University of Virginia

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The APS Bridge Program:
Changing the Face of Graduate Education

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APS Education and Diversity Programs

• APS Bridge Program
• PhysTEC
• Conferences for Undergraduate Women in Physics (CUWiP)
• National Mentoring Community
• New Faculty Workshops
• Best Practices in Undergraduate Physics Programs
• STEP UP 4 Women
  • Physics chairs meeting (7-9 June)
  • REU site leaders
  • Prof. skills development workshops
  • Graduate education conference

• Advocating for physics education
• Childcare at meetings
• Mentoring seminar materials
• Ethics case studies
Focus on professional development, networking, understanding pathways
Attendance more than tripled since APS became involved in 2012
Very good URM attendance
Departments using CUWiP as retention event for 1st year students
Support from NSF, DOE
11 sites for 2018, plus 1 in Canada
Directed research efforts to improve messaging to women sees positive changes
National leadership group; Current chair: Pearl Sandick, Utah; Overseen by CSWP
Site applications due 1 November for 2019 conferences
Percentage of Women in Physics

Source: National Center for Education Statistics and APS
Percentage of Women in Physics

Sources: NCES/IPEDS, AIP-SRC, HERI
Effects of Interventions

Hazari, Potvin, Lock, Lung, Sonnert, and Sadler, "Factors that affect the physical science career interest of female students: Testing five common hypotheses," PRST PER 9 020115 (2013)
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

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
URM Bachelor Degrees

Source: IPEDS

Hispanic
African American
Underrepresented Minority (URM) Physics degrees

Only ~30 students!

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

Percentage of URM Bachelor and PhD Degrees

- Computer Science: BS 639, PhD 78
- Biological Sciences: BS 161, PhD 6
- Chemistry: BS 386, PhD 61
- Engineering: BS 639, PhD 6
- Mathematics and Statistics: BS 161, PhD 6
- Physics: BS 386, PhD 6
- Astronomy: BS 639, PhD 6

Enhancing Diversity in Graduate Education
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 (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, 125)
  Free; receive information / updates; reduced fees for APS-BP conferences

• **Partnership Site** (graduate only, 32)
  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

**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
*Towson 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
• 125 in 38 states

Partnership Institutions
• 32 in 18 states
  ▪ 24 PhD
  ▪ 8 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%)

National Achievement Gap

Students

- Left Program
- Placed/Retained
- Project Funding

2013 2014 2015 2016 2017

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Where did the 48 students go (2017)?

- Bowling Green State University
- CSU Long Beach (2)
- CSU Los Angeles (5)
- 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 (5)
- 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**
  - Doctoral institutions (accepted for publication)
  - 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) (accepted for publication)
• **Student perspective on admissions**
Physics GRE: Impact of Cutoff Scores

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

- Black: 0.09
- Hispanic: 0.34
- White: 0.44
- Asian: 0.61

Graph showing the percent of students who meet the minimum cutoff scores, considering fraction: 650.
GRE Physics Scores: Impact of Cutoff Scores

Source: ETS

- Fraction (F): 0.25
- Fraction (M): 0.46

Score: 650
Next Steps...

• Replicate process in chemistry, math, 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/ncm)
  • New fund for emergency aid to NMC undergrads (BEAM: 
    Bringing Emergency Aid to Mentees)
• Planning joint Bridge Program / National Mentoring Community 
  Meeting: Fall 2018

Happy Physicists ⇒ Great Physics