Women in Physics

TEACHER GUIDE

THE MIDDLE SCHOOL EDITION

STEP UP

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QUICK REFERENCE GUIDE

Help students **examine the conditions for women in physics** and **discuss gender issues** with respect to famous physicists, gendered professions, and personal experience to **neutralize the effect of stereotypes and bias**. Students participate in an interactive presentation by the teacher, in which data about women in physics around the world are discussed. The role of culture and society are considered.

1. Students perform an Internet search for physicists to identify trends in stereotypes about those who work in physics.

2. Students read biographies of historical physicists and current physicists and complete a reflection worksheet.

3. Students participate in an interactive presentation by the teacher, in which data about women in physics are discussed. The role of culture and society are considered.

4. Students discuss the outcomes of their Internet search and biographical analyses, and synthesize conclusions from the whole class discussion.

5. Students are exposed to discussion norms and use these norms to share experiences in which they felt excluded and consider how this might influence their careers choices and feelings about physics.

6. Students respond to a prompt about their own experience with gender bias.

Learn more at STEPUPphysics.org and register to access instructional support & FAQs.

WOMEN IN PHYSICS SUPPORTING RESEARCH

Lesson Topic: In this lesson, students will examine the conditions for women in physics, drawing on current statistics/research and their experiences with science. The goal of the lesson is to help students reflect and think critically about the issue in order to neutralize the effect of bias, particularly for female students.

Lesson Evidence: This lesson has been shown to improve high school students' future physics intentions (e.g. majoring in physics in college, intending physics-related careers) in classes across the US (N=823). Figure 1 shows that both female and non-female students have positive gains from the lesson. In addition, the overall gains from the lesson across all students are positive (Cheng et al., 2018). This is the first formal adaptation of this lesson for middle school students, but a variety of middle school teachers have adapted the lessons themselves with positive results.

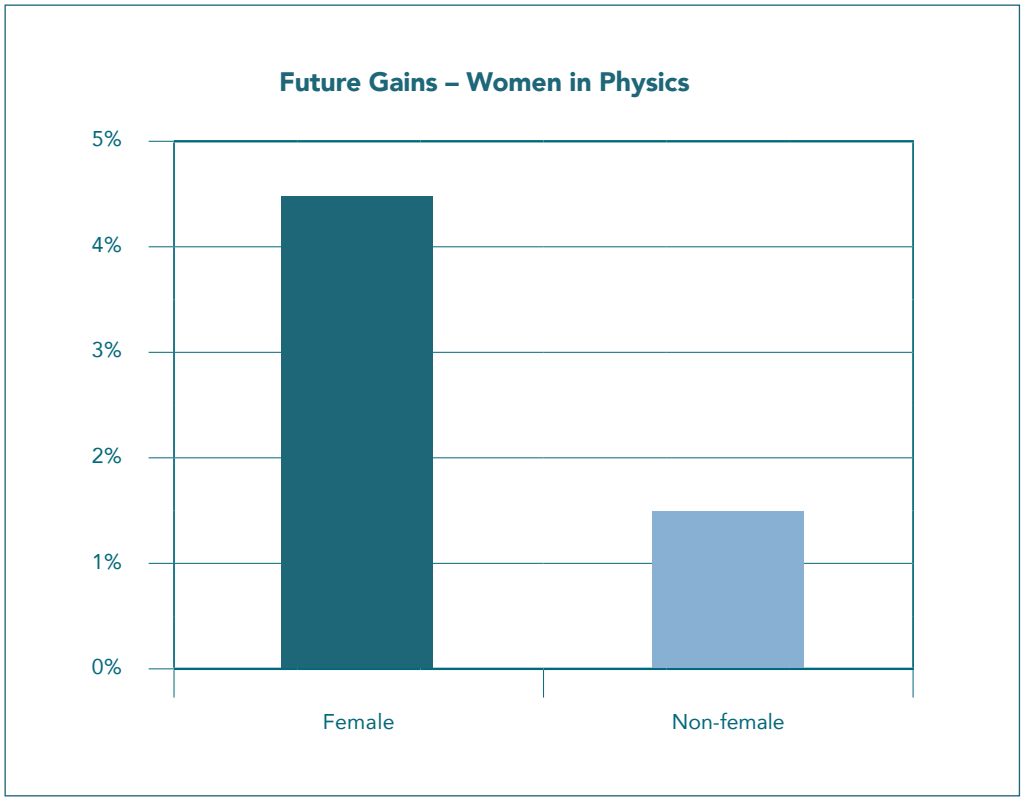

Figure 1. *Percentage gains in female and non-female students' future physics intentions (towards majoring/pursuing a career) due to the lesson.*

Teacher Motivations: Quotes about why physics teachers did the lesson.

- "It shows the women in the class that it is important to you, the teacher, if you discuss these issues. That they are important to you."
- "It challenges misconceptions about what helps women."
- "I was nervous about it but then I realized how much students got out of it."

Explaining It to Students: Quotes about how physics teachers justified it to students.

- "As a white guy, these may not be things I have experienced but that doesn't mean that these things aren't important to talk about."
- "I want to hear what you, the students, think about these issues."
- "It is important to not exclude others from opportunities."
- "It is important to understand what society thinks about physics and whether these beliefs are valid."

Implementation Timing: Teachers have suggested the optimal timing for implementation is (i) after a classroom community is established and (ii) the teacher is confident that the class is able to handle this mature topic.

LESSON PLAN: *WOMEN IN PHYSICS*

CONTENT AREA(S): Physics		TITLE: Women in Physics
GRADE LEVEL: 6-8	DATE(S): After a supportive classroom environment has been established	LESSON LENGTH: ~90 minutes

OVERARCHING PURPOSE OF THE LESSON

In this lesson, students will examine the conditions for women in physics starting with an assignment and interactive presentation that draws out their prior knowledge, illustrates the current state of women in physics, and reveals implicit biases and core equity issues. The students will then engage in a discussion (drawing on evidence) about gender issues with respect to famous physicists, gendered professions, and personal experience. The purpose of the lesson is to reveal students' prior perceptions about women in physics as well as current conditions for women in physics in order to neutralize the effect of stereotypes and bias, particularly for female students.

NOTE: This lesson contains content that may be sensitive for middle school students. Suggestions have been made that this lesson may work well with students in afterschool programs, STEM clubs, robotics clubs, Girls Who Code clubs, homeroom or advisory classes, Social-Emotional Learning classes, or spaces where gender inequality, gender issues, or social justice are discussed.

The two STEP UP lessons can stand alone, but if doing both lessons, we recommend doing Careers in Physics first. See implementation timing notes on page 4 for more guidance.

Standard(s) Alignment: This lesson addresses NGSS Appendix F – Science and Engineering Practices in the NGSS and NGSS Appendix H - The Nature of Science. It also addresses Common Core Language Arts Standard Reading Anchor #7.

NGSS Science and Engineering Practices

- **Practice 7: Engaging in Argument from Evidence**
  - Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.
  - Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.

NGSS Appendix H – Understandings about the Nature of Science

- **Science is a Way of Knowing**
  - Science knowledge is cumulative and many people, from many generations and nations, have contributed to science knowledge.
- **Science is a Human Endeavor**
  - Men and women from different social, cultural, and ethnic backgrounds work as scientists and engineers.
  - Scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination and creativity.

Common Core English Language Arts Standard - Reading Anchor #7

RST.6-8.7: "Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table)."

Performance Objectives

- Students will be able to compare the challenges faced by women in physics in the past (conscious bias) to the challenges faced today (more unconscious bias).
- Students will be able to give examples of gender inequalities with respect to science present in society today.
- Students will be able to define unconscious bias and give one example of the effect of unconscious bias.
- Students will be able to explain their own views on the current state of women in physics.

Assessments (formative and summative)

- Students' pre-lesson assignments about famous women physicists and their views about women in science today.
- Students' responses during the whole class discussion during which they share their views about famous scientists, gendered professions, and life experiences.
- Students' post-lesson writings about women in physics in the present day.

Accommodations:

- English Language Learners: Allow extra time for students to complete written responses to prompts and to formulate their responses prior and during discussions. Pair them with a student who knows their native language and/or is willing to help; allow the usage of a device for them to translate. Perhaps allowing them to look at women scientists from their home country will allow them to connect more deeply.
- Students with Disabilities: Depending on the disability, limit the need to move around the classroom during the writing prompt exchange, situate students where they can clearly see/hear slides and discussions, and allow extra time as necessary.

Materials/Resource List

- **Women in Physics Pre-Assignment** and **Women in Physics Post-Assignment** handouts (1 each per student, Appendix 1 and Appendix 2). Find print friendly versions of the two assignments here: https://engage.aps.org/stepup/curriculum/women
- Class whiteboard, projector, computer (for teacher use for presenting **Women in Physics Slides**, which shows slide thumbnails. Full presentation available at this STEP UP website at https://engage.aps.org/stepup/curriculum/women.
- A document that can be projected / shared
- Pieces of paper for writing prompt activities (2 per student)
- (Optional) Devices with internet access to participate in polls
- Preparation material: **Women in Physics Internationally** (Appendix 3)

Teacher Preparation

Critical lesson component: Read Women in Physics Internationally (Appendix 3) before implementing the lesson. Teachers who have previously done this lesson felt more comfortable having more information for themselves beforehand. Make sure that teacher has reviewed all documents and links beforehand to assess content and reading level to see if it matches students. Alternatives are provided. See Overarching Purpose of Lesson above for implementation notes. Make sure you have consulted STEP UP Guidelines for Discussion poster prior to conducting.

NOTE: This lesson contains content that may be sensitive for middle school students. Suggestions have been made that this lesson may work well with students in afterschool programs, STEM clubs, robotics clubs, Girls Who Code clubs, homeroom or advisory classes, Social-Emotional Learning classes, or spaces where gender inequality, gender issues, or social justice are discussed.

You can always consult the Quick Reference Guide for a bulleted list of this teacher's guide

INSTRUCTIONAL PROCEDURES

INTRODUCTION: In this part of the lesson, the goal is to prime the issue of gender and understand students' prior conceptions about gender issues in physics (est. time = 10 minutes)

What the Teacher Does	Anticipated Behaviors/ Responses from Students	Implementation Notes
Pre-assignment either prior to/during class class (Appendix 1). Print-friendly version can be found at https://engage.aps.org/stepup/curriculum/women. *(est. time = 10 minutes):* **1.** Have students conduct a Google search for "famous physicists." (You may want to start with a short discussion about what physicists do. See implementation notes.) **2.** Once they are finished show (slide 3) and discuss the following questions: • What trends do they notice about the names? • When did the women on the list live? (est. time = 25 minutes; Slides 5-6): **3.** Students will read two biographies. (1) about a historical physicist (Lise Meitner or Jocelyn Bell Burnell), and (1) of a current female physicist from the list provided (You can assign these for homework or in class–see implementation notes). • Respond to related questions from Appendix 1.	***In class:*** Students respond to what they found in their Google search and answer questions on top of Appendix 1 • Possible Answers: They are mostly men. They are mostly white. They are mostly of European heritage. They are mostly dead. • Possible Answers: Marie Curie lived around 100 years ago.	• Feel free to do at the end of a class as pre-assignment for the next day. • If you would like, and depending on the homework policy of class, school, and district, either assign articles in the next section for homework. • If not done for homework, may add 30 minutes to the lesson. • If you start the lesson with google search, the entire lesson will most likely take 2-3 45 minute classes. • If students have never been exposed to physics specifically before, you may want to start with a short discussion about what physicists do. This is a quick video that may help give context. • If online access at home or completing homeworks are issues for your students, consider doing this the day before you intend to do the main part of the lesson. • The articles can also be assigned online or attached to LMS in your context.
Introduce discussion guidelines **Critical lesson component**: Slide 7-8; est. time = 10 minutes. At the beginning of the presentation/ discussion (after the Google search discussion), introduce these guidelines to students (or refer to your class conduct rules). • **Share air time equitably**. Know yourself, balance your listening and talking. • **Value differences**. Remember that your perspective is not the only one. • **Argue using evidence**. Back what you have to say with data. • **Make sure everyone feels safe**. Safe is not the same as comfortable. • **Discomfort is OK**. We are often learning the most when we are a little bit uncomfortable. • **Own your impact.** Your intentions may not be the same as your impact.		• Consider active discussion strategies like: partner-talk, gallery walks, chalk talk to engage students in sharing their research. Here are a few ideas for short discussions. • Print posters and hang on wall. Good guide to point to during discussion. Guidelines for Discussion Posters in Spanish, English or for online discussions can be found here. • Students can read "HOW TO DISAGREE" or Teaching Students How to Disagree Productively about tough discussions. Or watch video by Kid President about "How to Disagree."

THIS MAY BE A GOOD PLACE TO STOP FOR A 45 MINUTE CLASS. THE ASSIGNMENT BELOW WHICH IS CRITICAL TO LESSON MAY BE DONE THE FOLLOWING DAY. IF A 60 MINUTE CLASS OR LONGER BEGIN THE SLIDE PRESENTATION AND GRAPH ANALYSIS.		
What the Teacher Does	**Anticipated Behaviors/ Responses from Students**	**Implementation Notes**
Interactive presentation can be found at https://engage.aps.org/stepup/curriculum/women Lead a whole class discussion organized around the slides. Think/Pair/Share technique (see here or other online resources) can be used throughout this discussion to stimulate conversation. If scheduling allows, this discussion can be broken into multiple class sessions, as deemed appropriate. **1.** Opening Slides: slides 9–19; est. time = 20-30 minutes. Feel free to choose slides you think will be most impactful in your context. • Encourage a few minutes of discussion on each slide, in particular regarding the role of the individual versus the role of culture and society (e.g. social norms). **2.** Leave students with the question on Slide 20 to think about for the next class.		• Look at speaker notes on the slides for important information. • Consider group white boards and group conferences before students respond. • For complex graphs, try printing them out and putting them in sheet protectors or laminate so students can see them up close. • Consider using the What I see (WIS)/ What it means (WIM) method when analyzing graphs. Have students write on lamination or sheet protectors • Consider looking at graphs in a gallery walk method or have each group of students analyze one graph only and share out about it with other students. • Consider using PearDeck or NearPod to make slides interactive.
THIS MAY BE A GOOD PLACE TO BREAK.		
3. Begin class reflecting on what students observed when looking at graphs. **4.** Intro: Have students think about definitions to the words: unconscious bias gendered stereotypes **5.** Use slides 22-23 to frame conversation. **6.** Slide 24 shows the major ideas that will be presented in discussion. **7.** Walk students through slides 25-39. Make sure students are using appropriate discussion guidelines. Alter slides in any way you see fit for your context. **8.** Use hidden slides and prompts as you see fit for your context.	**5.** Possible responses to gendered professions: Stereotypes - Students may notice that many female scientists portrayed in the media are in fields other than physics (e.g. on the Big Bang Theory, forensic shows, medical shows). Students may notice that most engineers are men or that most nurses are women. Terms indicating that a profession has a default gender may be shared, such as "male nurse" since the default gender of nurses is stereotyped to be female. Nature versus Nurture arguments will likely emerge. Some students might say that women "naturally" gravitate to fields other than physics and engineering. Other students may believe this is due to stereotypes and other societal influences.	• Consider the following questions about stereotypes and bias ○ What is true for you? ○ What have you observed? ○ What are the consequences of these STEM stereotypes? • Here are good resources for conducting difficult conversations in the classroom. ○ Difficult Dialogues ○ Using Circle Practice in Classrooms • Consider getting colored paint chips from a hardware store or using colored paper to give each student 3 colors (for agree/disagree/unsure) to hold up during discussion. • Consider using online discussion platforms like Padlet, Nearpod, MentiMeter, word clouds, etc. to make discussion engaging and active for students

		• Perhaps use a sign, symbol, or object (like talking sticks) so students feel safe to challenge each other. • Perhaps show videos of what successful student challenges look like. • Feel free to alter slides as you see fit for your students, school, political standing or your district and/or community.
9. ***Critical lesson component*** - *Personal experience:* = 20 minutes. • Stop and Reflect: Give students two minutes to write a first response to the prompt below, then give them time to share it with a partner. Next, students will have 5 minutes to write another response on a second piece of paper that they would like to share anonymously. The responses should be ***related to science and gender issues.*** Collect the papers, mix them up, and pass them out to be read anonymously. This structure supports discussing challenging topics. **Prompts:** • Have you ever felt you or a friend or family member's abilities were being questioned because of your gender? Have you ever experienced gender bias in your own life? • As students share anonymous experiences, make sure to challenge sexist or racist comments that might emerge. For example, if someone comments about women's lack of ability in physics, turn to the class and ask if there is disagreement. Students will raise objections themselves. These occasions are valuable because they reveal the presence of hidden bias. Challenge statements that generalize any group since these types of statements are particularly problematic. **General tips for class discussion** • Encourage students to disagree constructively (e.g. with evidence or argumentation). See paint chip note above. • If the students aren't challenging each other, encourage them to, or jump in yourself (e.g. if students mention women's disinterest in physics being biological, ask why the same trends are not seen in all countries). • Always encourage students to think about WHY gender disparities exist. At some point, a 'nature vs. nurture' discussion is likely to arise. Students need to become aware of the sociocultural pressures impacting their individual decisions.	**9.** Students will write a response to the prompt on a piece of paper and then share with a partner. They will then write a comment, experience, etc. on a piece of paper and turn it in directly to the teacher. Possible responses include students mentioning occasions when: • someone has said something disparaging • others have dominated a conversation/activity • they have been made to feel stupid • they prefer the environment in certain classes over others • they prefer working with people of certain genders more than others • they heard about experiences from friends or family • "women just aren't interested in science" • no experience of gender issues at all Students will voluntarily share viewpoints and experiences and be responded to by other students.	

LESSON CLOSURE: In this part of the lesson, students will come up with strategies to support diversity in physics and will be encouraged to enact the best strategies proposed (est. time = 10 minutes)		
What the Teacher Does	**Anticipated Behaviors/ Responses from Students**	**Implementation Notes**
1. **Proposing strategies:** slides 40-42; est. time = 10 minutes. • Ask students to write a response to the prompt on a piece of paper to be shared anonymously. Collect the papers, mix them up, and pass them out. • Prompt: What can be done to support diversity in physics? What could you do? 2. **Optional Discussion:** est. time = 5 minutes. (Additional Discussion Questions can be found on slides 45-50).	1. Students will write their ideas about how to support diversity in physics. 2. Students will volunteer to share ideas from the anonymous paper they have. Possible responses from students include the following: • Supporting diversity is not important (suggested counterpoints in this situation are: (1) Diverse teams produce better results. This is supported by research on teamwork; (2) Our current STEM workforce is insufficient. If we do not actively recruit women, we could be missing out on half of the potential workforce). • Encouraging peers to take physics in high school and/ or university. • Encouraging everyone to participate • Making sure conversations and activities are not dominated by any individual. • Encouraging classmates but letting them figure things out for themselves. • Giving help to women who are struggling in class (Note the counterpoint that this could undermine women's capabilities if you think they always need help).	• Consider some of these questions: ○ How can we counteract these stereotypes? ○ Once these stereotypes are broken down, what will be the result? • Free polling software: Slido Mentimeter PollEverywhere
3. **Critical lesson component** *Post-Lesson: Assign students to complete the* **Women in Physics Post-Assignment** *(Appendix 2). The assignment has them write about their views after the class discussion.*		• *Consider using a CER (Claim, Evidence, Reasoning) strategy to help student formulate their answers.*

EXTENSIONS

Curriculum enhancements: (additional lessons on underrepresentation)

- Teachers interested in additional lessons and resources on underrepresentation in physics, including issues of race and ethnicity, can implement curriculum from The Underrepresentation Curriculum (underrep.com)

BIBLIOGRAPHY

- Next Generation Science Standards – Appendix F on Science and Engineering Practices.

  Retrieved from: https://www.nextgenscience.org/sites/default/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf
- Next Generation Science Standards – Appendix H on the Nature of Science.

  Retrieved from: https://www.nextgenscience.org/sites/default/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf

Physicist information websites:

- Lise Meitner: https://www.sdsc.edu/ScienceWomen/meitner.html
- Jocelyn Bell Burnell: biography.com/people/jocelyn-bell-burnell-9206018

Data on race and ethnicity:

- Data on underrepresented minorities among undergraduates: aip.org/statistics/undergraduate/minorities
- Graph of physical science bachelor's degrees earned by African Americans: aip.org/statistics/data-graphics/trends-bachelor%E2%80%99s-degrees-earned-african-americans-physical-science-fields
- Graph of physical science bachelor's degrees earned by Hispanic Americans: aip.org/statistics/data-graphics/trends-bachelor%E2%80%99s-degrees-earned-hispanics-physical-science-fields-2002

Why women have a higher representation in some countries:

- https://blogs.scientificamerican.com/voices/countries-with-less-gender-equity-have-more-women-in-stem-huh/

Women in Physics Pre-Assignment

Appendix 1

Name: _____ **Date:** _____

Pre-Assignment:

1. Before getting started, **write the names** of any physicists you can think of below.

_____

_____

_____

Google search:

2. Google "famous physicist." **Write down the names** of the first five physicists you found.

_____

_____

_____

3. How many **years ago** did the earliest physicist on the list live?

_____

_____

_____

4. How many **women** appear on the list?

_____

_____

_____

Read TWO of the biographies shown below. Choose one (1) person from A and one (1) person from B:

A. Either an article on **Lise Meitner**, **Jocelyn Bell Burnell**, or **Chien-Shiung Wu**

B. One of the following scientist profiles: Claudia Alexander, Deborah Berebichez, Mae Jemison, Shirley Ann Jackson, Ellen Ochoa, or another woman scientist of your choice:

- **Claudia Alexander**, NASA-scientist who says, "I feel like a modern-day explorer; the last frontier is space." 2003 Emerald Honor for Women of Color in Research & Engineering.
- **Deborah Berebichez**, first Mexican woman to graduate from Stanford University with a physics PhD. Now has her own website called *Science with Debbie*.
- **Mae Jemison**, the first African American woman to go to space, aboard the shuttle Endeavor.
- **Shirley Ann Jackson**, the first African American woman to get a doctorate in nuclear physics.
- **Ellen Ochoa**, accomplished inventor and astronaut.

Respond to the following questions on the women from the two biographies:

What are the contributions made by these women? Summarize your response in your own words in a few sentences. Look up anything you don't understand!

What obstacles did the women overcome in their career paths?

In your view, is the opportunity to excel in physics any easier for women now than it was in the 20th century? Explain how, including what is easier and what is unchanged.

Women in Physics Post-Assignment

Appendix 2

Name: _____ **Date:** _____

Respond to the following questions by crafting at least one paragraph for each section:

Based on the class discussion, do you believe society discourages women from becoming interested in physics careers? Why or why not?

Make sure you use evidence from lessons and/or articles to support your claim.

If you responded "yes" above, what do you think could be done to reduce the effect of discouragement?

Do you think that societal beliefs have influenced your potential career interests?

If yes, in what ways?

If no, explain.

Does this influence bother you? Why or why not?

Women in Physics International Factsheet

Appendix 3

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.

Women in Physics International Factsheet

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.