The APS Bridge Program

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Senior Advisor to Education and Diversity
Departmental Programs

- PhysTEC
- APS Bridge Program
- Conferences for Undergraduate Women in Physics (CUWiP)
- National Mentoring Community
- Best Practices in Undergraduate Physics Programs

- New Faculty Workshops
- Physics chairs meeting
- REU site leaders
- Professional skills development workshops
- Graduate education conference

- Advocating for physics education
- Childcare at meetings
- Mentoring seminar materials
- Ethics case studies
Percentage of Women in Physics

Source: IPEDS
• Focus on professional development, networking, understanding pathways
• Attendance more than tripled since APS became involved
• Awarded 3-year grants from DOE, NSF for 2014-2020 conferences
• 10 sites for 2017, 12 in 2018
• Coordination of Canadian site in 2017
• Directed research efforts to improve messaging to women sees positive changes
• National leadership group; Current chair: Pearl Sandick, Utah; Overseen by CSWP

www.aps.org/cuwip

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Guide for Undergraduate Physics Program Assessment, Review, and Improvement

1. Develop a guide for self-assessment of undergraduate physics programs founded on documented best practices linked to measurable outcomes

   The guide should provide a physics-community-based resource to assist programs in developing a culture of continuous self-improvement, in keeping with their individual mission, context, and institutional type. The guide should include considerations of curricula, pedagogy, advising, mentoring, recruitment and retention, research and internship opportunities, diversity, scientific skill development, career/workforce preparation, staffing, resources, and faculty professional development.

2. Recommend a plan for ongoing review and improvement of this guide under the oversight of the APS COE
Physics / STEM
Bachelor Degrees

Source: IPEDS
Hispanic American Bachelor Degrees

US Population Fraction 18-24 year olds

Sources: IPEDS Completion survey by race, US Census

105
570
African American Bachelor Degrees

US Population Fraction 18-24 year olds

Sources: IPEDS Completion survey by race, US Census


CS  Chemistry  Biology  Math&Statistics  Engineering  Physics  Geosciences

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URM Bachelor Degrees

Bachelor's Degrees in Physics

- Hispanic
- African American

Enhancing Diversity in Graduate Education
Underrepresented Minority (URM) Physics degrees

Sources: IPEDS Completion survey by race, US Census

Only ~30 students!

66 PhDs on average

US College-age minority population

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Bachelor and PhD STEM Degrees

<table>
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<tr>
<th>Field</th>
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<th>PhD</th>
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</tr>
<tr>
<td>Astronomy</td>
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</table>
8.2 JOINT DIVERSITY STATEMENT
(Adopted by Council on November 16, 2008)
To ensure a productive future for science and technology in the United States, we must make physics more inclusive. The health of physics requires talent from the broadest demographic pool. Underrepresented groups constitute a largely untapped intellectual resource and a growing segment of the U.S. population.

Therefore, we charge our membership with increasing the numbers of underrepresented minorities in physics in the pipeline and in all professional ranks, with becoming aware of barriers to implementing this change, and with taking an active role in organizational and institutional efforts to bring about such change. We call upon legislators, administrators, and managers at all levels to enact policies and promote budgets that will foster greater diversity in physics. We call upon employers to pursue recruitment, retention, and promotion of underrepresented minority physicists at all ranks and to create a work environment that encourages inclusion. We call upon the physics community as a whole to work collectively to bring greater diversity wherever physicists are educated or employed.
Leadership / Oversight

National Advisory Committee
- Emilio Codecido (OSU, Grad student)
- J.D. Garcia (Arizona)
- Yolanda George (AAAS)
- Wendell Hill (UMCP)
- Renee Horton (NSBP)
- Anthony Johnson (Chair, UMBC)
- Ramon Lopez (UT Arlington)
- James Mathis (UM, Grad student)
- Steve McGuire (Southern University)
- Jesús Pando (NSHP)
- Ritchie Patterson (Cornell)

Architect’s Council
- Marcel Agüeros (Columbia)
- Ed Bertschinger (MIT)
- Andreas Bill (CSU Long Beach)
- Simon Capstick (Florida State)
- Kelly Holley-Bockelmann (Fisk/Vanderbilt)
- Cagliyan Kurdak (Michigan)
- Garrett Matthews (USF)
- Jon Pelz (Ohio State)
- Talat Rahman (UCF)
- Jon Urheim (Indiana)

Research / Assessment
- Deepa Chari (FIU-Postdoctoral Assoc.)
- Geoff Potvin (FIU-Research advisor)
- Rachel Scherr (SPU-Project evaluator)

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Bridge Program Design: Underlying Themes

- Focus on underrepresented minorities (Hispanic American, African American, Native American)
- Base components on published scholarship and operational successes of similar programs
- Design program to avoid “rearranging the deck chairs”
- Bring unique position of APS to bear on the problem
- Measurable outcomes must be immediately recognizable by an APS member as having significant value
- Must have significant national impact
APS Bridge Program: 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 (21):
  • 44 graduate programs looked at “other” applications (2016), recruited additional students; No direct support, some travel
  • “COM approved” Partnership Institutions; national recognition of program

• **Monitor** student/site progress
• **Research**
• **Disseminate / Advocate**
Bridge/Partnership 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
- Delaware State University
- DePaul University*
- Embry-Riddle Aeronautical University
- Fisk-Vanderbilt
- Florida International University
- MIT

- North Dakota State University
- Princeton University
- Texas State University*
- 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 N. Carolina, Chapel Hill
- University of Rochester
- University of Texas, Arlington
- University of Virginia

*Master's degree is highest awarded
Institutional Members

Member Institutions
- 112 in 38 states

Partnership Institutions
- 27 in 16 states
- 21 PhD
- 6 MS

- Ohio State University
  - 11 students
  - Established 2013

- Indiana University
  - 5 students
  - Established 2015

- University of Central Florida
  - 11 students
  - Established 2015

- California State University Long Beach
  - 13 students
  - Established 2014

- Florida State University
  - 8 students
  - Established 2014

- University of South Florida
  - 10 students
  - Established 2013
Bridge Sites and Partnership Institutions

• Admission decisions ("holistic" criteria)
• Financial support (timing)
• Coursework (induction advising critical, allow advanced undergrad courses, alternative plan)
• Progress monitoring (timing, tutors if needed)
• Multiple mentors (intervention, peer involvement)
• Research (appropriate match)
Bridge Program Achievements

Bridge Program Physics PhDs

- 23% Women (20%)
- 93% URM (6%)
  - 64% Hispanic
  - 24% African American
  - 5% Native
- 88% Retention (60%)
What we didn’t know...

1. Aggregating applications is a powerful tool
2. Admissions data are not what they seem
   a. GRE is a big factor
   b. Students’ perceptions are different than faculty
3. Applications are expensive
4. Importance of graduate student groups
Some reasons students are not admitted

Students:
• Low physics GRE score
• Apply to too few or wrong places
• “Feel” unprepared (self-esteem)
• Inadequate preparation: will fail in grad courses
• Application materials do not tell a predictive story
• Life intervenes

Admissions Committees:
• Members overwhelmed
• Members unaware of admissions research findings
Research Efforts

• **Graduate admissions study**
  • Doctoral institutions
  • Master’s institutions

• **GRE (and other) admissions data:** Correlations with student success; impact on diversity

• **Holistic admissions practices:** practical use of non-cognitive measures or other practical techniques for use by physics graduate admissions faculty (parallel effort by CGS)

• **Student perspective on admissions**
Physics GRE: Impact of Cutoff Scores

Fraction (White)
Fraction (Hispanic)
Fraction (Black)
Fraction (Asian)

0.61 (Asian)
0.44 (White)
0.34 (Hispanic)
0.09 (Black)
Examples of national BP objectives that have potential for scaling nationally and require regional implementation include, but are not limited to: all high schools in a state offer advanced placement courses in calculus, computer science, and engineering; a disciplinary organization launches a major initiative designed to significantly improve the diversity of PhD graduates in that discipline; creating preK-20+ pathways in major urban centers involving universities, community colleges, local schools, surrounding communities, not-for-profits, museums and science centers, local businesses and industries, and science-rich institutions designed to enable success for students from underrepresented and low socio-economic groups.

Program Components

- Approved by APS Council: November 2014
- Launched April 2015
- Goal: Increasing the number of URM students who receive undergraduate degrees in physics
- Pairing faculty and URM students
- 160 mentors; 105 mentees paired
- National conference (21-23 October 2016) – in conjunction with REU Site Leaders meeting, Houston, TX
- Emergency aid funds distributed via mentors
- Planned: recognition of mentoring

Register: www.aps.org/nmc
Traditional Admissions Parameters Limit Access of Women, Racial Minorities, and US Citizens to US Physics PhD Programs but fail to Predict Doctoral Completion

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(Dated: March 1, 2017)

Admissions data for students entering a wide variety of physics PhD programs during 2000-2010 was collected and analyzed with respect to their ability to predict PhD completion. The data set corresponds to about 20% of students admitted to PhD programs in those years. Logistic regression analysis was conducted to determine the extent to which admission requirements, such as undergraduate grade point average and standardized tests, are predictive of PhD completion. Undergraduate GPA was the only statistically significant model, though that was limited to only males at programs with NRC rank of 20 or above; it’s practical significance is limited, though, because finishers and non-finishers have very similar GPA distributions. Notably, none of the Graduate Records Examination (GRE) tests was predictive in any combination of PhD completion. This is particularly relevant because the GRE Physics Subject test is a prominent tool used to admit students to PhD programs. Together with these results and the well documented and strong GRE score differences based on the race, gender, and citizenship of the test taker, the use of the GRE exams in physics admissions should end.
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