

# **Enrollments and Faculty in Physics**

Roman Czujko  
Director, Statistical Research Center  
American Institute of Physics

This is a talk given at the Department Chairs Conference convened by APS and AAPT in College Park, Maryland on June 7-9, 2002. It provides a statistical overview of the current and historic trends in physics enrollments from high school through to the PhD. It also provides data on physics faculty in universities and 4-year colleges, including their numbers and age, as well as the characteristics of new faculty hired during 2000. This document contains the graphs, tables and key points from that talk.

# High School Physics Enrollments 1987 to 2001

## Academic Year   Number of Students

**2000-01**                      **900,000**

**1996-97**                      **807,000**

**1992-93**                      **697,000**

**1989-90**                      **623,000**

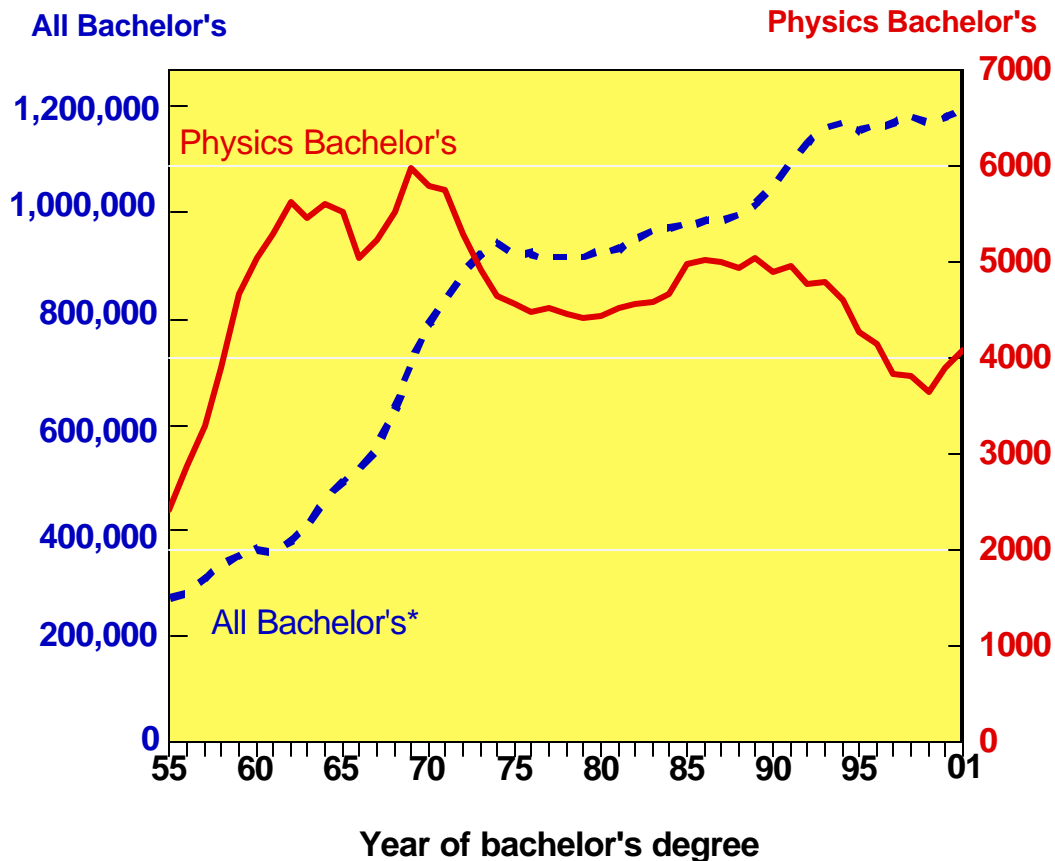
**1986-87**                      **624,000**

Source: AIP Statistical Research Center

### High School Enrollments

- The data above are based on a complex set of nation-wide studies conducted by AIP. Preliminary results from academic year 2000-2001, show that about 900,000 students had taken a physics course in high school. This is a dramatic increase from the physics enrollments in 1990.
- As the total number of high school graduates increased during the late 1990's, physics maintained its share of students. Approximately 29% of the high school senior class of 2001 had taken physics. This is about the same as the rate during 1997, but significantly more than the 20% that was common during the 1980's.
- Girls represented approximately 46% of high school physics students in 2001. This rate is roughly the same as in 1997, but considerably higher than the 37% in 1987.
- Enrollment increases have occurred across all types of physics courses - conceptual, regular, and Advanced Placement. AP is the fastest growing physics course and is also the pool from which many physics bachelors come.

## Physics bachelor's and total bachelor's produced in the US, 1955 to 2001.



AIP Statistical Research Center, Roster of Physics Departments, and  
\* NCES Digest of Education Statistics

### Physics Bachelors Degrees

- After nearly a decade of declining undergraduate majors, the number of physics bachelors awarded has increased each of the last two years - just over 4,100 for the class of 2001.
- About 1.2 million bachelors degrees were awarded across all fields in the U.S. in 2001.
- Physics is a comparatively small field. Of every 1,000 bachelors degrees awarded in the U.S., only 3.4 were in physics.
- Physics lost market share during the late 1980's and most of the 1990's. One of the reasons for this is that the academic environment for undergraduates has become very competitive. In other words, students have far more majors to choose from than they did 10 or 15 years ago.
- Thus, it is no longer possible to sit back and expect the best students to come to you. In order for a department to survive, let alone succeed, it must become proactive in recruiting potential majors and in developing both activities and programs that keep those majors through to the bachelor's degree.

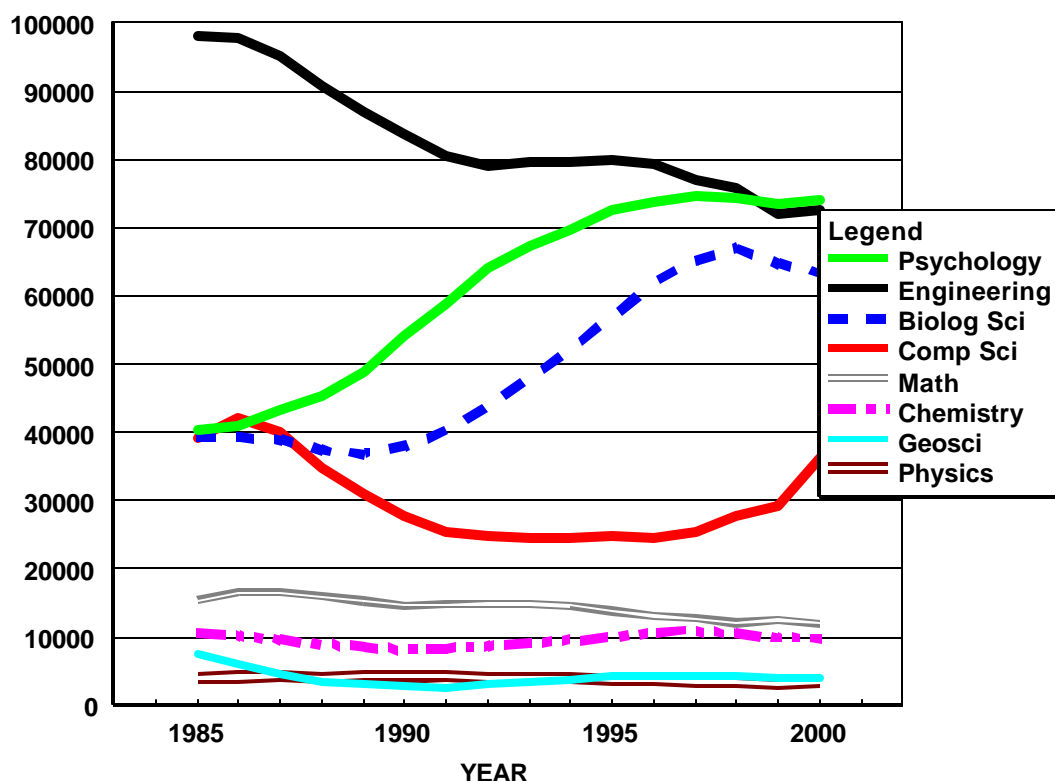
| <b>Number of physics bachelor's awarded by highest degree offered, 1998 to 2000</b> |                                  |                   |                     |                     |
|---|----------------------------------|-------------------|---------------------|---------------------|
| <b>Number of bachelor's, 3 year total</b>   | <b><u>Type of Department</u></b> |                   |                     | <b>Total Number</b> |
|   | <b>PhD %</b>                     | <b>Master's %</b> | <b>Bachelor's %</b> |                     |
| None  | -                                | 1                 | 4                   | 23                  |
| 1 to 5  | 3                                | 14                | 32                  | 173                 |
| 6 to 9  | 12                               | 24                | 25                  | 163                 |
| 10 to 14  | 16                               | 20                | 18                  | 134                 |
| 15 to 29  | 33                               | 37                | 16                  | 165                 |
| 30 to 44  | 16                               | 4                 | 4                   | 52                  |
| 45 or more  | 20                               | -                 | 1                   | 40                  |
| <b>Total Number of Departments</b>  | <b>174</b>                       | <b>70</b>         | <b>506</b>          | <b>750</b>          |

Source: AIP Statistical Research Center  
 Department Chairs Conference: June, 2002.

**Size of physics departments in terms of number of bachelors degrees awarded**

- The number of bachelors degrees awarded is one possible indicator of the size and productivity of a department. There are about 750 physics departments with undergraduate programs and they come in a wide range of sizes.
- Most physics departments are small. Nearly 500 (or two-thirds of all physics departments) average fewer than 5 bachelors degrees per year over a three year period. In fact, about 20 are so small that they don't produce a single bachelors degree in three consecutive years.
- Some physics departments are large. However, fewer than 100 departments average 10 or more physics bachelors per year over three consecutive years.

## Total number of bachelor's degrees granted by discipline, 1985 to 2000

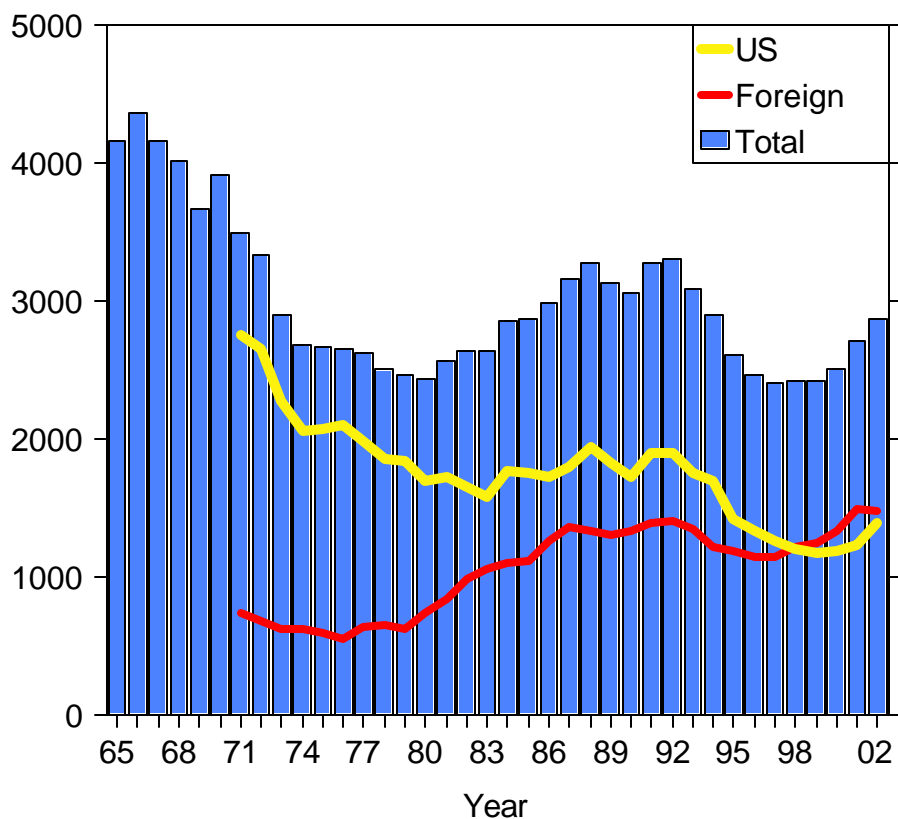


Source: AIP Statistical Research Center compiled data from NSF WebCASPAR Database System, March 2002  
Department Chairs Conference, June 20002

### Historic trends in bachelors degrees awarded in selected fields

- The decade of the 1990's was very volatile in terms of undergraduate education. This graph illustrates the bachelors degree production in selected fields from 1985 through 2000. Each of these fields portrays a different pattern.
- Many calculus-based fields, such as physics, engineering, and mathematics, lost majors at different points during the last decade.
- The two fastest growing fields during the 1990's were biology and psychology. Among the things that these fields have in common are women. About 75% of psychology majors are women.
- In fact, the decisions that women undergraduates make are, to a significant degree, driving higher education. In 1998, about 55% of all bachelors degrees awarded in the U.S. were earned by women. The U.S. Department of Education projects that this trend will continue to grow and that women will represent 58% of the bachelors class of 2010.
- Women have gradually increased their representation among physics bachelors, but at levels far below the overall trends. The physics bachelors class of 1999 was 21% women, the first time that it had ever passed 20%. The physics class of 2001 was 22% women.

## First-year US and foreign graduate physics students, 1965 to 2002.



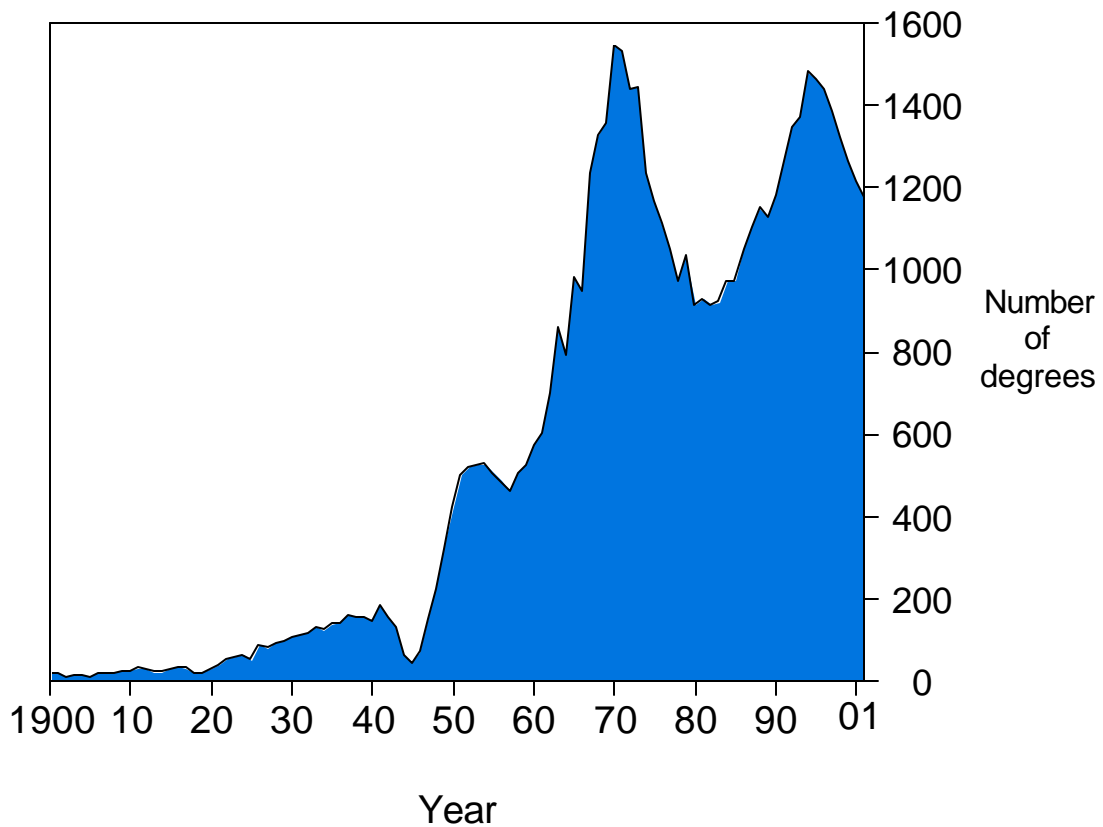
A change in wording on the 2001 questionnaire resulted in more accurate data on first-year graduate students. This change was responsible for 3% of the reported 8% increase in total first-year students between 2000 and 2001.

Source: AIP Statistical Research Center, Roster of Physics Departments.

### First-year graduate enrollments in physics from 1965 to 2002

- The height of the bars illustrates the number of students admitted into physics graduate programs each year. The two lines superimposed across the bars reflect the number of U.S. citizens and the number of foreign citizens entering graduate study in physics.
- The number of foreign citizens in graduate physics programs increased dramatically during the 1980's and 1990's.
- Over the last few years, enrollments among both US citizens and foreign citizens increased.

## Number of physics PhDs conferred in the United States, 1900 to 2001.



Sources: ACE (1900-19), NAS (1920-61), AIP (1962-01)  
AIP Statistical Research Center, Enrollments and Degrees Report.

### PhD production from 1900 to the present

- This graph depicts a system under stress. There is more going on in this curve than simply a reflection of the growing and waning interest in physics.
- Economic and political events in both the national and international arenas affect the number of physics PhDs awarded in the U.S.
- The number of physics PhDs awarded has been declining since 1994 at a rate of about 4% per year. We expect this trend to continue until the PhD class of 2003.
- The number of US citizens earning physics PhDs is expected to decline until the class of 2005, at which point fewer US citizens will have earned physics PhDs than in any year since 1965.

## Number of Full-Time Equivalent Physics Faculty and Physics Departments, 2000

| Type of Department | Number of Departments | FTE  |
|--------------------|-----------------------|------|
| PhD                | 186                   | 5000 |
| Master's           | 67                    | 775  |
| Bachelor's         | 513                   | 2600 |
| Total              | 766                   | 8375 |

Source: 2000 Academic Workforce Survey, Ivie and Stowe, AIP Statistical Research Center  
Department Chairs Conference: June, 2002.

### Number of physics faculty

- In 2000, there were 8375 Full-Time-Equivalent (FTE) faculty slots in the 766 physics degree-granting departments.
- This FTE faculty number does not include postdocs or emeritus faculty.
- The FTE is an undercount of the actual number of physicists employed by these departments because some faculty are charged, in part, to research grants and because some faculty are split across academic departments.
- Most physics faculty are employed in PhD-granting departments.

**Number of physics departments by faculty size and highest degree offered, 2000**

| Number of Faculty | Type of Department |           |            |
|-------------------|--------------------|-----------|------------|
|                   | Bachelor's         | Master's  | PhD        |
|                   | N                  | N         | N          |
| less than 5       | 275                | 2         | 0          |
| 5 to 9            | 184                | 25        | 11         |
| 10 to 14          | 33                 | 24        | 28         |
| 15 to 19          | 7                  | 11        | 31         |
| 20 to 24          | 0                  | 3         | 30         |
| 25 to 29          | 0                  | 2         | 22         |
| 30 to 34          | 3                  | 0         | 13         |
| 35 to 39          | 1                  | 0         | 17         |
| 40 or more        | 0                  | 0         | 34         |
| <b>Total</b>      | <b>503</b>         | <b>67</b> | <b>186</b> |

Source: 2000 Academic Workforce Survey, Ivie and Stowe, AIP Statistical Research Center  
 Department Chairs Conference: June, 2002.

**Size of physics departments in terms of faculty FTE**

- Many physics departments are small. Over 275 have fewer than 5 faculty slots and nearly 100 of those have fewer than 2 faculty slots.
- PhD-granting physics departments are, in general, much larger than bachelors-granting departments.
- Very few bachelors-granting physics departments have 10 or more faculty.
- Most masters-granting physics departments have between 5 and 15 faculty slots.
- Fewer than 100 physics departments (mostly PhD-granting) have 25 or more faculty slots.

| <b>Age Distribution of Physics Faculty in universities and four-year colleges, 2000</b> |              |
|---|--------------|
|   | Faculty<br>% |
| Younger than 35   | 5            |
| 35 to 39  | 11           |
| 40 to 44  | 14           |
| 45 to 49  | 11           |
| 50 to 54  | 13           |
| 55 to 59  | 14           |
| 60 to 64  | 15           |
| 65 to 69  | 11           |
| 70 to 74  | 4            |
| 75 and older  | 2            |

Source: AIP Statistical Research Center, 2000 Membership Survey  
 Department Chairs Conference: June, 2002.

**Age distribution of physics faculty**

- Only 16% of all physics faculty (full or part-time employed) are under 40 years old.
- Twice as many physics faculty are 60 or older than are under age 40. In fact, as many physics faculty are 65 or older as are under age 40.
- The age distribution of physics faculty in research departments is more skewed than at bachelors-granting departments.
- The aging of the physics faculty has been especially pronounced during the 1990's. Part of this aging is the result of deferred retirements and part is the result of recent hiring trends, especially at research departments.

## Backgrounds of New Physics Faculty, 2000\*

|   | Type of Department |              |
|---|--------------------|--------------|
|   | PhD<br>(%)         | Bach.<br>(%) |
| <b>Earned PhD in US within last 5 years</b> | 35                 | 60           |
| <b>Earned PhD outside US, any year</b>      | 34                 | 12           |
| <b>Earned PhD in US &gt; 5 years ago</b>    |                    |              |
| Previous Employer:                          |                    |              |
| US Academic Institution                     | 21                 | 22           |
| Industry, National Lab, Other               | 10                 | 6            |

\*Tenured, tenure-track, temporary full-time and permanent non-tenured faculty only.

Source: 2000 Academic Workforce Survey, Ivie and Stowe, AIP Statistical Research Center  
Department Chairs Conference: June, 2002.

### Characteristics of new hires among physics faculty

- During academic year 1999-2000, physics departments recruited for over 500 tenured and tenure-track openings. This is the largest number of faculty openings in the 15 years that we have collected such data.
- However, it should be noted that not all open positions are filled in one year. Many departments do not find the candidate they want and about 20-30% of the open positions are rolled over to be included among the next year's recruitment efforts.
- The profile of new faculty hired by physics departments at primarily undergraduate institutions is very different from those hired by research departments. Most of the new faculty hired by bachelors-granting departments are young physicists who earned their PhDs in the U.S.
- By contrast, only 35% of the new faculty hired by PhD-granting departments in 1999 were young physicists from the U.S. Almost as many of the new hires were physicists who had earned their PhDs abroad, most of whom had strong international reputations and were in mid career. Similarly, a significant number of new hires were mid-career physicists from industry and government labs.
- The profile of new faculty hired by PhD-granting physics departments in 2000 was very different from that of 10-20 years ago. For example, during the decade of the 1980's, only 16% of the new faculty hires were physicists who had earned their PhDs abroad.