

Gender diversity in physics

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Disclaimers

- Topic can be uncomfortable
- Learning is uncomfortable!
- Happy to provide sources
- Focus on gender
- QR code on last slide—my website & these slides
- I love this topic = I talk fast!

Use the chat box to ask questions,
comment, or answer my questions!

About me

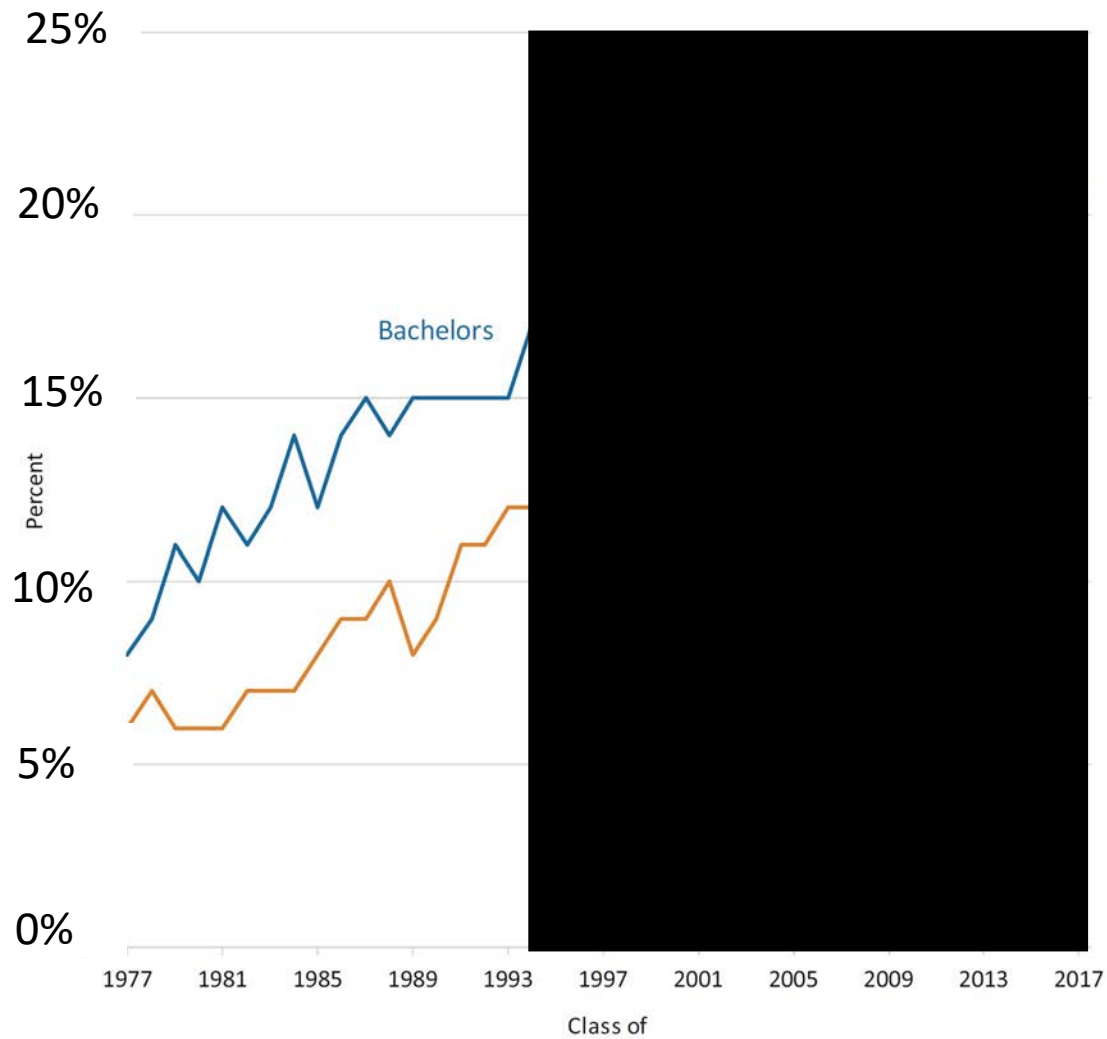
- BA in Physics, Hamline University, St. Paul MN
- MS in Physics, Univ. of Minnesota, Minneapolis MN
- PhD in Science Education, Univ. of Minnesota, Minneapolis MN

- Professor of Physics at UW-Stout for 21 years
- Dad is a PhD physicist, one mom a middle school math teacher, one mom a MS chemist

- Day 1 of physics grad school: WTH?

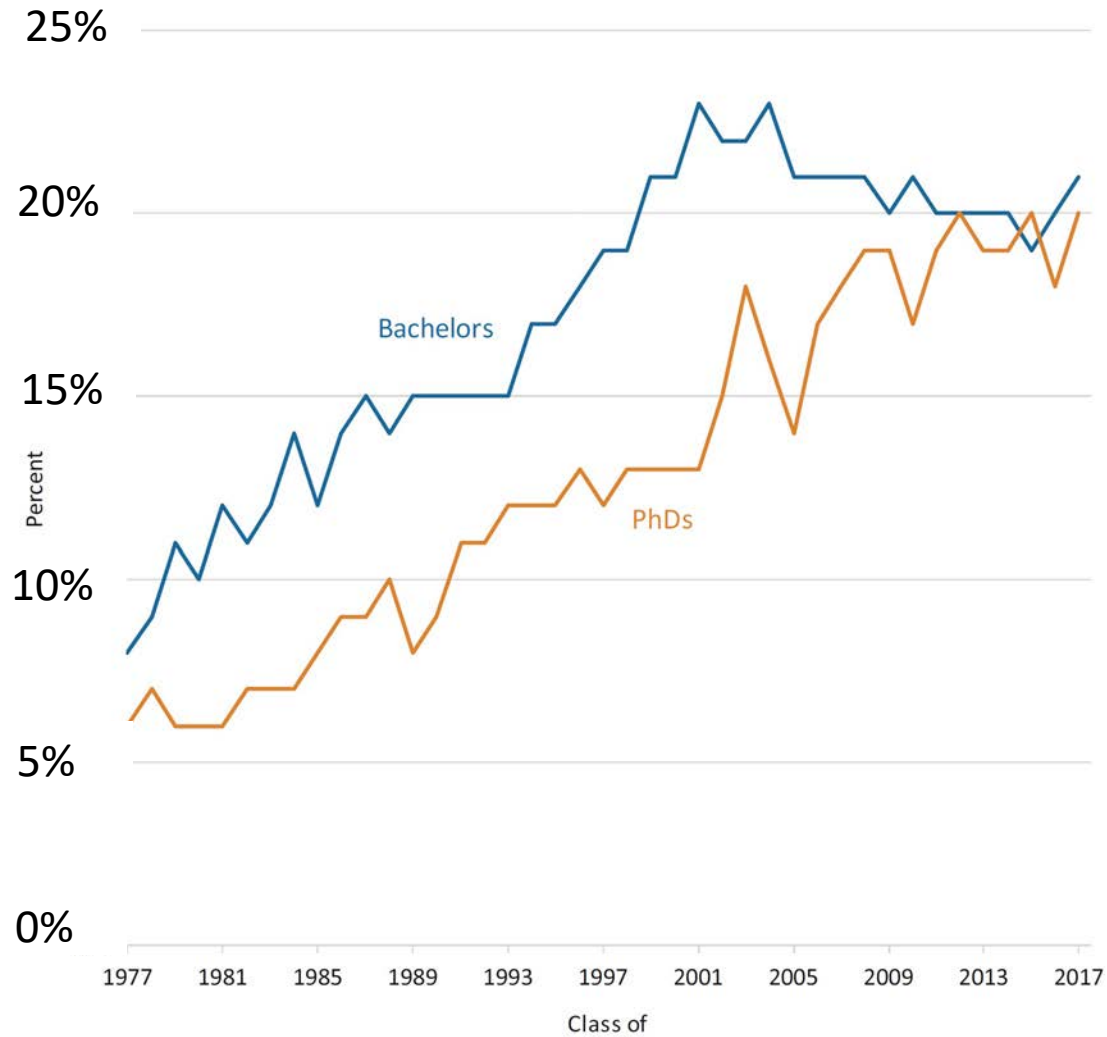
Why talk about gender and physics?

Percent of Physics Bachelors and PhDs Earned by Women, Classes of 1977 through 2017



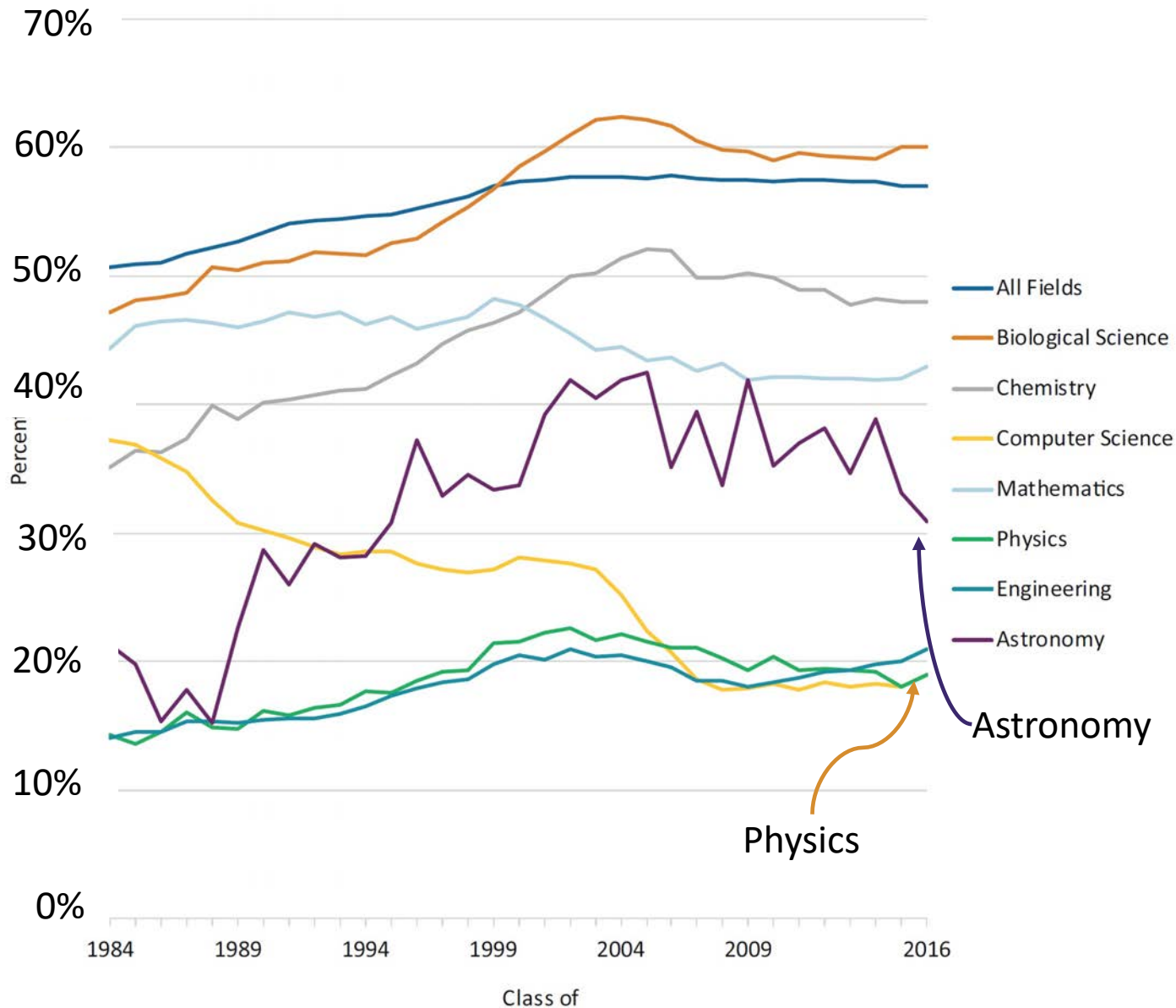
Source: AIP Statistical Research Center, Enrollments and Degrees Survey.

Percent of Physics Bachelors and PhDs Earned by Women, Classes of 1977 through 2017



Source: AIP Statistical Research Center, Enrollments and Degrees Survey.

Percent of Bachelor's Degrees Earned by Women in Selected Fields, Classes of 1981 through 2016



Source: National Center for Education Statistics. Data compiled by AIP Statistical Research Center

Number of African American, Hispanic, and Native American Women Earning Bachelors in Physical Science Fields, 2003 and 2013

	Total Number of Degrees Earned		Degrees Earned by African American, Hispanic, and Native American Women	
	Degrees in 2013 (#)	Change '03-'13 (%)	Degrees in 2013 (#)	Change '03-'13 (%)
Earth Sciences	5,506	64	223	182
Atmospheric Sciences	760	25	19	111
Chemistry	14,886	50	1,307	41
Physics	6,760	59	118	40
Astronomy	413	33	11	-8
Oceanography	247	75	13	333
Other Physical Sciences	812	23	62	138
All Physical Sciences	29,384	53	1,753	54

2013 women bachelors physics: 1162
astronomy: 128

Faculty women: 2014

Academic Rank	% Physics Dept	% Astro Dept
Full professor	10	15
Associate professor	18	29
Assistant professor	23	29
Instructor	23	19
Total	16	19
	N~9000	N~600

Faculty women of color: physics and astronomy

- PhD granting departments:
 - Black 2%
 - Hispanic 4%
- MS granting departments:
 - Black -0-
 - Hispanic 14%
- BS granting departments:
 - Black 3%
 - Hispanic 3%
- Hispanic women #s increasing; Black women #s steady

OK, so what?

- Waste of talent

- What ideas have been lost?
- How slowly have we made progress?
- How much energy has been diverted from science?
- How much money has been diverted from science?

- Moral issue

- Serious inequity in our culture
- Social justice issue
- Systemic racism, sexism, etc.

Factors causing underrepresentation

- Culture, not biology!
 - Harassment (3/4 of undergrad physics women!*)
 - Lack of role models
 - Lack of support
 - Societal messages
 - Microaggressions

*Aycock, Hazari, Brewster, Clancy, Hodapp, Goertzen. PHYSICAL REVIEW PHYSICS EDUCATION RESEARCH 15, 010121 (2019)

Factors continuing under- representation

- Work-home balance
- Microaggressions*
- Lack of support
- Gendered expectations
- Tokenism
- Sexual harassment

Cultural factors

- Societal belief that women don't belong in science
- Implicit bias
- Stereotype threat
- Mindset

Implicit (Unconscious) Bias

- Growing up → culturally instilled values
- Pervasive: everyone has them
- Separate from explicit biases (can be same or different)
- May differ from our declared beliefs
- Tend to favor our own in-group
- Malleable—thank goodness!

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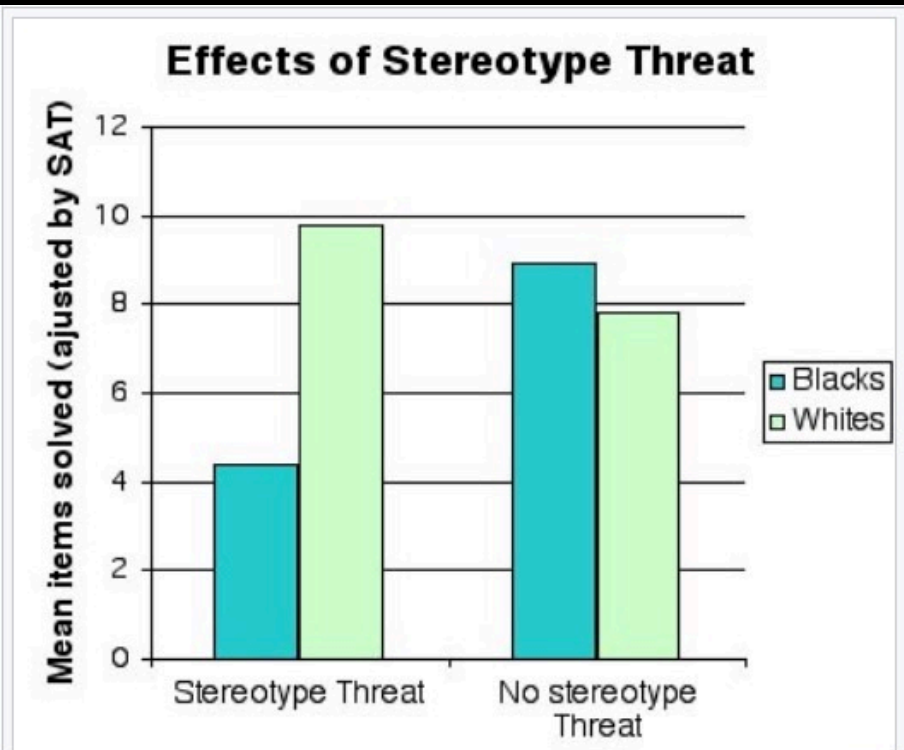
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Stereotype Threat

- Risk of confirming a negative stereotype
- Triggered by mentioning stereotype (or even being unconsciously aware of it)
- Lowers performance of stereotyped groups



"The Effects of Stereotype Threat on the Standardized Test Performance of College Students (adjusted for group differences on SAT)". From J. Aronson, C.M. Steele, M.F. Salinas, M.J. Lustina, *Readings About the Social Animal*, 8th edition, ed. E. Aronson

Mindset

- Fixed mindset: your qualities are set and unchangeable
- Growth mindset: your qualities can be cultivated and developed

How do these affect women?

- Implicit bias:
 - Women get lower evaluations, lower starting salaries, fewer job offers, etc.
 - Women's work is valued less than men's
- Stereotype threat:
 - Women's performance is lower than it should be
 - Self-doubt, less connection to field, less sense of belonging
- Mindset:
 - "Girls can't do science" vs. "Anyone can do science!"
 - Growth mindset improves women's performance more than men



What helps?

“It’s not that scary to be a woman in physics.”

The screenshot shows a web browser with several tabs open, including 'Applied Physics - School of Nat...'. The address bar shows the URL 'https://stockton.edu/sciences-math/physics.html'. The page header features the Stockton University logo and navigation links such as 'Apply', 'Give', 'Contact/Directory', 'A-Z Index', and 'Calendars'. A search bar is also present. The main navigation bar includes links for 'About Stockton', 'Academics', 'Admissions, Scholarships & Aid', 'Campus Life', 'Athletics & Recreation', 'Arts & Culture', and 'Alumni & Friends'. The page content is divided into a left sidebar and a main area. The sidebar, titled 'School of Natural Sciences & Mathematics', lists various categories like 'Academic Programs', 'Message from the Dean', 'NAMS Undergraduate Research', 'Laboratory Instrumentation', 'Virtual Events', 'Initiatives', 'Facilities', 'Staff Directory', 'FAQ's', and 'Contact Us'. Below this is 'Office Information' for the Unified Science Center, Room 240, with phone and fax numbers and an email address. The main area is titled 'Applied Physics' and features a video player showing a woman in a 'Stockton University Physics Program' hoodie with the text 'PHYSICS IS SIMPLE!'. Below the video, there is a paragraph describing the degree's preparation for scientific and technical careers, and another paragraph explaining the fundamental science background it provides. To the right of the text are four blue buttons: 'Apply', 'Visit', 'More Information', and 'Brochure'.

Stockton University

Applied Physics

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Office Information:
Unified Science Center
Room 240
609-652-4546
609-626-5515 FAX
nams@stockton.edu

Stockton University Physics Program

Watch later Share 1/3

Watch on YouTube

PHYSICS IS SIMPLE!

A degree in Applied Physics provides preparation for a wide range of scientific and technical careers and for secondary-school science teaching.

As a fundamental science, with applications in many fields, Physics (PHYS) also strengthens the backgrounds of students whose major interests are Biology, Marine Science, Physical Therapy, Mathematics, Chemistry, Astronomy, Environmental Science, Information and Computer Sciences, Computational Science, Geology, Pre-Medical Studies and Other Health Sciences.

Apply

Visit

More Information

Brochure

What helps: undergraduates

- Active SPS chapter
- Student lounge
- Engaged faculty
- CUWiP
- Mentors (peer and other)

- Data! Collect information and analyze

What helps: graduate students

- Open study/support groups
- “Safe face”
- Career advising
- Mentoring
- Check-ins
- Advisor education

What helps: careers

- Value service obligations
- Observations: who talks? who is the social secretary?
- Data! (Climate survey)
- Spousal hires (Women 204% more likely to relocate for a spouse)
- Spend resources on equity
- Acknowledge employees are human
- Avoid comparing people to people; compare people to specific goals/objectives

What can individuals do?

- Find your biases! Take the Implicit Association Test. <https://implicit.harvard.edu/implicit/>
- Look for counterexamples to stereotypes and share them widely <https://www.aps.org/publications/apsnews/202110/profile.cfm>
- Collaborate, support, promote
- Watch for bad language, interruptions, assumptions
- Ensure seminar/conference speakers represent many groups

Some reassurance

- Women's experiences in science are much better than it was 20 years ago
 - Most obvious discrimination is gone
 - Women are moving into positions of leadership and power and visibility
 - Younger generations more likely to engage on these issues
-
- Things have been getting better! We need to keep the momentum going.
 - This means YOU!

Conclusions

- Women are under-represented in physics and astronomy
- We should be welcoming everyone to physics
- Change comes from everyone working together
- Things are getting better
- We all can help make a difference!

Thank you!

