House of Commons Science and Technology Committee: Improving diversity in STEM

1. This is the official response from the Royal Astronomical Society (RAS) to the House of Commons Science and Technology Committee inquiry into improving diversity in STEM.

2. The RAS represents more than 4,000 astronomers and geophysicists, in the UK and around the world, in occupations in academia, industry, education and public engagement, and journalism, as well as others in the wider economy. Our members are described as 'Fellows'.

3. This written evidence was shaped by input from our governing Council, and more generally from RAS Fellows and others in universities and research establishments.

4. We do not believe there are any prejudicial conflicts of interest to declare. For the record, one member of RAS staff has diversity issues included in her remit, and serves in a voluntary capacity on an STFC committee covering this area. The Society also has a Committee on Diversity in Astronomy and Geophysics giving strategic advice on diversity and inclusion in all aspects of our work.

Executive Summary

5. **Data from the RAS and other organisations demonstrate the systemic under-representation of women and members of minority groups in astronomy and geophysics, and the space sector, particularly at senior levels.**

6. **Suggested explanations for this under-representation include a lack of diversity in school STEM curricula, and barriers to accessing appropriate qualifications that enable career progression. This offsets the positive impact of astronomy and space as 'STEM attractors' encouraging further study.**

7. **In the astronomy and geophysics workplace, bullying and harassment is widespread, and disproportionately affects women and members of minority groups. This is likely to be representative of STEM as a whole, can only hinder efforts to recruit a retain a more diverse workforce, and should be addressed as a matter of urgency.**

8. **RAS Fellows with an interest in diversity do not see UKRI as offering good leadership in this area, for example in readily sharing data.**

9. **Examples of good practice in fostering diversity in STEM include the Society's RAS 200: Sky and Earth project, which enabled under-represented groups to shape public engagement programmes.**

10. **Funding bodies, universities and research establishments should embed and give equal worth to employees taking advantage of part-time, hybrid and other flexible working arrangements, including career breaks and maternity and paternity leave.**

Responses to specific points from the Select Committee:

- **The nature or extent to which women, ethnic minorities, people with disabilities and those from disadvantaged socioeconomic backgrounds are underrepresented in STEM in academia and industry**

11. For our sector, the key sources of evidence are our periodic surveys of the demographics and research interests of the astronomy and geophysics communities, and our survey of bullying and harassment in the astronomy and geophysics workforce. We also collect UCAS data on the diversity of undergraduate admissions to relevant courses. The Space Census of the Space Skills Alliance[1] covers the whole space sector including industry, academia, government, the military and not for profit organisations.

12. The Society carries out a full survey of the demographics and research interests of the astronomy and geophysics community every five to six years, with this exercise most recently completed in 2016[2]. We separately surveyed the demographic composition of our Fellowship in 2014[3]. In 2022 we will repeat our full community survey to assess changes resulting from the Covid-19 pandemic and Brexit.

13. This and the other surveys provide the data requested by the Committee and described in the following paragraphs. *We note that diversity considerations encompass many other areas for which we also have data, and we will be pleased to supply these on request.*

Women

14. In employment in academic astronomy and geophysics, women are under-represented at all levels, though representation has improved in recent years.

15. In fixed-term research posts women made up 27.5%, 33% and 40.5% of staff in astronomy, solar system science and solid-Earth geophysics respectively. The proportion of female lecturers for the three subjects was 29.2%, 27.6% and 27.6%. Women made up 18.2%, 22.2% and 22.7% of senior lecturers / readers in the three disciplines. The proportion of female professors was 11.6%, 21.2% and 9.8% respectively.

16. The 'leaky pipeline' is very much in evidence in academia, particularly at professorial level. The proportion of women professors did increase in the six years between the two most recent RAS surveys (in 2010 and 2016), though by more in astronomy (up 81%) and solar system science (up 64%), than in solid-Earth geophysics (up 21%). This trend is welcome, but representation of women and men in all these disciplines remains a long way from parity, and at more junior levels was changing very slowly.

[1] https://spaceskills.org/census-demographics#summary
[2] https://ras.ac.uk/ras-policy/community-demographics/demographic-survey-2017
[3] https://ras.ac.uk/ras-policy/community-demographics/who-are-we-now-2014-ras-membership-survey

For example, the proportion of women lecturers in solid-Earth geophysics actually declined by 15% in the same period.

17. Membership of the Royal Astronomical Society reflects this broader picture. Overall, only 19% of our Fellows are women, skewed by the large number of male retirees in our membership. In our 2014 survey women made up 38-44% of respondents in their 20s and 30s, 20% of those aged 45-49, and just 6% of our members aged over 70.

18. These findings are consistent with the space sector as a whole, with women making up 29% of the space workforce. In that survey 35% of academic employees (including PhD students) were women, compared with 22% in private industry. Data in that survey also confirm the pattern of women being best represented under the age of 40, with steep declines in representation in successive decades after that point.

Ethnic minorities

19. University departments and research establishments are global recruiters, so often appear to have an ethnically diverse workforce. In astronomy and geophysics this masks significant under-representation of UK citizens from black and minority ethnic backgrounds[4].

20. Our survey data indicated:

- 87% of UK national PhD students were white
- 97% of postdoctoral researchers with British nationality were white
- 95% of British nationals employed as professors were white
- Strikingly some ethnic groups were exceptionally under-represented, and for example *just one black PhD student responded to the most recent survey*

21. Data on the Royal Astronomical Society also suggest our membership is overwhelmingly white. In 2014 7% of our UK Fellows were from a minority ethnic group, and *just 4 respondents (0.6%) indicated their ethnicity was Black, Black Caribbean or Black African.*

22. The Space Census showed a similar pattern, with half of Black employees originating from outside the UK, for example.

Disability

23. In the disciplines we represent, 7% of students who accepted places on astronomy undergraduate courses and 10% of those who accepted places on geophysics

[4] Geoscience is described as one of the least diverse disciplines. See e.g. "Scientists from historically excluded groups face a hostile obstacle course", A. A. Berhe et al, Nature Geoscience, 2021. https://www.nature.com/articles/s41561-021-00868-0?utm_medium=affiliate&utm_source=commission_junction&utm_campaign=3_nsn6445_deeplink_PID16125532&utm_content=deeplink

undergraduate courses were disabled in 2016[5] (note that these data, from UCAS, do not cover institutions offering natural sciences programmes). *Above this level representation is much poorer, and just 2% of postgraduate students and employees described themselves as disabled*. This compares with 16% of working age adults in the population as a whole.

24. Among our membership, 10.6% of respondents to a 2014 survey said they were disabled and / or had a health condition or learning difference. Within this total, and for those aged 20 to 59, this ranged from 2% of 25- to 29-year-olds to 15% of 55- to 59-year-olds.

25. The Space Census indicated that disabled people made up 8% of employees in the broader sector in 2020.

Socioeconomic background

26. The RAS currently has no data on the socioeconomic background of astronomy and geophysics employees, something we will attempt to address in our 2022 survey. To their credit, the Space Census team did gather data on this question, using type of school as a proxy measure for socioeconomic status. It found that employees educated in private schools were over-represented by a factor of 2.2, those educated in selective state schools by a factor of 4.6, and those educated in comprehensive schools were under-represented by a factor of 0.7.

- **The reasons why these groups are underrepresented**

27. The Committee is likely to hear many possible explanations for under-representation of specific groups in STEM. Here we choose to concentrate on those covered by our work, and include a summary of views from our Fellows solicited during the preparation of this response.

28. Astronomy and space in particular are recognised as a 'STEM attractor'[6] that encourages further study of science, and students all of ages are likely to respond positively to its inclusion in the curriculum or in events outside of the school timetable.

29. However, from school onwards, students from under-represented groups often face barriers to further study in STEM. For example, the respected ASPIRES study notes that access to triple science at GCSE level, an important factor in choosing and being able to study sciences at A level[7]. The study of A level Physics (and Mathematics) is a

[5] UCAS data supplied to the Royal Astronomical Society

[6] See e.g. "Pupils' and Parents' Views of the School Science Curriculum", J. Osborne and S. Collins, King's College London, 2000. https://www.kcl.ac.uk/archive/website-resources/education/web-files2/news-files/ppt.pdf

[7] "Is GCSE Triple Science making the STEM skills gap wider?" https://blogs.ucl.ac.uk/aspires/2016/04/21/triplescience/ and "Stratifying science: a Bourdieusian analysis of student views and experiences of school selective practices in relation to 'Triple Science' at KS4 in England", L.

prerequisite for undergraduate programmes in astronomy and geophysics, or core physics programmes that lead on to doctoral training in these areas.

30. The school physics curriculum also has a lack of diversity in its representation of scientists. This is in part a result of a focus on named laws, but the result is that those figures mentioned are overwhelmingly white, male and European. For example, a Fellow of the RAS who carried out a review of the AQA A level syllabus noted that it mentions 39 physicists, and that all of them fit this category[8].

31. For those who do succeed in pursuing an academic career, there is evidence that the current workplace culture in astronomy and geophysics is less welcoming to women and underrepresented groups than to the white male majority.

32. The RAS recently carried out a significant piece of work in this area, investigating the prevalence of bullying and harassment in astronomy and geophysics. The full report will be published in the spring of 2022, but the initial findings were made public last summer. We found that bullying and harassment is widespread and systemic in workplaces in the fields we represent.

33. 44% of those responding to the survey had suffered bullying and harassment in the past 12 months. Considering the groups the inquiry focuses on, disabled and Black and minority ethnic astronomers and geophysicists are 40% more likely to be bullied than non-disabled and White counterparts, and women and non-binary people in the field are 50% more likely than men to be bullied and harassed. Astronomy and geophysics are unlikely to have workplace cultures that are very different to the rest of STEM and to academia as a whole, but this finding nonetheless requires investigation and action.

34. Irrespective of the culture in their employers, academic researchers need a strong track record in securing grant funding to build successful careers. It was therefore disappointing to read the summarised response to a Freedom of Information request to UKRI last November, suggesting that White applicants were awarded 32% of the grant funding they applied for, whereas Black applicants only received 8% of their requested support[9].

35. RAS Fellows offered a variety of explanations for these concerns. They recognise that (the lack of) diversity in different occupations is a wider societal issue, but describe academia as very conservative in its response. In particular, RAS members who responded described how the leadership of academic institutions has little lived experience of discrimination, that they are not always aware of its consequences, and are not held accountable for the lack of diversity in their workforces. Fellows also describe 'general apathy' about how damaging the system is for people in minority

---

Archer et al., Research Papers in Education, Vol.3, Issue 2, 2017.
https://www.tandfonline.com/doi/full/10.1080/02671522.2016.1219382?scroll=top&needAccess=true

[8] Dr Olivia Keenan, SEPNET, private communication. She reviewed "AQA A and AS level Physics specifications" at https://filestore.aqa.org.uk/resources/physics/specifications/AQA-7407-7408-SP-2015.PDF

[9] See https://twitter.com/AddyAdelaine/status/1464620195675258893?s=20

groups. Members of those groups are expected to lead work on improving diversity, but this is not valued or recognised as relevant.

36. In academia, the career structure is also still very much seen as a barrier to diverse recruitment, as it favours short-term insecure contracts at the outset. This disadvantages women of childbearing age and people with caring responsibilities, not least with its implied frequent change of geographical location.

The implications of these groups being underrepresented in STEM roles in academia and industry

37. The central argument for improving diversity in STEM roles should be to achieve just outcomes, and to allow everyone to realise their potential, without discrimination on the basis of their protected characteristics or social background.

38. There are well documented reasons for institutions and organisations to work towards this goal, including evidence that diverse teams are more productive[10], and there is no reason to believe that astronomy and geophysics will not benefit in a similar way. A more diverse and larger recruitment base will also help to tackle the shortage of STEM graduates needed in the wider economy[11].

What has been done to address underrepresentation of particular groups in STEM roles?

39. The Royal Astronomical Society itself recognises that improving the diversity of people in astronomy and geophysics is vital, and embeds this in our work. A good example of this in the run up to our bicentenary year 2020 was RAS 200: Sky and Earth, which supported 12 public engagement projects in the UK, Ireland and South Africa[12].

40. These projects were selected in a different way to traditional top-down support for STEM public engagement by funding bodies, where applicants and recipients of support tend to be academics. For our scheme, community organisations *led* applications, shaping the design of projects to suit the interests of diverse groups of people.

41. The beneficiaries included carers in Scotland, prisoners in London and Kent, creative arts groups in Galway, young people not in education, employment or training, adult learners, girl guides and participants in the Welsh Eisteddfodau (the National Eisteddfod and the Urdd (Youth) events)

[10] "Diversity wins: How inclusion matters", mckinsey.com, 2020. https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters

[11] "Industrial Strategy: Building a Britain fit for the future", 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

[12] RAS 200 – projects: https://ras.ac.uk/ras200/projects

42. To date these projects have reached more than 130,000 people, with positive impacts on attitudes to astronomy and geophysics (many participants had not engaged with these subjects before) and on mental health[13].

43. Like similar organisations, the Society also has codes of conduct[14] which explicitly forbid discrimination, harassment, bullying and victimisation on the basis of protected characteristics. These apply to our Fellows and to those participating in our events and meetings, and serve to promote a more inclusive culture.

What could and should be done by the UK Government, UK Research and Innovation, other funding bodies, industry and academia to address the issues identified?

44. Earlier in this submission we described the lack of diversity in specifications for A and AS level physics. To redress this, the DfE, exam awarding bodies and textbook publishers should consider how to redress this representation in school curricula and syllabuses, to expose young people to a broader range of role models that more closely matches society as a whole.

45. In the academic workplace, the prevalence of bullying and harassment, and its disproportionate impact on women and people from minority groups should be addressed with some urgency. The RAS will continue its efforts in this area and we will certainly share our detailed findings and recommendations with relevant bodies. We support the calls by another of our Fellows, who has carried significant work in the specific area of sexual misconduct, and who proposes better staff training, improvements to complaint mechanisms and an end to the use of non-disclosure agreements by universities[15].

46. There are a number of recommendations we ask the Committee to consider in the area of flexible working in academia. The first of these is around the funding of maternity and paternity leave in postdoctoral posts funded by STFC / NERC / UKRI. The grant itself usually covers a given period, with additional financial support for leave after the birth of a child only available on a discretionary basis[16]. This could have the effect of deterring grant holding bodies from hiring women of childbearing age, so we recommend that supporting funding to be made available to all successful applicants for grants.

47. We would also like to see further political support for part-time roles in research, to ensure postholders have parity of esteem with full time peers. This would encourage a more diverse range of applicants, including those with family and other caring responsibilities.

---

[13] Evaluation report from Jenesys Associates. https://www.jenesysassociates.co.uk/
[14] RAS Codes of Conduct https://ras.ac.uk/about-the-ras/codes-conduct
[15] Professor Emma Chapman, private communication. (In her own submission to the Select Committee.)
[16] https://stfc.ukri.org/about-us/our-purpose-and-priorities/requesting-information-from-uk-research-and-innovation/rules-concerning-the-tenure-of-awards/#:~:text=All%20STFC%20funded%20students%20are,months%20of%20additional%20paternity%20leave.

48. The Covid-19 pandemic has forced changes in working patterns, many of which are seen as positive by the STEM research community, such as enabling home working for at least part of the time, offering online access to meetings and conferences, and carrying out virtual public engagement work. Few would suggest that there should be no in person working in offices, labs and lecture theatres, something employees welcome too, but the previous model of working in a single location should end.

49. The hybrid working model is of particular benefit to employees and students with family responsibilities, and some disabled staff who were previously unable to travel. This should be explicitly supported by UKRI, higher education institutions and research establishments, and should be routine for the STEM workforce.

50. In the coming years STEM research employers and funding agencies should also consider the impacts of the pandemic on the health and productivity of different groups. Some staff will have benefited from fewer in work distractions, but many will have a gap in their research output through no fault of their own, for example through having spent time home-schooling or caring for vulnerable relatives.

51. The perception of UKRI itself is that it lacks diversity at a senior level, and that transparency and accountability are not always features of its work. The funding body should be more open with diversity data, which should not require extraction through a freedom of information request like the one referred to earlier in this submission. A framework for recognising work by UKRI grantholders in equity, diversity and inclusion would also help build confidence in this area, and support better workplace practice.

52. A final suggestion from our affiliated organisation, the British Geophysical Association, is that members of award and prize lecture panels should have unconscious bias training to help improve the diversity of winners.