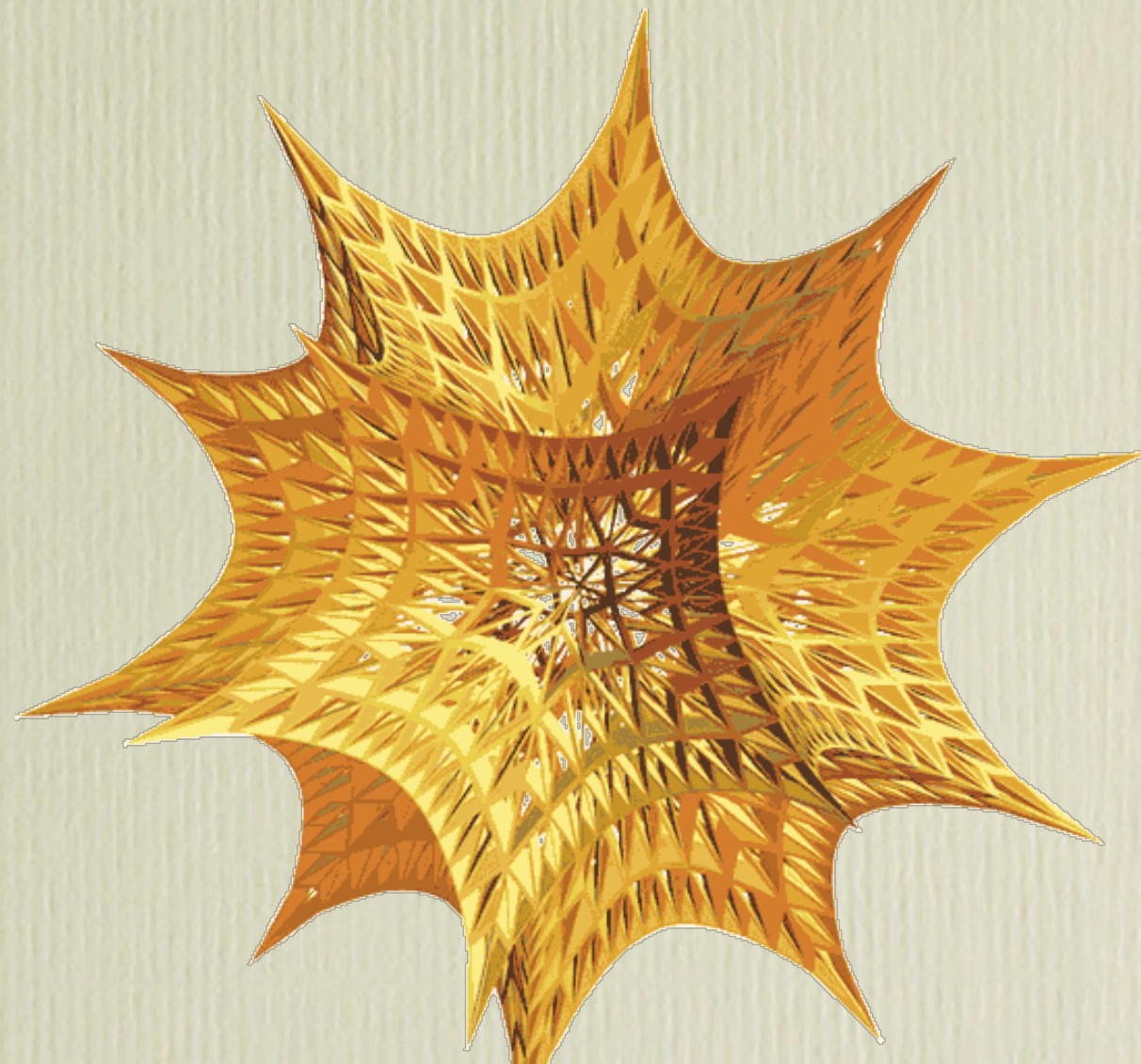
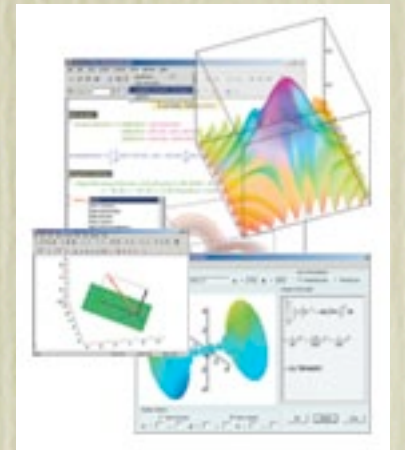
- Mathematica

- Derive

- ProSolv

- MathCAD

- MatLab



What can be done ?

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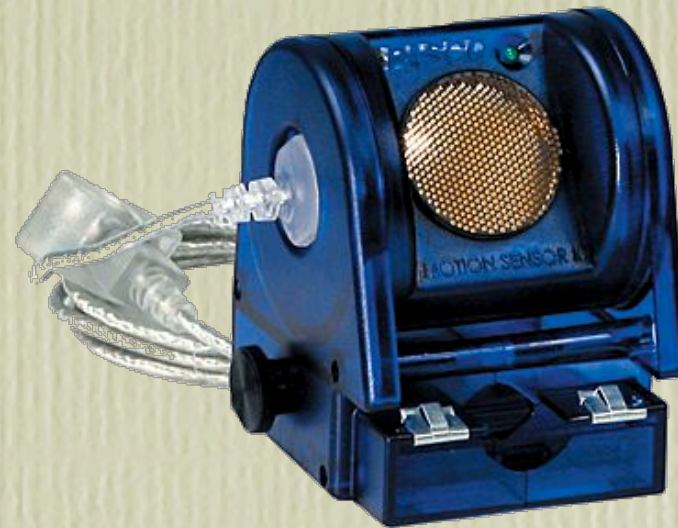
What can I do ?

- Data Collection

- Microcomputer-Based Labs (MBL)
- Video-Based Labs (VBL)
- LabView, MCA Cards, etc.
- World Wide Web
- Student Polling

Microcomputer - Based Labs

Motion Detector



Force Sensor

Acceleration Sensor



What can I do ?

- Data Collection

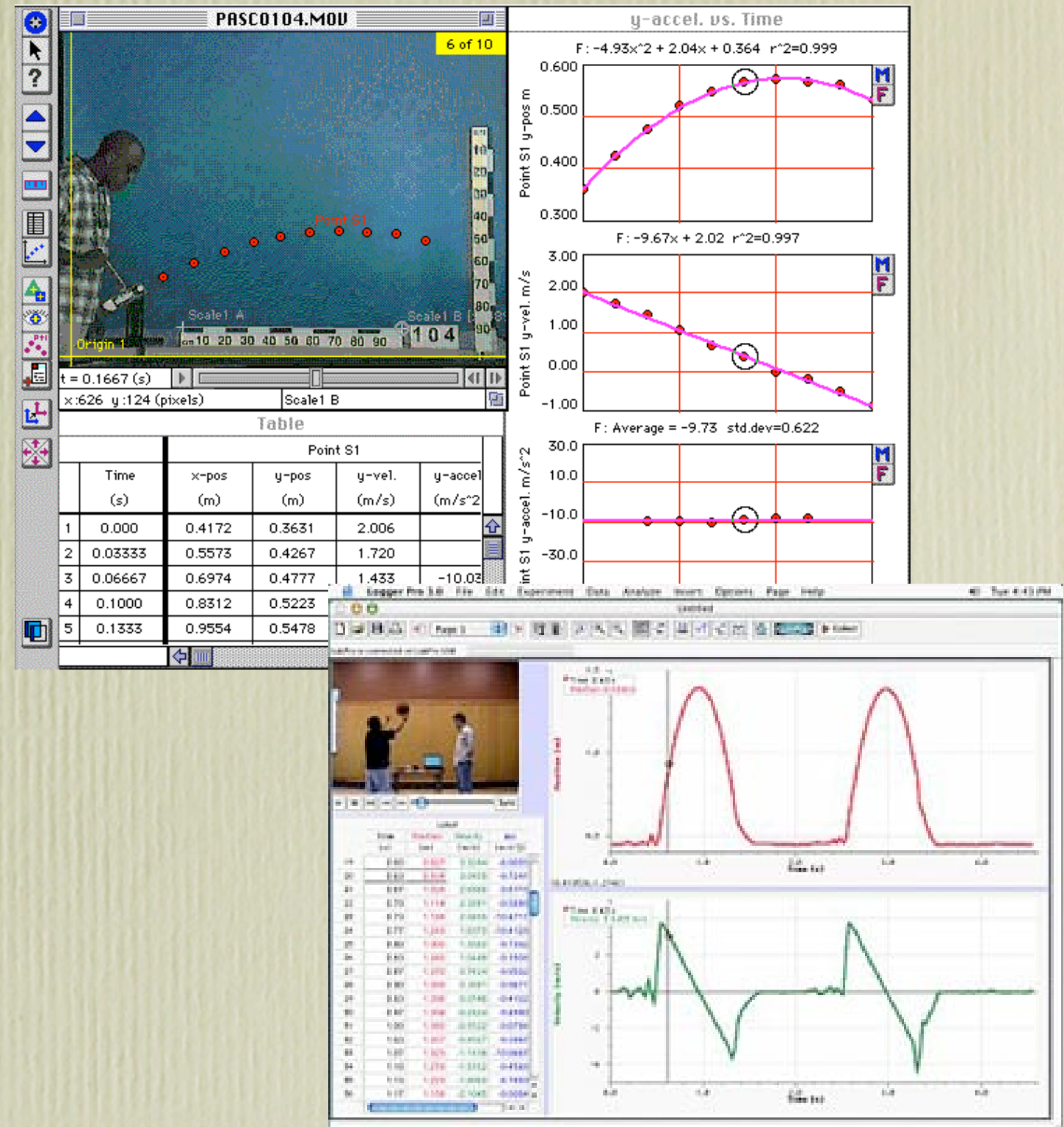
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Video - Based Labs

● *VideoPoint*

● *VideoGraph*

● *Data Logger 3.2*



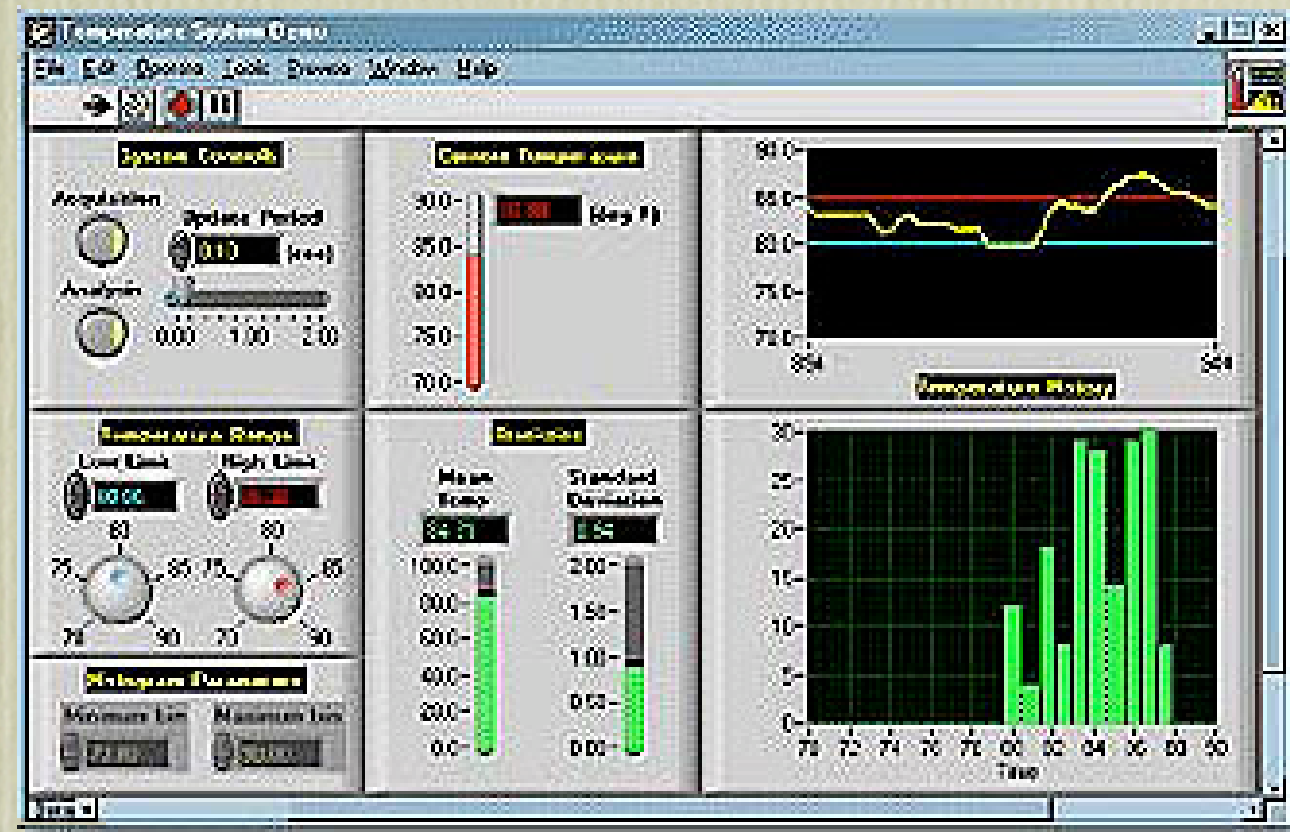
What can I do ?

- Data Collection

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What can I do ?

LabView



What can I do ?

- Data Collection

- Microcomputer-Based Labs (MBL)
- Video-Based Labs (VBL)
- LabView, MCA Cards, etc.
- World Wide Web
- Student Polling

**WebAssign.ncsu**

Wednesday, March 26, 2003 11:31 AM EST

Logged in as beichner.

[Switch to Faculty View](#) | [Logout](#)[Calendar](#) | [Assignment Summary](#) | [Grades](#) | [Message Board](#)[Guide](#) | [Help](#)**Course:** PY 208, section 002, 2003**Instructor:** Beichner, Robert J

Beichner, Robert J

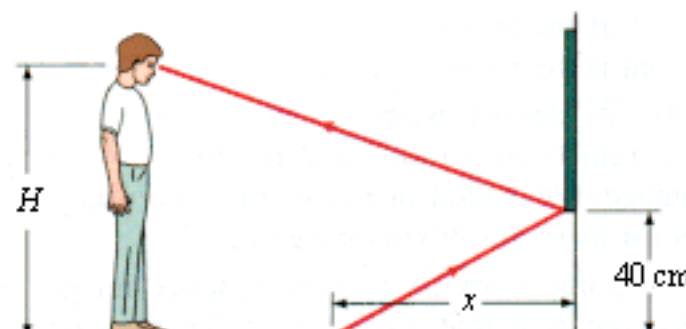
North Carolina State University

Week 10, P1, MWF-208

Due: Monday, March 31, 2003 07:05 AM EST

About this assignment

Chap. 33: 1,8,10 TEN (10) submissions are allowed. Answers to even numbered questions are posted in the case outside the classroom.

1. (a) What is the speed of light in **fused quartz**? m/s(b) What is the speed of light in **sodium chloride**? m/s2. Suppose that you want to take a photograph of yourself as you look at your image in a flat mirror **1.4** m away. For what distance should the camera lens be focused? m3. A person whose eyes are $H = 1.64$ m above the floor stands $L = 2.27$ m in front of a vertical plane mirror whose bottom edge is 40 cm above the floor, Fig. 33-44. What is the horizontal distance x to the base of the wall supporting the mirror of the nearest point on the floor that can be seen reflected in the mirror? cm

What can I do ?

- Data Collection

- Microcomputer-Based Labs (MBL)
- Video-Based Labs (VBL)
- LabView, MCA Cards, etc.
- World Wide Web
- Student Polling

Student Polling

- Personal Response System



- HyperInteractive Teaching Technology



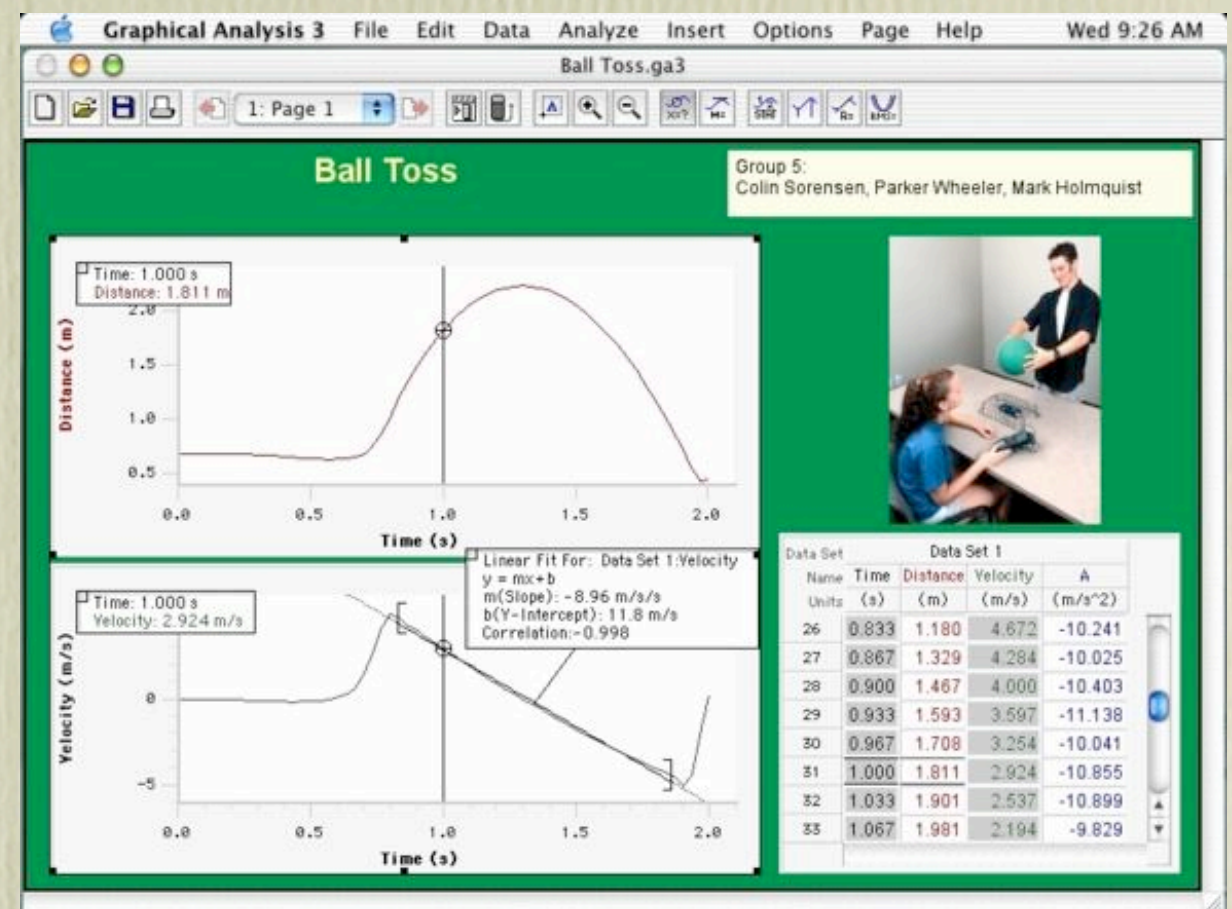
What can I do ?

- Data Collection

- Microcomputer-Based Labs (MBL)
- Video-Based Labs (VBL)
- LabView, MCA Cards, etc.
- World Wide Web
- Student Polling

What can I do ?

- Data Analysis
 - Graphical Analysis
 - Spreadsheets
 - Fourier Analysis



It's demo time !

