E-quality in Science

How equality makes science better: A lesson from women in science

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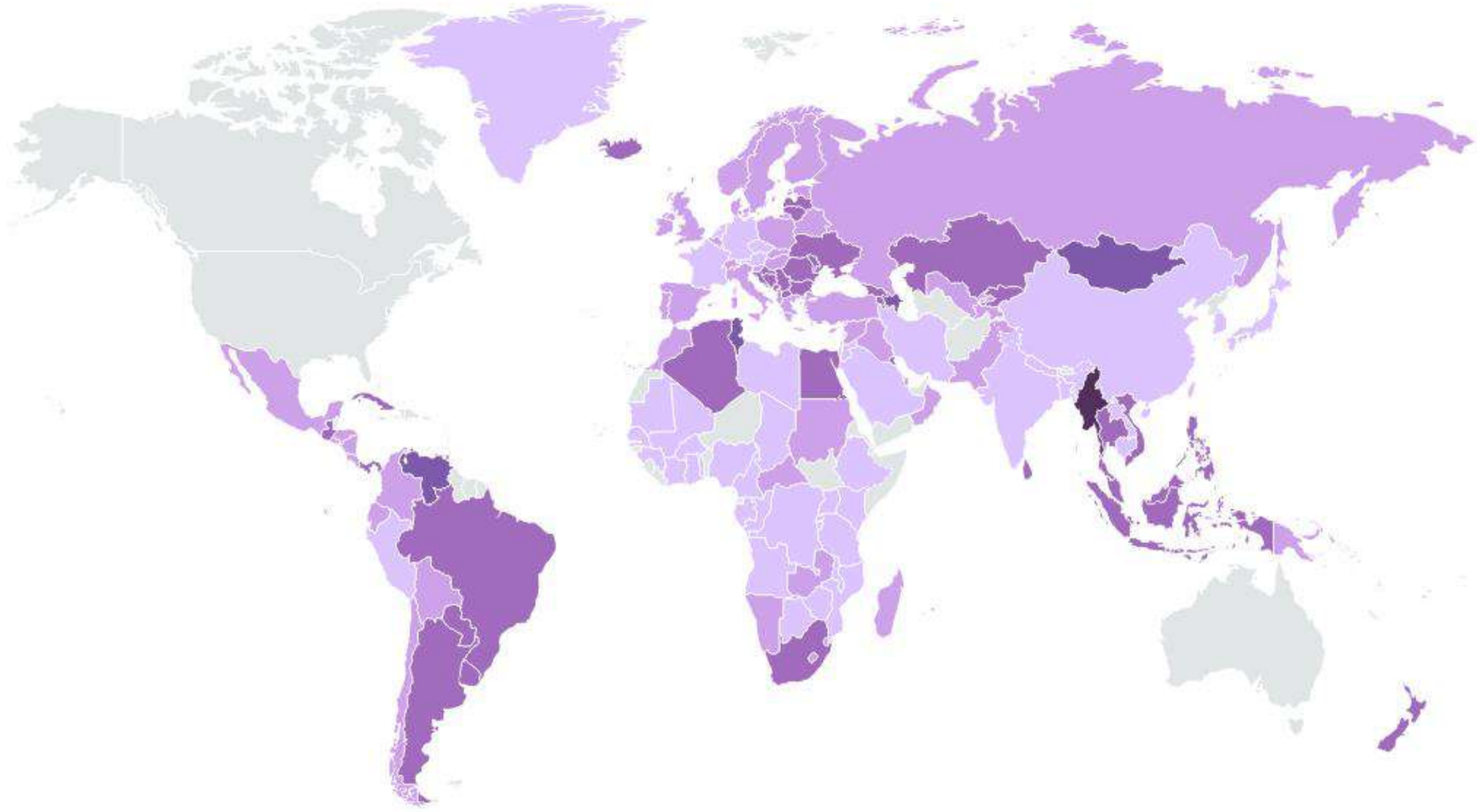
UNIVERSITY · CANADA

Art by Dániel Taylor

Where are the women?

WOMEN AS A SHARE OF TOTAL RESEARCHERS



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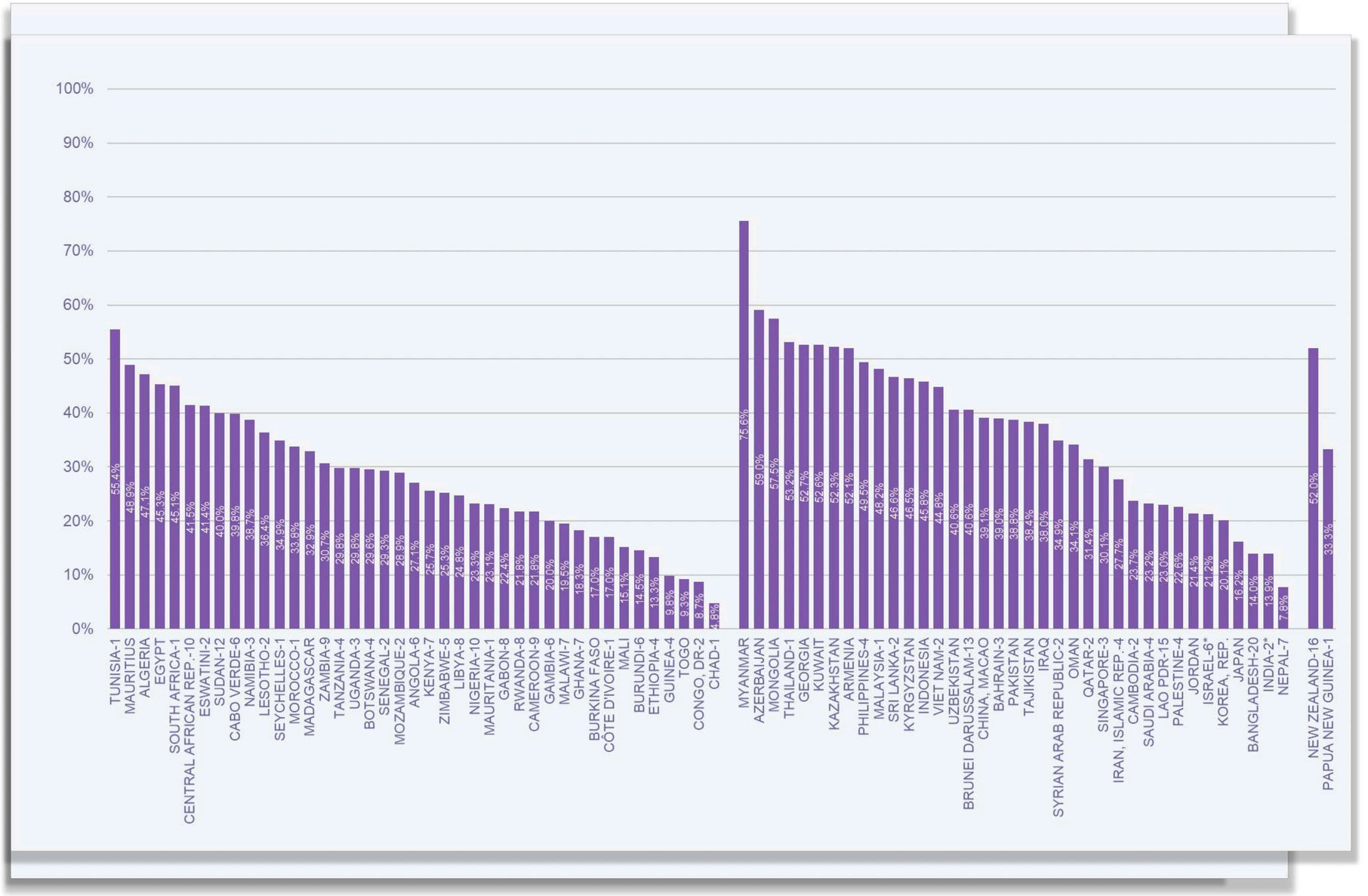
70.1%-100% 55.1%-70% 45.1%-55% 30.1%-45% 0%-30% No data

WOMEN AS A SHARE OF TOTAL RESEARCHERS



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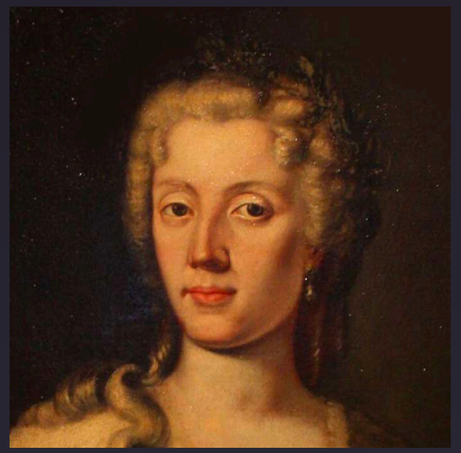
I STUDIED MATH BECAUSE WHERE I GREW UP ABSTRACT WORK IS CONSIDERED MORE APPROPRIATE FOR A WOMAN THAN PRACTICAL WORK!
I WORK IN THE LAB BECAUSE I WAS TOLD WOMAN ARE NOT THE BEST AT ABSTRACTION BUT IN MY PLACE WOMAN ARE CONSIDERED OK AT PRACTICAL WORK!

ITALY: WHY MORE WOMEN IN SCIENCE THEN ELSEWHERE?

Historical reasons

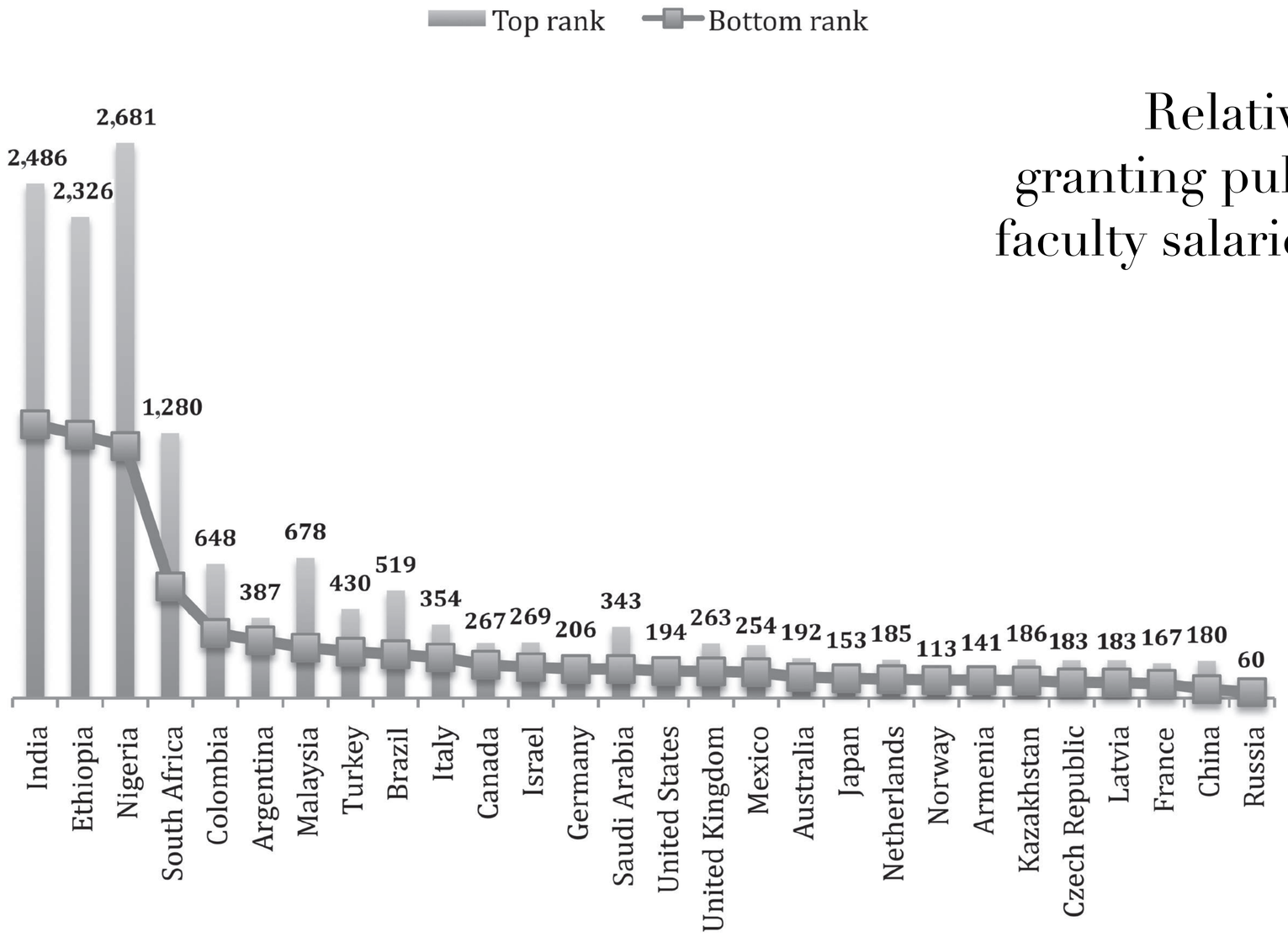


Models

Perception of science in society

HAPPY 101TH BIRTHDAY MARSGHERITA!

WHAT COUNTRIES VALUES THEIR RESEARCHER MOST?

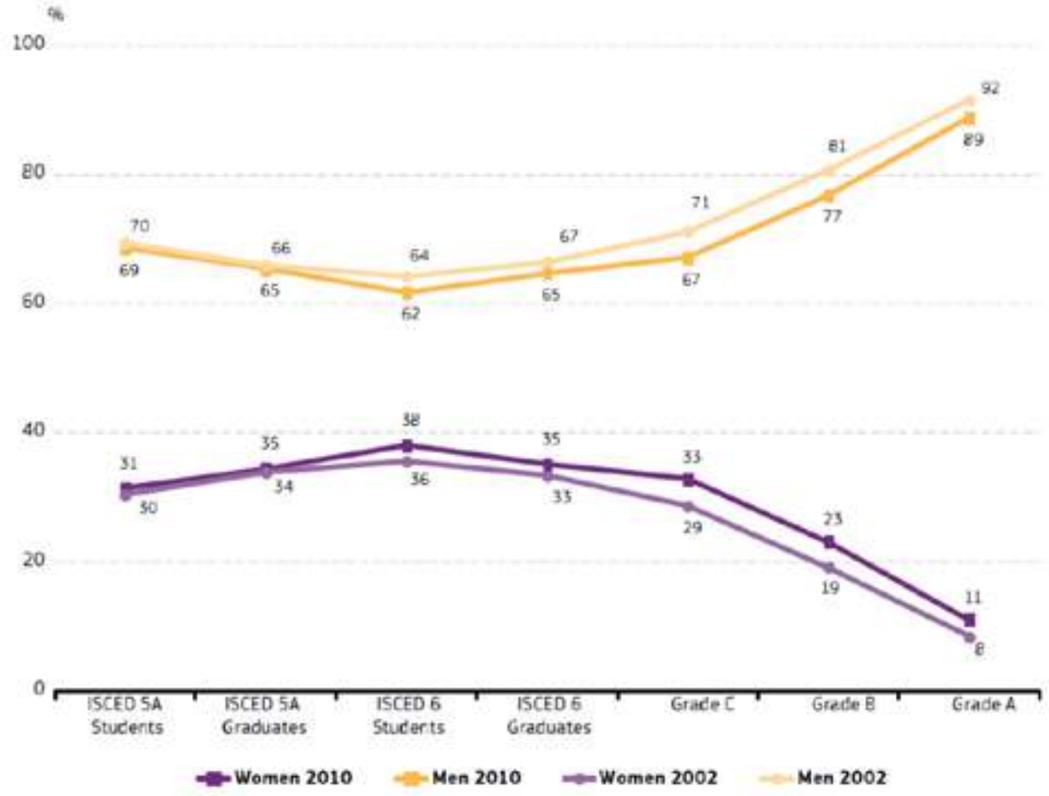


Relative academic salaries in degree-granting public universities (ratio of yearly faculty salaries to GDP per capita), percent.

Paying the Professoriate, edited by Philip G. Altbach, et al., 2012.

SCISSOR GRAPH & LEAKING PIPE

Figure 4. Proportions of men and women in a typical academic career in science and engineering, students and academic staff, EU-27, 2002–2010



Source: Eurostat - Education Statistics; WIS database (DG Research and Innovation)

Leaky pipeline

In 2015, women earned

48% of medical school degrees

55% of life sciences doctorates

38% of medicinal chemistry doctorates

In biotech, women represent

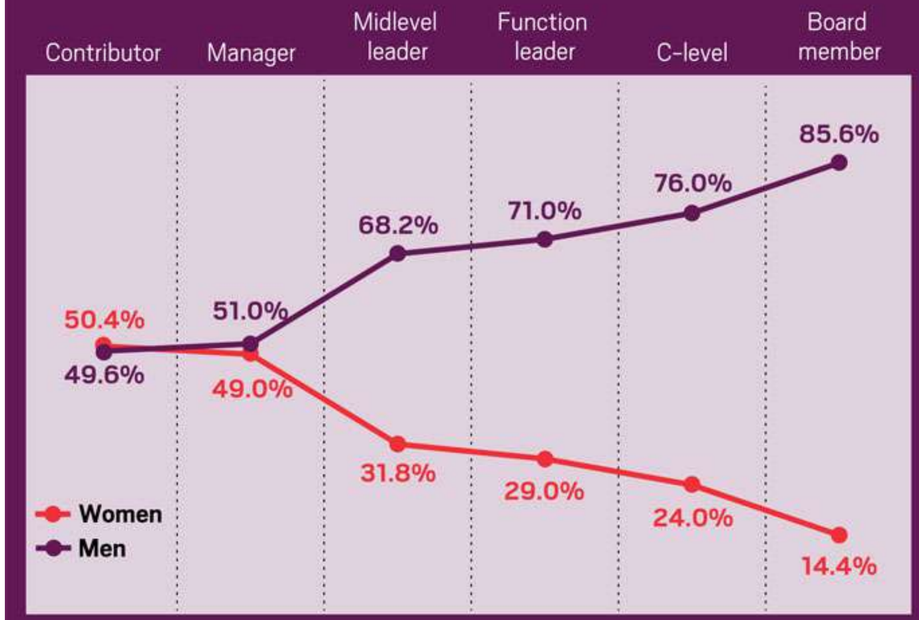
50% of entry-level positions

20% of leadership positions

10% of board seats

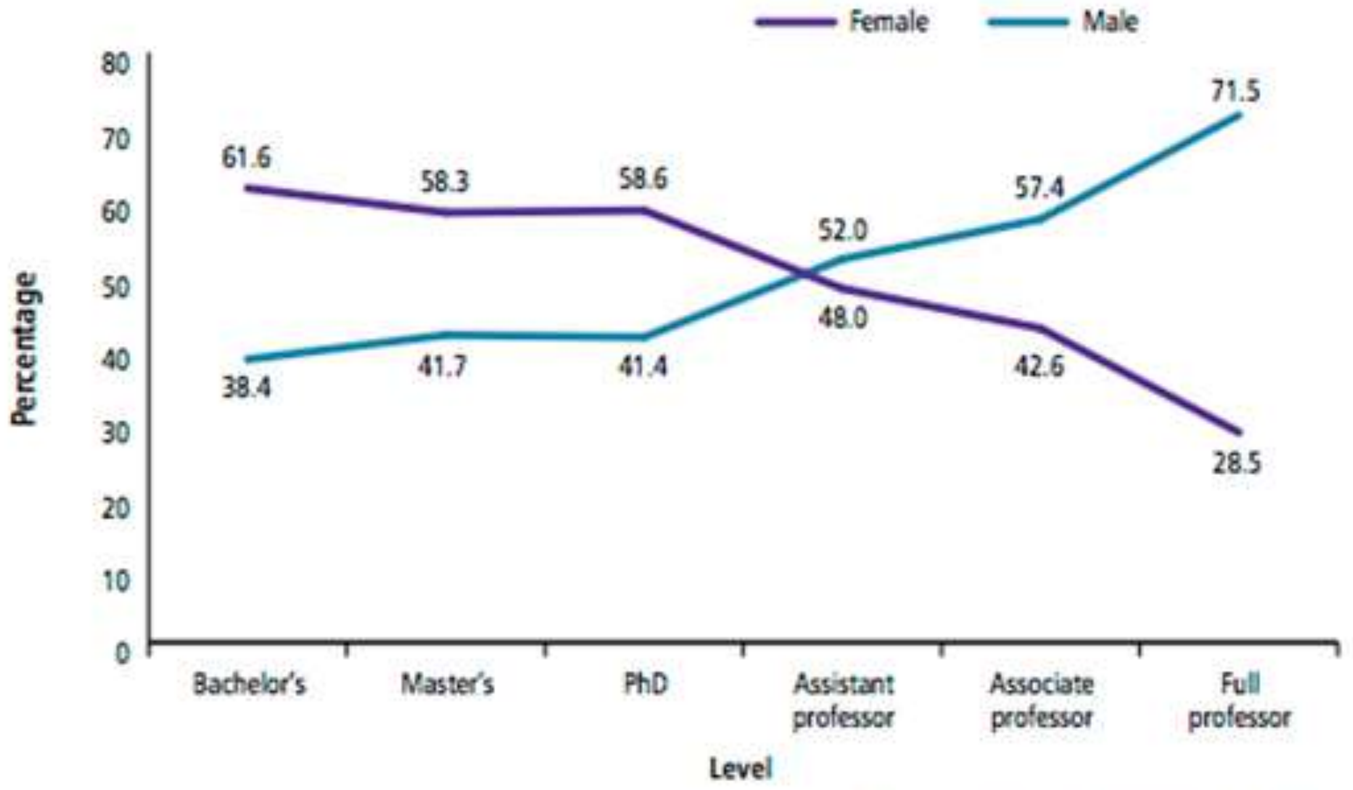
Sources: Association of American Medical Colleges, National Science Foundation, Liftstream, MassBio

Women's and men's career paths diverge dramatically after the manager level.



Source: Liftstream and MassBio survey of more than 900 life sciences workers in Massachusetts

IS IT A STEM PROBLEM?



(Data Source: Statistics Canada, n.d.d., n.d.b.)

Figure 3.2

Percentage of Women and Men at Different Academic Levels in HSE

This figure displays the percentage of women and men in humanities, social sciences, and education in 2008–2009 at various stages of the academic career in Canadian universities.

ARE WOMEN IN SCIENCE…

absent?

invisibles!

ITALIAN WOMEN BETWEEN RENAISSANCE AND MODERN SCIENCE

GYNOCENTRIC SCIENCE

From ART to SCIENCE:

Obstetrics

Nutrition

Botanics

Ecology

Pharmacology

Domestic Economy

Alchemy (Chemistry)

…

“Eve's fault was that of wanting to know, experiment, investigate with her own strength the laws that govern the universe, the earth, her own body, curiosity of science against the passive acceptance of faith. In a word, Eve represents scientific curiosity against the passive acceptance of faith.”

Margherita Hack (1995)

Let not he who loves scrutinizing secret dogmas
Neglect to take as an example everything that can help him.
Don’t you see how a woman is accustomed to cleaning dirty laundry
By pouring hot water over it?
Follow her example, so that you will not fail in your art.

THE CRAFT TRADITION

- Botanic
- Anatomy
- Astronomy

Maria Sibylla Merian (1647 – 1717) - *Anna Morandi Manzolini (1714 – 1774)*

Source: Schiebinger, The mind has no sex?

A LESSON FOR TODAY

Which knowledges that were traditionally dismissed as non-scientific should intenda be considered?

Which practices can we introduce in research methods and in teaching to free ourselves from undesirable aspects (colonialism, racism, homophobia…) that modern science has inherited from its history?

THE QUALITIES OF A GOOD SCIENTIST

DIVERSITY IS IMPORTANT BECAUSE:

Equity

Quality

Feminists have tended to make a distinction between getting women into science and changing knowledge. […] Both are institutional and intellectual problems. […]
Such initiatives should be collaborative efforts joining the expertise of scientists and humanists.
Schiebinger 1999

Making females visible and raising questions concerning gender can be done without feminism!
Conkey and Gowaty 2003

A word of caution: it is an interesting phenomenon that when feminist insights become mainstreamed in a science they are sometimes thought of simply as “good science.” And perhaps they simply are. This has the effect, however, of keeping things labeled “feminist” always on the radical fringe.
Schiebinger 2003

DIVERSITY IS IMPORTANT BECAUSE:

“a distinctive female way of knowing”

“do science as a feminist”

FARE SCIENZA COME UN@ FEMMINISTA

Fare scienza come femminista significa integrare l'analisi di genere politicamente impegnata in tutti gli aspetti della scienza: le sue istituzioni, teorie, pratiche, priorità e politiche. Fare scienza da femminista significa “modificare la retorica del movimento delle donne in ipotesi stabili” (Gowaty) da usare nella scienza. Le femministe, quindi, impiegano l'intera gamma di metodi, intuizioni e scintille creative a loro disposizione come scienziate e come femministe. Trovare prove in laboratorio o sul campo può essere fatto con metodi di ricerca consolidati, ma con nuovi fini. Nuove domande su vecchi presupposti spesso portano allo sviluppo di nuove tecniche e migliorano la struttura generale della ricerca.

Londa Schiebinger

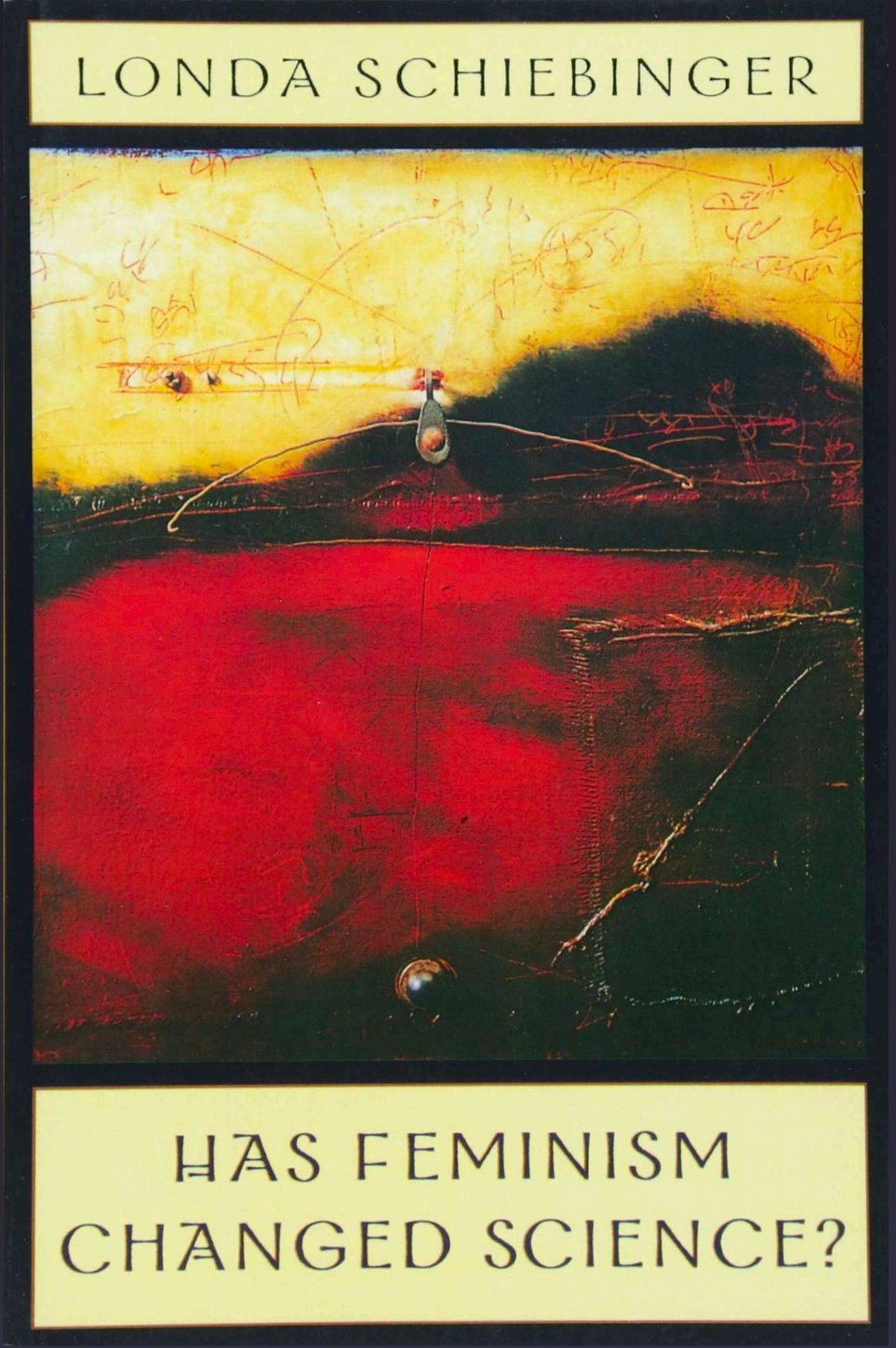
FEMINIST SCIENCE

- *democratizing research*
- *eliminating research that leads to exploitation of nature or other humans*
- *resisting explanations stripped of social and political context, and so forth*
- *acknowledging our values and beliefs*
- *being honest about our assumptions*
- *being responsible in our language*
- *tools must be newly fashioned and reworked as circumstances change*
- *…*
- *much beyond just feminist research!*

DIVERSITY IS IMPORTANT BECAUSE:

Equity

Quality



Archeology

Primatology

Biolology

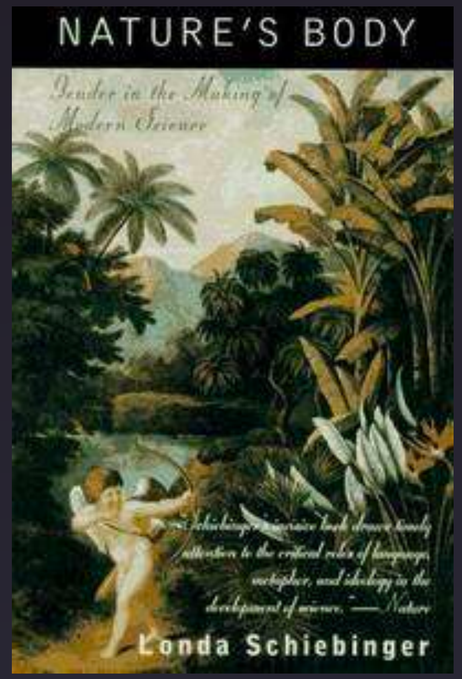
Medicine

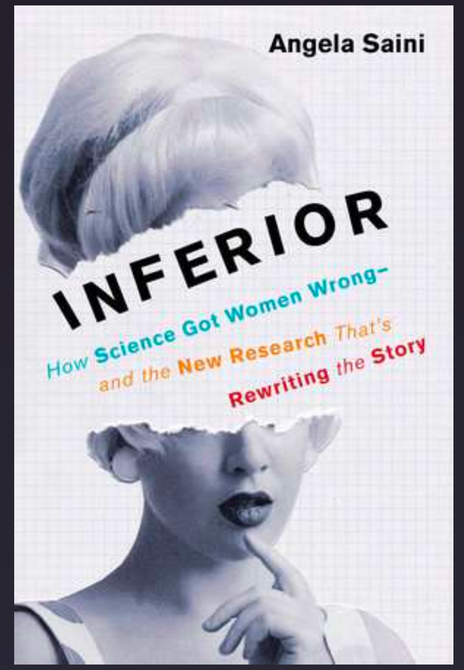
Chemistry

Neurosciences

BIOLOGIA E MEDICINA

- Esempio di Barbara McClintock (riportato da Evelyn Fox Keller) sull'approccio umile al materiale di ricerca, che si deve "lasciar parlare". L'empatia e la passione per gli organismi studiati permette di avvicinarcisi arricchendo la propria comprensione olistica senza pretendere un controllo totale su di essi.





- Tra il 1990 e il 1994 il Congresso degli USA ha promulgato almeno venticinque atti legislativi per migliorare la salute delle donne americane, che vanno dall'obbligo per le donne di essere incluse nelle sperimentazioni cliniche ai nuovi regolamenti federali per la mammografia. Bernadine Healy, ex direttrice del NIH, ha commentato che "la ricerca da sola non può correggere le disparità, le iniquità o le insensibilità del sistema sanitario": riformare gli aspetti della ricerca medica richiedeva nuovi giudizi sul valore sociale e una nuova volontà politica.

PRIMATOLOGY

- Meredith Small (1984) *Female Primates: Studies by Woman Primatologists*
- Linda Fedigan criticizes Hobbesian “killer ape” and “baboonization” of primate life
- Sarah Hrdy (80s) new “feminist sociobiology” (female competition)
- Jane Lancaster (1973) *In praise of the Achieving Female Monkey* (sameness)
- Telma Rowell studies “from the female monkeys’s point of view” (sexual difference)
- Donna Haraday (1989) *Primate Visions*
- Jane Goodall, Dian Fossey, and Birutė Galdikas’ role in conservation (ecofeminism)

PALEOANTROPOLOGY

- Sally (Linton) Slocum, Nancy Tanner, and Adrienne Zihlman (70s) “woman the gatherer” theory of human evolution: women’s foraging after wild plants, not men’s hunting, provided the primary source of subsistence for the earliest humans.
- Zihlman argued that it is a mistake to suggest that the woman-the-gatherer hypothesis was developed in the context of feminist theory. There was no such theory available in the early 1970s.The feminist social climate provided, she says,’‘the basis for asking questions, but it did not provide data.”
- Sally Slocum’s challenge to the definition of “tools” (supported by Richard Lee)
- Jane Balme and Wendy Beck have pointed out, “the rationale for the division of labor remained unchanged, men hunt and women gather because they are constrained by their reproductive roles.”
- Margaret Conkey rised critical awareness of why scientists seek the “origins” of certain cultural arrangements (such as marriage, the family, and sexual differences) and not others.

ARCHAEOLOGY

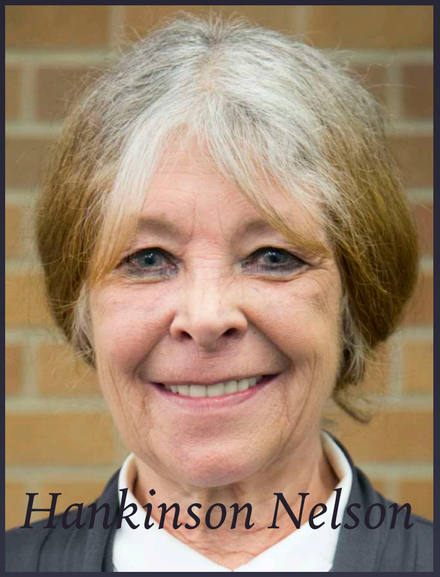
- Ironic “The Female Anthropologist’s Guide to Academic Pitfalls,” (1971) advised: Pick a field or branch where in you can function independently. Areas demanding “team type” research are out, unless, of course, you are married to the field director, an ideal situation, and one devoutly to be recommended.
- Margaret Conkey and Sarah Williams’ analysis of the “political economy of gender in archaeology” (1991) questioning how dealing with “origin stories” shape power structure in archeological practice
- From Slocum to Gero: a revision of “tools”
- Rita Wright: importance of the introduction of pottery
- Patty Jo Watson and Mary Kennedy: role of women in the development of agriculture
- Alison Wylie: role of feminism in the recent development of archaeology

OBJECTIVITY

View from Nowhere

VS

Standpoint Theories
Situated Knoledge



What do we mean by feminist science?

What is specific of physics?

Physics is not immune to feminist analysis simply because electrons are not obviously gendered. The issues at stake are subtle yet far-reaching. With a sense of human agency incorporated into scientific theories, perhaps physicists will no longer find it necessary to speak of elementary particles having attributes such as charm, beauty, and strangeness, or to give seminars with topless, naked bottom, and exotic hermaphrodite states in the titles. Of course, feminist scientists realize that the suggestion of human characteristics is seen as playful —a humorous, innocent distraction from serious concerns about the nature of the universe. After all, boys just wanna have phu-un.

Karen Barad, 1995

To the uninitiated, demographics is the only issue relevant to women in physics. This does not imply, however, that this concern is foolish or misplaced. It may be that a “critical mass” must be achieved before feminism within the field of physics can mature and proceed as in other fields.

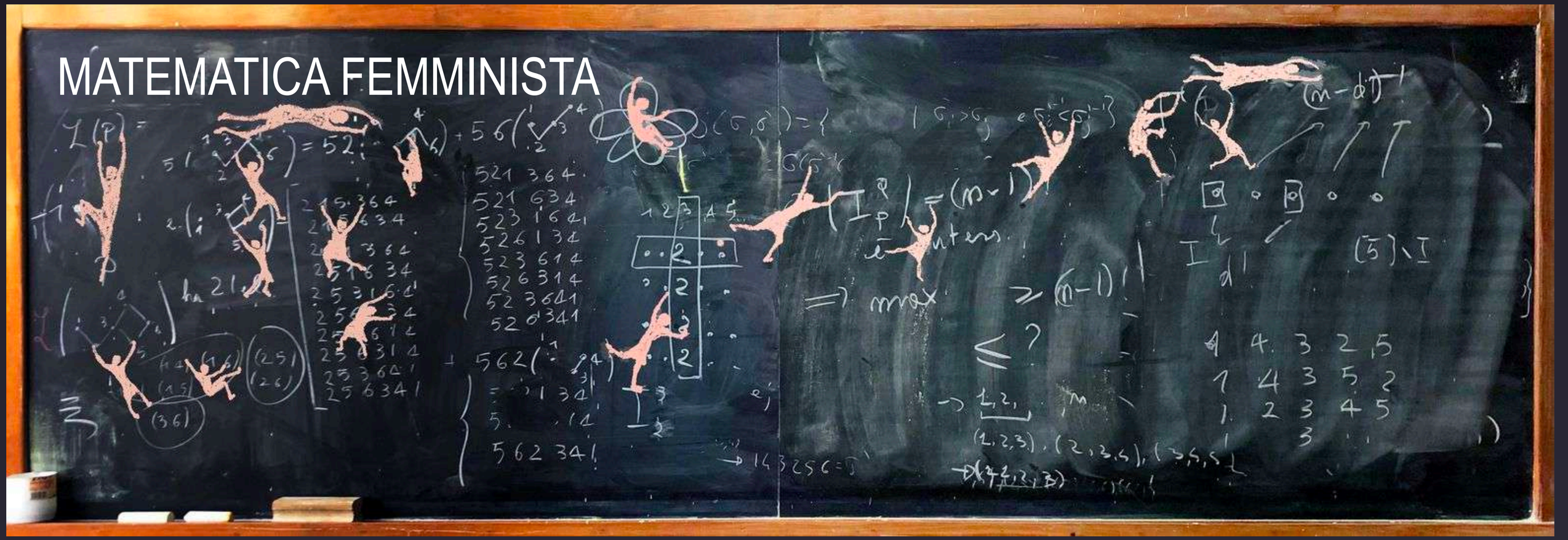
Arguments for including women tend to be based on equity concerns, or the concern that people with good minds should not be turned away when they might be utilized in the service of physics-as-is. Arguments tend not, for example, to be based on feminist empiricist claims that only a diversely gendered group can produce unbiased results or that the problems chosen and methods used must be divested of an existing Western or androcentric bias (Harding 1987).

Amy Bug, Steps toward a feminist physics 2003

ARE THE SO-CALLED HARD SCIENCES REALLY HARD?

- Sandra Harding questioned the prestige physics enjoys as the model science
- Physicists' military ties contributed to hold women at a distance
- Physics as a fortress of the "value-neutrality" mentality, insulating it from gender critique
- Sharon Traweek et al. emphasized the arrogant culture silencing women
- Karen Barad has identified a pedagogical style in physics that teaches students to value fun and irresponsibility over meaning and understanding

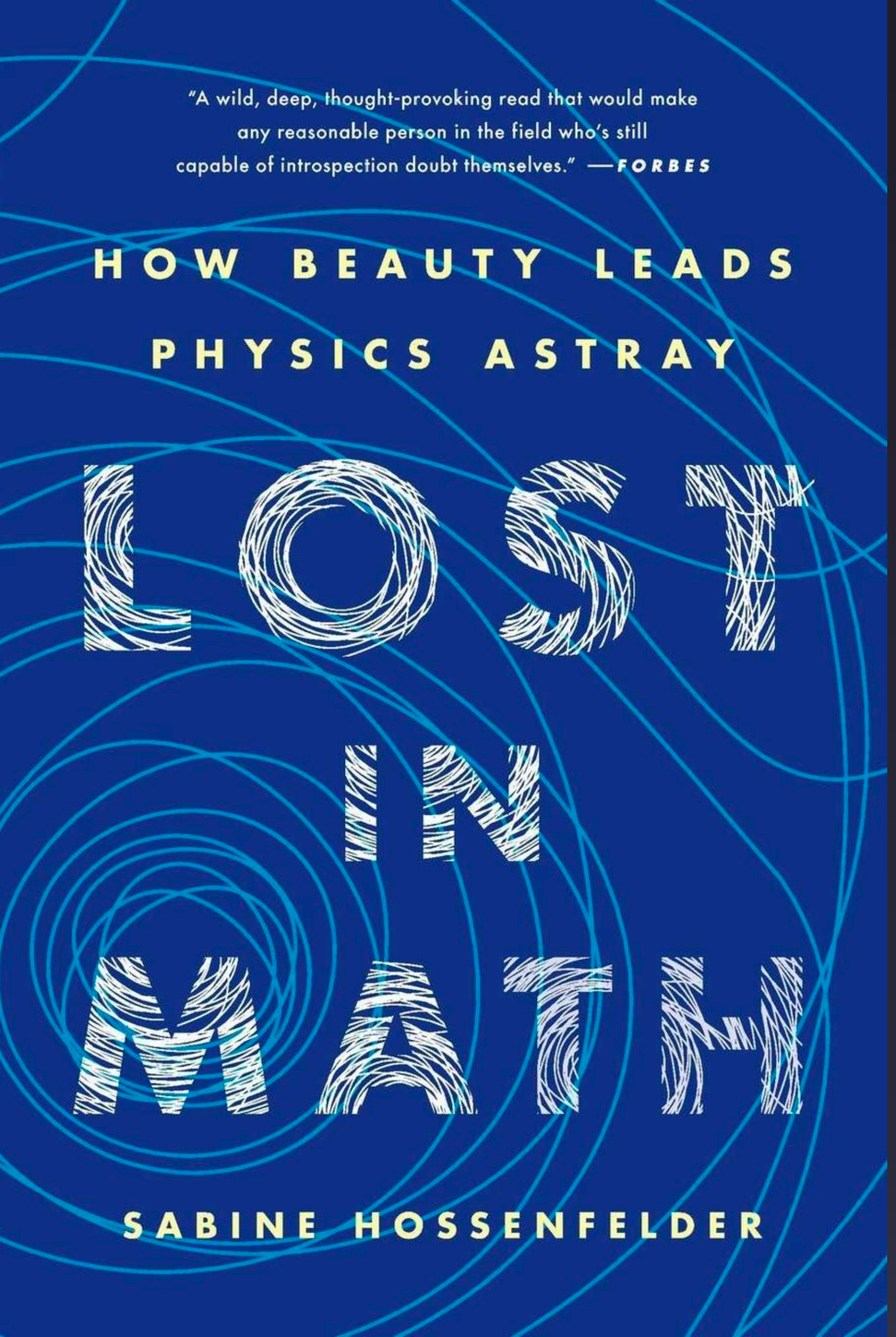
MATEMATICA FEMMINISTA



- Scoperta di leggi astratte ultraterrene (Platone)?
- Oppure creazione creativa di nuovi linguaggi, nuove logiche e nuovi mondi!
- Attitudine pragmatica: la matematica cattura aspetti del mondo, non viceversa
- Come processo creativo, la matematica può dipendere dalla provenienza culturale di chi la crea

FEMINIST SCIENTIST	Physicists
a) Acknowledge their values and beliefs	No
b) Explore how these affect their perspectives	No
c) Are explicit and honest about assumptions and methods	Yes
d) Are responsible in language	Yes (math) No (metaphors)
e) Eliminate research leading to exploitation of nature	No
f) Aim for diversity among participants	Yes
g) Recognize the complexity of nature	Yes
h) Resist single-cause explanations stripped of social context	No

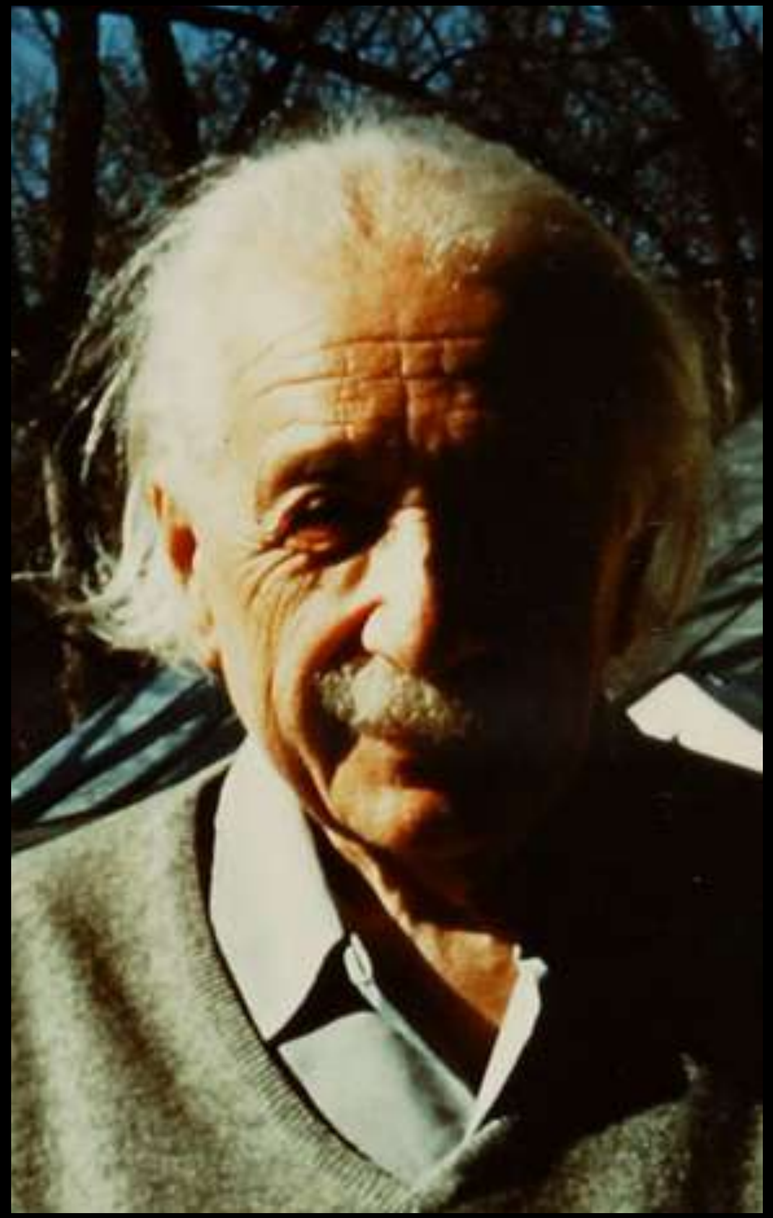
Bleier 1986


"A wild, deep, thought-provoking read that would make any reasonable person in the field who's still capable of introspection doubt themselves." —FORBES
HOW BEAUTY LEADS PHYSICS ASTRAY
LOST IN MATH
SABINE HOSSENFELDER

QUANTUM MECHANICS AND OBJECTIVITY

Real = Observed

Observations depends on the observer!



OBJECTIVITY

View from Nowhere

VS

Standpoint Theories
Situated Knoledge

DIVERSITY IS IMPORTANT BECAUSE:

Equity

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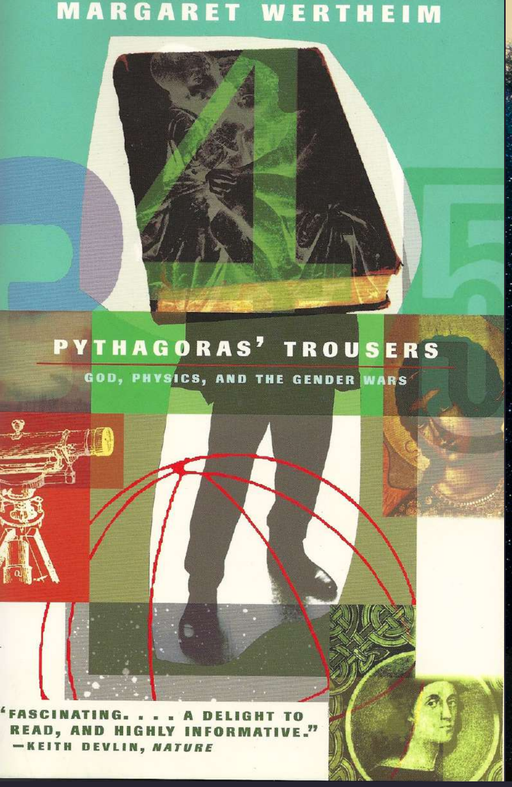
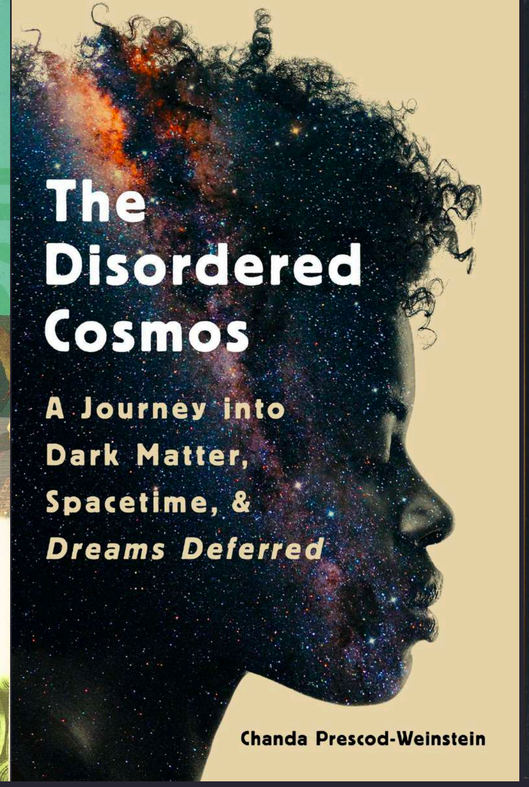
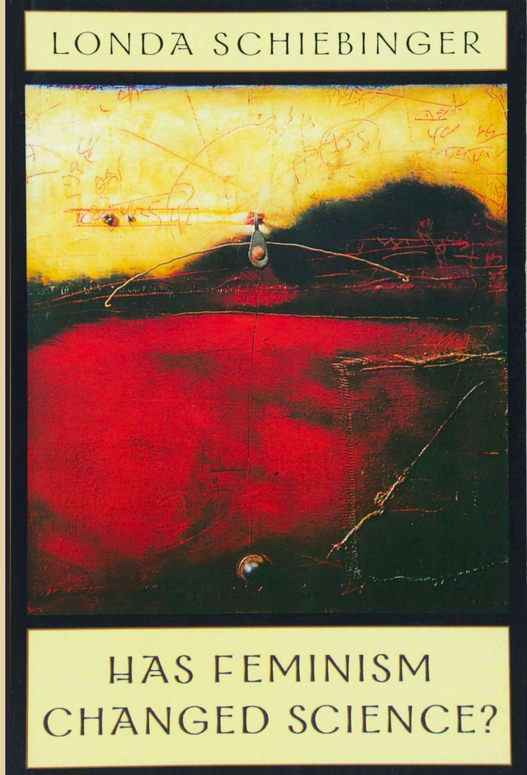
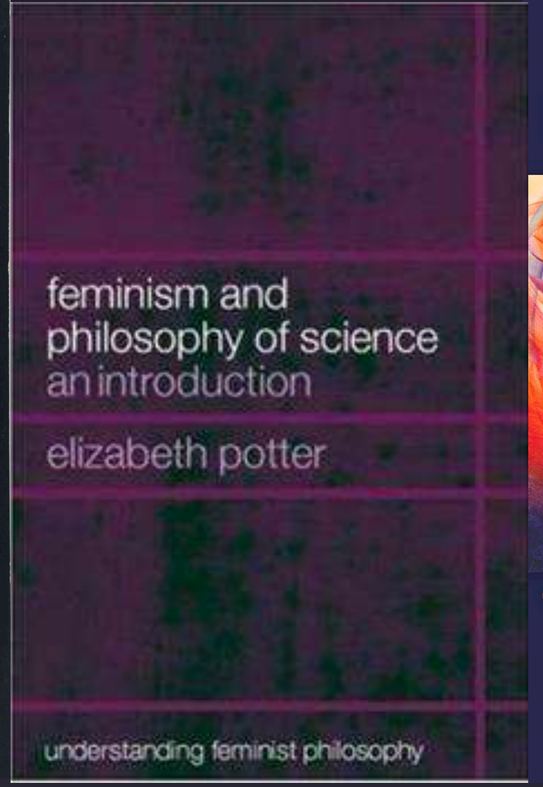
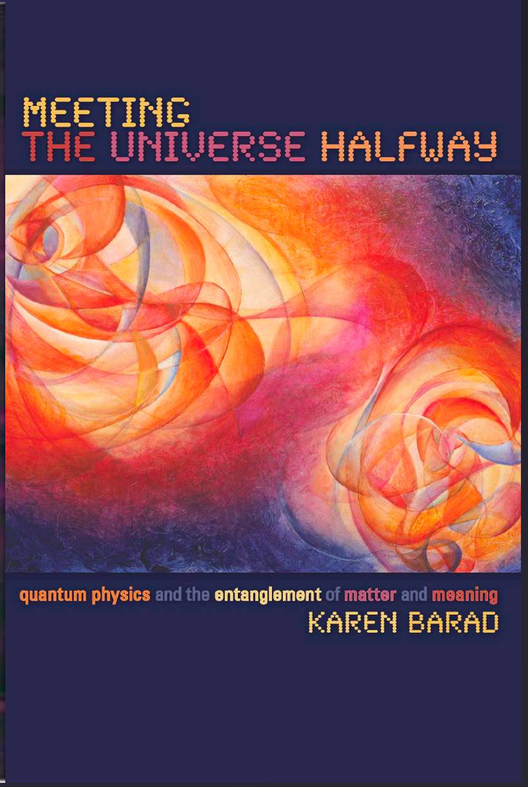










Wertheim
Pythagoras Trousers

Prescod-Weinstein
The Disordered Cosmos

Schiebinger
Has Feminism Changed Science?

Potter
Feminism and Philosophy of Science

Barad
Meet the Universe Halfway

Brian Keating @DrBrianKeating · 10h

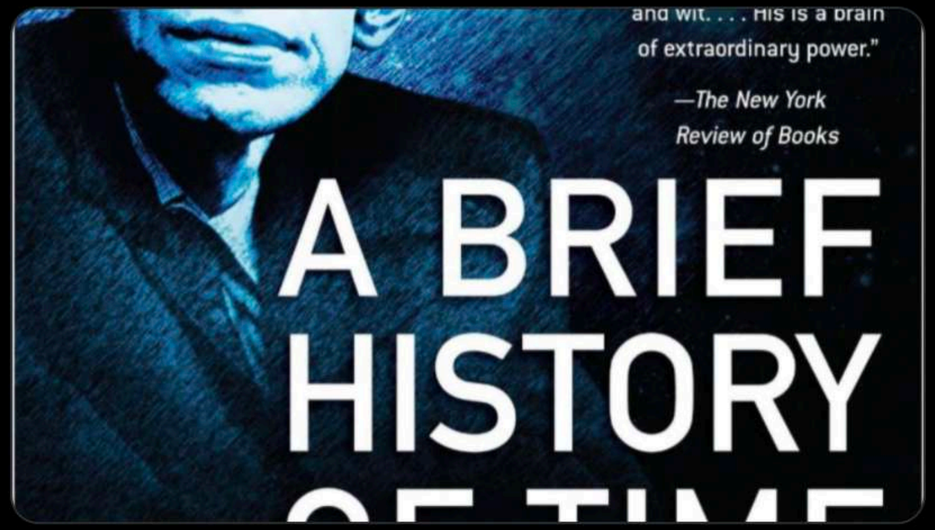
Why do physicists reference God so often? Many (most?) are devout atheists.

"Mind of God"
"God Particle"
"God Equation"

Appeal to authority?
Irony?
Attention?

It began in the last sentence of Brief History of Time whose final words are "the mind of God".

Why does it persist?



20 4 23

Prof Anna Watts @drannawatts · 9h

I think it's a male physicist thing tbh 😂 Delusions of grandeur and all that.

Cue multiple examples of female physicists doing the same.

2 1 5

FEMINIST CRITIQUES OF OBJECTIVITY

- These ideas are often combined into a package of claims about science: that its aim is to know the way things are, independent of knowers, and that scientists achieve this aim through detachment and control, which enable them to achieve aperspectivity and external guidance. This package arose in the 17th-18th centuries, as a philosophical account of why Newtonian science was superior to its predecessor. According to this account, the predecessor science, which represented objects as intrinsically possessing secondary qualities and ends, confused the way things are in themselves with the ways they are related to emotionally engaged human knowers, who erroneously projected their own mental states and value judgments onto things. Adoption of the objective methods listed above enabled the successor scientists to avoid these errors and achieve an "absolute" conception of the universe (Williams 1978). Feminists object to each element in this package as a normative ideal and as a general description of how science works.

Source: Wylie (2003) Why standpoints matter

OBJECTIVITY: SUBJECT/OBJECT DICOTOMY & APERSPECTIVITY

- Subject/object dichotomy: what is “really real” exists independently of knowers
- Aperspectivity: the view from nowhere

- Feminist perspective: situated knowers and standpoint theories
- Reflexivity & Plurality: knowers would make explicit their situatedness and how that shaped their inquiry, partiality of representations do not deny access to truth; democratic inclusion is necessary to better access truth

Source: Feminist Epistemology and Philosophy of Science - Stanford Encyclopedia: https://plato.stanford.edu/entries/feminism-epistemology/

OBJECTIVITY: DETACHMENT & VALUE NEUTRALITY

- Detachment: knowers have an "objective" stance toward what is known when they are emotionally detached from it
- Value-neutrality: knowers have an "objective" stance toward what is known when they adopt an evaluatively neutral attitude toward it.

- Feminist perspective: emotional engagement

Source: Feminist Epistemology and Philosophy of Science - Stanford Encyclopedia: https://plato.stanford.edu/entries/feminism-epistemology/

OBJECTIVITY: CONTROL & EXTERNAL GUIDANCE

- Control: "objective" knowledge of an object (the way it "really" is) is attained by controlling it, especially by experimental manipulation, and observing the regularities it manifests under control

- External guidance: "objective" knowledge consists of representations whose content is dictated by the way things really are, not by the knower.

- Feminist perspective: dissolution of the subject/object dichotomy in favour of agents.

Source: Feminist Epistemology and Philosophy of Science - Stanford Encyclopedia: https://plato.stanford.edu/entries/feminism-epistemology/

PLURALISM

- Democratic discussion: Longino (1990, 2001)
  Knowledge production is a social enterprise, secured through the critical and cooperative interactions of inquirers. The products of this social enterprise are more objective, the more responsive they are to criticism from all points of view. Feminists build on a tradition including Mill, Popper, and Feyerabend (Lloyd 1997a)

- articulate the idea of "all points of view", the equality among them, and the role of the knowers' social positions

- A community of inquirers is objective if it:
  (1) offers public venues for the criticism of knowledge claims
  (2) responds to criticisms by changing its theories according to publicly recognized standards of evaluation
  (4) follows a norm of equality of intellectual authority among its members (distinguishing legitimate differences of expertise from illegitimate exercises of social power)

- Methodological & Theoretical pluralism: as long as theories are empirically successful, unification is not necessary for objectivity
  ⟶ limited pluralism? (Intermann 2010)

Source: Feminist Epistemology and Philosophy of Science - Stanford Encyclopedia: https://plato.stanford.edu/entries/feminism-epistemology/

MARXISM AS A PROTOTYPICAL STANDPOINT THEORY

- Subordinated Standpoint
  - Fundamental social regularity
  - Contingency of social arrangement
  - Universal social interest
- Dominant Standpoint
  - Surface social regularity
  - Necessary, natural, universally advantageous
  - Parochial social interest

- A standpoint requires (collective) self-consciousness and autonomous agents

Every standpoint theory must explain how one gains access to it. Most standpoint theories represent the epistemically advantaged standpoint not as given, but as achieved through critical reflection on the power structures constituting group identities. If the group and its interests are defined objectively, the facts that constitute the group and its interests are publicly accessible. So anyone can theorize phenomena in relation to the interests of that group. However, if epistemic advantage lies in collective agent-knowledge, its site lies in the group defining itself as a collective agent.

Source: Feminist Epistemology and Philosophy of Science - Stanford Encyclopedia: https://plato.stanford.edu/entries/feminism-epistemology/

FEMINIST STANDPOINT THEORY

- Centrality
  wrt their body, their children, the house… (Hartstock 1987, Rose 1987)
- Collective self-consciousness
  reacting to women objectification (MacKinnon 1989)
- Cognitive style
  based on child development of sense of identity (Flax 1983, Hartstock 1987, Rose 1987)
- Oppression
  and “the multiply oppressed have additional epistemic authority” (Collins 1990, Harding 1991)
- The privileged standpoint is not that of women, but of feminists (MacKinnon 1989)
  Men can participate in the feminist movement, but not assume a dominant role in defining feminist interests
- Critical theory aiming to empower the oppressed.
  A social theories must
  - represent the world in relation to the interests of the oppressed
  - enable the oppressed to understand their problems
  - be usable by the oppressed to improve their condition

Source: Feminist Epistemology and Philosophy of Science - Stanford Encyclopedia: https://plato.stanford.edu/entries/feminism-epistemology/

FEMINIST STANDPOINT THEORY (WYLIE 2003)

- The project of developing critical consciousness–a jointly empirical, conceptual, and social-political enterprise–is the only way to answer questions about the epistemic relevance of a standpoint (in either sense) to specific epistemic projects.
- In particular, some standpoints (as opposed to locations) have the especially salient advantage that they put the critically conscious knower in a position to grasp the effects of power relations on their own understanding and that of others. The justification that an appeal to standpoint (or location) confers is, then, just that of a nuanced, well grounded (naturalized) account of how reliable particular kinds of knowledge are likely to be given the social conditions of their production; it consists of an empirically grounded assessment of the limitations of particular kinds of knowers, of how likely they are to be partial, and how likely it is that the knowledge they produce will fail to maximize salient epistemic virtues.