The APS Bridge Program: Changing the Face of Graduate Education

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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.
Hispanic American Bachelor Degrees

- Biology
- Engineering
- Chemistry
- Physics
- Math and Stats
- Earth Sciences

Source: National Center for Education Statistics, US Census, and APS
African American Bachelor Degrees

US College-Age Black Population

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

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URM Bachelor Degrees

Source: IPEDS
Underrepresented Minority (URM) Physics degrees

Only ~30 students!

Source: National Center for Education Statistics, US Census, and APS
Bachelor and PhD STEM Degrees

Enhancing Diversity in Graduate Education

Percentage of URM

<table>
<thead>
<tr>
<th>Field</th>
<th>BS</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td>78</td>
<td>6</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>639</td>
<td>61</td>
</tr>
<tr>
<td>Chemistry</td>
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<tr>
<td>Engineering</td>
<td>61</td>
<td>63</td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td>63</td>
<td>6</td>
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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)

Funding
- NSF
- APS
- Bridge sites

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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 (23):
  • 65 graduate programs looked at “other” applications (2017), recruited additional students; No direct support, some travel
  • “COM approved” Partnership Institutions; national recognition of program

• **Monitor** student/site progress

• **Research**

• **Disseminate / Advocate**
Student Eligibility

- Bachelor’s degree in physics or closely related discipline
- US citizen or permanent resident
- Either:
  - Applied but was not accepted
  - Did not apply to graduate program this year
- Be committed to improving diversity in physics
- Meet individual requirements of the institution
- Students may not be currently enrolled in a graduate program

We review applications AFTER April 15
Institution Involvement

• **Member Institution** (any institution, 134)
  Free; receive information / updates; reduced fees for APS-BP conferences

• **Partnership Site** (graduate only, 31)
  APS COM approval process; recommended site for Bridge Fellows (and others) to attend; demonstrate effective practices in graduate student support

• **Bridge Site** (graduate only, 6)
  Receive significant funding from APS; build sustainable program; prepare 2+ students each year for graduate study; significant institutional commitment

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**APS Bridge Partnership Sites**

*Bowling Green State University
*California State University Long Beach
*California State University, Los Angeles
Columbia University
Delaware State University
*DePaul University
Embry-Riddle Aeronautical University
Fisk-Vanderbilt
Florida International University
Florida State University
Illinois Institute of Technology
Indiana University
MIT
North Dakota State University
Ohio State University
Princeton University
*Texas State University
University of Central Florida
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 North Carolina at Chapel Hill
University of Rochester
University of South Florida
University of Texas at Arlington
University of Texas, San Antonio
University of Virginia
*Wright State University
Member and Partner Institutions

Member Institutions
• 134 in 38 states

Partnership Institutions
• 31 in 18 states
  ▪ 24 PhD
  ▪ 7 MS
Principles for Bridge 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%)

**URM PhDs reach same fraction as undergrad degrees**

Students

<table>
<thead>
<tr>
<th>Year</th>
<th>Left Program</th>
<th>Placed/Retained</th>
<th>Project Funding</th>
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<tr>
<td>2013</td>
<td></td>
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<td></td>
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<td>2016</td>
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<td></td>
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<tr>
<td>2017</td>
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Where did the 46 students go (2017)?

- Bowling Green State University
- CSU Long Beach (2)
- CSU Los Angeles (4)
- Delaware State University (2)
- DePaul University
- Fisk-Vanderbilt University (3)
- Florida State University (6)
- Indiana University (2)
- Ohio State University (3)
- Texas A&M University, Commerce
- Texas State University
- University of Central Florida (4)
- University of Cincinnati (3)
- University of Connecticut
- University of Houston, Clear Lake (3)
- University of Kansas (2)
- University of Massachusetts Dartmouth
- University of Minnesota Duluth
- University of North Carolina, Chapel Hill
- University of Rochester
- University of South Florida (2)
- University of Virginia
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
• **Graduate admissions study**
  • Master’s institutions (in preparation)

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

• **Holistic admissions practices:** practical use of non-cognitive measures or other practical techniques for use by physics graduate admissions faculty (parallel effort by CGS) (Phys. Rev. Phys. Educ. Res. 13, 020133 (2017))

• **Student perspective on admissions** (in preparation)
Physics GRE: Impact of Cutoff Scores

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

0.09 (Black)
0.34 (Hispanic)
0.44 (White)
0.61 (Asian)

650
GRE Physics Scores: Impact of Cutoff Scores

Source: ETS

Fraction (F) 0.25
Fraction (M) 0.46

650
Next Steps…

• Replicate process in chemistry, math, material science, astronomy, geosciences
• Mentoring / tracking students into careers / postdoc positions
• Broader implementation of advances made by Bridge Program (admissions, induction, 1st year support, peer and faculty mentoring)
• Spawning related research efforts in graduate education
• Interface with APS National Mentoring Community (www.aps.org/nmc)
  • New fund for emergency aid to NMC undergrads (BEAM: Bringing Emergency Aid to Mentees)
• Planning joint Bridge Program / National Mentoring Community Meeting: 16-18 November 2018: Stanford/Google

Happy Physicists ⇒ Great Physics