

## MANY STEPS FORWARD, A FEW STEPS BACK: WOMEN IN PHYSICS IN THE U. S.

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The situation of women in physics in the U. S. has seen some dramatic changes over the last few years, particularly in public policy. The 2010 reauthorization of the National Science Foundation (NSF) mandates wide-ranging education and policy initiatives, including a requirement for NSF to train staff and merit review panelists on evaluative gender bias in grant reviews and awards. It also directs the President's Office of Science and Technology Policy (OSTP) to conduct and evaluate the effectiveness of gender equity workshops, and to provide support for researchers who are caregivers [1].

Unfortunately, the proportional representation of American women has reached a plateau in recent years [2]. The fraction of women earning bachelor degrees in physics declined from 22.6 percent in 2002 to 19.3 percent in 2009, while the absolute number increased from 908 to 1036 [3]. Similarly, doctoral degree production leveled off at 18.5 percent despite a growth in number from 265 to 293 from 2007 to 2009. The number of women earning physics degrees in the U.S. has increased more slowly than the physics degree attainment by men, resulting in the first substantial proportional decline in decades [4].

In order to investigate possible variations with institution type, we examined data from U. S. Department of Education and the American Institute of Physics (AIP) summed over the 2000-2009 [3,5]. The percentage of bachelor's degrees awarded to women in physics is comparable at PhD and bachelor's institutions (17% and 20%) [6]. While institution type does not seem to be a factor, large variations in the fraction of women (for students, in particular) from one institution to the next demonstrates that cultural and social factors local to the institutions have a strong effect [7, 8]. Together with similar variations from one country to the next, this argues against common explanations for women's low participation in physics, such as lack of interest, poor preparation, or aptitude [9].

New research from AIP's Statistical Research Center show that the percentage of women physics faculty has increased to 14 percent overall, but varies by rank, with women serving as 22 percent of assistant professors, 15 percent of associate professors and 8 percent of full professors [6]. Women's representation among physics faculty also varies by institutional type, with 60 percent of men employed

**Table 1.** Percent of the 4646 physics bachelor's degrees awarded to U.S. citizens and permanent residents (2008), by gender and race.

White Female	<b>15.0%</b>
White Male	<b>61.9%</b>
Asian/Pacific Islander Female	<b>1.4%</b>
Asian/Pacific Islander Male	<b>5.3%</b>
Hispanic Female	<b>1.0%</b>
Hispanic Male	<b>3.9%</b>
Black Female	<b>1.0%</b>
Black Male	<b>2.1%</b>
Am. Indian/Alaska Native Female	<b>0.2%</b>
American Indian/Alaska Native Male	<b>0.3%</b>
Other or unknown Female	<b>1.7%</b>
Other or unknown Male	<b>6.2%</b>

SOURCE: National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

in PhD-granting departments compared to 54 percent of women. Further, 60 percent of Asian women are in PhD departments versus 54 percent, 50 percent and 48 percent of white, Hispanic and black women, respectively [10]. Outside of academia, women and minorities seem to be approaching equitable pay in the federal and private sectors, although pay equity is only one factor in achieving full equity [11].

Generally, women of color remain an untapped resource for fulfilling the ranks of future Science, Technology, Engineering and Mathematics (STEM) disciplines [12]. Table 1 shows the exceptionally low percentages of Asian/Pacific Islander, Hispanic, Black and American Indian/Alaska Native women receiving degrees in 2008 at the bachelor level. At the graduate level, minority women's representation is even lower; in 2006, they earned just over 3 percent of PhDs awarded in physics [3]. To contextualize these data, the 2010 census reports that 16.3

percent of the U.S. population is Hispanic, 12.2 percent is Black, 4.2 percent is Asian/Pacific Islander and 0.7 percent is American Indian/Alaska Native [13].

In 2009, an NSF-sponsored mini-symposium focused on women of color in STEM which generated suggestions for action for the Committee on Equal Opportunities in Science and Engineering (CEOSE) [14], the NSF, and Congress [15], including: increase funding to increase the number and success of women of color in STEM; increase research on the situation of women of color in STEM; and report data disaggregated by race/ethnicity and gender.

Coalitions that serve women in physics and minorities in physics have recently broadened to be more inclusive of one another. For example, the 2009 Women in Astronomy meeting included many speakers addressing issues of women of color. At its October 2009 meeting, the APS Committee on the Status of Women in Physics (CSWP) recommended that future issues of the *Gazette* be co-edited by the Committee on Minorities (COM) [16].

Our country team is designing a strategy to engage more practicing physicists in increasing gender equity. While some members of previous U.S. delegations have already become more engaged in building gender equity as a result of their participation in the conference, deeper engagement on multiple fronts is required. We plan to broaden our reach beyond those already focused on gender equity to physicists engaged in more general questions of education, outreach and public policy. Further opportunities exist in professional organizations that link to physics via education research, university administration or K-12 leadership. Lastly, we must connect with influential research institutes and national labs. We will recruit interested colleagues both to help us engage with members of these organizations personally and to help make the products of gender scholarship relevant and accessible to the broader physics community.

In addition to extending our connections and outreach to a broader range of our physics colleagues, we all must do more within our own spheres of influence. It will take even more effort and new strategies to reach the goal set by the APS Gender Equity Workshop: “doubling of the number of women in physics in both academia and national laboratories over the next 15 years” [17]. As teachers, we can take several steps to accomplish this goal. Admitting to students that learning and teaching physics was difficult for ourselves, assigning projects directly examining the issues of gender inequality and appealing to students' interests in humanitarian applications of physics can contribute to an increased affinity. Additionally, as educational leaders we can serve as mentors to diverse groups of students, remembering that connecting with students of color may increase our connections with women as well [18].

#### REFERENCES

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