

Physics Enrollments in Two-Year Colleges

Results from the 2012 Survey of Physics in Two-Year Colleges

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REPORTS ON PHYSICS IN TWO- YEAR COLLEGES

Physics Enrollments in Two-Year Colleges (April 2013)

Number of Physics Faculty
in Two-Year Colleges
(expected June 2013)

Physics Faculty Turnover in
Two-Year Colleges
(expected August 2013)

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THE 2012 SURVEY OF PHYSICS IN TWO- YEAR COLLEGES

During the spring semester of 2012, we attempted to contact all of the academic units on two-year college campuses in the US that were responsible for the physics courses on their campus.

THE 2007 SURVEY OF UNDERGRADUATE PHYSICS MAJORS

In the spring of 2007, we asked questions of undergraduate seniors in degree-granting physics departments. The analysis here is limited to those who had already graduated or who indicated they expected to graduate in the near future.

Physics Majors and Two-Year Colleges

Before examining physics offerings in two-year colleges (TYCs), we consider the role these schools play in post-secondary physics education. In our 2007 Survey of Undergraduate Seniors in degree-granting physics departments, we asked students if they had begun their post-secondary education at a TYC. Nine percent of the physics undergraduate seniors in 2007 had started their college education at a TYC. These physics majors differ significantly from those who did not start at a TYC. First, the physics seniors who started at a TYC are more racially diverse: about twenty percent of those who started at a TYC were Hispanic or a non-Asian minority (**Figure 1**).

Figure 1

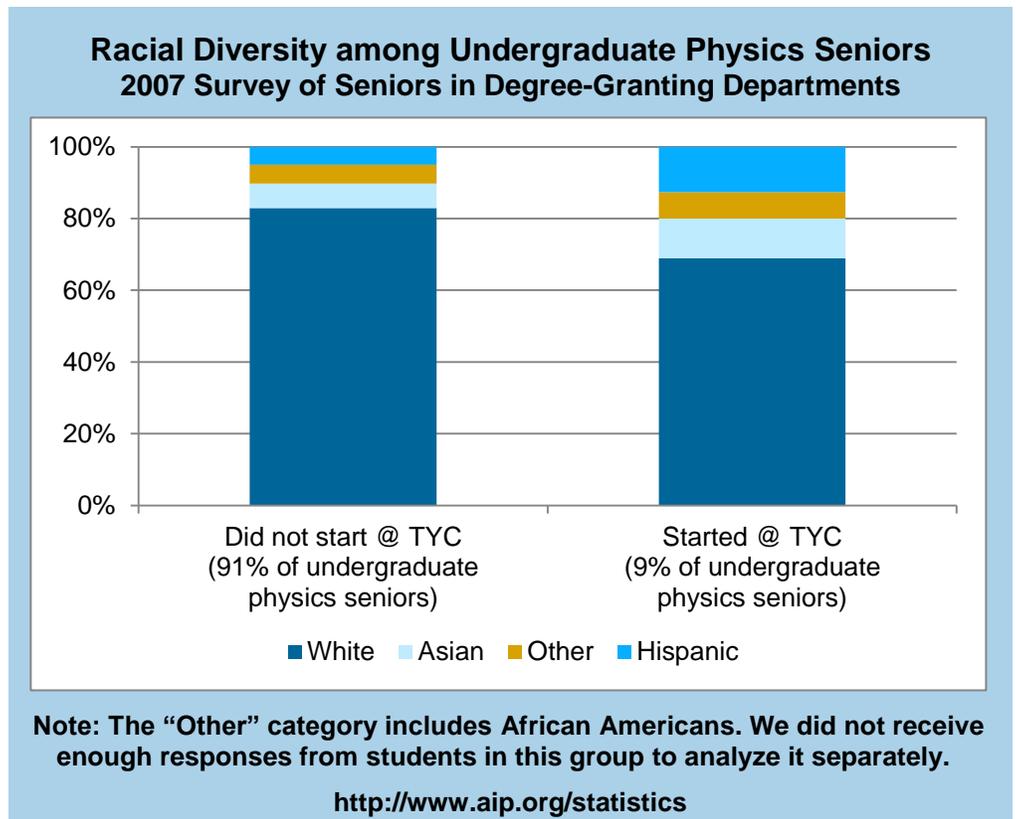
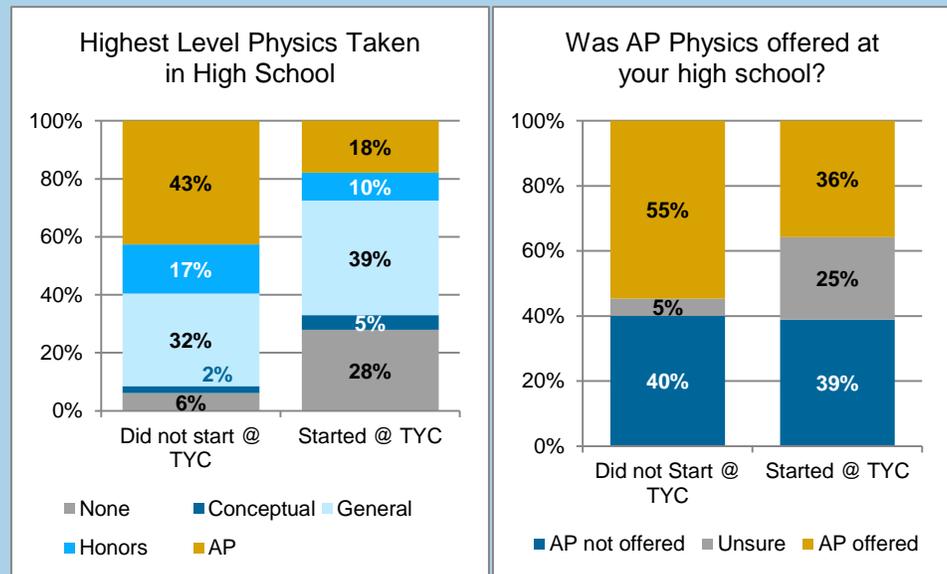


Figure 2

High School Physics Experience for Undergraduate Physics Seniors by First Post-Secondary Institution 2007 Survey of Seniors in Degree-Granting Departments



Note: About 95% of US high school seniors are enrolled in high schools where physics is available.

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Physics majors who started at a TYC seem to have had a very different experience with physics in high school when compared to those who did not start at a TYC.

A second major difference between physics seniors who started at a TYC and those who did not is their high school physics experience. More than one-fourth of those who started at a TYC did not take physics in high school, and only 18% took AP physics. (See **Figure 2**.) The 6% of those who did not start at a TYC and did not take physics is consistent with the 5% of high school seniors who attend a school where physics is not offered.

This apparent difference of interest in physics in high school is also evident from their knowledge about AP physics offerings: 25% of those who started at a TYC did not know if AP physics was offered at their high school versus only 5% of those who did not start at a TYC.

Since their high school physics experiences were so different, it is likely that something happened in their physics courses at the TYC that captured these students' interest in physics.

Two-Year Colleges: Finding Physics

Before we can discuss the prevalence of physics offerings at two-year colleges, we must first determine how many two-year colleges might reasonably be expected to offer courses in physics. This task is not as straightforward as one might expect. Some schools consist of only one campus, while others have multiple campuses. In addition, the name of the administrative unit where physics courses are taught may differ at different campuses of the same school and does differ across institutions.

We began with the US Department of Education's Integrated Post-secondary Education Data System (IPEDS). While some bachelor's granting institutions have historically offered associate's degrees (ADs), some TYCs now offer bachelor's degrees. So, we could not limit our search to schools that offered only ADs. We did limit our search to schools where at least 70% of the degrees awarded were ADs. We further restricted the schools to those that averaged awarding at least 25 ADs for each year the school was in operation between 2001 and 2010. This list included 1,199 schools.

We excluded 106 of these schools because they had limited academic offerings (Bible schools, schools of fashion merchandising, dramatic arts, and visual arts, for example). Thus, we estimate that there were 1,093 schools that might offer physics.

Knowing that there were 1,093 schools that might offer physics was not the final answer, however, since some entities that are represented by one listing in IPEDS actually consist of many campuses. For example, Ivy Tech Community College (Indiana) is one entry in IPEDS, and there are 31 locations listed on the Ivy Tech website. What we really want to know is how many campuses there are where we might reasonably expect physics to be offered.

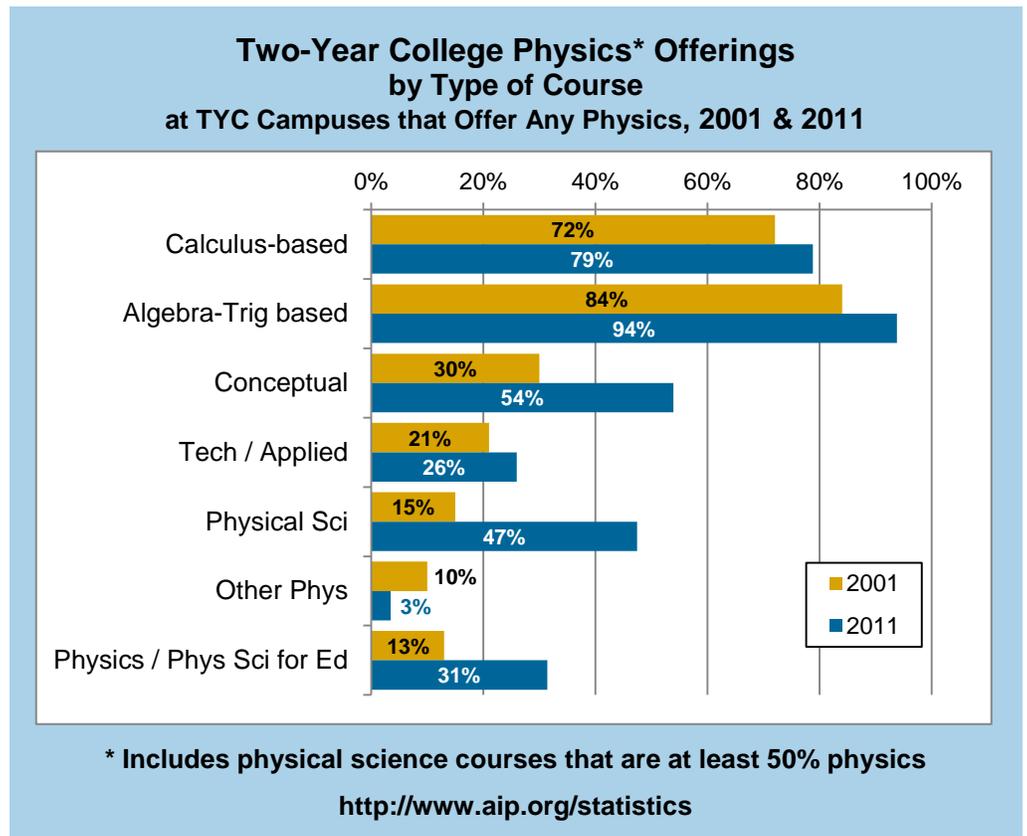
Based on stratified sampling (oversampling the smaller schools) and web searches for the sampled schools, we estimate that there are 1,681 campuses that might offer physics. Furthermore, we estimate that 63% of these campuses (1,060) do offer physics. This number is little changed from earlier studies; 1,056 campuses offered physics in 1995, and 1,072 campuses offered physics in 2001. Even though physics is offered on 63% of the campuses, it is important to note that these campuses account for 88% of the ADs awarded at TYCs between 2001 and 2010.

We estimate that physics is offered at 63% of TYC campuses. These campuses account for 88% of the ADs awarded at TYCs between 2001 and 2010.

Physics Offerings in Two-Year Colleges

What types of physics courses are taught on these campuses? **Figure 3** depicts the findings of our survey. The most commonly taught course is the algebra-trig-based physics class, which is taught at 94% of the campuses where physics is offered; this is up from 84% in 2001. In every case, except for Other Physics, the proportion of campuses offering various types of physics courses has increased since 2001.

Figure 3



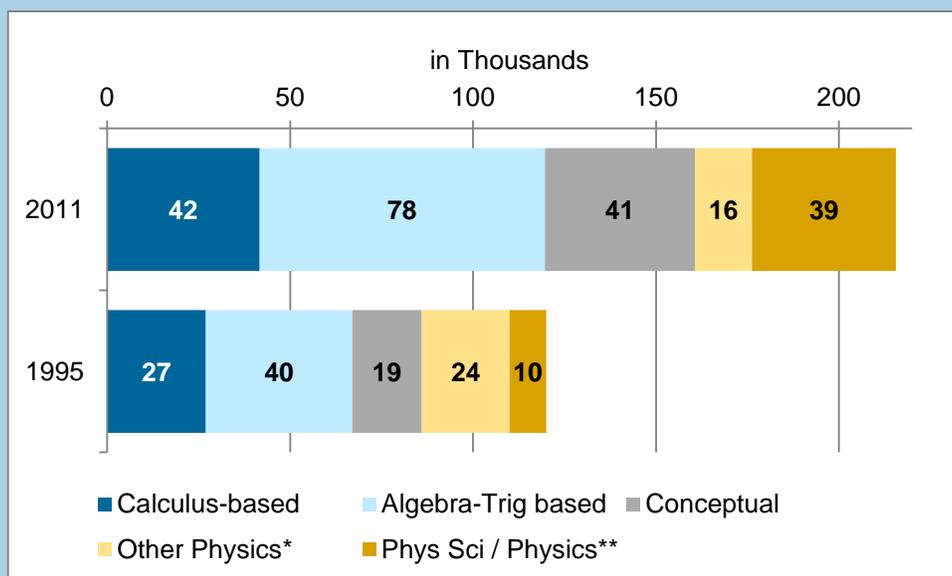
Physical science and physics / physical science courses for education majors accounted for almost one-fourth of the total enrollment in physics courses in two-year colleges in 2011.

We estimate that more than 215,000 students were enrolled in a physics or physical science course in a two-year college during the 2011-2012 academic year. (For courses that are taught in sequences across two or more semesters or quarters, these data include only enrollments in the first course of the sequence.) This is up from the 120,000 students estimated to have taken physics courses during the 1995-1996 academic year. Thus, physics enrollments grew at a 3.7% compound annual average rate over this 16-year period; this is on par with growth in full-time enrollments at TYCs over this same time frame.

Figure 4 provides enrollments by type of course. The number of students enrolled in algebra-trig-based and conceptual physics courses in two-year colleges has doubled, while enrollments in physical science and physics for education majors have almost quadrupled. The number of students taking calculus-based physics courses at TYCs has grown by about 50% and enrollments in other types of physics courses have dropped.

Figure 4

Number of Students Enrolled in Physics[‡] in Two-Year Colleges by Academic Year & Type of Course



[‡] Includes physical science courses that are at least 50% physics

*Includes Technical / applied physics

** Includes physical science and physics for education majors

1995 data represents the 1995-1996 academic year

2011 data represents the 2011-2012 academic year

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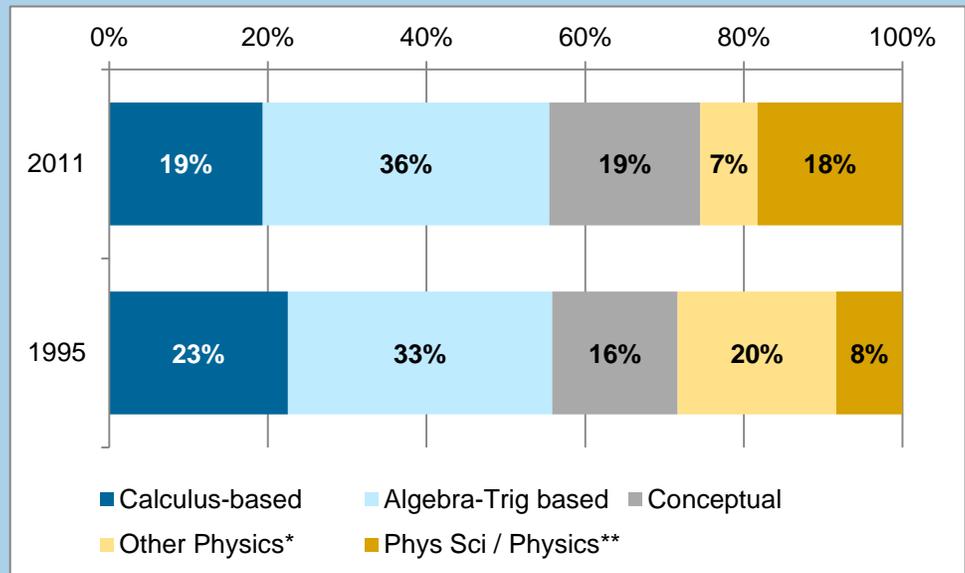
Enrollment in physics courses in two-year colleges almost doubled between 1995 and 2011.

As shown in **Figure 5** (next page), the proportion of students taking a calculus-based, algebra-trig-based, or conceptual physics course has changed little; these courses account for over 70% of the students taking physics at TYCs. The big changes in enrollment composition are seen in other physics and physical science & physics for education majors. Fewer than 11,000 students were enrolled in technical or applied physics in 2011; this is on par with enrollments in 1995. The large drop in the other physics category (which includes technical or applied physics) is in other physics courses: 13,000 students were enrolled in other types of physics courses in 1995, while these courses accounted for only 5,000 students in 2011. Perhaps the physics

curriculum in TYCs is becoming more closely aligned with that in four-year schools. Of course, as part of their mission, TYCs serve the local community, so it is likely that there will be physics courses on some campuses that are tailored to meet local needs.

Figure 5

Enrollment Distribution in Physics[‡] Courses at Two-Year Colleges by Academic Year & Type of Class



Calculus- and algebra-trig-based physics courses accounted for over half of the enrollments in both 1995 and 2011.

[‡] Includes physical science courses that are at least 50% physics

*Includes Technical / applied physics

** Includes physical science and physics for education majors

1995 data represents the 1995-1996 academic year

2011 data represents the 2011-2012 academic year

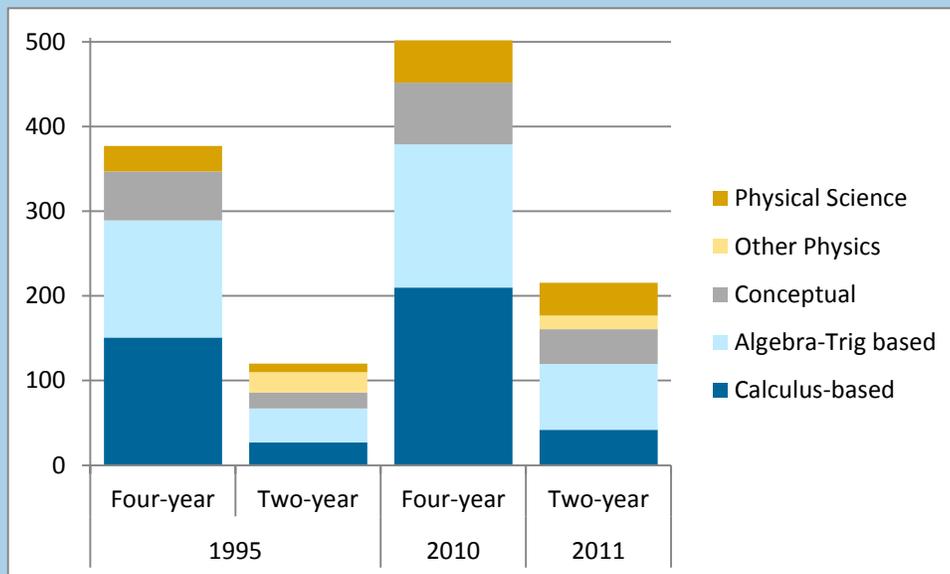
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Postsecondary Physics

When we compare physics enrollments in two-year colleges to physics enrollments in schools that offer at least a bachelor's degree, we see that TYCs account for about 30% of the total physics enrollments. At schools that granted at least a bachelor's degree in physics, total physical science plus physics enrollments (Calculus-based, Algebra-trig-based, and Conceptual) were about 380,000 in 1995, and they grew to about 500,000 in 2010 (the latest year for which data are currently available). In TYCs, enrollments in these courses were 86,000 in 1995 and almost 161,000 in 2011. (See **Figure 6** on next page.)

Figure 6

Number of Students Enrolled in Physics and Physical Science* Courses at TYCs and Institutions that offer a Bachelor's in Physics



* Includes physical science courses that are at least 50% physics

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

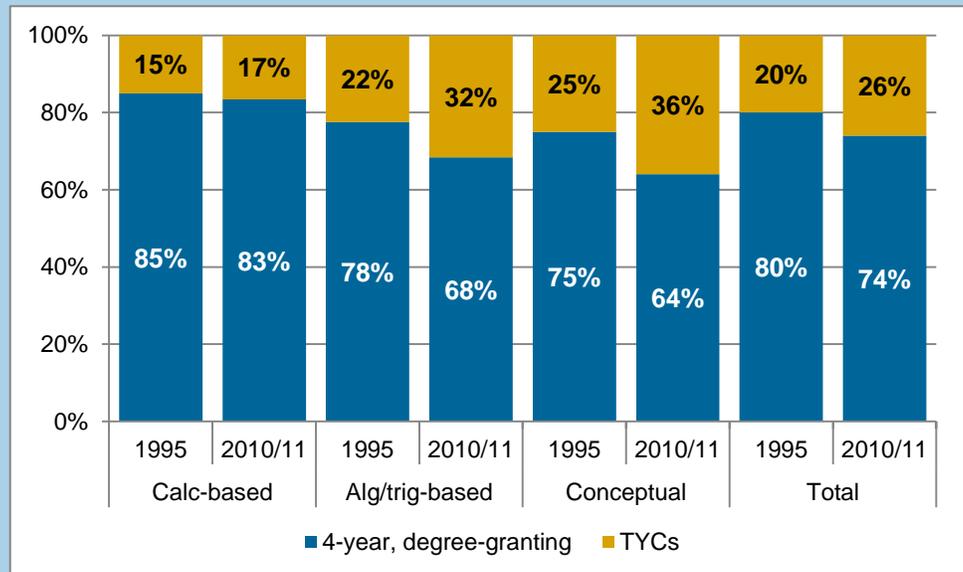
Enrollments in physics and physical science courses have grown faster at TYCs than at four-year schools that offer at least a bachelor's degree in physics.

Another way to look at the contribution of TYCs to postsecondary physics education is to consider the proportion of student enrollment in each type of physics course that is taught at TYCs versus degree-granting physics departments. This is shown in **Figure 7** (next page). In 1995, about 20% of students taking physics (calculus-based, algebra-trig-based, and conceptual) were enrolled in these courses at TYCs. The most recent data shows that about 26% of students in these courses were taking them at TYCs. (As noted previously, for courses that are taught in sequences across two or more semesters or quarters, these data include only enrollments in the first course of the sequence.)

The distribution varies by class, with students in calculus-based physics courses most likely to be enrolled in degree-granting departments. We must note that, in some engineering schools, the engineering students take their physics courses in the school of engineering. These students are not included in these data; these data include only students in degree-granting physics departments in four-year colleges and universities.

Figure 7

Total Student Enrollment in Physics Courses by Type of Institution



The proportion of students taking their postsecondary physics courses at TYCs has grown.

The enrollment data for four-year schools is for physics-degree-granting departments only.

The 2010/11 data is 2010 data for 4-year schools and 2011 data for TYCs.

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

Astronomy in Two-Year Colleges

In addition to examining physics offerings, we also collected data about astronomy offerings at TYCs. In 2011, we estimate that 71% of TYCs that offered physics courses also offered astronomy courses. It is possible that there are TYCs that offer astronomy that do not offer physics; data for these schools are not included in our estimates. We estimate that 51,000 students took an astronomy course at a TYC in 2011. We did not collect data on astronomy courses in our earlier TYC studies, so we cannot make historical comparisons. However, we do have data on enrollments in astronomy courses taught by physics departments that offer at least a bachelor's degree in physics and in astronomy courses taught by departments that offer a degree in astronomy – both stand-alone astronomy departments and combined physics and astronomy departments. These data are highlighted in **Table 1** (next page). The number of students enrolled in introductory astronomy courses at TYCs are equivalent to that in departments that grant at least bachelor's degrees in astronomy.

Table 1

**Enrollments in Introductory Astronomy Courses
in TYCs and Departments Offering at least Bachelor's Degrees**

Institution/Department	Year	Introductory Astronomy Enrollments
TYCs	2011	51,000
Physics degree-granting	2010	144,000
Astronomy degree-granting	2010	52,000

Note: The data for the astronomy degree-granting departments includes departments that offer degrees in both physics and astronomy.

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The number of students enrolled in introductory astronomy courses at TYCs are equivalent to that in departments that grant at least bachelor's degrees in astronomy.

Survey Methodology

In the Fall of 2011, we compiled a list of TYC campuses that we believed offered physics and likely best physics contacts at those campuses. We reached out to American Association of Physics Teachers (AAPT) members at TYCs to help ensure we were including all appropriate campuses. We also worked with the American Chemical Society (ACS) when we learned they would be conducting a survey of chemistry in TYCs since physics and chemistry are often in the same administrative unit at TYCs. We also visited the website or contacted someone at 80 campuses – oversampling small campuses – to help us better determine where physics was and was not offered.

Between March 1 and June 30, 2012, we attempted to reach the physics contact by e-mail multiple times. On June 12, we sent a postcard to approximately 600 campuses that had not yet responded. We had physics contacts for 111 of those campuses; the remaining postcards were addressed to “Physics Faculty”.

We received useable responses from 442 campuses; this is 42% of the campuses we believe offer physics. Final estimates were scaled based on the number of associate degrees awarded. We received a higher proportion of responses from larger schools, and a smaller proportion from smaller schools, but the results have been adjusted to reflect that.

We offer sincere gratitude to all those who helped compile this data. If you have any questions or comments, please contact Susan White at swhite@aip.org.



e-Updates

Thank you for your interest in our study of physics in two-year colleges. We also have data on physics in US high schools, physics in degree-granting departments, underrepresented minorities in physics, global physics, and careers. If you would like to be notified when we post a new report on a topic that interests you, please sign up for our data alerts at www.aip.org/statistics/e_updates.

We promise not to share your contact information with any other parties. You will be asked to indicate areas of interest to you. We promise not to overfill your inbox since we typically send about 20 e-Updates each year, averaging fewer than two each month.