

The background is a dark teal color. It features several large, overlapping circles in a lighter teal shade. In the top right corner, there is a small red rectangle.

Issues of gender in physics and astronomy

LAURA MCCULLOUGH
PROFESSOR OF PHYSICS
UNIVERSITY OF WISCONSIN-STOUT

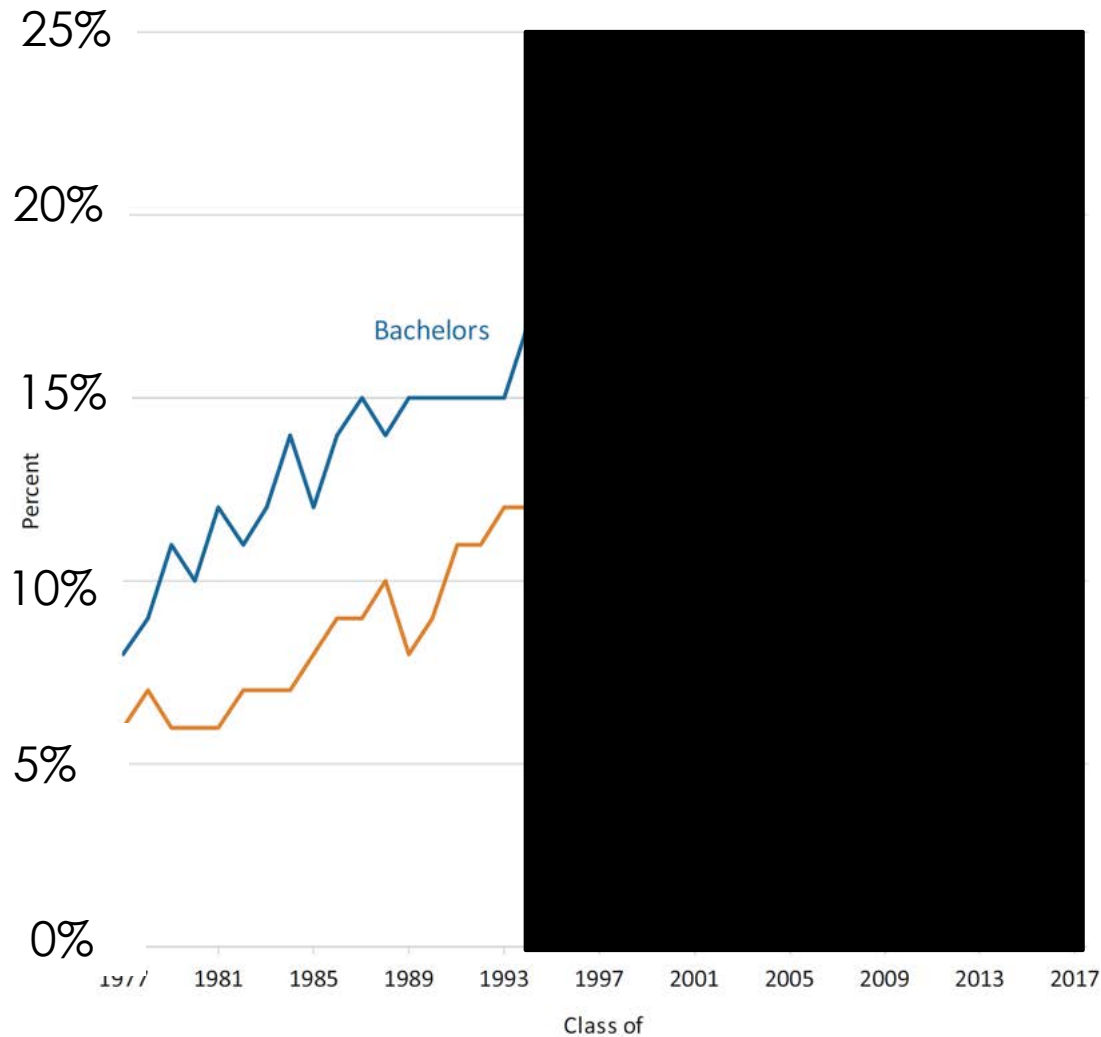
The background is a dark teal gradient. It features several large, semi-transparent teal circles of varying sizes. In the top right corner, there is a solid red vertical rectangle.

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

About me

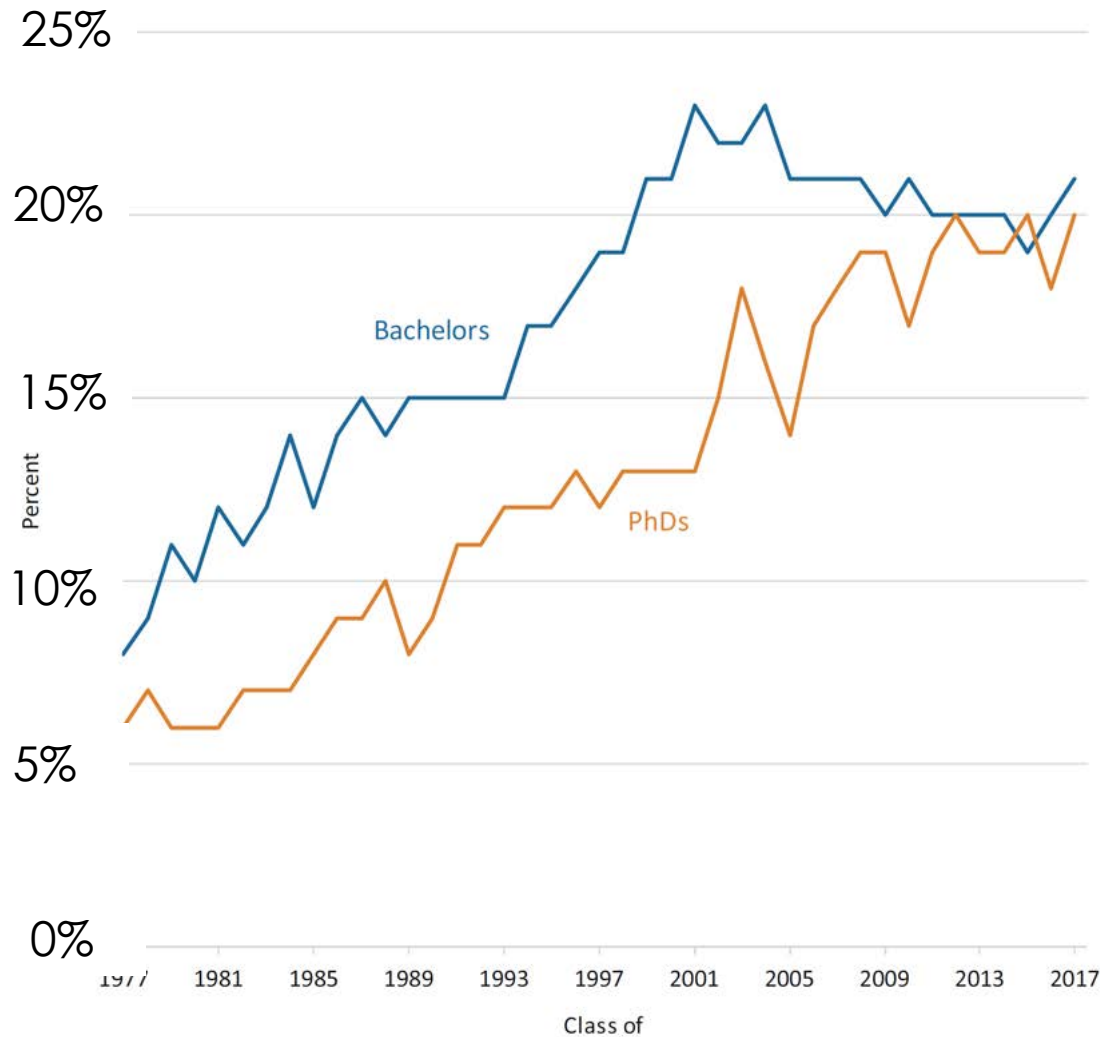
- ▶ BA in Physics, Hamline University, St. Paul MN
- ▶ MS in Physics, UMN-TC, Minneapolis
- ▶ PhD in Science Education, UMN-TC, Minneapolis
- ▶ Professor of Physics at UW-Stout for 20 years
- ▶ Dad is a PhD physicist, one mom a middle school math teacher, one mom a MS chemist
- ▶ Day 1 of physics grad school: WTH?

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



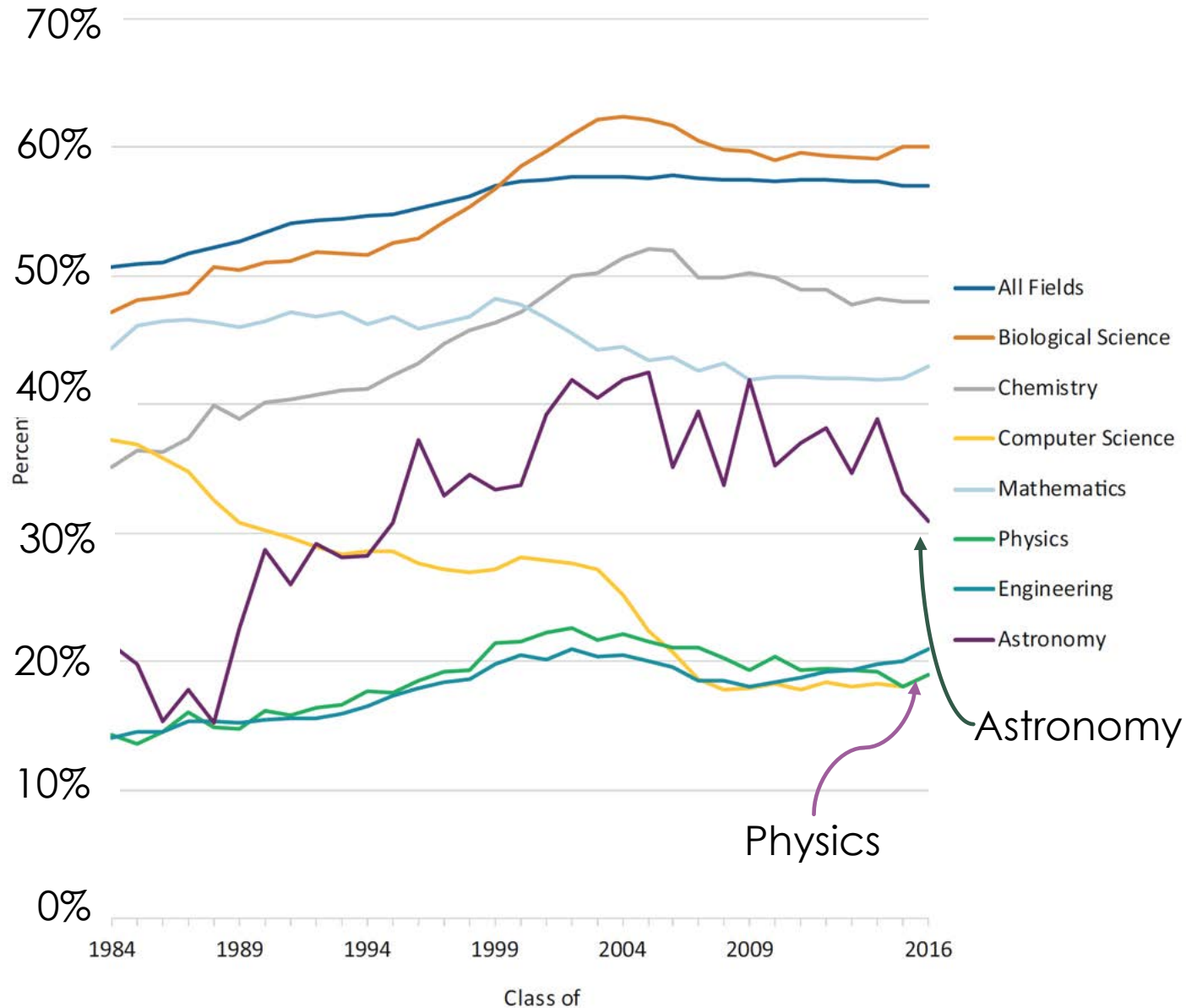
Source: AIP Statistical Research Center, Enrollments and Degrees Survey.

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 #s increasing; Black #s steady

Factors causing under-representation

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

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

Factors continuing underrepresentation

- ▶ Work-life 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
- ▶ Discrimination
- ▶ Sexual harassment

Implicit (Unconscious) Bias

- ▶ Growing up → culturally instilled values
- ▶ Pervasive: everyone has them
- ▶ Different 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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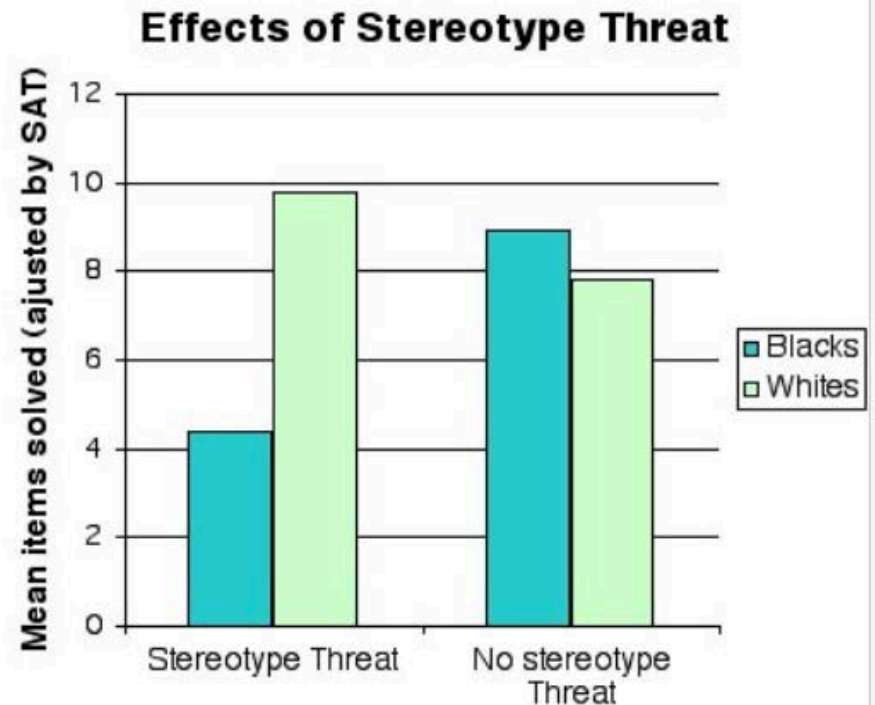
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Stereotype Threat

- ▶ 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

▶ Mindset:

- ▶ "Girls can't do science" vs. "Anyone can do science!"
- ▶ Growth mindset improves women's performance more than men

The background is a dark teal gradient. It features several large, light teal circles of varying sizes. A small red rectangle is positioned in the top right corner. The text "Heavy burden for women in science!" is centered in a white, sans-serif font.

Heavy burden for women in science!

Hello, COVID!

How has the pandemic alleviated
or exacerbated these factors?

Women's Stress in COVID

- ▶ Women's stress tends to be higher normally
- ▶ Women have much higher stress loads in COVID
 - ▶ Caregiving
 - ▶ Shift workers
 - ▶ Contract workers

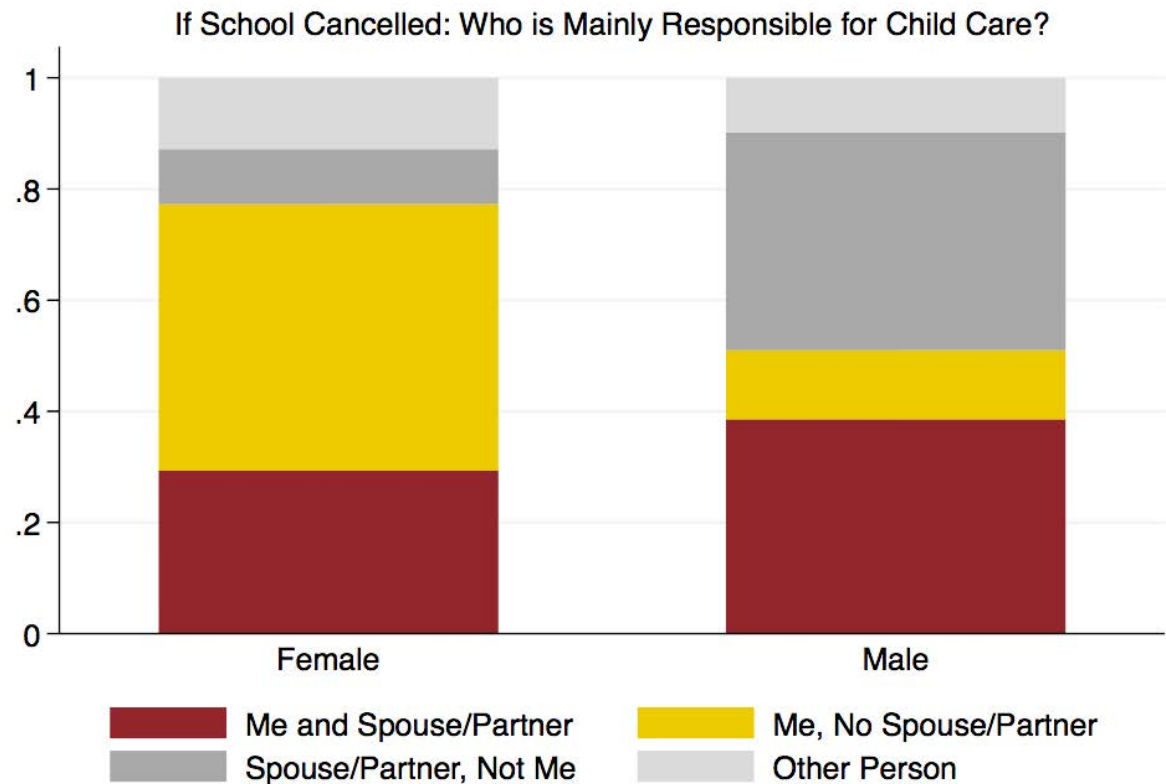
Caregiving and Childcare is a Gendered Burden



Misaligned perceptions: while only **29%** of married women report childcare is shared with a spouse/partner, **39%** of men report the same

Women do more: **49%** of married women report they are mainly responsible, **39%** of men report their wives are mainly responsible

Work is disrupted for all: Roughly **40%** of men and women report work is disrupted due to closure-induced childcare burdens

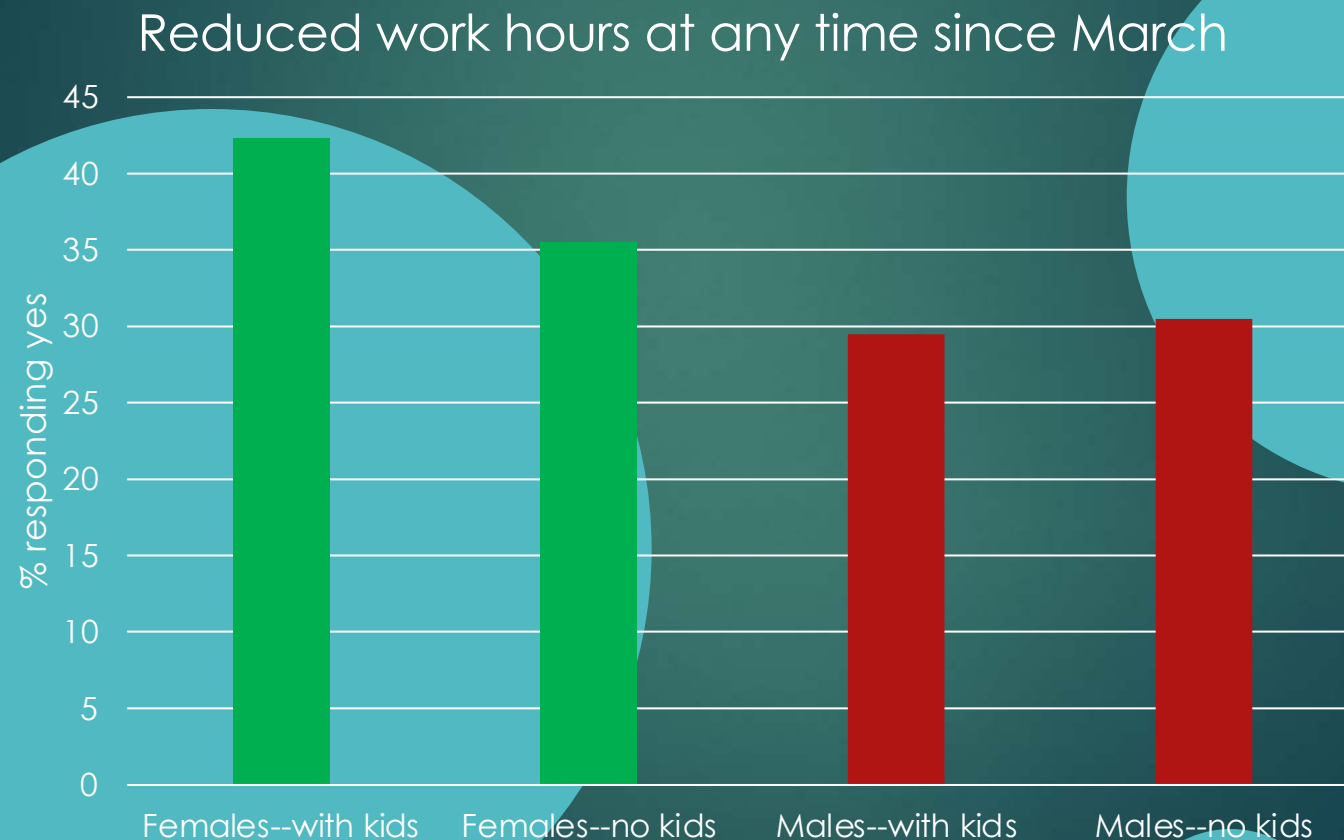


Note: Estimates weighted to be nationally representative. Wave 2, married individuals with coresident spouse only.

Source: USC Center for Economic and Social Research - Coronavirus Tracking Survey Waves 1 & 2. Contact uas-l@usc.edu for more information.

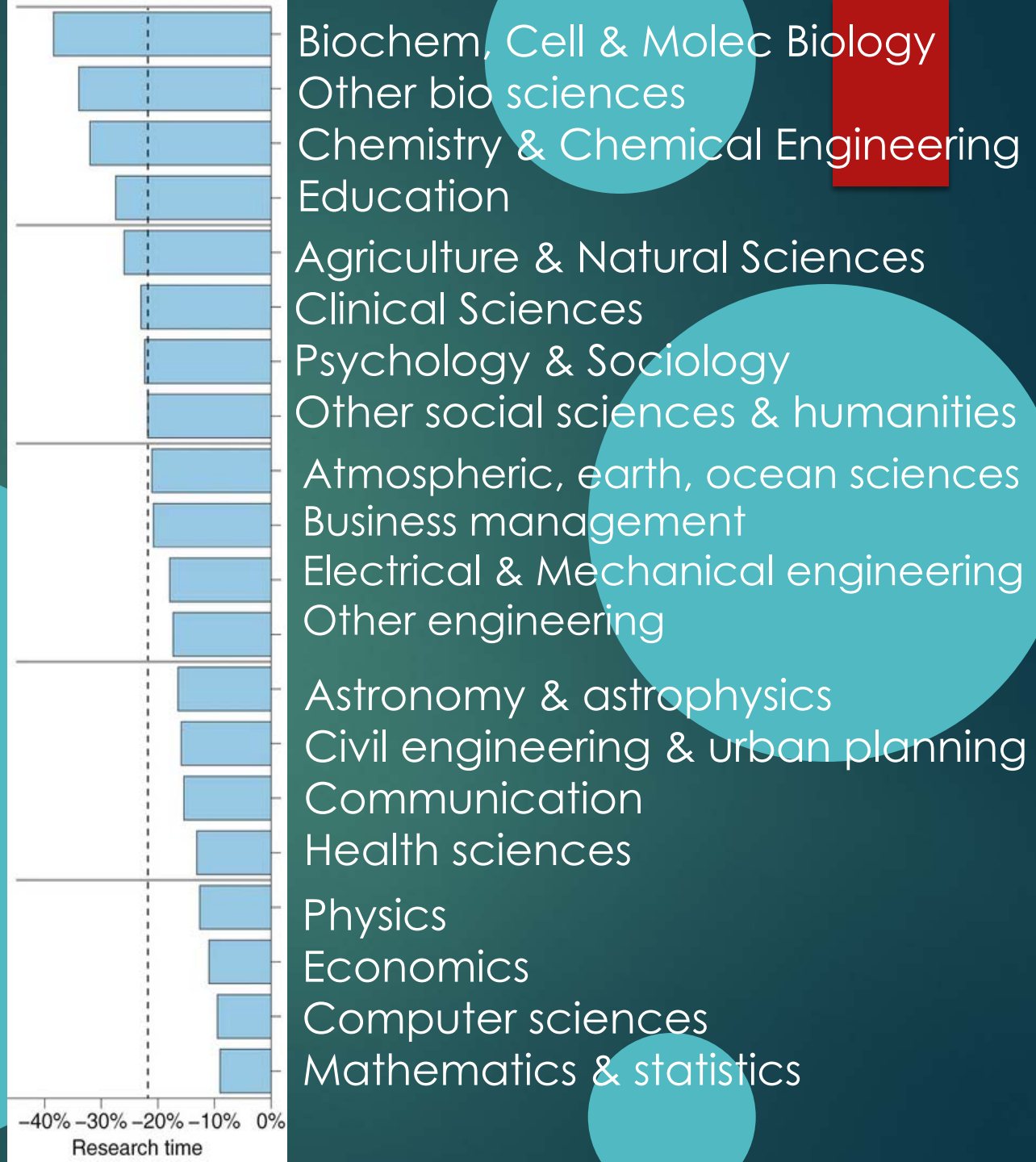
Slide from USC Dornsife: <https://uasdata.usc.edu/index.php>

Female, Kids = reduced work hours



Loss of research time by field (0-40%)

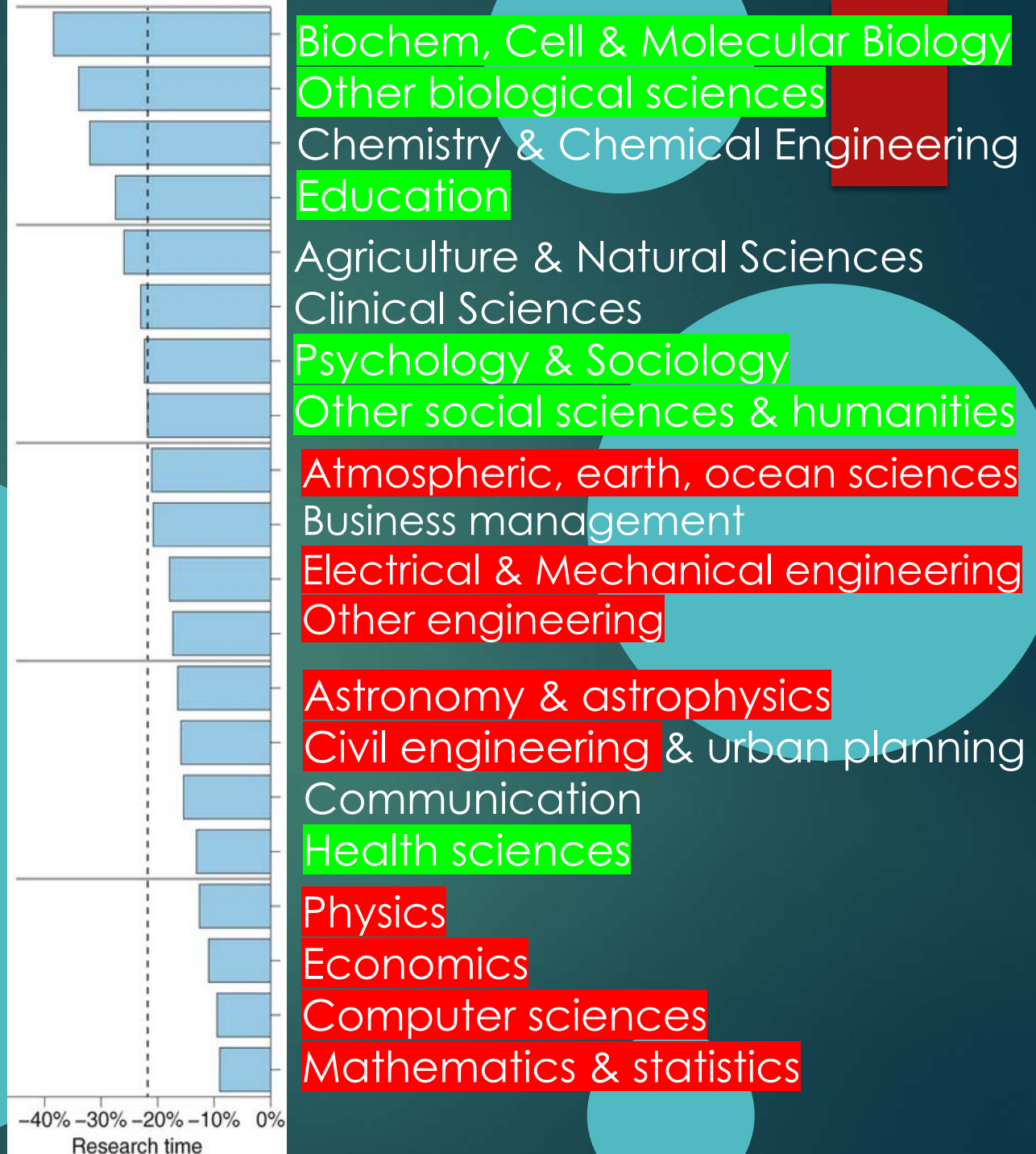
Myers, K.R., Tham, W.Y., Yin, Y. et al. Unequal effects of the COVID-19 pandemic on scientists. Nat Hum Behav 4, 880–883 (2020). <https://doi.org/10.1038/s41562-020-0921-y>



Loss of research time by field and field gender ratio

*denotes male-dominated field

†denotes female-dominated field



Publishing

- ▶ Women less likely to publish in early COVID months
- ▶ Women less likely to accept invitations to review

- Squazzoni, Bravo, Grimaldo, Garcia-Costa, Farjam, and Mehmani, Bahar, No Tickets for Women in the COVID-19 Race? A Study on Manuscript Submissions and Reviews in 2347 Elsevier Journals during the Pandemic (October 16, 2020).
- Pinho-Gomes, Peters, Thompson, et al. Where are the women? Gender inequalities in COVID-19 research authorship. *BMJ Global Health* 2020;5:e002922.
- Murić, G., Lerman, K., & Ferrara, E. (2020). COVID-19 amplifies gender disparities in research. *ArXiv*, abs/2006.06142.
- Andersen, Nielsen, Simone, Lewiss, Jagsi. Meta-research: is COVID-19 amplifying the authorship gender gap in the medical literature? *eLife* 2020;9:e58807 doi: 10.7554/eLife.58807

COVID & telecommuting

- ▶ COVID caused huge rise in working from home
- ▶ April: 35% shift to remote work, 15% already doing it

Telecommuting gender gaps

- ▶ Dads less tired at end of TC day than on-site day
- ▶ Moms more tired

Lyttelton, Thomas and Zang, Emma and Musick, Kelly, Gender Differences in Telecommuting and Implications for Inequality at Home and Work (July 8, 2020).

Zoooooooooom!

- ▶ Who talks in meetings?
- ▶ Who gets interrupted?
- How do these change when shifting to videoconferencing?
- ▶ Men & women behave differently if VC partner is male or female, if video on or off
 - ▶ Men more dominant if their body language visible
 - ▶ Women less dominant if BL visible

Teoh, Regenbrecht, O'Hare (2011) The Transmission of Self: Body Language Availability and Gender in Videoconferencing.

Teoh, Regenbrecht, O'Hare (2012) How the Other Sees Us: Perceptions and Control in Videoconferencing

Teaching

- ▶ Initial evidence that moving to online teaching helped women in STEM
 - ▶ Non-tenure-track and adjunct teachers
- ▶ Women's service load higher normally
- ▶ Heavy burden on women of color, particularly black women
 - ▶ Student emotional support

Preliminary findings presentation to NASEM, 6 Nov 2020, F. Jefferson, Fort Valley State U






What helps?

CGCA - Equity

https://cgca.uwm.edu/equity.html

Most Visited StoutCloud Search Stout Library Common Logins Weather.gov lauramccphd.com iCloud

 Home About Us People News & Events Research Internal For the Public

 Make a Gift

Equity & Diversity

The Center for Gravitation, Cosmology and Astrophysics is committed to building and maintaining an environment that recognizes the inherent worth and dignity of every person, fosters tolerance, sensitivity, understanding, and mutual respect, and encourages the members of our community to reach their full potential.


Diversity and Anti-Harassment Statement

In the Center for Gravitation, Cosmology and Astrophysics (CGCA), we are committed to building and maintaining an environment that recognizes the inherent worth and dignity of every person, fosters tolerance, sensitivity, understanding, and mutual respect, and encourages the members of our community to reach their full potential. Therefore, we do not tolerate discriminatory conduct of any kind. We are dedicated to the philosophy of equality of opportunity and treatment for all members, regardless of gender, gender identity or expression, race, color, national or ethnic origin, religion or religious belief, age, marital status, sexual orientation, disability, veteran status, or any other reason not related to scientific merit.

Please remember that behavior choices, from clothing to language, can constitute harassment and discourage members of under-represented groups from pursuing careers in science. And please work to remove the historical legacy of sexism and other discrimination within science.

As part of the UWM community, the CGCA prohibits and does not tolerate discrimination, harassment or retaliation. We follow the [procedures](#) set out by UWM for the investigation and remedy of such conduct. Specifically, options for reporting complaints are set out in Sections IV and V of that document.

The [UWM Women's Resource Center](#), located in the UWM Student Union, is available for people of all genders. If you experience any form of harassment, the Women's



The CGCA celebrates International Women's Day in 2017

What helps: undergraduates

- ▶ Active SPS chapter
- ▶ Student lounge
- ▶ Engaged faculty
- ▶ CUWiP
- ▶ Mentors (peer and other)
- ▶ Bystander intervention training?

What helps: graduate students

- ▶ Open study/support groups
- ▶ “Safe face”
- ▶ Career advising
- ▶ Mentoring
- ▶ Check-ins
- ▶ Advisor education (astro advisor ratings worse by women, bad advisor = more likely to leave field)

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

What can individuals do?

- ▶ Find your biases! Take the Implicit Association Test.
- ▶ Look for counterexamples to stereotypes and share them widely
- ▶ Collaborate, support, promote
- ▶ Watch for bad language, interruptions, assumptions
- ▶ Bystander/intervention training (?)
- ▶ Ensure seminar/conference speakers are diverse
- ▶ Read/listen/learn:
<http://womeninastronomy.blogspot.com/>

<https://implicit.harvard.edu/implicit/>

What to do—in COVID times

- ▶ Patience/Benefit of the doubt
- ▶ Golden rule
- ▶ Be especially kind to women, persons of color, LGBTQ+ folks, and other minoritized groups
- ▶ Recognize privilege = COVID experience easier
- ▶ Recognize lack of privilege = COVID experience harder
- ▶ Encourage/require personnel decisions to include COVID factors

- <https://www.umass.edu/advance/resources-and-tools>
- Supplement to Malisch et al. Opinion: Old Problem and New Solutions to ensuring gender equity in academia in the wake of COVID-19.

Some reassurance

- ▶ Women's representation in science is much better than it was 20 years ago
- ▶ Most of obvious discrimination is gone
- ▶ Women are moving into positions of leadership and power
- ▶ Things have been getting better! We need to keep the momentum going.
- ▶ This means YOU!

Conclusions

- ▶ Women in physics and astronomy have a hard road
- ▶ COVID makes it worse
- ▶ Change comes from everyone working together
- ▶ Things are getting better!

Thank you!

