

# University of Michigan Introductory Physics Reform

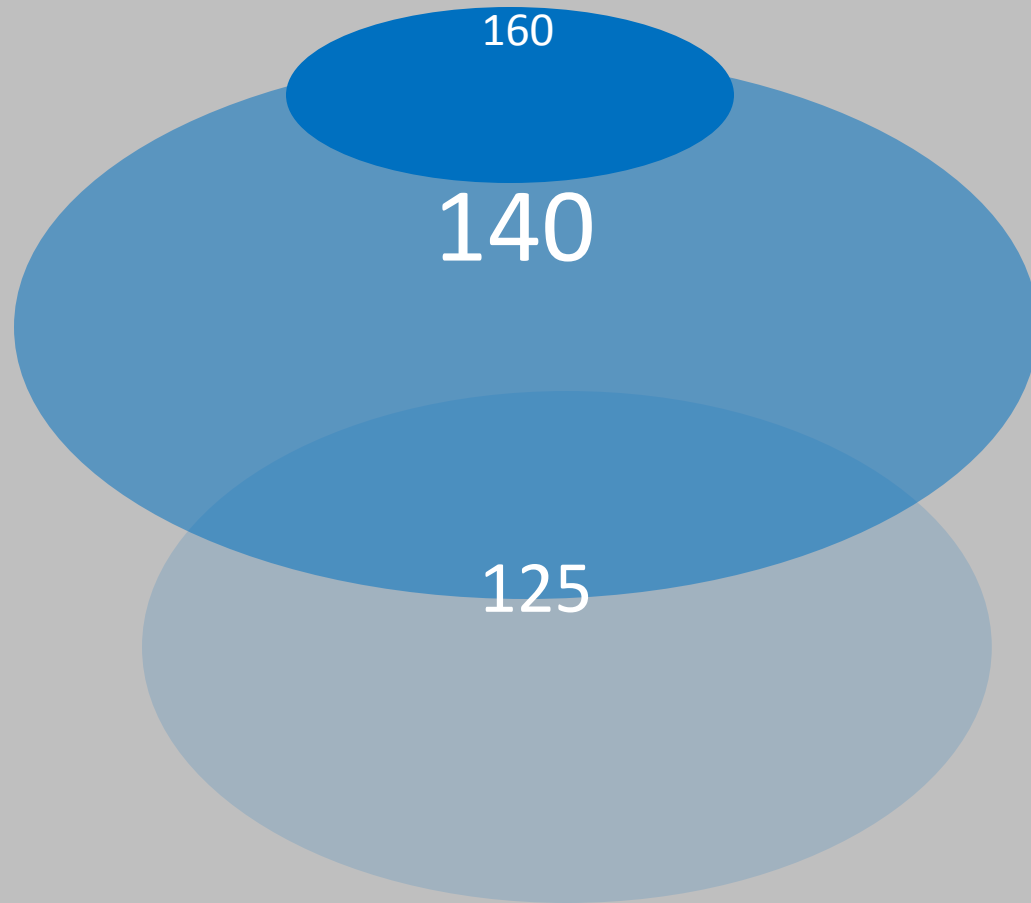
Spin-Up 6/2010

Rutgers

# Major Structural Change

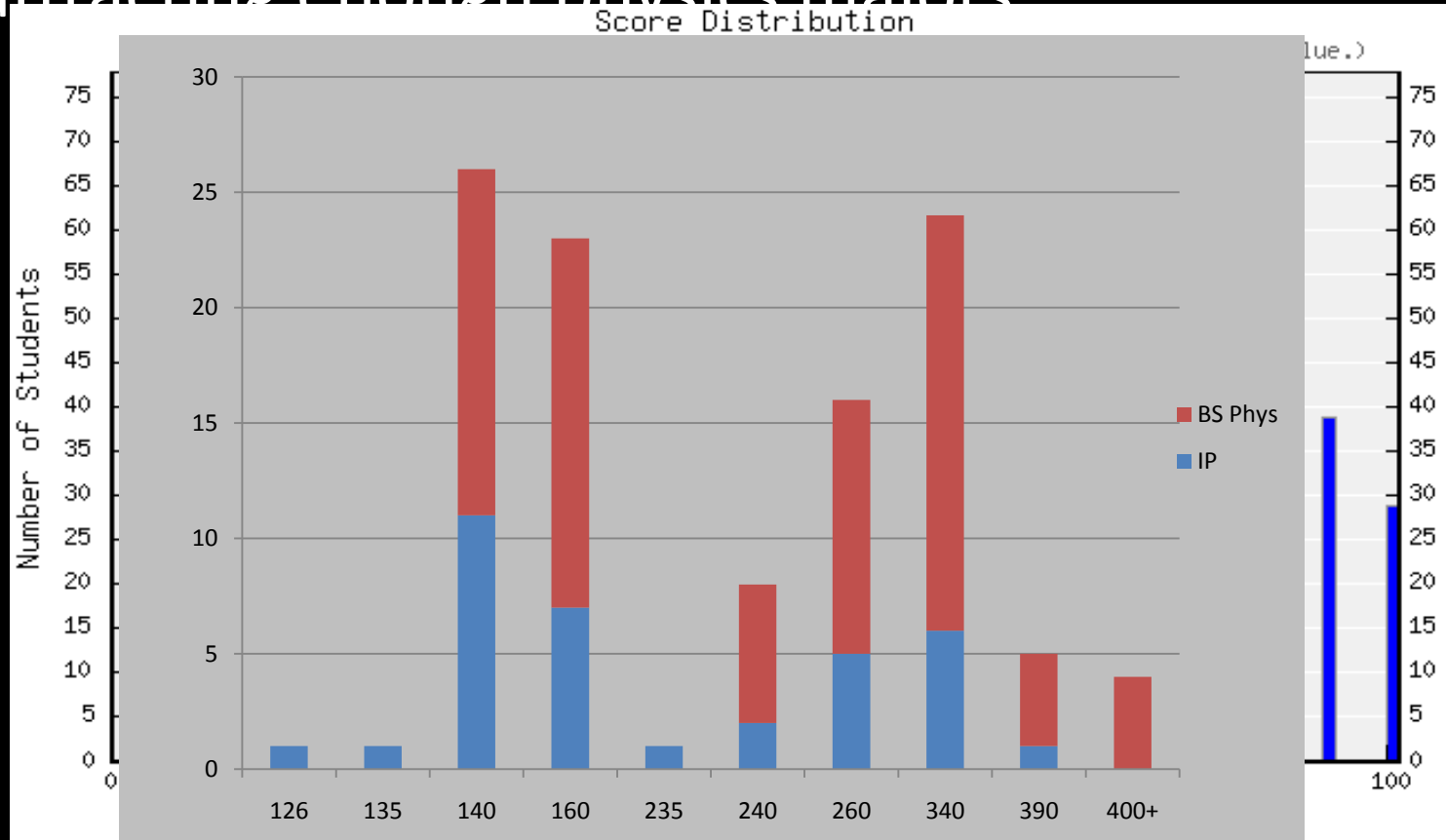
## 40+ year tradition

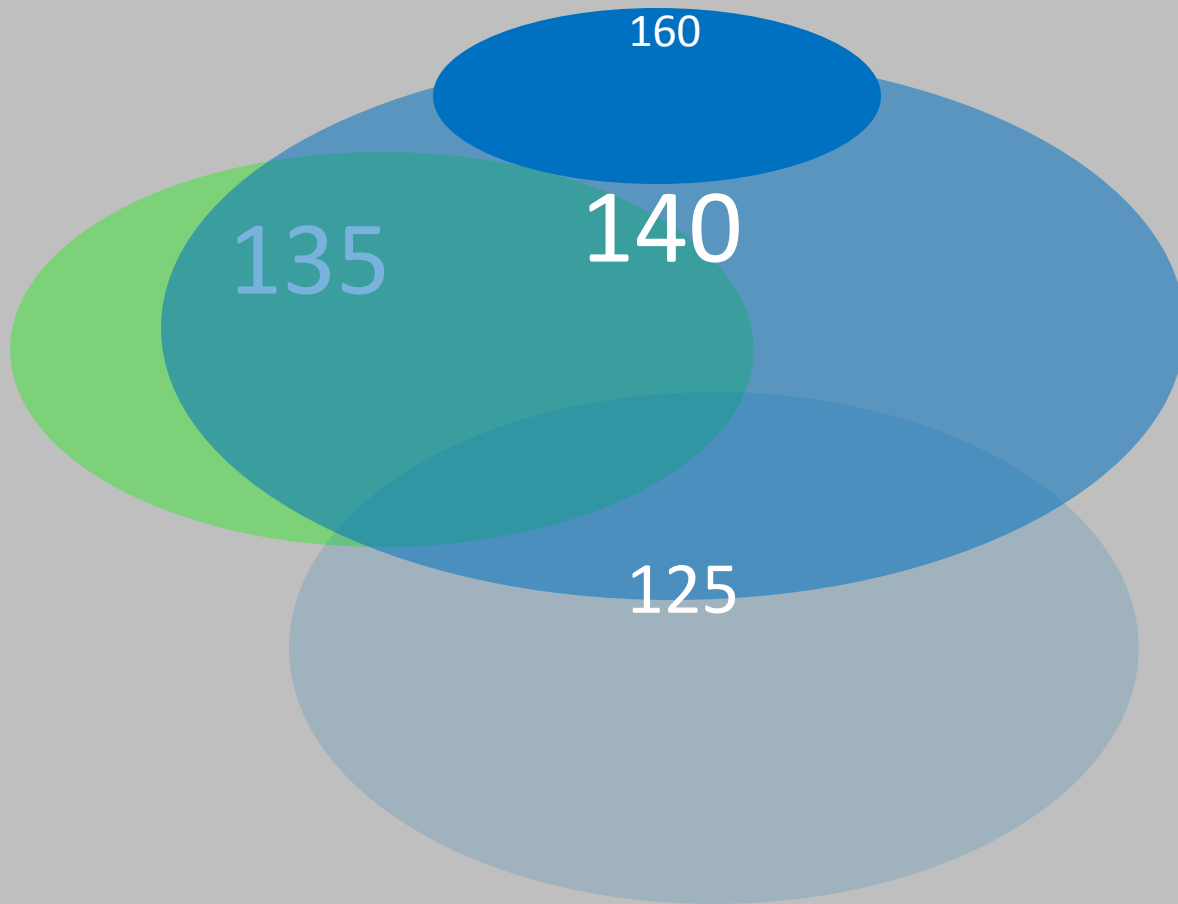
- Deploying faculty differently, no small discussions, use more peer instruction and active learning
- Meet 4 days a week in ~200 student groups



# Major issues with curriculum

- Strongest performers to either 140/135 or 140/135 or are bored for most of the course; 160 not either drop or withdraw from class attracting enough physics majors





# Life Sciences

- New Intro Physics for Life Sciences sequence begun in 2006, an informal part of a larger national IPLS movement
- Complete course redesign to emphasize the physics which enables and constrains life. Calculus is used, though lightly
- Two semesters:
  - Mechanics, thermal and statistical, fluids
  - E&M, waves and imaging, origins (nuclear & cosmo)
- Currently using coursepack of material developed at UM in place of a textbook; textbook in development
- Replacing old 'algebra-based' sequence for most students this year
- New labs which emphasize life science applications in development
- If nothing else, changes in AAMC and the MCAT review process should encourage people to think about this.

# Honors Physics (160)

- Application of fundamental principles to a wide range of systems i.e. from nuclei to stars
- Integrate some contemporary physics (atomic models of matter, relativistic dynamics)
- Engage students in physical modeling (idealization, approximation, assumptions, estimation)
- Integrate computational physics (now a partner of theory and experiment)
- Given the initial conditions and any set of forces acting on a particle, be able to calculate the trajectory of that particle.

# 160 Homework problems

- Racquetball court (something that they can relate to, 3D, elastic collisions, coefficient of restitution, leads to discussion of Drude' model of electron transport.
- Skydiver with parachute (importance of drag,  $d \sim t$ )
- Random walk of Paramecium (normal distribution  $d \sim t^{1/2}$ )
- Binary star system and Rutherford Scattering ( $\Delta t$  changes by  $\sim 10^{25}$ )
- Orbit around irregularly shaped object. (volume integration)
- Oscillation (1D wave motion of atoms L-J potential, CO molecular vibration)
- Driven oscillation, resonance (AFM, IR spectroscopy)



# Now we have space for a new course

- Design a course to assist the 15% of students who will not pass the introductory class
- The issue is not simple, what do they need?
  - Algebra, trig
  - “Word problem practice”
  - Slower pace
  - Probably no single magic bullet