

Gender and physics within Europe

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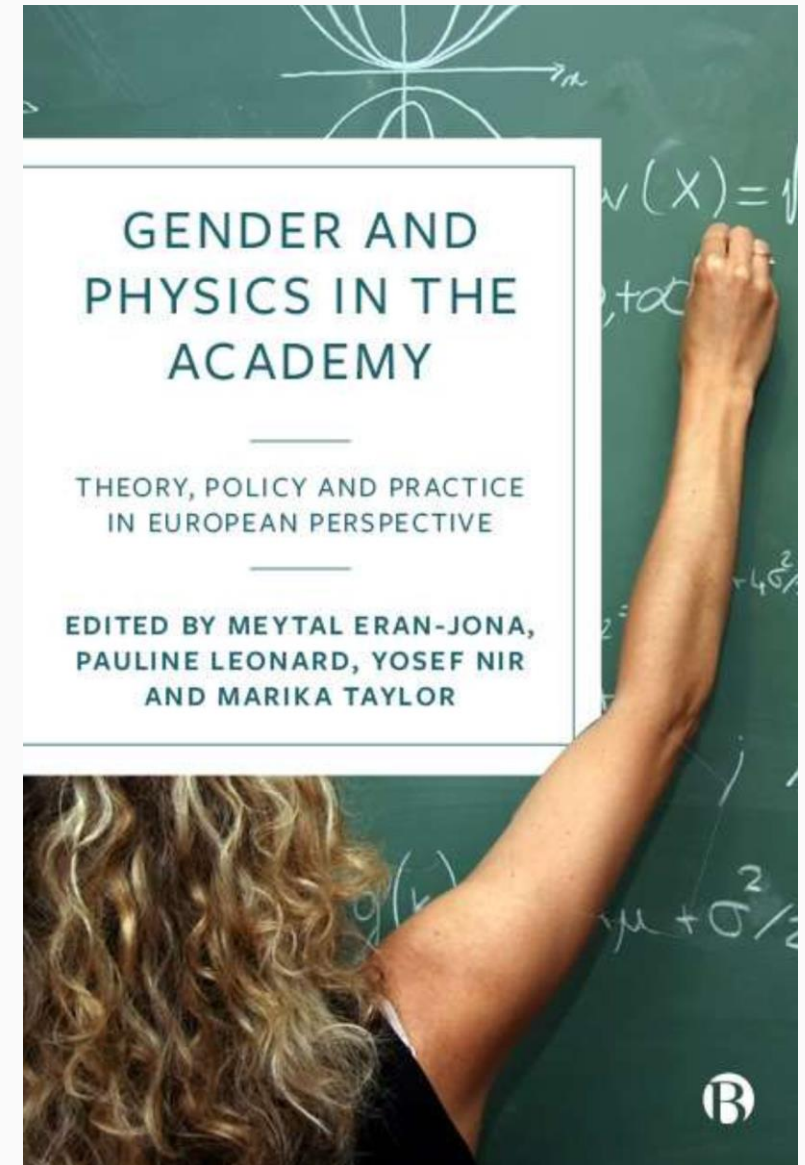


Gender and physics

- This talk will draw from a forthcoming book, edited by Meytal Eran Jona, Pauline Leonard, Yossi Nir and myself.
- The book includes chapters by **sociologists**, **physicists** and **practitioners** (leads of diversity initiatives).
- An overall goal of the project is to bring together (sociological) theory and empirical evidence (physicists, practitioners) to guide future initiatives and policies.



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Background to the book

- The book was initiated after a workshop at the Weizmann Institute in 2019.
- Themes arising from the workshop:

Different stages of development of diversity initiatives across Europe (and globally); lessons to be learned from the experiences of others.

Importance of engaging with social science, to understand the underlying issues and to identify evidence based approaches for interventions.

Need to promote policy recommendations widely, to achieve substantial culture shifts across academic physics.



Aims of the book

- To explore the impacts on physics as a discipline through the marginalization of women.
- To address why under-representation of women remains endemic and slow to change.
- To investigate how strategic leadership and evidence based interventions can lead to effective changes.
- To distill policy recommendations for culture shifts in academic physics.



Key recommendations

a) Use social science methodologies to collect and interpret data around the recruitment, retention and progression of women.

- Exploration of retention and progress often involves qualitative studies (surveys, focus groups, interviews), as well as quantitative data

b) Use these insights to design interventions around hiring and progression.

- Learn from best practices eg UK Athena SWAN/loP; departments that are more diverse.



Institutional leadership

- One of the chapters explores the GENERA project, which has brought together physics departments from nearly 40 countries, to work on gender equality actions.
- Within the GENERA network effective changes were seen when institute leadership embeds diversity and inclusion into their management, setting and leading the agenda.
- Where management did not engage, change did not happen.
- Our chapters reinforce many of the findings around organizational culture from other scholars e.g. Iris Bohnet; Colwell, Bear and Helman.



Key recommendations

c) Adopt policies (codes of conduct) supporting inclusive cultures and enforcement of respectful behaviours.

- Codes of conduct are more effective when agreed collectively by a department.

d) Involve the whole scientific community in changes of culture that make departments more inclusive.

- E.g. flexible working practices can benefit many researchers, but their implementation needs to fit with the needs of the institution.



Key recommendations

e) Celebrate and enhance the visibility of physicists from under-represented groups.

- Role models are consistently shown to be key in supporting the pipeline.

f) Mentoring, coaching and other targeted support.

- Benefits all researchers, but particularly from those from under-represented groups.



Diversity in physics: voices from within



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Context

- Over time my research portfolio has diversified – not just within STEM (eg foundations and applications of AI and quantum tech) but expanding into culture and philosophy of science.

How do personal characteristics and background influence scientific and technological outputs?

Biases within tech and AI are well-known e.g. sensors and skin colour; Siri responding to male voices. Do analogous biases also impact on fundamental science?

How does the culture of STEM impact on recruitment and retention of under-represented groups?

- Over the last decade I have become increasingly involved in academic leadership, currently as Vice-President for Engineering/Science.



Voices of physics researchers

- Based on a qualitative study of the factors that influence early career physicists to remain in science.
- Semi-structured interviews with around 30 scientists from the UK and Europe.
- We will draw out themes linked to diversity, including perceptions of how the science community could improve.



Physics culture

- Important to note that physics is not representative of all science.
- Physics remains not only overwhelming male (~80+%) but also lacks diversity across ethnicity, socio-economic background, disability...
- Physics is less vocational than many scientific subjects, impacting on perceptions of job prospects.
- Academic posts in physics are particularly over-subscribed, especially in theoretical and fundamental physics.
- Requirements for national/international mobility and extended postdoctoral period are very different from computer science or engineering.



What motivates physicists?

- Intellectual curiosity; fascination with the natural world; love of the subject.

“Physics is the only thing I want to do.... Provided I have enough money to live, I don’t particularly care about what I get paid.”

European white male, academic physicist

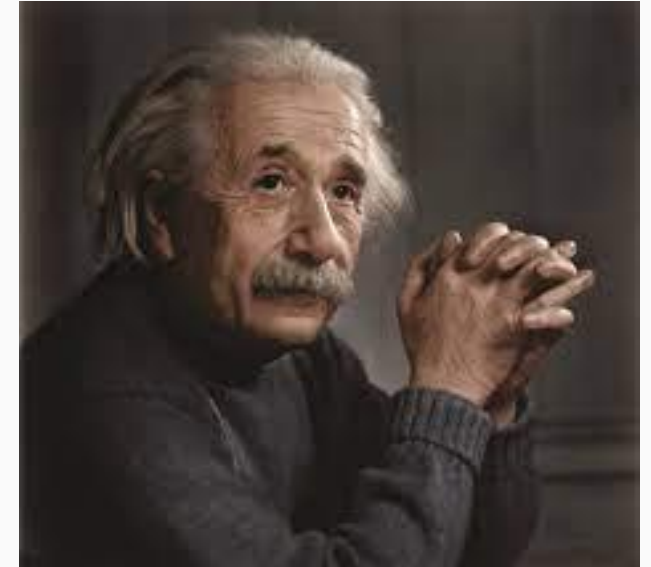
“I have never thought about what else I would do. At Oxford a group of us who studied together. We all went on to PhDs. There were others who were doing lots of societies, careers stuff, and went straight off to work in the City, but I want to do science.”

British white male, industrial physicist



Barrier: culture of genius

- **All** respondents reported having doubts about whether they could succeed in physics – some linked these doubts to the *culture of genius*.
- Lack of confidence was cited as a key factor for those who had transitioned into other careers.
- Those from under-represented groups (gender, ethnicity, socio-economic background) often reported feeling isolated, having nobody to reassure them when they lost confidence or experienced imposter syndrome.



Isolation versus mentoring and support

- *“I found the environment very difficult: so much was expected of us. Everyone else seemed to be doing fine, but I always felt like my work wasn’t good enough. I felt so isolated. I didn’t have anyone to talk to and the feelings of inferiority escalated ... It has taken me a long time to rebuild my confidence after leaving physics research.”*

European white female, now works in consultancy.

- *I have sometimes felt like I’m not good enough to make it but I work in a really supportive group. The head of group senses when you are feeling down and is there to help you.... Through him I’ve been mentored by several other senior researchers.”*

British white male, academic physicist.



Scientific culture

- Issues with culture in physics raised by many respondents, particularly those from under-represented groups:

Competitiveness

Aggressive behaviours

Work/life balance

Mobility requirements

Biases in recruitment and progression



Scientific culture

- *“I’m almost thirty. Even if worked out and I got a permanent academic job, I’d be in my mid 30s before I could start thinking about having a family. Starting salaries in tech companies are not far off what full professors make. I can’t wait for a decade to start a family.”*

European white male, now works in data analytics.

- *“The atmosphere is completely different in the data science company I now work for: we work as a team. There is still a hierarchy, and sometimes men do push their ideas, talking over women, but there are more women and together we usually manage to get our voices heard.”*

Minority ethnic female, moved from physics to data science.



Mobility

- In academic physics it is usual for researchers to spend 4-6+ years on postdoctoral research, moving between institutions, before obtaining a permanent post.
- Researchers need to move internationally, particularly in fields like astronomy or particle physics.
- Industrial science can also be highly specialist, tying scientists to particular companies and regions.
- Such mobility requirements are consistently cited as reasons for changing career paths, by women, those from minority ethnic backgrounds, first generation students.



Mobility

- *“My family is really close. I have four siblings, including a twin brother, and we grew up sharing rooms... Both my Mum and my Dad have health issues. I want to live near them even if that means a career shift away from physics.”*

Ethnic minority male, first generation student, left physics after doctorate.

- *“I had job offers after my PhD but I would have had to move away from London, probably from the UK. The better offers were from Europe. But my partner is in London, so is my family.”*

British white female, moved to research support post.

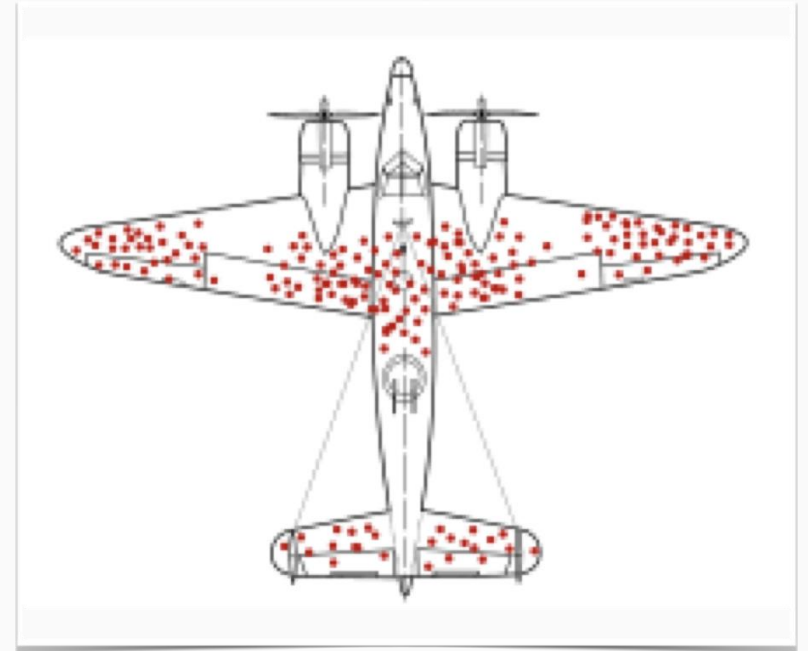


Survival bias

- Cultural issues were acknowledged by most respondents – but many of those remaining in physics were either not particularly impacted or were resigned to the issues.
- Many of these respondents seemed reluctant to discuss the problems.

“Yes, there is bias. I can see that. But for now I’m going to do the best work I can, work with good people, and see how it goes. I’m pretty thick skinned and it doesn’t bother me much as it bothers other women.”

BAME European female, academic physics.



Networks and mentoring

- Peer networks and mentoring were consistently discussed as being key to remaining in physics and progressing in career.
- Many respondents emphasised the importance of the support they have received from specific people.

“I’m lucky to have a longterm flexible fellowship – if I hadn’t won this I would have left physics. A senior professor approached me and suggested I apply, helped me with the application and coached me for the interview process.”

British white female, carer/disability.



Socio-economic background

- Relatively low salaries and slow career progression rates were cited as reasons to move away from physics.
- Many of the strongest academic physics departments are based in cities with high cost of living – London, Paris, Amsterdam,.....
- Particularly in early career, this disfavours those who cannot rely on family support.

“When I got a permanent lecturer post in London, I thought I had made it. But we can’t manage on my salary. We are going to return to [home country], even if I need to take a job outside physics.”

Non-European male, married with young children.



Taking ownership

- Physicists from under-represented groups are often the strongest advocates for the field to implement effective interventions.
- For other physicists, the onus for change is on governments (parental leave etc); on schools (choices of specialisations); on society (popular culture)....
- While societal approaches are important, effective change also requires groups and departments to have strong policies and practices, in line with their own contexts, cultures and norms, drawing on best practice and with clearly identified goals and outcomes.



Conclusions

- Most of the themes that have come out of this work are not new.
- The effectiveness of simple interventions such as mentoring and networking is well studied – but despite this there is still no consistent implementation of such interventions.
- Physics brands itself as a field of cutting edge ideas and of innovative thinking...
- But do we really want the diversity of thought achieved through diversifying the community?

“Who is wise? The person who learns from everyone.....”

אִיזָהוּ חָכָם? הַלּוֹמֵד מִכָּל אָדָם

