Institute of Optics

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Rochester, NY

Changing the Demographics of Physics Graduate Education:
The APS Bridge Program

Theodore Hodapp
American Physical Society
Director of Education and Diversity
Joint Diversity Statement

08.2 JOINT DIVERSITY STATEMENT
(Adopted by APS, NSBP, NSHP in 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.
Physics / STEM Bachelor Degrees

Source: IPEDS Completion Survey

www.APSBridgeProgram.org ©2015, American Physical Society; Email: hodapp@aps.org
Hispanic Science/Math Majors

US College-age Hispanic population

Sources: IPEDS Completion survey by race, US Census

www.APSBridgeProgram.org ©2015, American Physical Society; Email: hodapp@aps.org
African American Science/Math Majors

US College-age African American population

Sources: IPEDS Completion survey by race, US Census

www.APSBridgeProgram.org
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Physics PhDs Number by Origin

Source: IPEDS Completion Survey
Physics PhDs
Domestic Fraction

Source: IPEDS Completion Survey
Underrepresentation in Physics

Source: IPEDS, US Census

www.APSBridgeProgram.org

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URM Physics PhDs to Minority Population

9-10% of BS degrees in physics are granted to underrepresented minorities

52 PhDs awarded to minorities in 2010

US College-age minority population

Sources: IPEDS Completion survey by race, US Census

www.APSBridgeProgram.org

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APS Bridge Program: Project Goals

• Increase, within a decade, the number of physics PhDs awarded to *underrepresented minority* students to match the fraction of physics Bachelor’s degrees granted to these groups

• Develop, evaluate, and document sustainable model bridging experiences that improve the access to and culture of graduate education for *all* students, with emphasis on those underrepresented in doctoral programs in physics

• Promote and disseminate successful program components to the physics community
Leadership / Oversight

National Advisory Committee
• J.D. Garcia (Arizona)
• Yolanda George (AAAS)
• Wendell Hill (UMCP)
• Anthony Johnson (UMBC)
• Ramon Lopez (UT Arlington)
• Steve McGuire (Southern University)
• Cherry Murray, chair (Harvard, APS President 2009)
• Luz Martinez-Miranda (President, NSHP)
• Paul Gueye (President, NSBP)
• Brittany Kamai (Grad student)
• James Mathis (Grad student)

Funding
• NSF (PHY, DMR, HRD)
• APS

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

Project Leadership
• Brian Beckford (APS, Project Mgr.)
• Theodore Hodapp (APS, Project Dir.)
• Arlene Modeste Knowles (APS)
• Geoff Potvin (FIU-Research advisor)
• Monica Plisch (APS)
• Rachel Scherr (SPU-Project evaluator)
APS Bridge Program: Key Features

• **Recruiting** through graduate programs (now 115+ institutions, representing 73% of all doctoral students), undergrad programs

• **Establish** Bridge Sites:
  • Year 1: Advanced undergraduate or grad courses, introduction to grad-level research, active mentoring, progress monitoring, social integration into grad school *(APS funds)*
  • Year 2: Take 1st year grad courses, apply to PhD program, research underway *(Department funds)*

• **Place** ancillary students (at Partnership Institutions):
  • 69 graduate programs look at “other” applications, recruited additional 7 students (2014)
  • Beginning approval of APS “COM approved” Partnership Institutions; national recognition of program
  • No direct support for students, some travel support possible

• **Monitor** student/site progress; **Research; Dissemination**
Institution Involvement

• **Member Institution** (any institution)
  Free; receive information / updates; reduced fees for APS-BP conferences (~70 institutions)

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

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

- Admission decisions ("holistic" criteria)
- Financial support (timing)
- Coursework (induction advising critical, allow advanced undergrad courses)
- Progress monitoring (timing, tutors if needed)
- Multiple Mentors (intervention, peer involvement)
- Community (induction)
- Research (appropriate match)
Partnership Institutions

• Accept students into their program (either from APS application pool, or Bridge Fellows)
• Follow guidelines of Bridge Programs

• “Approved” by APS Committee on Minorities (COM)
• Programs promoted on APS website
• Get early access to applicant pool
• “Recommended” by URM student advisors

Next Deadline: June 1
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:**
- Columbia University
- Fisk / Vanderbilt
- MIT
- Princeton University
- University of Chicago
- University of Michigan
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 or have an existing physics graduate degree

We review applications AFTER April 15
Student Recruitment

• Application Packets sent to all physics departments:
  • BS: 500; MS: 82; PhD: 171
• Advertisements (newsletters, publications, websites)
• Applicant pool shared with all physics bridge programs

Results:

<table>
<thead>
<tr>
<th>Year</th>
<th>Completed</th>
<th>URM</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>29</td>
<td>93%</td>
<td>18%</td>
</tr>
<tr>
<td>2014</td>
<td>41</td>
<td>93%</td>
<td>32%</td>
</tr>
</tbody>
</table>

APS in unique position to do this
## Admissions Decisions

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>28</td>
<td>41</td>
<td>60?</td>
<td>Applications received</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td>Bridge students selected</td>
</tr>
<tr>
<td>2015</td>
<td>23</td>
<td>69</td>
<td></td>
<td>Departments expressing an interest in recruiting these students</td>
</tr>
<tr>
<td>2016</td>
<td>12</td>
<td>23</td>
<td></td>
<td>Remaining applications circulated</td>
</tr>
<tr>
<td>2017</td>
<td>5</td>
<td>7</td>
<td></td>
<td>Additional students recruited by “Affiliated” sites</td>
</tr>
<tr>
<td>2018</td>
<td>13</td>
<td>25</td>
<td></td>
<td>Total number of students entering grad studies</td>
</tr>
</tbody>
</table>

None of these students would have entered graduate studies
Admissions Decisions

- Each bridge site uses their own criteria
- Physics GRE not required
- APS provides support for students who meet our criteria – insures we increase the number of URM students
- Increasing use of “non-cognitive” assessments – explored through Skype or in-person interviews
  - Self-concept
  - Realistic self-appraisal
  - Long-range goals
  - Grit / determination
Bridge Program Achievements

National Achievement Gap

Placed Students

Project Year

2013 2014 2015 2016 2017

Project Goal

Project Achievement

95% Retention
10-year PhD Completion Rates

Source: Council of Graduate Schools

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Student/Site Progress

• Visits to all sites that accepted students
  • Each APS site has developed a “team” to address multiple components of admissions/advising/mentoring/research
  • USF had change in leadership – resolved
• APS stays in contact with students ~1/semester
• Ohio State reports that URMs in their regular applicant pool went up substantially
• Only 2 of 37 students admitted thus far have departed (95% retention rate)
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

Considering:

• Data gathering on MS programs
• Departure paths from physics graduate programs
Physics GRE: Impact of Cutoff Scores

- Fraction (White)
- Fraction (Hispanic)
- Fraction (Black)
- Fraction (Asian)
GRE Physics Scores:
Impact of Cutoff Scores

Source: ETS
Admissions Bias?

GRE Scores for Physics

Subject Test

Before Graduate Admission

After Graduate Admission

Graduate GPA

Source: PhD Recipients from Oregon State University
Selected Project Findings

• Students either don’t apply or apply to too few places to be successful
• Graduate student organizations are key, and easy to form
• Sites admit students for 2-year program (APS covers costs for one transitional year)
• APS acting as “matchmaker” for students and programs
• Sites plan on admitting students to their own doctoral program
• Students take advanced undergraduate courses and some grad courses in first year (some take all grad courses)
• Students either getting poor mentoring/advice, or not following it in selection of grad school choices
• To solve the larger issue – need more URM undergrads
National Mentoring Community (NMC)

Plans (pilot launch March 2015):

• Increase URM degree completion in physics
• APS identifies / connects mentors
• Mentors recruit mentees (locally)
• Provide an annual gathering of mentors and mentees to:
  • Spread best-practices; conduct professional skills workshops; connect students and their mentors with others (9-10 October 2015)
• Provide merit-based honors
• Needs-based scholarship program
• Track student progress
• Math Alliance has developed a network of 350+ mentors providing local mentoring to 600+ undergraduates
Key Takeaways

• APS acts as “super-recruiter” for many graduate programs (PhD and MS) – Essentially the “Ultimate Safety School” – applying for students to more than 70 institutions – at zero cost to students!

• Program could actually “solve” national achievement gap in physics (very rare!); APS in unique position to advance solution

• Just recruited first “Partnership Institutions”

• ACS, AMS interested in possible replication

• Annual meeting: 9-11 October 2015; Miami, FL at FIU

• National Mentoring Community arising from COM

www.NationalMentoringCommunity.org