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STEP UP 4 Women: Supporting Teachers to Encourage the Pursuit of Undergraduate Physics Degrees for Women

Zahra Hazari, PhD, Florida International University

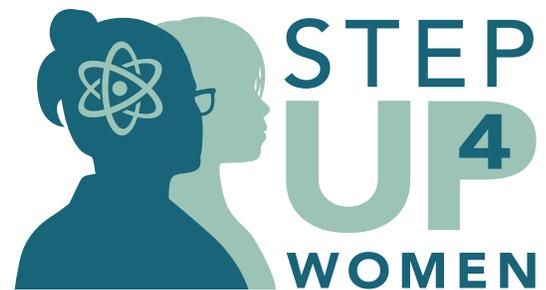
Why are 50% or more of bachelors degrees in physics going to women in countries like India and Iran, yet only 20% go to women in the US? What are the cultural messages we convey to women and how can this narrative be changed?

Drawing on research evidence, the STEP UP 4 Women project will mobilize thousands of high school physics teachers to help engage young women in physics and encourage them to pursue physics degrees in college. The goal is to narrow the US representation gap in physics bachelors degrees and begin to shift deep-seated cultural views about who does physics.

Why focus on high school physics?

Most women physics majors report that they became interested in physics careers in high school (Hazari, Brewe, Goertzen, & Hodapp, 2017). A high school physics teacher's recognition of a female student as being a "physics person" is a significant predictor for choosing a physics career. Furthermore, most female career physicists also report becoming interested in physics careers in high school (Ivie & Guo, 2006).

High school may be a critical period, particularly in the US, since by this time physics is delineated as a



separate science course and students are getting close to deciding college majors. Women are also still a captive audience in high school physics classes (see figure).

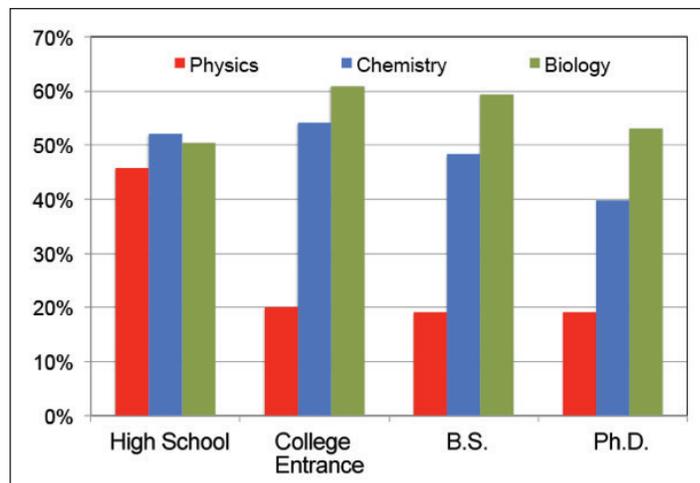
What do high school physics teachers need to do?

There are more than 1.3 million students who take high school physics every year, of whom more than 600,000 are women (White & Tesfaye, 2011; White & Tesfaye, 2014). Furthermore, there are approximately 27,000 high school physics teachers in the nation (White & Tyler, 2014). If these teachers recruited 4,500 more young women to get a degree in physics, the

representation gap would be closed. For high school physics teachers, that equates to recruiting only one additional female student to physics every three years – an accomplishable goal!

How will STEP UP 4 Women help?

The STEP UP 4 Women project will provide high school physics teachers with evidence-based resources shown to increase students' physics identity and the physics career interest of female students. These resources include: strategies for reducing marginalization in the classroom and enhancing physics identity development; lessons on careers in physics, particularly those that help solve societal problems; lessons on the underrepresentation of women in physics and the role of implicit bias and cultural stereotypes.



Percentage of students in physics, chemistry, and biology who are women at various academic stages. College entrance refers to first-year students' intent to major. SOURCE: AIP, HERI, AND IPEDS

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Graphic Designer
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Updated Effective Practices for the Recruitment and Retention of Women in Physics

Tricia Rankin, APS CSWP Chair

The APS Committee on the Status of Women (CSWP) has just completed a review of their best practices documents concerning the recruitment and retention of women in physics. We have updated the recommendations to reflect current practice and re-framed them as “effective practices.” You can visit go.aps.org/cswppractices for a full list.

We want the reader to understand that these practices are not static. They will change over time as we learn how to make our interventions more successful and as, in turn, women’s situations change. The effective practices cover undergraduate through faculty recruitment and retention as well as having some specific recommendations concerning conferences. Here are some of the ideas that we would like to see broadly adopted.

First, any and all interactions related to being a physicist (in the classroom, in study groups, in the lab, at coffee breaks, at meetings, and at department gatherings) should always be governed by the norms of professional behavior. The CSWP would like to stress that these expectations apply to students, staff, and faculty members.

Treating everyone as you would want to be treated if you were in their position goes a long way towards making everyone feel welcome. As part of this self-reflection, look at the ways that you encourage interactions in the department – do research groups keep to themselves or are there opportunities for members of different research groups to cross connect that encourage common expectations to be set? Are there ways for people to raise any issues or concerns they have with-

out being worried about this having a negative impact on their careers?

Second, review any materials that you use for teaching and/or presentations from a fresh perspective (it may help to get someone else to look). Could someone whose background and experiences differ from yours interpret them differently than you intend? Are phrases or acronyms that were in common usage in the past now in need of being changed (e.g., Field Alternating Gradients are better termed Alternating Field Gradients nowadays)? Be careful of casual comments that can be seen as trivializing historical wrongs such as by equating them to how hard graduate students are expected to work. And no, asking “are there are any girls in the room?” is not recommended as a way to single them out for encouragement.

Finally, understand that members of underrepresented groups in physics have many demands on their time and that it is not only their responsibility to make physics more inclusive.

The mentoring of members of underrepresented groups does not need to be done only by members of underrepresented groups – think about how best to share responsibilities and leverage special expertise. If some faculty members are taking on a larger share of student advising, then make it clear that the expectation is that they do less in other service roles so that the overall load is balanced.

We encourage you to take a look at the new effective practices pages at go.aps.org/cswppractices, and we welcome your comments to women@aps.org. ■



The 2016-2017 APS Committee on the Status of Women in Physics meeting at APS headquarters

Sexual Harassment in the Workplace

Roxanne M. Hughes, PhD, Florida State University

The week that I chose to begin drafting this article was also the week that news broke about alleged sexual misconduct by two well-known media figures – Matt Lauer of NBC’s Today Show being one of them. This was only a week after reports of alleged sexual misconduct by two US Congressmen as well as a famous American comedian. Some of these individuals have lost their positions and others are under investigation. But one cannot deny that 2017 was a year wherein victims of sexual harassment and assault came forward in large numbers with actual repercussions for bad behavior.

The topic of sexual harassment is not new to the physics community. In the last three years, stories of alleged sexual harassment by prominent faculty members in astronomy and physics have made the news. In response to these high profile cases, the American Astronomical Society and the American Physical Society (APS) have updated Code of Conduct statements and expectations, particularly for meetings. The APS Committee on the Status of Women in Physics (CSWP) formed a Sexual Harassment Subcommittee in 2016 to investigate the issue of sexual harassment in our community. One of the outcomes of this committee has been updated Effective Practices in the Recruitment and Retention of Women Undergraduate, Graduate, Postdoctoral, and Faculty (see page 2).

In our own data gathering, we know that sexual harassment occurs at all levels and is negatively affecting many young researchers from persisting in their chosen field. A recent study focused on sexual harassment in science in general tells us that one in ten graduate students at major universities have been sexually harassed by a faculty member and the typi-

cal form of harassment is physical contact not verbal (Cantalupo and Kidder, 2017). One of the more alarming findings from this study was 53% of these sexual harassment cases involved faculty members who allegedly engaged in serial sexual harassment.

Kathryn Clancy and her colleagues (2017) recently published a study focused on sexual and racial harassment within astronomy. The data for this study came from the APS Forum of Graduate Student Affairs survey sent in 2011. The survey included data from 400 APS members including undergraduates, graduates, postdocs, and faculty. The results indicated that women were more likely than men: (1) to hear racist and/or sexist comments; (2) to report experiencing verbal and physical harassment; (3) to report feeling unsafe because of their gender; (4) to report skipping events because they felt unsafe. These experiences were worse for women of color. The worst offenders of the comments and assaults were peers.

Sexual harassment is a form of discrimination and stems from an individual’s belief that the group that they belong to is better than other groups and therefore can treat these other groups as inferior. It stems from a sense of having more power than another individual and abusing that power through unwanted sexual advances, bullying or demeaning a person’s scientific contribution because of their sex.

Sexual harassment is more pervasive than many of us ever thought in our society and in our disciplines and workplaces. Although the number of individuals abusing their power and harassing others may be a minority, we all can play a role in stopping the behavior and protecting victims. Colleagues should step in and help victims. Universities use Title IX offices to report

... one in ten graduate students at major universities have been sexually harassed by a faculty member and the typical form of harassment is physical contact not verbal

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STEP UP 4 Women *continued from page 1*

How can you help?

Everyone can register to be a part of the STEP UP 4 Women movement and network by visiting www.stepup4women.com. Faculty, graduate students, and undergraduate students can all help by reaching out to their local high school physics teachers or other networks of physics teachers to join the campaign. As a community, we have the capability to ignite the future of physics, a future in which women play an integral role. ■

Hazari, Z., Brewster, E., Goertzen, R. M., & Hodapp, T. (2017). *The importance of high school physics teachers for female students' physics identity and persistence*. *The Physics Teacher*, 55(2), 96-99.

Ivie, R., & Guo, S. (2006). *Women Physicists Speak Again*. *American Institute of Physics Report*.

White, S., & Tesfaye, C.L. (2011). *Female Students in High School Physics: Results from the 2008-09 Nationwide Survey of High School Physics Teachers*. *American Institute of Physics Report*.

White, S., & Tesfaye, C.L. (2014). *High School Physics Courses & Enrollments: Results from the 2012-13 Nationwide Survey of High School Physics Teachers*. *American Institute of Physics Report*.

White, S., & Tyler, J. (2014). *Who Teaches High School Physics? Results from the 2012-13 Nationwide Survey of High School Physics Teachers*. *American Institute of Physics Report*

The Sixth International Conference on Women in Physics

Laura McCullough, PhD, University of Wisconsin-Stout

An unexpected speaker thrilled us all: Nobel Peace Prize winner Malala Yousafzai. She spoke on the importance of education for girls and women, and shared that she enjoyed physics classes, except for exams!

Last July, the University of Birmingham hosted the sixth International Conference on Women in Physics (<http://icwip2017.iopconfs.org/home>). This conference brought together 200 women from over 40 countries to share stories of success and challenges, talk about their research, and network with other female physicists from around the globe.

Each country is invited to present a poster on an issue relevant to women in physics in their country. The US delegation (<http://www.uswip.org/>) created a poster focusing on equitable participation: what we do to encourage girls and women to take physics, what barriers they encounter on their path, and how intersectional social identities result in barriers unique to specific groups of women. We provided current statistics on women's participation in physics, shared some of the common challenges women in physics face, and put a spotlight on the very successful Conferences for Undergraduate Women in Physics (CUWiP).

Participants were able to share their own research with a poster presentation in one of six different parallel sessions: Astronomy/Nuclear/Particle/Medical Physics; Condensed Matter Physics; Environmental Physics; Nanoscale Physics; Women in Physics in the Workplace; and Teaching Girls and Women in Physics. Papers based on the posters are published in the Proceedings, planned for an early 2018 release. Previous conference proceedings are available via AIP (http://www.iop.org/activity/groups/subject/wip/history/icwip/page_64677.html).

Plenary speakers from many subfields of physics opened each morning and afternoon session. These women spoke of their research, which they clearly loved, as well as how being a woman has shaped their path. An unexpected speaker thrilled us all: Nobel Peace Prize winner Malala Yousafzai. She spoke on the importance of education for girls and women, and shared that she enjoyed physics classes, except for exams!

The core of the conference was the workshops. Five workshops were available to participants: Gender studies and intersectionality; Science practice and ethics; Professional development and leadership; Cultural perception and bias; and Physics/science education. The workshops ran across the three days of the conference. Workshops started with two days of presentations, and the third day was devoted to coming up with recommendations for IUPAP, the IUPAP Working Group on Women in Physics, and for country teams and participants. One of the most important recommendations from the previous ICWIP in 2014 is the Waterloo Charter, which provides data and recommendations for equitable treatment of all physicists, from hiring to career path to safety in the lab.

The US delegation consisted of 25 members, 13 of whom attended the conference. We learned a great deal about the issues facing women in physics across the world, met fantastic colleagues, and had a chance to enjoy being in a room full of female physicists. The 6th ICWIP was an amazing experience for its participants. ■



Attendees of the 6th Annual International Conference for Women in Physics. COPYRIGHT LIZ HINGLEY, IOP AND UNIVERSITY OF BIRMINGHAM 2017

Sexual Harassment *continued from page 3*

sexual harassment cases and offer trainings for bystanders and supervisors. APS has allies at their meetings and ways to report sexual harassment. Please read the APS Code of Conduct Statement (<https://www.aps.org/meetings/policies/code-conduct.cfm>) to learn more. Leaders and peers should model appropriate professional behavior. For more information on direct actions that we can all take, please visit the Effective Practices developed by the CSWP at go.aps.org/cswp-practices. ■

Cantalupo, Nancy Chi and Kidder, William C., A Systematic Look at a Serial Problem: Sexual Harassment of Students by University Faculty (May 20, 2017). Utah Law Review, Forthcoming. Available at SSRN: <https://ssrn.com/abstract=2971447>

Clancy, K.B.H., Lee, K.M.N., Rodgers, E.M., & Richey, C. (2017). Double jeopardy in astronomy and planetary science: Women of color face greater risks of gendered and racial harassment. Journal of Geophysical Research: Planets, 122, doi:10.1002/2017JE005256.

2019 CUWiP Host Sites Announced

The 2019 APS Conferences for Undergraduate Women in Physics (CUWiP) will be hosted January 18 - 20, 2019. Student applications will open September 1 at aps.org/cuwip.

- College of William and Mary
- Michigan State
- Northwestern University
- Texas A&M University - Corpus Christi
- The College of New Jersey

- The University of Alabama, Tuscaloosa
- University of California, Davis
- University of California, Santa Barbara
- University of Massachusetts, Amherst
- University of Washington
- Utah State University

If your institution is interested in hosting an APS CUWiP in 2020, please visit go.aps.org/cuwiphost and submit an Expression of Interest by September 1. ■



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Inviting Mexican Girls to Explore STEM with Support from Real Engineers

Cha-Mei Tang, APS CWSP Member

Maria Makarova is enabling 10-18 year-old girls in Mexico to excel in STEM and achieve goals they could previously have only dreamed of.

Makarova received her Ph.D from Stanford University. As an undergraduate, she interned for Barbara Jones of IBM, the past chair of the APS Forum of Industrial and Applied Physics (FIAP). After receiving her Ph.D, she moved to Mexico, following her husband. She was a professor at the American School Foundation of Guadalajara and a professor of physics at the Guadalajara Tecnológico de Monterrey Campus. The lack of opportunity for girls and young women in STEM motivated her to help girls to develop skills to solve problems through technology.

As a form of focused effort, she invited girls to participate in Technovation Challenge, a flagship program of non-profit Iridescent, the world's largest global tech entrepreneurship competition for girls. The program offers girls around the world the opportunity to learn the necessary skills to emerge as tech entrepreneurs and leaders by challenging girls 10-18 to build a business plan and mobile app that will address a community problem.

Since 2009, over 15,000 girls have participated from over 100 countries. The top 12 projects selected worldwide are able to participate in the global competition in San Francisco, California. In 2016, Lilia Lobato, originally from Guadalajara, won the Mexican competition and went on to win the International Technovation competition, the first time for Mexico. Labato developed a cell phone app called Ool (meaning volunteer in Mayan) which connects volunteers with non-profit organizations.

John Pint of the *Guadalajara Reporter* asked the girls how they have benefited from the experience. Melissa Sarahi Garcia said, "Maybe the question should be, 'What didn't you learn?' That's because we learned so much. For example, how to do a market sur-

vey, how to program an application, the problems of street people, the problems of migrants, all about bank fees, and much more."

"We learned to work as a team and to do things we never imagined we could do," said Adriana Ibarra, whose app connects people who need blood transfusions with others willing to give blood. "Our project brought together everything we had been planning to work on in the future, in the fields of medicine, electronics and administration."

"I learned teamwork," contributed Camelot Ramírez, "and to solve a problem in a way that could really make a difference in the world."

"I discovered that team-work is essential for any project to be successful, because this taps the abilities of every member," said Monserrat Mariana Martínez. "It made me secure about the career I want to study, which is engineering. Now I know that I can do it."

When Mararova was still in Stanford, she participated as a mentor to girls. In Mexico, she initially devoted part of her time to helping girls while maintaining her position as professor. She found helping girls in STEM was very fulfilling. Starting in 2014, she decided to devote her full time to expend the effort. Makarova recruited female engineers to mentor the girls through a 12 week program, and she has grown her Technovation effort to 8 different states in Mexico reaching nearly 500 girls in 2017. Now, she is expanding the Technovation Challenge to girls throughout all of Mexico. She received the 2017 Regional Technovation Ambassador of the Year Award. She was featured in *Forbes Mexico* May 2017 as one of the 10 most influential foreign women in Mexico, providing a source of inspiration and contributing to the development of girls and women. ■

Pint, John. Technovation gets Mexican Girls excited about computer science (May 18, 2017). Guadalajara Reporter.



Mararova working with girls in Mexico on their Technovation projects. PHOTO COURTESY OF MARIA MARAROVA

Makarova recruited female engineers to mentor the girls through a 12 week program, and she has grown her Technovation effort to 8 different states in Mexico reaching nearly 500 girls in 2017



Need a Speaker?

The American Physical Society maintains online lists of women and minority physicists who are willing to give colloquium or seminar talks to various audiences. These lists are wonderful resources for colleges, universities, and general audiences. The lists are searchable by state, fields of physics, or speakers' last names.

www.aps.org/programs/women/speakers/

www.aps.org/programs/minorities/speakers/



PhysTEC recognizes the following institutions for graduating 5 or more well-prepared physics teachers in the past academic year. They are national leaders in addressing the severe nationwide shortage of secondary physics teachers.

The 5+ Club

2016-2017

- Rutgers, The State University of New Jersey (8)
- Brigham Young University (7)
- Rowan University (6)
- Stony Brook University (6)
- University of Texas at Austin (6)
- City College of New York (5)
- Georgia State (5)
- Illinois State University (5)
- University of Wisconsin–River Falls (5)

PhysTEC is led by the American Physical Society (APS) and the American Association of Physics Teachers (AAPT).



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- ✓ Enhance personal presence
- ✓ Negotiate for jobs
- ✓ Develop alliances as women in academia and the workplace



Funding for seminars is provided by the National Science Foundation under Award No. PHY-1419913

Visit the APS website for a list of trained physicists who will come to your college, university, or institution and lead a 2-hour interactive workshop for undergraduate and graduate women in physics.

QUESTIONS? READY TO REQUEST A SEMINAR? VISIT GO.APS.ORG/PSDWSEMINARS

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[www.facebook.com/groups/APSMinorities.](http://www.facebook.com/groups/APSMinorities)



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recycle it or pass it on to a friend.

Questions? Comments?
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