

Workforce Survey of 2021 US AAS Members Summary Results

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Contents

OVERVIEW – Who Was Surveyed	5
HIGHLIGHTS	5
RESULTS	8
US AAS MEMBERS – Educational Experience and Employment Status	8
Table 1 – Highest Degree Earned	8
Figure 1 – Highest Degree Earned	8
Table 2 – Highest Degree Earned by Gender	9
Figure 2 – Highest Degree Earned by Gender	9
Table 2b – Highest Degree Earned by Birth Year	10
Table 3 – Year of Degree	10
Figure 3 – Year of Degree	10
Table 4 – Country of Degree	11
Figure 4 – Country of Degree	11
Table 5 – Field of Degree	12
Table 6 – Field of Degree over Time	12
Table 7 – Employment Status	13
Figure 5 – Employment Status	13
Table 8 - Employment Type	14
Figure 6 – Employment Type	14
Table 9 - Current Employer	15
Figure 7 – Current Employer	15
Table 10 - Current Employer over Time	16
Table 11 – Academic Status	17
Figure 8 – Academic Status	17
EMPLOYMENT – Postdocs and Careers	18
Table 12 – Postdoctoral Experience	18
Table 13 – Desired Employer of Postdocs	19
Table 14 – Current Employer of Former Postdocs	19
Table 15 – Postdoc Experience by Employer	20
Figure 9 – Postdoc Experience	20
Table 16 - Main Activity in Current Job	21

Table 17 - Time Allocation in Current Job.....	22
Table 17b – Time Allocation in Current Job, Before and During Pandemic.....	23
Table 18 – Primary Areas of Interest	24
Table 18b – Primary Areas of Interest by Gender.....	25
Figure 10 – Primary Areas of Interest by Gender	26
Table 19 – Funding Sources for Salaries ¹	26
Table 20 – Funding Sources for Salaries over Time ¹	27
Table 21 – Variables Impacting Salaries.....	28
Table 22 – Encouraging the Pursuit of an Astronomy Career.....	29
Figure 11 – Encouraging the Pursuit of an Astronomy Career	29
AAS MEMBERS – Demographics and Family.....	30
Table 23 – Gender	30
Figure 12 – Gender by Age Group	30
Figure 13 – Gender Over Time.....	31
Table 24 – Marriage or Partnership Status	32
Figure 14 – Marriage or Partnership Status.....	32
Table 25 – Members with Children.....	33
Figure 15 – Members with Children	33
Table 26 - Relocated for a Spouse or Partner	34
Figure 16 – Relocated with a Spouse or Partner.....	35
Table 27 – Disabilities	36
Table 28 – Accessibility Aids	36
Table 29 – Ethnicity.....	37
Table 30- Sexual Orientation.....	37
AAS MEMBERS - Effects of COVID.....	38
Table 31 – Post-Degree Plans Change Due to COVID-19	38
Table 32 – Classes Cancelled Due to COVID-19	38
Table 33 – Degree Progress Slowed Due to COVID-19	39
Figure 17 – Degree Progress Slowed Due to COVID-19	39
Table 34 – Online or In-Person During COVID-19	40
Table 35 – Did you Learn More or Less Based on Online Classes?	40
Figure 18 – Did you Learn More or Less Based on Online Classes?.....	40

Table 36 – In How Many Online Classes Was Content Effectively Delivered?	41
Table 37 – Student Feelings of Isolation During Spring 2021	41
Figure 19 – Student Feelings of Isolation During Spring 2021	41
Table 38 – Student Feelings of Belonging During Spring 2021	42
Figure 20 – Student Feelings of Belonging During Spring 2021	42
Table 39 – Frequency of Students Seeking Help from Instructors, Spring 2021	43
Figure 21 – Frequency of Students Seeking Help from Instructors, Spring 2021	43
Table 40 – Graduate Students: How satisfied were you with your ability to interact with your research advisor during the 2020-2021 academic year?	43
Table 41 – Graduate Students’ Access to Computing Resources, Spring 2021	44
Table 42 – COVID-19 Impact on Graduate Students’ Research	44
Figure 22 – COVID-19 Impact on Graduate Students’ Research	44
Table 43 – Faculty Members’ COVID-19 Adjustments to Student Assessment	45
Table 44 – COVID-19 Impact on Faculty Members’ Course Delivery	46
Figure 23 – COVID-19 Impact on Faculty Members’ Course Delivery	46
Table 45 – Largest Impact of COVID-19 on Faculty Members’ Ability to Deliver Education	47
Table 46 – Impact of COVID-19 on Faculty Members’ Work	47
Table 47 – Impact of COVID-19 on Faculty Members’ Access to Resources	48
Table 48 – Ill with COVID-19	48
Table 49 – Care for Others with COVID-19	48
APPENDIX A: Challenges facing the field of astronomy	49
APPENDIX B: Additional Tables	50
Table 50 – Training Offered in Graduate Programs for Graduate Students	50
Table 51 – Training Offered in Graduate Programs for Postdocs	51
Table 52 – Encouragement for Graduate Students to Work Outside of Academia	52
Table 53 - Access to Career Center on Campus for Undergraduates	52
Table 54 – Cost of Living for Respondents	52
Table 55 – Salary Satisfaction	53
Table 56 – Inadequate Salary Outcomes	53

OVERVIEW – Who Was Surveyed

This survey is the fourth in a series of sample surveys of AAS members. The first three were conducted in 2013, 2016, and 2018 respectively. For the fourth survey, AIP sent a prenotice on November 30th, 2021, followed by the first wave of requests on December 6th, 2021. There were five requests sent, with the last sent on January 26th, 2022. The fourth survey included questions about the effects of the COVID-19 pandemic.

The sample consisted of 3,207 AAS members in the United States. We were able to contact 3,093 AAS members. Members who lived outside of the U.S. were not included in the survey. We received 1,808 responses, a response rate of about 58.5%. The table below shows where the responses came from, and how it compares to the sample and overall contact list we worked from.

Membership Types						
Membership Type	All N	All %	Sample N	Sample %	Resp N	Resp %
Full	3825	60%	1879	59%	1167	65%
Student (graduate or undergraduate, includes high school)	1760	27%	903	28%	409	22%
Emeritus	669	10%	349	11%	189	10%
Educator affiliate	131	2%	68	2%	37	2%
Alumni Affiliates	29	<1%	8	<1%	6	<1%
Total	6414		3207		1808	

HIGHLIGHTS

- Most US-resident AAS members have PhDs, and most of these are from the US. Most members' degree field is either astronomy/astrophysics or physics (Tables 1, 3, and 4).
- The increasing participation of women in the educational system for astronomy is reflected at several points in the data, including a more recent median year of highest degree for women than for men (Table 2).
- AAS members' careers are largely concentrated in academe at universities and 4-year colleges, which employed over half (57%) of AAS members with PhDs (Table 7).
- The amount of time US AAS members have spent in postdocs has been increasing (Table 12).
- Among current postdocs, working at universities and 4-year colleges was the job most desired. It is also the most common current position for US AAS members who are not postdocs (Table 13).
- US AAS members who worked in industry are less likely than others to have taken a postdoc (Table 15).

- AAS members employed at universities or four-year colleges reported teaching as a main activity more often than those in other sectors. On the other hand, AAS members in other sectors more often reported management or observatory/mission support/instrument commission as their main activity (Table 16).
- About 30% of US AAS members received funding from NASA in 2021. This is down from 39% in 2018. (Table 19).
- In the early years of this survey, there was a gender difference in salary, but in 2018 and 2021, there was no gender difference (Table 21) The significant predictors of salary include:
 - employment sector, with all sectors showing an increase over academe,
 - having worked as a postdoc (increase over those without postdocs), and
 - time since PhD, with an increase for each year.
- Most US AAS members would encourage someone else to pursue an astronomy career (Table 22).
- AAS members who identified as men were more likely to report having children (Table 25), consistent with other literature showing that careers in science are especially difficult for women with children due to cultural expectations placed on mothers.
- AAS members who identified as women and who were born in an older cohort (before 1988) were more likely than others to report having had a two-body problem (Table 26).
- Other demographics of US AAS members include (Tables 27, 28, and 30):
 - 74% report having no disability
 - About 20% identify as people of color
 - About 10% identify as lesbian, gay, or bisexual

Effects of COVID

- About one-third of undergraduate students reported that some classes had been cancelled due to COVID. The pandemic seemed to have little effect on graduate classes (Table 32).
- Graduate students more often reported that COVID-19 slowed progress towards their degrees than undergraduate students (Table 33).
- Very few (4%) of students reported attending classes solely in person in Spring 2021 (Table 34).
- Almost all (93%) students indicated that online courses were effectively delivered in at least some classes, but only 16% indicated this was the case in all their classes (Table 36).
- COVID-19 had effects on various social connections for students. Two-fifths of all students were less likely to seek help from instructors during the pandemic. Three-fourths of students felt more isolated in physics and astronomy courses and labs during the pandemic, and more than one-third of students reported a reduced sense of belonging during the pandemic (Tables 37-42).
- Two-thirds (66%) of graduate students were satisfied with their ability to interact with their advisors during the 2020-21 academic year (Table 40).
- 83% of graduate students indicated they still had access to computing resources most or all of the time during the Spring of 2021 (Table 41).
- 57% of graduate students did less research during the Spring of 2021, due to COVID-19 (Table 42).

- Almost all faculty members reported making some type of adjustment to student assessments during COVID-19 (Table 43).
- Most faculty members reported that their ability to deliver course content decreased during the pandemic (Table 44).
- Large percentages of faculty members said that they did less preparation for, and attended fewer, conferences; had less interaction with visitors and met with fewer people; and had less collaboration with colleagues. One third of faculty members said they did more administrative and committee work (Table 46).
- Among all respondents, only 3% of respondents missed time due to having COVID-19, but 11% missed time to care for others who had it (Tables 48 and 49).
- In response to an open-ended question about challenges facing the field of astronomy, many respondents voiced concerns about the lack of astronomy jobs available to PhDs following a postdoctoral position. Many respondents also noted issues of bias and discrimination within hiring practices and job settings (Appendix).

RESULTS

US AAS MEMBERS – Educational Experience and Employment Status

Table 1 – Highest Degree Earned

Highest Degree Earned by US AAS Members, 2021		
	%	N
PhD	74	1327
Master's	13	232
Bachelor's	9	171
No college	3	54
Other	1	21
Total		1805

- 354 respondents (20%) were currently enrolled in a degree program
 - 75% of bachelors were currently students
 - 66% of masters were currently students
 - 98% of respondents who selected “no college” were students
- 94% of respondents who were currently students indicated that they aspire to earn their PhD when asked “what is the highest degree you are planning to obtain?”
- There is no gender difference in degree aspirations (Table 2 and Figure 2).

Figure 1 – Highest Degree Earned

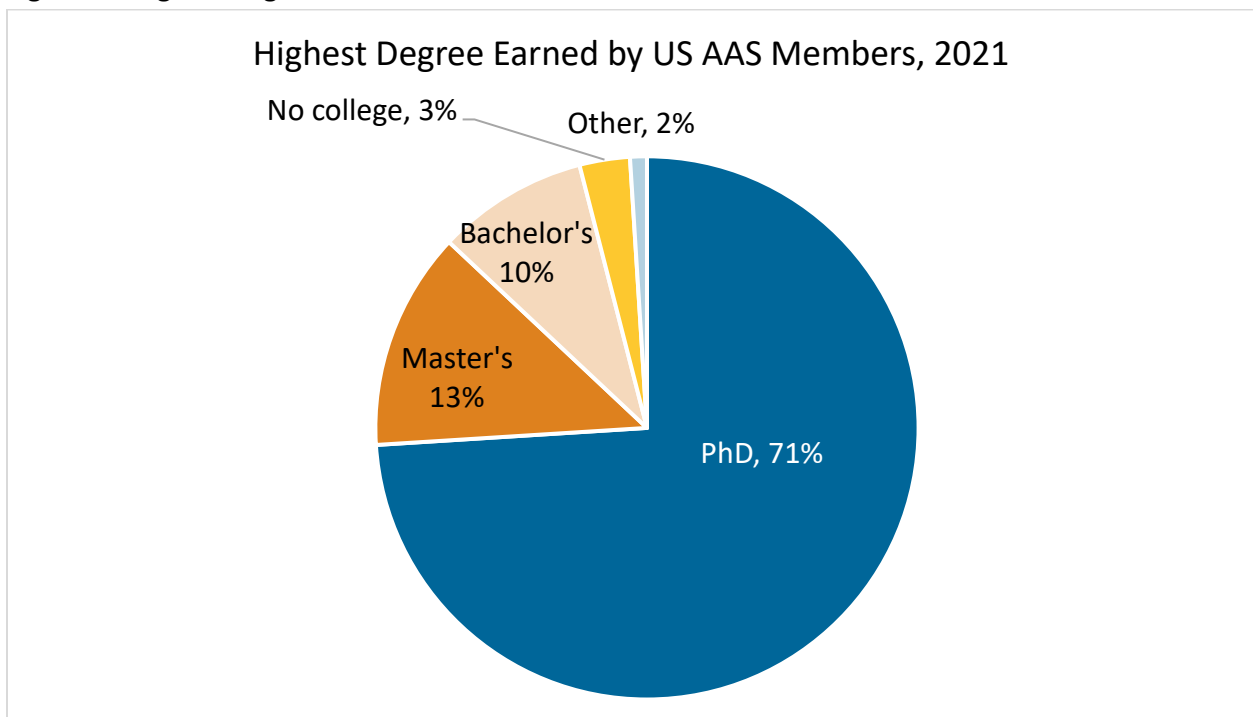


Table 2 – Highest Degree Earned by Gender

Highest Degree Earned by US AAS Members by Gender, 2021		
	Men	Women
PhD	82%	63%
Master's	9%	17%
Bachelor's	7%	13%
No college	2%	5%
Other	<1%	2%
Total	1105	530

- 38 respondents preferred not to share their gender.
- 29 respondents indicated that their gender was not man or woman.

Figure 2 – Highest Degree Earned by Gender

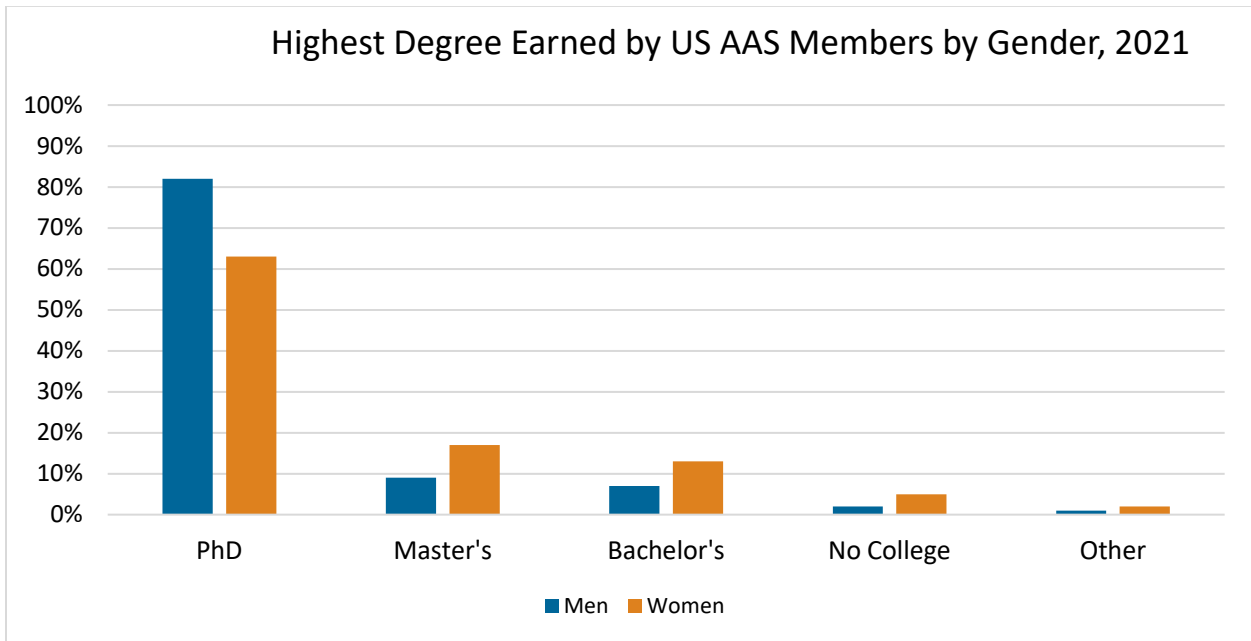


Table 2b – Highest Degree Earned by Birth Year

Highest Degree Earned by US AAS Members by Birth Year, 2021		
	Born Before 1988	Born 1988 & After
PhD	91	34
Master's	6	26
Bachelor's	3	27
No college	<1	10
Other	<1	3
Total	1178	475

Table 3 – Year of Degree

Year of Degree of US AAS Members with PhDs, 2021			
Year of PhD	25 th percentile	Median	75 th percentile
Overall	1983	1998	2011
Women	1995	2008	2017
Men	1979	1993	2008

- The median year that AAS members with doctorates earned their degrees was 1998.
- Reflecting the increasing percentage of women earning degrees in astronomy, the median year of degree for women is more recent than the median year of degree for men.
- A quarter of respondents with PhDs earned their degrees in or after 2011.

Figure 3 – Year of Degree

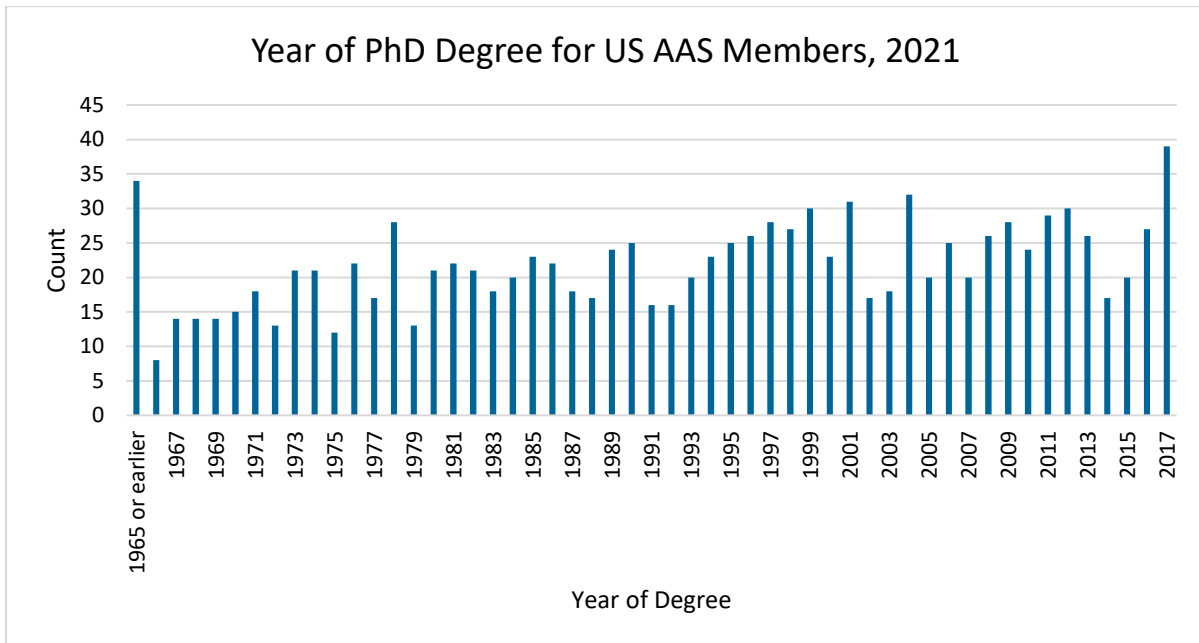
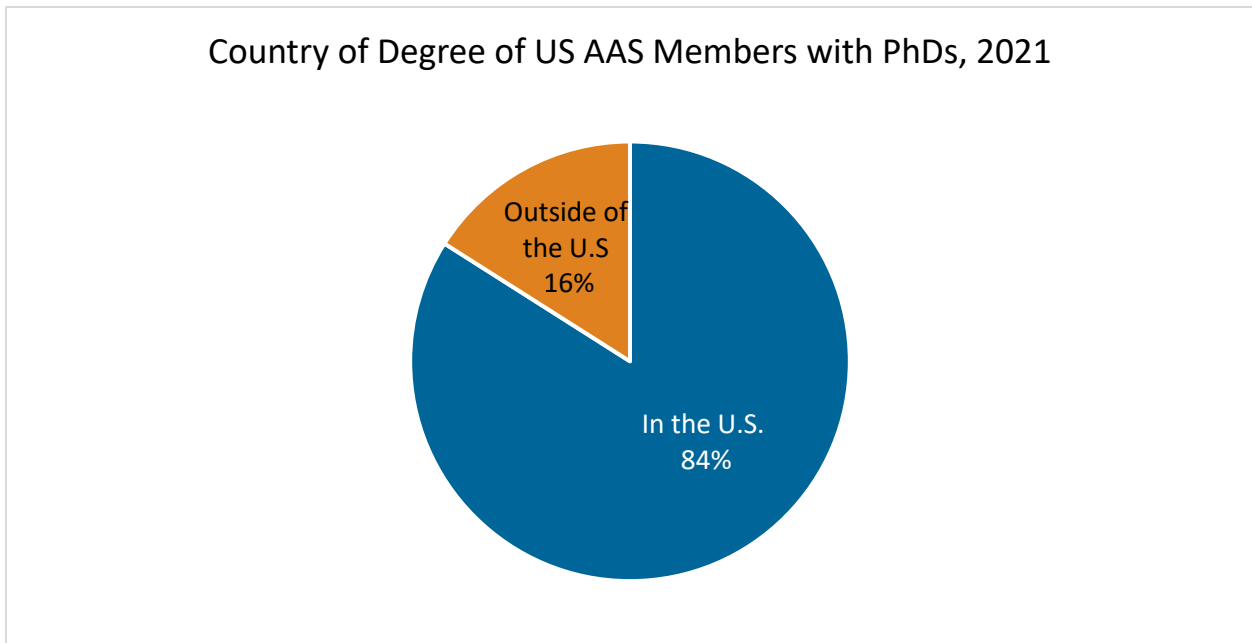


Table 4 – Country of Degree

Country of Degree of US AAS Members with PhDs, 2021		
	%	N
In the U.S.	84	1108
Outside of the U.S.	16	215
Total		1323

Figure 4 – Country of Degree



- Most US AAS members earned their highest degrees in the US.

Table 5 – Field of Degree

Field of Highest Degree of US AAS Members, 2021		
Field	%	N
Astronomy or astrophysics	68	1185
Physics	34	587
Engineering	2	32
Planetary science	2	36
Math	2	33
Something else	6	102
Total*		1808

*The sum of percentages exceeds 100 because respondents were asked to check all that apply.

- The vast majority of AAS member respondents earned their degrees in astronomy, astrophysics, or physics.
- Common engineering subfields included aerospace, electrical and mechanical.
- Write-in responses for “Something else” were nearly all scientific fields, with the most common being geology, geophysics, education, and chemistry.

Table 6 – Field of Degree over Time

Field of Degree over time of US AAS Members, 2013 - 2021				
Field	2013	2016	2018	2021
Astronomy or astrophysics	71	69	67	68
Physics	31	32	35	34
Planetary science	2	2	2	2
Engineering	2	2	3	2
Math	1	1	2	2
Something else	3	5	6	6
Total*	1564	1738	2020	1808

*The sum of percentages exceeds 100 because respondents were asked to check all that apply

- The most common degree field for US AAS members is astronomy/astrophysics, and that has not changed significantly over time.

Table 7 – Employment Status

Employment Status of US AAS Members, 2021		
	%	N
Employed, full-time	75	1088
Employed, part-time	7	109
Not employed	18	257
Total		1454

- Of those not employed, the majority (90%) were retired. The remainder were split between those seeking employment (n=12, 5%) and those choosing to be out of the workforce (n=13, 5%).
- More respondents who identified as women were employed full time than men (82% vs 71%). This probably reflects the somewhat younger age bracket of women members, which is again a result of the increasing percentage of women in astronomy.

Figure 5 – Employment Status

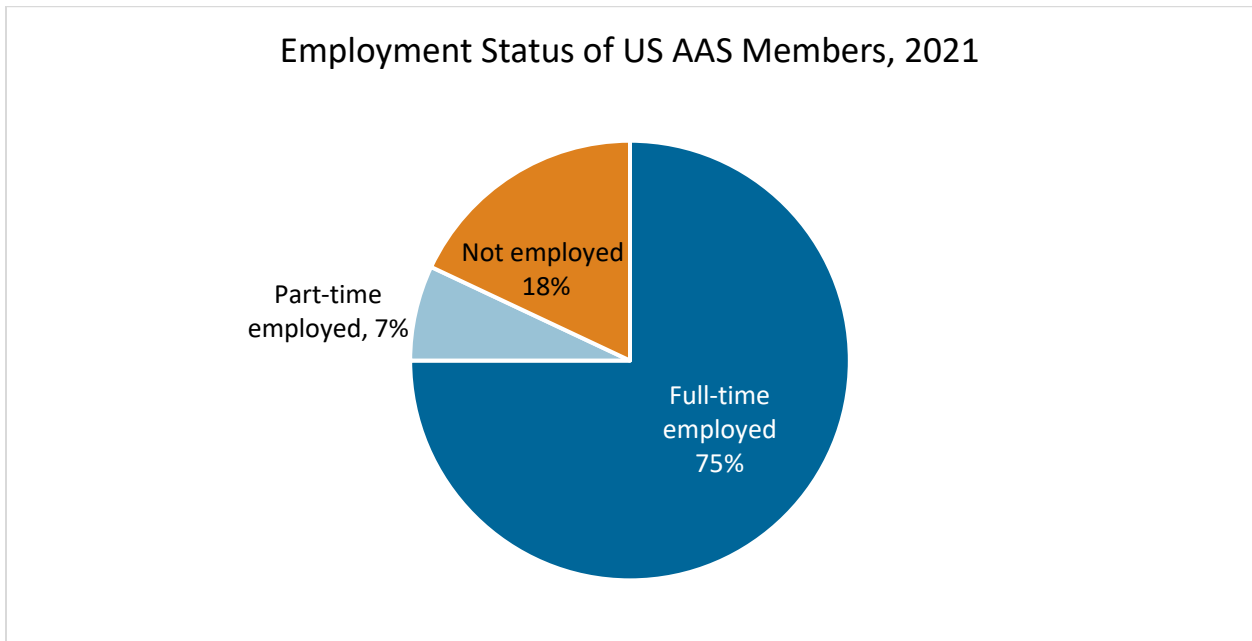


Table 8 - Employment Type

Employment Type of US AAS Members, 2021		
Position type	%	N
Potentially permanent	79	941
Temporary	21	254
Total		1195

- Of the respondents in temporary positions, 64% (n=162) were currently in postdoctoral positions.
- Other temporary positions included visiting and adjunct professors, research assistants, and contract jobs.

Figure 6 – Employment Type

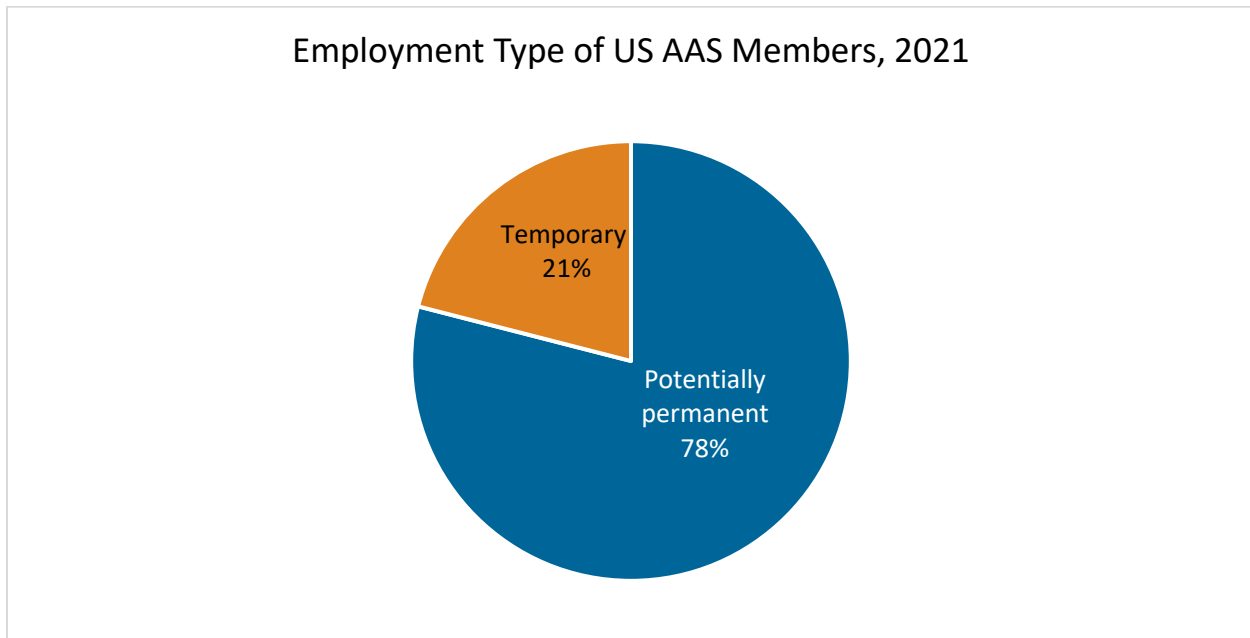


Table 9 - Current Employer

Current Employer of US AAS Members with PhDs, 2021		
Employer or Sector	%	N
University or 4-year college	57	484
Govt. lab or research facility	14	121
Research institute	8	66
Observatory	8	72
Industry	4	36
Other govt.	3	25
2-year college	2	14
Self-employed	1	8
Planetarium or museum	<1	1
Secondary school	1	6
Other	2	17
Total		855

Includes full-time employed respondents with PhDs excluding current postdocs.

- AAS members' careers are largely concentrated in academe at universities and 4-year colleges, which employed over half (57%) of AAS members with PhDs.

Figure 7 – Current Employer

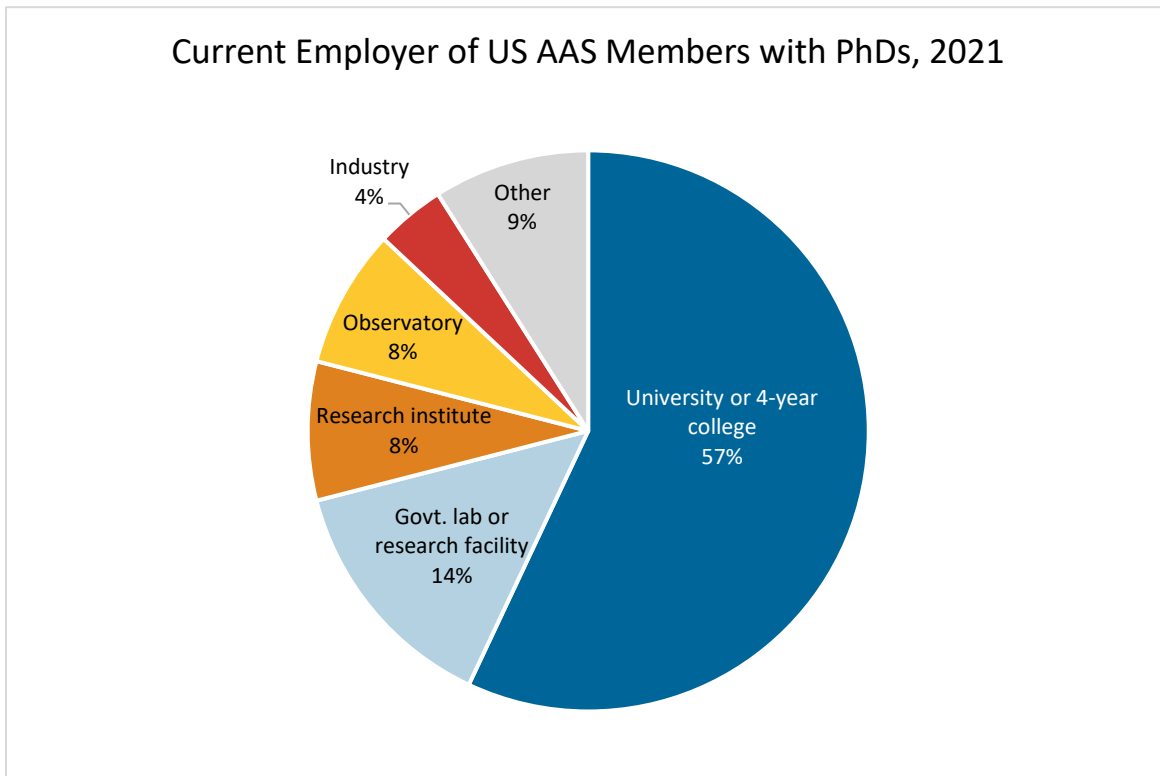


Table 10 - Current Employer over Time

Over Time Employer of US AAS Members with PhDs, 2021				
Employer or Sector	2013	2016	2018	2021
University or 4-year college	58	55	54	57
Govt. lab or research facility	14	16	14	14
Research Institute	8	8	10	8
Observatory	9	9	9	8
Industry	4	3	4	4
Other govt.	2	2	2	3
2-year college	1	1	2	2
Self-employed	1	1	1	1
Planetarium or museum	1	1	1	<1
Secondary school	-	-	-	1
Other	2	3	3	2
Total	873	940	948	855

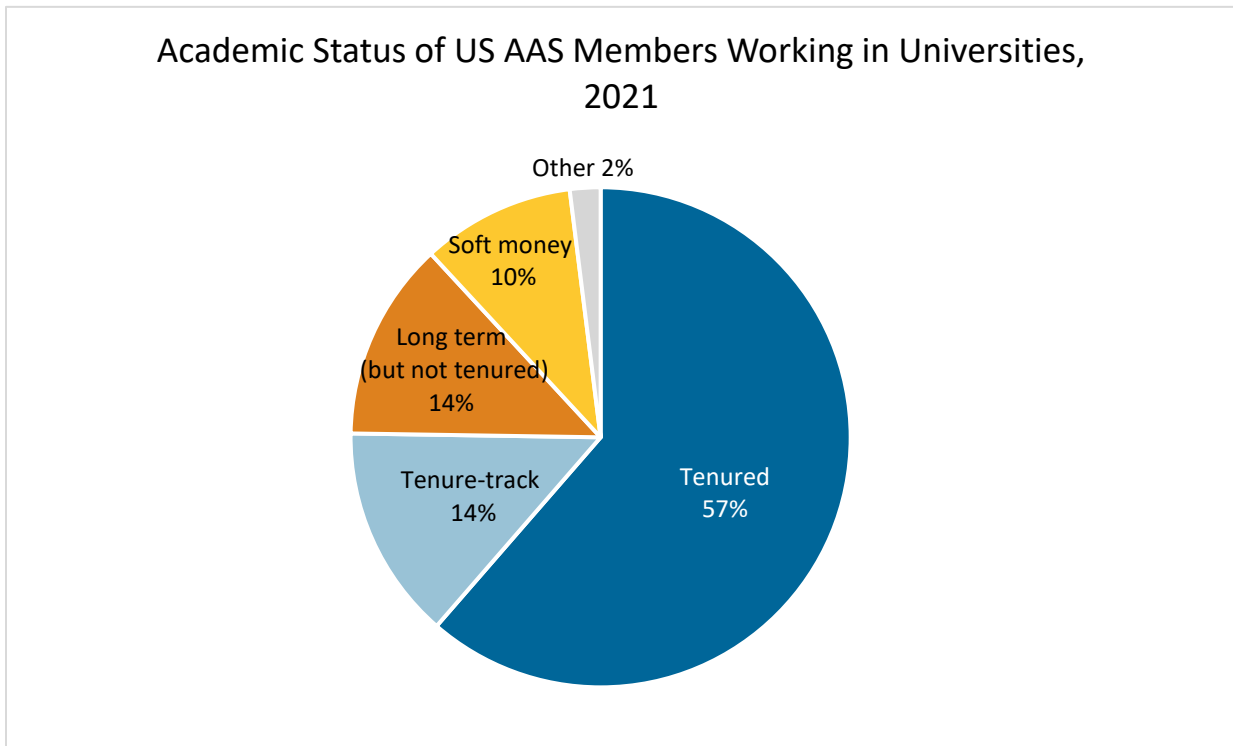
Table 11 – Academic Status

Academic Status of US AAS Members Working in Universities, 2021		
Status	%	N
Tenured	62	307
Tenure-track	14	68
Long term (but not tenured)	13	63
Soft money	10	50
Other	2	8
Total		496

The data represent respondents employed full-time at universities and 4-year colleges, excluding postdocs.

- Of AAS members working full-time at universities and 4-year colleges, more than three-fifths had gained tenure.
- An additional 13% reported having jobs that were not tenured but were long-term.
- The “other” category was comprised of respondents in temporary positions, like visiting professorships.
- Only respondents working in academe were asked about their tenure status. However, respondents employed in other sectors of the economy may also earn tenure.

Figure 8 – Academic Status



EMPLOYMENT – Postdocs and Careers

Table 12 – Postdoctoral Experience

Postdoctoral Experience by Groups of US AAS Member, 2021		
Group	Took Postdoc %	Median Duration (years)
Current postdocs	-	2*
Employed, with PhD	82	4
Retired, with PhD	62	3

*Current postdocs' duration is ongoing.

- Members who are currently working in postdoctoral positions (n=162) had a median degree year of 2019. Half of these respondents have been working in postdoctoral positions for at least 2 years, and 18% are 5 years or more into their cumulative postdoc experience.
- The median salary of current postdocs was \$68,000.
- Of respondents who earned doctorates and were currently employed, 82% took a postdoctoral position after earning their PhDs (n=760). The median number of years of cumulative postdoc experience for this group was 4 years.
- Members who have retired had a median degree year of 1974. 62% of retired members who had earned PhDs took a postdoc (n=126). Retired members' median duration of postdoc experience was 3 years.
- The time spent in postdocs and the percentage of people taking postdocs are both getting longer.

Table 13 – Desired Employer of Postdocs

Desired Employer of US AAS Member Postdocs, 2021		
Desired Employer or Sector	%	N
University or 4-year college	53	84
Research Institute	24	38
Govt. Lab or research facility	12	19
Observatory	3	5
Industry	6	10
Planetarium or museum	1	1
Other	2	4
Total		160

Table 14 – Current Employer of Former Postdocs

Current Employer of US AAS Members who took Postdocs, 2021		
Employer or Sector	%	N
University or 4-year college	58	439
Govt. Lab or research facility	15	110
Research institute	9	65
Observatory	9	66
Industry	3	23
Other govt.	3	21
2-year college	1	10
Planetarium or museum	-	1
Self-employed	1	9
Secondary school	-	3
Other	2	12
Total		759

Excludes current postdocs.

- There were slight differences in the distribution of the types of employers desired by current postdocs (Table 10) and the distribution of current employers of AAS members who had taken postdocs (Table 11).
 - Jobs at universities and 4-year colleges remained both the most desired and most often current positions. It should be noted that this is a survey of AAS members, who may be more likely than astronomers who are not members to be employed in academe.
 - A larger number of postdocs were hoping to work at research institutes (24%) than were former postdocs actually working at them (9%).
 - On the other hand, jobs at observatories are less popular (5%) than the reality (9%).

Table 15 – Postdoc Experience by Employer

Postdoc Experience by Employer Type of US AAS Members, 2021		
Employer or Sector	Took a postdoc	
	%	N
University or 4-year college	79	439
Govt. Lab or research facility	83	110
Non-Govt. Research Institute	77	65
Observatory	74	66
Industry	49	23
Total*		759

Excludes current postdocs. Employer categories with N < 25 are excluded from the table but included in the totals.

- Of respondents working in universities and 4-year colleges, about 79% had taken a postdoc.
- Those who had taken postdocs comprised 83% and 77% of respondents working in government labs and research institutes, respectively.
- Less than half of those working in industry had taken a postdoc.

Figure 9 – Postdoc Experience

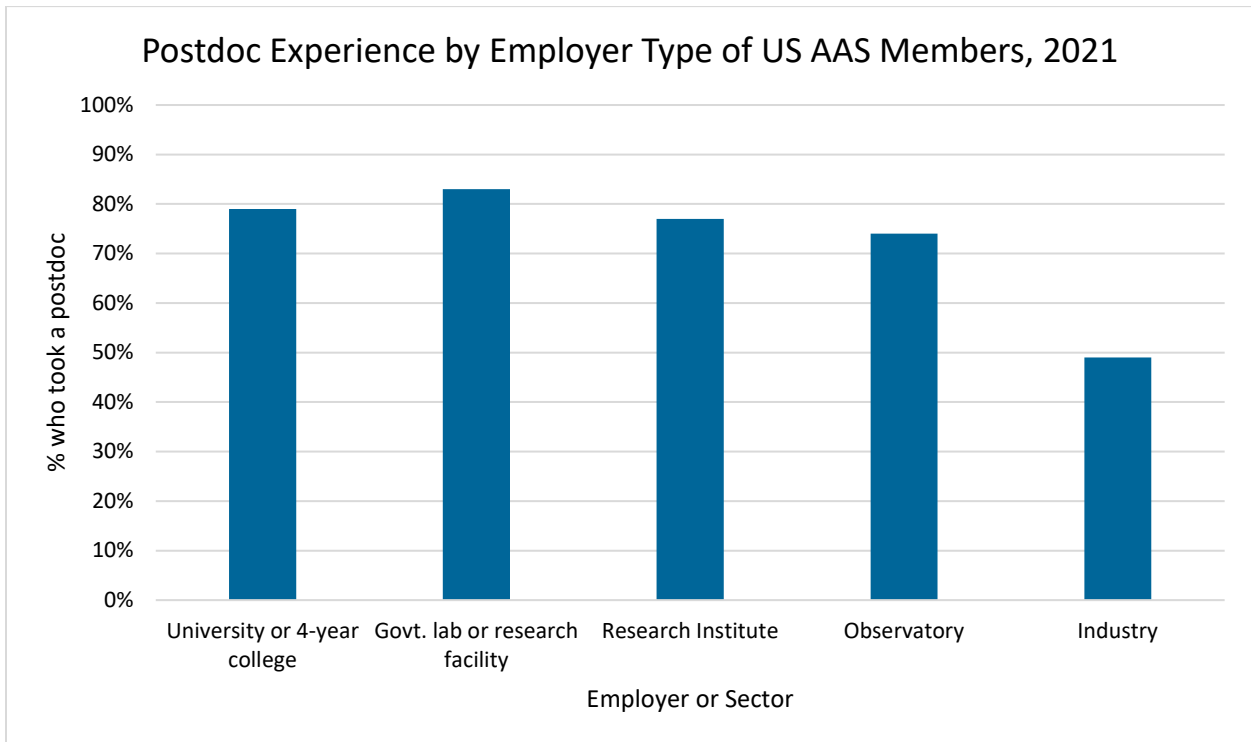


Table 16 - Main Activity in Current Job

Main Activity in Current Job Of US AAS Members, 2021				
Activity	University, 4-year college		All other sectors	
	%	N	%	N
Teaching	37	204	8	39
Devising, conducting observations	13	74	12	56
Theory, N-body simulations	12	64	4	20
Instrumentation, telescope design	6	33	10	47
Data visualization, mining	6	34	6	29
Education or public outreach	3	14	6	28
Management, administration	14	79	32	146
Multiple activities	-	2	1	3
Data analysis	2	10	2	10
Laboratory astrophysics	2	11	2	10
Other research	1	4	1	6
Software, IT	1	4	4	18
Other	3	19	11	52
Total		552		464

Includes current postdocs.

- Software, IT, data analysis, and other research were added based on their frequency in the write-in responses of those who originally selected “Other”.
- As expected, those who reported teaching as their main activity were concentrated in universities and 4-year colleges. On the other hand, management or administration were cited as the main work activity by a larger proportion of those employed in all other sectors than by those working in higher education.

Table 17 - Time Allocation in Current Job

Time Allocation in Current Job of US AAS Members, 2021				
Activity	University, 4-yr College		All Other Sectors	
	% Doing	Avg. % of Time Spent	% Doing	Avg. % of Time Spent
Research (includes writing proposals, articles and books, and attending colloquia)	93	42	79	38
Teaching (class, lab time, and prep, office hours, other student contact related to teach or advising)	74	39	25	33
Service activities (TAC, proposal reviews, advisor committees)	78	12	61	12
Education & public outreach	44	10	38	17
Management	48	22	56	36
Observatory/mission support/instrument commission	22	18	43	43
Other	7	37	12	60
Total	658		514	

Includes current postdocs. The sum of the average percent of time spent column does not add up to 100%, because it reports the average amount of time spent in an activity only for those who report doing the activity and not for the entire sample.

- AAS members employed at universities or four-year colleges reported teaching as a main activity more often than those in other sectors. They also reported it being a larger proportion of their time.
- On the other hand, AAS members in other sectors more often reported management or observatory/mission support/instrument commission as their main activity.
- Education & public outreach was reported at similar levels regardless of sector.

Table 17b – Time Allocation in Current Job, Before and During Pandemic

Time Allocation in Current Job of US AAS Members, 2018 and 2021				
Activity	University, 4-yr College		All Other Sectors	
	2018 Avg. % of Time Spent	2021 Avg. % of Time Spent	2018 Avg. % of Time Spent	2021 Avg. % of Time Spent
Research (includes writing proposals, articles and books, and attending colloquia)	43	42	40	38
Teaching (class, lab time, and prep, office hours, other student contact related to teach or advising)	39	39	32	33
Service activities (TAC, proposal reviews, advisor committees)	13	12	10	12
Education & public outreach	9	10	14	17
Management	19	22	38	36
Observatory/mission support/instrument commission	22	18	43	43
Other	35	37	61	60
Total	694	658	653	514

The sum of the average percent of time spent column does not add up to 100%, because it reports the average amount of time spent in an activity only for those who report doing the activity and not for the entire sample.

- A comparison of respondents' answers about time allocation in their jobs shows basically no effects of the pandemic.

Table 18 – Primary Areas of Interest

Primary Areas of Interest of US AAS Members, 2016 to 2021						
	2016		2018		2021	
	%	N	%	N	%	N
Star formation & evolution	31	541	30	595	33	545
Galaxy formation & evolution	23	394	23	458	25	408
Exoplanets	21	365	22	437	20	334
Solar systems, planetary science	23	392	21	407	22	359
Astronomy education	20	338	20	396	21	346
Supernovae, GRBs, high-energy phenomena	17	301	20	385	18	293
Cosmology	17	299	19	363	18	291
Galactic structure and stellar pop.	18	307	18	359	17	281
Active galactic nuclei	16	281	18	346	17	277
Interstellar medium	18	318	18	344	19	305
Clusters of galaxies, large-scale structure	12	210	12	243	11	185
Astrobiology	9	158	10	188	9	143
Heliophysics	9	149	9	166	9	152
Other	18	319	19	362	17	283
Total		<i>1730</i>		<i>1952</i>		<i>1643</i>

The sum of percentages exceeds 100 because respondents were asked to check all that apply.

- On average, respondents selected 2.5 primary areas of interest.
- The most reported area of interest was star formation & evolution.

Table 18b – Primary Areas of Interest by Gender

Primary Areas of Interest of US AAS Members with PhDs by Gender, 2021				
	Men		Women	
	%	N	%	N
Star formation & evolution	33	299	36	120
Galaxy formation & evolution	22	201	27	91
Interstellar medium	22	197	19	62
Exoplanets	20	176	17	58
Cosmology**	18	161	10	32
Solar systems, planetary science	20	181	19	64
Supernovae, GRBs, high-energy phenomena	19	171	15	50
Active galactic nuclei	17	149	16	52
Galactic structure and stellar pop.	18	158	16	55
Astronomy education	17	151	17	58
Clusters of galaxies, large-scale structure	11	100	9	31
Heliophysics	10	91	7	22
Astrobiology	6	58	8	28
Other	16	146	17	56
Total N		895		334

The sum of percentages exceeds 100 because respondents were asked to check all that apply.

** indicates that difference by gender is statistically significant.

- Men are more likely than women to be interested in cosmology.
 - There were fewer statistically significant gender differences in the 2021 survey than in the 2018 one.

Figure 10 – Primary Areas of Interest by Gender

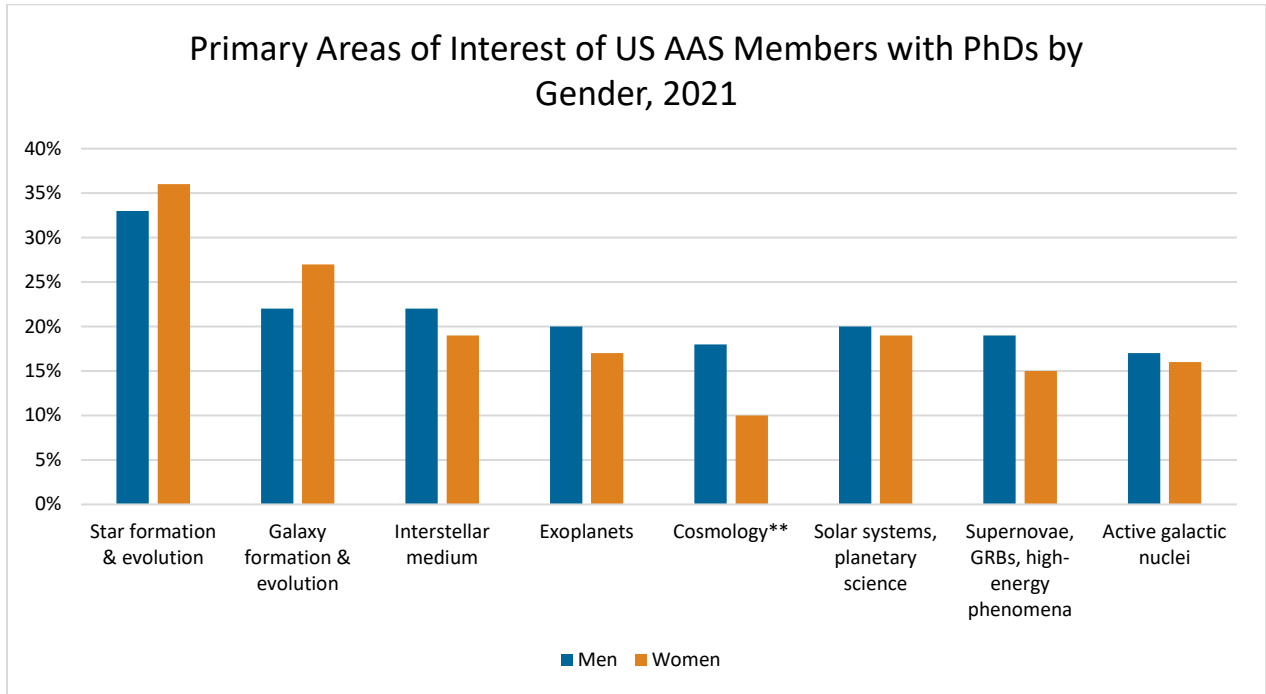


Table 19 – Funding Sources for Salaries¹

Funding Sources for Salaries of US AAS Members, 2021		
	% Receiving Funding	Average % of Total Funding
College/University	48	86
NASA	31	72
NSF	18	47
DOE	4	68
DOD	3	71
Foundation/Grant/Donors	3	69
Private Employer/Clients	2	76
Foreign Funding	<1	88
Other Government	<1	50
Smithsonian	1	90
AAS	<1	82
Other	9	78
Total N		1159

For those receiving funding from a particular source, the second column shows what % of their funding comes from that source. For example, 31% said they had NASA funding, and for those people, the average % of their funding that came from NASA was 71%

Table 20 – Funding Sources for Salaries over Time¹

Funding Sources for Salaries of US AAS Members 2018-2021				
	2018		2021	
	% Receiving Funding	Average % of Total Funding	% Receiving Funding	Average % of Total Funding
College/University	44	90	48	86
NASA	39	74	31	72
NSF	16	57	18	47
DOE	4	70	4	68
DOD	4	71	3	71
Foundation/Grant/Donors	3	74	3	69
Other	12	83	14	81
Total N		1410		1159

- The percentage of respondents receiving NASA funding is a bit lower than in 2018 and percentage receiving college/university funding is a bit higher than in 2018.

Table 21 – Variables Impacting Salaries

Variables Impacting Base Salaries of US AAS Members with PhDs, 2021		
Variable	Average Additional \$	Level of Significance
Working at a Government Lab	\$20,381	***
Working at a Research Institute	\$11,344	***
Working in Industry	\$21,443	***
Having taken a postdoc	\$10,320	***
Each additional year since earning PhD	\$926	***

***p-value < .01

Data include respondents who have earned PhDs and are full-time employed excluding postdocs. N=714

- Regression analysis on the base salaries (not including bonuses, overtime, or additional compensation for summertime teaching or research) of full-time employed AAS members estimates the average increase in salary due to a given variable compared to average salaries in the absence of that variable. The variables dealing with employer type are compared to the salaries of those employed at universities or 4-year colleges. We controlled for employer type, postdoc experience, and years since PhD. Exploratory analysis was conducted for various other controls, including race and gender. They were not a part of the final regression as they were not statistically significant indicators.
- The regression equation constant (or intercept) was just over \$79,100. This represents the theoretical average salary in the absence of all variables (i.e. the average salary of all respondents working at universities with zero years of experience since earning their PhDs who did not take postdocs).
- For illustrative purposes, we can use this model to predict the average salary of AAS members who earned their PhDs 10 years ago, took postdocs, and work at a government lab:
 $79,134 + 10 \text{ years} \times 926 + 10,320 \text{ (postdoc)} + 20,381 \text{ (gov't lab)} = \$119,095$
 - It is worth noting that this represents the average salary of a group of AAS members; salaries for individuals within the group will vary above and below this average.
- There was strong statistical evidence ($\alpha < .01$) of the effect of ever taking a postdoc, working at a government lab, a research institute, or in industry and the effect due to the number of years since respondents earned their highest degrees.
- The median salary for AAS members employed at university and four-year colleges was \$113,000. However, those who received their degrees before 2000 had a median salary of \$135,000, while those who received their degrees after 2000 had a median salary of \$92,000.
- Current postdocs had a median salary of \$68,000.
- Government labs and industry positions had the highest median salaries at \$160,000.
- The versions of this survey that ran in 2013 and 2015 found statistically significant differences in salaries between men and women. The 2018 and 2021 versions did not find a statistically significant difference in salaries by gender.

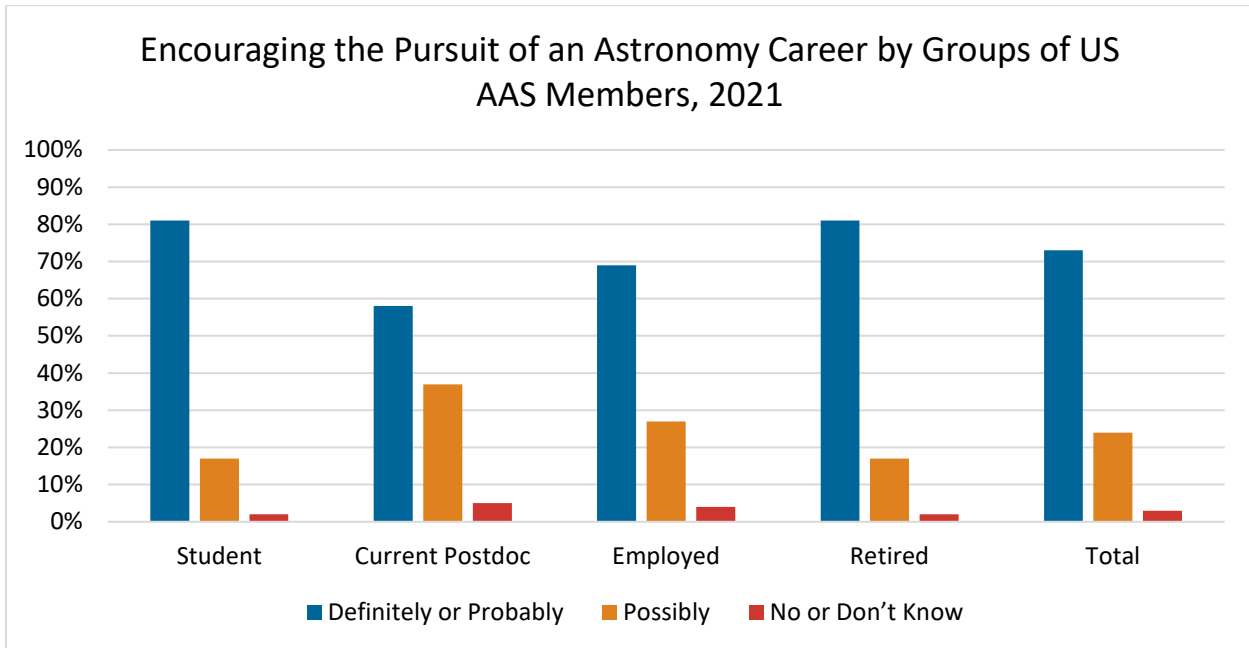
Table 22 – Encouraging the Pursuit of an Astronomy Career

Encouraging the Pursuit of an Astronomy Career By Groups of US AAS Members, 2021					
	Student %	Current Postdoc %	Employed %	Retired %	Total %
Definitely or Probably	81	58	69	81	73
Possibly	17	37	27	17	24
No or Don't Know	2	5	4	2	3
Total	260	156	1044	231	1691

Employed includes only full-time employed.

- Almost three-quarters of AAS members indicated that they would encourage the pursuit of an astronomy career.
- Postdocs were the least likely to recommend a career in astronomy.

Figure 11 – Encouraging the Pursuit of an Astronomy Career



Finally, in a separate question, more than a third (39%) of employed respondents indicated that they had looked for a job in the last two years. This is more than the proportion of employed respondents in temporary positions (21%).

AAS MEMBERS – Demographics and Family

Several tables describing demographic and family-related issues are presented by sex and age group. Because some outcomes differ by age, we split respondents into two groups: those born prior to 1988 (71% of respondents) and those born in 1988 or after (29% of respondents):

Table 23 – Gender

Gender of US AAS Members by Age Group, 2021			
	Born before 1988	Born 1988 or after	Total
	%	%	%
Men	72	48	66
Women	26	45	31
Another Identity	<1	5	2
Prefer not to respond	1	2	1
Total	1179	477	1656

- The proportion of AAS members who identify as women is much larger among those born in 1988 or later than those born before 1988. This reflects the increase in the proportion of women earning degrees in astronomy.
- The percentage of women should be interpreted with caution since women are more likely to respond to surveys than men are.
- Less than 1% of AAS members born before 1988 identify as non-binary, while 5% of those born in 1988 or later do.
- The number of AAS members identifying as transgender was not large enough to report without violating confidentiality.

Figure 12 – Gender by Age Group

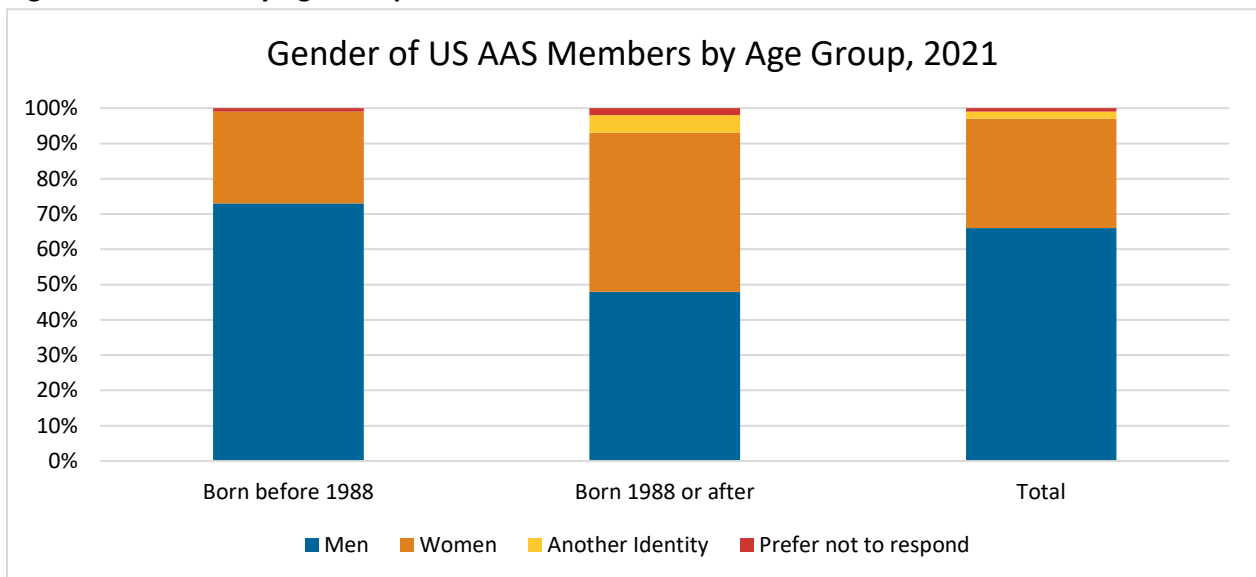


Table 23a—Gender Over Time

Gender of US AAS Members over time, 2013 - 2021				
	2013	2016	2018	2021
Men	73	72	67	66
Women	25	26	31	31
Another Identity	-	-	1	2
Prefer not to respond	1	1	2	1
Total	1512	1683	1902	1656

- Due to the increasing percentage of women earning astronomy degrees, AAS has a larger percentage of members identifying as women than in the past.

Figure 13 – Gender Over Time

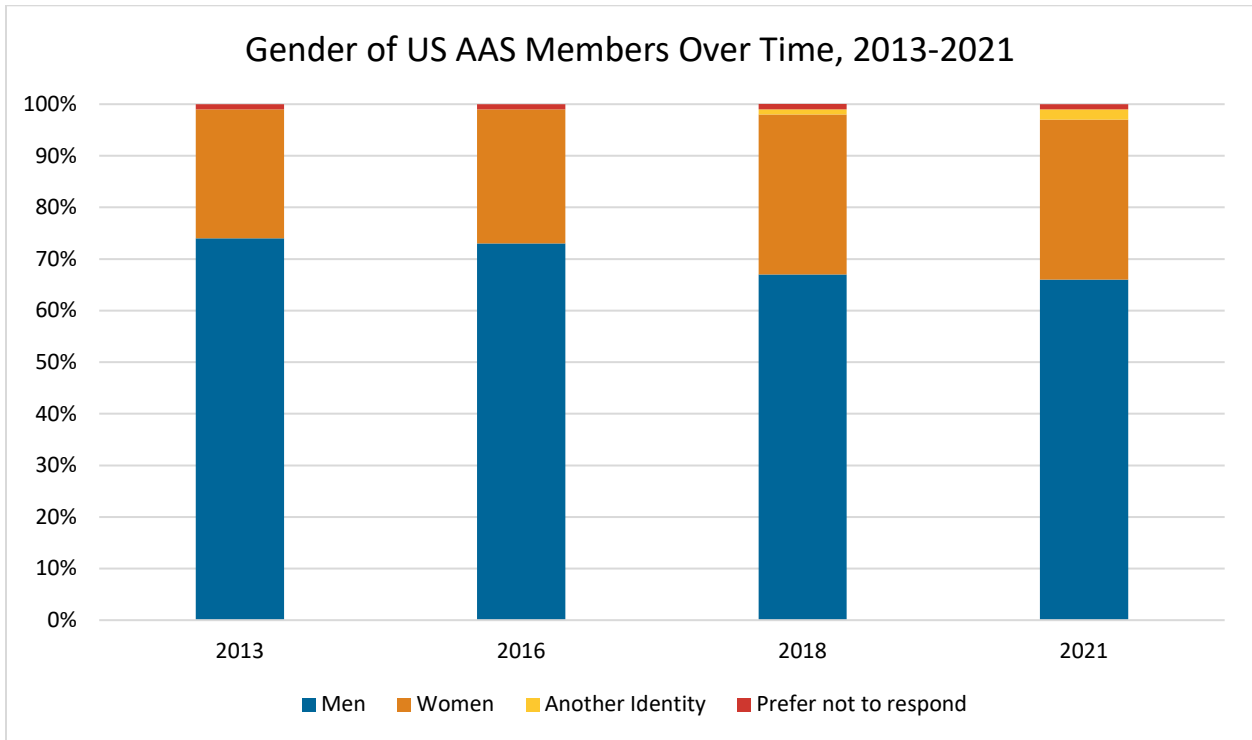


Table 24 – Marriage or Partnership Status

Marriage or Partnership Status of US AAS Members by Gender and Age Group, 2021			
Has been married or in a similar relationship	Born before 1988 %	Born 1988 or after %	Total %
Men	92	34	80
Women	86	32	63
Total	1153	444	1597

- Men and women born in 1988 or later are married or in similar relationships at similar rates.
- Overall, men were more likely to be or have been in a marriage or other similar relationship. This is especially true among the cohort born before 1988.

Figure 14 – Marriage or Partnership Status

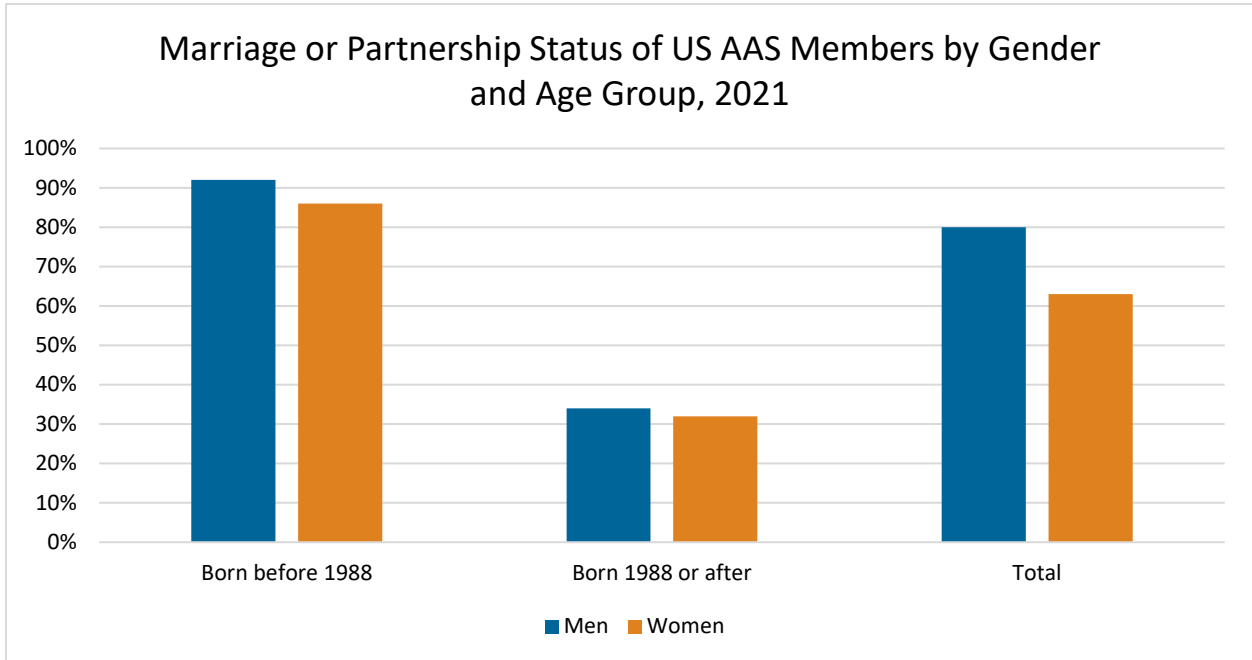


Table 25 – Members with Children

US AAS Members with Children by Gender and Age Group, 2021			
Has children	Born before 1988 %	Born 1988 or after %	Total %
Men	68	11	56
Women	52	5	32
Total	1156	445	1601

- Regardless of birth cohort, AAS members who identified as men were more likely to report having children, consistent with other literature showing that careers in science are especially difficult for women with children due to cultural expectations placed on mothers.
- AAS members born in 1988 or later were much less likely to report having children, possibly because they have not had children yet, but may in the future.

Figure 15 – Members with Children

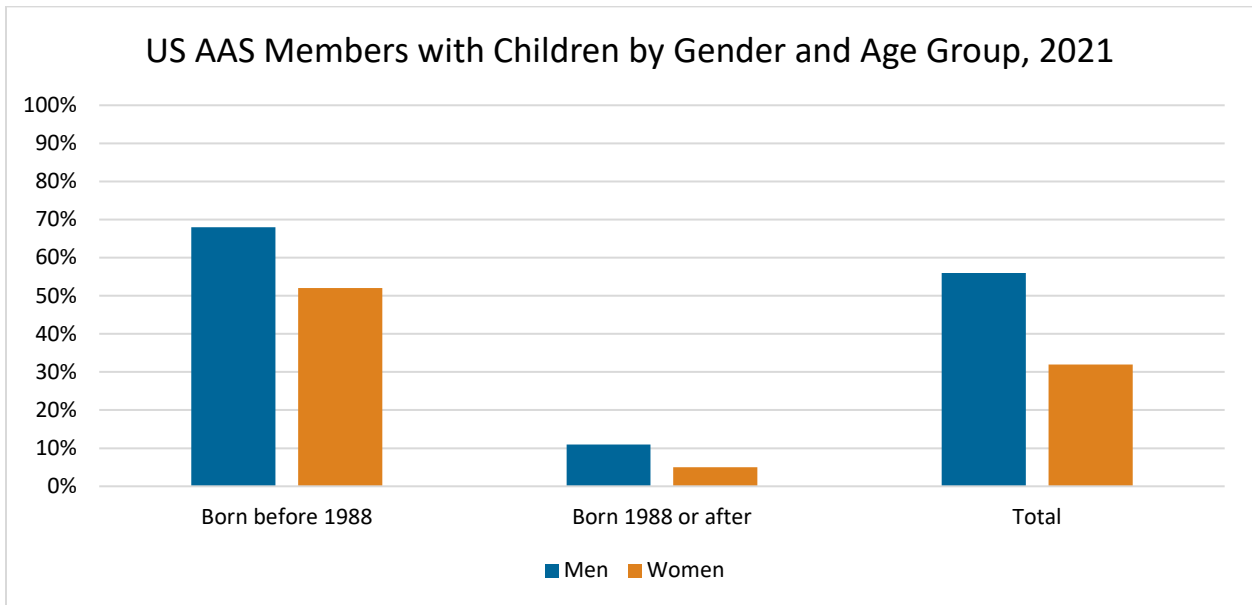


Table 26 - Relocated for a Spouse or Partner

Relocated for a Spouse or Partner US AAS Members, 2021			
	Women %	Men %	Total %
	Born before 1988		
Yes	32	13	18
No	57	79	74
N/A	11	7	8
	Born 1988 or after		
Yes	11	11	11
No	59	59	59
N/A	30	30	30

- 86% of respondents who answered N/A had never been married or in a similar relationship.
- AAS members who are women and in the older age cohort more often reported relocating for a spouse or partner.
- In a separate question, the majority (59%) of AAS members indicated that they have never limited career options because of someone else.
- 10% of respondents indicated that they maintained a residence in a different location from a spouse, partner or child in order to work or study.

Figure 16 – Relocated with a Spouse or Partner

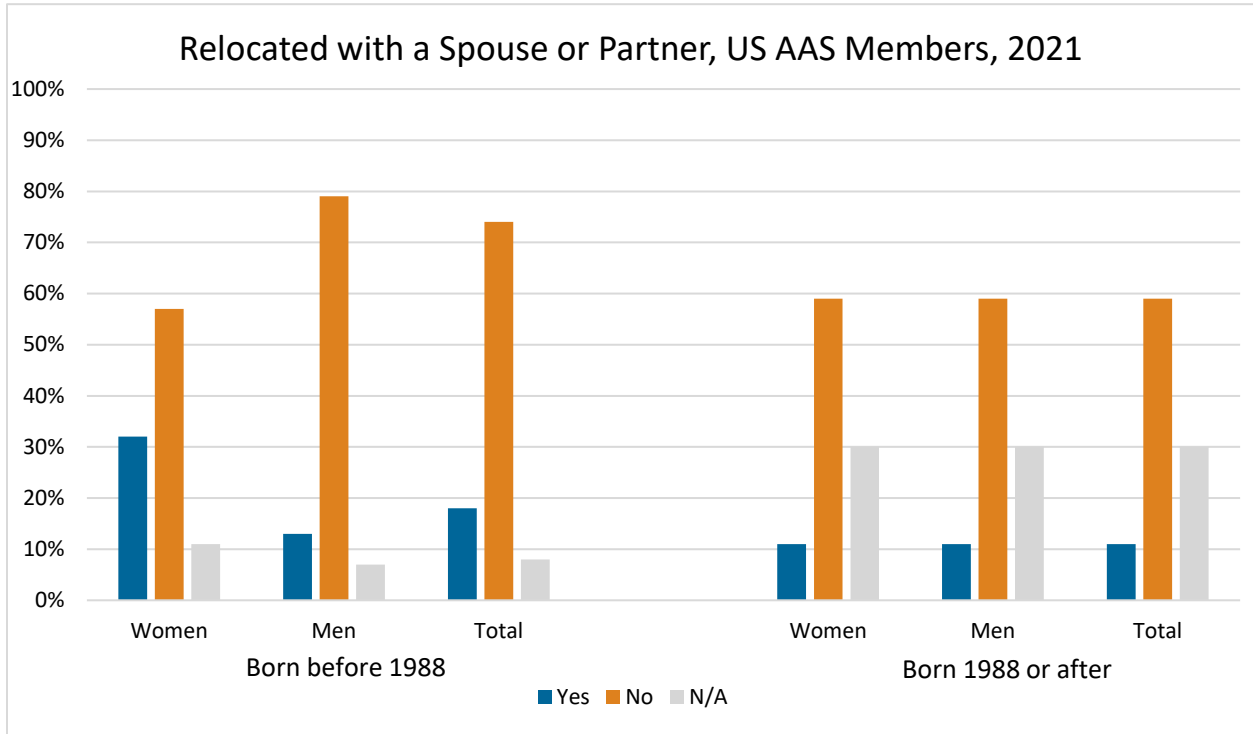


Table 27 – Disabilities

Disabilities Among US AAS Members, 2021		
Disability	%	N
I have a mental illness	7	120
I have an autoimmune or pain disorder, or other chronic condition	6	107
I am deaf or hard-of-hearing	4	73
I have disabling allergies, asthma, or other environment sensitivities	2	27
I am neuroatypical	4	68
I have difficulty seeing even when wearing glasses	1	22
I have serious difficulty standing, walking, or climbing stairs	1	23
I have a cognitive or learning disability	1	24
Other disability	3	44
None of the above	74	1129
Prefer not to respond	5	84

Sum of percentages exceeds 100 because respondents were asked to check all that apply

- Most AAS members did not report any disabilities.
- “I have a mental illness” was the most selected response choice in both 2018 and 2021.

Table 28 – Accessibility Aids

Accessibility Aids Used by US AAS Members, 2021		
Disability	%	N
Hearing aids, headphones, and other audio devices	7	103
Dietary accommodation related to health or disability	4	59
Environmental adjustments	4	58
Quiet spaces	5	74
Closed-captioning	4	70
Mobility aids	1	20
Note takers	<1	4
Service animal	<1	6
Screen readers	<1	3
Speech transcription	<1	4
Sing language (American or other)	<1	2
Braille	-	-
Other accessibility aid	2	29
None of the above	86	1323
Prefer not to respond	3	40

Sum of percentages exceeds 100 because respondents were asked to check all that apply

- Most US AAS members did not use accessibility aids. This is unchanged from 2018, although more options were added to the 2021 survey.

Table 29 – Ethnicity

Ethnicity of US AAS Members, 2021		
Ethnicity	%	N
White	81	1369
Asian or Asian American	10	163
Hispanic or Latino	6	93
Black or African American	2	42
American Indian or Alaska Native	1	21
Native Hawaiian or other Pacific Islander	<1	3
Other	2	29
Prefer not to respond	4	66

Sum of percentages exceeds 100 because respondents were asked to check all that apply

- The percentage distribution of ethnicity is basically unchanged from 2018.
- 5% of respondents checked more than 1 ethnicity.

Table 30- Sexual Orientation

Sexual Orientation of US AAS Members, 2021		
Orientation	%	N
Heterosexual or straight	83	1385
Gay or lesbian	3	57
Bisexual	5	91
Other	3	51
Prefer not to respond	6	94

- The percentage distribution of sexual orientation is basically unchanged from 2018.

AAS MEMBERS - Effects of COVID

Because of the pandemic, the committee added questions about the effects of the pandemic on US AAS members. The questions were designed to be appropriate for the status of the respondents. Some were specific to students. There were 72 responses from undergraduate students and 279 responses from graduate students. Only undergraduates who had been students before the pandemic were asked to compare their COVID experiences to the past. There were also questions designed to ascertain the effects of the pandemic on faculty members and several general questions for all respondents.

Students

Table 31 – Post-Degree Plans Change Due to COVID-19

Did Your Post-Degree Plans Change as a Result of the COVID-19 Pandemic?		
	Undergraduate %	Graduate %
Yes	20	14
No	79	82
N/A	1	4

- Although most students reported that their post-degree plans did not change as a result of COVID-19, 20% of undergraduates and 14% of graduate students reported a change.

Table 32 – Classes Cancelled Due to COVID-19

Were any of the Classes you were Scheduled to Take in 2020-21 Cancelled as a Result of the COVID-19 Pandemic?			
	Undergraduate %	Graduate %	Total %
Yes	31	9	15
No	69	91	85

- One third of undergraduate students reported that some classes had been cancelled due to COVID. The pandemic seemed to have little effect on graduate classes.

Table 33 – Degree Progress Slowed Due to COVID-19

Has Progress Towards Your Degree Been Slowed as a Result of the COVID-19 Pandemic?			
	Undergraduate	Graduate	Total
	%	%	%
Yes	30	40	38
No	64	41	46
Unsure	6	19	16

- Most undergraduate students reported that progress towards their degrees had not been slowed due to COVID. However, 40% of graduate students said that their progress had been slowed, and about 20% said they weren't sure.

Figure 17 – Degree Progress Slowed Due to COVID-19

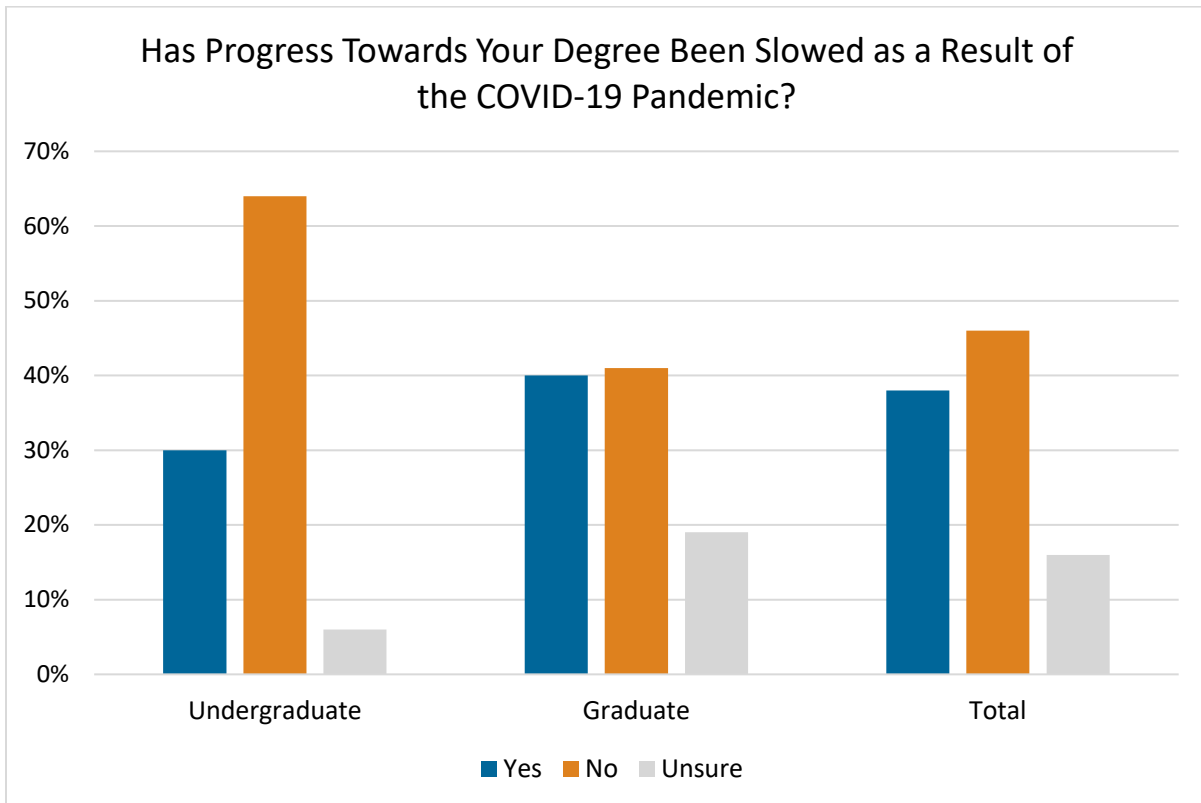


Table 34 – Online or In-Person During COVID-19

Did you Attend Classes In-Person or Online During Spring 2021?			
	Undergraduate	Graduate	Total
	%	%	%
Online	64	77	74
In-Person	3	5	4
Hybrid	33	18	22

- Very few students reported attending classes exclusively in person during Spring 2021 semester.

Table 35 – Did you Learn More or Less Based on Online Classes?

Did you Learn More or Less When Classes Switched to Online?			
	Undergraduate	Graduate	Total
	%	%	%
I Learned Less	70	65	67
I Learned the Same Amount	22	30	28
I Learned More	8	5	6

- Two-thirds of all students said they learned less in online classes.

Figure 18 – Did you Learn More or Less Based on Online Classes?

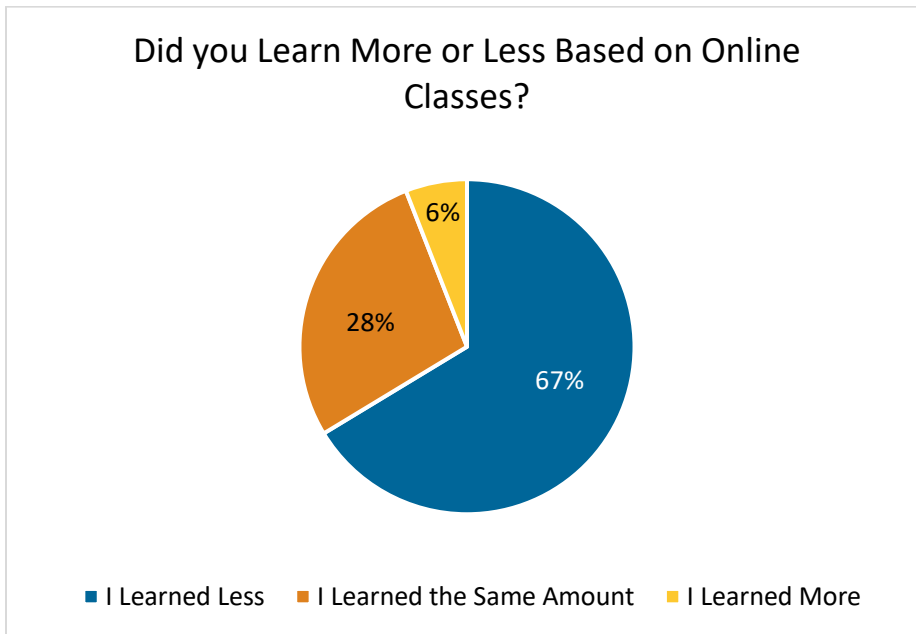


Table 36 – In How Many Online Classes Was Content Effectively Delivered?

In How Many of Your Online Courses was Content Effectively Delivered?			
	Undergraduate	Graduate	Total
	%	%	%
None of Them	9	5	7
Some of Them	83	75	77
All of Them	8	20	16

- Only 20% of graduate students said that content was effectively delivered in online courses, but the number was even lower for undergraduates, at less than 10%.

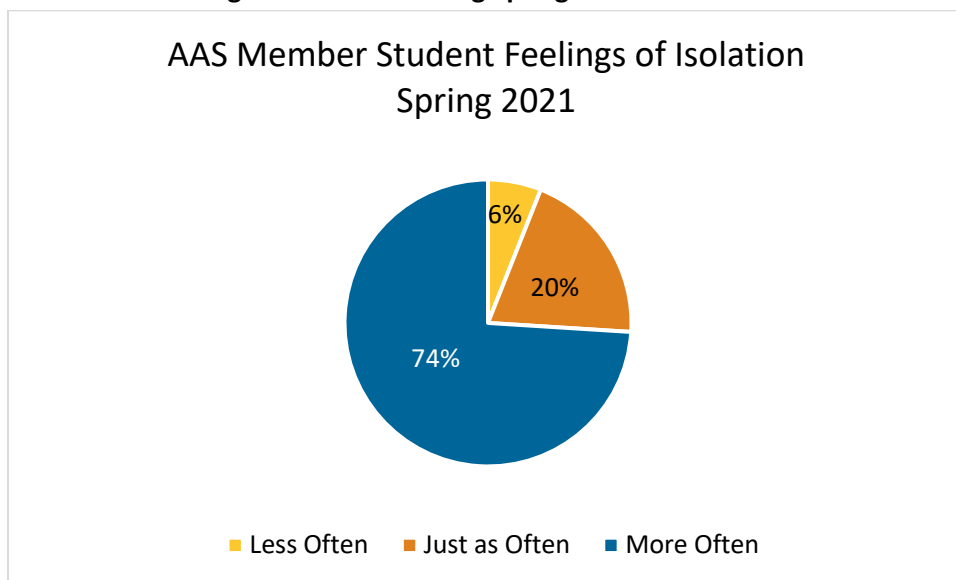
Social Connections

We asked students questions about the effects of the pandemic on social connections (Tables 37-39). We looked for statistically significant race and gender differences in the answers. There were none.

Table 37 – Student Feelings of Isolation During Spring 2021

Compared to Before COVID-19, How Often Did You Feel Isolated in Physics or Astronomy Courses or Labs during Spring 2021?		
	%	N
Less often	6	12
Just as Often	20	42
More Often	74	157

Figure 19 – Student Feelings of Isolation During Spring 2021

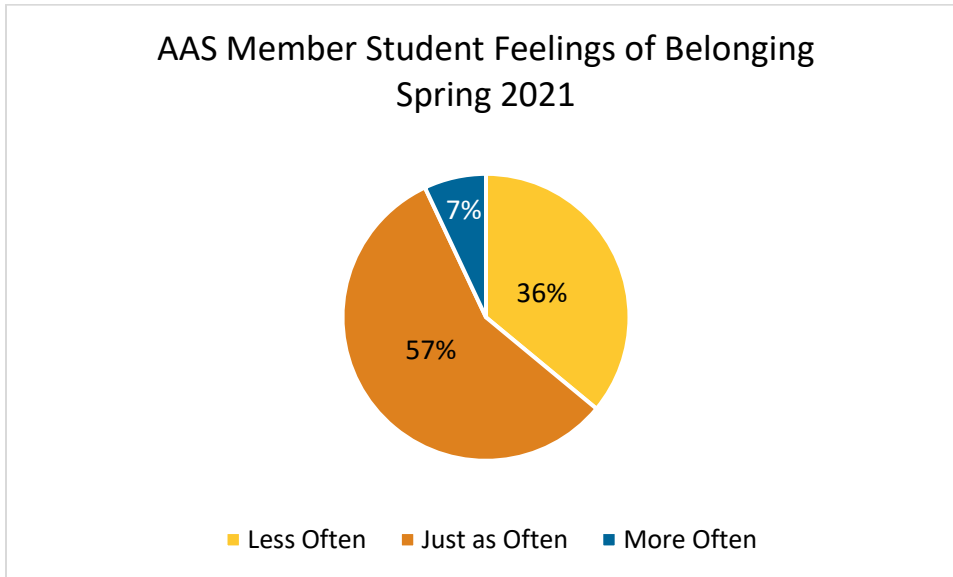


- Three-fourths of students felt more isolated in physics and astronomy courses and labs during the pandemic.

Table 38 – Student Feelings of Belonging During Spring 2021

Compared to Before COVID-19, How Often Did You Feel Like You Belonged in Physics or Astronomy Courses or Labs during Spring 2021?		
	%	N
Less often	36	78
Just as Often	57	125
More Often	7	15

Figure 20 – Student Feelings of Belonging During Spring 2021

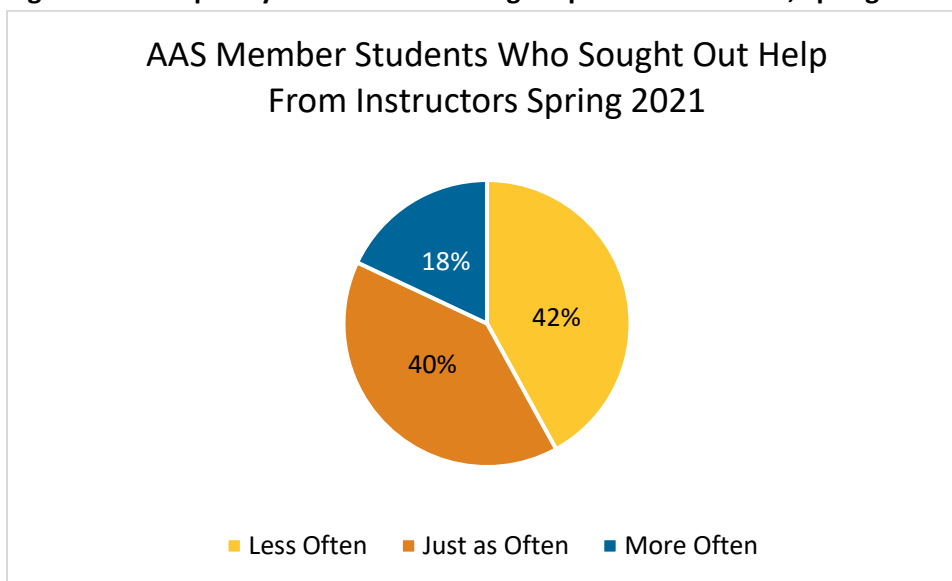


- More than one-third of students reported a reduced sense of belonging during the pandemic.

Table 39 – Frequency of Students Seeking Help from Instructors, Spring 2021

Compared to Before COVID-19, How Often Did You Seek Out Help from Physics or Astronomy Instructors during Spring 2021?		
	%	N
Less often	42	97
Just as Often	40	92
More Often	18	16

Figure 21 – Frequency of Students Seeking Help from Instructors, Spring 2021



- Two-fifths of students were less likely to seek help from instructors during the pandemic.

Table 40 – Graduate Students: How satisfied were you with your ability to interact with your research advisor during the 2020-2021 academic year?

Satisfaction with Advisor Interaction During Pandemic for Graduate Students, Academic Year 2020-2021		
	%	N
Dissatisfied	20	53
Neither Satisfied nor Dissatisfied	11	29
Satisfied	66	180
Did not have an advisor	3	9

- Although two-third of graduate students reported being satisfied with their level of advisor interaction during the pandemic, 20% reported being dissatisfied.

Table 41 – Graduate Students’ Access to Computing Resources, Spring 2021

Access to Necessary Computing Resources for Graduate Students, Spring 2021		
	%	N
Never or Rarely	1	4
Some of the Time	9	23
Most of the Time	29	79
All of the Time	54	146
N/A	7	18

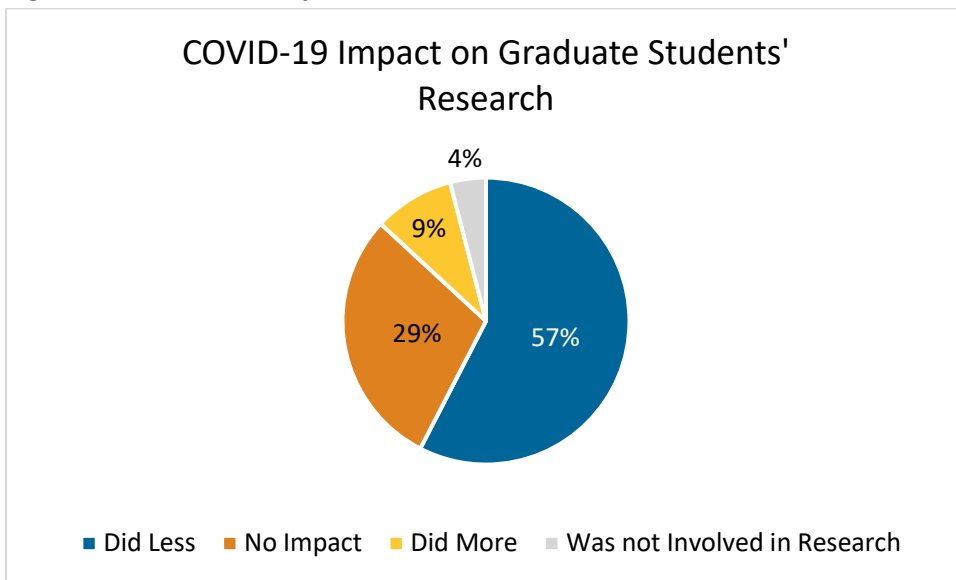
- Ten percent of graduate students reported not having adequate access to computing resources during the pandemic.

Table 42 – COVID-19 Impact on Graduate Students’ Research

Impact of COVID-19 on Ability to Research for Graduate Students, 2021		
	%	N
Did Less	57	154
No Impact	29	78
Did More	9	25
Was not Involved in Research	4	12

- More than half of graduate students said that they did less research because of the pandemic.

Figure 22 – COVID-19 Impact on Graduate Students’ Research



Faculty Members

Table 43 – Faculty Members’ COVID-19 Adjustments to Student Assessment

Faculty Member Adjustments to Student Assessment During COVID-19, Academic Year 2020-2021		
	%	N
Gave No Exams	7	27
Gave Fewer Exams	17	63
Exam Scores Contributed Less to Overall Course Grade	22	80
Increased Exam Time Limit	26	96
Offered More Flexibility in When Exams Were Taken	45	166
Allowed Open Books or Notes	41	148
Used Unique Exams (ex. Randomized Questions)	20	73
Changed Question Types	24	89
Graded More Leniently	36	130
Graded More Stringently	1	3
Administered Exams Online	62	227
Did Not Make Any Adjustments	10	28

- Almost all faculty members reported some type of adjustment to student assessments during COVID-19.

Table 44 – COVID-19 Impact on Faculty Members’ Course Delivery

Faculty Members’ Ability to Deliver Usual Course Content During COVID-19, Academic Year 2020-2021		
	%	N
Decreased	59	274
No Change	19	72
Increased	5	17
No Basis for Judgment	2	6

- The majority of faculty members reported that their ability to deliver course content decreased during the pandemic.

Figure 23 – COVID-19 Impact on Faculty Members’ Course Delivery

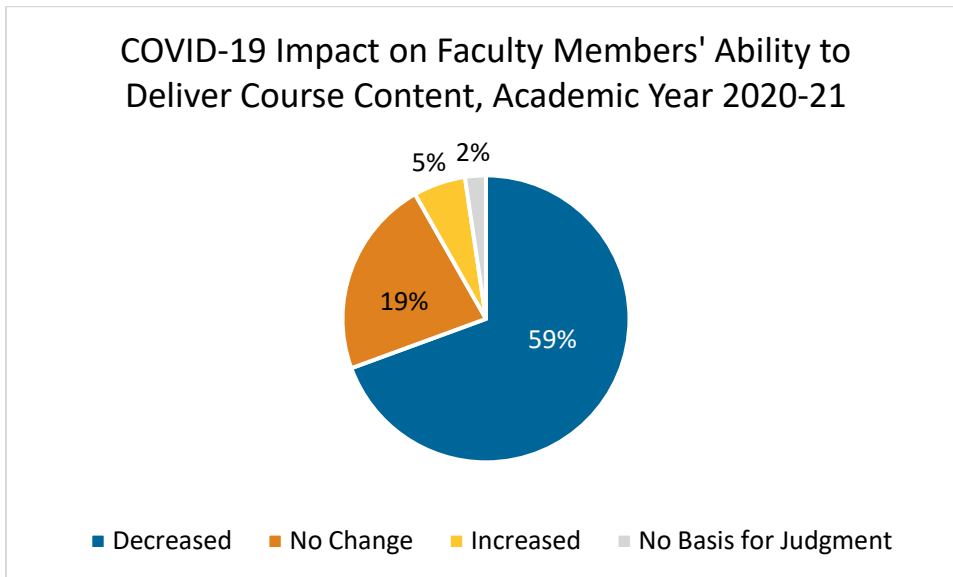


Table 45 – Largest Impact of COVID-19 on Faculty Members’ Ability to Deliver Education

Largest Impact on Ability to Deliver Education for Faculty Members During COVID-19, 2021		
	%	N
Lack of In-Person Options	26	94
Students Unable to Come to Institution	7	24
Resource Shortages	2	6
Lack of PPE or Filters or Ventilation	1	3
Inefficiencies of Online Teaching	28	98
Lack of Student Participation	27	95
Other	10	36

- The three largest impacts on faculty members’ ability to deliver education that students need were:
 - Lack of in-person options
 - Inefficiencies of on-line teaching
 - Lack of student participation in on-line teaching

Table 46 –Impact of COVID-19 on Faculty Members’ Work

COVID-19 Impact on Faculty Members’ Ability to Perform Types of Work, 2021		
	Did Less %	Did More %
Laboratory or Instrument Work	26	1
Collecting Data	38	3
Data Analysis	33	15
Colleague Collaborations	67	9
Seeking Funding	29	10
Administrative and Committee Work	19	32
Completing Service to the Field	23	12
Mentoring	46	21
Preparing for and Attending Conferences	80	8
Interacting with Visitors or Meeting People	89	3
Outside Consulting	14	4

- Large percentages of faculty members said that they did less preparation for and attending conferences, less interaction with visitors and meeting people, and less collaboration with colleagues. One third of faculty members said they did more administrative and committee work.

Table 47 –Impact of COVID-19 on Faculty Members’ Access to Resources

COVID-19 Impact on Faculty Members’ Access, 2021		
	Decreased %	Increased %
Research Funding	18	4
Student or Employee Researchers	48	5
Clerical Support	45	1
Internet Bandwidth	32	8
Journal Access	17	2
Interacting with Visitors or Meeting People	90	3
Colleague Collaborations	72	6
Adequate Office Space	37	4

- Almost all responding faculty members reported less access to visitors and meeting people. About three out of four reported less access to colleagues for collaborations. Almost half reported less access to student or employee researchers and clerical support. Almost no responding faculty members reported more access to the various resources.

All Respondents

Table 48 –Ill with COVID-19

Took Time Off Due to Illness with COVID-19, 2021		
	%	N
Yes	3	52
No	97	1640

Table 49 – Care for Others with COVID-19

Took Time Off Due to Caring for Someone with COVID-19, 2021		
	%	N
Yes	11	178
No	89	1510

- Three percent of respondents reported being sick with COVID themselves and about 10% reported taking time off to care for someone with COVID.

APPENDIX A: Challenges facing the field of astronomy

Respondents were asked “What do you view as the most significant challenge the field of astronomy is facing in the areas of employment and/or career development?” The vast majority (N=1299) of respondents provided an answer to this question.

- There were many concerns voiced about the lack of astronomy jobs available to PhDs following a postdoctoral position. Several respondents indicated that although the number of astronomy degrees granted is steadily increasing, the number of jobs has stagnated. There were also notes about the relatively poor pay, both specifically for postdocs as well as in the field in general. Several respondents indicated that they felt undereducated about working outside of academia because of their experiences in school.
- Many respondents noted issues of bias and discrimination within hiring practices and job settings. Most mentioned discrimination specifically against women and racial or ethnic minorities. There were several notes about how younger generations of astronomers appeared to be more diverse, but they also seemed underserved in the community.

APPENDIX B: Additional Tables

These tables were included at the request of the AAS Employment Committee and the Beyond Astronomy Academe (BAA) Task Force.

Table 50 – Training Offered in Graduate Programs for Graduate Students

Training Offered in Graduate Programs (Graduate Students)				
	Nothing Offered	An occasional talk seminar or short workshop session	Long or multi session workshops, regular seminar series	For credit courses, certification programs
Technical Topics with Broader Applications (e.g. big data, modeling complex systems, climate change)	16%	65%	16%	32%
People Management (e.g. leadership, mentorship)	38%	54%	12%	10%
Project Management	59%	35%	4%	5%
Science Writing or Science Communication	27%	49%	18%	27%
Science Policy	58%	33%	5%	6%
Preparing for Employment in the Private Sector	41%	50%	13%	2%
Opportunities to Meet Astronomers or Physicists who Work Outside Academia	23%	68%	14%	1%
Pedagogy, Course Development, Teaching and Mentoring Best Practices	29%	47%	25%	27%

Rows add to more than 100% because respondents were asked to select all that apply.

- Graduate students were least likely to report training in
 - project management
 - and science policy
- Graduate students were most likely to report
 - Training in technical topics such as big data and modeling complex systems
 - Opportunities to meet astronomers or physicists who work outside of academia
- About half of graduate students reported a seminar or short workshop in
 - People management
 - Science writing or communication
 - Preparing for private sector employment
 - Pedagogy and teaching

Table 51 – Training Offered in Graduate Programs for Postdocs

Training Offered in Graduate Programs (Postdocs)				
	Nothing Offered	An occasional talk seminar or short workshop session	Long or multi session workshops, regular seminar series	For credit courses, certification programs
Technical Topics with Broader Applications (e.g. big data, modeling complex systems, climate change)	25%	67%	14%	18%
People Management (e.g. leadership, mentorship)	53%	43%	11%	5%
Project Management	80%	16%	4%	3%
Science Writing or Science Communication	33%	56%	14%	13%
Science Policy	73%	26%	4%	5%
Preparing for Employment in the Private Sector	43%	53%	8%	3%
Opportunities to Meet Astronomers or Physicists who Work Outside Academia	26%	72%	7%	1%
Pedagogy, Course Development, Teaching and Mentoring Best Practices	31%	40%	22%	22%

Rows add to more than 100% because respondents were asked to select all that apply.

- The training that postdocs received as graduate students did not differ much from the training reported by current graduate students.

Table 52 – Encouragement for Graduate Students to Work Outside of Academia

Graduate Students Who Were Encouraged to Pursue Careers Outside of Academia by Others, 2021			
	Discouraged	Neither	Encouraged
My Advisor	11	38	51
Other Faculty Member	10	43	57
Department Information or Policies	13	52	35
My Institution	13	52	35
Broader Astronomy Community	18	38	44

- While about half of graduate students had been encouraged by their advisor or another faculty member to pursue careers outside of academia, large percentages of them had neither been encouraged or discouraged. They received less encouragement from their departments, institutions, and the astronomy community.

Table 53 - Access to Career Center on Campus for Undergraduates

Undergraduates Who Have Access to a Career Center on Campus	
	%
Yes	93%
No	1%
Unsure	6%

- Almost all undergraduates reported having access to a career center on campus.

Table 54 – Cost of Living for Respondents

Cost of Living		
	%	N
Very Low	1%	11
Low	14%	151
Average	23%	243
High	29%	309
Very High	31%	335
Unsure	2%	25

- 60% of respondents with PhDs reported living in an area that either has a high or very high cost of living.

Table 55 – Salary Satisfaction

Salary Satisfaction		
	%	N
Very Dissatisfied	7%	72
Dissatisfied	21%	223
Neither Satisfied or Dissatisfied	17%	184
Satisfied	38%	411
Very Satisfied	16%	175
N/A	<1%	5

- More than half of respondents with PhDs reported being satisfied or very satisfied with their salaries.

Table 56 – Inadequate Salary Outcomes

Has an Inadequate Salary for Your Needs Ever Caused you to do any of the Following?	
	%
Leave the Field	5%
Turn Down a Job	12%
Leave a Job	6%
Seriously Consider Leaving a Job	5%
None of the Above	80%

Rows add to more than 100% because respondents were asked to select all that apply.

- Most respondents reported that salary had never caused them to leave the field, turn down a job, leave a job, or seriously consider leaving a job. It should be noted that although 5% reported “leaving the field” due to salary, all respondents are members of AAS, so it is not clear what they meant by leaving.