AMERICAN INSTITUTE OF PHYSICS

AIP REPORT

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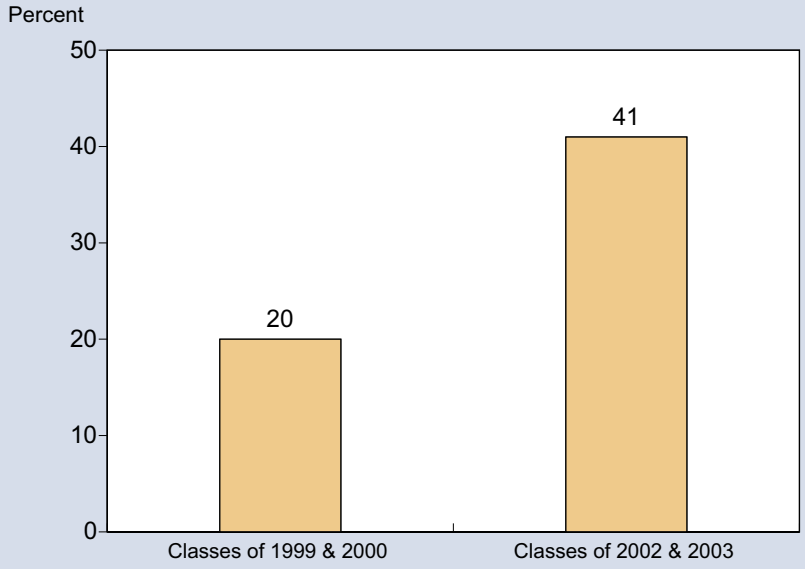
Initial Employment Report: Physics and Astronomy Degree Recipients of 2002 & 2003

Percent of new physics bachelors working in the private sector who took positions unrelated to science & engineering.



AIP Statistical Research Center, Initial Employment Report.

Highlights

- The proportion of new physics bachelors entering directly into the job market has declined significantly in recent years **(Figure 3)**.
- The proportion of physics bachelors working in the private sector who accept positions outside of science and engineering has doubled in recent years **(Figure 8)**. This has contributed to an overall decrease in starting salaries in the private sector **(Page 9).**
- The proportion of new physics PhDs taking postdocs has risen sharply for the third consecutive year to 69% in 2003 **(Figure 17)**. Foreign citizens accepted postdocs at a higher rate than their US counterparts **(Table 4)**.

Highlights continued

- The proportion of foreign physics masters continuing graduate study (80%) is far greater than that of US citizens (26%). As a result, foreign citizens represent only 12% of the physics masters entering the job market **(Table 3)**.
- If they had the opportunity to do it over again, well over three quarters of physics bachelor's recipients would choose to study physics again **(Figure 1).**
- The median debt for the two-thirds of the physics bachelors who borrowed money to fund their education was $18,000 **(Page 4)**.
- After receiving their PhDs, 17% of the foreign citizens and 4% of the US citizens left the country **(Page 15)**.
- Eighty-four percent of physics PhDs and 94% of astronomy PhDs would, if they had it to do over again, still get a PhD in their respective field **(Pages 20 & 22)**.
- Postdoctoral appointments continue to be the dominant outcome for new astronomy PhDs, with close to three quarters of the combined classes of 2002 and 2003 accepting one **(Figure 22)**.

Introduction:

Physics and Astronomy Degree Recipients face a variety of career and educational choices once they receive their degree. The decisions that they make are affected by a wide range of influences, such as student experiences, evolving interests, family issues, personal finances, long-term career goals, and the economic conditions they encounter.

The US economy has experienced some major changes in recent years, including a recession and slow recovery, the dot com bust, outsourcing and offshoring. It is, of course, virtually impossible to measure the impact of each of these major economic shifts on physics degree holders in particular. However, evidence of the troubled economy is visible for all degree levels discussed in this report. For example, although the private sector continues to be the dominant employer of physics degree recipients entering the workforce, its proportion has been declining for all degree levels, often a sign of economic weakness.

This report is based on the American Institute of Physics' Initial Employment Survey and focuses on the initial choices and career aspirations of recent degree recipients in the combined classes of 2002 and 2003. The survey is sent to physics and astronomy bachelors, masters and PhD recipients in the winter following the academic year in which they received their degree.

We would like to thank all of the physics and astronomy departments who make this report series possible by providing contact information for recent degree recipients, and supplying department level degree information. And we especially wish to thank the many degree recipients and faculty advisors who took the time to complete the questionnaires that are the basis for the data presented in this report.

Bachelor's Degree Recipients

Physics bachelor's degree production has risen dramatically in recent years. The 4553 bachelor's degrees granted in 2003 are up 6% over the class of 2002 and 25% from the class of 1999. The proportion of physics bachelors granted to foreign

citizens continues to hold steady at about 6%. The proportion of women receiving physics bachelors has been steadily rising and now represents 22% of physics bachelor's degrees. Despite the gains, physics continues to have a low proportion of female bachelor's recipients compared to most other science and engineering fields. For more information, see the American Instititute of Physics Enrollments and Degrees Report. (http://www.aip.org/statistics/trends/reports/ed.pdf)

Using a combination of department-supplied addresses and addresses supplied by students in their senior year, we obtained 2219 usable survey responses from the combined classes of 2002 and 2003. This represents 25% of the degree recipients in the combined classes. Bachelor's recipients can be very difficult to contact. Departments often do not maintain accurate forwarding information for their graduates, and the students themselves often can't predict what their mailing address will be 6 months to a year after receiving their degree. Beginning with the class of 2002, we started introducing an online version of the survey in conjunction with our traditional paper questionnaire. This methodical change has increased our response rate over that of past years.

The Initial Employment survey covers the outcomes of physics and astronomy bachelor's recipients, including employment and graduate school enrollment. The survey also addresses the financial debt incurred in order to attend college, perceptions of physics as a major, and long-term goals.

We ask the degree recipients whether, given the opportunity to do it over again, they would still major in physics. We use this question as a gauge of their overall sense of satisfaction with physics as a degree field. Overall, we found that 84% of the respondents from the combined classes of 2002 and 2003 would choose physics again **(Figure 1)**. Bachelor's recipients who continued on to graduate study held a slightly more positive attitude toward

Figure 1. Satisfaction with degree field, physics bachelors classes of 2002 & 2003.

"If I had to do it over again, I would still study physics or astronomy."

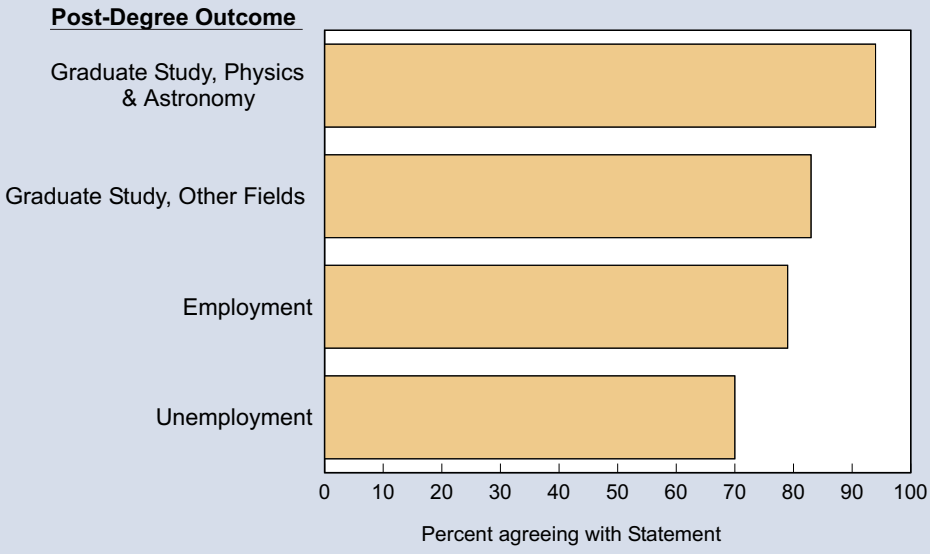


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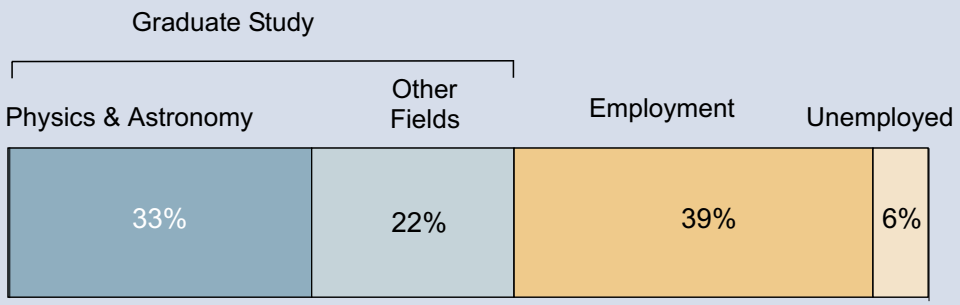
Figure 2. Initial outcomes of physics bachelors recipients, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

physics than their employed counterparts. Ninety-four percent of the degree recipients continuing on to graduate school said they would choose physics for their undergraduate degree again, compared to 79% of the employed and, surprisingly, 70% of the small number of unemployed bachelors.

Almost two thirds of the respondents from the classes of 2002 and 2003 borrowed money to fund their education. The median debt for those who did borrow was $18,000. Graduates from private institutions tended to carry more debt, with a median of $20,000, than those from public institutions, with a median of $16,000. Many of the respondents who borrowed to fund their education have been able to defer their debt repayments by continuing their education or, in a few cases, by enrolling in programs that offer debt relief, such as the Peace Corps or Americorps.

Initial outcomes for the combined classes of 2002 and 2003 are shown in **Figure 2**. Responding bachelors who are unemployed but not seeking employment (less than 2%) and those involved primarily in volunteer work (1%) are not included in the figure or the analyses that follow. The choices made by recent physics graduates have changed in recent years (**Figure 3**). Recent changes in data collection methods may have, to a small extent, magnified the increase in graduates immediately enrolling into physics graduate study as well as the decline in graduates directly entering the job market. Nonetheless, the declining job market for technical positions and the recent, steady increase in the number of US citizens enrolling in US graduate physics programs (AIP Enrollments & Degrees Report) suggest that much of this shift is real.

Figure 3. Trends in initial outcomes of physics bachelors, classes of 1995-2003.

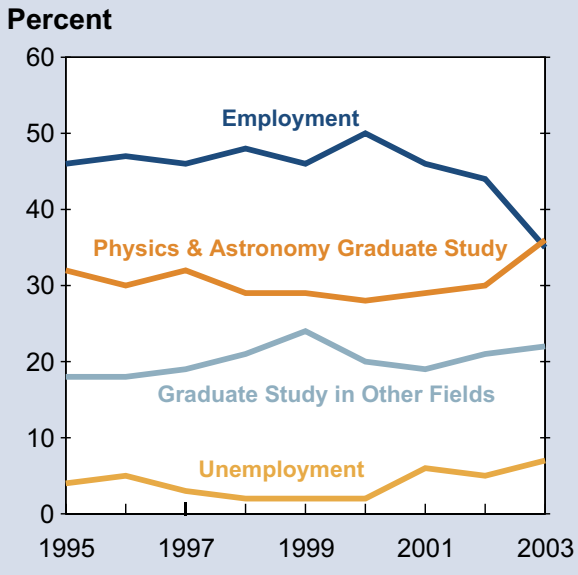


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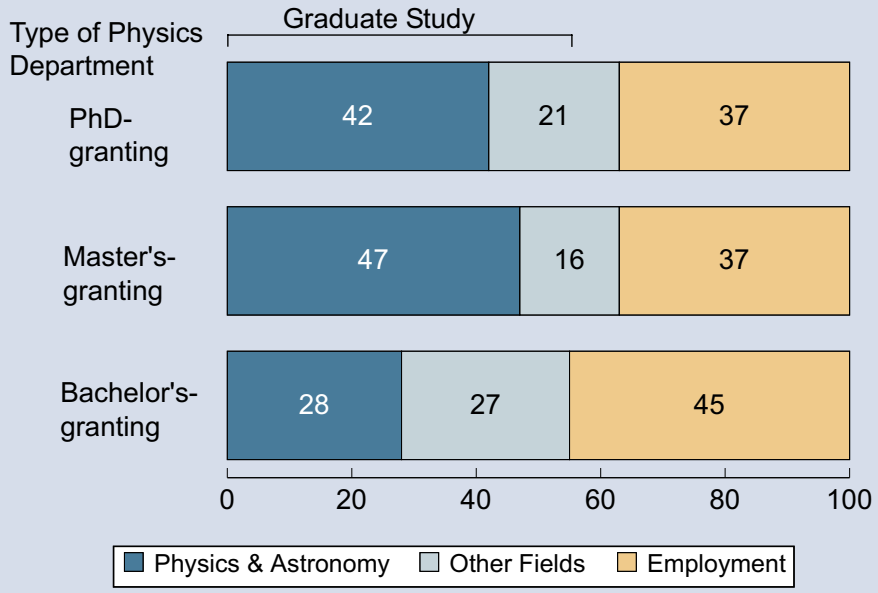
Figure 4. Initial outcomes by type of department attended, physics bachelor classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

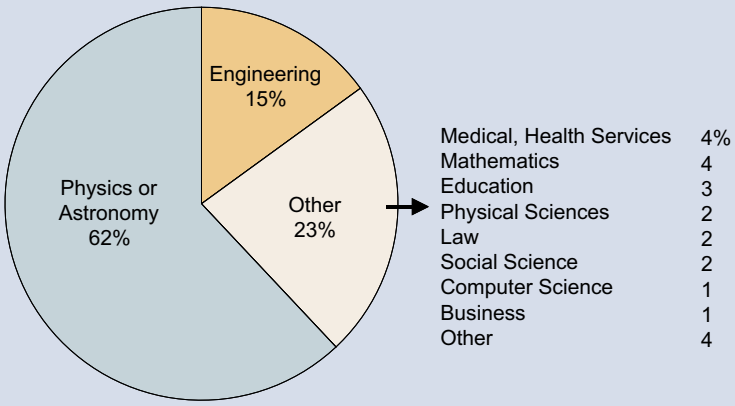
Initial outcomes for recent graduates vary by the highest physics degree granted by the graduates' bachelor-granting department (**Figure 4)**. As in the past, those receiving their bachelors from departments that also have a graduate physics program were more likely to continue with physics graduate study than degree recipients from departments that only offer bachelors in physics. This was especially true for those from departments whose highest physics degree was a masters. Bachelor-granting departments, which had the largest proportion of degree recipients entering directly into the workforce, also had the largest proportion choosing graduate school in other fields.

Physics Bachelors: Graduate Study

Just over half of the physics bachelors in the combined classes 2002 and 2003 chose to enroll directly into graduate school. Physics and astronomy continue to be the dominant fields of study chosen by recent physics bachelors **(Figure 5)**, but physics study prepares degree recipients for further study in many other fields as well. The overall proportion of physics bachelors continuing with graduate study in other fields has remained relatively stable for many years. Engineering continues to be the next most popular field of graduate study among physics bachelors. Fifteen percent of the bachelors who are continuing their education at the graduate level chose to study engineering. The wide variety of graduate study fields chosen by physics bachelors is depicted in **Figure 5**.

Among those continuing on with physics graduate study, some degree recipients chose to remain at the school that granted their bachelors. Degree recipients from departments where a masters degree was the highest physics degree offered were the most likely (36%) to remain at their school to continue their physics study. This compares to a little over a quarter of physics bachelors from departments where a PhD was the highest degree offered.

Figure 5. Fields of study for physics bachelors enrolling in graduate school, classes of 2002 & 2003.

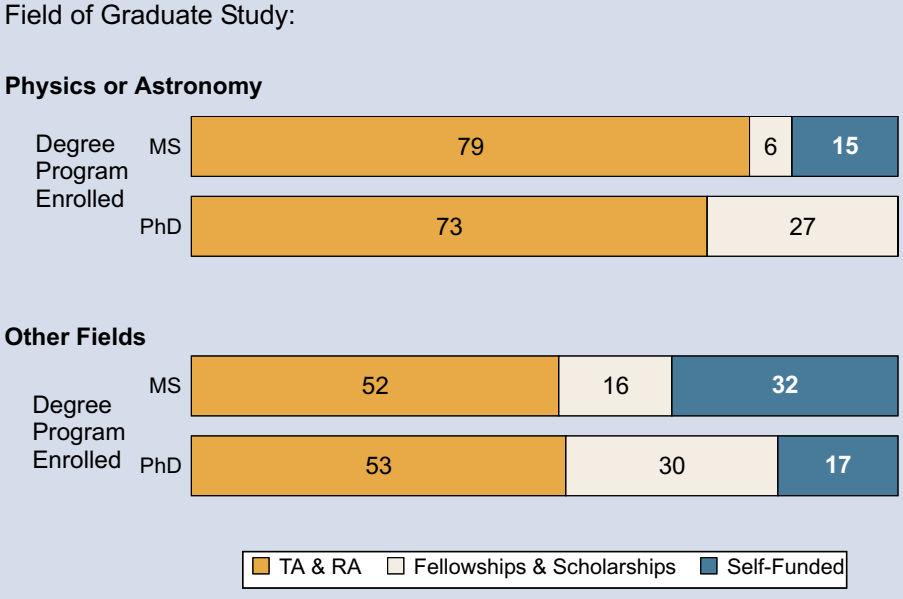


AIP Statistical Research Center, Initial Employment Report.

Nearly two-thirds of the physics bachelors entering graduate school enroll in a PhD program. The proportion of students continuing with physics who are enrolled in a PhD program is much higher (79%) than the proportion among students continuing in other fields (38%). Forty-four percent of the students continuing in other fields are enrolled in master's programs. The remaining 18% are spread between second bachelors, medical and legal, and other specialized degree programs.

The type of financial support that bachelors rely on to fund their graduate studies is strongly linked to both the field they pursue and the degree program that they enroll in. Students in master's degree programs, regardless of discipline, are traditionally more likely to support themselves than students in PhD programs **(Figure 6)**. And physics bachelors who switch out of physics are more likely to support themselves than physics bachelors who continue in physics and astronomy. Students who support the bulk of their own graduate study typically rely on savings, loans, family assistance and outside employment.

Figure 6. Types of financial support for physics bachelors continuing directly on to graduate school, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

Physics Bachelors: Employment

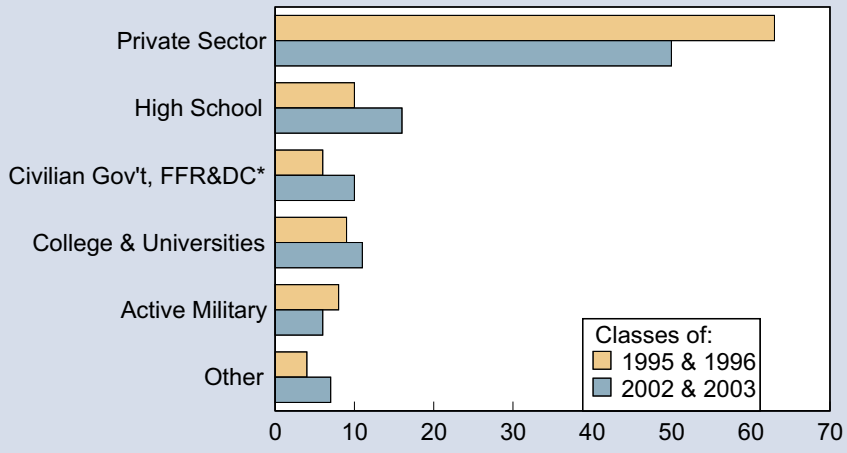
Not only has the proportion of new physics bachelors entering directly into the workforce declined in recent years, but the proportion accepting part-time positions has risen from 3-4% in the early 1990's to just over 10% in the classes of 2002 & 2003. Physics bachelors employed at colleges and universities had the highest proportion (about 1/5) indicating part-time employment, followed by the private sector (about 1/10). Part-time employed physics bachelors and bachelors employed outside the US are not included in the following employment analysis.

Although the private sector continues to be the dominant employer of physics bachelor recipients who enter directly into the job market **(Figure 7)**, its share has fallen to only half of the physics bachelors in the classes of 2002 & 2003, down from about almost two thirds in the mid-1990's. Civilian government and high schools have seen the largest concomitant increases in the proportion of new physics bachelors they employ.

Physics bachelors receive a diverse scientific training that includes not just knowledge of physics but also problem solving skills using computers and mathematics. Subsequently, their education has prepared them to accept employment in a variety of fields. Although some work directly in the field of physics, this remains a relatively small fraction (about a third) of new physics bachelors, mostly taking positions in colleges, universities, civilian government, and as high school physics teachers **(Table 1)**. Bachelors employed at secondary schools are primarily employed in the field of education, and the majority of them are teaching physics.

Looking just at the private sector, the fields in which physics bachelors are working have shifted in recent years **(Figure 8)**. While the proportion of bachelors employed within the field of physics has held remarkably steady, the proportion in positions outside of science or engineering have increased substantially.

Figure 7. Initial employment sectors of physics bachelors.



* FFR&DC: Federally Funded Research and Development Center, e.g. Los Alamos

AIP Statistical Research Center, Initial Employment Report.

Table 1. Field of employment by selected employment sectors, physics bachelor classes of 2002 & 2003.

	Sector of Employment		
	Private Sector %	Civilian Government %	University & College %
Not Science or Engineering	41	10	6
Engineering	26	30	5
Computer, Info. Systems	16	8	22
Physics or Astronomy	6	41	46
Other Science	9	11	8
Education	2	0	13

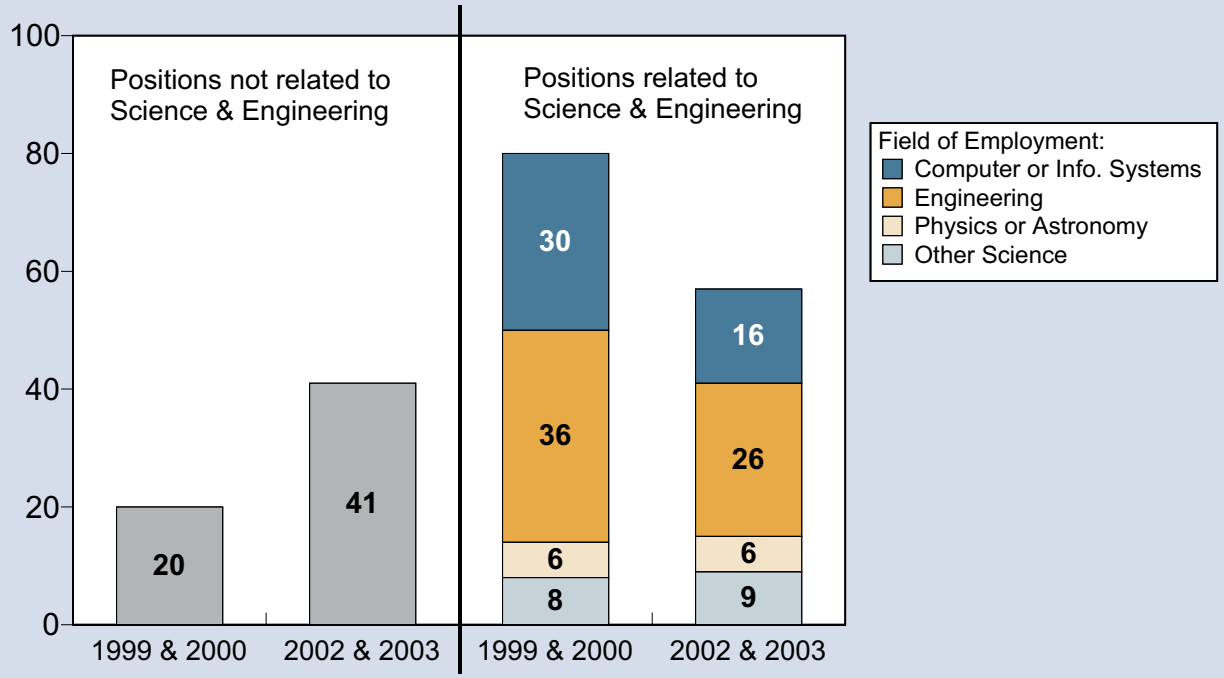
AIP Statistical Research Center, Initial Employment Report.

work activity. Bachelors employed in government are most likely to have positions that involve research, design and development, or computer related activities, such as programming, system administration and modeling. Within the private sector, work activity typically varies by field of employment. Bachelors in the science and engineering fields within the private sector do computer-programming, design and development, maintenance and modeling, and, to a lesser extent, research. In contrast, nearly two-thirds of the bachelors employed in non-science or non-engineering positions within the private sector had service-related work activities, including legal or financial services, sales or marketing, and functions within the food industry.

Physics bachelors' work activities vary greatly by their sector and field of employment **(Table 2)**. Almost half of those employed at colleges and universities reported research as their primary

Salaries for physics bachelor recipients vary by employment sector, as well as by field of employment (**Figure 9)**. Overall starting salaries in

Figure 8. Changes in field of employment for physics bachelors in the private sector.



Note: 2% of the classes of 2002 & 2003 indicated that their employment field was education.

AIP Statistical Research Center, Initial Employment Report.

Table 2. Primary work activity for physics bachelors in selected employment sectors, classes of 2002 & 2003.

	Employment Sector			
	Private Sector			
	Science & Engineering %	Not Science or Engineeering %	Civilian Government %	College & Universities %
Computer related [1]	34	3	21	19
Design & Development	29	2	25	5
Manufacturing [2]	13	12	5	1
Research	12	3	34	47
Service Related Activities [3]	7	64	8	4
Management & Administration	3	12	3	8
Teaching	2	2	0	9
Other	0	2	4	7

Activities include: (1) Computer programming, System Administration, and Simulation and Modeling
(2) Production, Operations, Construction, Quality Control
(3) Legal, Financial, Medical, Writing, Food Industry, Etc.

AIP Statistical Research Center, Initial Employment Report.

the private sector have declined fairly sharply in recent years. This is primarily a result of the increase in the proportion of degree recipients accepting traditionally lower-paid positions outside the fields of science and engineering. In addition, the starting salaries for science and engineering jobs in the private sector have declined slightly. In comparison to starting salaries reported by the combined classes of 2000 and 2001, salaries at colleges and universities are slightly lower, and salaries for civilian government positions have not changed. The only starting salaries that have increased since the combined classes of 2000 and 2001 were those of high school teachers.

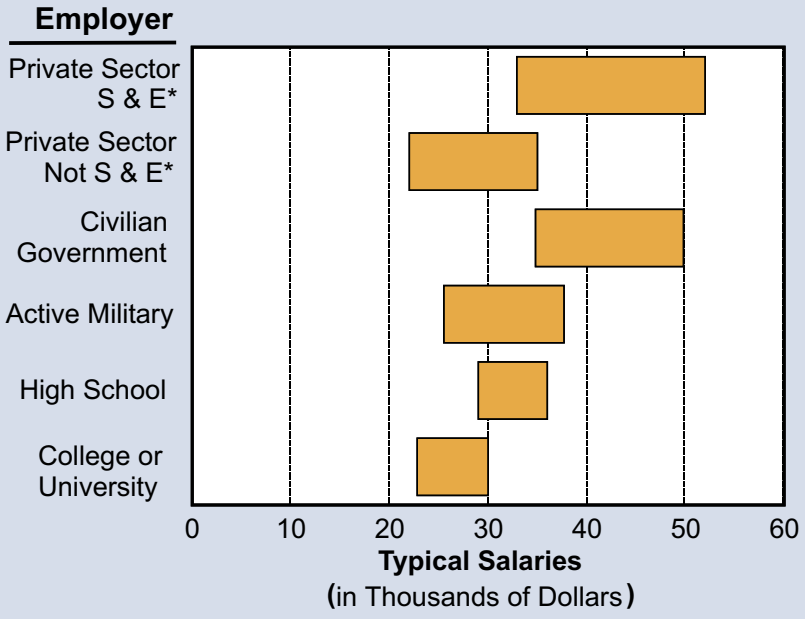
In summary, employment for physics bachelors has changed along with the declining job market. Engineering and computer science related positions have seen the largest declines, and salaries have fallen, as a larger proportion of bachelors accept lower-paying, less technical jobs outside of science and engineering.

Physics Bachelors: Long Term Career Goals

We asked the bachelors about their career aspirations 10 years in the future. Although over half of the bachelors who chose to continue directly onto graduate study in physics hope to eventually pursue academic careers **(Figure 10)**, academia was not the main goal for the majority of recent bachelors. Only about a quarter of those enrolled in graduate study in other fields and employed bachelors aspire to careers in academia. In contrast, forty-three percent of the bachelors who are pursuing graduate study in other fields, 39% of employed bachelors, and 21% of those pursuing physics or astronomy graduate education aspire to careers in the private sector. About a sixth of physics bachelors aspire to careers in civilian government or at a national lab.

Many employed bachelors seemed satisfied with their initial choice of employment sector. Over 60% of the physics bachelors who accepted high school teaching jobs had long-term aspirations of remaining in those positions, and two thirds of

Figure 9. Typical range of starting salaries for physics bachelors, classes of 2002 & 2003.



Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles.

S&E refers to positions in science and engineering related employment.

AIP Statistical Research Center, Initial Employment Report.

those in the military aspired to remain in the military. About half of all employed bachelors had aspirations to remain within their initial employment sector.

Master's Degree Recipients

Exiting master's degrees can be conferred from departments where a masters is the highest physics degree offered or from departments where a PhD is offered. While masters from departments where that is the highest degree offered were clearly enrolled in a masters degree program, a portion of the exiting master's recipients from PhD granting departments may have originally aspired to a PhD.

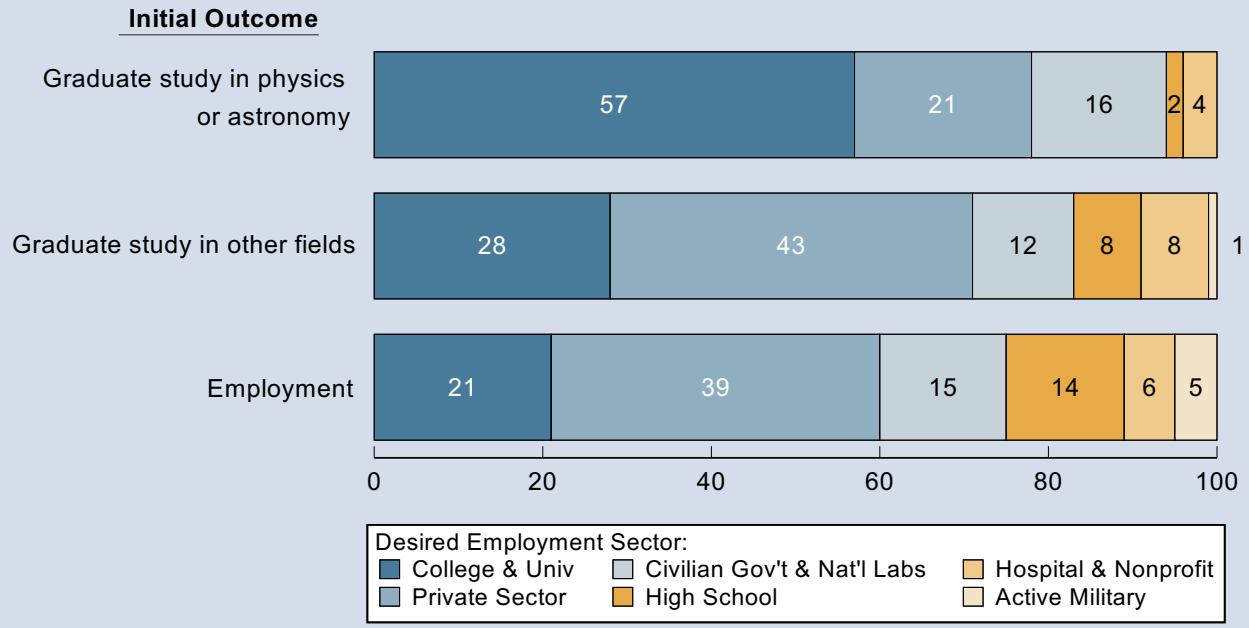
PhD programs also confer masters degrees to students who are continuing at the same department, enroute to their PhD. These enroute masters are not included in the following analysis. Our focus will be on the 657 exiting masters degrees conferred in the class of 2002 and 672 exiting masters degrees conferred in the class of 2003.

For the classes of 2002 and 2003, the 185 physics PhD granting departments awarded 68% of the exiting masters degrees, and the 68 master's granting departments awarded the remaining 32%. The combined exiting masters classes of 2002 and 2003 included 22% women and 40% foreign citizens. For more detail on master's degree production, see the AIP Enrollments and Degrees Report.

Because many departments do not maintain forwarding addresses for their recent graduates, and given the mobility of new graduates, master's recipients can be very difficult to reach once they leave their degree granting departments. We supplemented the information that we received directly from the degree recipients with basic follow-up information obtained from faculty advisors. Using both student and advisor sources, we were able to obtain information on nearly half of the combined masters classes of 2002 & 2003, with about half of the information coming directly from the students.

About 10% of exiting physics masters leave the US after receiving their degree. As one would expect, this is true of far more foreign citizens (20%) than US citizens (3%). Foreign citizens who received their masters from departments that offer a PhD were more likely (24%) to exit the US after

Figure 10. Long-term career goals for physics bachelors by initial outcome, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

receiving their degree than those getting their masters from departments that only go up to that level (13%). Masters recipients who left the US are not included in the following analysis.

Overall, the post-degree paths of physics masters recipients are divided fairly evenly between continuing with their education and entering the workforce **(Figure 11)**. Almost two thirds of those continuing with further graduate study are continuing with physics or astronomy graduate studies at another institution.

In addition, in the winter following the year in which they received their degree, 5% of the master's recipients about whom we had information about were unemployed and seeking work, and about 10% of employed physics masters were in part-time positions. Three quarters of the respondents in part-time positions were employed

Figure 11. Initial outcomes of exiting physics masters recipients, classes of 2002 & 2003.

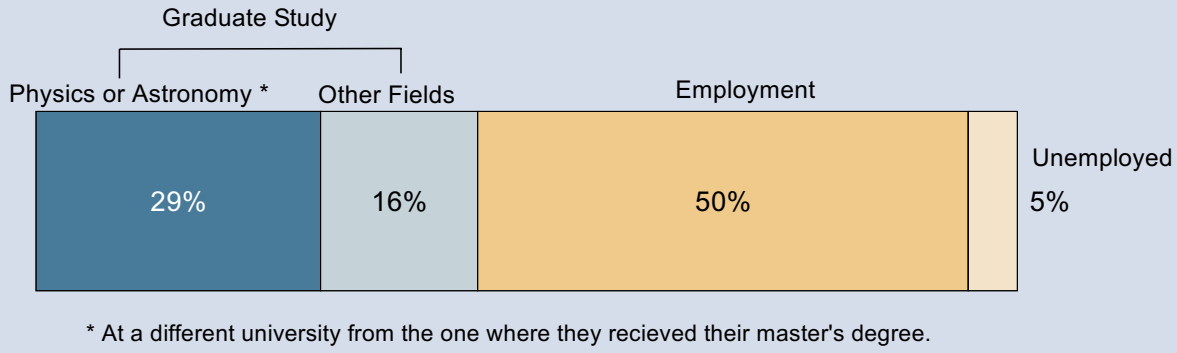


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Table 3. Initial outcomes of exiting physics masters by citizenship, classes of 2002 & 2003.

	US Citizens %	Foreign Citizens %
Graduate study in Physics or Astronomy	17	54
Graduate study in other fields	9	26
Employment	68	16
Unemployed	6	4

* At a different department from their master's-granting department.

AIP Statistical Research Center, Initial Employment Report.

in colleges and universities. Degree recipients in part-time positions are not included in the employment discussion below.

As has been historically true, the proportion of foreign physics masters continuing graduate study in another department is far greater (80%) than the proportion of US citizens continuing graduate study (26%) **(Table 3)**. Consequently, even though foreign citizens comprise 40% of master's recipients, they represent only 12% of the physics masters entering the job market from the combined classes of 2002 and 2003.

Although declining in proportion in recent years, the private sector continues to be the largest employer of physics masters recipients, followed by colleges and universities **(Figure 12)**. Starting salaries for physics masters have seen little change in recent years **(Figure 13)**.

Physics masters work in a variety of fields, but physics or astronomy (37%) and engineering (21%) top the list **(Figure 14)**. Following broad economic trends, the proportion of physics masters employed in the field of computers and information systems declined from about 20% in 1999 and 2000 to 8% in the classes of 2002 and 2003. Overall, the vast majority of physics masters are in positions that utilize their technical training, only 7% employed in a field outside of science and engineering. In comparison, 27% of all employed physics bachelors were in positions outside of science and engineering.

Figure 12. Employer distribution of full-time employed physics masters, classes of 2002 & 2003.

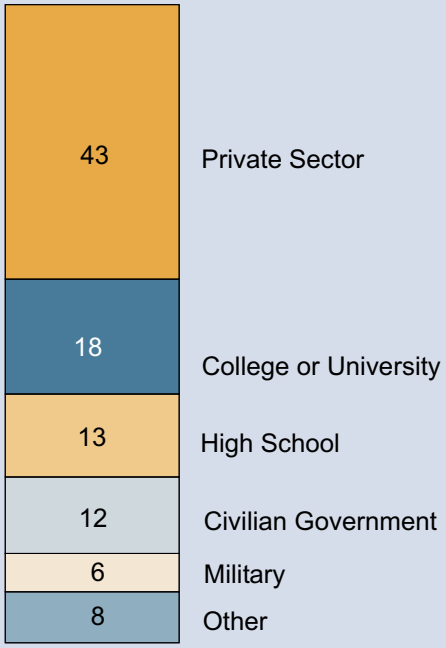

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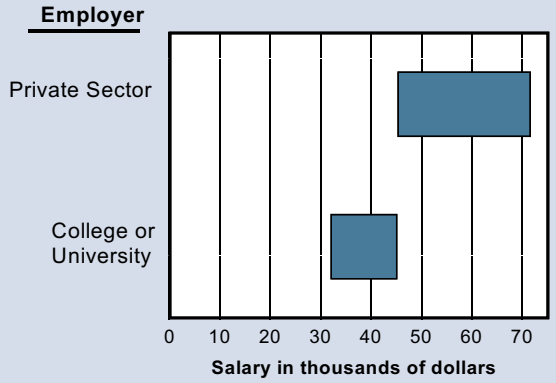
Figure 13. Typical range of starting salaries for physics masters, classes of 2002 & 2003.



Note: Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles. There were too few respondents in the categories of Active Military, High School and Civilian Government to accurately report salaries.

AIP Statistical Research Center, Initial Employment Report.

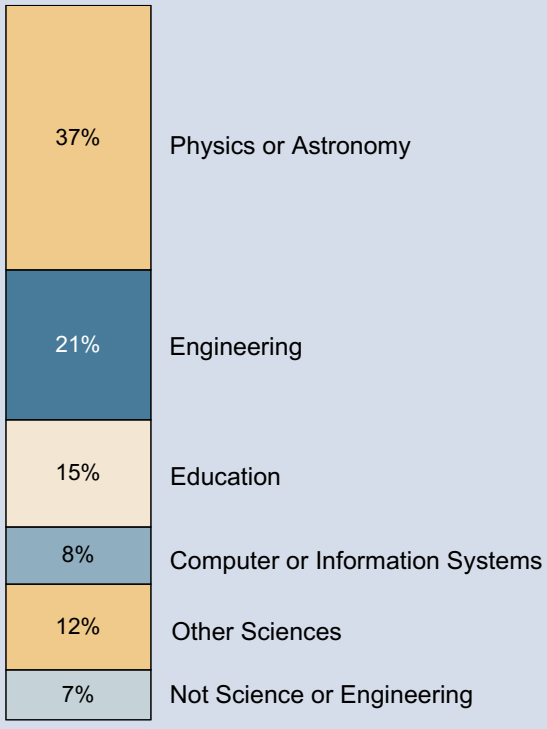
The long term goals (10 years in the future) of physics masters vary greatly. A significant proportion (48%) desire careers in research, and about one-fifth aspired to careers in teaching. Forty-one percent of physics masters hoped to be employed in a college or university setting, a quarter of whom would like to work in a university affiliated research institution. Almost a third of physics masters aspired to careers in the private sector, and 10% aspired to careers at federally funded research and development centers. Although roughly the same proportion of US and foreign physics masters desired careers in the private sector, a much greater proportion of foreign masters aspired to careers in academia (58% vs. 34%, respectively). A larger proportion of US masters aspired to positions in national labs and civilian government than foreign masters, most likely due to the visa requirements for many civilian government positions.

Of the exiting physics masters who are continuing with graduate studies in another field, over half (58%) are studying engineering. Regardless of the field they are in, physics masters who chose to continue their studies are well supported by teaching assistantships, research assistantships and fellowships. Less than 5% indicated that they needed to rely primarily on their own funding.

The median total education-related debt reported by physics masters recipients was $20,000 for the combined classes of 2002 and 2003.

A little over half of physics master's recipients were pleased with the job market and career options available to them. Employed masters were the most satisfied (62%), followed by 58% of those continuing their graduate education in physics and astronomy. Only 38% of the masters continuing their studies in other subjects and 14% of the unemployed said they were pleased with the job market. When asked whether, given the opportunity to do it over again, they would still study physics or astronomy, well over three quarters said yes.

Figure 14. Field of employment for physics masters, classes of 2002 & 2003.



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New Physics PhDs

The 1106 physics PhD's conferred in the class of 2003 represent a 1% increase over the 1095 PhD's in the class of 2002. After 8 years of steady declines in physics doctorate production, the class of 2003 marks a likely transition toward steady increases in degree production in coming years, a product of rising graduate enrollments. For more detailed information about physics degree production and enrollment statistics, see the AIP Enrollments and Degrees Report.

Overall, we received outcome data on 66% of the combined PhD classes of 2002 and 2003. We contacted the advisors of degree recipients who we were unable to reach, with about a third of our outcome data coming from advisors. The advisors provided basic information, including: type and location (in or out of the US) of initial employment, subfield of dissertation, gender and citizenship.

According to the departmental survey of Enrollments and Degrees, the combined PhD classes included 52% foreign citizens and 13% women. The reported median age of our respondents was 29 for US citizens and 30 for foreign citizens. Fourteen percent of each group were 35 or older.

Physics PhD's took a median of 6 full-time equivalent years to complete their degree (**Figure 15)**, with almost one-fifth taking 8 or more years. As a group, foreign citizens reported taking less time to complete their PhDs than their US citizen counterparts. However, according to the AIP Graduate Student Report, about 40% of foreign students enter US physics graduate programs with some amount of advanced study behind them, and differences in international educational systems make it very difficult to accurately compare time to degree by citizenship. The data presented in **Figure 15** is limited to US citizens and further divided by the degree recipients' dissertation research method.

Figure 15. Full-time equivalent years of study completed for physics PhDs* by type of research, classes of 2002 & 2003.

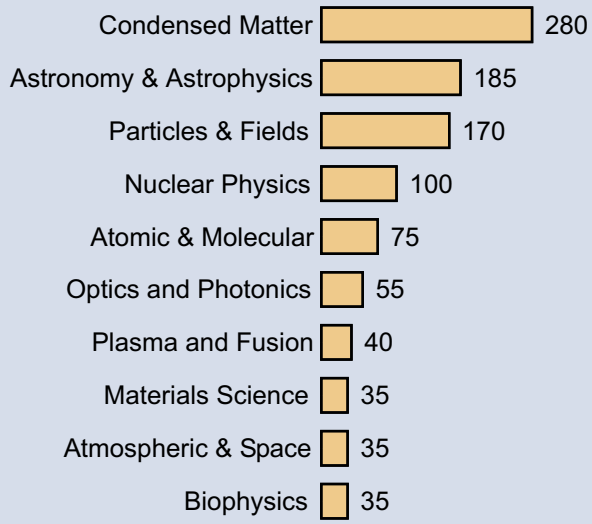
* US Citizens Only

AIP Statistical Research Center, Initial Employment Report.

Figure 16 illustrates the relative size of subfields chosen by physics PhDs. As in years past, condensed matter is the largest, followed by astronomy and astrophysics, and particles and fields. The number of astronomy and astrophysics degrees shown includes those granted by departments of physics and astronomy. A little more than half (52%) of the astronomy and astrophysics degrees shown came from astronomy departments and the remainder came from physics departments that offer the astronomy and astrophysics subfield. Outcomes of astronomy or astrophysics degree recipients from astronomy departments are discussed later in the astronomy section of this report.

The distribution of PhD subfields varies considerably by citizenship. Thirty percent of the foreign citizens had a subfield in condensed matter compared to only 17% of the US citizens. On the other hand, 23% of US citizens pursued a PhD in astronomy/astrophysics, compared to only 7% of the foreign citizens.

Figure 16. Number of PhDs granted in selected subfields.



All other physics subfirelds: 190.

Based on an average of 1,200 PhDs conferred at physics & astronomy departments in the classes of 2002 and 2003.

AIP Statistical Research Center, Initial Employment Report.

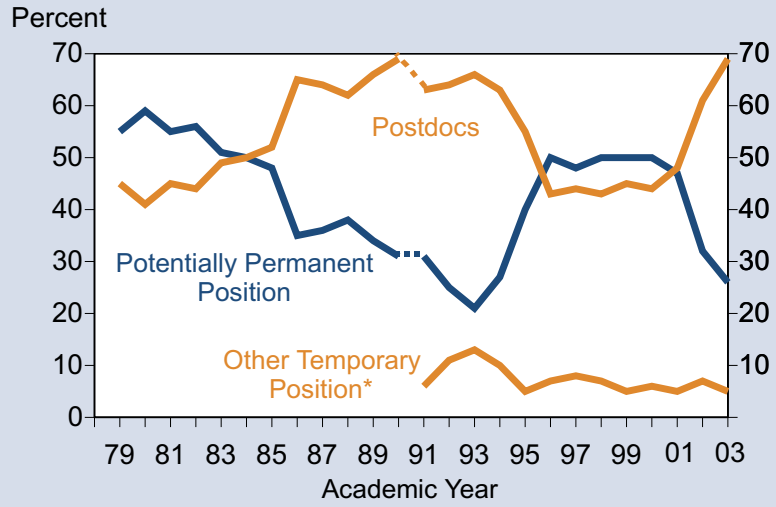
After receiving their PhDs, 17% of the foreign citizens and 4% of the US citizens left the country. This report focuses on outcomes of degree recipients who remained in the US. Therefore, PhD recipients who leave the country are not included in any of the following discussion.

The ratio of new physics PhDs accepting postdocs to those taking permanent positions can be an indicator of the health of the larger economy, or changes in the long term career goals of the degree recipients, or, for non-citizens, changes in visa regulations **(Figure 17)**. The proportion of new physics PhDs taking postdocs has risen sharply for the third consecutive year to an all-time high of almost 70% in the class of 2003. This increase is balanced by a simultaneous decline in the proportion of new physics PhDs accepting potentially permanent positions. This changing initial employment pattern comes on the heels of four years of stability in the late 1990's, when the proportion of PhDs accepting postdocs was similar to the proportion accepting potentially permanent positions. The current distribution of initial employment outcomes is similar to that seen during the difficult job market in the early 1990's.

A small proportion of physics PhD recipients took temporary jobs that are not postdoctoral fellowships. These positions include research scientists, visiting professors, lecturers, and sabbatical replacements. Over half of the PhDs in these other temporary positions indicated they accepted the position because no suitable permanent position was available.

The unemployment rate for new physics PhDs remains low. Two percent of the combined classes of 2002 and 2003 were unemployed in the winter following their degree. The unemployment rate is not a good indicator of the job market for new physics PhDs. Typically PhD scientists do not experience a significant level of unemployment, even during economic lows. Additionally, a large proportion of physics PhD recipients delay entry into the job market for a year or more by accepting postdocs before seeking potentially permanent employment.

Figure 17. Initial employment of physics PhDs, 1979-2003.



AIP Statistical Research Center, Initial Employment Report.

Although the proportions of both US and foreign citizens accepting postdocs has risen in recent years, foreign citizens accepted postdocs at a higher rate (74%) than US citizens (54%) **(Table 4)**. However, foreign citizens with permanent resident status more closely resembled US citizens in their initial post degree status. In contrast, 80% of those with temporary visas took a postdoc.

The type of employment accepted by new PhDs is related, to some extent, to the subfield in which they did their dissertation research **(Figure 18)**. A much higher proportion of PhDs with subfields such as particles and fields, and condensed matter accepted postdocs than PhDs in some of the more applied subfields, such as optics and photonics, and materials science.

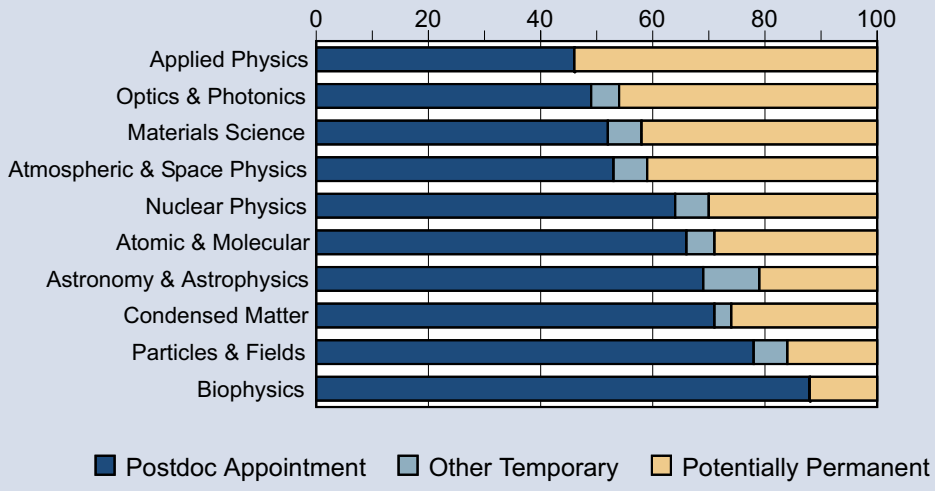
The employment sector in which a PhD works is closely linked to the type of initial employment they choose. Almost three quarters of postdocs were employed in an academic setting and a quarter were employed in the government sector **(Table 5).** For those postdocs employed with the government, the majority are at National Labs. The largest employer of PhDs accepting potentially

Table 4. Initial employment status of physics PhDs by citizenship, classes of 2002 & 2003.

	US Citizens %	Foreign Citizens %	Overall %
Potentially Permanent Position	36	20	29
Postdoc	54	74	63
Other Temporary Position	8	4	6
Unemployed	2	2	2

AIP Statistical Research Center, Initial Employment Report.

Figure 18. Initial employment of physics and astronomy PhDs by subfield of dissertation, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

permanent positions continues to be the private sector, although it employs a smaller proportion of physics PhDs than in the past. The majority of the small group of PhDs in non-postdoc temporary positions hold positions in academia that are outside the tenure-track. Nine percent of PhDs employed in academia are at university affiliated research centers.

Almost all PhDs who accepted temporary positions are either working in the field of physics or in an area at least somewhat related to physics. The fields of employment for PhDs accepting potentially permanent employment vary more than those of postdocs. Almost half, 48%, of PhDs with potentially permanent jobs are employed in the field of physics and an additional 37% are in a field

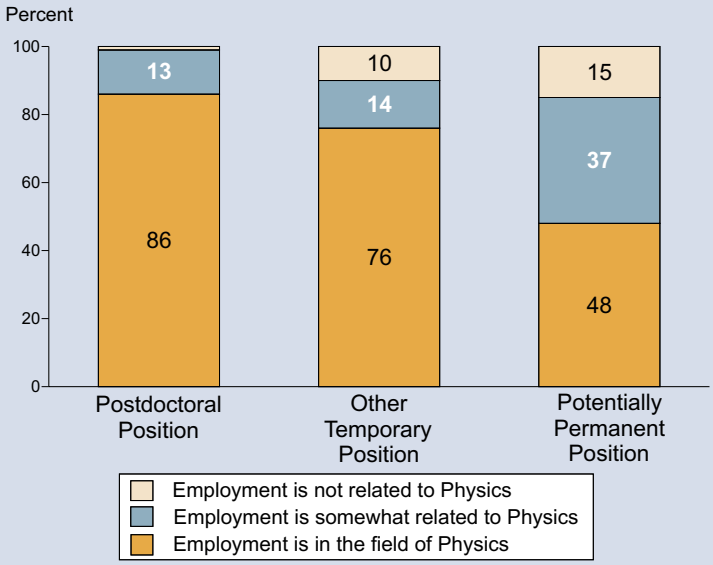
Table 5. Initial employment sectors of physics PhDs by type of position accepted, classes of 2002 & 2003.

	Potentially Permanent %	Postdoc %	Other Temporary %	Overal %
Academic*	27	72	78	60
Private Sector	50	2	5	16
Government	19	25	5	22
Nonprofit	2	1	2	1
Other	2	0	10	1

* Includes University Affiliated Research Centers

AIP Statistical Research Center, Initial Employment Report.

Figure 19. Initial employment of physics PhDs by field and type of position secured, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

that is somewhat related to physics. A small proportion, 15%, indicated they were employed outside of physics (**Figure 19)**. Most of the permanently employed PhDs who describe their positions as somewhat related to physics or in a field outside of physics are employed in the private sector and are concentrated in the fields of engineering, computer software, and business or finance.

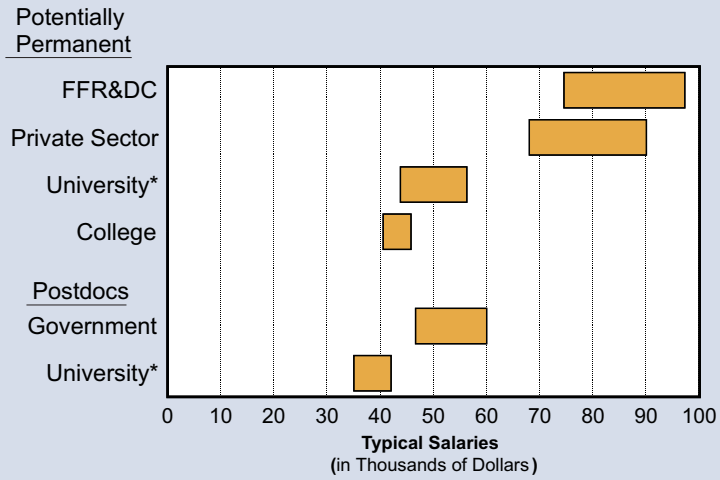
PhDs in potentially permanent positions outside the field of physics indicated they accepted employment in other fields primarily because of changes in career or professional interests, for better pay or promotion opportunities, or for a number of other reasons. Despite accepting a position outside of physics, 80% of the respondents who were employed in a non-physics position would, if they had it to do over again, still get a PhD in physics.

The typical salary ranges for potentially permanent employed PhDs in Federally Funded Research and Development Centers, and the private sector are larger and higher than the typical salary range for potentially permanent employed PhDs in academia (**Figure 20)**. Salaries received by postdocs in the government sector are substantially higher than those in a university setting.

We asked degree recipients to rate their current employment on a series of qualitative dimensions. As can be seen in **Tables 6 & 7**, physics PhDs are generally pleased with their current employment. PhDs in potentially permanent positions within the field of physics had the most positive outlook concerning their employment. PhDs in permanent positions that were somewhat related to physics or not related to physics rated their positions less favorably. Postdocs generally had a very positive outlook concerning their position, while a much larger percent of the PhDs in other temporary positions felt underemployed and were generally less satisfied with their employment.

When we looked at long-term employment goals among physics PhDs, we find large differences by initial employment status. For example, postdoctoral positions often function as a necessary stepping-stone for those who aspire to university tenure-track positions. Thus **Table 8** shows that

Figure 20. Typical range of starting salaries for physics PhDs, classes of 2002 & 2003.



Typical salaries are the middle 50%, i.e., between the 25th and 75th percentiles.
FFR&DC: Federally Funded Research and Development Center, e.g. Los Alamos.
*University includes University Affiliated Research Institutes.

AIP Statistical Research Center, Initial Employment Report.

over two thirds of postdocs aspired to permanent positions in academia. Almost three-quarters of other temporary employed physics PhD recipients aspired to a career in academia. But unlike the postdocs, many of the PhDs employed in other temporary positions aspired to positions at 2 or 4 year colleges rather than at universities.

For the PhDs who had accepted potentially permanent employment, the extent to which their position was physics related was correlated to their long-term aspirations. PhDs in positions directly in the field of physics were more likely to aspire to a college or university position than PhDs employed in other science fields.

Table 6. Qualitive aspects of initial employment for physics PhDs in potentially permanent positions, classes of 2002 & 2003.

Percent agreeing with statement:	Major Fields of Employment		
	Physics %	**Engineering %**	**All Other Science Fields %**
A physics PhD is an appropriate backround for my position	98	93	74
The position ofter utilizes my overall knowledge of basic physics principles	96	80	37
My current position is professionally challenging	90	68	75
I am satisfied with my current position	92	80	85
I consider myself underemployed	7	26	20

AIP Statistical Research Center, Initial Employment Report.

Table 7. Qualitative aspects of initial employment for physics PhDs in temporary positions, classes of 2002 & 2003.

Percent agreeing with statement:	Postdocs %	Other Temporary %
A physics PhD is an appropriate backround for my position	98	86
The position often utilizes my overall knowledge of basic physics principles	92	77
My current position is professionally challenging	87	51
I am satisfied with my current position	79	53
I consider myself underemployed	20	53

AIP Statistical Research Center, Initial Employment Report.

Employment goals varied in other ways in addition to initial unemployment status. Overall, almost three quarters of physics PhDs wanted to pursue a career in research. But among foreign citizens, that desire was more prevalent (80%) than among US citizens (64%). US citizens showed a stronger interest in teaching positions than their foreign counter parts.

We asked PhDs about their advisors' help in their career planning. Over three quarters of physics PhDs agreed that their advisors were helpful in their career planning. PhDs who accepted postdoctoral fellowships were the most likely to rate their advisor as helpful in their career planning. There was absolutely no difference in perceptions of advisor helpfulness by gender, and very little difference by citizenship.

TABLES 6 & 7 illustrate a relatively high level of satisfaction degree recipients felt toward their career choices at this early stage. Another indicator of high satisfaction with their career choices is that 84% said they would, if they had it to do over again, still get a PhD in physics. This was true regardless of gender or citizenship.

Table 8. Career goals of physics PhDs, classes of 2002 & 2003.

	Desired Sector					
Type of Potentially Permanent Position	**University* %**	**2 or 4 Yr College %**	**Private Sector %**	**Civilian Gov't. (incl. FFR&DC) %**	**Other %**	**Total %**
Primarily in the field of physics	35	14	28	19	4	100
Somewhat related to physics	16	9	54	12	9	100
In other science fields	3	3	82	6	6	100
Type of Temporary Position						
Postdoctoral	63	5	15	15	2	100
Other temporary position	47	25	12	8	8	100

FFR&DC: Fedrally Funded Research and Development Center, e.g. Los Alamos

*Includes University Affiliated Research Institutes.

AIP Statistical Research Center, Initial Employment Report.

Astronomy Degree Recipients

About half of the astronomy departments are combined with the physics departments at the same university, and half are administered separately. In the 2002 and 2003 academic years, the AIP survey of Enrollments and Degrees collected astronomy degree recipient demographics and contact information from 76 astronomy departments of both types. Students who received astrophysics degrees from stand-alone physics departments are included in the earlier discussion on physics degree recipients.

The astronomy bachelors degree classes of 2002 and 2003 each had 325 degree recipients. This represents a 63% increase in bachelor astronomy degrees from only two years earlier. We received survey responses from 42% of the astronomy bachelors in these two classes. The combined classes of 2002 and 2003 included 44% women (an all-time high) and 6% foreign citizens.

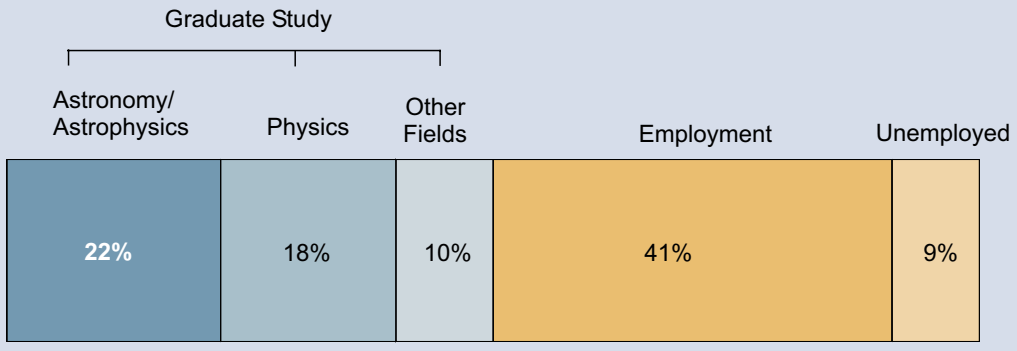
Half of astronomy bachelor's chose to continue their studies at the graduate level **(Figure 21)**, the majority continuing in astronomy and physics. The other half entered directly into the workforce. Almost half of the respondents who accepted employment directly after receiving their degree are employed in the fields of physics and astronomy. The private sector hired about half of the employed astronomy bachelors followed by academia, which hired about a quarter. Astronomy bachelors were also employed at high schools, in the military and in the civilian government.

Astronomy bachelors expressed greater satisfaction with the field of astronomy than with the job market they encountered. While only about half were satisfied with the job market and career choices available to them, almost 90% said, given the choice, they would study astronomy again.

Almost half of astronomy bachelors would like to be employed in academia in ten years, mostly doing research and education related activities. Astronomy bachelors were more concentrated in their goals for the future than their physics bachelor counterparts. Unlike the physics bachelors, even those who chose to enter the job market right after receiving their degree aspired to academic careers (46%).

The population of exiting master's degrees in astronomy is very small, 22 each in the classes of 2002 and 2003, too few to allow detailed analysis of outcomes. These combined classes included

Figure 21. Initial outcomes for astronomy bachelors, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

43% women and 30% foreign citizens. As in past years, most of this group entered directly into the workforce.

The 88 astronomy PhD recipients in the class of 2003 represented a significant decrease from the 101 and 102 astronomy PhDs awarded in 2001 and 2002, respectively. The combined classes of 2002 and 2003 included 25% women and 19% foreign citizens. We were able to obtain information on 53% of these degree recipients, either through direct contact with the students themselves or from their thesis advisors.

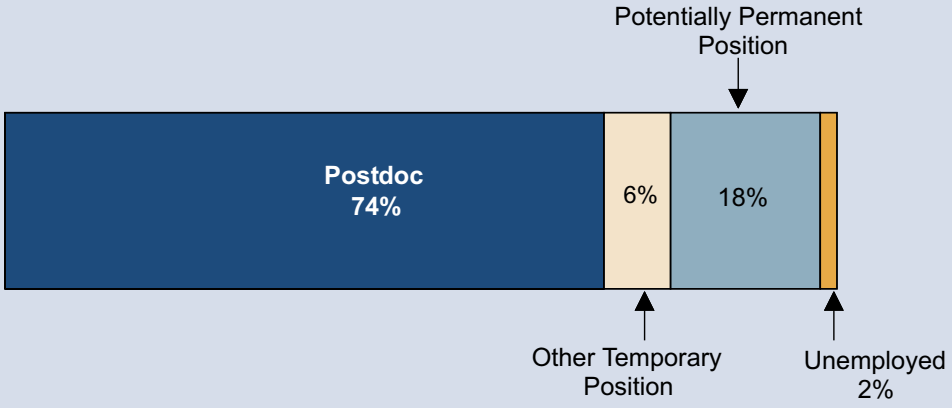
Because the focus of this report is the initial outcomes of individuals who remain in the US, the following analysis does not include the 12% of astronomy PhDs who left the US after receiving their degree.

Postdoctoral appointments continue to be the dominant initial outcome for new astronomy PhDs **(Figure 22)**. Almost three quarters of astronomy PhD recipients from the combined classes of 2002 and 2003 accepted postdocs. The median starting salary for a university postdoc position is $42,000, a little higher than that of physics postdocs at universities.

Only 7% of new astronomy PhDs were employed outside the field of astronomy. Over three quarters of the astronomy PhDs employed within the field of astronomy were employed within their dissertation subfield. Research was the primary work activity for 77% of PhDs.

Astronomy PhDs are very positive about their choice of degree field and initial employment situation. Eighty-eight percent found their positions challenging, 90% were satisfied with their positions, and 93% said they often utilize their knowledge of basic astronomy principles. Only 9% of astronomy PhDs described themselves as underemployed. Not surprisingly, 94% of astronomy PhD's would, if they had it to do over again, still get a PhD in astronomy.

Figure 22. Initial employment outcomes of Astronomy PhDs, classes of 2002 & 2003.



AIP Statistical Research Center, Initial Employment Report.

STATISTICAL RESEARCH CENTER - PARTIAL LIST OF PUBLICATIONS

The Statistical Research Center collects data on the composition and dynamics of the scientific labor force and the education system. Below is a partial list of the Center's current publications along with a brief description of each. Unless otherwise indicated, single copies can be downloaded for free at www.aip.org/statistics or by writing to:

American Institute of Physics
Statistical Research Center
One Physics Ellipse
College Park, MD 20740-3843
(301) 209-3070
stats@aip.org
www.aip.org/statistics

2004 Physics & Astronomy Academic Workforce Report (December 2005)

A detailed analysis of faculty openings and new hires in universities and four-year colleges.

Broadening the Base: High School Physics Education at the Turn of a New Century (August 2003)

An analysis and interpretation of information collected in a nationwide survey of teachers of physics at the secondary level.

Does it Matter Where I Go to College? Effects of Physics Departments on Students Outcomes (June 2004)

Compares the outcomes for physics bachelors from large and small departments, defined by number of bachelor's degrees awarded. It also looks at differences in physics bachelors' outcomes between departments that grant PhDs in physics and those that award only a bachelor's degree in physics.

Physics Bachelors with Master's Degrees (March 2003)

This report documents the employment patterns of those who earned physics bachelor's degrees in the early 1990s, earned master's degrees in a variety of fields, and were working five to eight years later.

Enrollments and Degrees Report, 2003 (July 2005)

An examination of academic enrollments and degrees conferred at the bachelors, masters, and PhD levels in physics and astronomy programs.

Physics Students From Abroad: Monitoring the Continuing Impact of Visa Problems (September 2005)

This report documents the impact of visa regulations on international students in US physics graduate programs during the Fall of 2004, with comparisons to two years earlier. It quantifies the number of first-year international students who enrolled and the proportion who were denied entrance or substantially delayed due to visa difficulties. It also discusses the visa problems experienced by non-US citizen faculty, postdocs and previously enrolled students when they tried to return from travel abroad.

Rosters of Physics and Astronomy Departments with Enrollments and Degree Data, 2004 (August 2005)

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://www.aip.org/statistics/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.