Promoting Gender Equity in STEM: Theory and Applications

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Why are we here?
Theory
The number of women receiving physics PhDs and bachelor's degrees are both at all-time highs, 365 and 1,550 respectively. The percentage of physics PhDs awarded to women has been increasing, whereas the percentage of physics bachelors awarded to women has been declining in recent years.
Percent of PhDs earned by women in selected fields, 1958-2006

AIP Statistical Research Center. Compiled from data collected by National Science Foundation.
Number of Hispanic and African-American female PhDs in Physics, 1979-2006.

- **African-American**
  - 1979 - 1985: 2
  - 1992 - 1986: 3
  - 1999 - 1993: 16
  - 2000 - 2006: 21

- **Hispanic-American**
  - 1979 - 1985: 7
  - 1992 - 1986: 16
  - 1999 - 1993: 21
  - 2000 - 2006: 18

AIP Statistical Research Center compiled from data collected by the National Science Foundation.
There are ~190 such departments and the median number of faculty is 29.
Number of Women in Physics and Astronomy Departments, 2012 by Highest Degree Awarded

- **PhD**
  - 2008: 465
  - 2012: 563
  - African-American: 14
  - Hispanic: 19
  - Asian: 147
  - White: 106

- **Master's**
  - 2008: 64
  - 2012: 74
  - African-American: 3
  - Hispanic: 7
  - Asian: 29
  - White: 22

- **Bachelor's**
  - 2008: 340
  - 2012: 411
  - African-American: 12
  - Hispanic: 12
  - Asian: 56
  - White: 77

[www.aip.org/statistics](http://www.aip.org/statistics)
Causes for Concern
adapted from APS Women in Physics site
http://www.aps.org/programs/women/reports/bestpractices/
[many of these also apply to members of other marginalized groups]

No effort to develop a sense of community or improve the climate. Denial that such issues matter to people.

A sub-critical mass of female employees; premature departure of female employees.

Lack of investment in and/or promotion of female employees at all levels. No visible leadership roles for female employees in the unit.

Isolation or marginalization of female employees.

Derogatory comments about female employees to reduce their ability to bring about change (e.g., “difficult” or “troublemaker”).

A highly politicized climate where decision-making processes are not transparent.

Inability on the part of senior female scientists/engineers to get sufficient lab space, research funding, or other resources needed to become leaders in their fields.

Strong support for more junior employees who are not in a position to drive change, but weak support for senior female employees who attempt to change the climate.
Why are we here?
Implicit Bias

• We are all (women and men) prone to unintentional bias

  Think not? try the Implicit Associations Test at
  https://implicit.harvard.edu/implicit/demo

• This affects many decisions we make in the course of our professional duties

The Gender Equity Project, Virginia Valian
www.hunter.cuny.edu/genderequity/
Our beliefs about pre-requisites for success are part of the problem:


Greater prevalence of belief that special talent/brilliance is required for success.
GRANT GAP

Aggregating data for 2008–12, the European Research Council found no correlation between the percentage of women on its evaluation panels and the success rate of female applicants.

Related results in Moss-Racusin et al., PNAS 1211286109 (2012).

Worse, we are all biased...

THE FUNDING GAP
Women are earning an increasing share of research grants from the US National Institutes of Health (NIH) but the average size of their awards has consistently lagged behind what men receive.

2002
NUMBER OF NIH RESEARCH GRANTS
31,801
10,199
Proportion going to women 24%
2002
AVERAGE SIZE OF GRANT
$403,047
$330,169

2012
NUMBER OF NIH RESEARCH GRANTS
30,768
13,025
Proportion going to women 30%
2012
AVERAGE SIZE OF GRANT
$507,279
$421,385

THE SALARY GAP
Female scientists in the United States earn much less than men, on average, with the difference varying strongly by field.

BIOLOGY
2008 median salaries
$65,000
$50,000

CHEMISTRY
2008 median salaries
$79,000
$62,000

PHYSICS AND ASTRONOMY
2008 median salaries
$89,000
$54,000

18% AVERAGE PAY GAP ALL POSITIONS
### Who has access to career-advancing experiences?

#### Table 2. Percentage of respondents with career-advancing experiences.*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Less developed countries</th>
<th>Very highly developed countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Gave a talk at a conference as an invited speaker</td>
<td>51</td>
<td>67</td>
</tr>
<tr>
<td>Served on committees for grant agencies</td>
<td>22</td>
<td>37</td>
</tr>
<tr>
<td>Conducted research abroad</td>
<td>54</td>
<td>71</td>
</tr>
<tr>
<td>Acted as a boss or manager</td>
<td>38</td>
<td>53</td>
</tr>
<tr>
<td>Served as editor of a journal</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Advised graduate students</td>
<td>63</td>
<td>77</td>
</tr>
<tr>
<td>Served on thesis or dissertation committees (not as an adviser)</td>
<td>52</td>
<td>66</td>
</tr>
</tbody>
</table>

* AIP Global Survey of Physicists 2012
• **solutions** include:

  ✴ **leaders** emphasize importance of diversity for achieving institutional goals

  ✴ **institutions** ensure criteria and processes for hiring, promotion and awards are clear, written, and available

  ✴ **HR departments and hiring/award committees**
    ✴ frame searches broadly to attract a diverse pool
    ✴ trained to recognize and minimize implicit bias
    ✴ explicitly use multiple dimensions to evaluate candidates’ qualifications (e.g. # publications, research impact, patents, projects led successfully)
    ✴ have women interviewees meet women employees

  ✴ **units and professional societies** offer professional development opportunities for women at all levels
Dual-Career Couples

• a pervasive issue in physics
  (Dual-Science-Couple Survey, McNeil & Sher, 1998; 1990 APS Survey)
  - 68% (18%) of married physicists have scientist spouses
  - 31% (6%) of all physicists < 31yrs have scientist spouses
  - In 85% of couples, man is older [thus, more senior in job]
  - Dual-science-couples seeking first faculty jobs reported
    • short-term career goals affected by these issues (86%)
    • one partner (usually woman) was under-employed (60%)

• solutions include:
  ➫ Employers advertise clear, gender-neutral partner hire policies
  ➫ Employers support 2nd partner’s career success
  ➫ Employers reframe dual-career assistance as recruitment tool
  ➫ Employers form Recruitment Consortia (e.g., HERC)
  ➫ Senior job candidates raise dual-career issues early [model]
Everybody is Very Busy

Mason, Stacy, and Goulden, 2004; Data on UC faculty, ages 30-50
Figure 1. The majority of housework is more likely to be done by women than by men. The results shown here were derived from the responses to a global survey conducted by the American Institute of Physics and filled out by almost 15,000 physicists. To generate this graph we disregarded the responses of those physicists whose spouse or partner was not employed. The disproportionate burden of housework on women holds independent of level of development of the respondent’s country.
What is the career impact of having children?

Figure 2. Having children tends to slow the career progress of women physicists but not that of their male counterparts. To generate the data that produced this graph, a global survey analyzed responses from some 15,000 physicists to compare their career progress with that of their colleagues.
POSTGRADUATE POSITIONS
A 2009 survey of postdoctoral fellows at the University of California showed that women who had children or planned to have them were more likely to consider leaving research.

POSTDOCS WHO DECIDED AGAINST CAREERS AS RESEARCH FACULTY MEMBERS (2009)

- 19% No children or plans to have them
- 20% No children, but plan to have them
- 17% Children previous to postdoc
- 19% New children since start of postdoc

“The plan to have children in the future, or already having them, is responsible for an enormous drop-off in the women who apply for tenure-track jobs.”
Wendy Williams, Cornell University

EARLY CAREER
Female representation among science and engineering faculty members in the United States has lagged behind gains in graduate education, in part because many women do not apply for tenure-track jobs. But women who do apply are more likely than men to receive interviews and offers.

“At least part of the lack of applications is due to the fact that women look at these careers and don’t see people like themselves.”
Hannah Valantine, Stanford University

<table>
<thead>
<tr>
<th>Field</th>
<th>Female PhDs (1999–2003)</th>
<th>Female applicants for academic jobs</th>
<th>Female interviewees for academic jobs</th>
<th>First job offers that went to women</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOLOGY</td>
<td>45%</td>
<td>26%</td>
<td>28%</td>
<td>34%</td>
</tr>
<tr>
<td>CHEMISTRY</td>
<td>32%</td>
<td>18%</td>
<td>25%</td>
<td>29%</td>
</tr>
<tr>
<td>PHYSICS</td>
<td>14%</td>
<td>12%</td>
<td>19%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Nature, Vol 495, 7 March 2013
Negotiation

Women Don’t Ask: Negotiation and the Gender Divide (Linda Babcock & Sarah Laschever, 2003)

• Women avoid negotiation because they are
  - unsure what they “deserve”; fear asking too much
  - worried about harm to relationships
  - less optimistic about benefits of negotiation
  - not confident of their negotiation skills
  - relatively risk-averse

• In negotiations, women tend to
  ✴ ask for less -- and therefore receive less
  ✴ use “interest-based” negotiation approach, focused on underlying needs/motives rather than narrow concrete goals

(Getting to Yes: Negotiating Agreement Without Giving In, Roger Fisher & William Ury, 1990)
Who has access to professional resources?

Table 1. Percentage of respondents with access to key resources.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Funding</td>
<td>34</td>
<td>51</td>
</tr>
<tr>
<td>Office space</td>
<td>64</td>
<td>74</td>
</tr>
<tr>
<td>Lab space</td>
<td>42</td>
<td>47</td>
</tr>
<tr>
<td>Equipment</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>Travel money</td>
<td>31</td>
<td>47</td>
</tr>
<tr>
<td>Clerical support</td>
<td>22</td>
<td>38</td>
</tr>
<tr>
<td>Employees or students</td>
<td>42</td>
<td>53</td>
</tr>
</tbody>
</table>
• **Solutions include**

  ✴ **Professional organizations** offer workshops on negotiation skills e.g. APS Professional Skills Development Workshops offered annually at major physics meetings (sponsored by NSF); has impacted > 250 women physicists since 2005 http://www.aps.org/programs/women/workshops/skills/

  ✴ **Mentors** teach women (and men) that interest-based negotiation is very effective and improves professional relationships

  ✴ **Mentors** recommend targeted readings such as *Ask For It* (Babcock/Laschever, 2009) and *Getting to Yes* (Fisher/Ury, 1990)

  ✴ **Employers** offer clear directions to job finalists to avoid unintended bias in discussions of salary and hiring packages
Applications
Application I:
ICTP
Career Workshops for Women Physicists from Developing Nations
(2013, 2015, 2017... planning for 2019)
Collaborating for 30 years

Shobhana Narasimhan (JNCASR, Bangalore, India)
Elizabeth H. Simmons (UC San Diego and MSU, U.S.A.)
Career Development Workshop for Women in Physics
12 - 16 October 2015
Miramare, Trieste - Italy
# Immediately Relevant Topics

<table>
<thead>
<tr>
<th>Specific Skills</th>
<th>Career Pathways</th>
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<tbody>
<tr>
<td>CV preparation</td>
<td>Picking a research problem</td>
</tr>
<tr>
<td>Publishing tips</td>
<td>Transitioning from academe to industry</td>
</tr>
<tr>
<td>Negotiation</td>
<td>Workplace challenges</td>
</tr>
<tr>
<td>Teaching strategies</td>
<td>Work-Life issues</td>
</tr>
<tr>
<td>Writing methods</td>
<td>The culture of physics</td>
</tr>
<tr>
<td>Funding opportunities</td>
<td>Careers in different countries</td>
</tr>
</tbody>
</table>
Varied Formats

Lecture, demonstration, panel, Workshop, team assignments, Theatre-based, posters, discussion
Diversity of Speakers

Physics sub-field, Country of origin, Career stage, Gender, ...

[Image of people standing in a line]
Impact
based on survey and post-workshop communications

- Sense of community
- An enduring network
- Inspiration to persevere
- New directly useful career skills
- Perspective on global context of women physicists
- Plans to share what was learned back at home institution
- Plans to organize a similar conference in home country
- Request for future workshops to benefit more women physicists
Application II:
Supporting LGBT Physicists in the American Physical Society
Charge to APS Ad-Hoc Committee on LGBT Issues

“…advise the APS on the current status of LGBT issues in physics, provide recommendations for greater inclusion, and engage physicists in laying the foundation for a more inclusive physics community.”

Kate Kirby,
Executive Officer of the APS
Welcome to the first website for lesbian, gay, bisexual, transgender, intersex, queer, questioning, asexual, pansexual, not-cisgender and not-straight (as well as friendly cis and straight) physicists. This resource website has come out of a need for resources for gender and sexual minority (GSM) physicists. We serve as a networking resource for young GSM physicists and students to find mentors, a place to find resources for laboratories and universities to make their physics departments more GSM friendly, as well as a hosting of information of get togethers of GSM physicists and allies.

Along with the AAS Working Group on LGBTQ+ Equality, have recently updated our Best Practices Guide for physics and astronomy departments! It includes a list of suggestions that your department can enact to make it more inclusive and welcoming towards LGBT+ students and faculty.

If you would like to join our mailing list, please join the the Google Group below. If you are a physicist who is either an out GSM or ally, please consider e-mailing us so that we can add you our OutList, which will help other physicists network with you. If you would like to offer your skills and talents towards this cause, please contact us.

We look forward to meeting you and continuing to build this community!

Subscribe to lgbtp+physicists
Email: [Input Field] [Submit]

Visit this group
Information Gathering

Focus Groups at APS Meetings
2014 and 2015 at both March and April Meetings

Climate Survey of LGBT Physicists (May-June 2015)
Surveyed 324 individuals through snowball sampling. Follow up interviews with 5 survey participants.

APS Membership Survey Question (October 2015)
2,596 responses of which 2.5% identified as LGBT and 14% preferred not to provide this information. Notably, 16.3% of those 18-25 identified as LGBT.
Background and Findings 2

The overall climate experienced by LGBT physicists was highly variable.
In many physics environments, social norms establish expectations of closeted behavior.

“In the last lab I worked with, I was afraid to even mention that I might be gay. They were all very traditional sort of people.”

“Because I am in the closet about my identity, and I pass just fine as a result, I am actually quite comfortable in these areas. What people don’t know can’t hurt me!”

“I don’t know of any other ‘out’ physics grad students. I know that a lot of them are very conservative. And I feel like they respect me right now. But I don’t know that they would respect me if I came out to them.”
Many LGBT physicists are at risk for leaving their workplace or school. 

36% Considered leaving their workplace or school in the prior year

“Just you not being able to figure me out doesn’t really need to qualify whether I can be educated here..”

“... And the outlook for me in terms of getting a Ph.D., which is what I’m kind of debating whether or not I want to do, is really contingent upon whether or not I have the right type of support system around me to be able to facilitate my success.”
Recommendation 1
Ensure a safe and welcoming environment at APS meetings.

APS should establish written best practices for APS meetings that support inclusion and attend to issues particular to LGBT physicists for dissemination to conference organizing committees and meetings staff.

APS should implement the Code of Conduct with thorough and careful regard to informing members and responding to reports of infractions.
Recommendation 6
Support the establishment of a Forum on Diversity and Inclusion.

APS should support the establishment of a new APS Forum that works to build a more inclusive, diverse and equitable society for all physicists, including those who identify as LGBT, women, racial or ethnic minorities, persons with disabilities and others.

Update: A proposal and bylaws for the Forum are in the works!
How all Physicists can Promote Diversity & Inclusion

- Recognize these issues are worthy of discussion and effort within the physics community
- Seek and support physics talent, potential, and accomplishment in the broadest range of individuals
- Stand up for colleagues who work on these issues
- Consciously examine the most reliable evidence when making decisions, to minimize the impact of implicit biases
- Listen closely to the lived experiences of other physicists
- Join the efforts to establish an APS Forum on Diversity & Inclusion, to help us all recruit, train, and keep the best physicists in our field
Resources:

AIP Statistical Research Center:  www.aip.org/statistics/

American Physical Society
   C-LGBT Report:  go.aps.org/lgbtphysics

Faculty Family Friendly Edge:  ucfamilyedge.berkeley.edu/

Gender Equity Project:  www.hunter.cuny.edu/genderequity/

Implicit Associations Test  https://implicit.harvard.edu/implicit/demo

lgbt+physicists
   Website, with Out and Ally lists lgbtphysicists.org

NSF ADVANCE
   Portal Website:  www.portal.advance.vt.edu/
   Michigan State’s ADAPP-ADVANCE Project:  www.adapp-advance.msu.edu/
   StratEGIC Gender Equity Toolkit:  www.colorado.edu/eer/research/strategic.html

More Resources:

Books:
• L. Babcock and S. Laschever [negotiation], *Women Don’t Ask* and *Ask For It*
• S.E. Page [diversity and teams] *The Difference*
• C. Steele [stereotype threat] *Whistling Vivaldi*
• J. Williams & R. Dempsey [patterns of bias] *What Works for Women at Work*
• E. Ideal & R. Meharchand, eds. [women role models in STEM] *Blazing the Trail*
• T. Wilson [conscious & unconscious mental processes] *Strangers to Ourselves*

Articles:
• *Nature* special issue: Vol. 495, 7 March 2013
• *Inside Higher Ed*, column: *Mend The Gap* [E.H. Simmons]
• *Inside Higher Ed*, column: *Mentoring 101* [Kerry Ann Rockquemore]

Organizations:
• National Center for Faculty Development & Diversity [http://www.facultydiversity.org](http://www.facultydiversity.org)
• MentorNet [http://mentornet.org](http://mentornet.org)
• National Society of Black Physicists [http://nsbp.org](http://nsbp.org)
• National Society of Hispanic Physicists [http://www.hispanicphysicists.org](http://www.hispanicphysicists.org)
• SACNAS [http://sacnas.org](http://sacnas.org)