AMERICAN INSTITUTE OF PHYSICS

AIP REPORT

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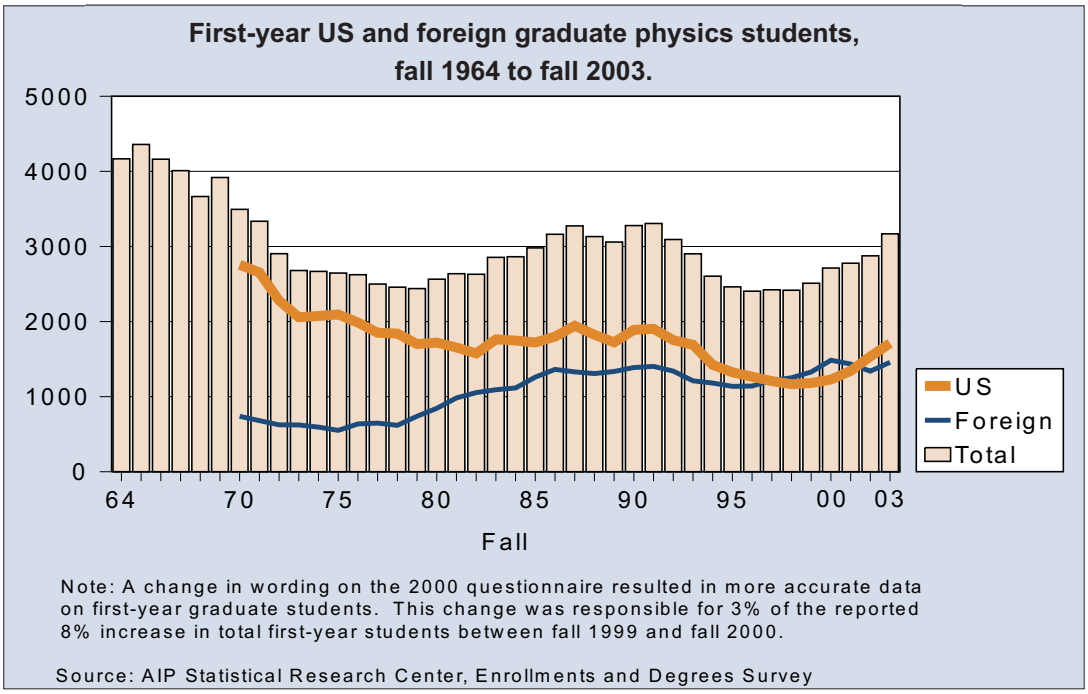
AIP Pub. Number R-151.40

July 2005

# ENROLLMENTS AND DEGREES REPORT, 2003.




## Highlights

➢Undergraduate physics degree production continues to rise rapidly. The number of bachelors granted to the class of 2003 (4553) is up 25% from the recent low in 1999. **(Figure 1)**

➢The physics PhD class of 2003 reflects a 1% increase in PhD production over the class of 2002, with 1106 degrees conferred. This small increase follows 8 years of steady decline in PhD production. **(Figure 5)**

➢Foreign citizens now comprise over half (52%) of the new physics doctorates. **(Figure 6)**

➢The number of students entering graduate physics programs has increased for the fifth consecutive year. From the low in the fall of 1998, US student enrollments have increased an astonishing 47%, while during this same period foreign student enrollments fluctuated somewhat and resulted in a more modest 16% increase. **(Cover)**

➢PhD production is projected to experience sizable increases starting around the class of 2005, a reflection of the recent increases in first-year graduate physics student enrollments. **(Figure 7)**

## highlights continued

➢Visa issues and the perceived climate toward foreign graduate students have been in the forefront of concerns when it comes to international students coming to study in the US since September 11, 2001. Approximately 20% of admitted foreign students in the fall of 2002 were at least initially prevented from attending. **(Page 8)**

➢There has been a sharp increase in the number of astronomy bachelors conferred. The 325 degrees in the class of 2003 represents a 61% increase from just 3 years earlier. Much of the growth is a result of an increase (122%) in the number of women receiving these degrees. **(Figures 9 & 10)**

## BACKGROUND

In the fall of 2003, the American Institute of Physics (AIP) surveyed all degree-granting physics and astronomy departments in the US and Puerto Rico. This census collects enrollment information for the current academic year and degree data for the previous one. The survey went out to 764 physics departments **(**see **Table 1)** and 76 astronomy departments.

**Table 1. Departments by highest physics degree offered, academic year 2002-2003.**

| | Number of Depts. | Percent of Depts. |
|---|---|---|
| Bachelor's-granting | 511 | 67 |
| Master's-granting | 68 | 9 |
| PhD-granting | 185 | 24 |
| Total | 764 | 100% |

AIP Statistical Research Center, Enrollments and Degrees Report.

Much of the departmental level data that is used to create the tables and figures in this report can be found in the "Roster of Physics Departments, with Enrollments and Degree data, 2003" and its sister publication the "Roster of Astronomy Departments". Printed copies can be ordered or an electronic version downloaded at no cost from the AIP's Statistical Research Center's web site: http://www.aip.org/statistics/trends/undtrends.htm

Data on the immediate post-degree experiences of students receiving physics and astronomy degrees comes from the AIP Initial Employment Survey. A full report discussing the educational pursuits and initial employment of new degree recipients at all levels can be found at the following URL: http://www.aip.org/statistics/trends/emptrends.html

This report is a direct result of physics and astronomy department chairpersons, faculty, and staff providing us with information on their individual programs. For the data on the class of 2003, we received responses from 96% of the departments. Data for the non-responding departments were estimated using responses to our survey in previous years, and those estimated figures are included in the totals presented in this report.

## UNDERGRADUATE PHYSICS ENROLLMENTS AND DEGREES

The total number of students taking an introductory physics, physical science or astronomy course at four-year US colleges and universities that offer a degree in physics has been slowly rising. About 360,000 students took an introductory physics course during the 2002-2003 academic year, an increase of about 10% from five years earlier. The number of students taking an introductory astronomy course (176,000) is up about 8% for the same time period.

**Table 2. Introductory course enrollments by type of department, academic year 2002-2003.**

| Department Type | Calculus Based | Algebra Based | Conceptual | Astronomy* | Physical Science |
|---|---|---|---|---|---|
| Bachelor's-granting | 44,000 | 41,000 | 21,000 | 61,000 | 31,000 |
| Master's-granting | 17,000 | 15,000 | 16,000 | 25,000 | 6,000 |
| PhD-granting | 104,000 | 70,000 | 32,000 | 90,000 | 21,000 |
| Total | 165,000 | 126,000 | 69,000 | 176,000 | 58,000 |

*Astronomy course enrollments also include students from degree-granting astronomy departments, which accounted for 52,000 of the 176,000 introductory astronomy enrollments.

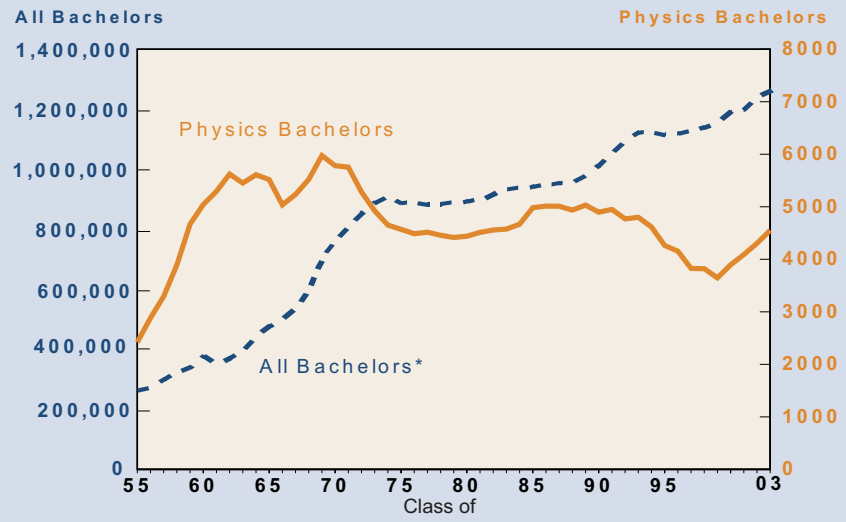
Note: In addition to the introductory course enrollments given above, a significant number of students take an introductory-level physics course at a two-year college. In 2002 this figure was approximately 120,000 students. ( *Physics in the Two-year Colleges:2001-02,* Mark McFarling and Michael Neuschatz, June 2003, College Park MD: American Institute of Physics)

AIP Statistical Research Center, Enrollments and Degrees Report .

The introductory enrollment numbers in **Table 2** are meant to reflect the enrollments in the first term of an introductory level physics, astronomy or physical science course offered by degree-granting physics and astronomy departments. To help complete the picture concerning the number of students who take a post-secondary school introductory physics course, there are approximately 120,000 additional students who took an introductory physics course at two-year colleges in 2002.[1]

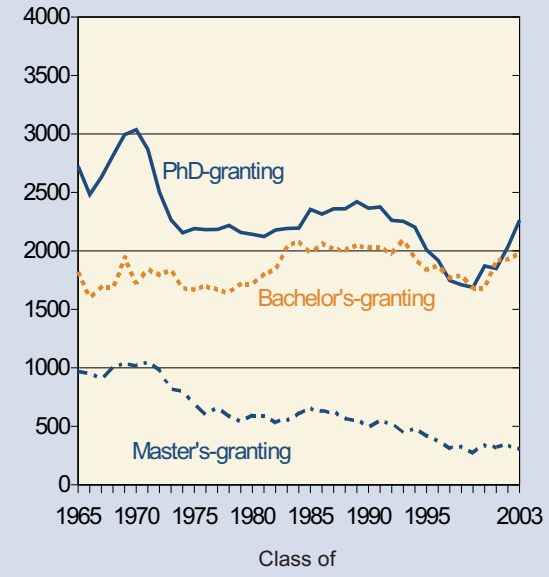
Undergraduate physics degree production continues to increase sharply after hitting a four decade low in 1999. **Figure 1** shows physics bachelor's production compared to total US bachelor's degree production in all fields starting in 1955. The number of physics bachelors produced has increased 25% since the recent low.

**Figure 1. Physics bachelors and total bachelors produced in the US, 1955 to 2003.**




AIP Statistical Research Center, Enrollments and Degrees Report and NCES Digest of Education Statistics

**Figure 2. Physics bachelor's degrees awarded by department type, 1965-2003.**




AIP Statistical Research Center, Enrollments and Degrees Report.

**Figure 2** breaks down bachelor's production by the highest degree offered by the department. As the figure shows, both the declines of the 1990's and the earlier drop in the 1970's were concentrated in departments that had graduate programs. Although the recent increases since the overall low in 1999 have been realized at all department types, the PhD-granting departments have gained the most (34%) and the master-granting departments the least (13%).

As Figure 1 shows, physics bachelor's degrees accounted for a small fraction (<0.4%) of the 1.3 million bachelors awarded in the US in 2003. To put the number of physics degrees awarded into perspective, **Table 3** compares the number of physics degrees granted in the class of 2002 to engineering and other science fields.

Continued increases in junior level enrollments (see **Appendix A2)** suggest continued increases in bachelor's degree production for at least the next couple of years. However, caution should be used when making predictions about future degree production based on these data. Due to attrition, the throughput of junior-level students to bachelor recipients the next year has a considerable drop-off, currently about 20%.

**Table 3. Bachelors degrees awarded in selected fields, class of 2002.**

| | Number |
|---|---|
| Engineering | 73,964 |
| Biological / Life sciences | 60,256 |
| Computer and Information sciences | 47,299 |
| Mathematics | 12,395 |
| Chemistry | 9,136 |
| Physics | 4,305 |
| Geoscience | 3,974 |

Note: Engineering includes degrees in general engineering fields and engineering-related technologies. Biological / life sciences include degrees in biology, biochemistry and biophysics, botany, cell and molecular biology, microbiology/bacteriology, zoology, and other biological sciences. Mathematics includes degrees conferred in applied math and statistics. Geoscience includes degrees in geology, geochemistry, geophysics, seismology, oceanography, earth and planetary sciences, atmospheric sciences and meteorology.

Non-physics data: NCES Digest of Education Statistics 2003, Table 255.

AIP Statistical Research Center, Enrollments and Degrees Report.

Foreign citizens and permanent residents continue to make up only a small fraction of the undergraduate physics degrees conferred in the US, with 6% of the class of 2003 being non-US citizens.

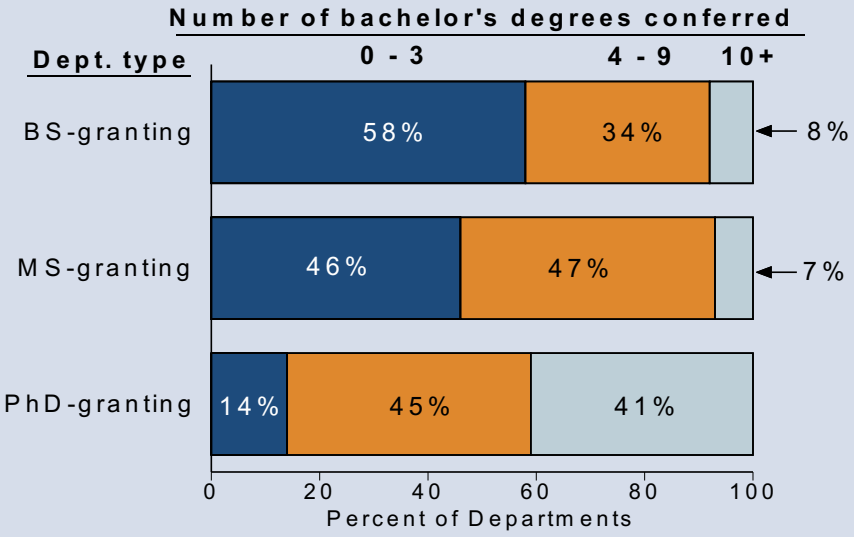
**Table 4. Size of physics bachelor's class by type of department, class of 2003.**

| Department Type | Degrees per Department: Average | Median |
|---|---|---|
| Bachelor's-granting | 3.9 | 3 |
| Master's-granting | 4.6 | 4 |
| PhD-granting | 12.8 | 8 |

AIP Statistical Research Center, Enrollments and Degrees Report.

Departments with doctoral programs tend to have considerably larger undergraduate classes than undergraduate-only programs and at departments where the master's is the highest physics degree offered. **Table 4** and **Figure 3** illustrate the difference in the size of degree classes by type of department for the bachelors conferred in the 2002-2003 academic year. Physics departments where the PhD was the highest degree offered (N=185) averaged 12.8 bachelors per department, with 41% conferring more than 10 degrees. This compares with an average of 3.9 degrees for undergraduate-only departments (N= 511), with only 8% conferring 10 or more degrees. Although the individual bachelor's-only departments tend to be smaller, their far greater numbers were responsible for producing 44% of all physics bachelors in the class of 2003.

**Figure 3. Number of physics bachelor's by highest physics degree offered, class of 2003.**

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**Tables 5**, **6** and **7** list the departments that were responsible for producing the largest number of physics bachelors during the last three years. The tables are organized by the highest physics degree offered by the department and show three-year averages to minimize year-to-year fluctuations.

About one-third of the physics bachelors take more than 4 years to complete their degree. The most frequently cited reasons for delayed graduation are earning a double major and changing majors.[2]

**Table 5. Bachelor's-granting departments averaging 10 or more physics bachelor's degrees per year, classes of 2001, 2002 and 2003.**

| | Annual Average | | Annual Average |
|---|---|---|---|
| US Air Force Academy (CO) | 22 | Bethel College (MN) | 11 |
| Harvey Mudd College (CA) | 21 | Bucknell U (PA) | 11 |
| Carleton College (MN) | 19 | Longwood U (VA) | 11 |
| College of Charleston (SC) | 19 | Middlebury College (VT) | 11 |
| US Naval Academy (MD) | 19 | U of Puget Sound (WA) | 11 |
| Illinois St U | 18 | Saint Olaf College (MN) | 11 |
| U of Wisconsin-La Crosse | 18 | U.S. Military Academy (NY) | 11 |
| Colorado College | 17 | Whitman Coll (WA) | 11 |
| Reed College (OR) | 17 | Colby College (ME) | 10 |
| Bates College (ME) | 16 | James Madison U (VA) | 10 |
| Grinnell College (IA) | 15 | Lawrence U (WI) | 10 |
| SUNY Coll-Geneseo (NY) | 15 | Murray State U (KY) | 10 |
| Bowdoin College (ME) | 14 | Pomona College (CA) | 10 |
| CA Poly St U-San Luis Obispo | 14 | Santa Clara U (CA) | 10 |
| Gustavus Adolphus Coll (MN) | 14 | SUNY Coll at Fredonia (NY) | 10 |
| Xavier U (LA) | 14 | Truman State U (MD) | 10 |
| Oberlin College (OH) | 12 | Western Washington U | 10 |
| U of Puerto Rico-Humacao | 12 | | |

Note: List includes only those departments who contributed degree data for all 3 years.

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**Table 6. Master's-granting departments averaging 7 or more physics bachelor's degrees per year, classes of 2001, 2002 and 2003.**

| | Annual Average |
|---|---|
| Miami U (OH) | 13 |
| Northern Arizona U | 13 |
| CA State U-Northridge | 12 |
| Appalachian State U (NC) | 10 |
| Southwest Missouri St U | 10 |
| CA State U-Fullerton | 9 |
| San Jose State U (CA) | 9 |
| Cleveland State U (OH) | 8 |
| Texas State U-San Marcos | 8 |
| Virginia Commonwealth U | 8 |
| Creighton U (NE) | 7 |
| U of Memphis (TN) | 7 |
| San Diego State U (CA) | 7 |
| SUNY-Binghamton U (NY) | 7 |

Note: List includes only those departments who contributed degree data for all 3 years.

AIP Statistical Research Center, Enrollments and Degrees Report.

Approximately half of new physics bachelors immediately continue their education at the graduate level after receiving their degree, with about two-thirds continuing in the fields of physics or astronomy. Only about 1 in 7 of US physics bachelor's recipients eventually receive a physics or astronomy PhD, joining a roughly equal number of foreign citizens earning these PhDs in the US. The bachelors not immediately continuing their education enter the workforce, with the largest proportion finding employment in the private sector.[3]

**Table 7. PhD-granting departments averaging 20 or more physics bachelor's degrees per year, classes of 2001, 2002 and 2003.**

| | Annual Average |
|---|---|
| U of California-Berkeley | 65 |
| U of Washington | 57 |
| MA Inst of Technology | 55 |
| Harvard U (MA) | 53 |
| Brigham Young U (UT) | 49 |
| CA Inst of Technology | 36 |
| U of IL-Urbana/Champaign | 36 |
| Rutgers U-New Brunswick (NJ) | 35 |
| U of Texas-Austin | 34 |
| U of California-San Diego | 33 |
| U of California-Santa Cruz | 30 |
| U of Virginia | 30 |
| U of Arizona | 28 |
| U of Chicago (IL) | 27 |
| U of Maryland-College Park | 26 |
| U of CA-Los Angeles | 25 |
| Ohio St U | 25 |
| U of California-Santa Barbara | 24 |
| Cornell U-Applied (NY) | 23 |
| Cornell U (NY) | 22 |
| Purdue U-W. Lafayette (IN) | 22 |
| Carnegie Mellon U (PA) | 21 |
| CO Sch of Mines & Tech | 21 |
| U of California-Davis | 21 |
| U of Michigan-Ann Arbor | 21 |
| Portland St U (OR) | 21 |
| U of California-Irvine | 20 |
| Georgia Inst of Tech | 20 |
| U of MN-Minneapolis | 20 |
| Pennsylvania St U | 20 |
| Coll of William & Mary (VA) | 20 |

Note: List includes only those departments who contributed degree data for all 3 years.

AIP Statistical Research Center, Enrollments and Degrees Report.

## GRADUATE PHYSICS ENROLLMENTS

The number of students entering US graduate physics programs has increased for the fifth consecutive year. There were 3,168 students entering physics departments in the fall of 2003, representing a 31% increase over the recent low in the fall of 1998 **(**see **Cover)**.

Although international students still make up a significant portion of the first-year graduate students at US physics departments, they now represent less than half of the incoming students. In the fall of 2003 foreign students comprised 46% (1457 out of 3168) of the entering students, compared to 55% in the fall of 2000. The decline in the proportion of first-year foreign students is not due to a fall in their actual numbers, but rather can be attributed to a remarkably rapid rise in the number of entering US students. The fall of 1998 marked the end of 7 years of declining US student enrollments. From that low point, new US student enrollments have increased 47% while new foreign student enrollments have increased only 16%.

Visa issues and the perceived climate toward foreign graduate students have been in the forefront of concerns when it comes to international students coming to study in the US since September 11, 2001. Approximately 20% of admitted foreign students in the fall of 2002 were at least initially prevented from attending.[4] Although some of the shifts in recent incoming foreign student enrollments can be attributed to heightened visa regulations, it should be noted that foreign student enrollments experienced a decline prior to 9/11 and have now risen for the students entering in the fall of 2003. A second report addressing international student enrollments in the fall of 2004 and the impact of visa regulations at US graduate physics departments will be available later this year.

The majority of incoming students were physics bachelors who received their undergraduate degree the previous academic year. Approximately 15% of first-year physics graduate students indicated that they received their undergraduate degree in a subject other than physics. A significant proportion, about a quarter, of the first-year students who were US citizens indicated they delayed entry into graduate school for a year or more after receiving their bachelor's degree. Finally, the figures for first-year student enrollments include as many as 10% who had transferred from other US physics graduate programs.[5]

**Table 8. Characteristics of first-year physics graduate students by highest degree of department, fall of 2003.**

| | | PhD-granting | Masters-granting |
|---|---|---|---|
| Number of departments | | 185 | 68 |
| Gender (%) | | | |
| | Male | 79 | 80 |
| | Female | 21 | 20 |
| Citizenship (%) | | | |
| | US | 53 | 60 |
| | Foreign | 47 | 40 |
| Type of support* (%) | | | |
| | Teaching assistantship | 60 | 69 |
| | Research assistantship | 18 | 13 |
| | Fellowship | 18 | 3 |
| | Self-financed | 4 | 15 |
| Total first-year enrollments | | 2863 | 305 |

*Graduate Student Report: First-year Physics and Astronomy Students in 2002 & 2003

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**Table 8** shows the characteristics of first-year graduate students by the type of department in which they are enrolled. The table shows that non-US citizens make up a somewhat larger proportion of students enrolling in departments that offer a PhD than in departments that offer the masters as their highest physics degree. It also shows that first-year physics graduate students are typically well supported, with the vast majority receiving some type of financial support, most commonly teaching assistantships.[5]

## GRADUATE PHYSICS DEGREES

There were 672 students who exited physics departments with a master's degree in the class of 2003. Only about one-third of these degrees came from the 68 physics departments that offer the masters as their highest degree. The remainder received their degrees from the 185 departments that also have a doctoral program (see **Figure 4**). Twenty-one percent of these exiting masters were women and 40% were non-US citizens. The distribution of these two groups was similar for both department types.

Clearly, all the master's recipients who received their degree from a department where the master's was the highest degree offered intended to receive a master's, although many have intentions to continue their education in physics or another field. This is not necessarily the case for master's recipients exiting departments that also offer a PhD. A proportion of these may have always intended to only go as far as the masters while others may have originally aimed at a PhD.

The master's-granting departments listed in **Table 9** awarded the largest number of exiting master's degrees during the last three years.

**Figure 4. Master's degrees conferred by type of degree and department, 1983-2003.**

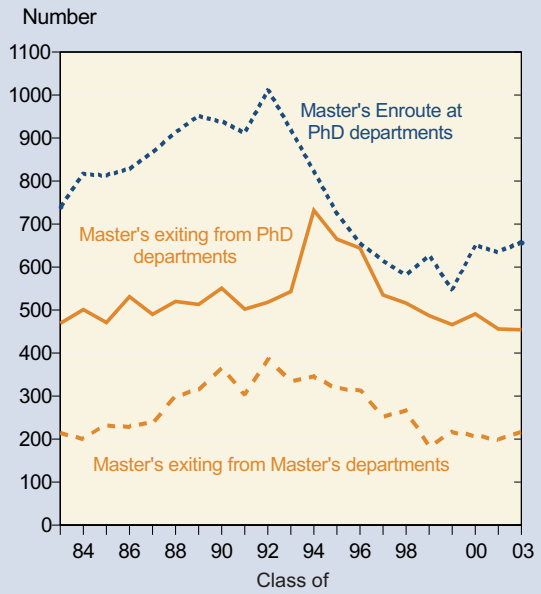


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**Table 9. Master's-granting departments averaging 3 or more physics master's degrees per year, classes of 2001, 2002 and 2003.**

| | Annual Average |
|---|---|
| Ball State U (OH) | 7 |
| U of Mass, Dartmouth | 7 |
| San Jose State U (CA) | 7 |
| Central Michigan U | 6 |
| Christopher Newport U (VA) | 6 |
| U of Louisville (KY) | 6 |
| San Diego State U (CA) | 6 |
| San Francisco State U (CA) | 6 |
| Southwest MO State U | 6 |
| Miami U (OH) | 5 |
| U of Texas, El Paso | 5 |
| Western Illinois U | 5 |

Note: List includes only those departments who contributed degree data for all 3 years.

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These 12 departments represent 18% of the departments but awarded 34% of all the master's degrees from master's-granting institutions over the three-year period.

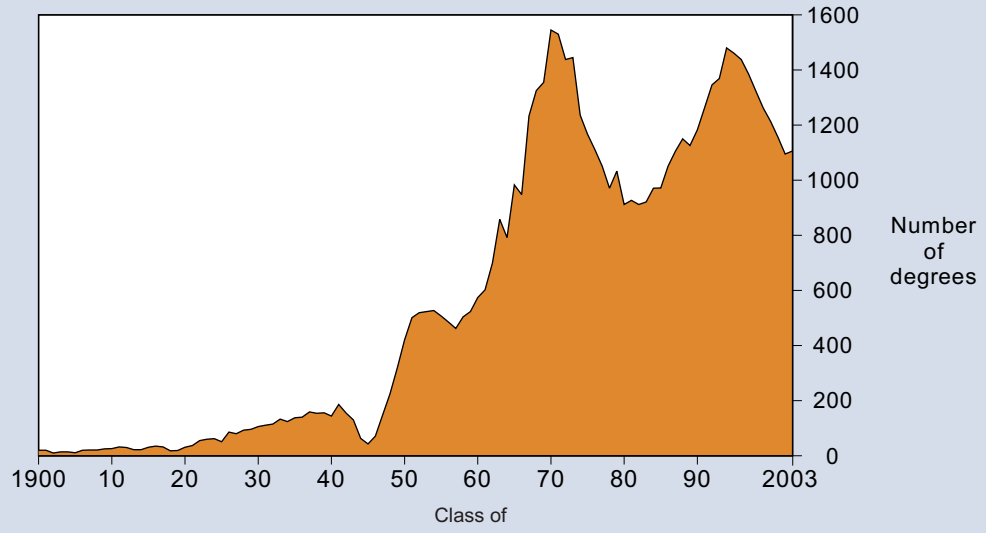
The initial outcomes of exiting masters vary greatly by citizenship. A little over a quarter of the masters who are US citizens continue with graduate studies in another department, compared to about three-quarters of the foreign citizens. For both groups, the majority of the individuals continuing with their graduate studies enroll in a physics PhD program at another US institution.[3]

The number of students that departments reported as receiving a master's degree enroute (continuing at that same doctoral institution in pursuit of a physics PhD) has been relatively stable for the classes of 2001 through 2003 at around 650 degrees **(**see **Figure 4)**. The master's enroute degree is optional in many PhD departments so not all students who obtain a PhD receive this interim degree. The number of these degrees conferred is expected to rise in the next year or two, following recent increases seen in first-year student enrollments.

The PhD class of 2003 reflects a 1% increase in physics PhD production over the class of 2002, with 1106 degrees conferred **(**see **Figure 5)**. Although small, this increase marks the end of 8 years of steady declines totaling 26% in all.

The last two degree classes have reflected some important changes in the composition of new US physics PhDs. Women made up 18% of the class of 2003, up from 13% just two years earlier. Changes in the representation of women among physics degree recipients will be discussed later in the report. The second notable change is in the representation of non-US citizens **(**see **Figure 6)**. Foreign citizens comprised over half of the new doctorates (52%) in the classes of 2002 and 2003, the first time this threshold has been reached.

**Figure 5. Number of physics PhDs conferred in the United States, 1900 to 2003.**




Sources: ACE (1900-1919), NAS (1920-1961), AIP (1962-2003)
AIP Statistical Research Center, Enrollments and Degrees Report.

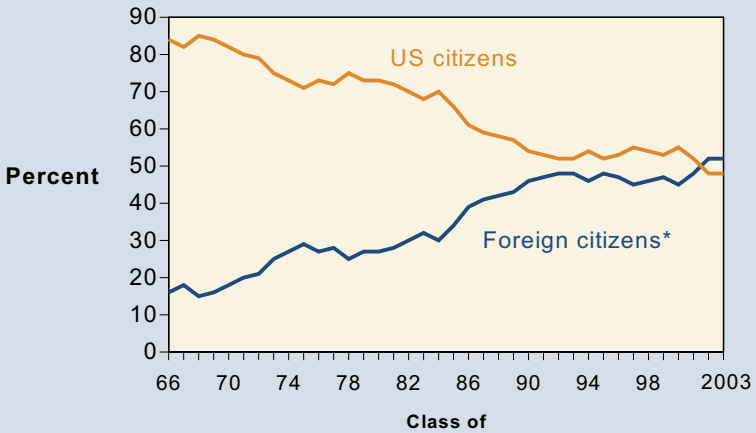
The physics PhDs in the classes of 2002 and 2003 who were US citizens reported both a median and an average of 6 Full-Time Equivalent (FTE) years of graduate study to complete their degree.[3] Generally, foreign PhD recipients spend a shorter amount of time enrolled in US graduate physics programs. However, it is unclear how many FTE years of physics graduate study foreign citizens took to receive their degree, because such a large proportion (about 50%) had been enrolled in the equivalent of a physics graduate program, often in their home country, before enrolling in their current department.[5]

The number of FTE years that PhD recipients reported taking to complete their degree varied by dissertation research method. About ¾ of recent physics PhD recipients who were US citizens reported their dissertation method was experimental or observational. Of these PhDs, only 26% reported completing their PhD in 5 FTE years or less. On the other hand, PhDs whose research method was theoretical or primarily involved computer modeling, represented a significantly larger percentage, 41%, completing their PhD in 5 FTE years or less.[6]

**Table 10** lists the departments that are responsible for producing the largest number of physics PhDs during the last three years. The 18 departments listed represent only 10% of all the doctoral departments, but they awarded 34% of all the PhDs conferred over the three-year period.

In recent years there has been a sharp increase in the proportion of new PhDs accepting postdocs. In 2003, 68% accepted a postdoc, up from around 45% in the late 1990's.[6] There can be many factors influencing the type of initial employment a new PhD will accept, including: the economic conditions at the time they receive their degree, their subfield of dissertation, and an individual's long-term career goal. In general, poor economic conditions, larger proportions of students in theoretically-orientated subfields, and more students aspiring to academic careers, will all tend to raise the proportion of PhDs accepting postdocs after graduation.

**Figure 6. Citizenship of physics PhDs, 1966 to 2003.**




*Foreign citizens include individuals with permanent resident status and those with temporary visas.

Sources: NSF(1966-1991), AIP (1992-2003)
AIP Statistical Research Center, Enrollments and Degrees Report.

**Table 10. Departments averaging 15 or more physics doctorates per year, classes of 2001, 2002 and 2003.**

| | Annual Average | | Annual Average |
|---|---|---|---|
| MA Inst of Technology | 33 | U of California, Santa Barbara | 17 |
| U of Texas-Austin | 31 | U of Maryland, College Park | 17 |
| U of California-Berkeley | 30 | CA Inst of Technology | 16 |
| U of IL-Urbana/Champaign | 30 | U of CA, Los Angeles | 16 |
| SUNY-Stony Brook (NY) | 27 | U of MN, Minneapolis | 16 |
| Stanford U (CA) | 22 | U of Wisconsin, Madison | 16 |
| Harvard U (MA) | 21 | U of California, San Diego | 15 |
| Ohio St U | 21 | Princeton U (NJ) | 15 |
| Cornell U (NY) | 18 | Stanford U, Applied (CA) | 15 |

Note: List includes only those departments who contributed degree data for all 3 years.

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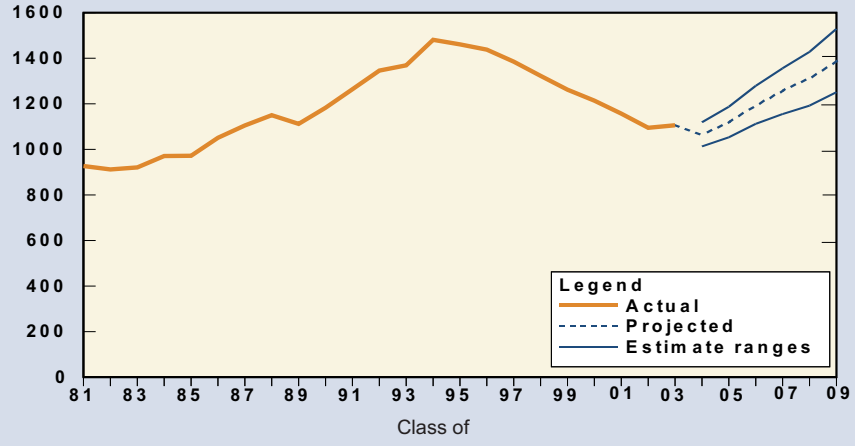
## PHYSICS DOCTORATE PROJECTIONS

Figure 5 shows that, after 8 years of steady declines, PhD production increased modestly in 2003. The relatively stable first-year student enrollment figures in the late 1990's, which were followed by consistent yearly increases, suggest that this is not just a one-year anomaly. PhD production should start to register relatively steady increases in a couple of years.

By using past first-year student enrollment figures and factoring in the time it takes to earn a PhD, along with the percent of individuals who exit doctoral programs prior to receiving a PhD, we have projected PhD production through the class of 2009 **(**see **Figure 7)**.

**Figure 7. Projections for the number of PhDs in the classes of 2004 through 2009.**




AIP Statistical Research Center, Enrollments and Degrees Report.

## WOMEN

The proportion of women receiving physics bachelor's degrees had experienced steady increases of about one percent a year during the 8 year period covering the classes of 1994 to 2001, topping out at 23%. The classes of 2002 and 2003 represent a leveling off of the proportion of bachelor's degrees conferred on women, with 22% in both classes **(**see **Figure 8)**. Physics has one of the lowest representations of women among undergraduate degree recipients of any of the science and engineering fields.

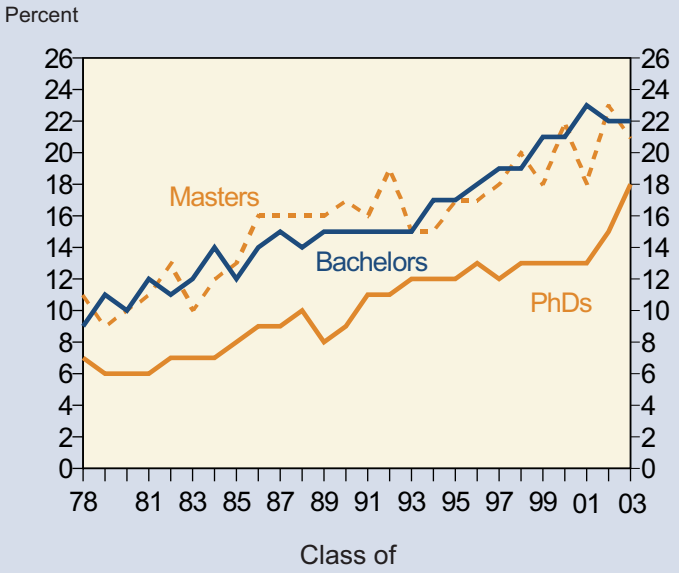
Although the representation of women among physics bachelors is low, the steady increases experienced in recent years do translate into a sizable increase in the total number of women receiving physics bachelor's degrees. The 988 women who received a physics bachelor's degree in the class of 2003 represent an increase of approximately 40% from a decade earlier.

The proportion of exiting master's degrees conferred on women has been very similar to the proportion for undergraduate degrees. The exiting masters in the class of 2003 included 21% women, which corresponds to 142 individuals.

The representation of women at the doctoral level has risen especially sharply during the last two years, reaching an all time high. The class of 2003 included 18% women, up from 13% only two years earlier. It should be noted that this recent sharp increase is largely a result of an increase in the proportion of women among PhD recipients who were foreign citizens. In the class of 2003, 19.5% of the physics PhDs awarded to foreign citizens were women, compared to only 15% for US citizens.

For more detail on the representation of women throughout the physics and astronomy community please see the AIP report: *Women in Physics and Astronomy, 2005* at http://www.aip.org/statistics/trends/reports/women05.pdf

**Figure 8. Percent of bachelor's degrees, masters degrees and doctorates in physics earned by women, 1978-2003.**




Note: A form change occured in 1994 resulting in a more accurate representation of women among physics bachelors. Some of the increase in 1994 only, may be a result of that change.

AIP Statistical Research Center, Enrollments and Degrees Report.

**Table 11. Number and percent of physics degrees granted to US citizens by minority / ethnic group status, class of 2003.**

| | Bachelor's | | Exiting Master's | | PhD's | |
|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent |
| African-American | 152 | 4 | 15 | 4 | 12 | 2 |
| Hispanic-American | 144 | 3 | 14 | 4 | 13 | 2 |
| White | 3711 | 87 | 332 | 83 | 465 | 88 |
| Asian-American | 171 | 4 | 20 | 5 | 29 | 6 |
| Other | 110 | 3 | 18 | 4 | 11 | 2 |
| Total US Citizens | 4288 | 100% | 399 | 100% | 530 | 100% |

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## MINORITIES

Hispanic-Americans and African-Americans continue to be seriously under-represented among physics degree recipients **(**see **Table 11)**. Physics has one of the lowest proportions of African-Americans and Hispanic-Americans of all the science fields, and this is true regardless of degree level.

The nation's Historically Black Colleges and Universities (HBCU's) play a significant role in producing a large proportion of the degrees conferred on African-Americans, regardless of discipline. The 35 HBCU's that have degree programs in physics were responsible for conferring 49% of all the physics bachelor's degrees conferred to African-Americans in the class of 2003. **Table 12** lists the institutions, all of which are HBCU's, which have recently averaged the greatest number of physics bachelor's degrees granted to African-American students.

Similarly, at the graduate level, the four doctoral-granting physics programs and six masters-granting departments at HBCU's conferred 42% and 33%, respectively, of the PhDs and master's degrees granted to African-Americans in 2003.

Although not necessarily from specific institutions, Hispanic-Americans receiving physics bachelor's degrees tend to be concentrated in the southern states. Two-thirds (65%) of the 144 Hispanic-Americans receiving physics bachelor's degrees received their degrees either from Puerto Rico or one of four states that each conferred more than 3 three times the national average of physics bachelors on Hispanic-Americans: California, Florida, New Mexico, and Texas.

**Table 12. Departments averaging 3 or more African-American physics bachelor's per year, classes of 2001, 2002 and 2003.**

| | Annual Average |
|---|---|
| Xavier U (LA) | 14 |
| Benedict Coll (SC) | 5 |
| Alabama A&M U (AL) | 4 |
| Florida A&M U | 4 |
| Hampton U (VA) | 4 |
| Morgan St U (MD) | 4 |
| North Carolina A&T St U | 4 |
| Spelman Coll (GA) | 4 |
| Grambling St U (LA) | 3 |

Note: List includes only those departments who contributed degree data for all 3 years.

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## ASTRONOMY

The 76 departments with astronomy degree programs in 2003 fall into two distinct groups **(**see **Table 13)**. About half are stand-alone departments devoted strictly to the fields of astronomy and astrophysics, while the remaining half are administered in conjunction with a physics program. It should be noted that some students also receive degrees in astrophysics (primarily at the doctoral level) from stand-alone physics departments. These astrophysics degrees are included in the physics degree totals presented earlier in the report.

**Table 13. Number of degree-granting astronomy departments by highest astronomy degree offered, academic year 2002-2003.**

| Department Type | Combined with physics | Separate astronomy | Total |
|---|---|---|---|
| PhD-granting | 10 | 29 | 39 |
| Master's-granting | 2 | 2 | 4 |
| Bachelor's-granting | 25 | 8 | 33 |
| Total | 37 | 39 | 76 |

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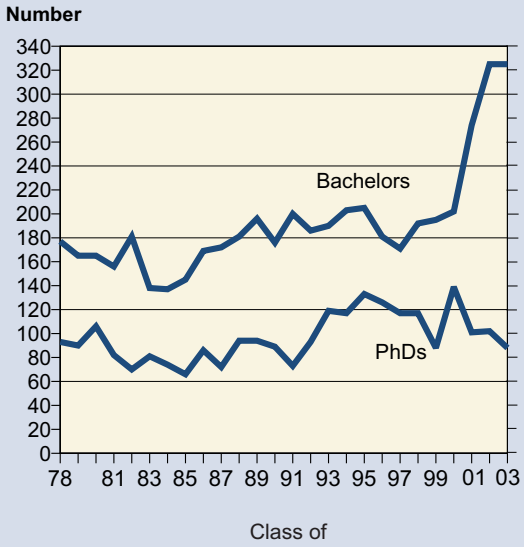
Approximately 176,000 students took an introductory astronomy course during the 2002-2003 academic year **(**see **Table 2)**. Most students took that course in a physics department that had no astronomy degree program. But, 30% took this course at an astronomy degree-granting department, even though such departments represent only about 10% of all physics and astronomy departments.

The number of astronomy bachelor's degrees conferred in recent years has risen sharply to an all time high **(**see **Figure 9)**. Although the 325 degrees conferred in 2003 represented no change form the previous year, the current total represents a 61% increase over the 202 degrees conferred in the class of 2000.

**Figure 9. Astronomy bachelors degrees and doctorates awarded in the US, 1978-2003.**




Note: The astronomy doctorate totals presented here do not include astrophysics degrees conferred by physics departments. Those degrees are included among the physics totals.

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A great deal of this gain is attributable to a sharp increase in the number of women receiving astronomy bachelor's degrees **(**see **Figure 10)**. During the last three years the number of men receiving astronomy bachelor's degrees has increased 30%, during the same time period the number of women has increased 122%. While women have traditionally been better represented among astronomy degree recipients at all levels, the 46% of the astronomy bachelors conferred on women in the class of 2003 is now more than double that of their undergrad physics counterpart.

**Figure 10. Percent of bachelor's degrees and doctorates in astronomy earned by women, 1973-2003.**

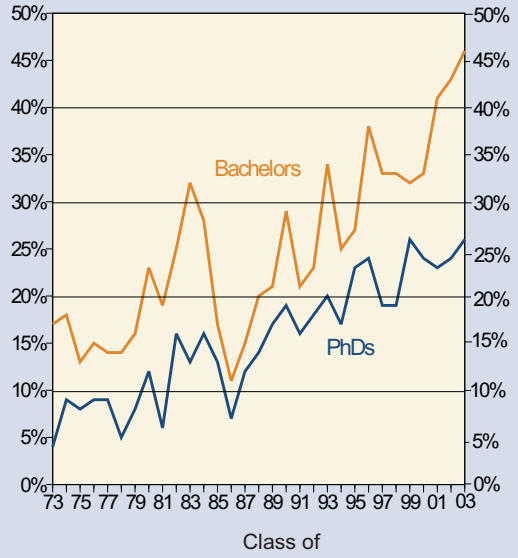


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**Table 14** lists the astronomy departments that granted the largest number of astronomy bachelor's during the last three years. All but one (Williams College) of the departments listed also have a doctoral program in astronomy. Almost three-quarters of all the astronomy bachelors came from departments that also offer an astronomy PhD.

About half of astronomy bachelors chose to continue their studies at the graduate level, over half of which continue in physics or astronomy. For those going directly into the workforce, the private sector is the largest employer.[3]

There were 22 exiting astronomy master's degrees conferred on the class of 2003. Of these, 12 were women and 6 were non-US citizens, of whom half are women. Only two of these masters were conferred at one of the four astronomy departments where the masters is the highest degree offered.

There were 88 astronomy PhDs conferred at the 39 doctoral-granting departments in the class of 2003. Women and foreign citizens each comprise about a quarter of the new astronomy doctorates. This is only the second time in over a decade that astronomy PhD production has fallen below 100 degrees. With first-year astronomy student enrollments slowly rising in recent years, it is likely that PhD production will not remain at this lower level.

Postdoctoral appointments are the prevailing post degree outcome for new astronomy PhDs, with about three-quarters of new doctorates accepting one.[3]

**Table 14. Astronomy departments averaging 7 or more astronomy bachelor's degrees per year, classes of 2001, 2002 and 2003.**

| | Annual Average |
|---|---|
| U of Washington | 17 |
| U of Wisconsin-Madison | 13 |
| U of CA-Los Angeles | 12 |
| U of Arizona | 11 |
| U of Texas-Austin | 11 |
| U of Virginia | 11 |
| Boston U (MA) | 10 |
| Pennsylvania St U | 10 |
| Michigan State U | 9 |
| U of MA-Amherst | 9 |
| U of Maryland-College Park | 8 |
| Williams College (MA) | 8 |
| Florida Inst of Tech | 7 |
| Harvard U (MA) | 7 |

Note: List includes only those departments who contributed degree data for all 3 years.

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# APPENDIX

**A1. Trend in astronomy enrollments* and degrees, academic years 1991 to 2004.**

| Academic Year | Number of astronomy degrees granted: Bachelor's | Exiting Master's | PhD's | Undergraduate astronomy major enrollments: Juniors | Seniors | Graduate astronomy student enrollments: 1st-year | Total |
|---|---|---|---|---|---|---|---|
| 1991-92 | 186 | 31 | 93 | 290 | 331 | 175 | 935 |
| 1992-93 | 190 | 56** | 119 | 337 | 348 | 173 | 939 |
| 1993-94 | 203 | 34 | 117 | 257 | 388 | 180 | 901 |
| 1994-95 | 205 | 43 | 133 | 269 | 351 | 165 | 905 |
| 1995-96 | 181 | 44 | 126 | 272 | 361 | 149 | 874 |
| 1996-97 | 177 | 23 | 117 | 265 | 332 | 155 | 837 |
| 1997-98 | 192 | 29 | 116 | 252 | 330 | 143 | 777 |
| 1998-99 | 195 | 23 | 88 | 263 | 340 | 165 | 799 |
| 1999-00 | 202 | 25 | 139 | 395 | 409 | 187 | 838 |
| 2000-01 | 274 | 13 | 101 | 391 | 461 | 180 | 809 |
| 2001-02 | 325 | 22 | 102 | 420 | 478 | 170 | 807 |
| 2002-03 | 325 | 22 | 88 | 385 | 576 | 201 | 892 |
| 2003-04 | | | | 441 | 540 | 218 | 966 |

* Includes part-time students.
** Thirty-four Master's came from the Arizona Summer Science Institute for science teachers at the University of Arizona.

Note: The astronomy doctorate totals presented here do not include astrophysics degrees conferred by physics departments. Those degrees are included among the physics totals.

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**A2. Trend in physics enrollments* and degrees, academic years 1991 to 2004.**

| Academic Year | Number of physics degrees: Bachelor's | Exiting Master's | PhD's | Undergraduate physics major enrollments: Juniors | Seniors | Graduate physics student enrollments: 1st-year | Total |
|---|---|---|---|---|---|---|---|
| 1991-92 | 4770 | 906 | 1346 | 6435 | 7268 | 3306 | 14534 |
| 1992-93 | 4800 | 877 | 1369 | 6287 | 7297 | 3090 | 14430 |
| 1993-94 | 4615 | 1077 | 1481 | 6146 | 7289 | 2902 | 14201 |
| 1994-95 | 4263 | 985 | 1461 | 5620 | 6836 | 2604 | 13285 |
| 1995-96 | 4156 | 959 | 1438 | 5335 | 6489 | 2462 | 12596 |
| 1996-97 | 3826 | 789 | 1385 | 5057 | 6116 | 2404 | 11786 |
| 1997-98 | 3821 | 782 | 1323 | 5006 | 5857 | 2423 | 11302 |
| 1998-99 | 3646 | 671 | 1262 | 5026 | 5593 | 2417 | 10971 |
| 1999-00 | 3894 | 684 | 1214 | 5227 | 5913 | 2510 | 10768 |
| 2000-01 | 4091 | 701 | 1157 | 5428 | 6309 | 2713** | 10978 |
| 2001-02 | 4305 | 657 | 1095 | 5599 | 6521 | 2777 | 11402 |
| 2002-03 | 4553 | 672 | 1106 | 6026 | 7104 | 2875 | 11995 |
| 2003-04 | | | | 6333 | 7532 | 3168 | 12141 |

* Includes part-time students.
** 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 8% increase in total first-year students between 2000 and 2001.

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**A3. Trend in physics enrollments* and degrees by institution type, academic years 1991 to 2004.**

| | Number of physics degrees granted | | | Undergraduate physics major enrollments | | Graduate physics student enrollments | |
|---|---|---|---|---|---|---|---|
| Academic Year | Bachelor's | Exiting Master's | PhD's | Juniors | Seniors | 1st-year | Total |
| **Doctorate-granting institutions** | | | | | | | |
| 1991-92 | 2261 | 518 | 1346 | 3057 | 3729 | 2831 | 13118 |
| 1992-93 | 2253 | 543 | 1369 | 3038 | 3845 | 2688 | 13222 |
| 1993-94 | 2203 | 732 | 1481 | 2920 | 3729 | 2509 | 13042 |
| 1994-95 | 2009 | 665 | 1461 | 2648 | 3453 | 2209 | 12173 |
| 1995-96 | 1918 | 644 | 1438 | 2461 | 3344 | 2117 | 11545 |
| 1996-97 | 1746 | 535 | 1385 | 2200 | 3133 | 2074 | 10900 |
| 1997-98 | 1710 | 516 | 1323 | 2223 | 2899 | 2127 | 10432 |
| 1998-99 | 1688 | 487 | 1262 | 2363 | 2814 | 2174 | 10256 |
| 1999-00 | 1871 | 466 | 1214 | 2412 | 3053 | 2304 | 10104 |
| 2000-01 | 1849 | 491 | 1157 | 2565 | 3270 | 2431** | 10272 |
| 2001-02 | 2036 | 456 | 1095 | 2684 | 3399 | 2480 | 10622 |
| 2002-03 | 2262 | 454 | 1106 | 2951 | 3792 | 2614 | 11237 |
| 2003-04 | | | | 3058 | 4079 | 2863 | 12141 |
| **Master's-granting institutions** | | | | | | | |
| 1991-92 | 525 | 388 | | 802 | 938 | 475 | 1416 |
| 1992-93 | 448 | 334 | | 719 | 887 | 405 | 1208 |
| 1993-94 | 475 | 345 | | 696 | 930 | 393 | 1159 |
| 1994-95 | 420 | 320 | | 610 | 813 | 395 | 1113 |
| 1995-96 | 376 | 315 | | 556 | 703 | 345 | 1047 |
| 1996-97 | 314 | 254 | | 530 | 667 | 330 | 886 |
| 1997-98 | 320 | 266 | | 561 | 636 | 296 | 870 |
| 1998-99 | 275 | 184 | | 478 | 576 | 243 | 715 |
| 1999-00 | 335 | 218 | | 465 | 589 | 206 | 664 |
| 2000-01 | 323 | 210 | | 438 | 574 | 282** | 706 |
| 2001-02 | 340 | 201 | | 443 | 594 | 297 | 780 |
| 2002-03 | 310 | 218 | | 494 | 610 | 261 | 758 |
| 2003-04 | | | | 548 | 694 | 305 | 800 |
| **Bachelor's-granting institutions** | | | | | | | |
| 1991-92 | 1984 | | | 2576 | 2601 | | |
| 1992-93 | 2099 | | | 2530 | 2565 | | |
| 1993-94 | 1937 | | | 2530 | 2630 | | |
| 1994-95 | 1834 | | | 2362 | 2570 | | |
| 1995-96 | 1862 | | | 2318 | 2442 | | |
| 1996-97 | 1766 | | | 2327 | 2316 | | |
| 1997-98 | 1791 | | | 2225 | 2322 | | |
| 1998-99 | 1683 | | | 2185 | 2203 | | |
| 1999-00 | 1688 | | | 2348 | 2271 | | |
| 2000-01 | 1919 | | | 2425 | 2465 | | |
| 2001-02 | 1929 | | | 2472 | 2528 | | |
| 2002-03 | 1981 | | | 2581 | 2702 | | |
| 2003-04 | | | | 2727 | 2759 | | |

* Includes part-time students.

** A change in wording on the 2001 questionnaire resulted in more accurate data on first-year graduate students. This change was responsible for half of the increase at PhD institutions and a quarter of the increase at masters institutions.

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***Physics and Astronomy Senior Report: Class of 2001 (June 2004)***

Looks into the backgrounds, experiences and future plans of physics and astronomy majors at the point of graduation.

***Rosters of Physics and Astronomy Departments with Enrollments and Degree Data, 2003 (September 2004)***

Two reports detailing data for both physics and astronomy degree-granting departments in the U.S.

***2004 Salaries: Society Membership Survey Tables (April 2003)***

Collection of twelve tables each focusing on different aspects of PhD employment. The statistical data are based on salaries reported by U.S.-resident members of AIP's ten Member Societies during March 2004. Tables can be purchased individually for $5.00 each or as a collection for $25.00. Members of AIP's Member Societies and the Society of Physics Students receive a 20% discount. To order visit the AIP iStore at http://store.aip.org/salaries/

***Women in Physics and Astronomy, 2005 (February 2005)***

Data on the current and historic trends in the representation of women in physics, including comparative data on women in related fields.