New equivariant methods in algebraic and differential geometry
3 January – 28 June 2024

Many of the most powerful tools in geometry exploit the existence of symmetry. While this is an old idea, several recent developments in algebraic geometry - where the objects of interest are determined by polynomial equations - have introduced new, more broadly applicable techniques, with the promise of applications to various central goals of the field. This has led to a surge of interest in "equivariant" techniques in general, namely those that employ symmetry, and further suggests that equivariant techniques should be powerful beyond questions of classical interest.

Our programme "New equivariant methods in algebraic and differential geometry" brought together experts and early career researchers across various different subfields of mathematics whose areas employ equivariant techniques. This led to a broad programme with an emphasis on new collaborations, both within subfields of mathematics and between different subfields. While the majority of our participants were algebraic geometers, there were many differential geometers, algebraists, geometric analysts and computational geometers, leading to a wealth of new activity between these fields.

The origin of our programme was the recent development of "non-reductive GIT" by two organisers (Gergely Berczi, Frances Kirwan), which greatly expands the applicability of equivariant techniques in algebraic geometry, by allowing much more general classes of symmetry than had previously been possible. Already having produced several breakthroughs in the field, our strong expectation is that there are many directions in which these key new tools can be applied. One of our main goals was therefore to explain and advertise these new ideas to the next generation, particularly through a minicourse held in February given by Frances Kirwan.

We began our programme with a winter school for early career researchers, held jointly between the Isaac Newton Institute and the University of Ibadan, Nigeria. The courses taught in Cambridge were livestreamed in Ibadan and vice versa, greatly expanding the reach of the school. We then held four further week-long workshops on an array of topics: applied geometry, hyperbolicity, K-stability and moduli theory. Aside from these, we encouraged new collaborations by fostering an active culture in the programme and by holding several more informal seminars, with the facilities enabling a remarkable degree of new collaboration between the participants.

Programme highlights were the Rothschild Public Lecture of Michael Thaddeus and the Kirk Public Lecture of Barbara Fantechi. Our Kirk Fellow also gave an illuminating talk at a well-attended diversity event “Mathematical Paths” organised together with the concurrent ADI programme. The inspiration for our program, derived from moduli theory, will also be highlighted in Plus Magazine. Additionally, we are editing a thematic book that compiles mini-courses given by participants.

We have already observed early indicators of the programme's genuine success, evidenced by several new collaborations among our participants. We hope and expect these initiatives will inspire further collaborations.