Isaac Newton Institute for Mathematical Sciences

Annual Report **2020-2021**

UNIVERSITY OF CAMBRIDGE

Isaac Newton Institute for Mathematical Sciences

The Isaac Newton Institute is an international hub for supporting mathematical sciences research of the highest quality and impact. It aims to attract the world's leading researchers, in all areas of mathematics and its applications, who interact through a variety of long and short thematic programmes as well as associated workshops. Based in Cambridge, and benefiting from a bespoke building and other world leading facilities of this great University, INI is nevertheless an independent forum serving the whole of UK mathematical sciences. INI's environment, and supporting mechanisms, enable its programmes to have a translational effect on their respective research areas.

All INI scientific programmes are carefully designed to allow for novel ideas to be created, nurtured and exchanged. Programme topics cover all areas of mathematics, with increasing focus on emerging intra and interdisciplinary fields, where engagement is with other scientists, social scientists, economists, policy makers etc. The Institute also helps to develop the next generation of mathematical scientists by encouraging participation of young researchers, by widening access, and by addressing the gender gap in mathematics.
The INI has broadened its role in the community in recent years, and informs policy makers and funders about the relevance, value and timeliness of emerging mathematics. Through the Newton Gateway to Mathematics it carries out stand-alone knowledge exchange events, and activities within programmes, aimed at end users of mathematical ideas in commerce, industry, government, and other sciences. Further, it assists universities in achieving their own goals; showcases UK research in the mathematical sciences; and engages with non-mathematicians through public lectures, exhibitions, and other activities for schools and the general public.

Newton Gateway to Mathematics

The Newton Gateway to Mathematics acts as a vehicle for knowledge exchange between the mathematical sciences and potential users of mathematics, including industry, government, business and other academic disciplines, both in the UK and internationally. It does this by facilitating interactions and activities such as programmes of work, research and training events, as well as bespoke projects. The Newton Gateway aims to widen access to mathematics generally, to shorten pathways to impacts for academic research, and to support education and training in areas where mathematical skills are needed.

Director's Foreword

In autumn last year I wrote the Director's Foreword to the 2019-20 INI Annual Report. In it I noted that it had been a quite exceptional and difficult second-half to the year due to Covid-19, and that the progression and resolution of the pandemic was still very unclear. But I ended on an optimistic note, with news of likely effective vaccines that would allow us to return to normality sooner rather than later. Well, a year on, and we have to marvel at the collective efforts of so many around the world at producing, in such a short time, powerful ways to mitigate the pandemic and its effects. We have, in particular, to recognise the astonishing teams from around the globe, who have produced highly effective vaccines, and had them tested, approved for treatment, and put into our arms, in just a few months.

The pandemic clearly highlights that the biological and physical sciences, underpinned by the language of mathematics and validated by statistical methodologies, are such a critical part of modern day society. Yet, despite the unprecedented progress to-date to tackle the pandemic, the whole of the last year has continued to be difficult for everyone, including this Institute, with several more lockdowns, persistent border closures, and substantial fatigue in the university sector as academics strive to engage effectively with students and maintain their research activity remotely. I particularly wish to thank the organisers of the two INI programmes, Infectious Dynamics of Pandemics (IDP) and Applicable Resurgent Asymptotics (ARA) who worked extremely hard to ensure that their virtual events were successful. ARA will return next year to complete their programme in-person, and IDP has concluded with a set of set of forward-looking articles in a special issue of the journal Epidemics, entitled 'Challenges for Future Pandemics'. The latter will, I am sure, prove to be extremely important in ensuring our readiness for future local and global disease outbreaks.

The summer and early autumn of 2021 has finally seen a most welcome return to near normality, with two exciting programmes running in hybrid form, Mathematics of Deep Learning (MDL) and Cluster Algebras and Representation Theory (CAR), plus an active calendar of one-off in-person events organised by INI and its knowledge exchange (KE) team, the Newton Gateway. The Institute is now gearing up for an intense two-year period over 2022-3, during which the backlog of scheduled long-term research programmes, postponed due to the pandemic, will be alleviated by running three or four in parallel. To do this, we will be enhancing our physical space by employing the excellent nearby conference facilities of the Møller Institute. In addition to this activity, we are undertaking a highly ambitious programme of expansion, thanks to receipt over the last year of substantial additional funding, spread over five years, from our principal sponsor, EPSRC. This will allow us to greatly increase our support to the national and international mathematical sciences community via a range of novel and ambitious mechanisms. There are essentially seven strands to this expansion: (i) enhanced training (especially for early career researchers) and support for the people pipeline; (ii) a greater focus on equality, diversity and inclusivity in all of our activities; (iii) increased INI and the Newton Gateway activities to meet demand; (iv) establishment of a programme of INI and Newton Gateway activities outside Cambridge; (v) a greater range of national and international INI partnerships; (vi) enhanced societal roles and responsibilities; and (vii) enhanced promotion and communication.

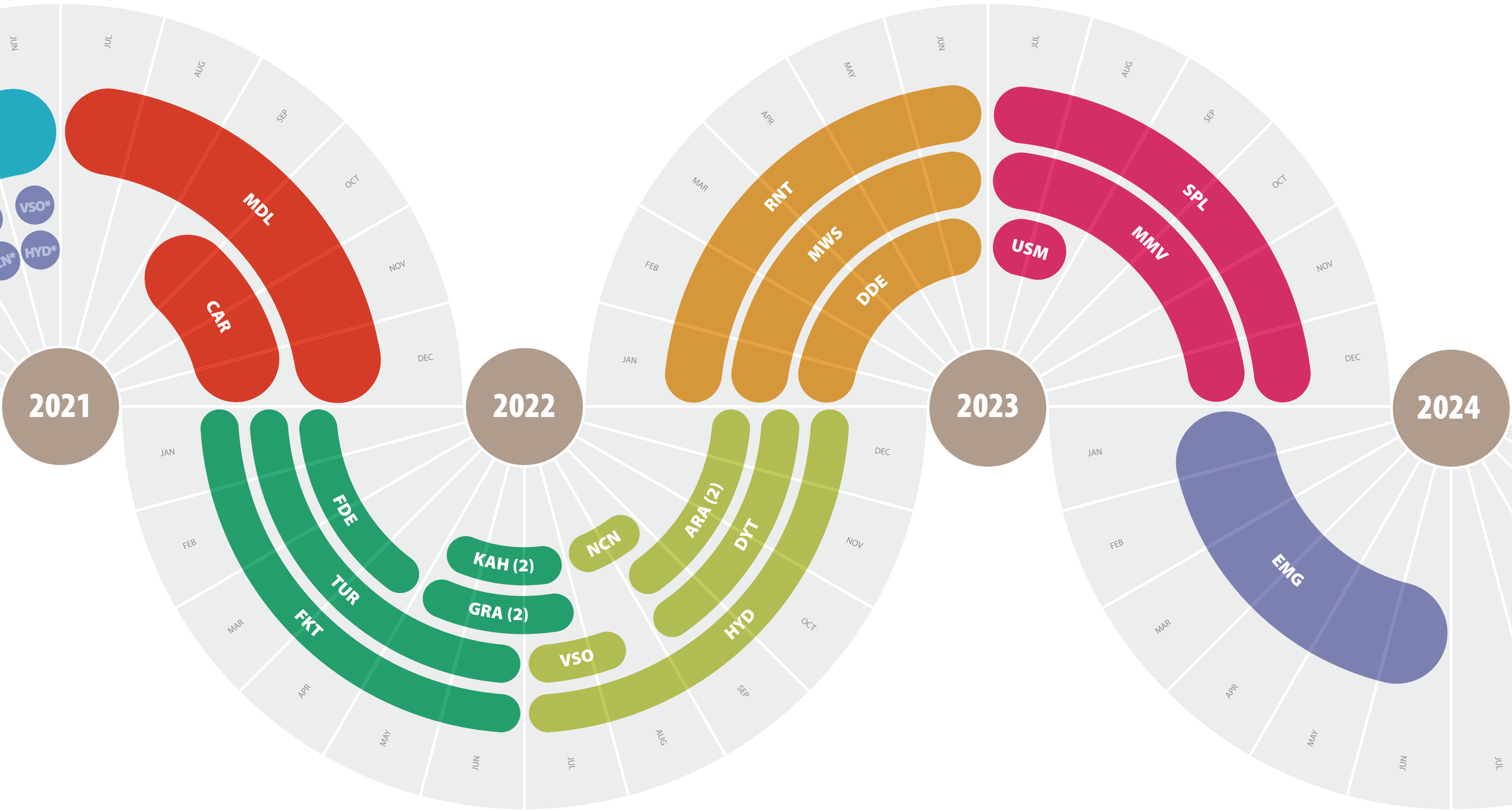
Alas, this is my fifth and final Director's Foreword, as my term of office has finished. I make way for my successor Professor Ulrike Tillmann FRS, who comes from Oxford University. I wish her well and leave the stewardship of the Institute in her highly experienced hands. She will flesh out the details of the additional activities set out above and offer concrete details via INI and Newton Gateway Newsletters, through the Correspondents Network, and via the website. However, there have already been a number of new initiatives within each of the seven strands. Under (i), and thanks also to the generosity of the Simons Foundation, we have five early-career postdoctoral research fellows working in the Institute over the forthcoming year, and under (ii) we have revamped all of the INI and Newton Gateway committees to make them more inclusive, accessible, and have greater community representation. As to activity outside Cambridge, (iv), we have recently formed a partnership to support the annual London Mathematical Society Symposia at Bath University over the next four years, and have also approved two pilot programmes to take place outside Cambridge in the near future. On the KE side, the Institute has commissioned a detailed consultation document for the setting up of an ambitious national Connected Centres Network in Mathematical Sciences, to build links between academia and government, industry, commerce, NGOs and other bodies.

Progress on the other strands include, (v), partnering with the Alan Turing Institute on their intensive research 'Theory and Method Challenge Fortnights' and under (vi), upgrading of INI's AV equipment, together with agglomeration and integration of a suite of software tools, to ensure that all of our activities offer near-parity between physical and remote participants. We have also been busy, with a small group of dedicated colleagues from across the UK, in preparing a green paper on the proposed creation of a National Academy for Mathematical Sciences. Finally, under (vii), I am delighted that we have joined forces with Plus Magazine to enhance the written content of much of the activity that takes place at the Institute, and make it more accessible to a broad readership.

In conclusion, I wish to offer sincere thanks to the many hundreds of individuals I have had the pleasure and privilege of working closely with over the last five years. I owe you all a great debt of gratitude. Finally, especial thanks must, of course, go to all the staff at the Isaac Newton Institute, without whom our many activities and achievements would be impossible.

David Abrahams, *INI Director 2016-2021*

Programme Schematic



MDL Mathematics of deep learning
CAR Cluster algebras and representation theory
FKT Frontiers in kinetic theory: connecting microscopic to macroscopic scales - KineCon 2022

* denotes Bridging Events

TUR Mathematical aspects of turbulence: where do we stand?
FDE Fractional differential equations
GRA Groups, representations and applications: new perspectives
KAH K-theory, algebraic cycles and motivic homotopy theory

HYD Dispersive hydrodynamics: mathematics, simulation and experiments, with applications in nonlinear waves
VSO Verified software
DYT Frontiers in dynamo theory: from the Earth to the stars
ARA Applicable resurgent asymptotics: towards a universal theory

RNT Rich and Nonlinear Tomography - a multidisciplinary approach
MWS Mathematical theory and applications of Multiple Wave Scattering
NCN New Connections in Number Theory and Physics
DDE The Mathematical and statistical foundation of future Data-Driven Engineering

SPL Statistical physics in living matter: nonequilibrium states under adaptive control
MMV Mathematics of Movement
USM Uncertainty quantification of Soft Materials

EMG Equivarient methods in algebraic and differential geometry

Infectious Dynamics of Pandemics: Mathematical and statistical challenges in understanding the dynamics of infectious disease pandemics

Since the beginning of the pandemic, mathematics has been at the heart of the COVID-19 response both in the UK and globally. This programme was put together in response to the urgent need to bring together international experts from a diverse range of disciplines to support the mathematical modelling of Covid-19. A key focus was to provide space for longer-term thinking about the challenges of understanding the dynamics of this and future novel pandemics.

The Infectious Dynamics of Pandemics programme was put together in record time and began virtually in May 2020 while the UK was still in a national lockdown. The programme aimed to be both responsive and forward thinking. Enabled by the presence of programme organisers and participants who were concurrently members of government advisory panels in the UK (including SAGE and SPI-M), the programme was able to react to key themes as they emerged as policy priorities. Such topics included contact tracing and potential exit strategies from lockdown. These responsive activities were the focus of the first half of the programme which was originally due to end in Aug 2020 (see last year's annual report for further details).

With the world still in the midst of the pandemic at the start of September 2020, the IDP programme was extended until Dec 2020. Kicking off with a virtual workshop on 'Future Pandemics' the focus of the second half of the programme shifted to providing space for longer term thinking about the wider challenges of understanding and managing future novel pandemics. This workshop ran over three weeks, with each week focused on a different theme: the emergence of new diseases, tackling new diseases and finally disease modelling in the wider context of economics and politics. Highlights included a talk by Professor Charlotte Watts from the Department for International Development on 'How does Science Interface with Policy' which was followed with a panel discussion with Sir Bernard Silverman and Professor Frank Kelly.

The workshop provided a unique opportunity to take a step back and reflect on lessons learned from COVID-19 with regard to planning, prevention and control for future pandemics. Capitalising on these discussions ten working groups were set up to identify the key challenges in the context of dealing with future pandemics. Groups built on the strong community of epidemiology modellers that existed from previous INI programmes (Epidemic models 1993, IDD 2013 and IDF 2014) as well as bringing in ouside disciplines, such as economics and uncertainty quantification, through the programme's strong links with Royal Society's Rapid Assistance in Modelling the Pandemic (RAMP). These working groups have produced a series of opinion papers which will form a special issue of the journal Epidemics on 'The Challenges for Future Pandemics', due to be released at the end of 2021. Topics include challenges in modelling, inference, data and economics. The paper series concludes with a discussion of the problems of adopting effective policies to make best use of scientific understanding. Preprints of the papers are available on the INI preprint server.

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COVID-19 Initiatives

The COVID-19 pandemic has shown the power of using mathematical methods to support decision making involving complex systems under great uncertainty. Mathematical modelling has been at the heart of advice throughout the pandemic: from evidence regarding lockdown and other non-pharmaceutical interventions to the optimal allocation of limited vaccine doses as well as weekly short-term forecasts on the likely progression of the pandemic, with the mathematically derived epidemiology concept of 'the R number' becoming a household conversation topic.

IDP and RAMP

Whilst the Infectious Dynamics of Pandemics programme was due to end in Aug 2020, with the end of the pandemic far from sight at that time the programme was extended until the end of 2020.

Building on the strong epidemiology modelling community that already existed at INI from previous programmes, IDP aimed to be both responsive and reflective. Furthermore, with the increased interest in the research area from various other disciplines, IDP provided a forum to create links with other initatives, such as the the Royal Society's Rapid Assistance in Modelling the Pandemic (RAMP) initiative and the Virtual Forum for Knowledge Exchange (V-KEMS), to the wider epidemiology modelling community.

An example of this link up, provided via INI, was on the topic of COVID-19 and higher education. The virtual study group on unlocking higher education spaces led into a workshop within IDP focused around COVID-19 in higher education. The group of academics from V-KEMS, IDP and JUNIPER continue to meet on a regular basis, working closely with colleagues at the Department for Education and various higher education institutions. In particular, they were the only group to present work to SPI-M on the potential impacts of opening up higher education spaces in Jan 2021 (you can view a copy of the report here: https://www.gov.uk/government/publications/isaac-newton-institute-covid-19-and-universities-13-january-2021).

Another example is the Evolutionary Implications of COVID-19 Vaccination Programme, a RAMP Continuity event organised by the Newton Gateway. This event arose from discussions during the challenges with vaccinations IDP subgroup meetings and was developed in collaboration with the JUNIPER consortium to ensure policy relevance of the areas covered. This event was well attended by academics from a range of mathematical and scientific disciplines, as well as by government departments such as the Department for International Development (DfID).

V-KEMS

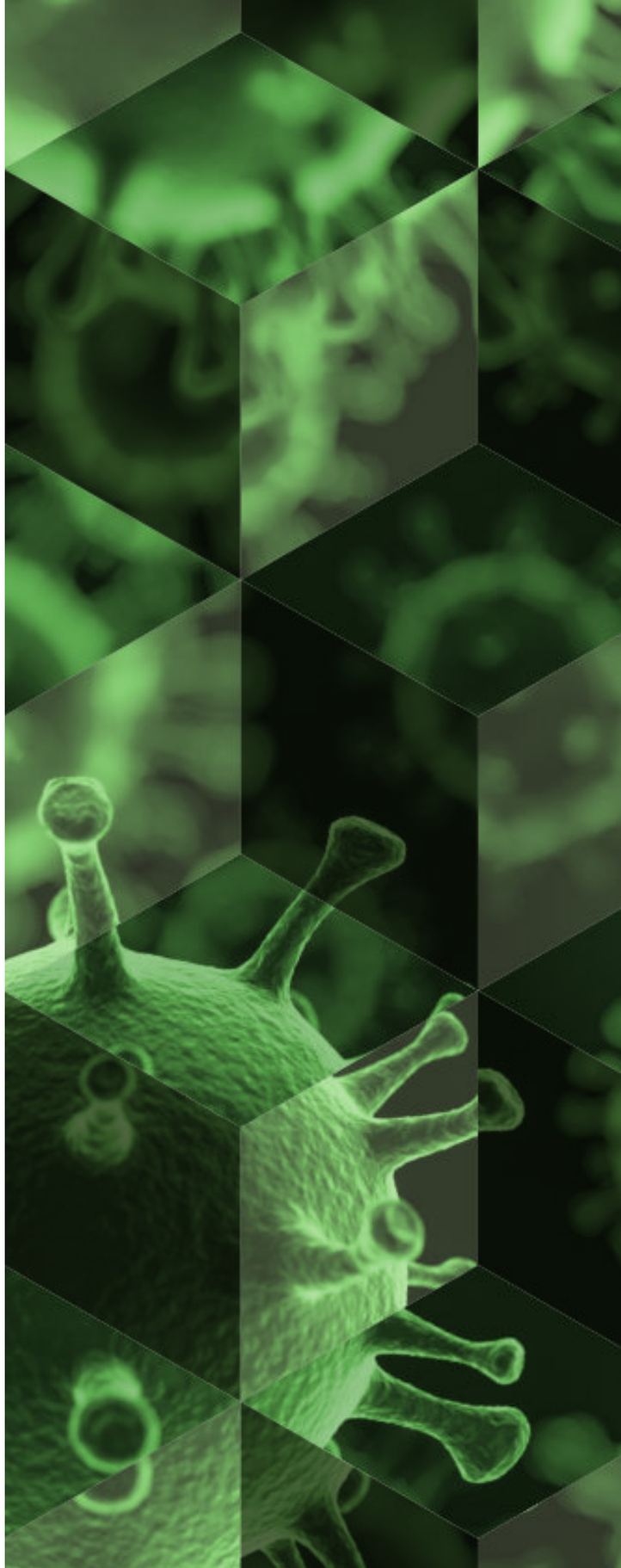
Through the Newton Gateway, INI has continued to support the virtual study groups via *Virtual Forum for Knowledge Exchange in the Mathematical Sciences* (V-KEMS) in collaboration with the International Centre for Mathematical Sciences (ICMS) and the Knowledge Transfer Network (KTN). The study groups have continued to address key challenges from business and industry and other groups outside academia that have arisen as a consequence of the present disruption to UK society as a result of the Ppandemic. Topics covered include reducing the risk of COVID-19 transmission on trains, COVID-19 safety in large events and modelling solutions to the impact of COVID-19 on cardiovascular waiting lists.

RAMP

The Royal Society's *Rapid Assistance in Modelling the Pandemic* initiative was set up at the beginning of the pandemic to enhance modelling capacity and support rapid assessment of strategies of immediate policy relevance. Through its activities the initiative engaged several hundred scientists with complementary skill sets to those of the traditional epidemic modelling community in COVID-19 related research. To support this new research ecosystem and enhance connectivity to other COVID-19 research activities in the UK, the Newton Gateway has developed a number of workshops, research meetings and virtual study groups. Topics include: Evolutionary implications of the COVID-19 Vaccination programme, Environmental and Aerosol Transmission of COVID-19, New Models of Spatial and Social Behaviour in a Pandemic and COVID-19 Safety in Large Events. The aim of these has been to ensure scientific networking to help maintain strong communication links among RAMP-initiated projects, and further develop links between these and the wider modelling community around COVID-19. This will help to create a truly multiscale approach and will ensure engagement with the wider mathematical community as well as with those from industry and the public sector.

JUNIPER

JUNIPER (Joint UNIversities Pandemic and Epidemiological Research) is a consortium of modelling groups from eight universities funded via UKRI COVID-19 emergency response fund. The teams of epidemiological modellers and statisticians in the JUNIPER consortium represent a core of committed and experienced research groups that have been generating predictions, forecasts and insights feeding into the Scientific Pandemic Influenza Group on Modelling (SPI-M) and the Scientific Advisory Group for Emergencies (SAGE), both of whom advise the UK government on scientific matters relating to the UK's response to the pandemic. A key goal of the consortium is to be outward-facing and inclusive through its monthly seminar series and regular half-day research meetings. INI has hosted these meetings allowing the epidemiology modellers to link to the wider mathematical research community. Furthermore, JUNIPER has developed a number of events with the Newton Gateway for the RAMP continuity activities to ensure these topics are timely and of interest to the epidemiology modelling community.



Applicable resurgent asymptotics: towards a universal theory

Asymptotic analysis underpins many fields in mathematics and physics. A key goal of this programme was to bring together two distinct communities within this research field: applied mathematicians working on exponential asymptotics and theoretical physicists working on resurgent theory. Bringing these two branches together provided an opportunity to make significant steps towards unifying these approaches in asymptotics into techniques of enhanced and broader applicability.

Over two decades ago, an INI programme on the emerging field of exponential asymptotics brought together a group of applied mathematicians to explore the role of previously neglected exponentially small terms in asymptotic expansions. Following on from this initial work, it has now been extensively shown that including such terms, whilst numerically irrelevant, can provide much more information about the system and ultimately improve numerical accuracy.

Simultaneously theoretical physicists have made remarkable progress in the applications of the comprehensive theory of resurgent asymptotic analysis. This approach has revealed new and deeper insights into the non-perturbative structure and dynamics of quantum field theories, string theory, random matrix and knot theories, as well as computationally efficient techniques for path integral evaluation.

The advances in these two areas of asymtptotic analysis, whilst overlapping, have remained largely distinct from one another. This programme brought together these separate communities providing a unique opportunity for significant mathematical technology transfer between the two branches, and to the benefit of both research areas. Such cross-over between these subject areas has wider applications in fields ranging from rigorous analysis to aeroacoustics, from quantum field theory to biomathematics.

Originally due to run over six months, the programme was split into two with the first part running in spring this year. Due to the ongoing restrictions of the pandemic this first part was primarily virtual. Although the institute was very pleased to welcome six participants to attend in person, the first since the institute shut in March 2020.

The programme kicked off with a week-long virtual 'summer school' which provided training in state of the art, advanced methods to a younger generation of mathematical scientists and theoretical physicists. Lectures were accessible for first year postgraduate researchers, focusing on practical calculations with problem sessions and support. Topics covered included: Ecalle's theory of resurgence, exponential asymptotics, physical applications and computational Riemann-Hilbert problems. A key goal of this summer school was to form the next generation of interdisciplinary collaborations among highly talented researchers with complementary expertise.

A key challenge of the programme was the different terminology and language used by the applied mathematicians and theoretical physicists. Seminars held twice a week covering a wide range of topics aimed to breaking down this language barrier between the different research communities. Highlights included a talk by Professor Jon Chapman from University of Oxford which provided an overview of the vast range of applications of asymptotic analysis.

This first part of the programme ended with a week-long summary workshop. Spanning the widest range of resurgent or exponential asymptotic techniques and applications, topics included progress made during the first part of the programme. This workshop also highlighted key challenges for the second part of the programme due to take place in person in autumn 2022.

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EBD Follow-on workshop
Integrating quantitative social, ecological and mathematical sciences into landscape decision-making

This was a follow-on workshop to the 2019 programme on Mathematical and Statistical Challenges in Landscape Decision-Making.

While the 2019 INI programme focused on bringing together the environmental and mathematical sciences research communities, the primary goal of this workshop was to extend these interdisciplinary links to the social sciences community. This is vital, as landscapes are complex systems involving interactions between both natural and human processes.

The four-day workshop took place virtually in Sept 2020 due to ongoing pandemic restrictions. Talks by DEFRA (Department for Environment, Farming and Rural Affairs) and the Food, Farming and Countryside Commission set the scene, providing an overview of the changing needs in landscape decision-making. There were also research talks on methodological advances in statistical techniques for calibrating computer models and the state of the art in quantitative social modelling.

The workshop quiz on the second day provided an opportunity for informal discussion. The final day provided further opportunity to network through facilitated discussion in breakout groups. Each group focused on dealing with one of four topics within landscape decision making: uncertainty, spatio-temporal dynamics, complexities and non-linearities, and human processes and social influence. Participants also reflected on how to better integrate across disciplines to address these challenges. Recurring themes included: data linkage, embedding social process within models, communication of uncertainty to decision makers and supporting long-term cross-disciplinary collaborations. The need to invest in methodological research was also identified as key to ensuring the development of novel techniques to address the big challenges in landscape decision-making.

PROGRAMME HIGHLIGHTS | MAY – JUNE 2021

VSO Bridging Workshops Verified software: from theory to practice & Verified software: tools and experiments

Computer software plays an increasingly critical role in our lives. From driving cars, to performing surgery, we entrust many critical tasks to software. Such applications run on a software stack that can execute complex tasks requiring billions of co-ordinated steps with a few keystrokes. While the software stack is a profound engineering achievement, it also has significant security vulnerabilities, where even a small programme error within the software stack can leak private data or delete valuable information. Formal verification techniques provide a way to protect against such vulnerabilities.

However, there are signification challenges to the adoption of verification technology in large-scale software production. These challenges require significant advances in the theory in a number of key areas including the design of modelling frameworks and languages, programme and proof methodologies, and analysis and synthesis algorithms.

The Verified Software Programme will bring together a diverse mix of researchers to solve theoretical problems and build new tools to support the composition of software components. This six-week programme, originally due to run in summer 2020 was postponed until summer 2022 due to the global pandemic. As a precursor to this research programme, two virtual workshops were held this summer to promote cross-fertilization between theory, applications, and tools.

The first workshop, ***'Verified software: from theory to practice'*** involved an intensive exchange of ideas between researchers facing the challenges of cutting-edge applications and theoreticians armed with the conceptual tools to address these challenges.

The four-day workshop kicked off with a talk from one of the founders of the field, Sir Tony Hoare, who gave a personal account of the early origins of the verified software initiative. The remainder of the workshop focused on formal methods for the specification and verification of software-intensive systems. Talks bridged both theory and applications, with topics covered including random testing and formal methods, stateless model checking and probabilistic model checking.

The second workshop, ***Verified Software: tools*** aimed at defining an integrated tool resource for automated formal methods with standardised interfaces, interchange and data/evidence formats that allow services and arguments to be composed, and test cases and counter-examples to be shared across different formal models. The goal of this workshop was to lay the foundation for powerful automated tools and integrated tool suites that can be deployed in a range of large-scale experiments and case studies. A highlight of the five-day workshop was a Q&A session with Sir Tony Hoare at the end of the first day to mark the 60th anniversary of his invention of Quicksort - a highly efficient sorting algorithm that is still widely used today..

Over 100 international researchers took part in both workshops, including researchers from industry. The workshops provided a unique opportunity to take stock of the first fifteen years of Tony Hoare's Verified Software Challenge and initiated the exchange of ideas between theory and application. This will be extended further in the Verified Software research programme next year.

PROGRAMME HIGHLIGHTS | AUGUST 2020

HYD Bridging Workshop New horizons in dispersive hydrodynamics

Dispersive hydrodynamics has emerged as a unified mathematical framework for the description of multiscale nonlinear wave phenomena in dispersive media, encompassing both dynamic and stochastic aspects of wave propagation.

The main research programme on this topic, which will take place in the second half of 2022, is organised around four overlapping themes: modulation theory and dispersive shock waves, analysis of dispersive hydrodynamic systems, random phenomena and dispersive hydrodynamics, and physical applications. This two-week bridging workshop explored novel connections across these four themes, in preparation for the research programme next year.

Bringing together mathematicians specialising in the analysis of dispersive systems with physicists and engineers working in theoretical and experimental aspects of this field, a key aim of the workshop was to stimulate novel cross-disciplinary collaborations and attract new audiences to the subject of dispersive hydrodynamics. Special emphasis was given to involving young researchers, with a number of introductory lectures from leading experts, including a plenary talk by Professor Sylvie Benzoni-Gavage, Director of Insitut Henri Poincaré, which provided an overview of dispersive shocks. To encourage interactions between different research communities there were two virtual poster sessions, as well as time for free discussion on each day of the workshop.

The workshop themes included: new directions, mathematical techniques and applications in nonlinear waves; statistical mechanics and dispersive hydrodynamics; applications in glaciology and sea-ice systems; dispersive hydrodynamic phenomena in fibre optics and magnetisation dynamics. Talks and discussions focused on identifying the major challenges that will shape future directions and developments. The research programme next year will look to address these challenges through the new cross-disciplinary collaborations started at this workshop.

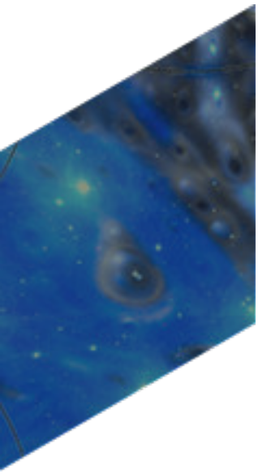
NCN Bridging Workshop
New connections in number theory and physics

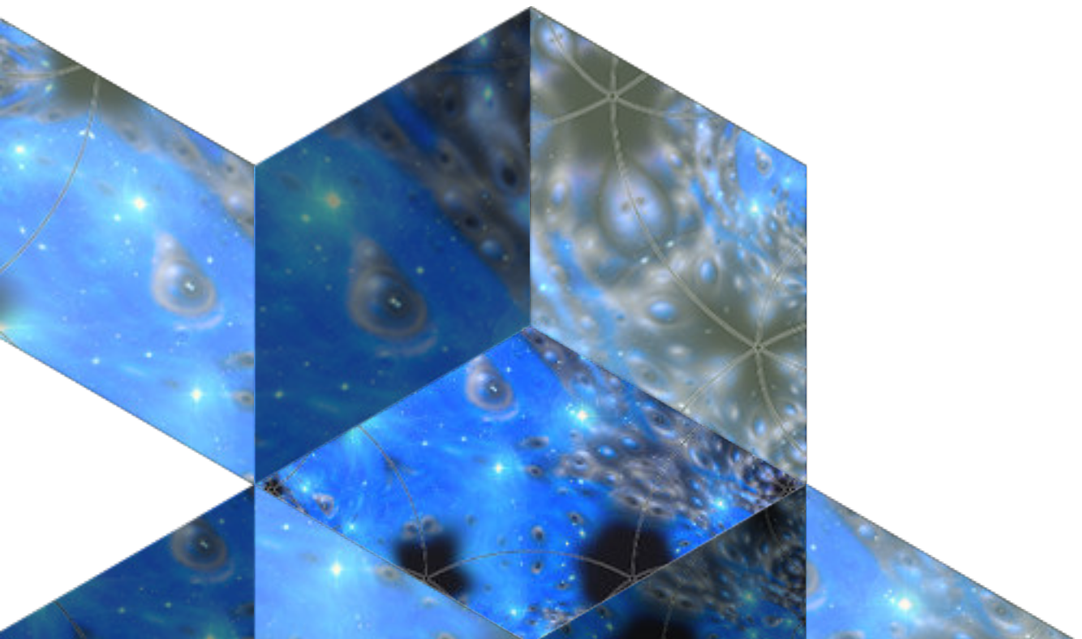
This week-long workshop was a precursor to the research programme on this topic which will take place in the summer of next year. The research programme aims to develop new connections between number theorists and physicists to investigate connections between various fields of theoretical physics, in particular string theory and statistical models of crystals, the theory of automorphic forms, mock modular forms and beyond.

Over recent years momentum has been building around new connections between number theorists and string theorists, primarily through the theory of automorphic forms. This emergent research area has the potential for cross-disciplinary collaborations that will lead to revolutionary advances in both areas, in a similar way that interactions between geometers and theoretical physics throughout the 20th century led to such unexpected developments as mirror symmetry and the impact of topological field theory on invariants of 4-manifolds.

This workshop brought together leaders from number theory, automorphic representation theory and string theory to further drive forward these new cross-disciplinary connections in preparation for the research programme in 2022.

The workshop included talks from experts covering the five key topics which the research programme will focus on: string amplitudes and automorphic representations; modular graph functions and multiple zeta values; mock modular forms, moonshine and black holes; metaplectic Einstein series and quantum groups; and automorphic forms on Kac-Moody groups. In addition, each day ended with an extended period of discussion. These discussion sessions proved popular with participants, with smaller breakout rooms allowing the opportunity for cross-disciplinary networking. The research programme in2022 will build on these new connections between mathematics and physics in a substantial and sustained way.





The Unity of Mathematics: A conference in honour of Sir Michael Atiyah

Rachel Thomas & Marianne Freiberger

In September 2021 the Isaac Newton Institute held a conference in honour of Sir Michael Atiyah, entitled The Unity of Mathematics. Atiyah, who passed away in 2019 at the age of 89 and was the first Director of the Newton Institute, was a towering figure in mathematics. In a career that spanned nearly seven decades he dominated and shaped the field, not only advancing mathematics itself but also pioneering deep connections between mathematics and theoretical physics.

"Michael was such a completely outstanding person, we thought that we needed to do something rather special to honour him," says Caroline Series, who co-organised the conference and was President of the London Mathematical Society (LMS) at the time of Atiyah's death. The LMS spearheaded the event and, since Atiyah was the founding Director of the INI between 1990 and 1996, the INI was the perfect choice of venue.

"This meeting is a memorial to Sir Michael," said Nigel Hitchin, who headed the scientific committee, in his opening talk. "But the intention is not so much to discuss his influence and legacy, but to present a cross-section of current ideas — the sort of things that he would enjoy listening to and talk about afterwards."

The conference was a hybrid event with around 75 people attending in person and 176 people from around the world joining the meeting online. The title, The Unity of Mathematics, was inspired by Atiyah's 1976 address as LMS President, a role he held from 1974 to 1976. "The aspect of mathematics which fascinates me most is the rich interaction between its different branches, the unexpected links, the surprises...," he wrote then.

The speakers at the meeting were chosen to highlight the depth and breadth of Atiyah's interests, to illuminate surprising connections, and to represent a range of mathematical generations.

Pure beginnings

Atiyah started his career working in pure mathematics, in particular in the fields of algebraic geometry and topology. A famous result from this era is the index theorem, which Atiyah proved with Isadore Singer in the 1960s. Loosely speaking, the theorem tells us that, under appropriate circumstances, the number of solutions of a system of differential equations depends on the topology of the space the system is defined on. (Mathematically, it says that for an elliptic differential operator on a compact manifold, the analytical index is equal to the topological index.)

The index theorem links analysis (of which the study of differential equations is a part) and topology, illustrating the fertile ground that can be found in the fault lines between mathematical fields. It won Atiyah and Singer the prestigious Abel Prize in 2004 and can be seen as the culmination of the first part of Atiyah's career — an era entirely untroubled by potential applications the work might have in the physical world. As Atiyah wrote in the preface to Volume 4 of his Collected Works, "My knowledge of physics was very slim, despite having attended a course on quantum mechanics by [Paul] Dirac himself."

Making connections

To today's physicists, this would come as a complete surprise. "Every single part of the [index theorem] equation would now be seen as basic field theory physics," said Bernd Schroers in his talk at the Unity of mathematics conference. "To think that this came out of work that wasn't looking at physics is extraordinary."

Intrigued by the impact his work had turned out to have on theoretical physics, and influenced by Singer as well as Roger Penrose, Atiyah himself became interested in theoretical physics in the late 1970s, focussing in particular on the connections between physics and geometry. His mathematical prowess had an enormous impact, especially on the study of gauge theories: mathematical structures designed to describe the fundamental particles of nature and their interactions.

The grand aim of modern theoretical physics, including the gauge theoretical approach, is to unify all of nature's particles and interactions, describing them in a single mathematical framework. Deep mathematical understanding has become crucial in this, drawing on areas as far afield as number theory, and posing fascinating questions feeding back into mathematics. Until the end of his career Atiyah was there to make the connections, find the surprises, and solve many of the hard problems.

From strings to knots

The talks at Unity of Mathematics reflected the broad range of Atiyah's interests. "We have seen an amazing display of mathematics, from mathematical physics, analysis in the form of non-commutative geometry, number theory, algebra, and of course many shades of geometry," said Ulrike Tillmann, who has just taken over as INI Director from David Abrahams.

A highlight was a talk by Rahul Pandharipande, who was introduced by Hitchin as one of the leading researchers in algebraic geometry over the last few decades. Focusing on a single line in Atiyah's Collected Works, Pandharipande explored Atiyah's research with Rahul Bott, emanating from Bott's 1967 residue formula: this gives a way of expressing information about the global geometry of a manifold in terms of a finite amount of geometric data that is easier to calculate. Atiyah and Bott framed this insight in a larger geometric context in their 1984 localisation formula, which has exciting applications even today — not least, as Pandharipande explained, by providing a "dream plan" for potentially proving conjectures about moduli spaces.

A fascinating look at theoretical physics was provided by Edward Witten, pioneer of string theory and a major influence on Atiyah. Witten described how Atiyah, in the 1970s, spotted an important object from number theory (part of the

Langlands programme) in the description of a form of electric-magnetic duality that had been conjectured by physicists; a conjecture that appeared rather "wild" and unlikely. Witten traced the interplay between mathematics and physics which eventually established the conjecture not only as true, but also important in understanding quantum field theory and string theory. Atiyah's influence could be seen all over the work Witten described, and in results which illuminate the physical interpretation of the geometric Langlands programme.

Another highlight was the talk by Lisa Piccirillo, who may have been the youngest speaker at the conference, but who recently used an elegant approach to solve a long-standing problem in knot theory. In her talk Piccirillo explained how you can extend the notion of a trivial knot from the classical sense (that a knot bounds a disc in a 3-sphere), to higher dimensions. "We let the disc

take up a bit more space," she explained, by locating the disc in a four-dimensional ball. A knot is slice if the disc is smoothly embedded in this ball, and topologically slice if the disc is locally flat. Picirrillo explained her method of proving that the Conway knot was not slice, despite being topologically slice, a question that had remained unanswered for 50 years. Her approach also provides new insights into knot theory and 3- and 4-dimensional manifolds.

Talking and listening

From those speakers who knew Atiyah there was no shortage of photos and anecdotes. Atiyah was known, not just for his mathematical ability, but also for his infectious enthusiasm. "Many of us have attended conferences where Michael would have been in the audience," Hitchin said in the opening talk. "You would have seen him sitting

right at the front, interjecting various comments. [And in the coffee break] you would immediately have heard which part of the room he was in. Talking and listening was a fundamental part of his mathematics."

The Unity of Mathematics conference set out to re-create this communicative atmosphere. Around a third of the in-person audience consisted of PhD students and early-career postdocs. "They were just so happy to be able to come to an actual, real conference and talk to people and network," says Series. "The older people who came were equally delighted to have a chance to see people again."

The INI is perfectly suited — in fact it was designed to — facilitate interaction between researchers, and it achieved this aim even while keeping in mind the risk still posed by COVID-19. "Just the right number of people came [in person]," says Series. "In the breaks we all sat outside and had our coffee. There were all sorts of conversations going on, not just about mathematics but about what was going on in the mathematical world. That was a very important aspect of it." She also praises the INI's technological capabilities which enabled people who could not attend in person to speak or watch online without hitches.

On the whole, Series says, the Unity of Mathematics conference was a success. "Michael's interests were so broad and deep; he inspired so many people in so many different directions. I really think he would have enjoyed this conference."

Institute activities

With the UK and the rest of the world in varying degrees of lockdown throughout academic year 2020-21, the metrics for measuring activity at the Isaac Newton Institute for this period are necessarily different to previous years. But even through this different lens we see easily that INI played a vital role in supporting the mathematical sciences community in the UK and across the world.

As described elsewhere in this report, the entirely virtual ***Infectious Dynamics of Pandemics*** (IDP) programme, with its six associated workshops, ran from May to December 2020, and the ***Applicable Resurgent Asymptotics*** (ARA) programme (originally due to run from January to June 2021), with its two associated workshops, ran in hybrid form with 6 "in person" participants from March to June 2021: it will resume in September 2022 and run for a further 4 months. Additionally there was a 4-day follow-on workshop for the 2019 ***Mathematical and statistical challenges in landscape decision making*** (EBD) programme, and there were four "bridging" workshops for programmes postponed due to the pandemic: the 2-week bridging workshop associated with the 6-month ***Dispersive Hydrodynamics*** (HYD) programme, (postponed from the second half of 2020 to the second half of 2022), was held in June 2021; the two one-week workshops associated with the 6-week ***Verified Software*** programme (postponed from Summer 2020 to Summer 2022) were held in May and June 2021; and a one-week workshop associated with the 6-week programme on ***New connections in number theory***, (postponed from Summer 2020 to Summer 2022) was held in May 2021. Collectively, these events accounted for 281 programme participants, 1806 workshop participants, 313 seminars and panel sessions given by 267 distinct speakers, and many hundreds of additional hours of Zoom meetings.

Whilst the nature of online meetings facilitated participation from across the globe, the nature of the IDP programme meant that it had a higher proportion of UK-based participants (68%) than any other programme in INI's history. However, although necessarily UK-centric for the most part in terms of data set, it also engaged with academics and research from across the globe with, for instance, sessions devoted to the current COVID-19 situation in Asia, Africa and mainland Europe and other sessions on what can be learned from the past and what should be learned for the future. Geographic distribution of participants on the ARA programme reflected once more that typical of INI programmes with a third of participants from the UK, a third from the rest of Europe, and the remaining third from the rest of the world.

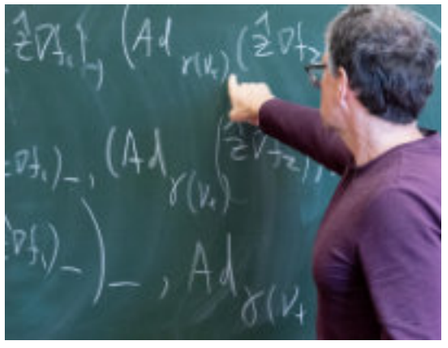
INI now collects data on whether or not participants are early career researchers (ECRs), defined as an individual who, at the time of their participation and excluding career breaks for family or health reasons, is within eight years of the award of their PhD or equivalent professional training or within six years of the first academic appointment, as opposed to using age as a proxy measure. This data is now complete for 88% of programme participants and 90% of workshop participants, with 25% of programme participants and 28% of workshop participants self-identifying as ECRs. 1 of the 12 programme organisers (8%), and 11 of the 164 workshop organisers (7%) were ECRs. Corresponding data for seminar speakers remains sparse and we will re-visit our internal processes to rectify this in future.

INI's efforts to redress the gender imbalance in the mathematical sciences continued unabated throughout the pandemic. The lead organiser of ARA and five of the ten IDP organisers - including the lead organiser and three of the four principal organisers - were female. Of all workshop organisers, 37 (23%) were female. Further 23% of programme participants and 25% of workshop participants were female and, where known, 24% of seminar speakers / panellists were female. The Institute continues to monitor the proportion of participants who choose not to give their gender (currently 2%) and will, following consultation, expand the classification options in the database accordingly.

Programme and workshop participants were of 65 different nationalities, and from 384 different institutions in 44 countries spanning all 6 continents. These included 92 participants with home institutions in 10 different DAC listed countries and 238 participants with 25 different DAC-listed nationalities. Workshop timings were adjusted to accommodate different time zones and, subject to speaker permission, all recorded seminars were subsequently made available online for catch-up. The UK-based participants came from 82 different home institutions including HEIs, Governmental Departments, Offices and Commissions, business and industry.

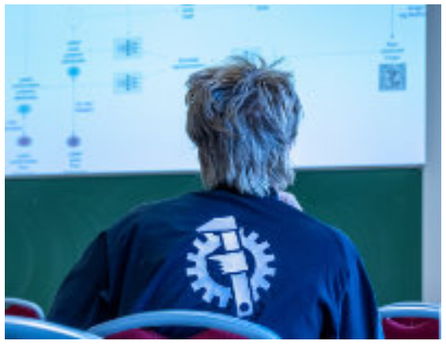
The national importance of getting results in the public domain as rapidly as possible meant that participants on the IDP programme made great use of the Institute's preprint facilities, publishing 15 papers with 138 distinct authors. A further 9 preprints associated with former INI programmes including 2020's ***Groups, representations and applications*** (GRA), and ***K-Theory*** (KAH) programmes, and from 2019's ***Geometry, compatibility and structure preservation in computational differential equations*** (GCS) and ***The mathematical design of new materials*** (DNM) programmes were also published during this period.

Appealing to a more general audience, 13 podcasts and a video interview with the ARA organisers were also produced. These covered topics ranging from Professor Anotida Madzvamuse (Sussex), lead organiser of the 2015 programme on Coupling



Institute activities

geometric PDEs with physics for cell morphology, motility and pattern formation, reflecting on life growing up in rural Zimbabwe and his travels as a young academic; to early career researcher Dr Elena Luca (UCL) discussing the importance of having supportive mentors; and Sir David Spiegelhalter (Cambridge) discussing the frenetic period, risk communication, and how the COVID-19 pandemic has affected the relationship between scientists, media and government. Additionally, a new *"Introduction to INI"* video featuring Anotida Madzvamuse (Sussex), Reidun Twarock (York) and Wendelin Werner (ETH Zürich) has been created along with two information videos: *"Welcome to INI"* and *"Virtual Participation"*. These have all been produced by DragonLight Films.



Dr Emily Shuckburgh OBE's zoom talk on ***Mathematics: a tool kit to tackle climate change***, the Institute's contribution to the 2021 Cambridge Festival (formerly the Cambridge Science Festival), was very popular. Emily spoke to a fascinated online audience about her research on modelling localised effects of climate change including floods, droughts and extreme weather.

Also incredibly popular were two virtual soirees hosted by INI's Management Committee Chair, Dr Ewan Kirk. The panellists for the soiree on Infectious Dynamics in Pandemics were Professor Julia Gog OBE (Cambridge), Professor Valerie Isham (Imperial) and Professor Dame Angela McLean DBE FRS (Oxford) and panellists for the Soiree on Data Privacy in Pandemics were Professor Cynthia Dwork (Harvard) and Professor Neil Lawrence (Cambridge).

Correspondents Day, virtually hosted by ICMS on 27 and 28 January attracted 38 attendees and included a presentation by Alison Etheridge, Chair of EPSRC's Advisory Group, on plans for the "new maths money", the additional £300 million allocated to UK Mathematical Sciences, and an introduction to the virtual reality "office space", GatherTown.

A highlight of the year was a virtual workshop in honour of the late Sir Peter Swinnerton-Dyer who served as Executive Director of INI under Sir Michael Atiyah. Sir Peter, who passed away in December 2018 at the age of 91, is best known for the famous conjecture of Birch and Swinnerton-Dyer (one of the Millenium Clay Maths Problems), relating the arithmetic of elliptic curves to the value of its Hasse-Weil L-function, and this workshop celebrated his tremendous and wide-reaching contributions to mathematics.

Art and the Mathematical Sciences at the Isaac Newton Institute

Barry Phipps

The connection between mathematics and art may not always be obvious; however by making the connection between the two it can bring new opportunities to people. Art aspires to re-frame the world and may change the way people think, as artists invent possibilities not previously imagined. Moreover, art may challenge, excite, comfort, and motivate, whilst bringing us closer together by providing a forum for shared experiences and by forging a sense of community.

Over the past twelve months INI has continued to develop a significant collection of artworks that sit alongside artifacts relating to the Institute and its foundation. Recent gifts, loans and acquisitions include paintings by Michelle Fletcher and Hannah Maybank, prints by Basil Beattie RA and Peter Randall-Page RA, and a large-scale outdoor sculpture, Star and Cloud (1999) by Bruce Gernand. These sit alongside the earlier works by John Robinson, Eduardo Paolozzi RA, and others. These carefully chosen works offer an opportunity for visitors to reflect, respond and communicate thoughts.

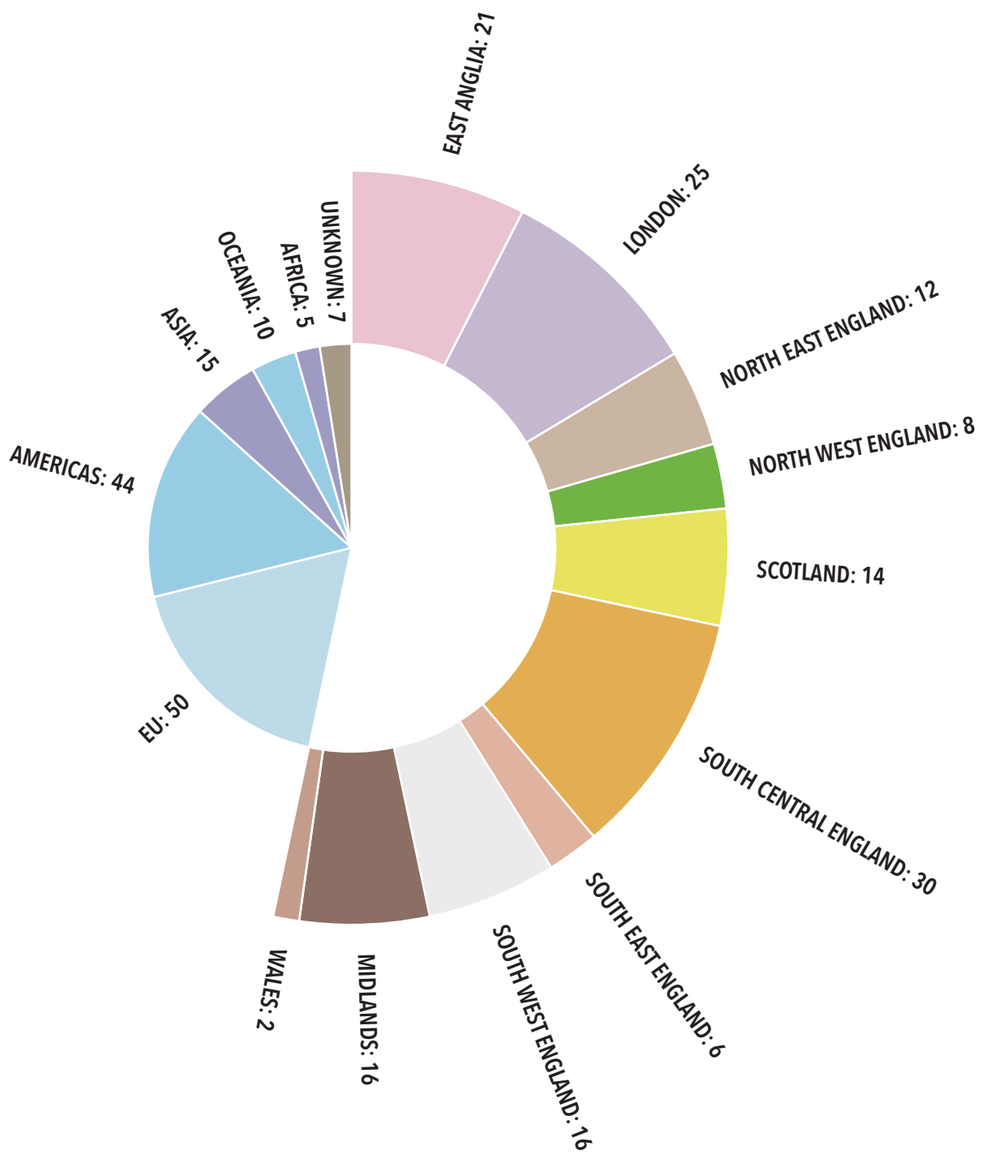
The trajectory of this activity began with the 20th Anniversary exhibition which explored the influence of mathematics on the work of the internationally renowned sculptor, Henry Moore. The inspiration that Moore took from the mathematical models at London's Science Museum into his own work was the basis for Intersections: Henry Moore and Stringed Surfaces, which ran jointly at the Royal Society and the Science Museum in London, in collaboration with the Henry Moore Foundation.

Five years later, Gesture and Geometry brought together a number of drawings and sculptures by the Royal Academician Nigel Hall RA. The exhibition at the Institute formed the basis of a conversation between Nigel Hall and Dorothy Buck (Research Professor of Mathematics/Biology, Duke University, and an organiser of the 2018 “Homotopy harnessing higher structures” programme), chaired by Barry Phipps (Curator of Art and Science, INI). The conversation examined the complex and inspiring relationship(s) between art and mathematics.

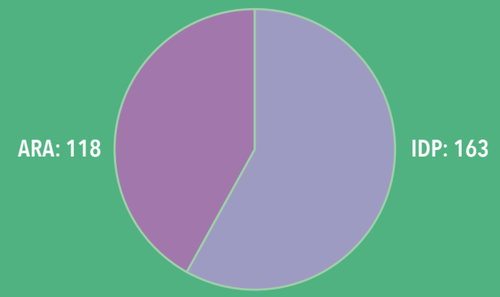
In 2017, Form in Art: Art of Form was an international group exhibition exploring the relationship between form, as understood mathematically, and art. A variety of artwork was displayed throughout the Institute; from a light work by Paul Friedlander to ceramics by Mella Shaw, as well as paintings by Manoel Veiga and a video work by Ulyana Gumeniuk. The exhibition was part of the Growth, Form and Self-Organisation programme and accompanied the workshop on Form in Art, Toys, and Games, organized by Andrzej Herczyński (Boston College) and Roberto Zenit (Brown University). The aim of the project, from the scientific point of view, was to identify general ideas on the physics of artistic processes and the emergence of form in art.

By placing art in the working environment, both permanently and through changing exhibitions, the Institute has developed an innovative way to showcase its values, promote conversation between mathematics and the arts, and support wider cultures. Through the encouragement of the previous Director, David Abrahams, INI has continued to promote engagement between its work and art collection through a wide-ranging series of events, including a programme of exhibitions and an artist associate scheme, as well as a range of events and lectures by artists, scientists and mathematicians.

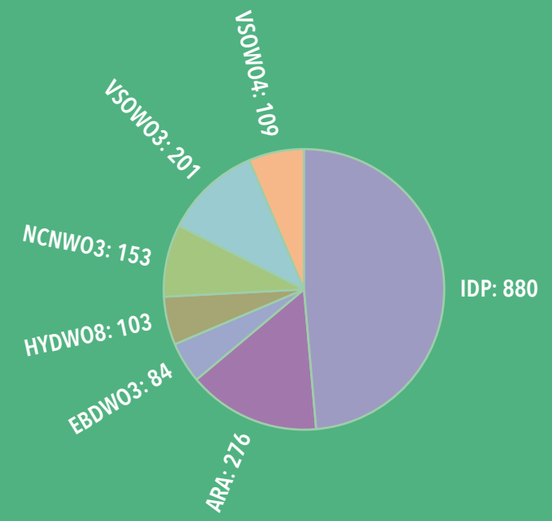
Worldwide geographic spread of programme participants



Programme and workshop participant numbers

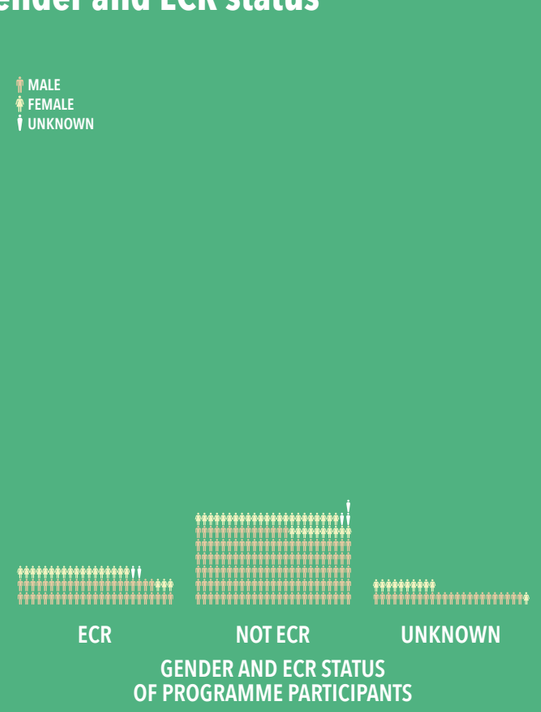


281
PROGRAMME PARTICIPANTS

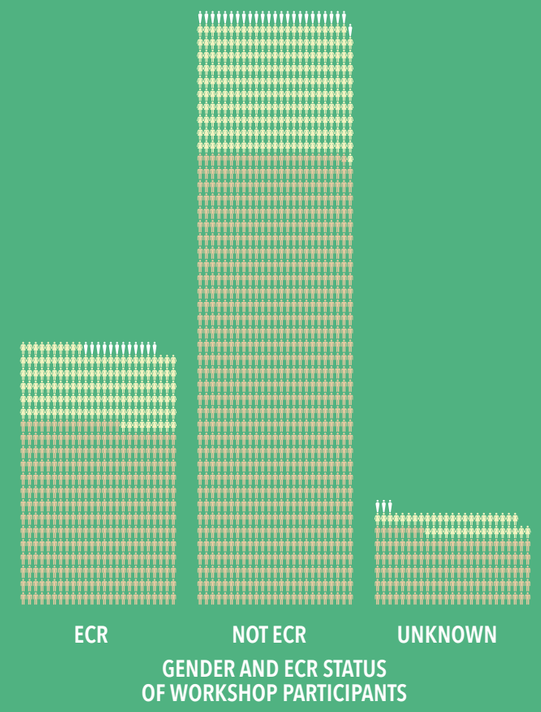


1806
WORKSHOP PARTICIPANTS

Gender and ECR status



GENDER AND ECR STATUS
OF PROGRAMME PARTICIPANTS



GENDER AND ECR STATUS
OF WORKSHOP PARTICIPANTS

Finances

Accounts for August 2020 to July 2021

For the Isaac Newton Institute and Newton Gateway to Mathematics

Income	*Notes*	**2020-2021**	2019-2020
		£000	£000
Research Grants and Contracts	*1*	**1,997**	1,911
Contribution from the University of Cambridge	*2*	**443**	441
Donations	*3*	**18**	60
Additional workshop income		**7**	24
Additional income	*4*	**123**	206
Endowment and investment income		**525**	512
Total income		**3,113**	3,154
Expenditure			
Staff costs		**1,085**	952
Travel and subsistence	*5*	**877**	1,115
Other operating expenses	*6*	**242**	369
Overheads paid to the University	*7*	**605**	551
Total expenditure		**2,809**	2,987
Surplus / (deficit)		**304**	167

Notes to the Accounts

Note 1 - Research Contracts and Grants (EPSRC & Simons Foundation)

Salaries	593
Participant costs (travel and subsistence)	872
Estates and indirect income	532
Total	**1,997**

Note 2 - Contribution from the University of Cambridge

The University's financial contribution towards the Institute's running costs. In addition, the University provides the main and Gatehouse building, and pays for all services and rates.

Note 3 - Donations

Heilbronn Institute for Mathematical Research	10
Donations, other	8
Total	**18**

Note 4 - Additional income

Merchandise sales	1
HEIF (Newton Gateway)	50
Newton Gateway events income	72
Total	**123**

Note 5 - Travel and Subsistence

Programme & workshop	875
Staff travel & subsistence	2
Total	**877**

Note 6 - Other operating expenses

Computing	60
Institute running costs	62
Catering	5
Furniture	1
Professional & brought in services	114
Total	**242**

Note 7 - Overheads paid to the University

Includes Estates and Indirect costs on grants and overheads on Trust Funds.

Celebrating David Abrahams, INI Director 2016-2021

Dr Ewan Kirk

Once again, the Isaac Newton Institute says goodbye to one Director and welcomes another into the fold. As always, there are mixed feelings at a time like this: sadness to see somebody who has worked so hard for the Institute move on but excitement about a new head of the Institute arriving.

Dr Ewan Kirk

I have worked with David during his entire tenure at the INI and observed first hand his focus and dedication to the Institute. During David's tenure the INI ran 32 programmes and 69 Gateway events. Given that David's tenure overlapped with the COVID-19 pandemic (of which more later), these are quite exceptional numbers. Running an organisation with this level of activity, while continuing one's own research, is not an easy task. David was instrumental in the INI receiving a £10m funding increase which will help the Institute nearly double the number of programmes it runs over the next five years. He has also fought tirelessly to bring to fruition an expansion of our buildings by helping to develop plans and coordinating with both our colleagues at CMS and with external agencies.

Other notable achievements include developing the idea of Satellite INI Programmes which will increase the reach of the INI across the UK, and he was also instrumental in pulling together the KE Connected Centres Network.

All in all, it is clear that the INI's activity, reach and future plans were all increased substantially as a direct result of David's leadership.

However, I think we all saw David at his very best as the COVID-19 crisis engulfed the world. In our small corner of the mathematical world, there were programme participants stranded in the UK, future programmes to cancel or reschedule and the staff of the INI needing sensitive leadership as we transitioned to an extended period of virtual working. David led the Institute through this most difficult of times, made sure stranded participants were taken care of and helped to bring about our very first virtual programme – the exceptionally topical Infectious Disease Pandemics. I hope that future Directors of the INI will not have to deal with something like this.

On a personal note, I have enjoyed working with David immensely over his five year tenure. He was constantly focussed on coming up with ideas to enhance the Institute's position in the community, raising money from philanthropic sources, making the INI run more smoothly, trying to come up with solutions to the perennial problem of space and capacity within the building... the list goes on and on. Whilst occasionally overwhelming (but in a good way), I cannot express how much fun it was. Finally, it was enjoyable to have long discussions with somebody who is as obsessed with the minutiae of professional cycle racing as I am...

Ulrike's appointment as the new Director is happening at an exciting time. New appointments bring new ideas and new priorities which refreshes the Institute. However, I think we can all agree that David, like all the Directors before him, has left an indelible mark on the Isaac Newton Institute and, consequently, the entire mathematical sciences community.

Governance: Advisory Council

Management Committee

The Management Committee is responsible for overall control of the budget of the Institute and for its financial planning. The Director is responsible to the Management Committee, which provides essential advice and support in relation to fund-raising activities, employment of the staff of the Institute, appointment of the organisers of programmes and general oversight of Institute activities. Its aim is to facilitate to the fullest possible extent the smooth and effective running of the Institute's programmes and all related activities. Membership of the Management Committee at 31 July 2021 was as follows:

Name	Institution	End of Service
Dr Ewan Kirk (Chair)	General Board	31-Dec-22
Professor Miguel Anjos	University of Edinburgh	31-Dec-22
Dr Katie Blaney	EPSRC	
Professor Tara Brendle	University of Glasgow	31-Dec-21
Professor Colm-Cille Caulfield	Head, DAMTP, University of Cambridge	
Professor John Greenlees	University of Warwick	31-Dec-22
Professor Niall MacKay	Chair of Correspondents, York	
Dr Christie Marr (Secretary)	Deputy Director, Isaac Newton Institute	
Professor James Norris	Head, DPMMS, University of Cambridge	
Professor Nigel Peake	Head, School of Physical Sciences	
Dr Richard Pinch	Retired	31-Dec-21
Professor Marian Scott	University of Glasgow	31-Dec-23
Professor David Abrahams	Director, Isaac Newton Institute	30-Sep-21
Professor Helen Wilson (Chair)	Chair of the Scientific Steering Committee	31-Dec-23

Scientific Steering Committee

The Scientific Steering Committee (SSC) meets twice each year to consider proposals for programmes (of 4-week, 4-month or 6-month duration) to run two or three years later. Successful proposals are usually developed in a discussion between the proposers and the SSC conducted through the Director, and may well be considered at more than one SSC meeting before selection is recommended. Complete details of the Institute's regular call for proposals, including guidelines for submission, can be found on the Institute's website at **www.newton.ac.uk/science/proposals**. Membership of the Scientific Steering Committee at 31 July 2021 was as follows:

Name	Institution	End of Service
Professor Helen Wilson (Chair)	University College London	31-Dec-23
Professor David Abrahams	Director, Isaac Newton Institute	30-Sep-21
Professor Andrea Bertozzi	University of California Los Angeles	31-Dec-24
Professor Ken Brown	University of Glasgow	31-Dec-23
Professor Mark Chaplain	University of St Andrews	31-Dec-21
Professor Susanne Ditlevsen	Københavns Universitet	31-Dec-24
Professor Robin Henderson	University of Newcastle	31-Dec-23
Dr Kristin Lauter	Facebook AI Research (FAIR)	31-Dec-24
Professor Sara Lombardo	Loughborough University	31-Dec-24
Professor Aleksandar Mijatovic	University of Warwick	31-Dec-22
Professor Mary Rees	University of Liverpool	31-Dec-23
Professor Carola-Bibiane Schönlieb	University of Cambridge	31-Dec-22
Professor John Shawe-Taylor	University College London	31-Dec-22
Ex-Officio: Professor Paul Glendinning	Scientific Director, ICMS	

Cumulative Financial Grants and Donations above £10,000

Elena Ambrosiadou • Michael Astor • Apple Computers Ltd. • Applied Probability Trust • Autonomy Systems Ltd. • Iain Bratchie • Bank of England • Benfield Greig • BNP Paribas • British Aerospace • British Gas • Howard & Veronika Covington • William Craig • Cambridge Philosophical Society • Clay Mathematics Institute • CNRS • Credit Suisse • Daiwa Anglo—Japanese Foundation • DERA • Deutsche Forschungsgemeinschaft • Emmanuel College • European Molecular Biology Organisation • European Science Foundation • European Union • Dill Faulkes Foundation • Garfield Weston Foundation • GLC Charitable Trust (Lawrence Staden) • Gonville and Caius College • David Harding Foundation • Henderson Global Investors • Hewlett—Packard • Clive Humby & Edwina Dunn • Institute of Physics • Jesus College • John Templeton Foundation • Dr EM Kirk & Dr PJ Turner • Leverhulme Trust • London Mathematical Society • Hamish Maxwell • Steve Mobbs • Magnox Electric • Medical Research Council • Met Office • Microsoft Corporation/ Microsoft Research • National Science Foundation • NATO • Nomura Corporation • Nuffield Foundation • Office of Naval Research • Old Mutual plc • Paul Zucherman Trust • PF Charitable Trust • Prudential Corporation plc • NM Rothschild and Sons • Research Councils UK (SERC/ EPSRC/ PPARC/ STFC/ NERC/ BBSRC/ ERSC) • Rolls Royce • Rosenbaum Foundation • Royal Commission for the Exhibition of 1851 • Schlumberger • Simons Foundation • St John's College • Sun Microsystems Inc. • Thriplow Trust • Trinity College • Trinity College (Isaac Newton Trust) • TSUNAMI • Unilever • University of Cambridge • David & Elizabeth Wallace • Wellcome Trust • Winton Philanthropies • Anonymous Donation

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You may donate to the Isaac Newton Institute online by credit or debit card through the University of Cambridge's secure site. US tax payers may donate to Cambridge in America, a 501(c)(3) tax-exempt organisation, and qualify for an income tax deduction. Please state when making your gift that you would like your donation to support the Isaac Newton Institute for Mathematical Sciences. The University has charitable status and so donations made to it or its constituent parts, including the Institute, may attract tax relief. For UK tax payers this is available under Gift Aid.

All donors will be acknowledged formally in the Institute's Annual Report (unless anonymity is preferred). The Institute offers recognition in various ways, including naming opportunities. If you would like to discuss these or other aspects of supporting our work, please do not hesitate to contact the Director (+44 (0)1223 335980 /director@newton.ac.uk) or Josh Bowerman at Cambridge University Development and Alumni Relations (+44 (0)1223 330112 / gw366@cam.ac.uk).

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