Fixing gender in theory

It is high time we addressed the low representation of women in high-energy theoretical physics.

In 2012, a group of string theorists in Europe launched a COST (European Cooperation in Science and Technology) action with a focus on gender in high-energy theory. Less than 10% of string theorists are female, and, worryingly, postdoc-application data in Europe show that the percentage of female early-career researchers has not changed significantly over the past 15 years.

The COST initiative enabled qualitative surveys and the collection of quantitative data. We found some evidence that women PhD students are less likely to continue onto postdoctoral positions than male ones, although further data are needed to confirm this point. The data also indicate that the percentage of women at senior levels (e.g., heads of institutes) is extremely low, less than 5%. Qualitative data raised issues specific to HET, including the need for mobility for many years before getting a permanent position and the long working hours, which are above average even for academics. A series of COST meetings also provided opportunities for women in string theory to network and to discuss the challenges that they face.

Following the conclusion of the COST action in 2017, women from the string theory community obtained support to continue the initiative, now broadened to the whole of the HET community. “GenHET” is a permanent working group hosted by the CERN theory department whose goals are to increase awareness of gender issues, improve the presence of women in decision-making roles, and provide networking, support and mentoring for women, particularly during their early career.

GenHET’s first workshop on high-energy theory and gender was hosted by CERN in September, bringing together physicists, social scientists and diversity professionals (see p39). Further meetings are planned, and the GenHET group is also developing a web resource that will collect research and reports on gender and science, advertise activities and jobs, and offer advice on evidence-based practice for supporting women. GenHET aims to propose concrete actions, for example encouraging the community to implement codes of conduct at conferences, and all members of the HET community are welcome to join the group.

Diversity is about much more than gender: in the HET community, there is also under-representation of people of colour and LGBTQ+ researchers, as well as those who are disabled, carers, come from less privileged socio-economic backgrounds, and so on. GenHET will work in collaboration with networks focusing on other diversity characteristics to help improve this situation, turning the high-energy theory community into one that truly reflects all of society.

By Marika Taylor

Improving the participation of under-represented groups in science is not just the right thing to do morally. Science benefits from a community that approaches problems in a variety of different ways, and there is evidence that teams with mixed perspectives produce creativity. Moreover, many countries face a skills gap that can only be addressed by training more scientists, drawing from a broader pool of talent that cannot reasonably exclude half the population.

In the high-energy theory (HET) community, where creativity and originality are so important, the problem is particularly acute. Many of the breakthroughs in theoretical physics have come from people who think “differently”, yet the community does not acknowledge that being both mostly male and white encourages groupthink and lack of originality.

The gender imbalance in physics is well documented. Data from the American Physical Society and the UK Institute of Physics indicate that around 20% of the physics-research community is female, and the situation deteriorates significantly as one looks “higher” on the career ladder. By contrast, the percentage of females is higher in astronomy and the number of women at senior levels in astronomy has increased quite rapidly over the last decade.

However, research into gender in science often misses issues specific to particular disciplines such as HET. While many previous studies have explored challenges faced by women in physics, theory has not specifically been targeted, even though the representation of women is anomalously low.

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**LHC REPORT**

**Machine powers down until 2021**

The Large Hadron Collider’s 2018 proton physics run came to an end on 24 October, having accumulated an impressive dataset. The integrated luminosity delivered to both the ATLAS and CMS experiments reached an average of around 66 fb⁻¹ for the year, 10% higher than the target. This corresponds to around 5 x 10²⁶ inelastic collisions per experiment. LHCb accumulated just under 2.5 fb⁻¹, while ALICE notched up 27 pb⁻¹. The high figures are due to excellent machine availability and an instantaneous luminosity that regularly touched 2 x 10³² cm⁻² s⁻¹ in ATLAS and CMS – twice the nominal value.

The end of the proton run was followed by three and a half weeks of lead-lead collisions at a centre-of-mass energy of 5.02 TeV per colliding nucleon pair. Beginning on 5 November, this is the fourth lead-lead run since the collider began operation. During the last run of this type in 2015, the luminosity achieved was more than three and a half times higher than the LHC’s design luminosity, and the goals for 2018 are even more ambitious. Lead ions were also collided with protons in the LHC back in 2016.

This year’s shut-down marks the end of LHC Run 2, which began in 2015 and saw proton collisions take place at a centre-of-mass energy of 13 TeV. The total data accumulated since the start of Run 2 corresponds to an integrated luminosity of 160 fb⁻¹ to both ATLAS and CMS. From 10 December, CERN’s accelerator complex will enter “long shutdown 2” and undergo an extensive programme of renovation and upgrades, in particular for the High-Luminosity LHC. A week of LHC magnet training tests for operation at a future proton–proton collision energy of 14 TeV is one of the first activities.

**High performance**

In terms of performance, LHC Run 2 has been a major success for both the machine and its detectors. In terms of physics output, highlights from ATLAS and CMS include several key measurements of the Higgs boson’s properties, in particular its couplings to top and bottom quarks and to tau leptons, and numerous searches for physics beyond the Standard Model. LHCb has found a clutch of new hadrons, deepening our understanding of strong interactions, and has accumulated interesting results concerning the universality of lepton couplings. In the sphere of nuclear collisions, ALICE has dug even deeper into the extreme dynamics of the quark–gluon plasma – also finding strong evidence that this state is produced in proton–proton collisions.

This is just a flavour of the numerous results produced. So far, no firm signs of physics beyond the Standard Model have been seen at the LHC, but the majority of data collected during Run 2 are still to be analysed. Between now and the return of data collected during Run 2 are still to be analysed. Between now and the return of protons for Run 3 in 2021, the LHC experiment collaborations will throw everything they have at the data to see if anything new is lurking in the Run 2 data.