The APS Bridge Program: Changing the Face of Graduate Education

Theodore Hodapp
Director of Project Development
Senior Advisor to Education and Diversity
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

US College-Age Hispanic Population

Source: National Center for Education Statistics, US Census, and APS
Underrepresented Minority (URM) Physics degrees

Only ~30 students!

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

<table>
<thead>
<tr>
<th>Field</th>
<th>BS</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td>78</td>
<td>639</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>639</td>
<td>639</td>
</tr>
<tr>
<td>Chemistry</td>
<td>161</td>
<td>639</td>
</tr>
<tr>
<td>Engineering</td>
<td>386</td>
<td>639</td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td>61</td>
<td>63</td>
</tr>
<tr>
<td>Physics</td>
<td>61</td>
<td>63</td>
</tr>
<tr>
<td>Astronomy</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Percentage of URM
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)
- Maria Womack (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)
- Geraldine Cochran (Rutgers-Researcher)

This material is based upon work supported by the National Science Foundation under Grant No. 1143070. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
Bridge Program Design: Underlying Themes

• Focus on underrepresented racial/ethnic minorities (Hispanic American, African American, Native American)
• Based on published scholarship and operational successes of similar programs
• Avoid “rearranging the deck chairs”
• Measurable outcomes, easily recognizable by an APS member as having significant value
• Significant national impact
Bridge Program: Key Features

- **Recruit** students from entire country (application aggregation)
- **Establish** Bridge Sites (6):
  - Identified first universities that would commit to close attention to Bridge students through:
    - Induction into graduate student community / life / expectations
    - Constellation mentoring
    - Flexible curricula to prepare student for graduate coursework
    - Progress monitoring
    - Financial support.
- **Certify** Partnership Institutions (36):
  - APS Committee on Minorities reviews applications from physics graduate programs to ensure proper support for Bridge Students
  - Approved Partnership Institutions gain access to Bridge Student applications
- **Monitor** student / site progress
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, 137)
  Free; receive information / updates; reduced fees for APS-BP conferences

• **Partnership Site** (graduate only, 36)
  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)
  Received significant funding from APS; build sustainable program; prepare 2+ students each year for graduate study; significant institutional commitment

**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
- Florida International University
- Florida State University
- Illinois Institute of Technology
- Indiana University
- MIT
- North Dakota State University
- Ohio State University
- Princeton University
- Rensselaer Polytechnic Institute
- *Texas State University
- University of Alabama
- University of California, Los Angeles
- 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 Minnesota
- 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
• 137 in 38 states

Partnership Institutions
• 36 in 20 states
  ▪ 29 PhD
  ▪ 7 MS
Bridge Program Achievements

Bridge Program
Physics PhDs

- 23% Women (20%)
- 93% URM (6%)
  - 64% Hispanic
  - 24% African American
  - 5% Native
- 86% Retention (59%)

132 Students making progress toward PhDs

- All traditionally excluded

URM PhDs reach same fraction as undergrad degrees
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
Bridge Program Impacts: Ohio State

% URM of Current Domestic Graduate Students

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

National % BS
National % PhD

©2018, American Physical Society; Email: hodapp@aps.org
2018 Class (in progress)

- 86 applications
  - 36% female
  - 6% Native American
  - 53% Hispanic
  - 37% African American
  - 83% URM
  - 3 DACA students

- 49 received offers
  - More likely to receive offers from our Partnership Institutions

- 29 accepted
  - 19 at bridge
  - 10 at partnership sites
  - 20 students received offers, but have not yet accepted
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:
- Apply to too few or wrong places
- Low physics GRE score
- “Feel” unprepared (self-esteem)
- Inadequate preparation: will fail in grad courses
- Application materials do not tell a predictive story
- Life

Admissions Committees:
- Overwhelmed by application numbers
- Unaware of admissions research findings
Research Efforts

• Graduate admissions
  • Doctoral institutions (Phys. Rev. PER 13, 020142 (2017))
  • Master’s institutions (in preparation)

• Admissions data (GRE, GPA, etc.):
  • Correlations with success; diversity impact (in press: Science Adv.)

• Holistic admissions practices:
  • Use of non-cognitive measures and other techniques by physics graduate admissions faculty (Phys. Rev. PER 13, 020133 (2017))

• Student perspectives
  • Barriers to admissions (PERC, 10.1119/perc.2017.pr.018)
  • On admissions (in preparation)
  • In bridge programs (in preparation)
Use of Graduate Record Exam

Are GRE scores (quantitative, verbal, written, or physics subject) used as a minimum cutoff in admissions decisions?

- 32% indicate yes

How are GRE scores (quantitative, verbal, written, and physics subject in particular) being used in the admissions process?

- There is widespread (but not universal) use of GRE cutoffs:
  - “a rough cutoff”
  - “preferable score”
  - “as a first cutoff”
  - “No fixed cutoff, but GRE quantitative should be about 90 percentile or higher.”
  - “No hard cutoff, but used as a first cut in going through applications and GRE scores trump GPA scores in assessing students.”

- Lower NRC-ranked departments were more likely to use cutoff scores
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)
Physics GRE "Correlation" with Grad GPA

$r = 0.24; N = 1686$
“Weak” Correlation
Preliminary results: Interviews with bridge students

Importance of shared physical space to student success (and building community):

[Student 1:] So, we have a floor where everybody taking the core courses sit, and everybody keeps their door open when they are in their office. So, I can just pop in and ask, “Hey, are you working on this?” So, yeah, it makes it a lot easier to interact with people in my class. And, I know there are few others who have changed their floor (laughs) and moved with us ...they were taking these core courses last semester and they did not do so well. So, those were kind of isolated earlier because nobody kind of goes down on that floor to meet with them.

The Bridge Program as a critical opportunity:

[Student 2:] Honestly, the best moment of being a bridge student was when I became one. I had applied to many schools, and I was rejected from every single one. Someone reminded me about this program; I had seen it a long time ago and I was like, yeah, I have this in my back pocket in case I need it. But, you know, I was so delusional when it came to graduate admissions because, you know, you forget that you are competing with students globally ...So, it was the most exciting time [when] ...I was selected.
More Info / Next Steps…

• Re-create process in chemistry, material science, astronomy, geosciences using collective impact
• Mentoring / tracking students into careers / postdoc positions
• In talks with ETS to change how they report GRE Scores
• Broader implementation of advances made by Bridge Program (admissions, induction, 1st year support, peer and faculty mentoring)
• APS National Mentoring Community (www.aps.org/nmc)
• Bridge Program / NMC Meeting: 16-18 Nov 2018: Google / Stanford
• More info:
• Apply to become a Partnership Institution (next deadline: 1 Sept.)
More Info

Nature Comment published Today

Recommendations:
- Re-think admissions
- Provide a supportive culture
- ACS, AGU, AAS, MRS should also do this

Making physics more inclusive

Theodore Hodapp and Erika Brown explain how the American Physical Society is helping to recruit and retain PhD students from under-represented minorities.