

Trends in Physics PhDs

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REPORTS ON ENROLLMENTS AND DEGREES

Trends in Physics PhDs (February 2014)

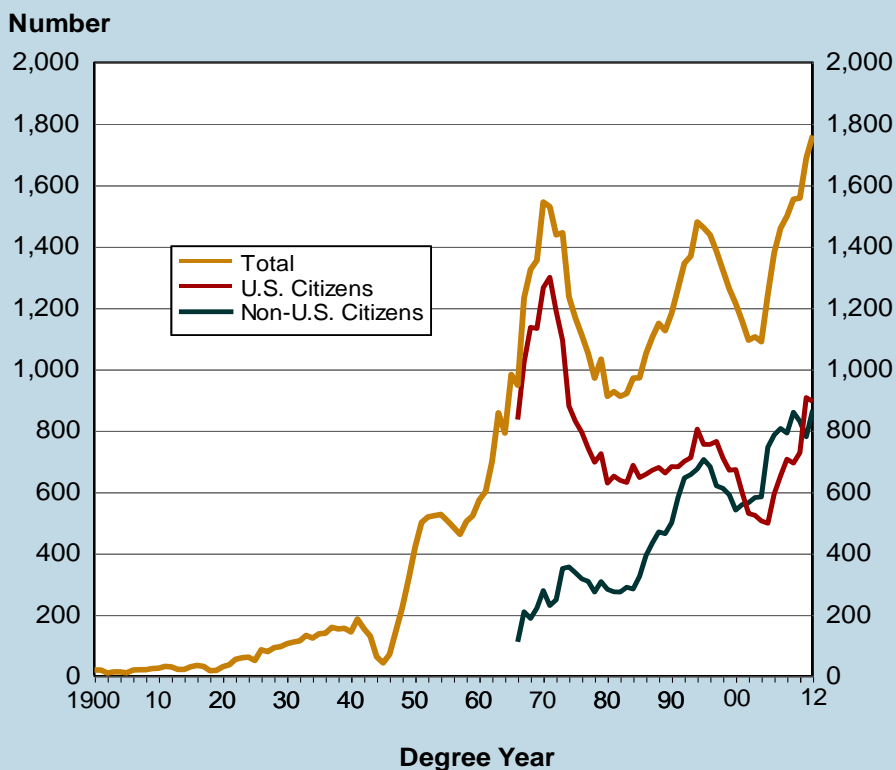
Trends in Exiting Physics Master's (*Forthcoming*)

Largest Graduate Physics Departments (*Forthcoming*)

PhD production in the U.S. has gone through cycles of rapid growth and sharp decline. The cycle is currently in an upswing with the class of 2012 reaching a new high of 1,762 physics PhDs.

Figure 1

Physics PhDs Conferred in the U.S., 1900 through 2012.



<http://www.aip.org/statistics>

For the second year in a row, the number of U.S. citizens receiving physics PhDs is greater than that of non-U.S. citizens.

THE SURVEY OF ENROLLMENTS AND DEGREES

Degree-granting physics departments are contacted each fall and asked to provide the number of degrees they conferred the previous year.

THE FOLLOW-UP SURVEY OF PHD RECIPIENTS

Degree recipients are contacted in the winter following the academic year in which they received their degree.

This *focus on* provides an in-depth analysis of physics PhD production in the U.S. It presents detailed trends on the number of physics PhD awarded in the U.S. including data on citizenship, women, and minorities. It includes data on recent PhD recipients such as time to degree, subfield of dissertation, and general satisfaction with degree.

The number of physics PhDs awarded in the U.S. continued to climb with the class of 2012 reaching a new high. The 1,762 physics PhDs awarded in the class of 2012 represented a 4% increase over the previous year and a 62% increase from a recent low 8 years earlier.

Changes in PhD production are affected by a variety of influences, many of which reflect circumstances six to ten years prior to a given degree class. These influences include changes in undergraduate physics education, visa policies, and economic conditions both in the U.S. and internationally. Some of the economic factors include university budgets, availability of government research funding, and the job market for new graduates.

The bulk of the recent growth in physics PhD production has been driven by U.S. citizens. U.S. citizens comprised 54% of the class of 2011 and 51% of the class of 2012. This follows a decade where non-U.S. citizens received the majority of the physics PhDs awarded. The number of U.S. and non-U.S. citizens receiving physics PhD's have both been increasing in recent years, but the increase for U.S. citizens has been far greater. Since the recent overall low in the number of PhDs awarded in 2004, the number of U.S. citizens receiving physics PhDs has increased by 77% where non-U.S. citizens have increased by 48%.

During the recent increase in PhDs awarded, the number of departments offering a physics PhD has had a net increase of nine. Only about two percent of the increase from eight years ago is a result of the additional departments. Increases in PhD production have been happening at departments of all sizes. Eighty-six percent of the departments that offered a physics PhD in both 2004 and 2012 experienced an increase in the number of PhDs they awarded. The median number of PhDs awarded by departments in 2004 was 4, where in 2012 it was 6.

The number of physics PhDs awarded in the U.S. has reached an all-time high with 1,762 doctorates earned in the class of 2012.

There were 51,000 PhDs awarded in the U.S. in the academic year 2011-12, and physics represented about 3.5% of these.

The average age of physics PhD recipients in the classes of 2010 and 2011 was 30.5 with 10% of PhDs being over the age of 35. U.S. citizens tended to be slightly younger than their non-U.S. citizen counterparts with average ages of 30.2 and 30.9 respectively.

Table 1

Demographic profile of Physics PhDs, Classes of 2010, 2011 & 2012 Combined.

Sex	Male	81%
	Female	19%
Citizenship	U.S.	51%
	Non-U.S.	49%
Average Age		30.5

<http://www.aip.org/statistics>

10% of physics PhDs were 35 years of age or older.

A small proportion of both U.S. and non-U.S. citizens indicated they were enrolled in a different U.S. graduate physics program prior to enrolling at the department from which they earned their PhDs. Some of these PhDs would have earned a master's degree as a result of their prior graduate study.

Table 2

Graduate Education Characteristics of Physics PhDs, Classes of 2010 & 2011 Combined.

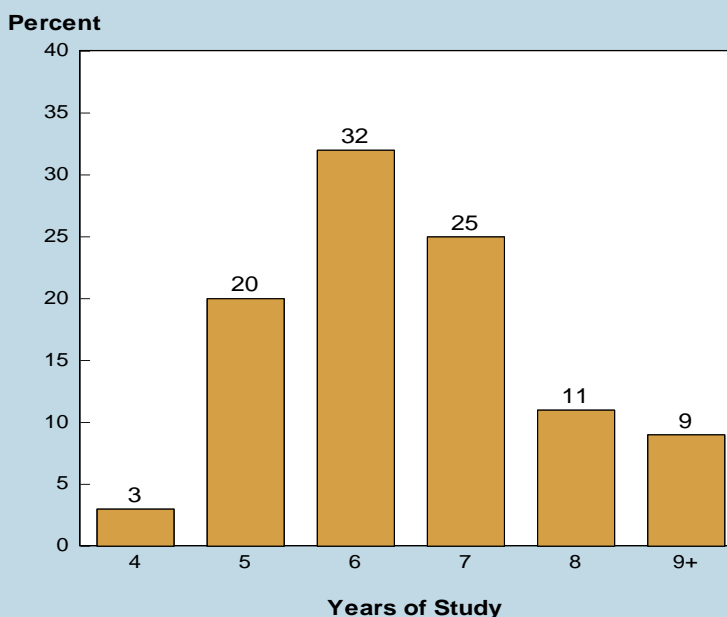
	U.S. Citizens	Non-U.S. Citizens
Studied physics at the graduate level outside U.S.	3%	37%
Studied physics at a U.S. graduate department other than where they ultimately received their degree	13%	14%

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Over a third of the non-U.S. citizens earning physics PhDs in the U.S. had studied physics at the graduate level before coming to the U.S.

Figure 2

Years of Physics Graduate Study to Earn a PhD, Classes of 2010 & 2011 Combined.



Note: This graph depicts the number of full-time equivalent years of physics graduate study completed in the U.S. by PhD classes of 2010 & 2011 combined and excludes PhDs who had previous graduate study at a non-US institution.

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One-fifth of the physics PhDs in the classes of 2010 and 2011 combined took 8 or more years of physics graduate studies to earn their degrees.

The average length of time to earn a physics PhD for degree recipients in the combined classes of 2010 and 2011 was 6.3 years. For this report the number of years taken to earn a PhD is measured by a self-report of the full-time equivalent (FTE) number of years registered at a physics department.

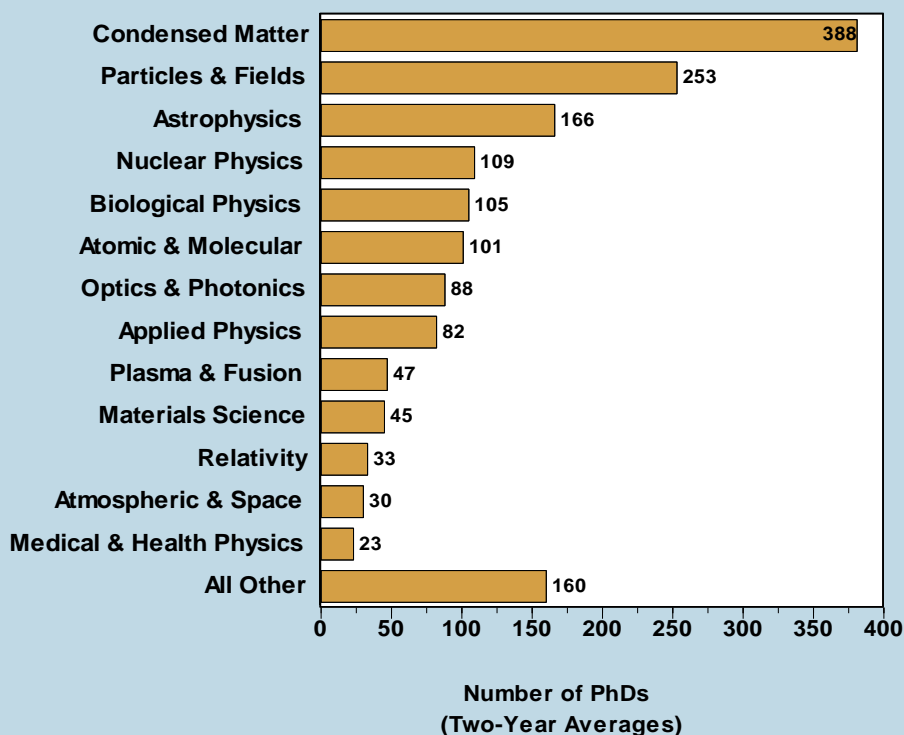
PhDs who were non-U.S. citizens and had been enrolled in a graduate physics program outside the U.S. reported a slightly shorter time to degree than the non-U.S. students who only studied in the U.S. Students who reported physics graduate study at a non-U.S. institution are not included in Figure 2.

Some differences in FTE were seen by the primary research method of the doctorate recipient. Experimentalists reported an average FTE of 6.4 years where theorists averaged slightly less time with 6.1 years. There was little difference in FTE by gender and citizenship when controlled for primary research method.

Condensed matter physics continues to be the most common dissertation subfield of physics PhDs, with 24% of the combined classes of 2010 and 2011 choosing this subfield. Although condensed matter was the foremost subfield for both U.S. and non-U.S. citizens, a greater proportion of non-U.S. citizens (28%) had a subfield of condensed matter than did U.S. citizens (19%). Astrophysics was the only other subfield that showed a noteworthy difference by citizenship, with a greater proportion of U.S. citizens (14%) with dissertations in the subfield than their non-U.S. counterparts (6%). As has been historically true, non-U.S. citizens were more likely to have a primary dissertation research method that was theoretical than did U.S. citizens (43% vs. 31%).

Figure 3

Number of Physics PhDs Granted by Subfield From Physics Departments, Classes of 2010 & 2011 Combined.

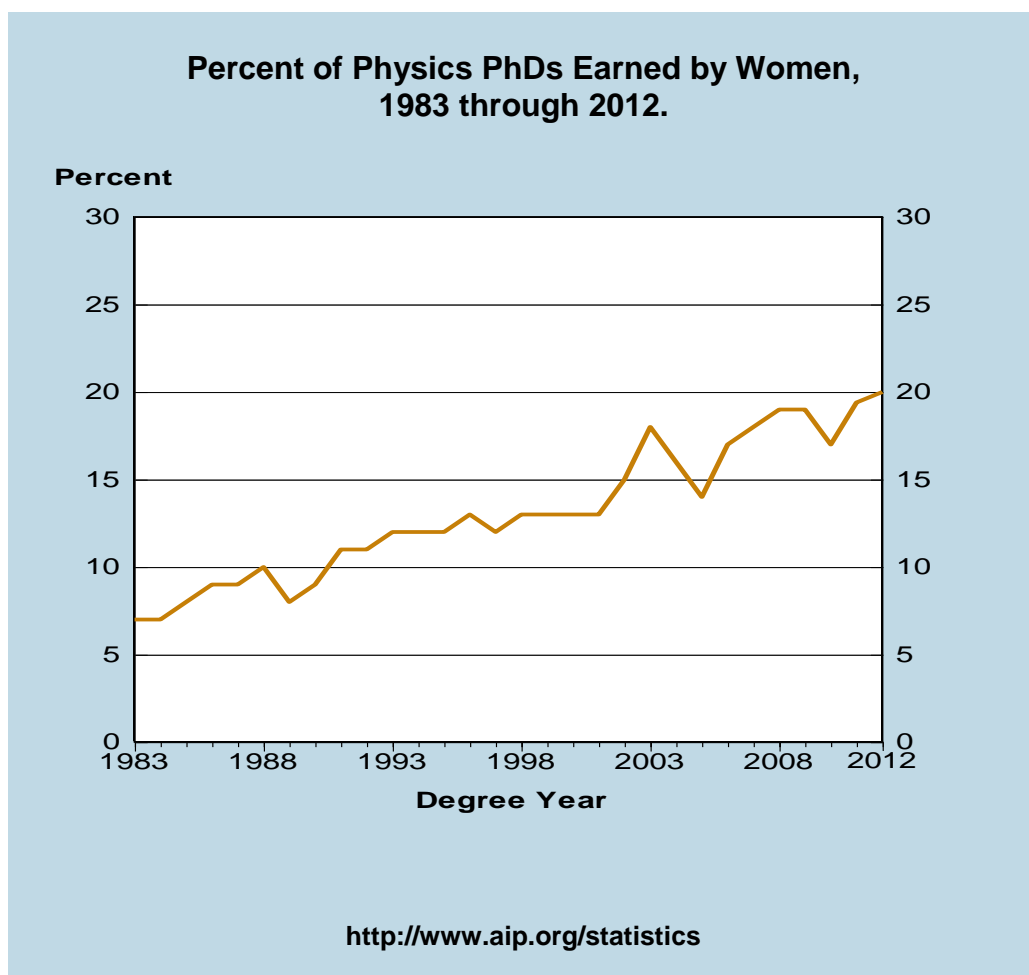


About a quarter of physics PhD recipients had a dissertation in condensed matter physics.

Note: These data are based on a 2 year average of 1,623 PhDs conferred at U.S. physics departments. Additionally, there was an average of 158 PhD astronomers from departments that offer astronomy degrees.

<http://www.aip.org/statistics>

Figure 4



The proportion of physics PhDs earned by women reached an all-time high of 20% in the class of 2012.

The number of women earning physics PhDs has increased from 153 in the class of 2001 to 354 in the class of 2012, a 131% increase.

The representation of women at the PhD level has reached an all-time high in the class of 2012. In the class of 2012, 20% of the physics PhDs were earned by women, this is up from 13% 11 years earlier. This increase along with a growth in the overall number of physics PhDs awarded has resulted in a sharp increase in the number of women receiving degrees. Women earned 354 of the physics PhDs in the class of 2012, up from only 153 in 2001 (a 131% increase).

The proportion of non-U.S. citizens earning physics PhDs who are women is higher than for U.S. citizens. Women comprised 23% of the non-U.S. citizens in the class of 2012 and 17% of the U.S. citizens.

Hispanic Americans and African Americans continue to be under represented among physics PhD recipients when compared to 26 - 35 year olds in the U.S. population. The number of Hispanic Americans and African Americans earning physics PhDs averaged 28 and 17 degrees respectively for the classes of 2010 through 2012. Of the 195 departments that offered a physics PhD in 2012, 4 were located at an Historically Black College and University (HBCU). These 4 departments were responsible for one-third of the PhDs earned by African Americans in the classes of 2010 through 2012.

Table 3

Race and Ethnicity of Physics PhDs, Classes of 2010 through 2012.

	3-Year Average Number	Percent of all Physics PhDs	Percent of U.S. Physics PhDs*
White	744	45	88
Asian American	41	2	5
Hispanic American	28	2	3
African American	17	1	2
Other U.S. Citizens	13	1	2
Non-U.S. Citizens	826	49	-
Total	1,669	100%	100%

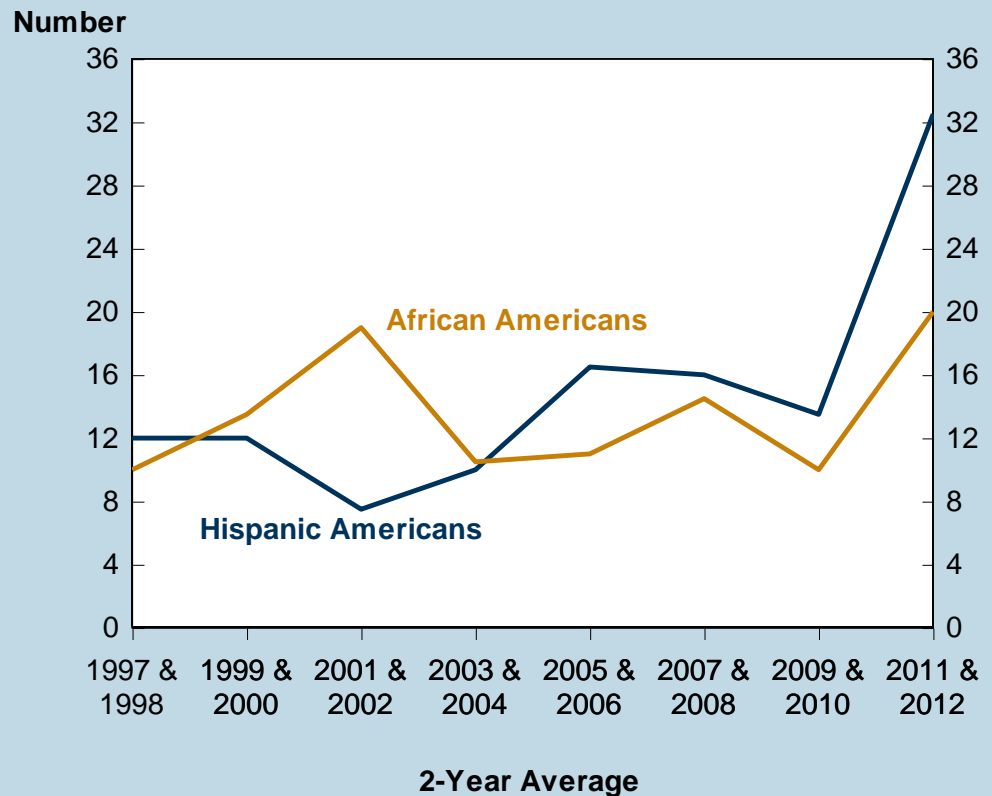
*Based on a 3-year average of 843 U.S. citizens.

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The 4 physics doctoral departments located at HBCUs produced one-third of the PhDs earned by African Americans in the classes of 2010, 2011, and 2012 combined.

Figure 5

Number of Physics Doctorates Earned by African Americans and Hispanic Americans, Classes of 1997 through 2012.



The number of physics PhDs earned by Hispanic Americans has increased by about 300% in less than a decade.

<http://www.aip.org/statistics>

There have been significant increases in the representation of Hispanic Americans among physics PhD recipients. The number of physics PhDs earned by Hispanics Americans has increased by about 300% during the last decade. The number of African Americans earning physics PhDs has not experienced a similar growth, with the number of degrees earned during the last decade averaging between 10 and 20 PhDs.

The majority of new physics PhD recipients in the classes of 2010 and 2011 would still get a physics PhD if they had the opportunity to relive their educational pursuits. There were significant differences between U.S. citizens and non-U.S. citizens when reflecting on their education choices concerning their pursuit of a physics PhD. Less than half (48%) of the non-U.S. citizens indicated they would repeat their physics doctoral education at the same institution. This compares to almost three-quarters of the U.S. citizens. Non-U.S. citizens were more likely than U.S. citizens to have indicated a desire to have attended a different physics department to obtain their PhD or have pursued a PhD in a discipline other than physics.

Table 4

**Response to the Question “If You Had To Do It Over Again, Would You Still Get a PhD in Physics?”
Classes of 2010 & 2011 Combined.**

	U.S. Citizens	Non-U.S. Citizens
Yes, at the same institution	73%	48%
Yes, at a different institution	11%	26%
No, I would get a PhD in another subject	8%	17%
No, I would not get a PhD	8%	9%

<http://www.aip.org/statistics>

A large majority of physics PhD recipients would still get a physics PhD if given the opportunity to change their educational pursuits.

**Appendix 1. Physics Doctorates Conferred,
Academic Years 2002-2012.**

Academic Year	Total
2002-2003	1,106
2003-2004	1,090
2004-2005	1,244
2005-2006	1,380
2006-2007	1,460
2007-2008	1,499
2008-2009	1,554
2009-2010	1,558
2010-2011	1,688
2011-2012	1,762

<http://www.aip.org/statistics>

About the Surveys

Survey of Enrollments and Degrees

Each fall AIP's Statistical Research Center conducts its Survey of Enrollments and Degrees. The survey is sent to all degree-granting physics and astronomy departments in the U.S. and Puerto Rico and asks them to provide the number of degrees they conferred in the previous academic year. The academic year is defined as being from September to August.

In the academic year 2011-12 there were 195 departments with a physics PhD program. And we received responses from 96% of these departments. Estimates were derived and included in the totals for non-responding departments.

Data from this survey are also used to produce the "Roster of Physics Departments," which provides a departmental-level enrollment and degree snapshot for each academic year. The most recent roster can be found at:

<http://www.aip.org/statistics/trends/reports/physrost.pdf>

Follow-Up Survey

The annual AIP follow-up surveys are conducted in the winter following the academic year in which PhDs received their degrees. The academic year is defined as being from September to August.

Data from the follow-up surveys of the physics PhD classes of 2009-10 and 2010-11 were used to calculate age in Table 1 as well as the data presented in Table 2, Figure 2, and Figure 3. These classes consisted of 1,558 and 1,688 PhDs, respectively and we received post-degree information on 53% of these degree recipients. Sixty-six percent of our responses came from the PhD recipients themselves, and the remainder came from their thesis advisors.

We thank the many physics departments, degree recipients, and faculty advisors who have made these publications possible.

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