THE IMPORTANCE OF DIVERSITY

2016 NSF ASTRONOMY AND ASTROPHYSICS POSTDOCTORAL FELLOWS SYMPOSIUM
Our sources for the future S&E workforce are uncertain… Non-US citizens… have accounted for almost all growth in STEM doctorate awards, and in some engineering fields, comprise the majority of new doctorates.

… [at the same time] the demographics of our domestic population are shifting drastically… Those groups that are most underrepresented in S&E are also the fastest growing in the general population.

… Diversity is an asset. Increasing participation and success in S&E contributes to the health of the nation.
51% of US population are women
38% of US population are part of a racial or ethnic minority
32% of US population are underrepresented minorities (URMs) in STEM

Percentage of bachelor and doctorate degrees awarded to women and underrepresented minorities (URMs) in physics at US institutions

<table>
<thead>
<tr>
<th>Year of Degree</th>
<th>URM PhD</th>
<th>URM Bachelors</th>
<th>Women PhD</th>
<th>Women Bachelors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>0%</td>
<td>5%</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>1997</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>1999</td>
<td>20%</td>
<td>25%</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>2002</td>
<td>30%</td>
<td>35%</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>2004</td>
<td>40%</td>
<td>45%</td>
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<tr>
<td>2006</td>
<td>50%</td>
<td>55%</td>
<td>60%</td>
<td>65%</td>
</tr>
<tr>
<td>2008</td>
<td>60%</td>
<td>65%</td>
<td>70%</td>
<td>75%</td>
</tr>
<tr>
<td>2010</td>
<td>70%</td>
<td>75%</td>
<td>80%</td>
<td>85%</td>
</tr>
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<td>2012</td>
<td>80%</td>
<td>85%</td>
<td>90%</td>
<td>95%</td>
</tr>
<tr>
<td>2014</td>
<td>90%</td>
<td>95%</td>
<td>100%</td>
<td>105%</td>
</tr>
</tbody>
</table>

1 Less than 13% of STEM Bachelors degrees, National Action Council for Minorities in Engineering.
2 Sources: US Census (2014), Integrated Postsecondary Education Data System Completion Survey by Race

Here is the status of women and minorities as of a little over a year ago...

Black or African American
Hispanic and Latino Americans
Native American Indians
Native Hawaiians or Pacific Islander Americans

In physics (and astronomy, but use these numbers as an example), these group attain a share of degrees much smaller than share of the demographics.

Despite notable growth in the production of female PhDs, female baccalaureates, URM baccalaureates and PhDs, have shown nearly no growth in 20yrs.
THE CASE FOR DIVERSITY:

...[some] view scientific workforce diversity efforts as antithetical to the ideals of [a scientific] meritocracy.


LARGER TALENT POOLS
More STEMists = most meritorious outcomes

SOCIALLY RESPONSIBLE
Everyone has the right to an equal share of education and the workforce

Why is this-- come to a little later

Why should we care? Science is a meritocracy, advancing the best ideas, concepts, theories— Doesn’t this also apply to the STEMists who are involved in it?

No. The previous graph showed we’re missing a large segment of society, who potentially take with them lost ideas, and so A case is larger talent pools: Don’t want to miss the next Einstein— But maybe, given the state of education and mentorship, not many from these groups are sufficiently prepared to contribute to these fields,

Another case may be that everyone has the right to an equal share of education and workforce, but our social policies (whatever their intention) have kept disenfranchised a large fraction of our population, that also happen to be female and ethnic or racial minorities.

but I can think of other reasons too
A study of for-profit businesses in the late 90s showed that companies with larger racial and gender diversity have more customers, make more sales, have larger market shares, and all around have higher profitability than competitors with less diversity.

Several studies similar to this conducted in the 90s and 2000s all showed very similar outcomes. So it makes good business sense, but science is not a business (at least, it shouldn’t be)
THE CASE FOR DIVERSITY: THE CROSSROADS ARGUMENT

By around 2020, >1/2 of the nation’s children will be part of a racial or ethnic minority.
In 2040’s, more than >1/2 of the nation’s workforce will be non-white.
In 2060’s, working age population shrinks from 62% to 57%.  

“There are those who contend that it does not benefit African-Americans to get them into the University of Texas where they do not do well, as opposed to having them go to a less-advanced school, a slower-track school where they do well.”


“As minority groups increase as a percentage of the US population, increasing their participation rate in science and engineering is critical if we are just to maintain the overall participation rate in science among the US population.”

sometime around 2040, these children will be fully realized into the nation’s workforce, making the majority non-white.

all the while, the working age population is shrinking

Degrees not increasing:

At the crossroads of a path that is potentially disastrous
an overall a less knowledgeable, and necessarily less competitive US workforce,

the solution to the problems with student body diversity cannot be to set up a system in which not only are minorities going to separate schools, they’re going to inferior schools.
acknowledged a plan must be in place to sustain US scientific and technological leadership, and put forth actions aimed at improving K-12 STEM education, and providing incentives for students to pursue S & E undergraduate and graduate degrees.

several studies written on the growing disconnect with technology: tech strives to make knowhow (and knowledge) less important; society has become less interested in attaining technological competence.
At the 1906 West of England Fat Stock and Poultry Exhibition, 787 people guessed the weight of a steer on display.

Works best when diverse rationale, (experimental data), and basis for conclusions
The Case for Diversity: By the Numbers

2006 Netflix Prize: $1M to algorithm, increases the accuracy of its movie recommendations.

2007 BellKor (US AT&T Labs): +8.43% improvement
2008 BellKor + BigChaos (Australia): +9.44%
2009 BellKor + BigChaos + Pragmatic Theory (Canada): +10.09%

Crowds make accurate predictions.
Diverse crowds often make most accurate predictions.


Final entry called “BellKor in Pragmatic Chaos”
What unique perspective does a minority student bring to a physics class?… Just wondering what the benefits of diversity are in that situation?

Chief Justice John Roberts, US Supreme Court, 2015 arguments of Fisher v. Univ. of Texas (Austin)

Crowds make accurate predictions.
Diverse crowds often make most accurate predictions.

Benefits of diversity in research requires diversity in classroom

The benefits of diversity in research can only be achieved with a diverse workforce, which requires diversity in the classroom.

Implied outcome of the absence of diversity — less accurate scientific outcomes
Affects everyone who participates in scientific endeavors
HOW TO TAKE ACTION:

The keys to improving the participation of women and minorities in physics is to improve preparation, recruitment, climate, and retention.

Similar percentages are seen at all pipeline levels from Bach. to early career.

No silver bullets— fields with higher success have worked to address two or more of these key areas.

Note: Source: Integrated Postsecondary Education Data System Completion Survey by Race
HOW TO TAKE ACTION:
Get involved early!

- Targeted mentoring programs
- Partnerships with community/2-year colleges and minority serving institutions

REUs, summer internships, and other undergraduate mentoring programs:

- Expose students to forefront research in astronomy, and astronomy enterprise fields
- Provide opportunities for growth, achievement, and personal development
- Place students in a cohort of friends and colleagues for their future
- Need selection criteria to engage students lacking research experience but with a propensity for scientific research (creativity, organization, and tenacity)
- Basis for National Astronomy Consortium (NRAO/AUI/NSBP)— augment to summer programs (see 313.01, E. Mills, “The National Astronomy Consortium”)

Always looking for mentors! Find ways to engage women and URM students in your work.

As postdocs— you can take action—- now!

Important adjustment— look for students who lack research experience, but are keen toward science, and show some important skills— look for creativity, organization, and tenacity, not just python/IDL experience.

When you get the chance see,
The number of physics students at two-year colleges is on the rise. These draw URMs and women due to affordability.

MSIs are still a large draw for URMs because of environment, cultural inclusion

Consider these students too. Find partnerships with their faculty for co-mentorship opportunities.

There are 100s of MSIs around the country.. odds are, one not to far from where you work.
How to take action:
Support Bridge programs

Transition (or Bridge) programs provide
- academic preparation for PhD programs
- graduate research experience
1 - 2 yr

California State University Long Beach
Florida State University
Indiana University
The Ohio State University
University of South Florida
University of Central Florida

As you transition to junior faculty members, keep some of these important opportunities in mind.
HOW TO TAKE ACTION:
Encourage participation (at all levels) in societies for women and URMs in physics and astronomy.

Building the cohort for colleagues, through cultural inclusiveness.
HOW TO TAKE ACTION:
Plan for Astro2020!

State of the Profession/Infrastructure Study Groups:
• broad range of topics—facilities (incl. comp. centers), EPO, demographics
• due early 2019
• short, ≤ 10 pages

NRC convenes panels to review white papers, provide report to Committee for a Decadal Survey of Astronomy and Astrophysics,

Reviewed along with reports from Science Frontiers panel and Program Prioritization panels (published separately)

Synthesized into the final Survey report.
**HOW TO TAKE ACTION:**

As community members

- family friendly practices
- inclusion policies
- zero-tolerance policies toward harassment and bullying

The benefits of diversity in research can only be achieved with a diverse workforce, which requires diversity in the classroom.
TAKE-AWAY POINTS:

Diversity (gender, ethnic, racial, and geographical) should be a priority for the 2020’s, not just a goal.

Must devise policy (2020 Decadal, institutional action plans) to address concerns on diversity.

Funding (especially Federal) should be tied to metrics in inclusion.

Astronomy must acknowledge responsibility as ‘good citizens’.