

## New Astronomy PhDs: What Comes Next

Data from the degree recipient follow-up survey for the classes of 2018, 2019, and 2020

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Astronomy PhD recipients generally follow three main outcomes after receiving their degrees: they accept a postdoctoral position, a non-postdoctoral temporary position, or a potentially permanent position. To learn more about these outcomes, AIP annually asked new astronomy PhDs about their immediate post-degree outcomes. For the classes of 2018, 2019, and 2020, an average of just over 160 individuals per year earned an astronomy PhD at one of the 45 departments in the US with an astronomy doctoral program.

From these three classes, around two-thirds of PhD graduates accepted a postdoc. Most of the other graduates secured potentially permanent employment. The graduates accepting potentially permanent jobs entered very different employment positions than those accepting postdocs. Most of the postdocs were in academia, while most of the potentially permanent positions were in the private sector. Those taking positions in the private sector typically reported considerably higher starting salaries than those accepting postdocs. Despite the lower pay, more of the graduates accepting a postdoc find their work challenging, and a higher proportion indicate being satisfied with their employment.

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### Three Main Outcomes

About two-thirds of new astronomy PhDs from the classes of 2018, 2019, and 2020 accepted a postdoctoral appointment in the year following the receipt of their degree. This is an about 10% increase from a few years earlier (**Figure 1**).<sup>1</sup> Non-US citizens were more likely to accept postdoctoral positions (80%) than US citizens (63%), while US citizens were more likely to accept potentially permanent positions (30%) than non-US citizens (15%). These differences are statistically significant.

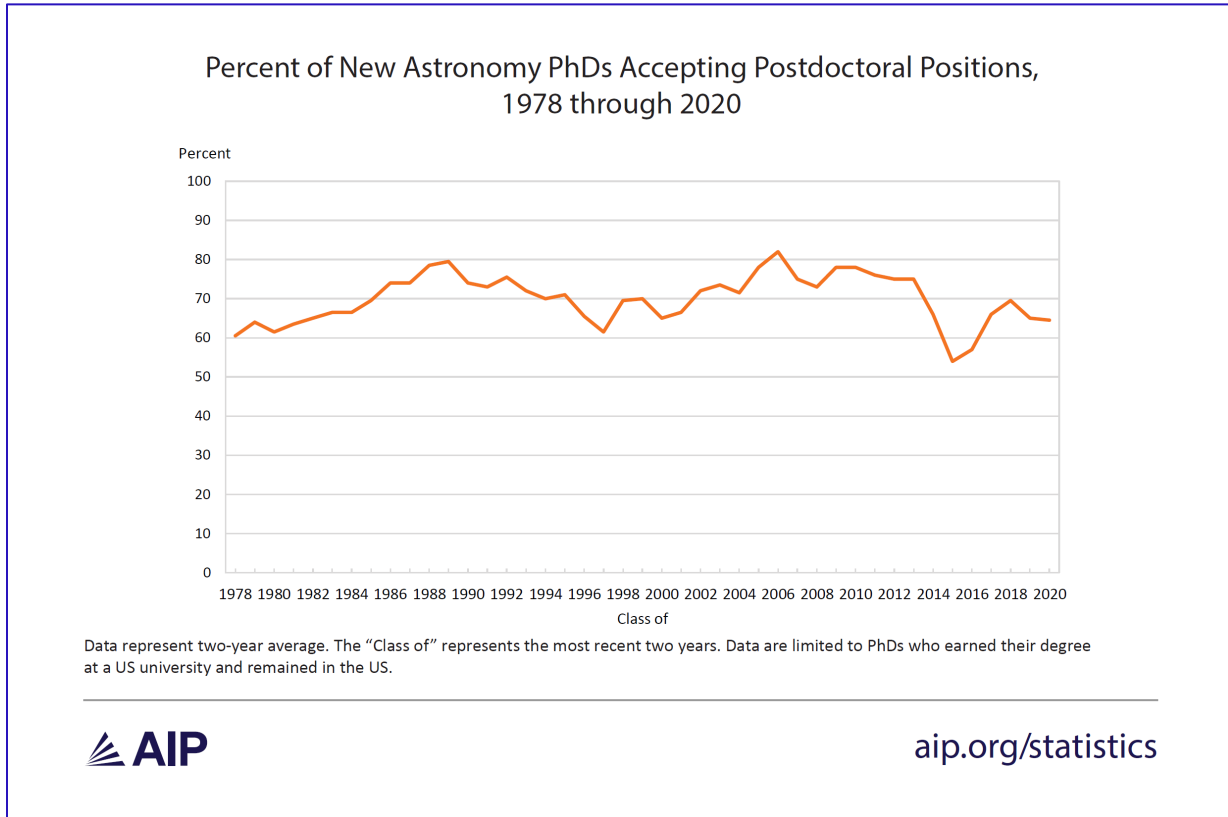
There are a variety of reasons for an astronomy PhD to accept a postdoctoral position following receipt of their degree. When asked about what influenced their decision to accept a postdoctoral appointment, the most commonly selected responses were “to work with a particular research group or scientist” (87%) and “to obtain research experience in my field” (92%). About a third (32%) of the postdocs who were not US citizens indicated that “visa restrictions limited their options.”

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<sup>1</sup> Most of the graduates in this report had received their degrees and secured postgraduate situations before the COVID-19 pandemic, so the recent increase in postdoc taking is likely not an effect of the pandemic.

About one-quarter of the new astronomy PhDs accepted potentially permanent employment, and an additional 5% accepted non-postdoctoral temporary positions. Three percent of the PhDs in the classes of 2018, 2019, and 2020 indicated they were unemployed and seeking employment in the winter following the academic year in which they received their degree.

**Figure 1**



## COVID Impacts

The COVID-19 pandemic greatly impacted institutions during the end of the 2019–20 academic year, causing most institutions to close their campuses. To access the impact of this on astronomy PhDs, the class of 2020 was asked if the COVID-19 pandemic delayed the defense of their PhD thesis. Almost a third (29%) of degree recipients indicated that COVID-19 delayed the defense of their dissertation. When asked to describe the circumstances of the delay, many PhDs indicated the delay was relatively short and was a result of needing to coordinate a time when they and their oral defense committee could meet virtually. We believe that there were additional PhD candidates who were unable to meet graduation requirements due to the pandemic, but they were not included in this survey that went only to those who successfully defended their PhD thesis by the end of the spring 2020 semester.

The pandemic did not significantly impact the types of initial employment new PhDs accepted. The proportion of the astronomy PhD class of 2020 that accepted a postdoc as their first post-

degree position is similar to the proportion accepting one in the class of 2019. Below we look at other aspects of initial employment, such as sector, salary, and job satisfaction. There are no statistically significant differences between what was reported by the classes of 2019 and 2020, indicating that the COVID-19 pandemic disruptions did not have a substantial impact on the employment outcomes of new astronomy PhDs.

The COVID-19 pandemic did cause a delay in the employment starting date for a fifth of the respondents from the class of 2020. In addition, at the time that the class of 2020 answered our survey (spring 2021), 96% of employed astronomy PhDs were working either entirely remotely (76%) or in a hybrid fashion (20%).

## Employment Sectors

Almost four in five (79%) astronomy PhDs holding postdoctoral positions were employed at a college or university (**Table 1**). By contrast, only about one in five (21%) of those accepting a potentially permanent position were employed in the academic sector.

As has been historically true, the majority of new PhDs holding potentially permanent positions were working in the private sector. The government sector made up about a tenth of the positions held by new astronomy PhDs, regardless of employment type. Additionally, about 9% of respondents indicated working in “other” sectors such as nonprofits or museums.

**Table 1**

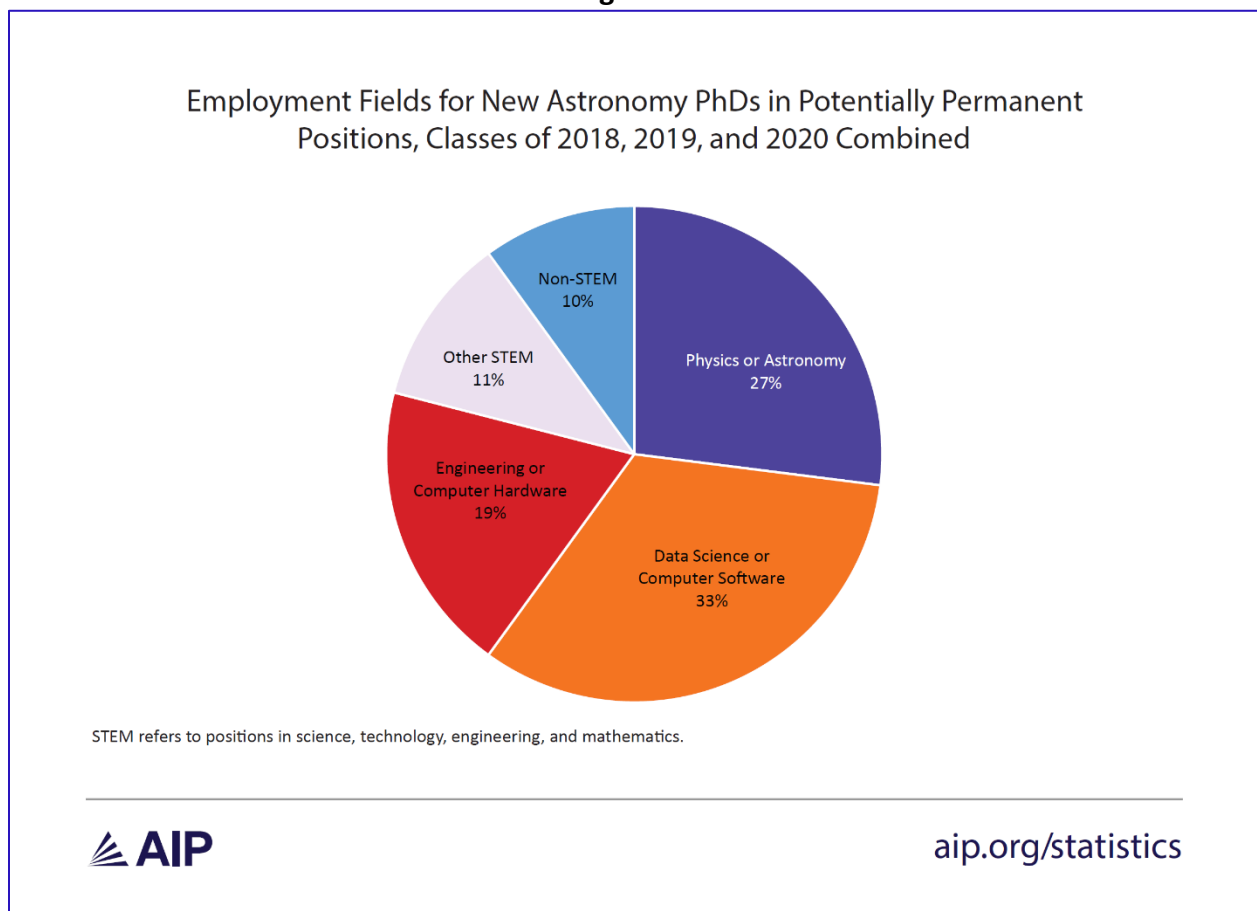
Type of Employment of New Astronomy PhDs by Employment Sector,  
Classes of 2018, 2019, and 2020 Combined

| Sector of Employment | Postdoc % | Potentially Permanent % |
|----------------------|-----------|-------------------------|
| Academic             | 79%       | 21%                     |
| Private              | 0%        | 63%                     |
| Government           | 12%       | 10%                     |
| Other                | 9%        | 6%                      |

## Fields of Employment

Astronomy PhDs secure employment in a variety of fields. Almost all astronomy postdocs (97%) indicated they were working in the fields of either astronomy (87%) or physics (10%). The remaining 3% were working in a variety of other STEM fields. The fields of employment for new astronomy PhDs holding potentially permanent employment were more varied, with the most common fields being data science or computer software (**Figure 2**). Over a quarter of new astronomy PhDs holding potentially permanent employment were working in the fields of astronomy or physics, and about a fifth were working in engineering or computer hardware.

**Figure 2**



## Satisfaction, Skills, and Salaries

New astronomy doctorates in postdoctoral positions were more satisfied with their positions across all measurements than those holding potentially permanent positions (**Table 2**). All of the new PhDs holding postdocs indicated they felt their PhD was an appropriate background for their position. This compares to only about three-quarters of the PhDs holding potentially permanent positions. A smaller proportion of postdoc holders felt they were underemployed

than those holding potentially permanent positions, 6% and 22%, respectively. Regardless of employment type, the vast majority (90%) of astronomy PhDs were, overall, satisfied with their employment.

**Table 2**

Measurements of Position Satisfaction by Employment Type for Astronomy PhDs, Classes of 2018, 2019, and 2020 Combined

| Percent who felt:                                   | Postdoc | Potentially Permanent | Overall |
|-----------------------------------------------------|---------|-----------------------|---------|
| A PhD was an appropriate background for my position | 100%    | 78%                   | 94%     |
| My position is professionally challenging           | 93%     | 83%                   | 90%     |
| I consider myself underemployed in my position      | 6%      | 22%                   | 12%     |
| Overall, I am satisfied with this position          | 93%     | 80%                   | 90%     |

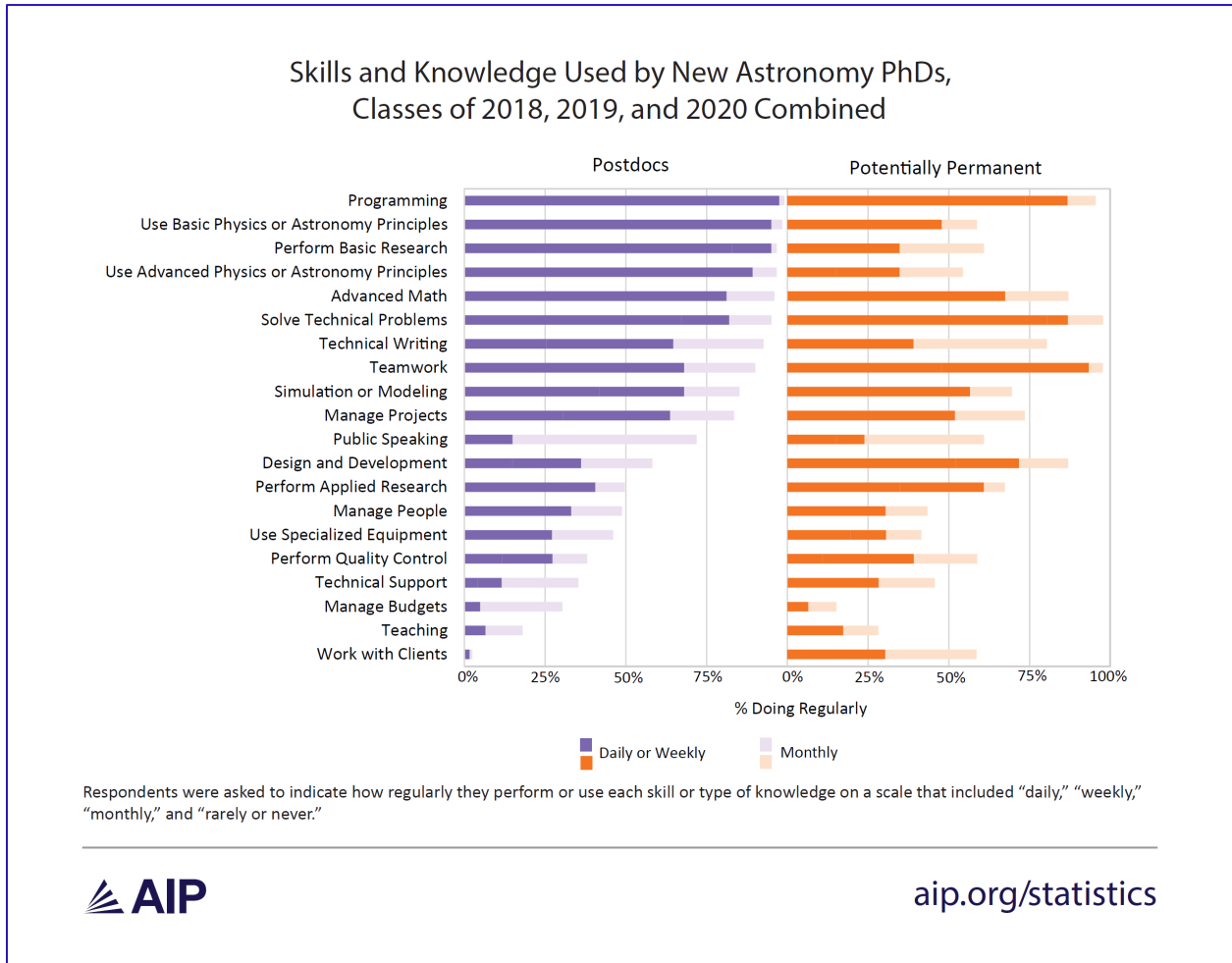
Respondents were asked to indicate their level of agreement with each statement using a five-point scale that included options such as “very satisfied,” “satisfied,” “somewhat satisfied,” and “not at all satisfied.” Response option wording varied slightly by statement.



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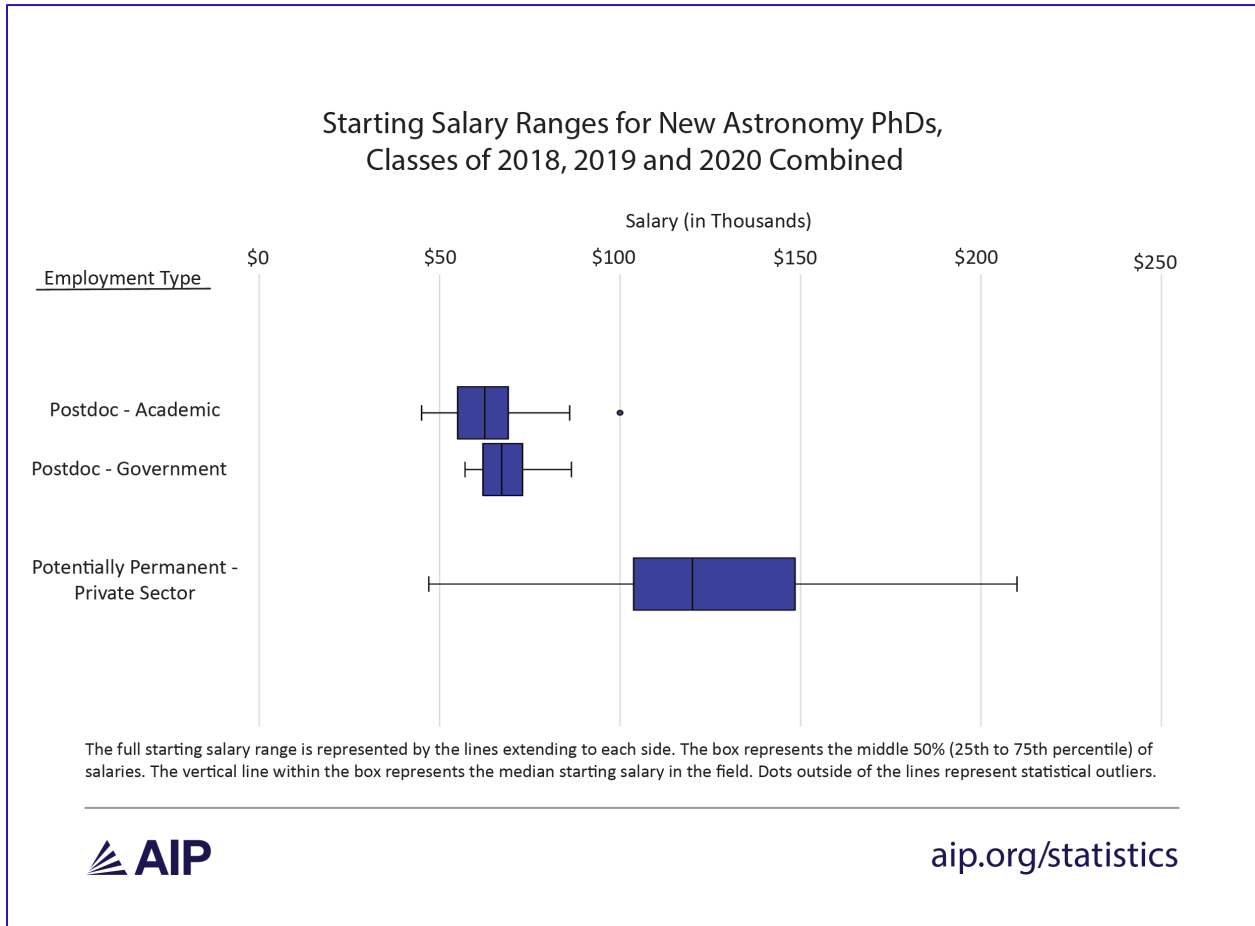
Astronomy PhDs use a wide variety of skills in their positions. Both postdocs and those employed in potentially permanent positions reported that they regularly “solve technical problems,” “work on a team,” and “do programming.” There were, however, some distinct differences between the two groups. Postdocs more often reported using “basic” or “advanced physics or astronomy principles” and “performing basic research.” Those employed in potentially permanent positions more often reported that they regularly “perform design and development,” “perform quality control,” and “work with clients” (**Figure 3**).

**Figure 3**



New astronomy PhDs holding postdocs in academia or the government had relatively similar and narrow salary ranges, with medians of \$62,500 and \$67,000, respectively. The median starting salary for potentially permanent private sector positions was substantially higher, at \$120,000. The range of salaries in the private sector was also much wider, with a low of \$47,000, and a high of \$210,000 (**Figure 4**). This wide range of salaries reflects the diversity of positions new astronomy PhDs hold in the private sector, with the higher salaries typically earned by PhDs with job titles of data scientist or engineer.

Figure 4



## Demographics

In some cases, physics departments may have students specializing in astrophysics; they are not included in this report. Over a third of astronomy PhDs for the classes in this report went to women (**Table 3**); this is higher than the 20% of physics PhDs that went to women. Non-US citizens made up just over a quarter of respondents (**Table 3**). About 17% of astronomy PhD recipients over this time frame left the US after graduation. Most of these had accepted a postdoctoral appointment abroad. Those who left the US are not included in the analyses.

**Table 3**

Demographics of Astronomy PhDs, Classes of 2018, 2019, and 2020 Combined

|              |        |     |
|--------------|--------|-----|
| Gender*      | Men    | 64% |
|              | Women  | 36% |
| Citizenship* | US     | 73% |
|              | Non-US | 27% |
| Age          | Median | 29  |

\*Data from AIP Enrollments and Degrees Survey. For the degree classes used in this report, the Enrollments and Degree Survey did not provide other gender response options. Of the respondents to the Follow-Up Survey, 1% indicated a gender other than "man" or "woman."



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## Survey Methodology

Each fall the Statistical Research Center conducts a Survey of Enrollments and Degrees, which asks all degree-granting physics and astronomy departments in the US to provide information concerning the number of students they have enrolled and counts of recent degree recipients. At the same time, we ask for the names and contact information for recent degree recipients. This degree recipient information is used to conduct our follow-up survey in the winter following the academic year in which respondents received their degrees. The post-degree outcome data in this Focus On come from that survey.

Recent degree recipients can be difficult to reach because they tend to relocate after receiving their degrees. Departments often do not provide or do not have accurate contact information for their alumni. To assist us in determining outcome information and to help obtain updated contact information, we contact the advisors of nonresponding degree recipients. The information obtained from the advisors is limited to citizenship, gender, employment status, sector of employment, location (in or out of the US), and subfield of dissertation for the PhDs.

Because astronomy degree classes at all levels are relatively small, we combined follow-up survey response data for three degree classes in order to reliably report on degree recipient outcomes. The follow-up surveys for astronomy degree recipients in the classes of 2018, 2019, and 2020 were administered in a web-based format. Nonresponding degree recipients were contacted up to five times with invitations to participate in the survey. The class of 2020 survey included questions concerning the impact of the COVID-19 pandemic on the degree recipient's post-degree plans and outcomes.

The astronomy PhD classes of 2018, 2019, and 2020 consisted of 173, 159, and 155 PhDs, respectively, averaging about 162 per year. We received post-degree information on 65% of these degree recipients. Thirty percent of the post-degree data came from advisors, and the remainder came from the PhD recipients themselves. PhD recipients with dissertation subfields of astrophysics who received their doctorate from a separate physics department are not included in this analysis

We thank the many astronomy departments, degree recipients, and faculty advisors who have made this publication possible.

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Published: January 2023

A product of the Statistical Research Center of the American Institute of Physics  
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