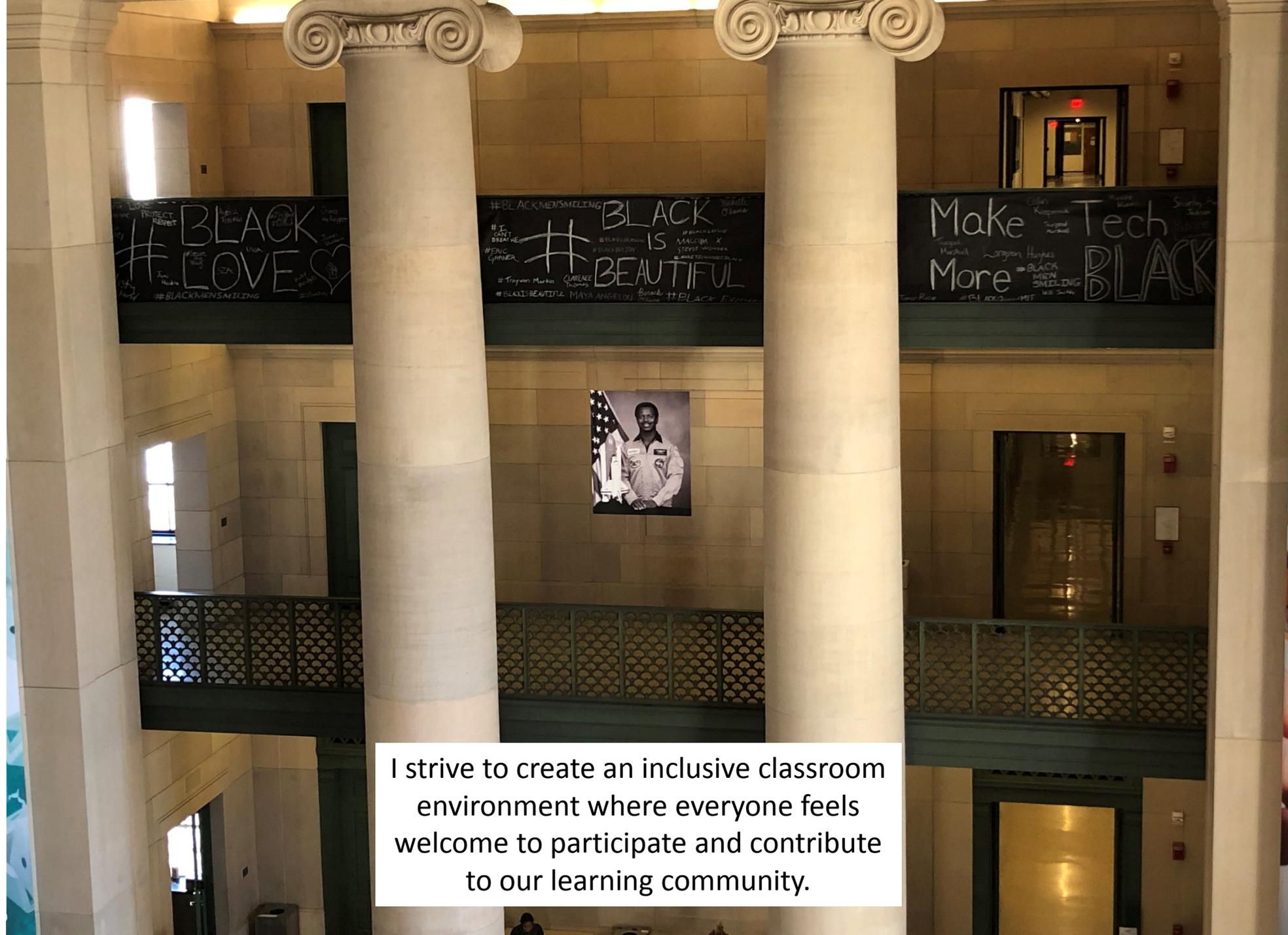




Towards a More Inclusive Physics

Edmund Bertschinger
and Nergis Mavalvala,
MIT

CAP Congress
June 11, 2018



I strive to create an inclusive classroom environment where everyone feels welcome to participate and contribute to our learning community.

Land Acknowledgement

We acknowledge that the land we stand and sit on today is the traditional home of the Mi'kmaq First Nations.

We thank the original caretakers of this land.



Equity, Diversity and Inclusion are not synonyms

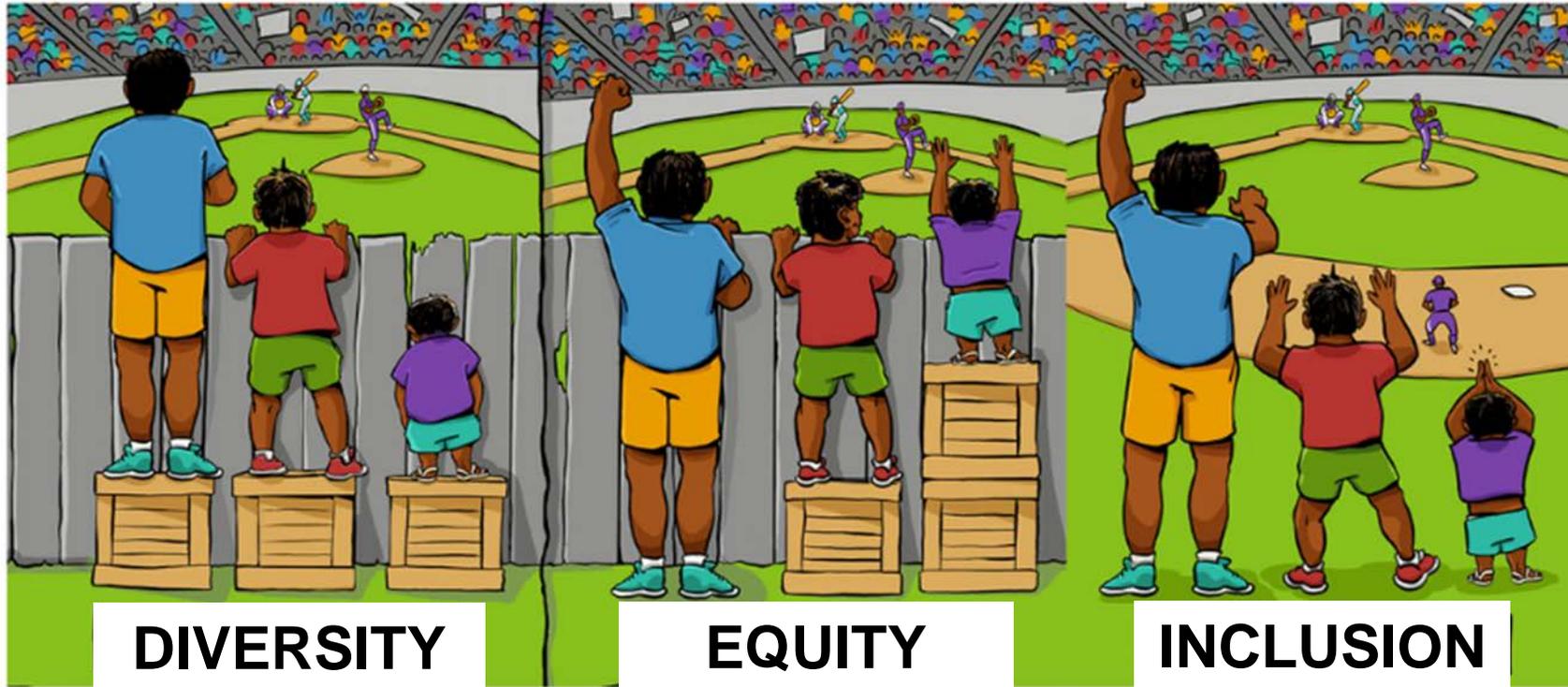


image credit: Angus Maguire/IISC
Labels added by E. Bertschinger



Why might Physicists Care About EDI?

1. Good ideas can come from anyone, anywhere
2. Excellence requires developing talent
3. CRC, NSERC, and Universities require it
4. Our departments are not entirely safe
5. You might experience or witness marginalization



Students say it best:

Colin Webb, MIT Class of 2018 President



How to increase diversity and excellence in physics

Awareness → Understanding → Action → Reflection :||

Process ↗

Tap all available talent: recruit more female, visible minority and other underrepresented people

Improve the climate and community

Share the value and excitement of physics

← Content

MIT Physics EDI effort, 2007–2013

Competition for graduate students (2007 compilation by MIT students)

School	Percent women graduate students
Princeton	12.4
MIT	13.7
UIUC	13.7
U. Chicago	15.8
UCSB	16.4
Cornell	16.8
Stanford	18.2
Caltech	22.8
Columbia	35.8
Harvard	37.3

Competition for graduate students (2007 compilation by MIT students)

School	Percent women graduate students	
Princeton	12.4	
MIT	13.7	I first met with women
UIUC	13.7	graduate students even
U. Chicago	15.8	before starting as head.
UCSB	16.4	
Cornell	16.8	They told me, "You have to
Stanford	18.2	create a culture of caring.
Caltech	22.8	We know you can do it,
Columbia	35.8	and we will help you."
Harvard	37.3	



A Vision shared with the Department in 2008

By 2012, women comprise more than 10% of the faculty and they join several underrepresented minority faculty. Women make up 40% of our undergraduate majors and 25% of our graduate student body. Underrepresented minority graduate students have doubled. There is an air of excitement about our recruitment, mentoring, and retention of diverse talent.

A Vision shared with the Department in 2008

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Female faculty (primary only)

2007: 4, 6%

2013: 6, 9%

2017: 8, 12%

Female Bachelors degrees

2007: 25, 29%

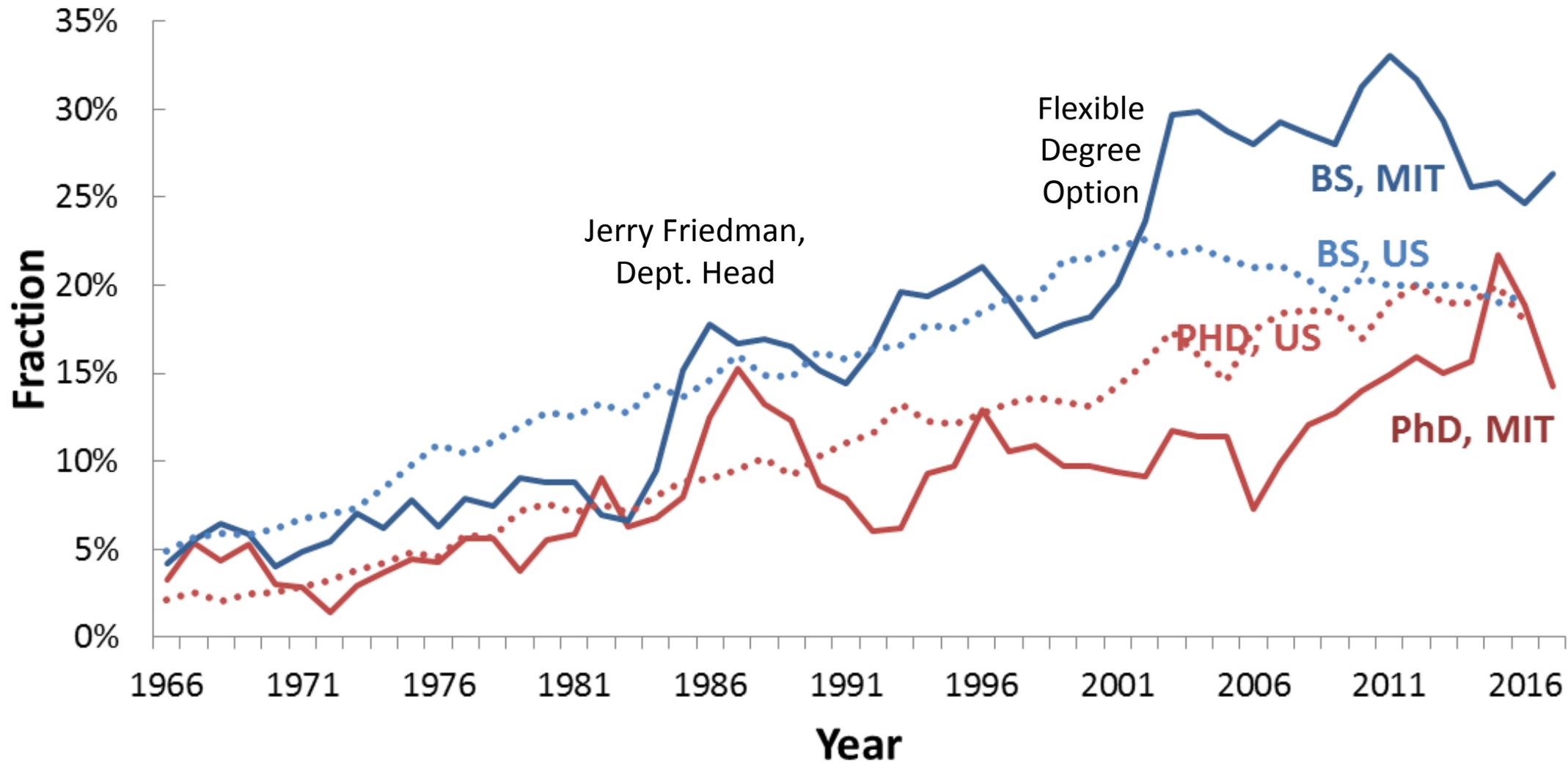
2011: 36, 38%

2017: 20, 29%

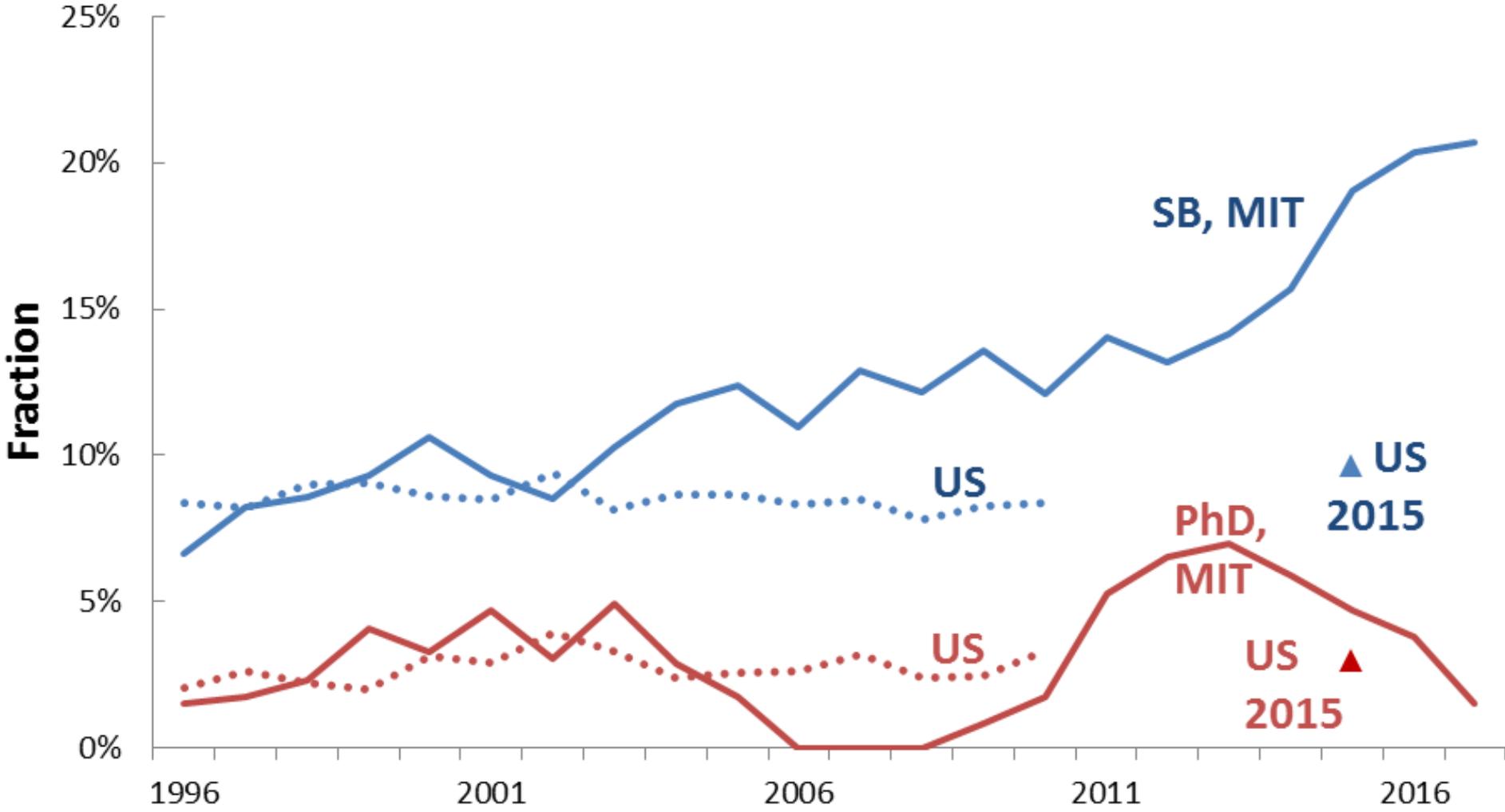
Peer comparison of physics bachelors degrees 2007-2011 (IPEDS)

Department	% Women	Department	% visible minorities
Yale	31.8%	MIT	12.8%
MIT	30.5%	UCSB	12.2%
Cornell	25.8%	UC Berkeley	8.1%
Harvard	23.6%	Princeton	6.7%
UPenn	23.5%	Harvard	6.7%
UMichigan	22.5%	Caltech	6.4%
UC Berkeley	21.9%	Stanford	6.3%
UChicago	20.2%	UPenn	5.9%
UIUC	19.1%	UChicago	4.7%
Stanford	19.0%	Yale	4.5%
Caltech	18.5%	UMichigan	4.5%
Princeton	16.0%	UIUC	3.3%
UCSB	9.0%	Cornell	1.6%

Fraction of Physics Degrees Awarded to Women



Fraction of Physics Degrees Awarded to Visible minorities



What I learned as MIT's first Community and Equity Officer:

Change is much slower than you expect,
until it becomes much faster.

Three ingredients for successful change

- 1. Engagement:** People must find enthusiasm in a new vision
- 2. Assessment:** Leaders and community members need to know the successes and challenges
- 3. Accountability:** To whom is the organization accountable? How?

Set community values and expectations

MIT DEPARTMENT OF PHYSICS

News About Prospective Students Current Students Subjects Research People Events Giving Policies

about mit physics

Welcome

Physics Community Values

Diversity

Diversity Resources

physics@mit

History of MIT Physics

Employment Opportunities

Contact

Directions

Headquarters

Department of Physics, 4-304
Massachusetts Institute of
Technology
77 Massachusetts Avenue
Cambridge, MA 02139-4307
tel: 617.253.4800
fax: 617.253.8554
email: physics@mit.edu

Academic Programs

Department of Physics, 4-315

MIT Physics Community Values

Provisional Title: MIT Physics Community Values

Document Last Updated: May 2018

This statement of values informs departmental policies and structures and applies to the MIT Physics community, including students, faculty, staff, and all those who choose to affiliate with the MIT Physics Department. The Department commits to ensuring that the entire community understands and strives to uphold the values in this document.

[Download PDF version of Physics Community Values](#)

Our Physics Community Values stem from the basic principle that members of our community should treat each other with respect and decency at all times. In turn, we should not alienate, diminish or insult each other, either in word or deed.

Based on this principle, we believe that well-being, respect, inclusion, collaboration and mentorship are moral imperatives that are vital to scientific progress. These ideals are essential for excellence in teaching and research and guide our participation in the MIT Physics community.

Well-being: We support each other at all times and remember that we are not alone.

Mental and physical health are priorities above all else. Proactively addressing wellness is essential to everyone in our community. We look out for others who may be in distress or struggling and offer them compassion and understanding. Just as we treat others well, we must be compassionate with ourselves. Asking for support is brave and admirable no matter the circumstances. We strive to find a healthy balance between our professional and personal lives and proactively seek out any support that we need.

Respect: We value the multitude of ways to be a physicist and the many paths through our field and Department.

We are all respected as physicists, regardless of the problems we choose to study or our current level of mastery. No field of research is inferior; all areas of study are worthy of respect. Much of physics research is interdisciplinary. We value the richness that interdisciplinary research brings and recognize the worth of other research fields.

Our community includes an invaluable team of dedicated administrative and support staff members. We value the diverse

Our community includes an invaluable team of dedicated administrative and support staff members. We value the diverse strengths and experiences of all staff members and recognize them as an integral part of the Department.

Inclusion: We strive to speak and act in ways that support and include all members of our community.

We are informed and shaped by our identities and experiences. A diversity of identities and experiences is essential to bringing broad perspectives to our Department and academic mission. It is our responsibility to ensure that these diverse voices are included and heard. As individuals and as a community we constantly work to avoid all forms of discrimination, including explicit, implicit and/or unintended bias. We respect and validate other people's identities and the language they use to describe themselves. Comments made with good intentions can still be hurtful and we strive to be aware of how our comments impact others.

Collaboration: Physics is a social endeavor and we proudly collaborate with others to advance the field.

When we collaborate, we take other people's ideas seriously and recognize that they might understand concepts and approach problems differently. Exclusion or derision of others based on different points of view is not acceptable. Collaboration requires sharing knowledge and skills, and is based on appropriately acknowledging everyone's intellectual contributions. Proper acknowledgement is crucial to all activities in the Department.

Mentorship: All physicists are here because of the mentorship we have received and continue to receive, and the mentorship we offer to others.

We all act as both mentors and mentees throughout our careers. Mentor-mentee relationships entail constructive feedback, active listening, responsiveness and a mutual respect and appreciation of each other's efforts and time. Humiliation and degradation are unacceptable forms of interaction. Mentors should act with compassion, empathy and a strong belief in the potential of their mentees. Mentees should be communicative, ask questions and take initiative.

As members of our community, we uphold the principles of well-being, value, inclusion, collaboration and mentorship. We take an active responsibility in ensuring that everyone feels welcome and respected. We recognize that other people's life experiences are not our own, but are valid in and of themselves. Given this, we realize that our actions may impact others in unintended ways even as we strive to treat each other with respect. We understand that we will make mistakes. When we do, we will work to correct them and educate ourselves. We take pride in being upstanding members of our community.

Contributors:

- Undergraduate Students (SPS and UWIP): Caitlin Fischer, Zachary Hall, Radha Mastandrea, Jeanette Maisano-Brown, Andrea Herman, Grace Zhang, Megan Yamoah, Amir Karamlou, Richard 'Trey' Watts, III, Hector Iglesias, Adrian Meza
- Graduate Students (PGSC, GWIP and PhysREFS): Constantin Weissner, Dahlia Klein, Maggie Tse, Zoe Yan, Carina Belvin, Nick Rivera, Haocun Yu
- Physics Department Staff: Cathy Modica, Sydney Miller, Emma Dunn, Kimeee Heatley
- MIT Staff: Libby Mahaffy, Amanda Bennett
- Physics Faculty: Peter Fisher, Nergis Mavalvala, Scott Hughes, Jolyon Bloomfield

New in 2018! <https://iceoblog.mit.edu/measuring-the-climate-for-inclusion/>

MIT Climate Dashboard

	Satisfied	Supportive	Fair	Taken seriously	No bias	Relaxed	No bigotry	Well-being	Average
Admin (MC)			*	*	*	*	*		*
Support (MC)			*	*	*	*	*		
Service (MC)	*					*			
Faculty (MC)	*	*		*		*			
Other Instructional (MC)						*			
Postdoc (MC)	*			*			*		
Research (MC)		*		*		*	*		
Admin/Support/Service (LL)			*	*		*	*		
Research (LL)		*		*		*			*
Undergraduate Student	*	*	*	*	*	*	*	*	
Graduate Student			*	*		*	*	*	

Asterisk (*) indicates statistically significant difference (compared to overall population) at 0.001 level.

Based on 11,300 survey responses 2016 and 2017 (40% response rate)

Climate Dashboard

Select First Breakout
 Gender ▼

See Notes tab for more information on sources and methodology



Select Second Breakout
 Race/Ethnicity ▼

Mean value where Orange is "Bad" and Blue is "Good"

Intersectionality: gender and race/ethnicity

Undergraduate students

			Satisfied	Supportive	Fair	Taken seriously	No bias	Relaxed	No bigotry	Well-being	Average
Undergraduate Student	Female	White/Unk..		*		*	*	*	*		*
		Asian			*	*	*	*		*	
		Internation..			*	*		*			
		URM		*	*	*		*	*	*	*
	Male	White/Unk..		*	*	*	*	*	*	*	*
		Asian			*		*		*	*	*
		Internation..						*		*	*
		URM		*	*	*		*	*	*	*
Graduate Student	Female	White/Unk..			*		*	*	*	*	*
		Asian			*	*	*	*	*	*	*
		Internation..				*	*	*	*	*	*
		URM			*	*	*	*	*	*	*
	Male	White/Unk..		*	*	*	*	*	*	*	*
		Asian			*		*	*	*	*	*
		Internation..			*	*	*	*	*	*	*
		URM			*	*	*	*	*	*	*
		White/Unk..			*		*	*	*	*	

Graduate students

Asterisk (*) indicates statistically significant difference (compared to overall population) at 0.001 level.

Climate Dashboard

Select First Breakout
 Gender ▾

Select Second Breakout
 Race/Ethnicity ▾

See Notes tab for more information on sources and methodology



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Undergraduate students

Graduate students

			Satisfied	Supportive	Fair	Taken seriously	No bias	Relaxed	No bigotry	Well-being	Average
Undergraduate Student	Female	White/Unk..	Blue	Blue*	Blue	Blue*	Blue*	Blue*	Blue*	White	Blue*
		Asian	Blue	Blue	Blue*	Orange*	Blue*	Orange*	Blue	Blue*	Blue
		Internation..	Blue	Orange	Blue*	Orange*	Orange	Orange*	Blue	Blue	Blue
		URM	Blue	Grey*	Blue*	Orange*	Blue	Orange*	Blue	Orange*	Blue*
	Male	White/Unk..	Blue	Blue*	Blue*	Orange*	Blue*	Orange*	Blue	Orange*	Blue*
		Asian	Blue	Blue	Blue*	Orange*	Blue*	Blue	Blue*	Blue	Blue*
		Internation..	Blue	Blue	Blue	Orange*	Blue	Blue	Blue*	Blue	Blue
		URM	Blue	Blue*	Blue*	Orange*	Blue	Orange*	Blue*	Blue	Blue
Graduate Student	Female	White/Unk..	Blue	Blue	Blue*	Orange*	Blue*	Blue	Blue*	Blue	Blue*
		Asian	Blue	Blue	Blue*	Orange*	Blue	Grey*	Blue	Blue	Blue
		Internation..	Blue	Blue	Blue	Orange*	Blue*	Orange*	Blue	Blue	Blue
		URM	Blue	Blue	Blue*	Orange*	Orange	Orange*	Blue	Blue	Blue*
	Male	White/Unk..	Blue	Blue*	Blue*	Orange*	Blue	Orange*	Blue*	Blue*	Blue*
		Asian	Blue	Blue	Blue*	Orange*	Blue	Blue	Blue*	Blue	Blue
		Internation..	Blue	Blue	Blue*	Orange*	Blue	Blue	Blue*	Blue*	Blue*
		URM	Blue	Blue	Blue*	Orange	Blue	Blue	Blue*	Blue	Blue
		White/Unk..	Blue	Blue	Blue*	Blue	Blue*	Blue*	Blue*	Blue*	

Imposterism

Female

Male

Female

Male

Asterisk (*) indicates statistically significant difference (compared to overall population) at 0.001 level.

Climate Dashboard

Select First Breakout
 Gender ▼

Select Second Breakout
 Sexual Orientation ▼

See Notes tab for more information on sources and methodology



Mean value where Orange is "Bad" and Blue is "Good"

Intersectionality: gender and LGBTQ+ status

Undergraduate students

Graduate students

			Satisfied	Supportive	Fair	Taken seriously	No bias	Relaxed	No bigotry	Well-being	Average	
Undergraduate Student	Female	Heterosexu..		*		*	*	*	*		*	
		Lesbian/Ga..						*				
	Male	[Not answe..		*		*						
		Heterosexu..	*		*	*	*	*	*	*	*	
		Lesbian/Ga..		*		*		*	*	*	*	
		Unsure/Oth..				*		*	*	*		
		[Not answe..			*							
		Heterosexu..	*		*	*	*	*	*	*	*	
		Lesbian/Ga..			*							
		Unsure/Oth..							*	*		
Graduate Student	Female	[Not answe..				*	*	*				
		Heterosexu..			*	*	*	*	*	*	*	
	Male	Lesbian/Ga..		*		*	*	*	*	*	*	
		Unsure/Oth..				*	*	*	*	*	*	
		[Not answe..			*	*					*	
		Heterosexu..			*		*	*	*	*	*	
Lesbian/Ga..												

Asterisk (*) indicates statistically significant difference (compared to overall population) at 0.001 level.

Summary Scorecard

New in 2018! <http://diversity.mit.edu/scorecard/>

Year	2010	2011	2015	2015	2015	2015	2016	2016	2016
Report	Hammond Report	Women Faculty	ICEO Report	BSU	BGSA	BAMIT Platform	LBGTQ+	Undergraduate Women	Staff
# Recommendations	38	13	36	11	7	14	19	14	25
% Completed	29%	35%	29%	(major) 57%	29%	52%	22%	43%	43%
			61%	(minor)					
			46%	average					
Total	177	Total recommendations	39%	Average completion rate					

**39% Completion rate:
Not good enough!**

The reports that were reviewed are listed here with their scorecards.

- Report on the Initiative for Faculty Race and Diversity (2010 Hammond Report) – **Scorecard**
- Report on the Status of Women Faculty in the Schools of Science and Engineering at MIT, 2011 – **Scorecard**
- ICEO: Advancing a Respectful and Caring Community: Learning by Doing at MIT, 2015 – **Scorecard**
- BSU Recommendations, 2015 – **Scorecard**
- BGSA Recommendations, 2015 – **Scorecard**
- BAMIT Platform for Diversity and the Black Experience at MIT, 2015 – **Scorecard**
- Recommendations of LGTBQ + Students and Communities at MIT, 2016 – **Scorecard**
- Undergraduate Women at MIT, 2016 – **Scorecard**
- Recommendations from DUE (OME, UAAP/SDS)/DSL (OMP, LBGTQ)/ODGE Staff, 2016 – **Scorecard**

**Nergis will discuss some
of these reports later**

What you can do

1. Show up: Participate in activities of your EDI offices and student groups
2. Educate yourself: Read, form discussion groups, invite EDI speakers
3. Know your departmental data: demographics, climate, advancement
4. Let your students know you value EDI—**you** will benefit

For further information:

1. MIT EDI data: <http://diversity.mit.edu/data/>
2. “What I learned as a department head,”
<http://web.mit.edu/fnl/volume/285/bertschinger.html>
3. The Nashville Recommendations for Inclusive Astronomy,
<https://aas.org/media/press-releases/aas-endorses-vision-statement-inclusive-astronomy>
4. APS LGBT Climate in Physics Report,
<https://www.aps.org/programs/lgbt/>

Toward a more inclusive Physics

Nergis Mavalvala and Ed Bertschinger

MIT

Beyond numerical data



... the lived experience



MIT Studies and Reports

- 1995: MIT School of Science report on status of women “commissioned”
- 1999: “The MIT report” made public
- 2010: Faculty race and diversity
- 2011: Follow-up report for women faculty in Schools of Science and Engineering
- 2016: Report on the status of undergraduate women

The 1999 Report

- Measureable deficits in resources
 - Lab space
 - Salaries
 - Leadership and voice
- Significant differences in worklife experiences
 - Marginalization
 - Disrespected and undervalued



The 2011 Report:

“a celebration with caveats”

- Celebration
 - More equitable distribution of resources: gaps in salaries and space allocation closed
 - Greater numbers of women through excellent hires: 8% to 19%
 - Many women in leadership positions and committees
 - Stigma and disadvantaging of women for childbirth reduced
 - Greater satisfaction at all career levels

The 2011 Report:

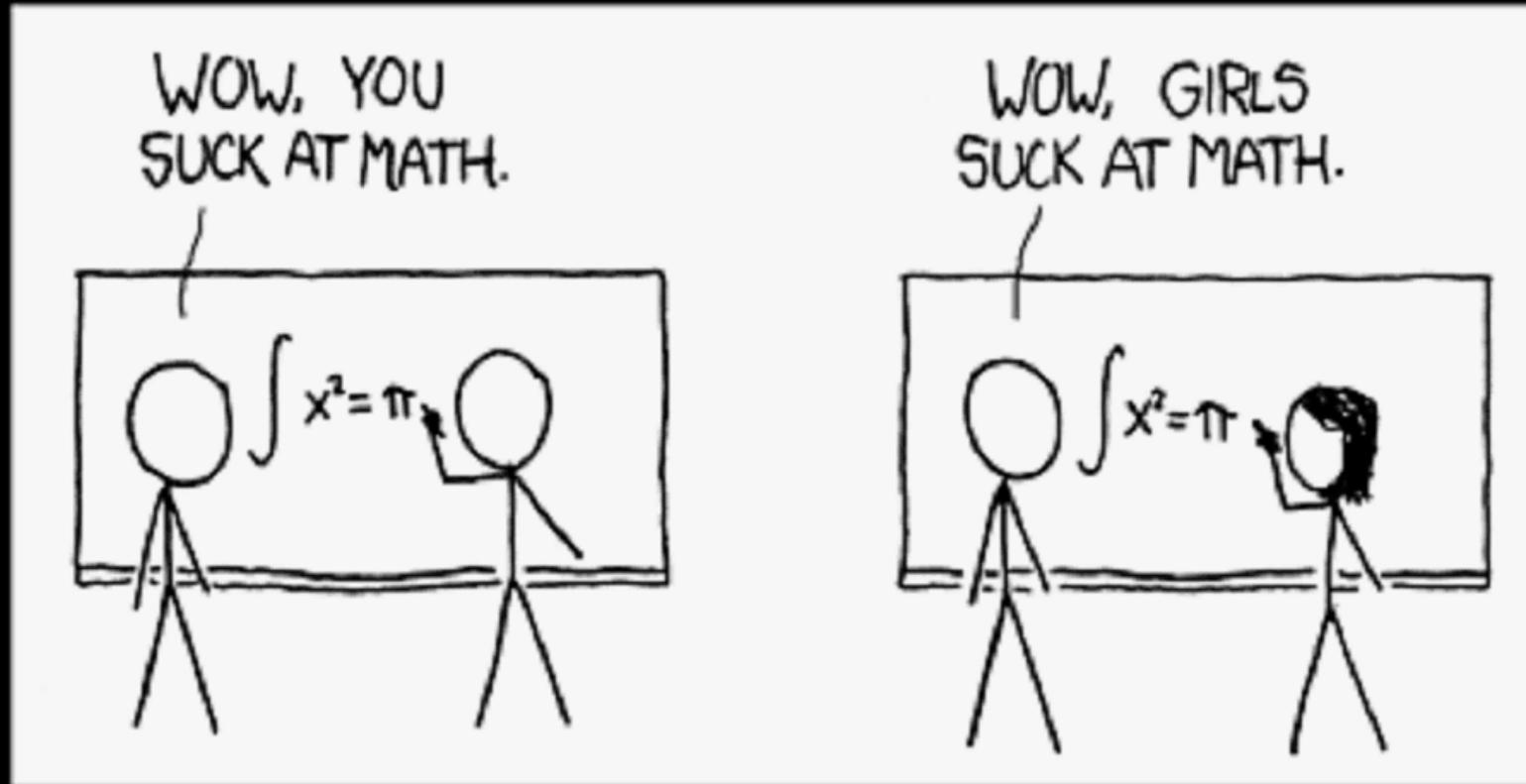
“a celebration with caveats”

- Caveats
 - Women in leadership positions report being undermined relative to male counterparts
 - Complexity of family issues
 - Parenting
 - Dual career couples
 - Stereotypical expectations of behavior from women
 - Hidden labor and the burden of service
 - Consulting and commercialization
 - Pervasive presumption that standards for hiring and tenuring of women are lower than for men

SYSTEMIC BARRIERS

The need for social change

Explicit and/or implicit bias



“What a sad era, when it’s easier to
smash an atom than a prejudice”

Albert Einstein

Stereotype threat

A negative stereotype about a group can cause reduction in performance of group members



When women were reminded — even subtly — of the stereotype that men were better than women at math, the performance of women in math tests measurably declined. (Claude Steele)

Stereotype threat

A negative stereotype about a group can cause reduction in performance of group members



When women look at tech companies and math departments, they see few women. This activates the stereotype that women aren't good at math. The stereotype makes it harder for women to enter those fields. To stay. To thrive. (Schmader and Mehl)

Imposter experience

Persistent feelings of inadequacy despite evident success. Self-doubt, feeling like a fraud.

THIS IS DR. ADAMS. SHE'S A SOCIAL PSYCHOLOGIST AND THE WORLD'S TOP EXPERT ON IMPOSTOR SYNDROME.

HAHA, DON'T BE SILLY! THERE ARE LOTS OF SCHOLARS WHO HAVE MADE MORE SIGNIFICANT...

...OH MY GOD.



Xkcd.com

UT Austin study: imposter feelings combining with discrimination exacerbates mental health problems for minority students. (Bernard et al. 2017; Cokley et al. 2017)

Imposter experience

Persistent feelings of inadequacy despite evident success. Self-doubt, feeling like a fraud.

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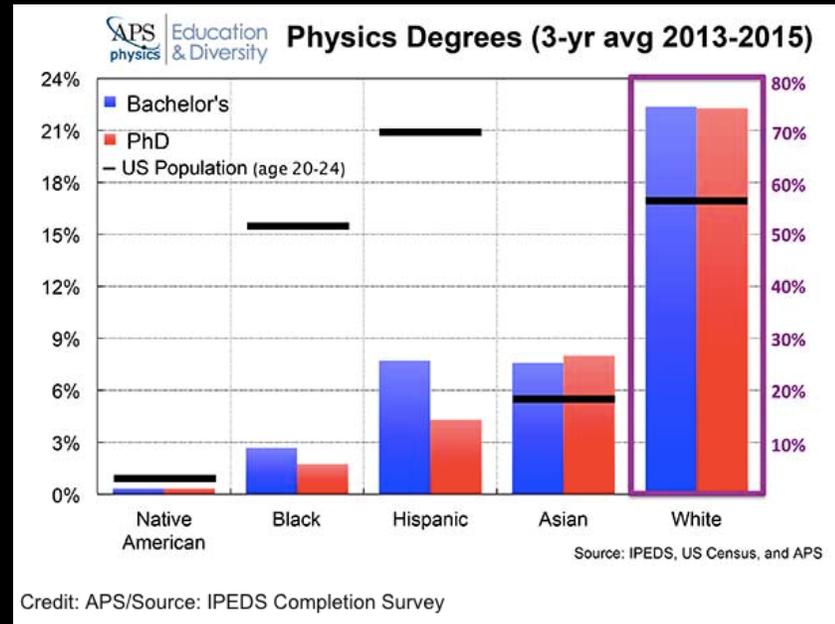
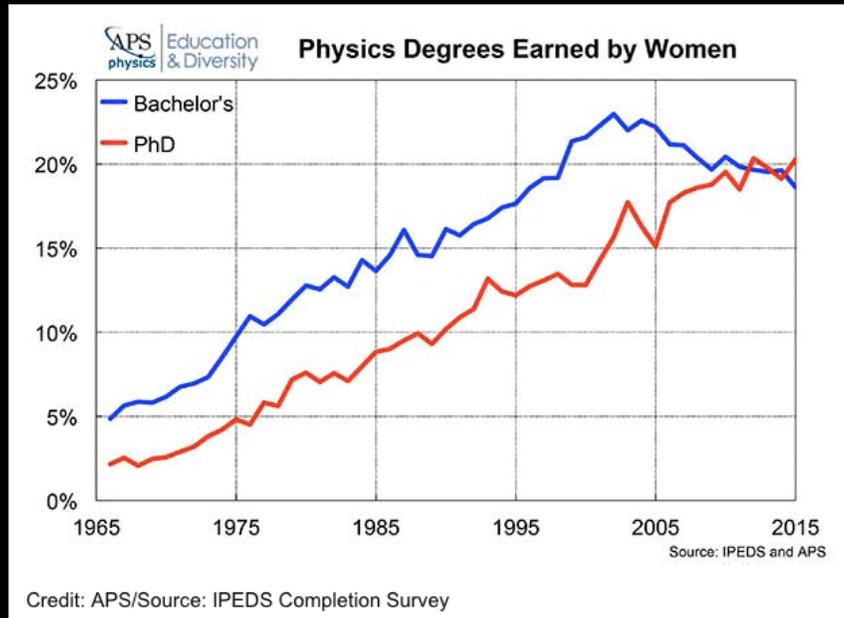
...OH MY GOD.



“The whole problem with the world is that fools and fanatics are always so certain of themselves, and wiser people so full of doubts.”
(Bertrand Russell)

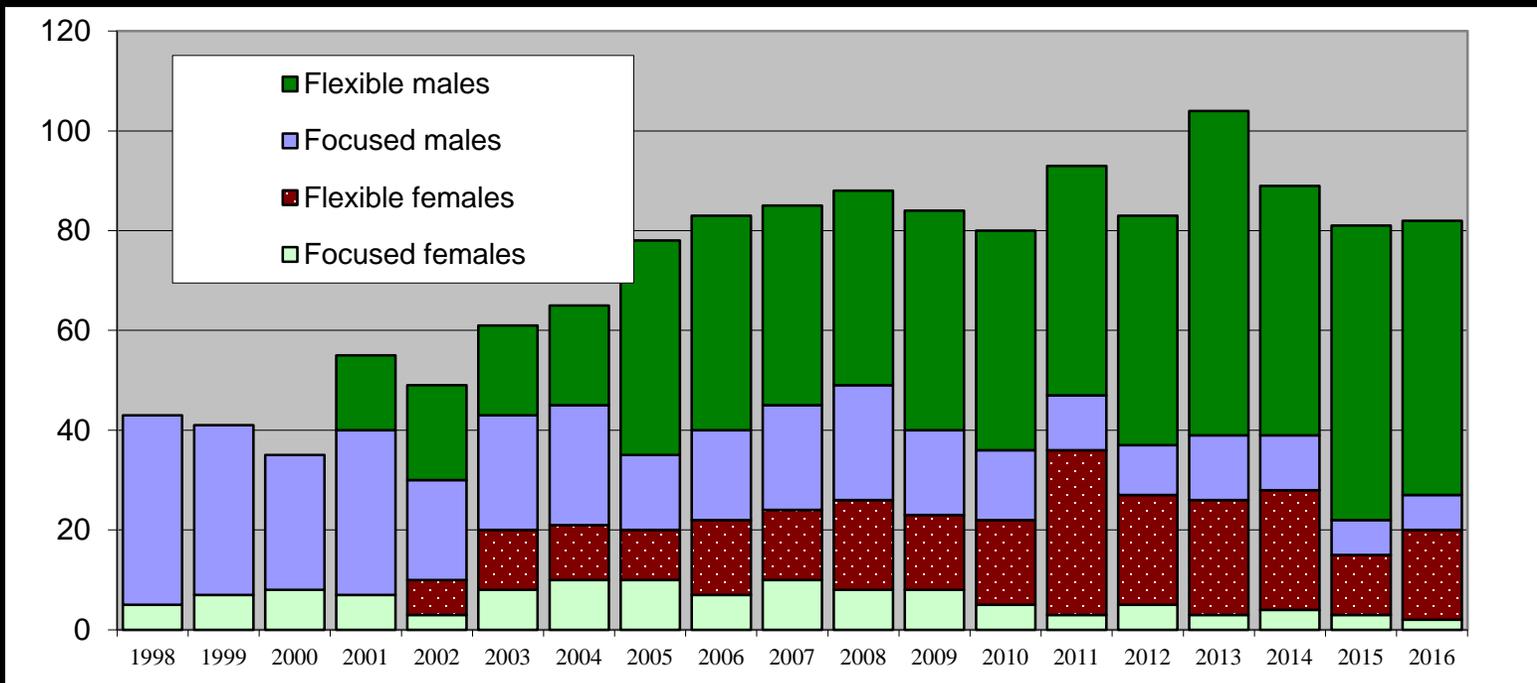
INCREASING PARTICIPATION

Some successful “experiments”



The MIT Physics Flexible degree

- Same core as Focused degree
- More electives, fewer requirements
- Possible to double major



- More opportunities for societal impact
- More ability to nurture multiple interests

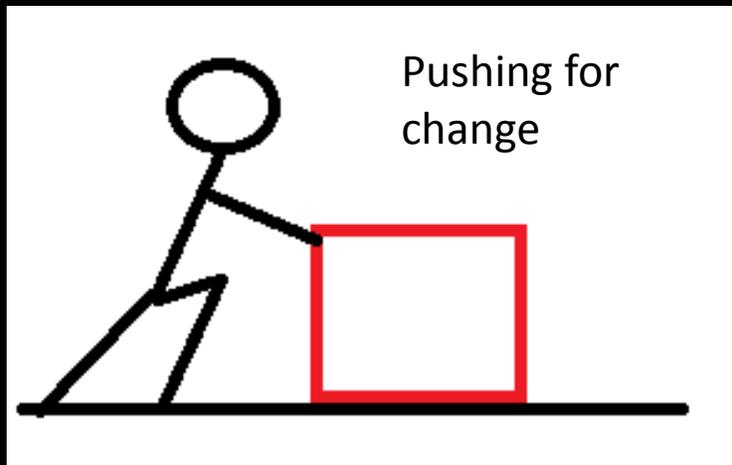
The Harvey Mudd CS first year

- Separated intro CS class into sections by prior experience
- Created an environment that is supportive and engaging for everyone
- Reduced intimidating “macho behavior” with private talks with dominating students
- Built confidence and community among underrepresented groups – mentoring and encouragement to continue in CS



50%
↑
18%

“Every system will remain at rest or in uniform motion in a straight line unless compelled to change its state by the action of an external force”



Newton's First Law

BACK UP SLIDES

LGBTQ IN PHYSICS

Report of the American Physical Society

APS LGBTQ Report (March 2016)

- LGBT physicists have faced uneven protection and support from legislation and policies
- The overall climate experienced by LGBT physicists was highly variable (15% M, 25% W, 30% T experience “uncomfortable” climate at work)

APS LGBTQ Report (March 2016)

- In many physics environments, social norms established expectations of closeted behavior (40% respondents say “employees are expected to not act too gay”)
- Isolation was a common theme for many LGBT physicists

APS LGBTQ Report (March 2016)

- A significant fraction of LGBT physicists have experienced or observed exclusionary behavior (40% but 60% for T)
- LGBT physicists with additional marginalized identities faced greater levels of discrimination (3x for women)

APS LGBTQ Report (March 2016)

- Transgender and gender-nonconforming physicists encountered the most hostile environments
- Many LGBT physicists were at risk for leaving their workplace or school (1/3)
- LGBT physicists reported trouble identifying allies to help mitigate isolation, exclusion, or marginalization

EB Backup slides



Graduate Education Statistics

Population

Diversity
Dashboard

Students

Student Body
Diversity
Demographics
by Residence
Hall
Degrees
Retention and
Graduation
Rates
Graduate
Education
Statistics
Student
Placement

Office of the
Registrar
Enrollment &
Degree
Statistics

Faculty and
Staff
Awards and
Honors

Financial

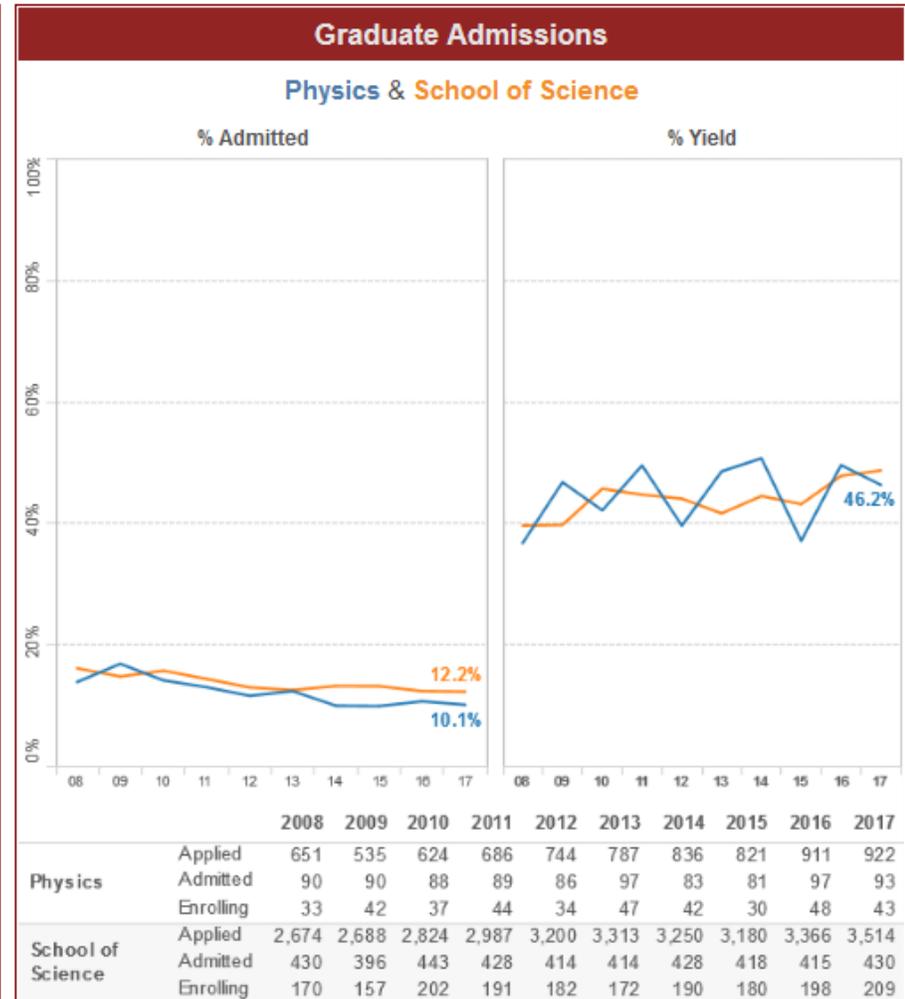
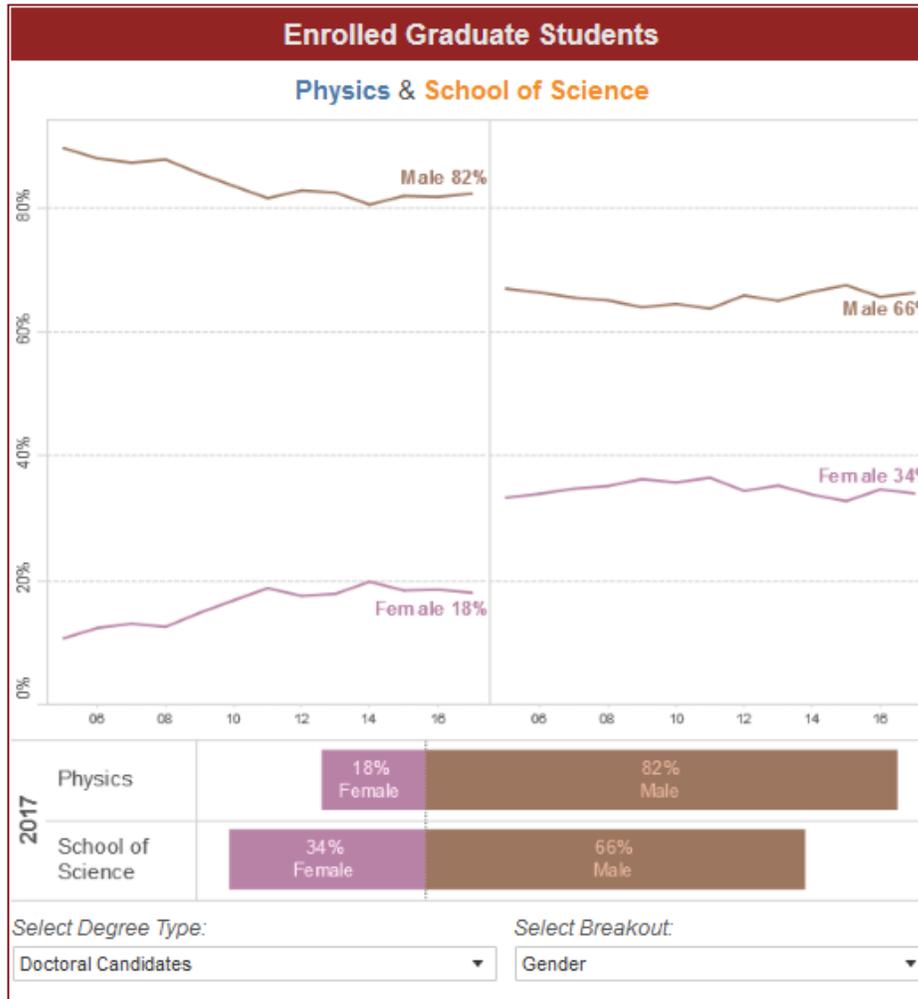
Select MIT Schools and Departments for comparative data:

Select a Department:

Physics

Select a School:

School of Science



Meritocracy

“a system in which the talented are chosen and moved ahead on the basis of their achievement” -- Merriam Webster dictionary

This is problematic! How is talent identified and fostered? How does systematic discrimination hinder talent development?

“Researchers in the social psychological tradition have suggested that merit justifies beliefs that help legitimize the (unequal) *status quo* in society. Such beliefs may allow individuals and groups at the top of the status hierarchy to use “merit” to justify and sustain their privileged status and reduce resistance from lower-status groups.”

- Emilio J. Castilla in *The SAGE Encyclopedia of Political Behavior*, chapter on *Meritocracy*

Privilege

“the advantages and immunities enjoyed by a small usually powerful group or class, especially to the disadvantage of others.”

<https://educalingo.com/en/dic-en/privilege>

Racism = Prejudice + Power