Women in physics in the United States: Reaching toward equity and inclusion

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Summary
- In the US, only 20% of undergraduates, graduate students and assistant professors are women.
- Challenges involved in recruitment and retention include microaggressions, active discouragement, poor advising and mentoring, inadequate acknowledgement of achievement, sexual harassment, and others.
- Research suggests that unconscious gender bias and stereotype threat produce major impediments in women’s advancement in physics.
- Intersectionality issues can exacerbate the suboptimal climate and treatment of women in physics.
- Increased participation of women in physics requires a multi-pronged approach: access and encouragement to take high school math/physics courses, availability of research opportunities and funding, presence of mentors and role models, training to reduce the negative impacts of gender bias, and support from professional societies.

Challenges faced by women in physics in the USA

Top issues faced by female physicists

- Inherent Gender Bias
- Disagreement
- A Lack of Role Models
- Intense Competition
- Microaggressions
- Lack of Mentored Competence
- Work-life Balance

Implicit (unconscious) bias

Because we all grow up in a social community, we learn certain biases from our society. In the US, there is a bias against women in science. This bias does not have to be known or understood by a person to affect that person’s actions. Implicit or unconscious bias can cause people to give less credit to a woman’s work, make them less likely to hire her even when she is well qualified, change decisions to be more discriminatory or aggressive, and minimize the true talent and contributions of women. There are results in women exhibiting reduced confidence, as well as working environments that lack diversity. Interview data from women with Black female physicists revealed exclusionary practices from peers.

Gender and race

Analysis of nationally representative survey data of college students in STEM revealed that Black and Hispanic male students were less likely (40-45%) than White male students (60%) to strongly identify as “physics people”. Women were less likely (40%) than White women to identify this way. Black and Hispanic women have the lowest percentages (roughly 30%) of any group for identifying strongly as “physics people”.

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Women in physics face challenges created by race, gender, ethnicity, social class, age, sexuality and other dimensions.

Broadening participation to all women

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 catch them early

- Early influences play a critical role in helping women break the stereotypes and develop an identity as a physicist.
- Encouragement, outreach and mentoring of young women can positively impact their determination, persistence and their choice of high school and college physics/math courses.
- About half of HS physics students are female.

CULWIP

One successful approach: the Conference for Undergraduate Women in Physics (CULWIP)

Started in 2006 with a site, 29 attendees; this year (2017) 10 sites, 1500 (reaching nearly every female physics undergrad). Three days of lab tours, poster sessions, presentations, panels, and networking events.

CULWIP Conference evaluation suggests:
- very positive understanding of physics careers and potential losses for women
- growth in physics community and mentoring
- belief that career successes of women in physics were due to luck and other people’s perception (as opposed to talent in physics and being prepared and seizing opportunities) [See the section on Imposter Syndrome]

Careful framing of the rewards, opportunities and challenges involved in being a female physicist is essential for recruiting and retaining talented impressionable women.

Statistics on physics participation

Note: many surveys on participation in physics fail to track the interaction of gender and race/ethnicity. We include interstatial notes where available.

In 2012, the number of women receiving physics bachelor’s and PhD degrees was at an all-time high of 1,915 (1,192 bachelor’s, 723 PhD). However, the percentage of women who received PhDs was the lowest in years. As such, the percentage of women in physics bachelor’s degrees earned by women decreased for several years in a row (see above, APF).

In 2012, about 20% of physics bachelor’s degree recipients were women.

In 2013, only 10% of physics PhDs were awarded to women.

In 2014, 8% of physics PhDs went to women.

The total number of physics women and astronomy faculty members was 1,638 in 2008, increasing to 1,912 in 2011. The rate was 22% in 2008 and increasing to 28% in 2011. Since 2010, the percentage of women in physics faculty is comparable to the general population of the U.S. (see above).

Percentage of women in freshman physics classes is 35% (2008-2011) and 40% in 2012 (APF).

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Gender bias in physics website

genderbias.compadre.org

A website was created to serve as an international forum for discussing gender bias in physics. Experiences shared on the site were analyzed for effective strategies to combat gender bias.

Conclusions
- Women face many challenges that produce barriers to their identity as a physicist and their recruitment and retention in physics.
- These barriers include societal stereotypes including implicit gender bias and stereotype threat, lack of encouragement at all stages, poor advising and mentoring, climate in the physics departments/physics community including workplace and data resources, lack of recognition for accomplishments and support along with a feeling of isolation, not finding in and lack of role models
- Intersectionality can significantly increase these barriers
- To ensure that excellence is not compromised, we must recognize the stereotypes, work to breakdown the barriers from early stages, provide adequate resources, support & mentoring, and improve the climate for women in physics
- Some approaches are shown to be effective
- Research-based approaches implemented as part of a comprehensive plan can help change society’s views towards women in physics, promote an equitable culture in physics and ensure excellence of physics research and education

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