String Pheno 2024: Diversity and inclusion in physics

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Introduction

- This talk will explore diversity and inclusion within the string theory community, and the physics community more broadly.
- Three parts:

1. *Demographics of the hep-th community*
2. *Evidence based actions*
3. *Reflections on experiences of early career researchers*

- Important to combine quantitative analysis (diversity data) with qualitative approaches (surveys, focus groups, interviews).

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Demographics of hep-th

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Demographic data

- How is the diversity of the hep-th community evolving?
  (gender, race, …)
- Some perceive that the fraction of women at postdoc/PhD level has increased substantially, and it is just a matter of time before faculty representation catches up.
- Others perceive that the rate of change is very slow.
- Demographic data from professional bodies such as American Physical Society suggest that the truth is somewhere in between for physics and astronomy as a whole.
- Collecting demographic data for the subfield of hep-th is complex….

Data for hep-th: challenges

- There is no global professional body for hep-th, so we do not have the analogue of the large, high quality datasets of APS.
- The field is inherently global, with researchers moving between countries – hard to track whether early career researchers have left hep-th entirely, or simply moved to another country/continent.
- Gender, race etc are “sensitive data”, and are recorded in different ways in different countries.
- Different tenure track systems around the world – lack of comparability for assistant, associate and full professor posts.

Sources of data

- **Leuven postdoc application database**

  Joint European postdoc application system has collected gender data since 2003. (Non-binary added only recently.)

  Almost all European based hep-th researchers apply to Leuven; sampling of broader global community.

- **Demographic surveys**

  Based on hep-th groups reporting their demographics, with group members' consent.

  Survey of hep-th carried out in 2017, and updated recently by GenHET group (Agnesi Bissi, Yolanda Lozano and Silvia Penati).

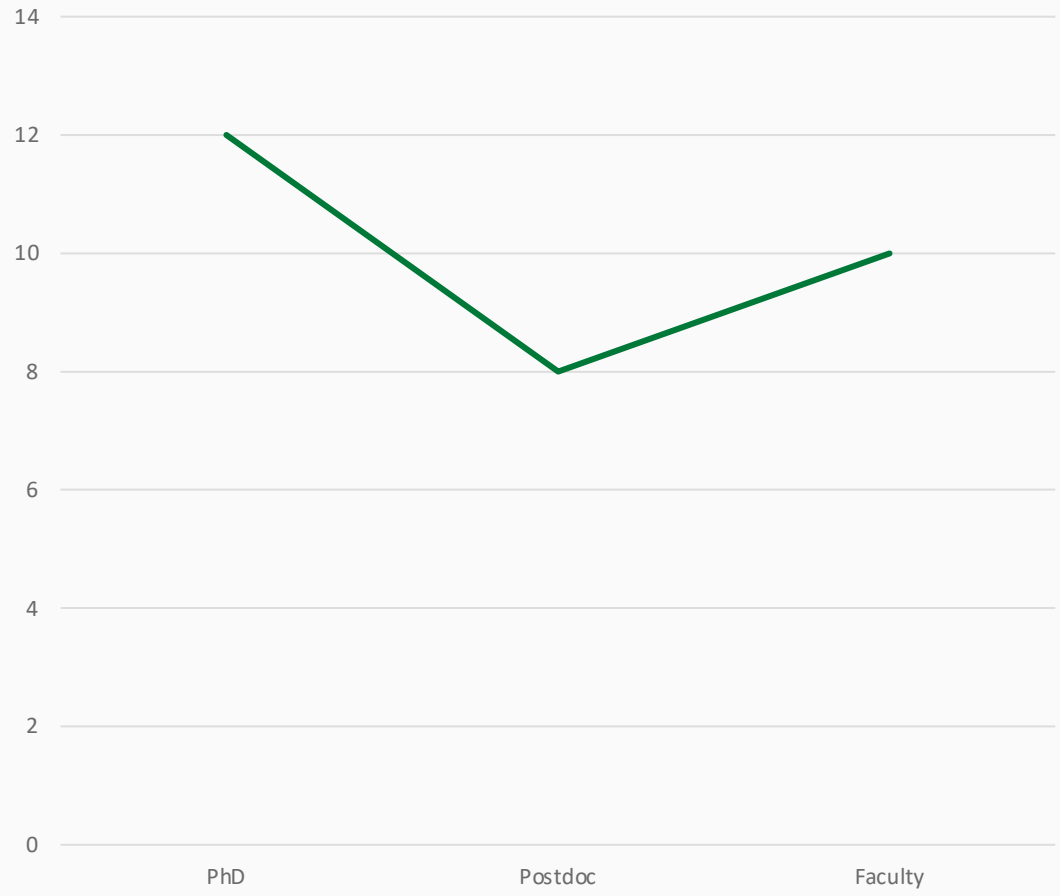
Key features

While there are limitations in the available data, we can draw some tentative conclusions:

1. Leaky pipeline for women – PhD to Postdoc?
2. Gender ratio of postdoc applications has not changed substantially in 20 years.
3. No significant gender differences in success rates in obtaining postdocs

Leaky pipeline?

- **2017 survey**: based on US groups, plus BE, DE, ES, IT, NL, SE, UK, 1500 participants
- Important to note that the actual percentages vary quite substantially by country.
- Data by country is of course quite noisy as absolute numbers of women are small.



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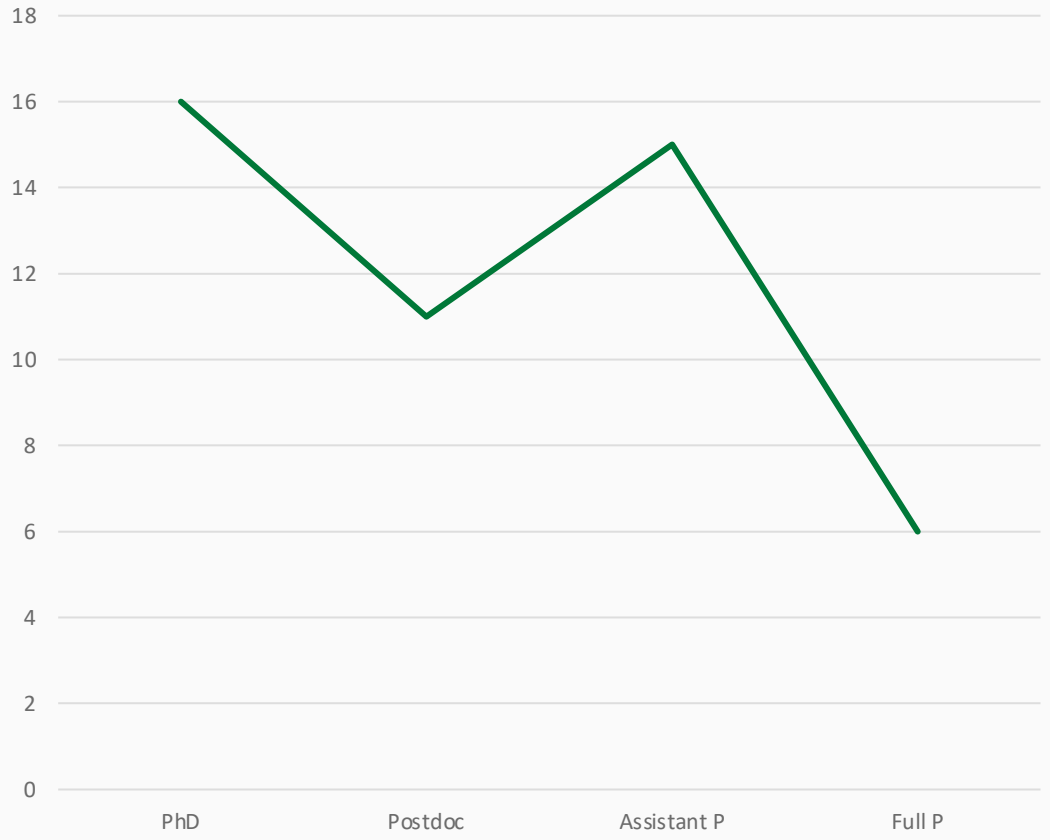
Leaky pipeline?

- **2024 survey**: Europe, 1062 participants
- NB: not directly comparable to 2017 as different countries included.
- Same feature: dip at postdoc level, but bounce back for faculty



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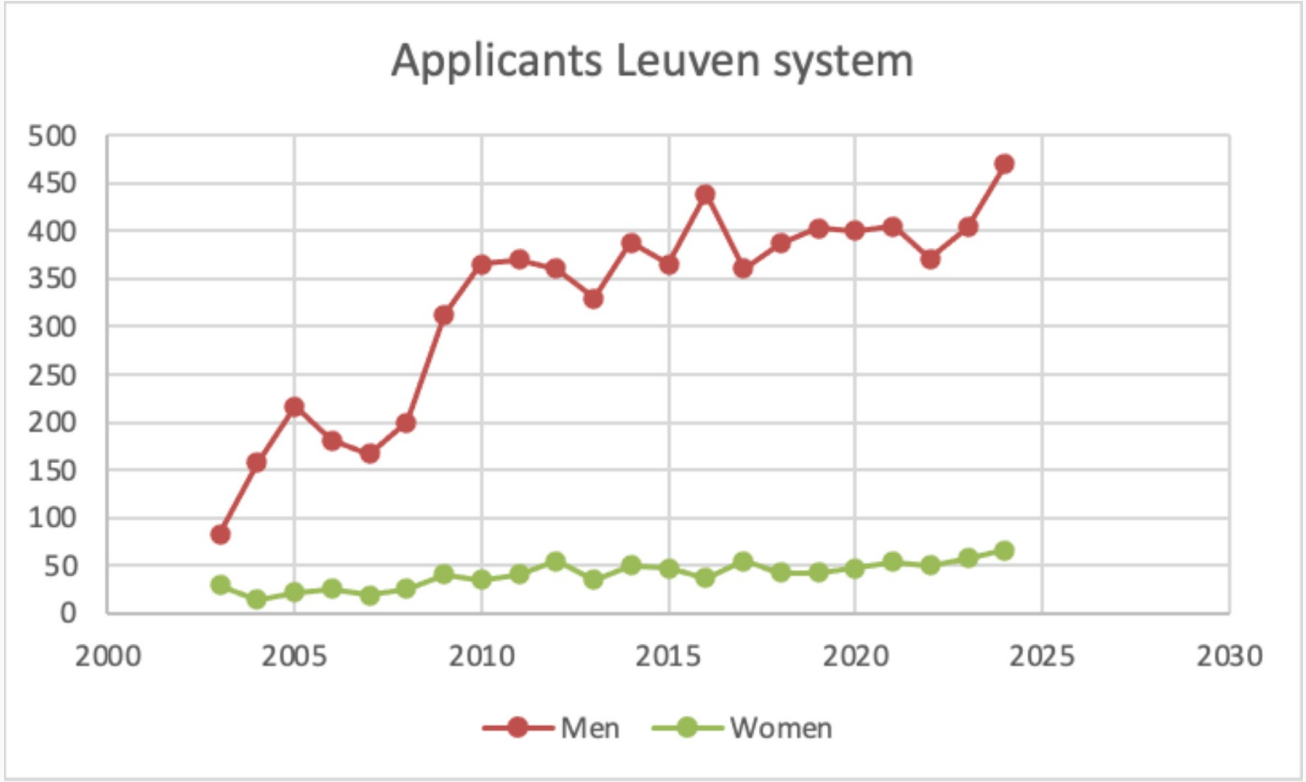
Postdoc applications

- Percentage of women applicants varies, in the range 9-13%.
- No statistically significant increase in percentage since 2003.
- Absolute number of women has increased – but so has the number of male applicants.



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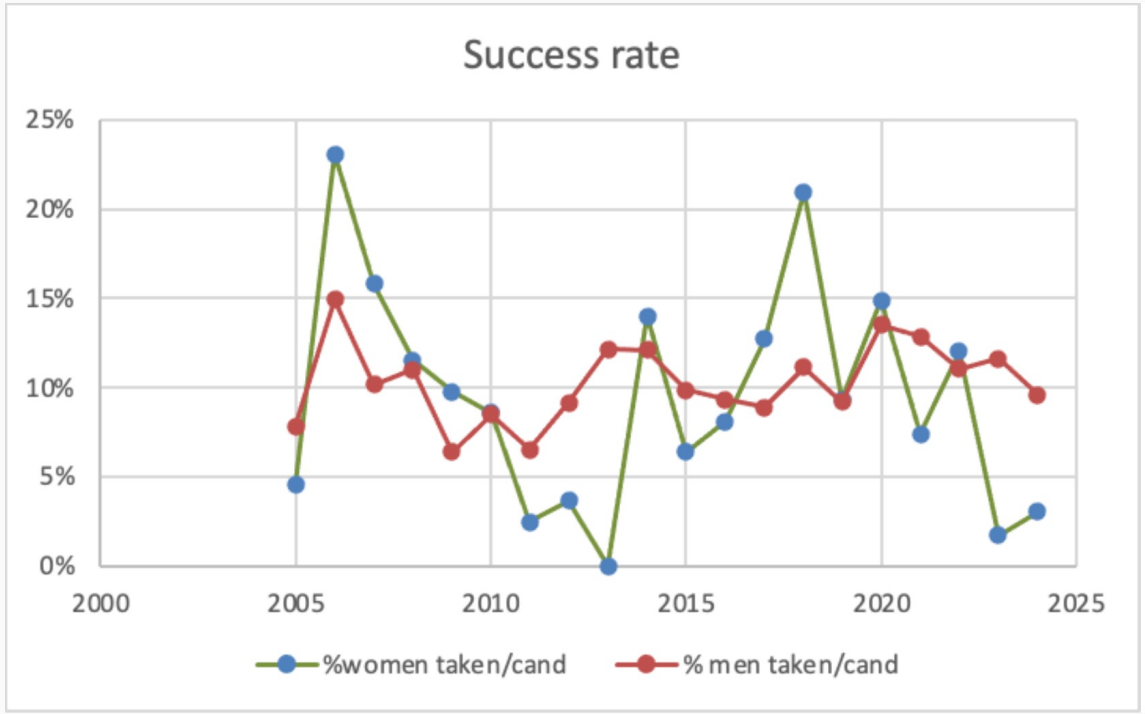
Success rates

- Volatile success rates due to small numbers of women.
- Analysis of rates aggregated over 3-5 years shows little difference between genders.
- Also important to note that this data refers to success rate in Leuven institutions – many Leuven applicants obtain posts in North America and elsewhere.



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What next?

- **Global data:** Could the community agree to a standardized framework for monitoring data?
- **Beyond gender:** How can we capture the broader diversity of our community? (Personal data such as race/ethnicity is categorized very differently around the world.)
- **Qualitative data:** Supplement demographic data with data from surveys, narrative around reasons for declining/accepting posts etc.

Diversity and inclusion: What works?

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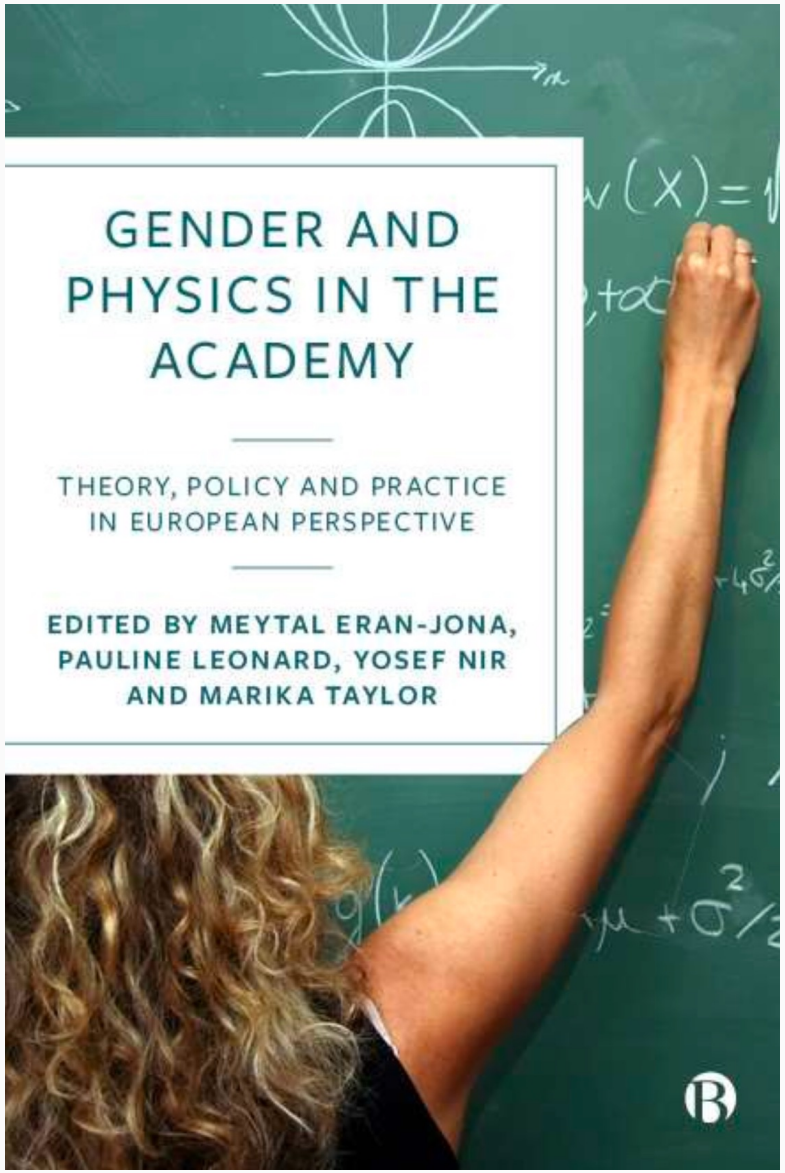
Gender and physics

- Here we 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.



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.

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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 inventions around hiring and progression.

- Learn from best practices eg UK Athena SWAN/IoP; 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 or research community.

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.

Culture

- Examples of actions include codes of conduct for conferences, as well as for departments.
- Hep-th conferences have introduced such codes of conduct in recent years.
- Working patterns: from times of departmental seminars and social events, to facilitating part-time working for family reasons.

Code of Conduct:

The string community is committed to providing an environment at the Strings conference that is free from any form of discrimination, harassment, or retaliation. Participants of the conference will avoid any inappropriate actions or statements based on individual characteristics such as age, race, ethnicity, gender, sexual orientation, marital status, nationality, or political affiliation. Harassing behavior of any kind will not be tolerated. Harassment includes but is not limited to inappropriate or intimidating behavior and language, unwelcome jokes or comments, unwanted touching or attention, offensive images, photography without permission, and stalking……

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, networks, coaching and other targeted support.

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

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Mentoring, coaching and networks

- Mentors – share knowledge, skills and experience to support development of mentee.
- Coaches – specific guidance to facilitate achieving full potential; often more structured than mentoring.
- Networks – in this context, networks are created or facilitated to bring together people with shared characteristics (gender etc) and experiences.
- String mentoring and networks:

  https://sites.google.com/view/mentoring-program-string-th/

  https://genhet.web.cern.ch

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 color; 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 draw out themes linked to diversity, including perceptions of how the science community could improve.

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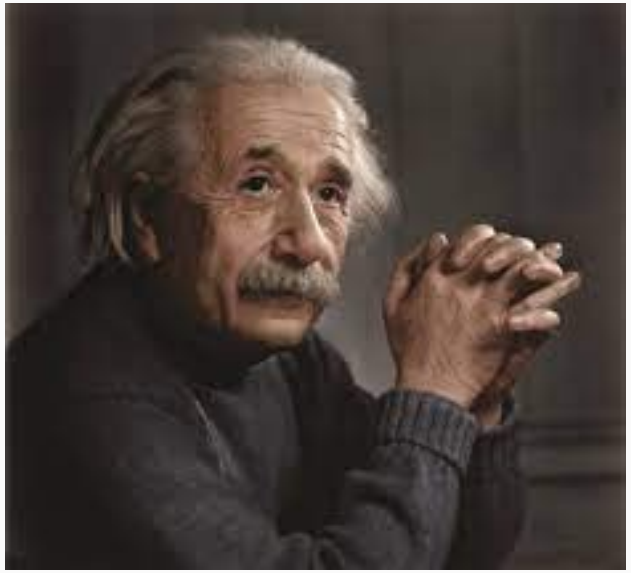
Barrier: culture of genius

- ***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 and race, socio-economic background) often reported feeling isolated, having nobody to reassure them when they lost confidence or experienced imposter syndrome.



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

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.

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.

Conclusions

- **Data** – could the community agree to a framework for monitoring hep-th diversity data?
- **Culture** – continue to develop good practices such as conference codes of conduct.
- **Networks and mentoring** – consistently shown to be effective in supporting under-represented groups.
- Physicists from under-represented groups are often the strongest advocates for diversity and inclusion, but there are many ways for us all to contribute.