

## **All Party Parliamentary Group (APPG) on Diversity and Inclusion in Science, Technology, Engineering and Maths: Equity in the STEM Workforce**

### **Written evidence submitted by the Royal Astronomical Society**

1. This is the official response from the Royal Astronomical Society (RAS) to the inquiry by the APPG into Equity in the STEM Workforce.
2. The RAS represents more than 4,000 astronomers, space scientists 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. All our members are described as 'Fellows'.
3. This written evidence was shaped by input from our governing Council, our Committee on Diversity in Astronomy and Geophysics, and more generally from RAS Fellows and others in universities and research establishments.
4. We have considered our whole workforce, including PhD students and postdoctoral researchers – often described as early career researchers - who are an essential part of the ecosystem that enables our sciences to flourish.

### **Executive Summary**

5. The Royal Astronomical Society supports efforts to broaden the diversity of the STEM workforce, including in astronomy and geophysics, without reservation.
6. It is essential that the APPG notes the differences between disciplines and areas of work in STEM. Our submission covers astronomy and geophysics, where women, disabled people and people from minority ethnic groups are very under-represented. Our dataset is one of the few covering these areas for these subjects, as information from the Higher Education Statistics Agency (HESA) is much broader.
7. Key concerns for us are:
  - The lack of intersectional data resulting from small number statistics – in itself a reflection of poor recruitment in multiple areas
  - The 'leaky pipeline' remains very much in evidence for women
  - The stark data on people from minority ethnic backgrounds and disabled people – representation of these groups is extremely low in our sciences
  - There are no data on the differential impact of social class on career outcomes in our disciplines
  - There are no data on people who have undergone gender reassignment
8. Our community has offered positive proposals such as blind recruitment of postgraduate students and staff, reinstating the requirement to meet Athena Swan (or a similar framework) standards to obtain grant funding, and ensuring that organisations meet progression targets in diversity frameworks.

9. Finally, we strongly urge changes in diversity policy and practice to be developed on the basis of evidence – those programmes where *outcomes* change are the only ones worth pursuing.

**What are the demographics of STEM workers in your organisation or sector? Are there gaps in the quality of evidence, monitoring or reporting?**

10. The Society carries out a full survey of the demographics and research interests of the astronomy and geophysics community every five years, with this exercise most recently completed in 2016<sup>1</sup>. We separately surveyed the demographic composition of our Fellowship in 2014<sup>2</sup>.
11. Data in this survey cover some but not all of the protected characteristics, listed below.

Sex

- Women were under-represented at all levels, though representation improved between 2010 and 2016
  - 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
12. The 'leaky pipeline' is very much in evidence, particularly at professorial level. The proportion of women professors did increase in the six years between the two most recent surveys, 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. For example, the proportion of women lecturers in solid-Earth geophysics actually declined by 15% in the same period.
  13. Membership of the Royal Astronomical Society reflects this broader picture. Overall, only 19% of our Fellows are women, skewed by the large number of 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.

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<sup>1</sup> <https://ras.ac.uk/ras-policy/community-demographics/demographic-survey-2017>

<sup>2</sup> <https://ras.ac.uk/ras-policy/community-demographics/who-are-we-now-2014-ras-membership-survey>

## Race

14. University departments and research establishments are global recruiters, so often appear to have an ethnically diverse workforce. In astronomy and geophysics this though masks significant under-representation of people from black and minority ethnic backgrounds.
15. Our survey data indicate:
  - 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 are exceptionally under-represented, and for example *just one black PhD student responded to the survey*
16. 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*

## Religion or belief

17. Astronomy and geophysics are disciplines dominated by people who have no religion or describe themselves as atheists, and in 2016 this covered 77% of permanent staff, 72% of postdoctoral researchers, and 75% of postgraduates. The vast majority of the remainder were Christians, with very small numbers (less than 2% in all groups) adhering to other religions.
18. In 2014 around 60% of RAS Fellows had no religion or were atheists, and 31% were Christian, and no more than 1% of members adhered to any other religious faith.

## Disability

19. In the disciplines we represent, 7% of students studying astronomy and 10% studying geophysics at undergraduate level were disabled in 2016. *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.
20. Among our membership, 10.6% were disabled, which is unsurprising given our large cohort of retired members. In younger age groups the proportion is much lower, and for example only 4% of RAS Fellows in their 20s described themselves as disabled.

## Sexual orientation

21. Respondents to both surveys were somewhat less likely to define themselves as exclusively heterosexual than the population as a whole, where ONS data at the time indicated that 98% of the population who answered the question reported they were heterosexual, 1.2% lesbian or gay, and 0.7% bisexual<sup>3</sup>.
22. For permanent staff, 2% reported themselves as lesbian or gay, 4% as bisexual, and 95% as heterosexual (rounding errors mean these values do not add up to 100%). 4% of postdoctoral researchers said they were lesbian or gay, 4% bisexual, and 86% heterosexual.
23. Of postgraduate researchers responding, 83% reported they were heterosexual, 8% lesbian or gay and 9% bisexual.
24. Among RAS Fellows, 84% described themselves as heterosexual, 3% as bisexual, 4% as gay and 0.2% as lesbian. (The last value is in part a reflection of the low number of women in the Society.)

## Age

25. Our data cover staff in astronomy and solar system science, but not solid-Earth geophysics as the number of people reporting was too low to be statistically significant. In the first two, the median ages of respondents were 30-34 years for postdoctoral researchers, 35-39 for lecturers, 40-44 for senior lecturers / readers and 50-54 for professors.

## Pregnancy and Maternity

26. Academic staff in astronomy and geophysics appear less likely to have children than the population as a whole. At professorial level there is some evidence that a large proportion of women (more than 40%) are childless, compared with between 9% and 20% for women born from 1946 onwards<sup>4</sup>. The small number of women employed as professors in our subjects, and who responded to the survey, places a caveat on the significance of this finding.
27. In 2016 only 4% of men had taken career breaks, mostly relating to parental leave, compared with 35% of women.

## Gender reassignment

28. Our surveys to date have little or no information on people who have undergone gender reassignment.

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<sup>3</sup><https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/sexuality/bulletins/sexualidentityuk/2017#:~:text=An%20estimated%202.0%25%20of%20the,at%20similar%20levels%20to%202016.>

<sup>4</sup><https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/conceptionandfertilityrates/bulletins/childbearingforwomenbornindifferentyearsenglandandwales/2019#childlessness>

## Socioeconomic background

29. We have no data on the impact of socioeconomic background on the careers of those employed in astronomy and geophysics.

## Gaps in the quality of evidence, monitoring and reporting

30. The most recent demographic and membership surveys took place in 2016 and 2014 respectively. We are not aware of any other work specifically covering the disciplines we represent, so plan to repeat these in 2021, as they are an essential tool for monitoring and reporting on diversity.
31. In the forthcoming surveys we will specifically include questions relating to gender reassignment and attempt to assess the impact of socioeconomic status.
32. We will also explore obtaining data on salary levels for different groups, to understand for example how the gender pay gap applies in astronomy and geophysics.

## **Where is there inequity across the different protected characteristics and how are different communities impacted across different:**

- **STEM disciplines or sector/subsectors**
  - **types of organisation (e.g. private, public, non-profit)**
  - **type of STEM activity (e.g. academic research, education, engagement, commercial, funding)**
  - **job levels and/or qualification**
33. The RAS remit is primarily aligned with the academic community working in astronomy and geophysics, given our role as a learned society supporting fundamental research. Within that sector, the most notable inequities are connected to sex, race and disability.
34. Women remain significantly less likely to enter employment than men, and are even less well represented in senior roles, as described in the summary of our data in the previous question. The low number of disabled employees in astronomy and geophysics, and employees from minority ethnic backgrounds means we do not have reliable data on how this impacts progression to different job levels.

## **Where are there evidenced inclusive behaviours and policies within different organisations, subsectors, sectors and countries on:**

- **Recruitment;**
  - **and/or Retention**
35. Good practice in recruitment and retention is important for the whole STEM sector, and we strongly agree that it should be evidence-based. Useful schemes include the Daphne Jackson Fellowship, which enables a return to research for scientists who left for family, caring or health reasons.

36. Our Fellows cite examples in higher education institutions, such as ‘blind’ recruitment of PhD students in the Institute for Astronomy in Edinburgh<sup>5</sup>, which aims to select applicants for interview without knowledge of their protected characteristics. This has just been introduced, so its efficacy should become clear by the autumn of 2021.
37. In the University of Nottingham, the School of Physics and Astronomy is acting on a series of commitments as part of its Athena Swan action plan. These include: the Head of School contacting staff who have not been promoted in the last five years, to discuss their progress and how they can be supported; monitoring grant submission numbers by gender and training in grant application writing, monitoring seminar speakers to ensure a diverse range of contributors, a mentoring scheme for staff taking maternity or parental leave, a bi-annual stress survey to identify issues that are preventing staff succeeding in their work; and mentoring networks for female physicists, BAME physicists, LGBT+ physicists, and physicists with disabilities.
38. Turning to our own organisation, at the beginning of the last decade, the RAS created our Committee on Diversity in Astronomy and Geophysics. In 2014 we were a founding signatory of the Science Council Declaration on Diversity, Equality and Inclusion<sup>6</sup>, now endorsed by more than 40 organisations. We use the Science Council Framework to monitor our progress on diversity and inclusion.
39. Fellows of the RAS are bound by our Code of Conduct<sup>7</sup>, which explicitly prohibits discrimination on the basis of protected characteristics, and other attributes such as physical appearance and level of intellectual / professional achievement. Harassment, bullying and victimisation are forbidden.
40. Irrespective of membership status, attendees at RAS events are bound by a separate Meetings Code of Conduct<sup>8</sup> governing their behaviour and with the expectation of respect and courtesy to all those present.

**Are there policies or activities undertaken by the UK Government, or its agencies, that advance or inhibit equity and inclusive cultures within the STEM workforce?  
Where could policy change or sector action lead to addressing the equity of opportunity within the UK’s STEM workforce?**

41. Our research active UK Fellows largely depend on funding from the Science and Technology Facilities Council (STFC), the Natural Environment Research Council (NERC), and the UK Space Agency.

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<sup>5</sup> <https://ifa.roe.ac.uk/phds-jobs-fellowships/phd-studentships>

<sup>6</sup> <https://sciencecouncil.org/professional-bodies/diversity-equality-and-inclusion/>

<sup>7</sup> <https://ras.ac.uk/membership/membership-fellows/code-conduct>

<sup>8</sup> <https://ras.ac.uk/code-conduct-ras-meetings#:~:text=As%20such%20the%20RAS%20will,%2C%20race%2C%20nationality%2C%20religion.&text=Respect%20RAS%20staff.,exclusionary%20jokes%20are%20not%20appropriate.>

42. The merger of the seven research councils, including STFC and NERC, into UK Research and Innovation (UKRI) carries the risk that the detailed analysis required to understand the differences between STEM disciplines is no longer possible. UKRI's stated intention to no longer publish these is a concern<sup>9</sup>, and APPG members may wish to explore this further.
43. We are also concerned at the ending of the requirement for universities to meet the standards of the Athena SWAN charter, which fosters gender equality<sup>10</sup>. The cited reasons for the decision – to remove unnecessary bureaucracy – ignore the possibility of reforming the charter system, and in any case no replacement framework is in place.
44. Three specific comments are put forward by RAS Fellows, firstly around the funding of maternity and paternity leave in postdoctoral posts funded by STFC / UKRI, which is usually met from the grant, without additional financial support being available<sup>11</sup>. This could have the effect of deterring grant holders from hiring women of childbearing age, so we ask for supporting funding to be put in place.
45. The second is to see further political support for part-time roles in research, to ensure postholders have parity of esteem with full time peers. This level of flexibility encourages a more diverse range of applicants, including those with family and other caring responsibilities.
46. A final point is on adverts for jobs, to ensure that they contain inclusive language, and state the starting salaries, to help ensure that applications come from candidates in all demographic groups.

**What are the impacts of COVID-19 on equity for STEM workers (including job and income security, contract type etc) in the short- and medium-term? Which communities, groups, organisations or sectors are being most impacted?**

47. There is little *quantitative* evidence available on the impacts of the pandemic on the STEM workforce. Nonetheless, reports from our Fellows suggest a range of consequences across astronomy and geophysics.
48. The lack of access to facilities, including ground-based observatories, will particularly affect early career researchers on fixed term funding, who are expected to produce research outputs within the lifetime of a grant. In geophysics fieldwork is prevented by travel restrictions, with a similar effect. When the pandemic abates access to

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<sup>9</sup> <https://www.ukri.org/our-work/supporting-healthy-research-and-innovation-culture/equality-diversity-and-inclusion/diversity-data/>

<sup>10</sup> <https://www.nature.com/articles/d41586-020-03027-4>

<sup>11</sup> <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.>

facilities is likely to be heavily oversubscribed, making access harder for some time to come.

49. Postgraduate researchers are very much affected by the pandemic in general, particularly those involved in experimental work, or who are reliant on data whose collection has been / will be affected by the shutdown of facilities. The announcement from UKRI of funded six-month extensions for the PhD students they support, due to finish between 1 March 2020 and 31 March 2021, was therefore welcome.
50. For postgraduates in earlier years, UKRI has requested that they review their research projects to ensure completion within the original schedule, but there is less funding available to support any necessary time extensions. There are also a large number of postgraduates without funding, or funded by their institutions, where no additional financial support is available. In these cases, the number of students who do not complete their research projects is likely to rise significantly, and will give those who have had funded extensions an unfair advantage over those who have not.
51. STEM staff and postgraduate students with families and other caring responsibilities are a group particularly affected by COVID, with a reported disproportionate impact on women. There is so far no specific data for astronomers and geophysicists, but more general studies suggest that either women published fewer papers as a result (including in physical sciences)<sup>12</sup>, or that where output increased, it did so for men much more than women<sup>13</sup>.
52. Researchers in astronomy and geophysics have adapted to e-working well, at least in continuing collaboration and keeping lines of communication open. Some in our sector (largely in universities, with teaching responsibilities alongside research work) however report high levels of workplace stress, little opportunity to reduce this pressure, and that their employers are reluctant to offer support such as access to the parental furlough scheme. Employees also report serious concerns about the long-term impact of the pandemic on their work, as a result of wider economic pressures.

**What are the implications and opportunities of new policies and employer action in the next 5-10 years following COVID-19 and Brexit? What will the future impacts be for communities, groups, organisations or sectors?**

53. In the next few years STEM research employers and funding agencies should take account of the impacts of the pandemic on the health and productivity 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 the reasons described above.

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<sup>12</sup> <https://www.insidehighered.com/news/2020/10/20/large-scale-study-backs-other-research-showing-relative-declines-womens-research>

<sup>13</sup> <https://www.nature.com/articles/d41586-020-02183-x>

54. The researchers we represent also note positive effects of the Covid-forced change in working patterns, such as enabling online access to meetings and conferences. This benefited many people with family responsibilities, who found long periods away from home difficult, and some disabled staff who were previously unable to travel.
55. Moving public engagement work online is certainly no panacea, not least given it demands high quality IT equipment and a fast broadband connection, but as with professional events this shift has broadened the audience of those involved, in many cases to a global level. For example, an event run by the RAS in December 2020 attracted more than 15,000 participants from different schools, a reach we would simply never have had in the past.
56. Employment in STEM in general where part of the work is done at home also benefits many researchers, again particularly those with caring responsibilities, at least when schools and childcare settings are open. Few would suggest that there should be no in person working in offices, labs and lecture theatres, something employees welcome, but the model of working in a single location should end.
57. Employers, funding agencies and scientific organisations should take note of these changes, many of which are likely to endure. It now seems almost inconceivable that we will move back to running conferences that mandate in person attendance, or that scientific outreach will not include an online component.
58. UKRI and also Universities UK should take positive action on this, and embrace the opportunities presented by this modal shift in working patterns. Accessible and flexible working must be routine for the STEM workforce, rather than a concession to particular groups.
59. Brexit presents different challenges, somewhat overshadowed by the pandemic. The late decision to remain associated with Horizon Europe and future EU framework programmes is welcome, albeit with a likely lower return for the UK than we enjoyed with full EU membership. The new immigration rules will though reduce the ease of movement for employment between the UK and the EU27 countries.
60. For example, EU27 scientists who secure employment in the UK, or UK scientists who obtain posts in EU27 member states may face additional charges to relocate, such as for NHS access or visa fees. For the employee the visa application fee is relatively low (£152 for Global Talent visa, £97 for applicants from EEA countries and Turkey, significantly more for Skilled Worker visas), but each additional family member then needs to pay £608, and everyone planning to move to the UK needs to pay an NHS healthcare surcharge of £624 each year<sup>14</sup>.
61. Together with an endorsement fee of £456, a researcher with a family of four will then need to pay nearly £5,000 to move here in the first year alone. This

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<sup>14</sup> <https://www.gov.uk/global-talent>

immediately sets up a barrier for older scientists with families to join our STEM workforce, to the detriment of the UK scientific base.

62. There is also already some evidence that academics from both EU27 and non-EU countries working in the UK are leaving in larger numbers since Brexit<sup>15</sup>.
63. For younger researchers, particularly PhD students and postdocs, the UK decision to leave the Erasmus+ scheme could reduce their international mobility. The replacement Turing scheme is welcome<sup>16</sup>, but lacks crucial components of Erasmus+, such as supporting incoming students, who will now rely on exchange agreements between individual institutions. The new scheme also no longer covers tuition fees for UK students, which can be significant, and may well deter applicants from low-income backgrounds<sup>17</sup>. We recommend that the DfE monitor the demographics of applicants to the Turing scheme, and review its provision to ensure fair provision across the student and postdoctoral researcher population.
64. Placing all countries on an equal footing is described as removing discrimination against applicants from outside the EU, with the expectation that the UK will see more skilled workers and professionals moving here from the rest of the world. It remains to be seen whether this happens, once the effect of the pandemic comes to an end. The UK government and its agencies should monitor patterns of migration by skilled workers, including in STEM, to establish whether employers are able to recruit the talented people they need.

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<sup>15</sup> <https://www.the-scientist.com/news-opinion/increase-in-academics-leaving-the-uk-since-brexit-vote-66656>

<sup>16</sup> <https://www.gov.uk/government/news/new-turing-scheme-to-support-thousands-of-students-to-study-and-work-abroad>

<sup>17</sup> <https://theconversation.com/erasmus-what-the-turing-scheme-must-do-to-ensure-uk-students-dont-miss-out-152543>