

A SNAPSHOT SURVEY OF WOMEN IN ASTRONOMY

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1. INTRODUCTION

When the core organizing committee for this workshop started planning the agenda, we realized we had a problem. We knew about many of the problems facing women in astronomy, about many of the causes, about what the manifestations were, and about potential solutions. But little quantitative data was available. For example, there is a common perception that although the percentage of women starting out in astronomy is relatively high, it decreases steadily, due to problems with advancement. Although we knew that one of the prime goals of the workshop would be to discuss the reasons for this problem, we could not find data to verify the magnitude of the problem, or even that this perception was correct. Most surveys and published results we knew about dealt with women in technical fields, or at best, in physics and astronomy together. We wanted to single out astronomy. Thus, one of the goals of the workshop became to gather such data.

Although we recognized that the problems women face in science may start in the early years—pre-school, elementary school, etc.—we thought it would be more appropriate as astronomers, as well as more tractable, for us to focus on the question of retention and advancement of women in astronomy once they have chosen the field. Thus, we chose to look at the numbers of women compared with men as graduate students, post-docs, and beyond.

This paper summarizes the results of the survey. I wish primarily to present the raw data we have obtained. Although I include some rather simple analysis, I stress that this is not a sophisticated survey, and we are not social scientists. The main point is to present a current snapshot of the numbers of women at various levels in the astronomy profession. I would hope that this survey will be repeated periodically, monitoring progress in our attempts to rectify whatever problems we conclude are the most critical. I also look forward to suggestions from this workshop for making this rather simple survey more useful.

2. THE DATA SOURCE

Following our decision to gather data on women in the astronomy profession, we chose to concentrate on universities and academic-style institutions. We gathered data from a large sample of US institutions with graduate programs in astronomy. We also included in our survey the national observatories (NOAO, NRAO, ST ScI) and the Harvard-Smithsonian Center for Astrophysics, all of which have significant research and academic components and which, taken together, constitute a sizable fraction of the U.S. astronomy community. We wrote to department chairs (or directors) and asked for the numbers of women and men separately in five categories: graduate student, post-doctoral fellow, assistant, associate, and full professor. We did not ask for a differentiation between “soft money” and full faculty positions, or between tenured and

non-tenured positions. We understand that these differences are significant, especially to the individual involved, but the number of women at senior levels is small enough that the significance of the results would not be very meaningful. We intentionally wanted to keep the survey very simple, to encourage rapid and full response. We asked the respondents to specify the equivalent levels of staff who did not fall neatly into our categories [*e.g.*, “research associates” could sometimes be at the post-doc level and sometimes at the assistant professor level]. We only stressed that women and men be reported comparably! We believe our sample of institutions is large enough that small ambiguities at individual institutions will not significantly affect the totals.

Our sample does not include at least three groups—astronomy faculty at four year colleges, astronomers at private companies, and astronomers at government laboratories. The primary reasons for these exclusions were lack of time, and the difficulty involved in defining the relevant categories. We apologize to any of our colleagues who feel disenfranchised. We recognize that women astronomers may be disproportionately represented in some of these groups, and it would be interesting to add these other categories of institutions to our survey; anyone with comparable data is encouraged to send them to me.

Over 30 universities and the four other institutions mentioned were contacted. We may have inadvertently missed putting some institutions on our initial list, and again we apologize. Although it took some perseverance, all of the contacted universities and centers responded. Several responses were received in the weeks following the workshop; they have been included in the data presented below. A few responses were incomplete, but on the whole, the response was extremely gratifying.

3. THE DATA

The results include the responses from 32 universities and the 4 other institutions, and include over 1100 Ph.D. astronomers, and nearly 800 astronomy graduate students. As such, it should be a useful cross-section of the academic astronomy community. The tables below summarize the data from the universities, the other centers, and the totals, respectively.

The appendix includes the data from the individual institutions. Note that the “Tot PhDs” entry represents the sum of the Post Docs and the three faculty ranks. We also stress that these numbers represent a snapshot of the best numbers available as of summer of 1992, and total accuracy is not guaranteed.

4. ELEMENTARY CONCLUSIONS

4.1. Total Numbers of Ph.D. Astronomers in Surveyed Institutions

About 65% of the surveyed astronomers are in universities, the rest are in the four national observatories. Of the total 1157 Ph.D. astronomers reported in our survey, 12% are women. There is no statistically significant difference between the two types of institutions in the relative fractions of women Ph.D.s.

Table 1.

	UNIVERSITIES				CENTERS			
	Female	Male	Total	%Fem.	Female	Male	Total	%Fem.
Grad Stud	170	592	762	22%	6	10	16	38%
Post Docs	42	220	262	16%	21	81	102	21%
Asst	14	65	79	18%	15	75	90	17%
Asso	11	78	89	12%	7	84	91	8%
Full	18	301	319	6%	5	120	125	4%
Tot PhDs	85	664	749	11%	48	360	408	12%
ALL INSTITUTIONS								
	Female	Male	Total	%Fem.				
Grad Stud	176	602	778	23%				
Post Docs	63	301	364	17%				
Asst	29	140	169	17%				
Asso	18	162	180	10%				
Full	23	421	444	5%				
Tot PhDs	133	1024	1157	12%				

4.2. Fraction Women vs. Seniority

We are now able to quantify the original perception that the fraction of astronomers who are women decreases with seniority. While nearly one quarter (176) of the surveyed graduate students (778) are women, less than one fifth of post-docs are women. The fraction stays the same at the assistant professor level, and then decreases further, with women associate and full professors representing only 10% and 5%, respectively, of their ranks. In fact, women represent fewer than 7% of the total in the combined senior categories usually associated with tenure.

4.3. Attrition at the Graduate Student Level

The results of this survey show that there are nearly three times as many women graduate students as women post-docs. Without further data on the time-dependence of graduate student populations, and the average numbers of years people spend at the different levels, it is hard to draw firm conclusions. However, if we assume that astronomy graduate student admissions have not changed significantly over the past few years, and make the further reasonable assumption that the times spent at the two levels are similar, then we conclude that two thirds of women graduate students do not continue in academic astronomy positions as defined in this survey; they either go in to one of the un-surveyed groups (*e.g.*, industry, 4-year colleges, government laboratories), or they leave the field. Although we can't further pursue the question with the current data, we can ask the same question about men. We find that the number of male post-docs is half that of male graduate students in astronomy. We conclude either that

there has been a recent proportionately greater increase in women astronomy graduate students, or that there is a greater attrition rate for women at the graduate student level.

4.4. Entry into the Faculty

The situation appears to have equalized at the faculty entrance level. The number of assistant professors is roughly one-half the number of post-docs, and there is no apparent difference between men and women. This suggests that efforts to recruit women at the junior faculty level have been successful.

4.5. Faculty Advancement

As we move to the associate and full professor levels, the numbers of women decrease further—there are only 18 associate and 23 full professors in our sample of women, compared with 29 women assistant professors. Thus, there is some further attrition in the numbers of women past the assistant professor level, but no evidence for further attrition between the associate and full professor levels. If we compare these numbers with those for men, we find the most outstanding, if not unexpected result. Although there are slightly more men associate professors than assistant professors, there is an enormous increase in the number of full professors: men associate and full professors together are about 4 times more numerous than assistant professors. Relative percentages of women at the senior levels thus go down significantly, as mentioned earlier, to 10% at the associate level and 5% at the full professor level, not so much because of attrition of women, but because of the enormous number of senior men.

Although this likely just represents the outcome of decades of the tenure system with under-representation of women in the profession, the implication for the representation of women in the “power structure” is obvious.

5. FURTHER IMPLICATIONS AND CONCLUSIONS

Mentoring:

The importance of mentors and role models has been widely discussed. In this regard, we can make several observations. First, well over half of the institutions surveyed have no women full professors, two thirds have no women associate professors, and, in fact, eight have no women astronomy faculty at all. It is clearly not trivial for a student or post-doc to find a woman mentor. Using our whole sample, there are altogether 41 senior women (associate, full) faculty members for a population of 176 women graduate students, and 63 women post-docs. By comparison, there are 583 senior men faculty members, for a population of 602 men graduate students and 301 men post-docs. Again, it is, perhaps, not surprising that there could be a greater problem retaining women graduate students if the presence of female mentors and role models is a significant factor. This situation also clearly places a great burden on the existing senior women.

Numbers:

The relatively small number of women astronomers at all levels, but particularly at the senior ones, supports the anecdotal reports about the problems institutions face in trying to hire women astronomers. Since women currently represent about 17% of junior staff (post-docs and assistant professors), we can expect the fraction at the senior levels to very gradually approach that level. But we note that even if all women assistant professors were suddenly promoted, women would still only represent 9% of senior faculty, due to the large number of existing senior (and possibly old) men.

However, it is very likely that the addition of even one senior woman to the staff of an institution which currently has none could be very significant in retaining graduate students and encouraging junior staff. Thus, as the current 176 women graduate students, and then the 63 post-docs, make their way through the ranks, we can expect them to have a multiplicative effect via increased graduate student retention and increased representation on hiring and advisory committees, enabling a qualitative change in the status of women in astronomy. We should all do our best to encourage and support them.

Acknowledgment

I wish to thank the many department chairs and others who cheerfully responded to my requests for data. In fact, a common response was a reciprocal request to receive the survey results. I hope they will be able to use the results presented here to good effect.

APPENDIX

The following table includes the data as received from the individual institutions. We asked for the data during the summer of 1992, with a request that the numbers be current as of the fall semester. We hope that these numbers thus represent a snapshot of the best data available, but stress that total accuracy is not guaranteed. Note also that the “Tot PhD” entry represents the sum of the Post Docs and the three faculty ranks.

Notes for Appendix Table “Institutional Data”

(a) not all categories available.

(b) includes AURA and on-site ESA and CSC staff.

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Table A1. INSTITUTIONAL DATA

UNIVERSITY	Women						Men					
	Full	Asso	Asst	Post	Grad	TotPhD	Full	Asso	Asst	Post	Grad	TotPhD
Berkeley	0	1	0	3	7	4	12	2	1	13	24	28
Boston U	0	0	0	0	5	0	7	2	3	1	25	13
Caltech	2	0	0	3	7	5	12	7	2	20	24	41
Chicago	0	0	0	5	9	5	20	13	2	20	30	55
Columbia	0	1	2	0	7	3	7	2	4	8	15	21
Cornell Univ	1	0	0	1	3	2	13	4	2	24	27	43
Harvard (a)	1	0	1		6	2	16	1	1		27	18
Indiana	0	1	0	0	2	1	4	2	0	0	16	6
JHU (a)	0	1	0	0		1	8	0	1	9		18
LSU	0	0	0	0	0	0	6	2	0	2	8	10
Minnesota	1	0	0	1	7	2	9	0	1	4	11	14
MIT	1	0	2	1	11	4	19	2	2	3	42	26
New Mexico	1	0	0	0	5	1	6	0	4	3	22	13
Northwest'n	0	0	0	1	3	1	2	0	4	7	4	13
Ohio State	0	0	2	1	3	3	5	1	4	4	11	14
Penn State	2	0	1	1	8	4	9	4	3	7	15	23
Princeton	2	0	0	3	5	5	7	2	0	3	14	12
Purdue Univ	0	0	0	0	1	0	4	0	0	2	3	6
Rice Univ	1	0	0	1	9	2	11	1	0	5	30	17
Santa Cruz	1	1	0	1	6	3	17	1	2	9	24	29
Stony Brook	0	0	1	0	6	1	7	0	0	2	15	9
U of Arizona	1	1	1	3	10	6	13	8	0	11	20	32
U of Illinois	1	2	1	1	6	5	17	2	1	9	19	29
U of Iowa	0	0	0	0	2	0	4	0	1	0	9	5
U of Mass	1	1	0	3	10	5	8	3	3	6	16	20
U of Md	0	0	0	5	9	5	9	2	2	18	25	31
U of Texas	0	1	1	5	5	7	15	7	13	16	45	51
U Virginia	0	0	1	0	2	1	7	6	1	4	17	18
U of Wash.	2	0	0	1	3	3	8	1	3	0	19	12
U of Wisc	0	1	0	2	6	3	10	2	0	9	19	21
UCLA	0	0	1	0	6	1	7	0	4	0	15	11
CaseWestern	0	0	0	0	1	0	2	1	1	1	1	5
TOTAL UNIV	18	11	14	42	170	85	301	78	65	220	592	664
OTHER INST	Full	Asso	Asst	Post	Grad	TotPhD	Full	Asso	Asst	Post	Grad	TotPhD
CfA	3	3	8	12		26	25	37	39	38		139
NOAO	1	0	0	2	2	3	19	11	3	9	0	42
ST ScI (b)	1	3	7	7	2	18	34	28	22	21	4	105
NRAO	0	1	0	0	2	1	42	8	11	13	6	74
TOT OTHER	5	7	15	21	6	48	120	84	75	81	10	360