

# Attracting and Advancing Women in Physics



Second IUPAP International  
Conference on Women in  
Physics

2005

*Crackerbarrel Session*  
*2005 August AAPT Meeting*  
*Salt Lake City, UT*

**Beverly Karplus Hartline**  
**Barbara L. Whitten**



# Women in Physics: Few but Fantastic!

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- **Melba Newell Phillips**
- **Lise Meitner**
- **Maria Goeppert Mayer**
- **C.S. Wu**
- \* \* \*
- **How many girls and women had the potential to be great physicists, but . . . ?**
- **Where would physics and physics education be today, if more women had been encouraged and allowed to participate?**

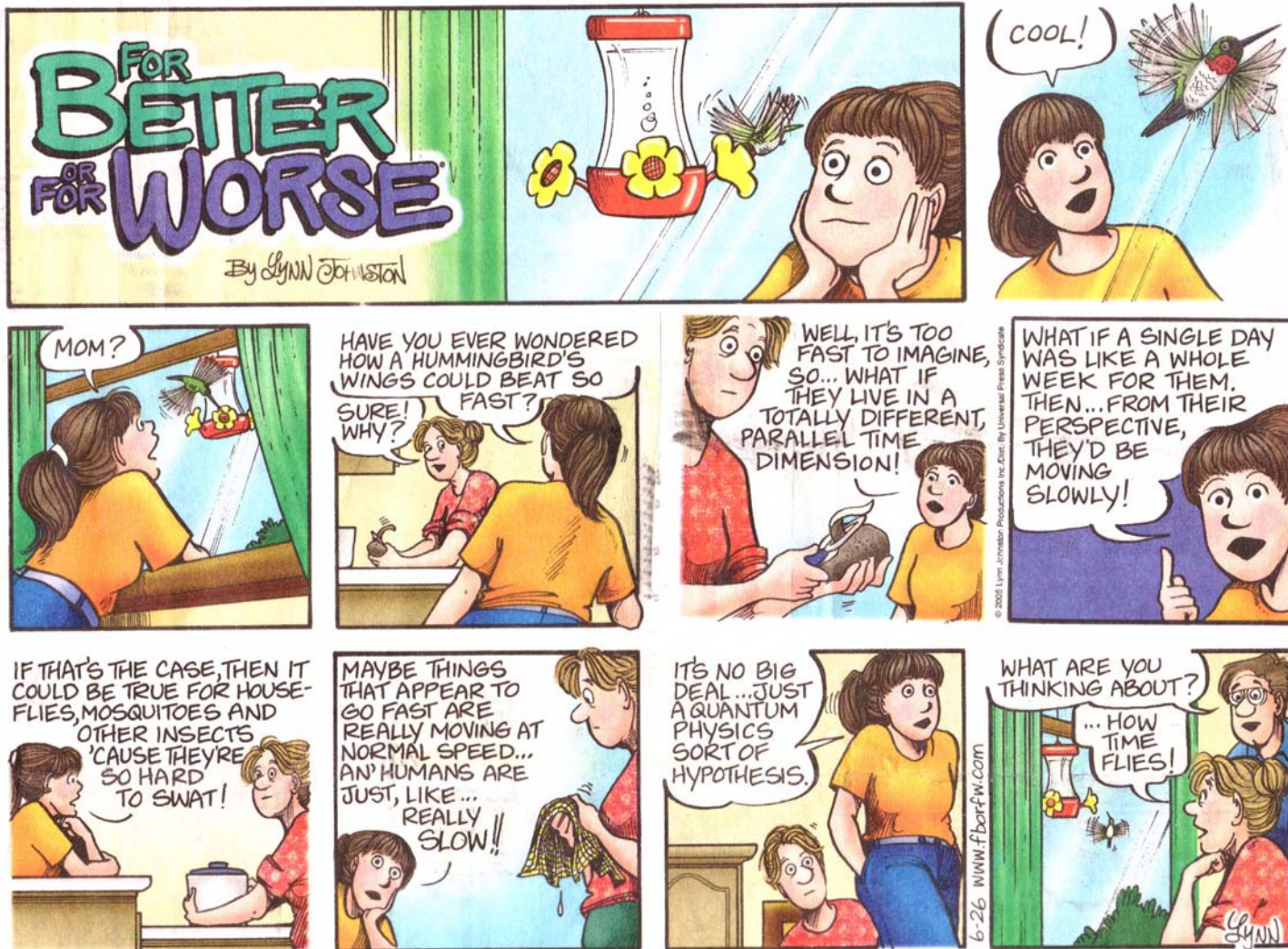


# Ideas lost ...



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# Setting the Stage

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- **Women are scarce in physics internationally**
  - Some countries have more, some fewer, than USA
  - Physics is deprived of the ideas more women would bring
  - Women lack the opportunities physics offers
- **Many are working to change these sorry statistics**
- **Purpose of Crackerbarrel is to identify and share strategies that increase the participation and advancement of women in physics**
  - Ideas from around the world: 2nd International Conference on Women in Physics, Rio de Janeiro
  - Your ideas and experiences

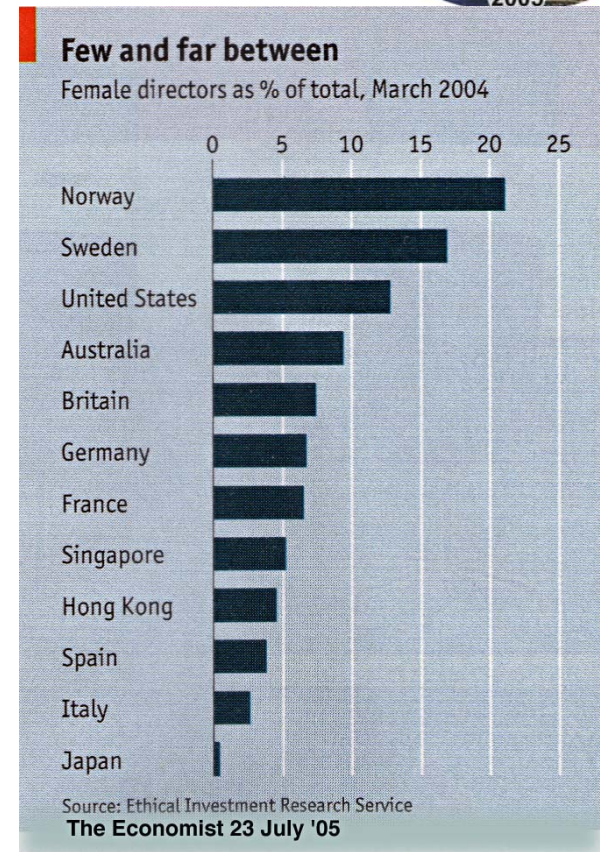


# Physics PhDs to Women ~1998



- France 27%
- Ukraine 23%
- India 20%
- United Kingdom 16%
- USA 13%
- Canada 12%
- Germany 9%
- Japan 8%

From R. Ivie et al "Women Physicists Speak"  
(2002), in Women in Physics, AIP Conf. Proc.  
628

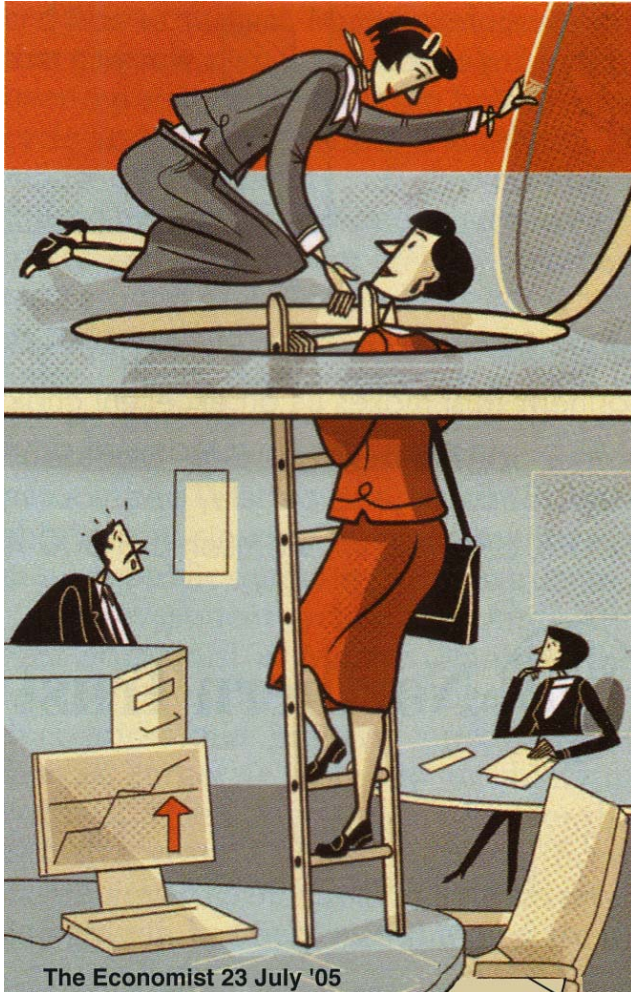


Women on corporate boards.

Source: *Economist* 7/05



# A "Glass Ceiling" in All Countries



The Economist 23 July '05

Source: *Economist* 7/05

- Zero to very few women in leadership positions
- Zero to few "professors"
- Few assistant and associate professors
- Several post-docs
- Even more grad students
- Efforts by women & men are helping some women through the glass ceiling into leadership

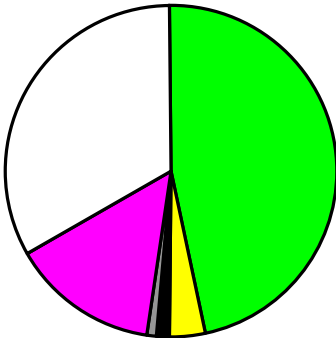


# S & E PhDs in the 1999 Workforce:

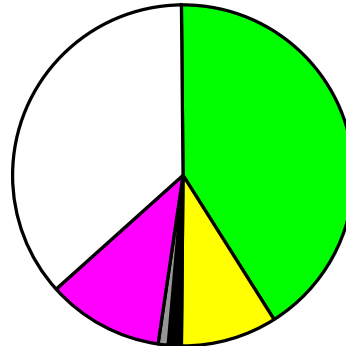
## **Variable** Women & Asians; Minorities **Scarce**



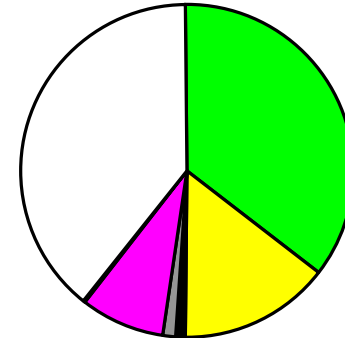
**Engineering**  
(84 K)



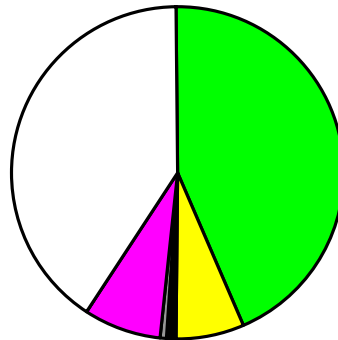
**Computer Sci/Math**  
(67 K)



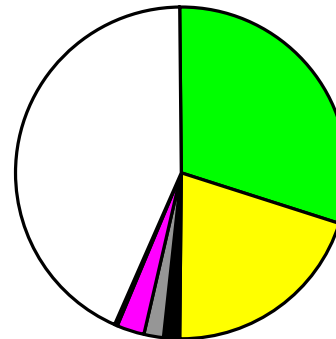
**Life Science**  
(121 K)



**Physical Science**  
(85 K)



**Social Science**  
(127 K)

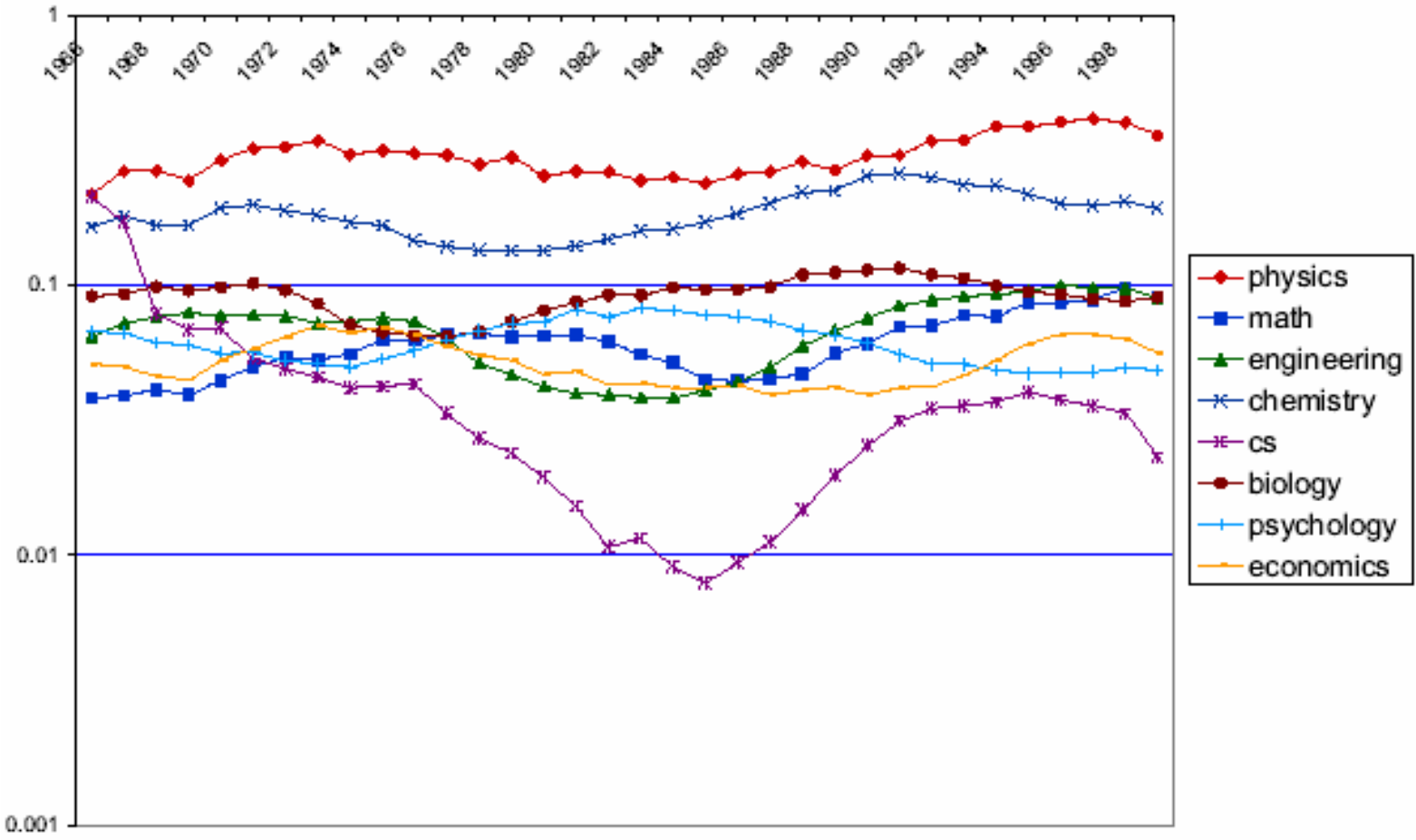


Source: NSF 7/03)





## PhDs / BAs



From Howard Georgi





there is a lot of structure - probably many things are going on - but three things stand out about physics

- 1:** it is MALE - there are very few women
- 2:** it is TINY - particularly at the undergraduate level
- 3:** and it is FOCUSED on advanced degrees

From Howard Georgi



# Second International Conference on Women in Physics, Rio de Janeiro, May 23-25, 2005



- **Organized by Brazil (E. Saitovitch and M. Barbosa) under the umbrella of the Working Group on Women in Physics of IUPAP**
- **Purpose:**
  - **Follow-up on the First Conference (Paris, March 2002)**
  - **Share progress and status to date,**
  - **Pursue strategies to increase participation and advancement of women in physics**
- **Attended by ~145 physicists from 42 countries: ~93% women, ~7% men**



# Rio Conference Content and Format



- **Plenary talks on specific successful initiatives**
- **Posters on status and progress from each country**
- **Posters and networking on physics research or women-in-physics research**
- **Shared progress and ideas in small groups**
  - **Attracting girls to physics**
  - **Launching a successful career**
  - **Achieving leadership roles**
  - **Improving the institutional climate**
  - **Balancing family and career**
  - **Understanding regional differences**



# Women in Physics: The Second IUPAP International Conference



Web site: <http://www.cbpf.br/~women-physics/>



# Team USA



- **21 Americans from 15 states**
  - 12 White, 5 Black, 2 Hispanic, 2 Asian (1 male)
  - 4 grad students, 3 post-docs, 3 early-career
  - 2 social scientists plus others whose research centers on women and/or minorities in physics/science
  - Supported by NSF-PHY, NSBP, AIP, Oklahoma State, LSU, Olin College of Engineering, Univ. Alabama, LLNL



# Unanimous Resolution to IUPAP

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- **Spur action to increase inclusion of women of all races and nationalities in physics & its leadership:**
  - **Accountability and reporting of participation: countries and international conferences & family-friendliness**
  - **Inclusion of isolated physicists (e.g. on family leave, in developing countries, from marginalized groups)**
  - **Transparent processes in physical societies and institutions**
  - **Training on gender equity, mentoring, pedagogy and curricula**
  - **Global survey in 2007 followed by 3rd International Conference in 2008 (possibly in Asia)**
- **To be presented for approval at IUPAP 25th General Assembly in Cape Town, South Africa**



# Lobby Our IUPAP Liaison Committee

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- **Chair: Barry C. Barish, California Institute of Technology**
- **Vice Chair: Robert Austin, Princeton University**
- **Secretary: Amy Flatten, American Physical Society**
- **AAPT: Edward F. (Joe) Reddish, University of Maryland**
- **AIP: James Stith**
- **APS: Lynn Boatner, Oak Ridge & David Ernst, Vanderbilt University**
- **Acoustical Soc. of America: Philip Marston, Washington State Univ.**
- **Members-at-Large: Cherry Murray, LLNL; Pierre C. Hohenberg, Yale University; David D. Jackson, UCLA; Morton S. Roberts, NRAO; Stephen White, UC-Irvine**



# Some International Insights

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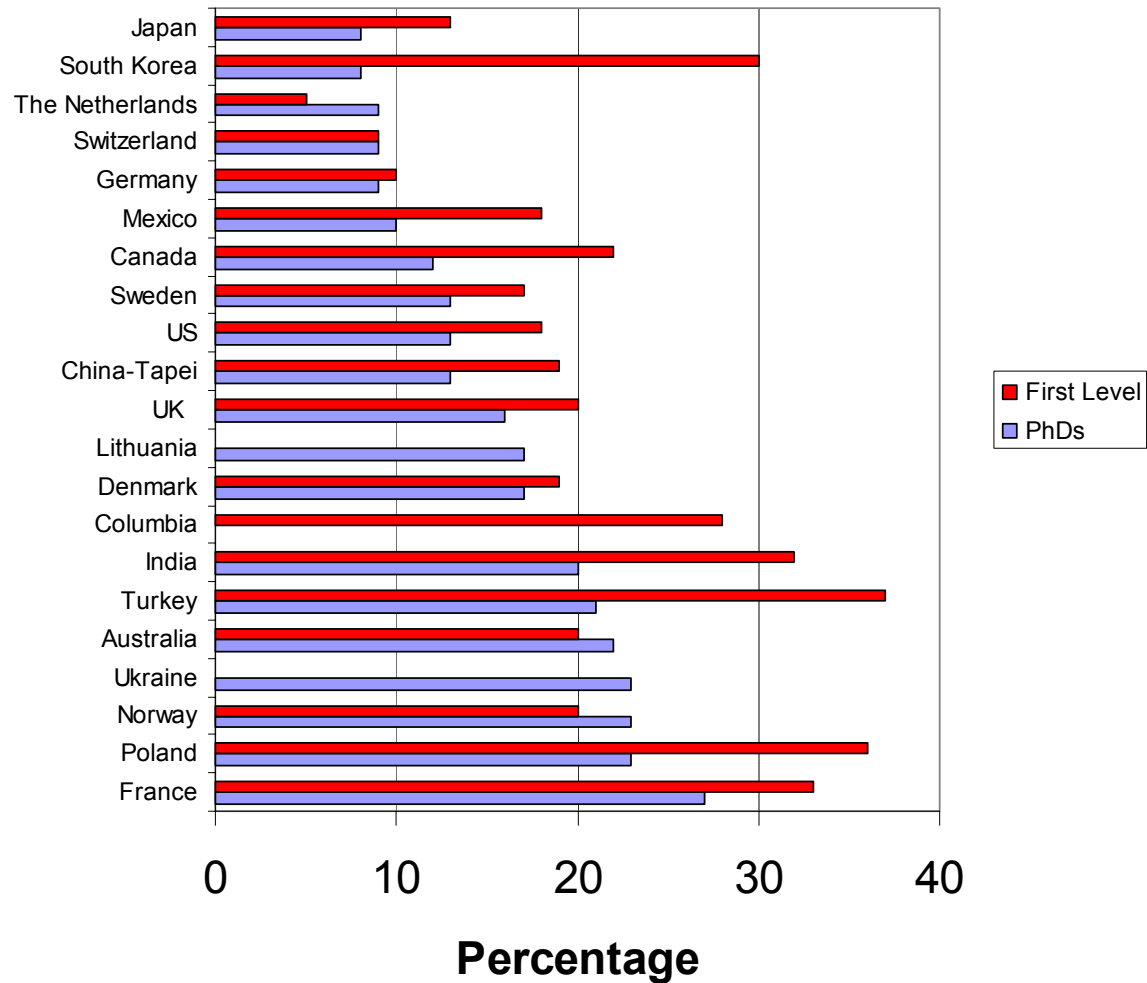


- In an international meeting, non-native English speakers are significantly disempowered.
- The US is a **VERY** rich country. After listening to Zohra Ben Lakhdar talk about her struggles to set up a research group in Tunisia, I promised myself I would never complain again about lack of resources.
- The economic reforms in China have in some ways made things worse for women—the enforced gender equality of socialism is giving way to discrimination.





## Percentage of Physics Degrees Awarded to Women, 1997-8



# More International Insights

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- The percentage of women in physics varies wildly from one country to another, and in ways that are not obvious or easy to understand.
- We can learn something from this: Larry Sommers was *wrong*. The lack of women in physics is cultural, not genetic, or it would be more consistent.
- Cultural variations are complex and not easy to understand. Denmark, for example, has excellent maternity and childcare benefits, but 97% of physics professors are male.



# Some International "Best Practices"

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- Networking helps. The Paris meeting led many women in small countries to begin to collect statistics about women in physics in their country, and to get to know each other.
- There isn't much interest in minority women in physics. Many countries would like to believe this is only an American problem (contrary to evidence).
- Emphasis on women taking "career breaks" for family reasons.



# Some International "Best Practices"

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- Government subsidized childcare in many European countries is very helpful to professional women.
- In Canada, NSERC (NSF equivalent) provides childcare expenses (leave for postdocs and grad students, travel allowances) as part of research grants.
- UK Institute of Physics has a division for women.
  - More inclusive than committees, anyone can join (men included).
  - Sponsors sessions and social events at IOP meetings.
  - Undergraduate female physics majors can join free.
  - We (women in AAPT and APS) should do this!



# Your Strategies & Ideas Needed!

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- **To interest girls and ensure they get the needed math background in ES, MS, & HS**
  - **To overcome the special challenges and barriers faced by girls and women of color**
  - **To attract and graduate women majors**
  - **To attract and retain women grad students**
  - **To launch female postdocs into physics careers (broadly defined and respected)**
  - **To get women into the physics professoriate**
  - **To promote women physicists into leadership**
  - **To solve the family-career conflict**
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# Some Resources

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- **B. K. Hartline & D. Li, eds: Women in Physics, AIP Conf Proceedings 628, 2002. Available for free download at: <http://proceedings.aip.org/proceedings/confproceed/628.jsp>**
- **B. K. Hartline & A. Michelman-Ribeiro, eds: Women in Physics 2, AIP Conf Proceedings 795 (November 2005) in Press. Available for 35% discount or for free download, probably at : <http://proceedings.aip.org/proceedings/confproceed/795.jsp>**
- **Committee on Equal Opportunity in Science and Engineering (CEOSE), Broadening Participation in America's Science and Engineering Workforce (June 2005). Available for free download at: <http://128.150.4.107/od/oia/activities/ceose/reports/ceose2004report.pdf>, or by request from Dr. Margaret Tolbert at NSF ([mtolbert@nsf.gov](mailto:mtolbert@nsf.gov))**



# Student-Created Mural from LIGO Livingston, Louisiana, USA



# Understanding the Barriers to Advancing Women & Minorities in SMET Careers

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- **According to Dr. Virginia Valian (*Why So Slow?*)**  
**Two key concepts help explain the slow pace of women's advancement in science and engineering**
  - ❖ "Gender schema"
  - ❖ Accumulation of advantage
- **These hidden barriers are likely to be compounded for under-represented minorities**

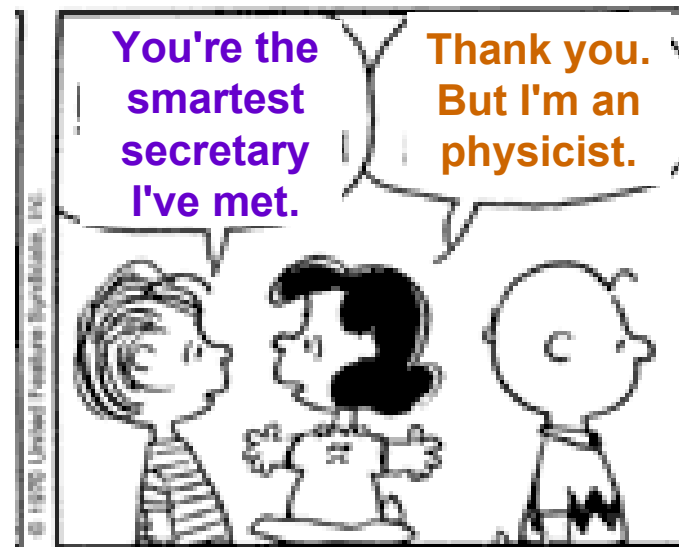


# Gender and Ethnic "Schema"



- *Gender and ethnic "schema" are widely held beliefs about men, women, and people from ethnic groups with respect to their competence, career roles, and leadership ability*
  - *Lead us to overrate white men*
  - *Lead us to underrate women and ...inorities*

**Overheard  
at the Physics  
conference:**



Drawing © UFS, Inc, 3/6/04



# Accumulation of Advantage

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- **"Accumulation of advantage" refers to the cumulative long-term effect of small differences in the way males and females from different ethnic groups are treated throughout their lives**
  - **At home and in school**
  - **On the sports field**
  - **In the workplace**
  - **In restaurants, stores, theatres,...**
- **If majority males experience "1.001" and others experience "0.999" the difference accumulates profoundly**
  - **White males' experience  $\rightarrow \infty$  ("1400" after 20 years)**
  - **Others' experience  $\rightarrow 0$  ("0.00067" after 20 years)**



# Tensions for Women & Minorities in S&E



- **Being oneself *versus* fitting into the culture**
- **Making connections: political relationships *versus* meaningful relationships and performance**
- **Controlling your destiny *versus* conforming to others' expectations ("Agency")**
  - Moreover, expectations about women & minorities conflict with expectations about scientists/engineers
- **Achieving wholeness: freedom to align your ideas, personality, and passions while being and being perceived as professionally successful**
- **Gaining self clarity: knowing what you need to do and be**

Adapted from M. Ruderman and P. Ohlott: Standing at the Crossroads

