Women in Physics Internationally

Summary

The representation of women in physics at the undergraduate level varies widely between countries, with Iran having the highest percentage of women in physics and western cultures such as the US and Germany having the lowest. Even in countries with relatively high percentages of female undergraduates, women are underrepresented at the faculty level.

The reasons for these disparities are not well known, but representatives from different countries do posit some ideas. Albania has the clearest reason for its lack of a gender gap: students are assigned their majors based on their grades and are not free to choose. This shows that women have equal abilities in physics, a fact also reported by Italy and Iran. Iranian sources cite families' investments in educating girls, national policies, and boys' decreasing interest in physics as reasons for the high representation of women in undergraduate physics. The state of physics is in flux in Argentina, where widespread government funding for science has been implemented only recently and where a positive perception of scientists is generally on the rise. In Italy, female physicists are disproportionately represented in the subfields of applied physics, history of physics, and didactics of physics, while in Albania, women in graduate level physics gravitate towards environmental physics, physics education, and biophysics. Countries such as Canada, Germany, and Australia invest in initiatives to attract women into physics but have seen relatively little success. Included below is a summary of multiple papers from the IUPAP International Conference on Women in Physics, with information from each country & a relative reference.

Germany

Anja Sommerfeld, Susanne Krankl, and Barbara Sandow, "Area of actions: Equal opportunities for women in physics in Germany," AIP Conference Proceedings 1697, 060020 (2015); doi: 10.1063/1.4937667

In 2012, the percentage of university degrees in physics awarded to women in Germany was slightly less than 20%. The percentage of physics Ph.D.'s awarded to women was similar, but the percentage of women in the German Physical Society (*Deutsche Physikalische Gesellschaft*, DPG) was lower (14%). The participation of women in undergraduate physics remained relatively constant from 2005-2015, but the percentage of women at the faculty level increased. The report cites that parenthood affects female physicists' careers "distinctly more strongly than it does for men" and found that female physicists' professional competence and accomplishments are less appreciated. Furthermore, women in physics careers make less money than men with the same duties, responsibilities, and educational level. The efforts of the DPG Working Group on Gender Equality, founded in 1998, are credited with increasing the number of women in leadership positions in their organization and the number of women giving DPG plenary talks. Further efforts of that group include organizing the German Conference of Women in Physics and the DPG Mentoring program. They were also considering a program to encourage girls at the high school level to enter physics.

Canada pt. 1

Li-Hong Xu, Shohini Ghose, Marina Milner-Bolotin, Janis McKenna, Sampa Bhadra, Adriana Predoi-Cross, Arundhati Dasgupta, Melanie Campbell, Svetlana Barkanova, and Michael Steinitz, "Women in physics in Canada," AIP Conference Proceedings 1697, 060009 (2015); doi: 10.1063/1.4937656

(The 2015 paper does not have the statistics for physics, specifically, but the 2005 paper does. See below.) In 2015, 24% of all undergraduates in the physical sciences, computer science, engineering, and mathematics were women. Additionally, at the full professor level, only 9% of physicists were women. There are many efforts to increase the representation of women in physics in Canada. The Natural Sciences and Engineering Research Council (NSERC) supports parental leave for trainees and grant deferral during times of leave. The Canadian Conference for Undergraduate Women in Physics aims to support women at the undergraduate level. Additionally, many outreach programs aim to recruit middle school and high school girls into physics. Despite these efforts, women remain underrepresented in physics.

Canada pt. 2

Maria Kilfoil, Janis McKenna, Adriana Predoi-Cross, and Michael Steinitz, "Women in physics in Canada: Progress and shortcomings," AIP Conference Proceedings 795, 103 (2005); doi: 10.1063/1.2128284

In 2005, 22% of undergraduate physics students were women. Compared with the percentage for the physical sciences, computer science, engineering, and mathematics in 2015, this suggests that there has not been a significant change over the past decade.

Australia

C.P. Foley, "Status of women in physics in Australia," AIP Conference Proceedings 1517, 72 (2013); doi: 10.1063/1.4794225

The percentage of women in physics undergraduate majors in Australia decreased seven points from 2002 to 2013 (28% to 21%). The report cited that 21% of physics staff at universities were women. On average, women were paid less and held less senior positions than men. Women's careers were also seen to be more disrupted by private life concerns than men's, causing women to take more breaks from their careers, spend more time on teaching, and complete less postdoctoral/research fellowships than men. Pointing to the fact that the Australian Institute of Physics women's group has not been active since 2010, the report says perhaps "the physics community has taken their 'eye off the ball.'" Thus, despite a perceived "high level of goodwill" towards women in physics, the research suggests that this is not enough.

Italy

F. Albertini, P. Cenci, A. Di Virgilio, and G. Trichieri, "Women and physics research in Italy," AIP Conference Proceedings 1119, 126 (2009); doi: 10.1063/1.3137735

The report from Italy found that though women constituted the majority of graduate students (58%) across all fields, women were a minority in physics graduate degrees and reported no significant changes since 2003. Women represented ~40% of the undergraduate and graduate "physics science" degrees and only ~32% of "pure physics" degrees at these levels. Note that "physics science" includes pure and applied physics, history of physics, and didactics of physics. The percentage of women steadily drops at the researcher, assistant professor, and full professor levels, and the report notes that these drops are not due to performance since women and men perform at equal levels in their studies. In 1997, the European Union adopted an Equal Opportunity policy to achieve gender equity. Subsequent affirmative action plans that were required included such practices as balancing work and personal life and being culturally aware. However, the widespread implementation of these policies does not appear to have resulted in appreciable changes in women's representation in physics careers over the intervening years.

Argentina

Vera Brudny, Cecilia Lagorio, Marisa Frechero, and Francisco Tamarit, "Update on women in physics in Argentina," AIP Conference Proceedings 1517, 70 (2013); doi: 10.1063/1.4794224

Though the total female enrollment in undergraduate physics in Argentina dropped from 31% in the 1990's to 27% in the 2000's, the percentage of graduating students was 34% women for the latter decade. Government support for scientific research increased significantly from 2003 to 2013 thus attracting more people to scientific careers. The percentage of graduate scholarships and research grants awarded to women has increased, and several women hold leadership positions in scientific agencies. However, the percentage of women that are employed in research positions decreased. Hence, the trends for women's representation in physics in Argentina are mixed.

Albania

Antoneta Deda, Mirela Alushllari, and Silvana Mico, "Albanian women in physics," AIP Conference Proceedings 1697, 060001 (2015); doi: 10.1063/1.4937648

Only one university in Albania supports physics doctoral students, the University of Tirana. At the graduate level, the percentage of women was 70% in 2012, up nearly 30% from the prior year. However, women are concentrated in specific fields. The majority of doctoral students in the areas of physics education, environmental physics, and biophysics are women. At the undergraduate level, 50% of the physics majors were women in 2014. This is due in part to the fact that students are assigned their majors based on their grades rather than their preferences. Challenges facing physics students of all genders after graduate school include a paucity of government funding and lack of affordable child care. Despite these problems, large percentages of women physicists are being promoted in academia and have begun taking on upper-level administration positions. The Ministry of Education and Science is funding gender equality initiatives primarily to connect Albanian women physicists with women physicists in other countries, and both this ministry and the Institute of Applied Nuclear Physics are directed by women.

Iran

A. Iraji zad, F. Roshani, and D. Izadi, "Improving the status of Iranian women in physics," AIP Conference Proceedings 1697, 060024 (2015); doi: 10.1063/1.4937671

Overall, representation of women in physics in Iran has increased dramatically. For example, from 2012-2015 the representation of women at the Ph.D. level rose from 39% to 47%. Additionally, 60% of undergraduate and master's students in physics were women in 2015. This increase of women in physics is attributed to families investing in the education of girls, supportive national policies, and boys' decreasing interest in physics. Interestingly, both genders perform similarly on physics assessments. Since there is some lag in women matriculating into higher degrees and careers in physics, women still make up a very small fraction of physics faculty members and instructors. Women are very active in the Physical Society of Iran (PSI), with 39% of associate members and 28% of permanent members being women in 2013. A Women in Physics branch of PSI was established in 2012 and has established plans to further increase the representation of women in physics.