

Physics and: diversity profiles

An Institute of Physics briefing note



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Like any other endeavour, attracting the best people into physics means casting the widest net.

Ensuring diversity among professional physicists means having a workforce

with a variety of experiences and motivations, more able to bring fresh approaches to scientific problems and to look upon them with different perspectives.

And it means that anyone is free to study a subject that unlocks doors to a wide range of future opportunities, and entitled to pursue an exciting career.

The Institute takes the diversity of the field seriously, as physics has a particular problem – mainly with the underrepresentation of women but also of ethnic minorities, people with disabilities, and those from poorer socio-economic backgrounds.

But we're optimistic that, through our work and with a joined-up approach from partner organisations, teachers and government, our science will increasingly attract more people from the widest pool of talent – the best way for the UK to produce a cadre of graduates with the skills it needs for a high-tech economy.

Prof. Sir Peter Knight
President, Institute of Physics

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- *Survey of Academic Appointments in Physics*
- *Diversity in University Physics: Statistical Digest*
- *Childcare Survey*
- *Academic Physics Staff in UK Higher Education Institutions*
- *Physics Students in UK Higher Education Institutions*
- *The Career Paths of Physics Graduates*
- *Accepted Applicants to Degree Courses in UK Higher Education Institutions*
- *It's Different For Girls*
- *Gravitating towards physics: How will higher fees affect the choices of prospective physics students?*

Physics should widen horizons

If the UK is to increase the number of people with skills in science and technology, it will need to take them from a wider variety of backgrounds. Physics has traditionally not been good at this.

"For many years, physics has recruited its students from a narrow pool of available talent – that of white, middle-class boys," says Liz Whitelegg, the Chair of IOP's Diversity and Inclusion Committee. "Not only is this pool not large enough to supply the quantity of physics-trained people needed in the future, selection of talent from such a narrow pool is not able to utilize creative and divergent thinking that comes from including a range of people from a variety of backgrounds, with different characteristics and different ways of thinking and behaving."

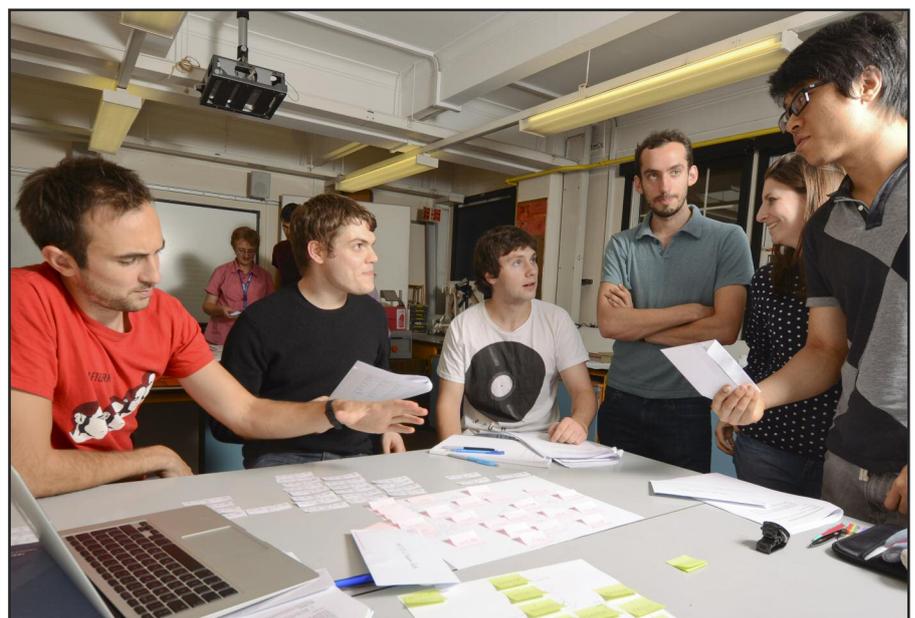
The underrepresentation of women in physics starts in schools, with far fewer girls choosing to study physics at A-level or Highers: in 2012 A-level physics was the fourth most popular subject for boys but only 19th for girls. Data from the Institute's report *It's Different for Girls* found that 46% of all schools in England sent no girls to study A-level physics in 2011. There are significant differences in the progression of girls

"It's important that physics is seen as attractive by a wide range of young people."

to physics depending on whether the school was co-educational or single-sex, and whether it was a state or independent school. However those differences were not present for the other sciences or for boys, suggesting that the experience of physics by girls is particularly different for girls in co-ed state schools.

The underrepresentation of girls in A-level physics feeds into the underrepresentation of women in physics at university and beyond, where men account for 80% of undergraduate physics students, 84% of physics academic staff and 95% of professors. "With the important contributions made by physicists to the economic, technical and intellectual wellbeing of the country, it is important that careers open to physics graduates are seen as attractive by a wide range of young people," says Imperial College's Prof. Joanna Haigh, one of just three female heads of a university physics department. "I fear this may be more the case for boys than girls, many of whom see the traditional high-tech geeky portrayal of physics as not something to which they aspire."

The Institute has a programme dedicated to addressing diversity and inclusion in physics and seeks to work with other learned societies, schools, universities and government to counter the underrepresentation of women, and other groups, in physics at all levels.



A lab in a university physics department. Physics is overwhelmingly white and male

The Institute is working on it

“The Institute is working to expand the pool of available talent and broaden the range of images of physics students to include girls, students from a variety of ethnic and low socio-economic backgrounds, and students with a disability,” says Whitelegg. “There is much to do but the health of the subject depends on its success.” The Institute has major projects to tackle the gender imbalance at two crucial stages of the pipeline – in schools and in higher education.

At school level, the Institute’s Girls in Physics programme aims to encourage teachers to examine their teaching methods, and shares information on successful teaching and learning

Diversity should be made a fundamental part of Ofsted inspection criteria

strategies to engage girls with physics. The Institute’s Stimulating Physics Network, an initiative funded by the Department for Education, aims to improve the uptake of A-Level physics by working directly with schools. The number of girls taking physics has increased by 200%, compared to 70% for boys, in partner schools.

The Institute is working with key partners, including Ofsted, to address gender-stereotyping using a whole-school culture approach. The Institute would like to see diversity introduced as an inspection criterion, as it would mean schools having to reconsider their approaches and take steps to address any clear gender imbalances. One example of where this might apply is a school with timetable clashes in which physics and

biology are scheduled for the same slot – implying that students can take one or the other but not both, and helping to drive scientifically inclined girls towards biology and away from physics.

For universities, the Institute runs Project Juno, a scheme to recognise and reward physics departments that are working to address the under-representation of women. A department moves through three levels of recognition – Supporter, Practitioner and Champion – as they identify issues, develop an action plan and work through it. Juno has enabled all Champions to change the culture of their departments, addressing gender issues from the bottom up and embedding good practice at every level. One Juno Champion now has around a third of applications to its degree programmes coming from girls, showing that voluntary reward schemes can and do work – provided that they are well supported and resourced. Almost three quarters of UK university physics departments have a Juno status, but the Institute would like to see all of them signed up.

However, it is the hidden effects of gender bias that are often the most systemic and difficult to counterbalance. The Institute’s Childcare Study in 2010 found that women were significantly more likely than men to report that childcare had affected their career progression, as they were less able to attend events, meetings and conferences, and a recent study of academic recruitment in the US found evidence of clear gender bias in hiring.

Tackling gender stereotyping in physics requires cultural change and will need to involve partnerships between schools, parents, educators, employers and professional bodies like IOP.

The complete picture

Although the underrepresentation of women in physics is the most well researched, the Institute also works on addressing other groups of potential talent. “Careers or study paths involving physics should be seen as potential options regardless of gender, ethnicity or background,” says Dawn Leslie, the secretary of the Institute’s Women in Physics Group. “The public perception of physics and physicists is something we should be mindful of, and be sure we are not unfairly or unwittingly prejudicing girls or other groups of people against the field.”

Social background

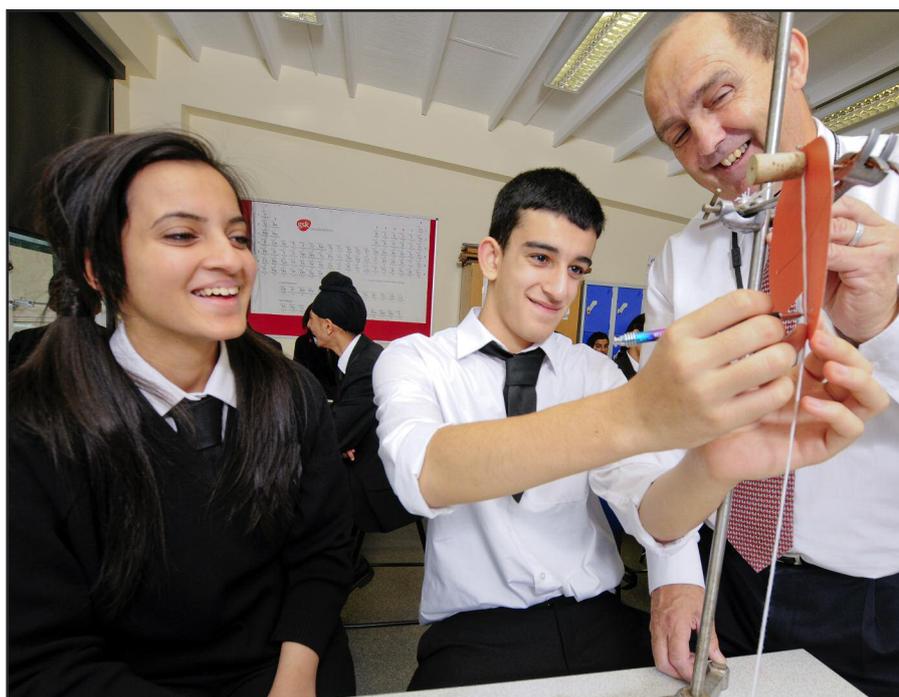
Over the past decade there has been a large increase in students from lower socio-economic backgrounds entering university. However, this widening participation has not been seen for physics. The Institute is carrying out a pilot project with a school in the North East of England that aims to raise aspirations of students and parents from lower socio-economic backgrounds to study physics post-GCSE, by increasing their awareness of career options, supporting teachers of physics, and developing an understanding of factors that limit aspirations of students and how they might apply elsewhere.

Ethnicity

Among physics students starting degree courses in 2009–10, 90% of those who specified an ethnicity were white – the highest proportion across science and engineering subjects, and significantly higher than the 78% average across all subjects. Over the past three years, the Institute has worked with a school that offers A-level physics and has a large number of ethnic-minority students. By offering them and their parents positive experiences of physics and correcting their misconceptions, the project increased the number of students choosing A-level physics.

Disability

Higher Education Statistics Agency data from 2007–8 revealed that only 1.2% of university physicists declared that they had a disability. This is lower than both the proportion among the employed population, at five per cent, and the average across academic staff in science and engineering, 1.9%. The Institute has worked with other science and engineering organisations to establish the STEM Disability Committee, a collaborative group of professional bodies that considers practical ways to improve policies, practices and provision for disabled people. One project has seen the creation of more than 100 new British Sign Language signs for physics terms that would once have to be finger-spelled, providing access to physics GCSE for deaf students.



IOP encourages teachers to reflect on their methods to avoid putting off girls