Efforts to improve diversity and inclusion in physics

Brian Beckford
University of Michigan
Background
Representation in physical sciences

• Women and racial/ethnic minorities make up a substantial portion of the US population
  
  • Women (50%), Hispanic (17%), Black (13%), Asian, 6%, (American Indian, Alaskan Native, Native Hawaiian, Pacific Islander, and those who reported more than one race (2%).
  
  • Racial ethnic minority ~ 35%

• Underrepresented Minority (URM)
  
  • Statistically underrepresented group in a field/discipline that is not representative of population. For this talk, the URM is Hispanic-, African-, and American Indian, Alaskan Native, Native Hawaiian, and Pacific Islander

Noninstitutionalized resident population of the United States ages 18–64, by race, ethnicity, and sex: 2014

Science and engineering degrees earned by underrepresented minority women and men: 1995–2014

Percent

<table>
<thead>
<tr>
<th>Year</th>
<th>Bachelor's, women</th>
<th>Bachelor's, men</th>
<th>Doctorate, women</th>
<th>Doctorate, men</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
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<td>2005</td>
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<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
BS earned by URM student

- Hispanic American and African American physics BS accounts for 2-3% of earned degrees, respectively.

- Native American physics BS is roughly 0.5%.
BS earned by Native Americans

- Hispanic American and African American physics BS accounts for 2-3% of earned degrees, respectively.

- Native American physics BS is roughly 0.5%.
Physics continues to be the least diverse of the sciences

- Initiatives to increase the participation of women in physics has yielded positive results
Participation of women in physics

- Physics continues to be the least diverse of the sciences
  - Initiatives to increase the participation of women in physics has yielded positive results
- The increase of women in physics is mostly attributed degrees earned by white women

![Percentage of women in physics](chart1)

![PhD degrees earned by women in physics by race](chart2)
HEP PhDs earned

PhDs Earned in 2016

- Elementary particle physics
- Nuclear physics

PhDs Earned

- All
- Temp. Visa
- Total
- Latino
- Am. Indian
- Asian
- Black
- White
- More than one race
- Other or not reported
- Ethnicity not reported

Ethnicity and Temp. Visa

- US Citizens or Permanent Residents

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Put it in perspective

- Physics degrees earned in physics since 1973 can demonstrate the point
- Degrees earned by URM men and women of color are orders of magnitudes below those of white men and women

**Women who earned physics doctorates (1973-2015)**

- Hispanic: 211
- Am. Indian/Alaska Native: 4
- Asian: 2,581
- Black: 59
- White: 3,582
- Two or more races: 21
- Other or race not reported: 65
- Ethnicity not reported: 475

**Men who earned physics doctorates (1973-2015)**

- Hispanic: 1,411
- Am. Indian/Alaska Native: 42
- Asian: 12,848
- Black: 420
- White: 29,018
- Two or more races: 103
- Other or race not reported: 505
- Ethnicity not reported: 3,920
Many students have never had any faculty of color in their entire academic career.

### Number of Physics Departments with African-American and Hispanic Faculty by Highest Degree Awarded, 2016

<table>
<thead>
<tr>
<th>Number of Departments that have...</th>
<th>PhD</th>
<th>Master's</th>
<th>Bachelor's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both African-American and Hispanic Faculty</td>
<td>25 (12%)</td>
<td>7</td>
<td>3</td>
<td>45 (6%)</td>
</tr>
<tr>
<td>African-American Faculty and no Hispanic Faculty</td>
<td>25 (12%)</td>
<td>8</td>
<td>53</td>
<td>86 (12%)</td>
</tr>
<tr>
<td>Hispanic Faculty and no African-American Faculty</td>
<td>75 (37%)</td>
<td>20</td>
<td>61</td>
<td>156 (20%)</td>
</tr>
<tr>
<td>Neither African-American nor Hispanic Faculty</td>
<td>75 (38%)</td>
<td>22</td>
<td>365</td>
<td>463 (62%)</td>
</tr>
<tr>
<td>Total</td>
<td>202</td>
<td>56</td>
<td>492</td>
<td>750</td>
</tr>
</tbody>
</table>
DEI

• **Diversity:** All the ways un which people are different. Bringing together individuals of diverse identities and abilities along multiple axes.

• **Equity:** Recognizing the all people are not afforded the same access and opportunities as other and working o eradicate barriers.

• **Inclusion:** Creating an environment where differences are welcomed, valued, respected, and all are invited to participate.
Lowered quality?

- Diversity does mean that standards of quality are lowered
- Diversity does not have to come at the expense of quality
- Idea of lowering the bar only reinforces stereotypes
- It also perpetuates feelings associated with imposter syndrome
- And bar for what?
Ideas to foster diversity

- Recruit far and wide
  - Attend identity or affinity based scientific conferences
    - NSBP, SACNAS, CUWiP, CU2MiP, OSTEM
  - Build relationships with faculty and researchers in other institutions including MSIs
- Employ strategies to curb bias in section processes for students, awards, in hiring, etc.
- Check your biases - implicit.harvard.edu
Ideas to foster inclusion

• Share your struggle with your students

• Acknowledge the work of others who are typically marginalized in physics spaces

• Recognize isolation in your students and colleagues and find resources to combat it
Efforts
• Conference for Undergraduate Women in Physics (CUWiP)

• New faculty workshop, Professional skills workshop, Physics Chair meeting, and Graduate Education conference

• Joint Task Force on Undergraduate Physics Program report. (JTUPP)

• National Mentoring Community (NMC)

• LGBTQ+: Ad Hoc Committee on LGBT Issues (C-LGBT)
  • LGBT Climate in Physics report recommendations endorsed by APS council

• APS Bridge Program

• Participation tripled since APS became administrative home

• LGBT Climate in Physics report
  • Survey of 300+ LGBT physicists:
    • Many experienced isolation, exclusionary behavior
    • Many at risk for leaving school or workplace
  • Recommendations endorsed by APS Council (April 2016)
  • Report featured by Nature, AAAS, Physics World, others

www.aps.org/programs/lgbt

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APS Bridge Program

- APS Bridge Program - National effort to increase the number of PhD earned by underrepresented students in physics.
  - Increase the fraction of physics PHDs Awarded to underrepresented minority students to match the fraction of physics bachelors awarded
  - Develop, evaluate, and document sustainable bridging experiences that improve the access to the culture of graduate education for all students, with emphasis on underrepresented groups in doctoral physics programs
  - Promote and disseminate successful program components to the physics community
APS Bridge Program goal

Percentage of degrees earned by URM in Physics

US Graduate-Age URM population

Only ~30 students!

Source: National Center for Education Statistics, US Census, and APS

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Student eligibility

• App: **Opens December 1, 2018** and **Closes: March 22, 2019**

• In order to eligible to apply to the Bridge Program, students must:
  • Have a bachelor’s degree in physics or a closely related discipline
  • Be a U.S. citizen or permanent resident (or be part of DACA)
  • Satisfy one or more of the following criteria in the current academic year:
    • Did not apply to a physics graduate program; or
    • Applied to one or more physics graduate program, **but not accepted by any program.**
  • Be committed to improving diversity in physics
  • Meet an additional requirements that individual bridge sites may have, including minimum GPA.
Key features

- **Recruit** students through graduate programs (unaccepted), undergrad programs (promising but uncompetitive, or unsure)
- **Establish** Bridge Sites (6):
  - Year 1: Advanced undergraduate or grad courses, introduction to grad-level research, active mentoring, progress monitoring, social integration into grad school *(Project funds)*
  - Year 2: Take 1st year grad courses, apply to PhD program, research underway *(Department funds)*
- **Place** additional students at Partnership Institutions (30):
  - 17 PI graduate programs looked at applications (2018), recruited additional students; No direct support, some travel
  - “COM approved” Partnership Institutions; national recognition of program
- **Monitor** student/site progress
- **Research**
- **Disseminate / Advocate**
Bridge programs in physics

• Bridge Program -
  • An approach to addressing the underrepresentation of some groups in physics
  • Aimed at providing opportunities for students to be successful that may not have had such chances by traditional means

APS Funded Sites:
- Florida State University
- Indiana University
- Ohio State University
- University of Central Florida
- University of South Florida
- Cal. State Long Beach

Other Programs:
- University of Michigan
- Columbia University
- Fisk/ Vanderbilt University
- MIT
- Princeton University
- University of Chicago
- Others under development
Bridge programs in physics

Member Institutions
• 137 in 38 states

Partnership Institutions
• 36 in 20 states
• 29 PhD
• 7 MS

APS Bridge Program Institutions
This map illustrates current institutions participating in the APS Bridge Program. Students were placed at Bridge and Partnership sites. Although funding sources vary, all students generally receive some financial support.
Bridge programs in physics

**APS Sites:**
- Cal State Long Beach*
- Florida State University
- Indiana University
- Ohio State University
- University of Central Florida
- University of South Florida

**Non-APS Sites:**
- Bowling Green State University*
- Cal State Los Angeles*
- Columbia University
- Case Western Reserve University
- Delaware State University
- DePaul University*
- Embry-Riddle Aeronautical University
- Fisk-Vanderbilt
- Florida International University
- Illinois Institute of Technology
- MIT

- North Dakota State University
- Princeton University
- Texas State University*
- University of Alabama
- University of California, Los Angeles*
- University of Chicago
- University of Cincinnati
- University of Connecticut
- University of Hawai'i at Manoa
- University of Houston, Clear Lake*
- University of Michigan
- University of Minnesota
- University of N. Carolina, Chapel Hill
- University of Rochester
- University of Texas, Arlington
- University of Texas, San Antonio
- University of Virginia
- Wright State University

*Master’s degree is highest awarded
Best practices

• Faculty involvement
  • 10-15% tenure faculty involvement needed for sustainability

• Admissions decisions (holistic approach)
  • Decide what are you selecting for? Success? (“Holistic review”)

• Financial support
  • Secure funding for at least one year for bridging experience (timing)

• Mentoring
  • Mentor-mentee compact outlining expectations, and multiple mentors (including peer mentoring)
Best practices

• Coursework
  • Flexibility in courses and usage of cross listed courses (induction advising and alternate plan)

• Progress monitoring and inductions
  • Introduction into graduate life and new culture
  • Weekly progress meetings (timing, intervention)

• Research
  • Appropriate match
Retention best practices

Mentoring

• Faculty seeking to become better mentors
  • Training on culturally sensitive mentoring
  • Seek others that could be a mentor in a way that you are unable

Expectations and feedback

• Discuss what is success for you and for the student?
  • Provide support that can combat imposter syndrome and help develop a physics identity

• Progress monitoring that involves regular check-ins

• Support systems
  • Mental health, student, and community organizations
Achievements

Bridge Program
Physics PhDs

- 23% Women (20%)
- 93% URM (6%)
  - 64% Hispanic
  - 24% African American
  - 5% Native
- 85% Retention (59%)

168 Students making progress toward PhDs

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OSU outcomes

% URM of Current Domestic Graduate Students

- %URM of PhD+Bridge
- %URM of PhD

National % BS
National % PhD

Year:
- 2008
- 2010
- 2012
- 2014
- 2016
- 2018
First graduating cohort May 2019

• APS Bridge Program achievement

• Two Bridge students, Tommy Boykin (University of Central Florida) and Kevin Galiano (The Ohio State University), were both set to receive their Ph.D.s in May, becoming the first Bridge participants to do so.

“I ended up applying to 12 different schools. I actually didn't get into any of them,” said Boykin. “One of my professors from Berea recommended I speak with Ted Hodapp [APS Senior Adviser to Education and Diversity], and he put me in touch with Dr. Talat Rahman [from UCF] who said that they were starting the Bridge Program and that I should apply. And so, I applied, I got in, and then I was actually admitted to UCF.”
Strategies adopted for persistence and success

• Circumventing unsupportive advisors
• Combating isolation with peer networks
• Consciously demonstrating abilities to counteract doubt
• Finding space for whole selves
• Getting OUT to stay in
• Remembering your passion for science
• Engaging in activism in order to change the future STEM culture
TEAM-UP: Taskforce to Elevate the African American Representation in Undergraduate Physics and Astronomy

- Formed fall 2017 to examine and assess the reasons for the persistent underrepresentation of African Americans in physics and astronomy (BS level)

Long term goal:

- Through broad community based efforts we aim to bring the percentage of African American physics & astronomy BS to parity with their overall graduation rate (from 4%—>9%)

- Produce a report that will include (~fall 2019)
  - Findings from our study
  - Institutional case studies featuring innovative programs and student narrative
  - Evidence based, actionable recommendations
TEAM-UP Motivation

- Number of physics BS earned continues to increase.
- 130% increase since 1999 low
- African Americans are 15% of college students, and there was ~10% increase in overall BS (2003-2013)
- Percentage of physics African Americans BS continues to be low (2-4%)
- Physics and astronomy is not benefitting from growth in African American degrees
Activities

• Learn from prior research

• Student experience
  • Survey and interview African Americans that persisted to BS
  • 90/117 survey respondents identified as African American
  • Focus groups at 2018 NSBP conference

• Department survey
  • Survey departments from which large number African Americans have graduated

• Site visits
  • Conducted site visit to “high-producing” physics & astronomy programs

• Engaged pilot departments to implement Task Force recommendations
Summary

• We can and should do better
• Look for the stories in the data
• Become a NMC mentor
• Join the APS Bridge Program
• TEAM-UP report is coming January 2020!
Supplemental
Resources

- AIP TEAM UP: [www.aip.org/TEAMUP](http://www.aip.org/TEAMUP)
- AIP Statistical Research Center: [aip.org/statistics](http://aip.org/statistics)
- APS Bridge Program: [www.apsbridgeprogram.org](http://www.apsbridgeprogram.org)
- APS Bridge Program: [Induction manual](http://www.apsbridgeprogram.org/inductionmanual)
- National Academies of Science report on Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine (2018)
- LGBT+ Inclusivity in Physics and Astronomy: [A Best Practices Guide](http://www.aip.org/TEAMUP/bestpractices)

Fisk-Vanderbilt Bridge Program: [fisk-vanderbilt-bridge.org](http://fisk-vanderbilt-bridge.org)

University of Michigan Bridge Program: [Michigan Imes-Moore Fellows program](http://www.umich.edu/)

Stereotype Threat: [www.reducingstereotypethreat.org](http://www.reducingstereotypethreat.org)

AIP TEAM-UP Project Staff:

- Arlene Modeste-Knowles, Project Manager
- Philip “Bo” Hammer, AIP Senior Director

Contact us: TEAMUP@aip.org, 301-209-3164

More Information: [www.aip.org/TEAMUP](http://www.aip.org/TEAMUP)
On attending an HBCU...

When you go to different institutions, sometimes you don't get that representation. You don't get that feeling of, "Oh yeah. This is exactly what I can do” because...sometimes the people don't look like you. Well, when they don't look like you it’s like, "All right. Well, I'm in this community and I already know I'm underrepresented.” It's sometimes overwhelming, and so I think at [HBCU], that's one of the great aspects of just being able to talk to your teachers and they're African American, being able to talk to the students and they're African American. Be able to go around and talk to people and you feel represented.
I go to a predominantly white institute. I'm a junior and I've only had two other black students in my classes. [In] only two classes I have had another black student. Not the same black student. Most of my classes I'm the only black person, the only black woman and you're surrounded by a lot of white men who think they know everything, who try to argue with the teacher and so when you try to make a point it is sort of hard to have your voice out there. To them it's not intentional because they are so used to being able to have their way. To me it's sort of difficult to make your way in there. I was lucky enough to have a white friend who introduced me to them, which...I really didn't appreciate, but I [came]to appreciate in the end because they started to connect with me more. But definitely [during my] freshman year it was just really daunting, because there was not anybody else to talk to.
Let's say the biggest obstacle that I had was directly after my summer REU. For context I went to [An Ivy League school]....Another student apparently who applied for the same REU...was convinced that I got in and he didn't because there was a racial bias in my favor. This student actually wasn't white, he was [another ethnicity overrepresented in physics]. He wasn't the best student anyway, he even comes to me for help...So he had actively challenged me on this and that really bugged me because, for one, it's not true. Then for a couple of weeks, maybe even a couple of months after that I just started thinking. I started like really coming to terms [with what] if that were indeed the case and then I tried to make arguments in favor of and opposing that position. I think the conclusions I came to as a result, helped me more going forward.
American Physical Society (APS)

• Committees
  • Committee on Status of Women in Physics (CSWIP)
    • Committed to encouraging the recruitment, retention, and career development of women physicists at all levels.
  • Committee on Minorities (COM)
    • Committed to addressing the production, retention, and career development of minority physicists and gathers and maintains data on minorities in physics in support of these objectives
  • Committee on Education (COE)

• Units
  • Forum on Education (FED)
  • Forum on Graduate Student Affairs (FGSA)
  • Forum on Diversity and Inclusion
  • Topical Group on Physics Education Research (GPER)
Underrepresented Minorities in Physics

Source: IPEDS and APS

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Goal: Increase the number of African American, Hispanic American, and Native American undergraduates obtaining physics bachelor’s degrees.

Strategy: Connect students with local faculty mentors and provide support and resources. Emergency financial aid fund to mentees (BEAM). National recognition of mentoring service (upcoming).

NMC Mentor and Mentee Registration

Cumulative Participants

<table>
<thead>
<tr>
<th>Date</th>
<th>Mentors</th>
<th>Mentees</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-Apr-15</td>
<td>202</td>
<td>144</td>
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</tbody>
</table>

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Physics GRE cutoff on admissions

Physics GRE cutoff on admissions

AIP National Task Force to Elevate African American Representation in Undergraduate Physics & Astronomy (TEAM-UP)

Background

The number of physics and astronomy bachelor's degrees awarded in the US is at an all-time high (8,440 degrees in 2016, across all demographics). African Americans are ~ 15% of all college students and their receipt of bachelor's degrees across all majors has grown faster than the overall population (43% increase vs. 32%, 2003-2013).

Yet, the percentage of African Americans earning physics bachelor's degrees has, for decades, been appallingly low, hovering between 2% and 4%.

The data are similarly discouraging in astronomy.

What does the data show?

Physics and astronomy are neither driving nor benefiting from the growth in overall African American bachelor's degrees.

This begs the question...

Why aren't physics and astronomy showing greater growth in African American bachelor's degrees? Importantly, what is behind this persistent underrepresentation?

Addressing the Problem

In 2017, the AIP Liaison Committee on Underrepresented Minorities (LCURM), a committee of representatives from the AIP Member Societies, identified the persistent underrepresentation of African Americans in physics and astronomy as the most important issue regarding underrepresented minorities in the physical sciences and recommended that AIP take action.

A Task Force is Formed

AIP formed and committed significant funding to a new two-year task force to address this issue in response to LCURM’s recommendation.

In the fall of 2017, the AIP National Task force to Elevate African American representation in Undergraduate Physics & Astronomy (TEAM-UP) was formed.

Mission

To examine and assess the reasons for the persistent underrepresentation of African Americans in physics and astronomy at the bachelor's level.

Long Term Goal

Through broad-based community efforts, our goal is to bring the rate of African Americans in physics & astronomy to parity with their overall graduation rate (from ~4% to 9.5%)

Task Force Activities

- Learn from prior research & existing programs
- Survey and interview African American students who have persisted or left
- Conduct Site Visits to "high-producing" physics and astronomy programs
- Engage pilot departments to augment the process and implement Task Force recommendations prior to release of report
- Produce a detailed, printed Task Force Report and disseminate it widely

The Fall 2019 TEAM-UP Report will include:

- Findings from the Task Force’s study
- Institutional case studies featuring innovative programs and student narratives
- Evidence-based, actionable recommendations

How Can You Help?

- Distribute the survey to your African American students when it becomes available.
- Share information with the Task Force on innovative programs or initiatives that have increased African American undergraduate participation in physics & astronomy.
- If your department is having success, consider inviting the Task Force for a site visit.
- Share with us your ideas for solving this problem

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