What can/should KITP do to impact High School Physics across the Nation ?

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My Personal Experience

Dos Pueblos Engineering Academy

Dos Pueblos Engineering Academy

- Was founded in 2002 at Dos Pueblos High School in Goleta, California.
- Now enrolls > 100 freshmen per year, from the entire Santa Barbara community, for an eventual total of more than 400 students.
- Is a four-year integrated course of study in physics, computer science, art and engineering design. All go to college, and ½ are women.
- Participates in FIRST Robotics as the capstone senior project.
- Is run as a small business by the students, who learn skills for their future success.
- Includes service learning by our students (e.g. FIRST Lego League, AVID tutoring) outreach to younger students, helping to boost their interest in Science, Technology, Engineering and Math (STEM).

Three Critical Pieces Mattered

- A passionate and dedicated teacher
  - Amir Abo-Shaeer, winner of a 2010 MacArthur “Genius” Fellowship
- The Santa Barbara Unified School District accommodates a new approach
- A non-profit 501c(3) Foundation that engages the parents, community, corporations and philanthropists.

DPEA is project-based learning. That requires a lower student-teacher ratio, more flexible thinking regarding ``teaching to the test”, and more resources than normally available. This could be achieved in many High Schools, but requires, in my view, all three pieces.

KITP's Relevant Strengths

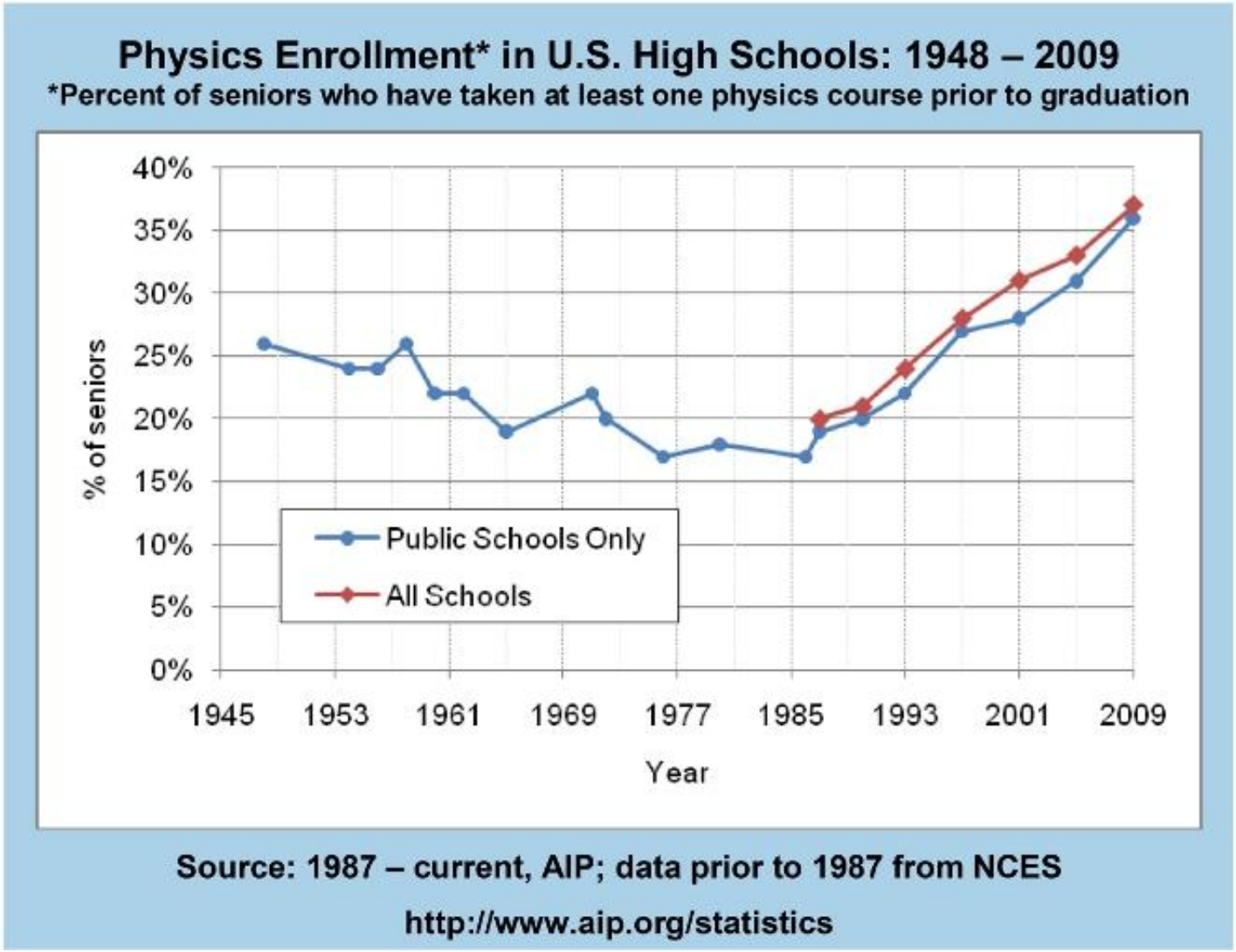
- Access to the Physics Community
  - ~1000 unique visitors per year
  - All are active researchers; 40% foreign
  - Ability to convene the community
- KITP Scholars, theorists at primarily undergraduate institutions, visit for 6 weeks over a 3 year period.
- Online Talks, Public Lectures, Journalists-in-Residence
- Connections to Foundations, some of which fund education (Knowles, Keck, Simons)

What's The Scale of the Issue?

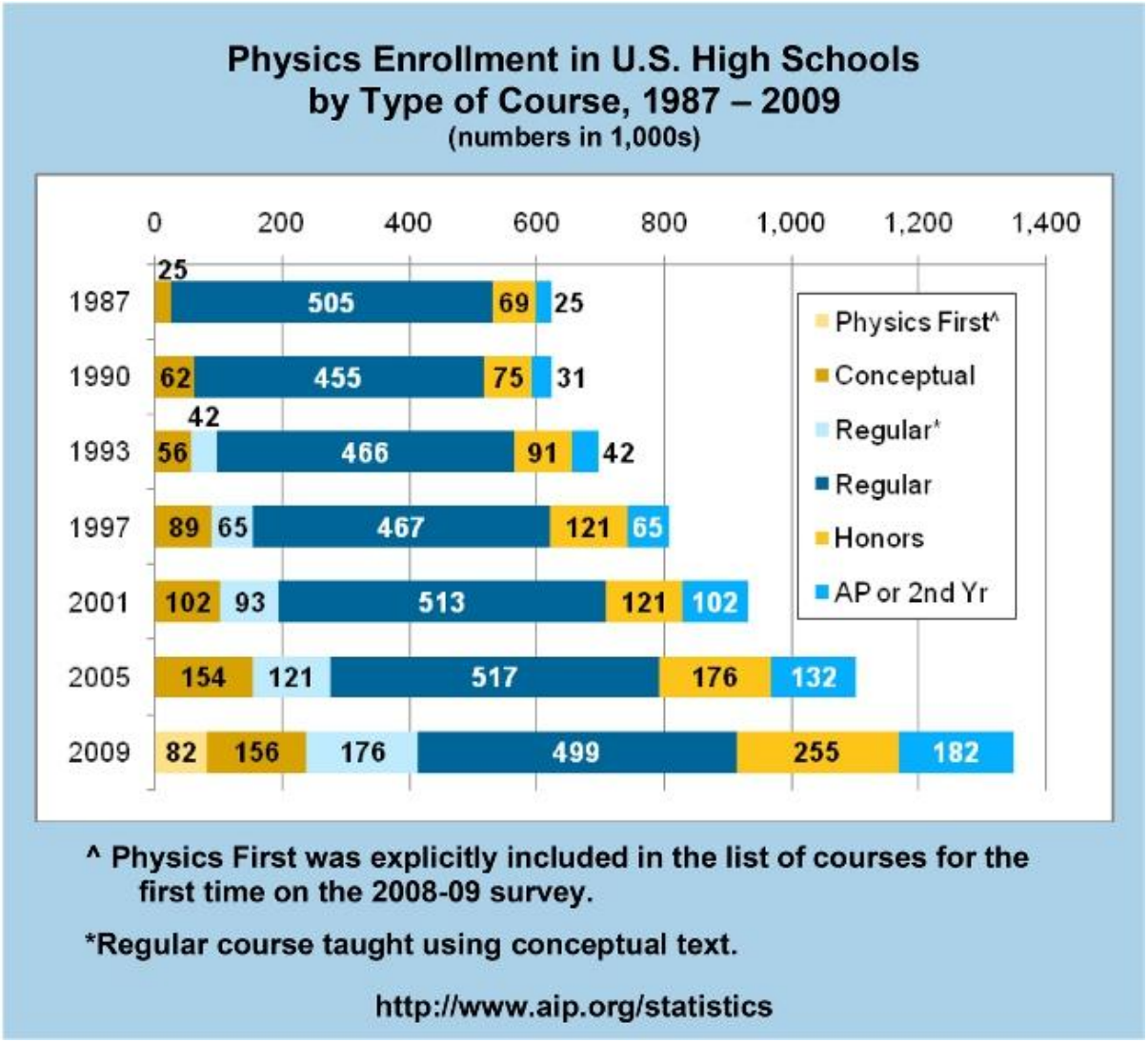
- 30,000 Physics Teachers Nationwide
- 3,000 Teachers find themselves in front of a Physics class for the first time every year
  - ½ are new teachers, ½ are existing teachers new to physics
- 400 of the new teachers have a Physics degree
- 1.4 M students taking physics
- Rapidly evolving in numbers! (data coming)
- Class-size = ? ? (Take a Poll)

Thanks to Ted Hodapp for updated content

Fraction of HS Students learning Physics is Increasing

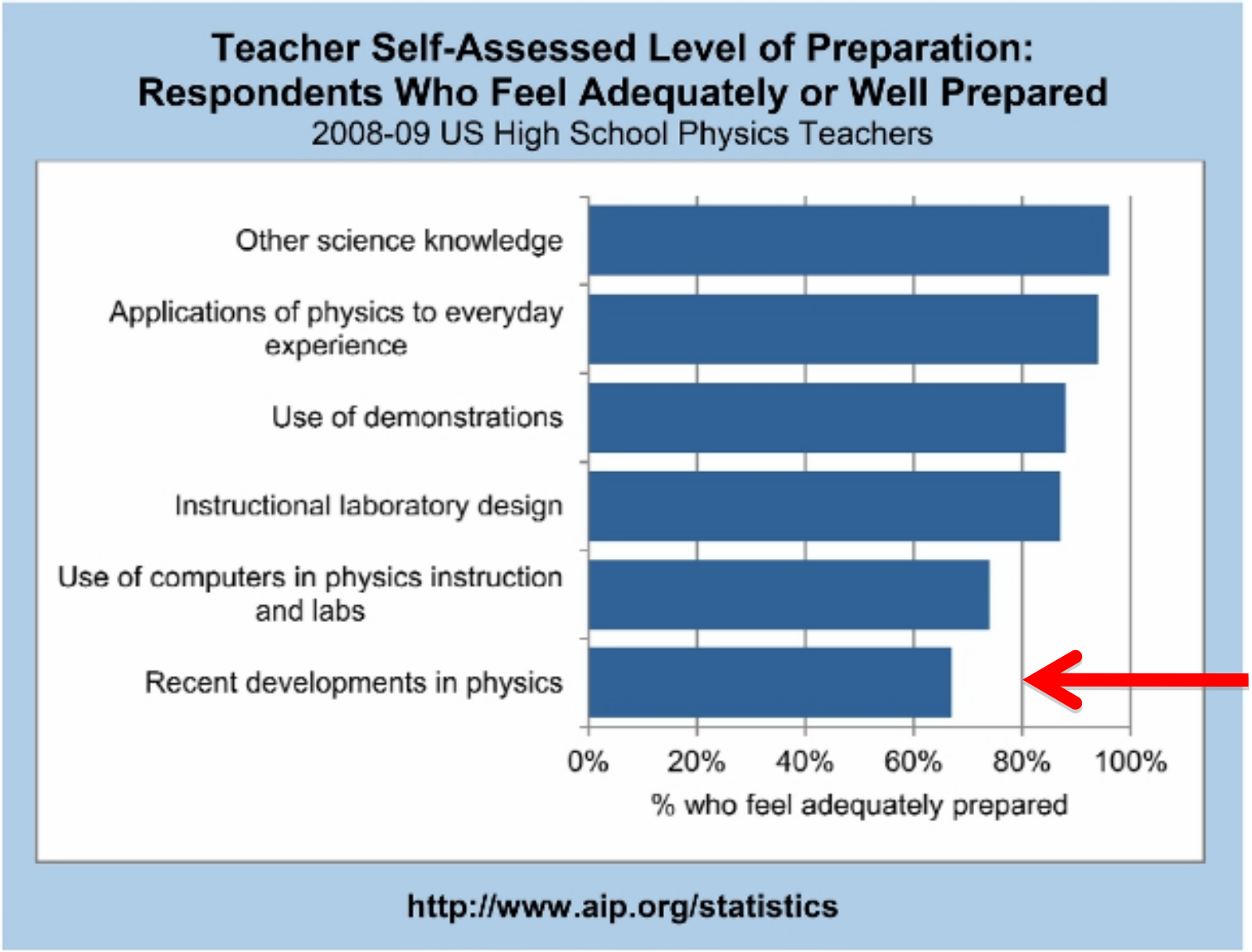


High School Physics Classes



- Growth has been in
  - Conceptual
  - Honors/AP
- Flat in "regular"
- 500,000 a year in AP+Honors in 2009, was 1/3 that in 1997

Teacher Self Assessment



Something KITP can Address! Youtube?

How Many were Physics Undergraduates?

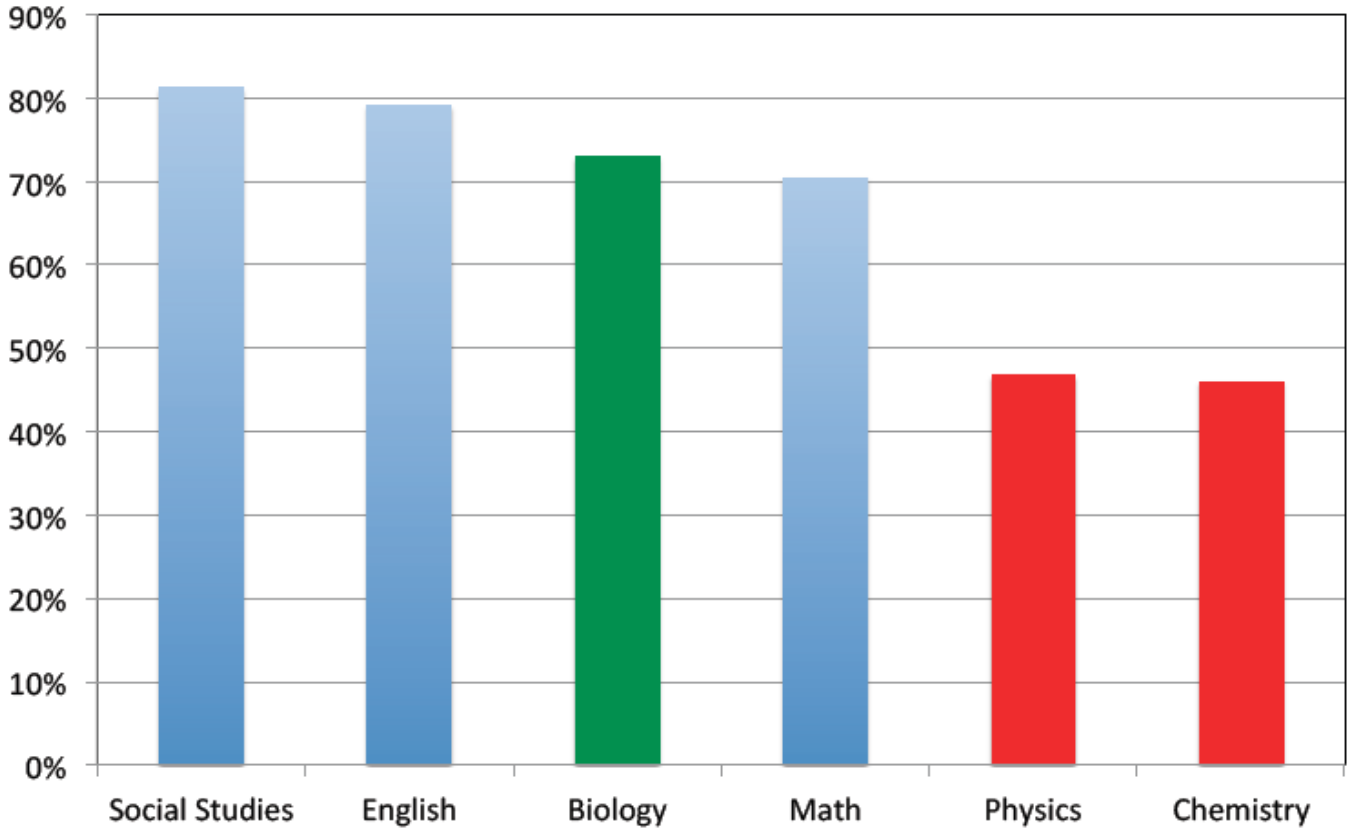
Teacher Demographics

	2009	2001	1993	1987
Number of teachers	27,000	21,000	18,000	17,900
Median age (years)	46	46	43	41
AAPT Membership (%)	27	24	29	24
Degree Level				
Bachelor's (%)	30	35	38	37
Master's (%)	63	60	58	59
Doctorate (%)	7	5	4	4
Any Physics Major (%)	34	33	29	26
… in Physics (%)	25	22	18	—
… in Physics Education (but not Physics) (%)	9	11	11	—
Self-described physics specialist (%)	57	56	40	—

http://www.aip.org/statistics

Physics Teacher Education Coalition

High school classes taught by teacher with degree in the field



Source: Schools and Staffing Survey

2010 Study

Need for High School Teachers

Relative Demand by Field: Highest Demand Fields

Considerable Shortage (5.00 - 4.21)

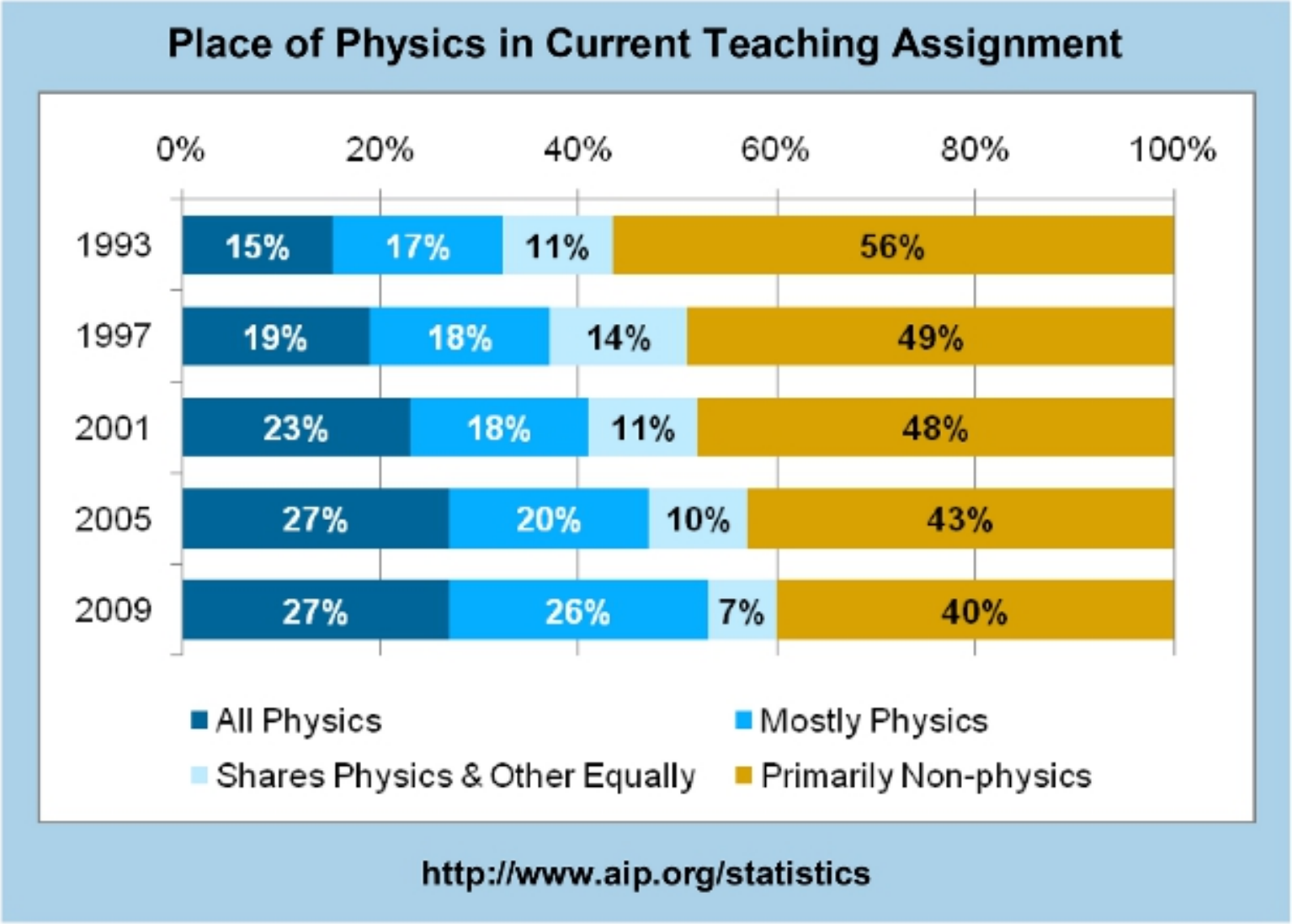
Physics	**4.26**

Some Shortage (4.20 - 3.41)

Spec. Ed. – Multi-categorical	4.15
Mathematics	**4.13**
Chemistry	**4.12**
Spec. Ed.	4.06
Spec. Ed. – Mild/Moderate Disabilities	4.04
Spec. Ed. – Learning Disability	4.03
Spec. Ed. – Mental Retardation	4.03

2010 AAEE *(American Association of Employment in Education)*
Educator Supply and Demand in the United States Report

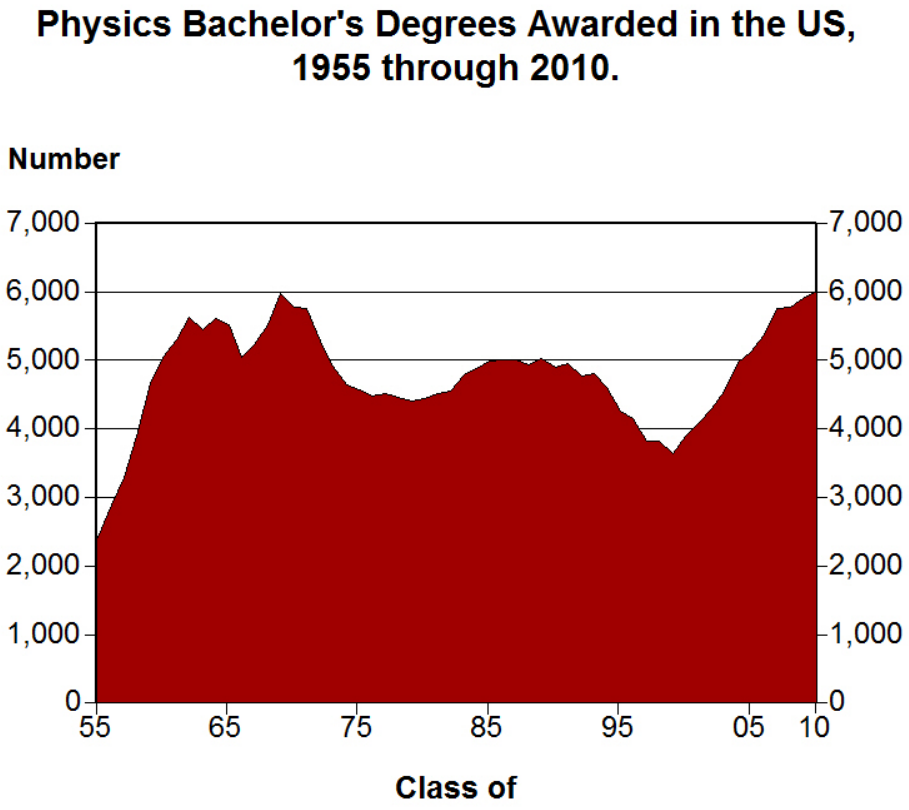
Physics teachers are teaching more Physics

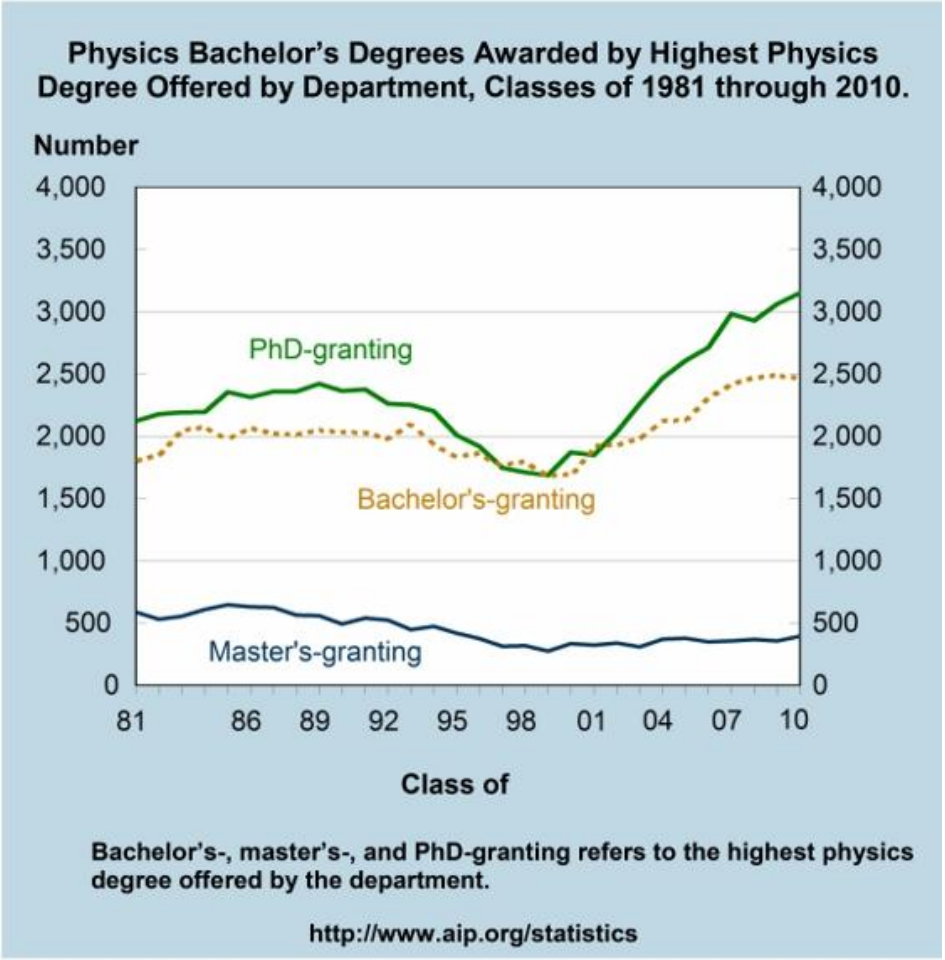


Summary

- ~1500 new teachers are needed every year to accommodate the expanded teaching and normal attrition. High Demand!
- Today, 25% of these teachers (~400) have Physics undergraduate degrees.
- Physics teachers are spending more of their class-time teaching physics. Should be positive!
- When Polled, Physics teachers rate their knowledge and prep as strong, but miss the recent developments.
- Anything else ? ?

Growth in Physics Bachelor's Degrees





What they say they want to do

Long-range career goals, physics bachelor's classes of 2006 & 2007.

Preferred future employment sector	Percent
Private sector	35
College or university	32
Civilian government or national lab	12
Hospital or medical setting	6
High school	6
Other	9

http://www.aip.org/statistics

Summary

- Large increase in the number of College Freshman that declare Physics as their major. Here at UCSB, it has tripled in five years.
- If this growth continues, it's unlikely it will be absorbed by PhD programs
- Need to start exposing Physics undergraduates to teaching as a possible career path.
  - 6% of 6000 is only 360. Need more!
- Must coordinate with Education schools, and varies state-by-state. Hard Problem.

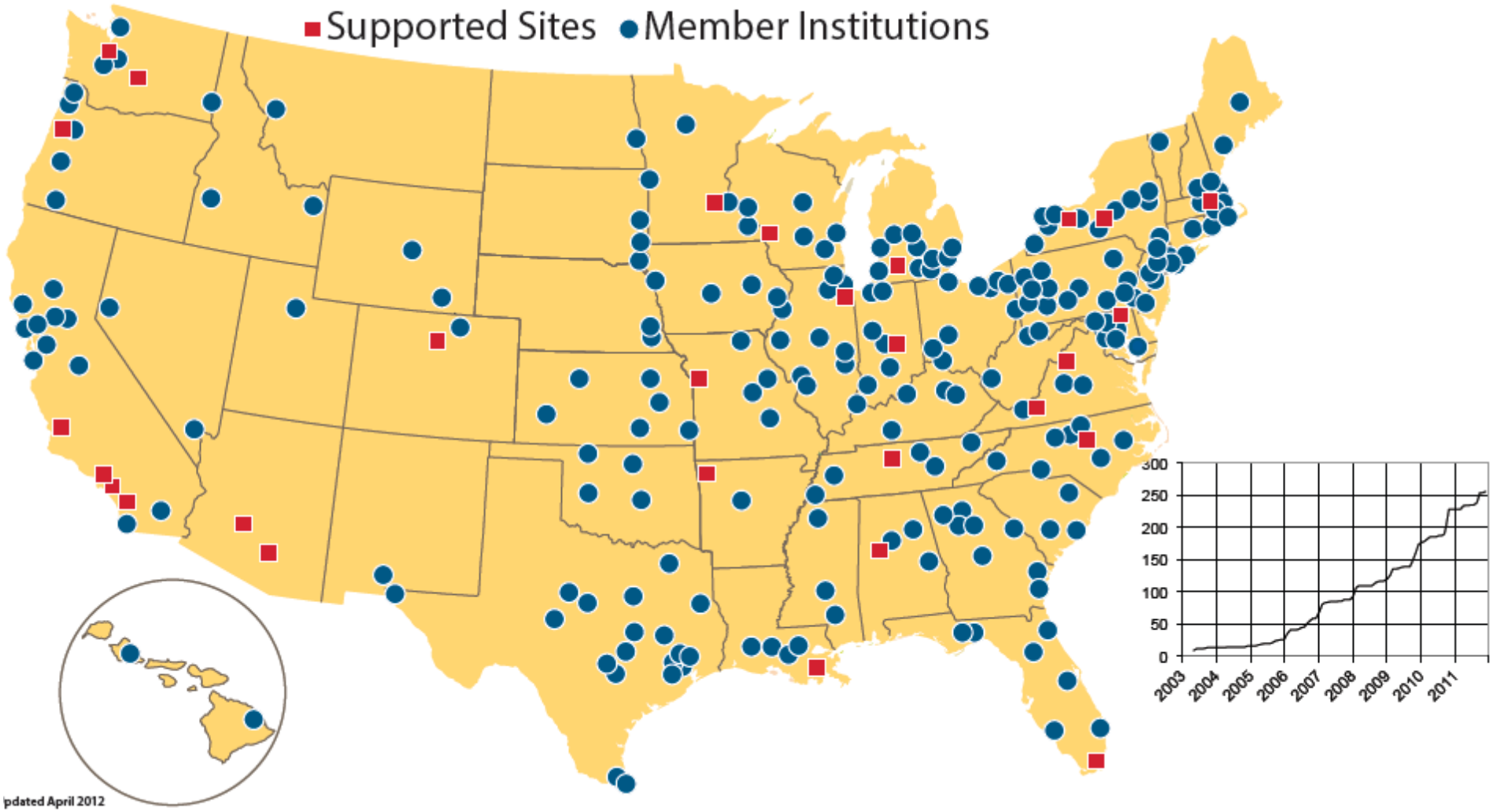
PhysTEC Project Goals

- Transform physics departments to engage in preparing physics teachers
- Demonstrate successful models for increasing the number of highly-qualified physics teachers
- Spread best-practice ideas throughout the physics teacher preparation community

21st Century Campaign
A SCIENCE EDUCATION INITIATIVE

Physics Teacher Education Coalition

PhysTEC Member Institutions



PhD-Granting Departments Averaging 20 or More Physics Bachelor's Degrees Per Year, Classes of 2008 through 2010.

	Annual Average		Annual Average
Mass. Inst. of Technology	83	Carnegie Mellon U (PA)	31
U of California, Berkeley	74	Stanford U (CA)	29
U of Maryland, College Park	70	California Inst of Technology	28
Colorado School of Mines	59	North Carolina State U	28
U of Washington	57	Yale U (CT)	27
U of California, Los Angeles	55	U of Arizona	26
Brigham Young U (UT)	52	U of California, Irvine	26
U of California, Santa Barbara	46	Brown U (RI)	25
U of California, San Diego	42	Princeton U (NJ)	25
Cornell U-Applied (NY)	40	Purdue U, West Lafayette (IN)	25
Ohio State U	40	U of California, Davis	25
U of Colorado, Boulder	40	U of Notre Dame (IN)	24
U of Michigan, Ann Arbor	40	Cornell U (NY	22
U of Rutgers, New Brunswick (NJ)	40	U of Rochester (NY)	22
U of Texas, Austin	40	Case Western Reserve U (OH)	21
U of Virginia	39	SUNY, Stony Brook (NY)	21
U of Chicago (IL)	38	SUNY, U at Albany (NY)	21
Michigan State U	37	Washington U (MO)	21
Pennsylvania State U	37	Arizona State U	20
Georgia Inst of Technology	35	Florida Institute of Technology	20
U of Minnesota, Minneapolis	34	Portland State U (OR)	20
U of Wisconsin, Madison	33	Rice U (TX)	20
Rensselaer Polytech Institute (NY)	32	Texas A&M U, College Station	20
U of California, Santa Cruz	32	U of Arkansas, Fayetteville	20
U of Florida	32	U of Oregon	20
U of Utah	32	Virginia Polytech Inst & State U	20

List includes only departments that offered a PhD as the highest physics degree in 2010 and contributed degree data for all 3 years.

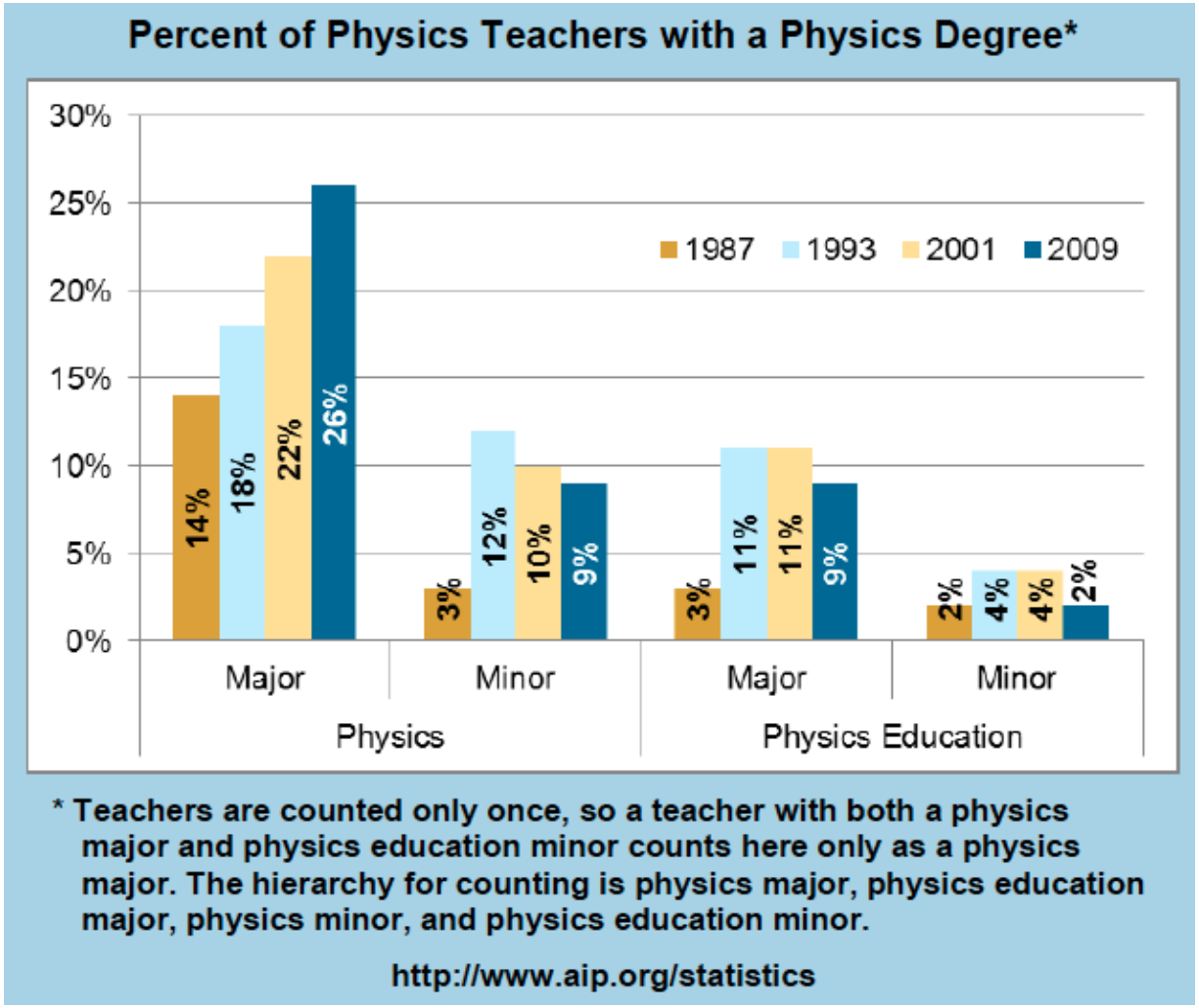
http://www.aip.org/statistics

- These are universities where KITP has immediate access
- Red are locations with PhysTech sites

What can KITP Do?

1. Provide more content helpful to you?
2. Convene Physics department chairs (in concert with APS) to engage more deeply in undergraduate prep for HS teachers
3. Help you with connections to nearby universities, potentially providing teaching exposure to undergrads there and assistance to you
4. ??
5. ??

Additional Data



Growth in HS Physics