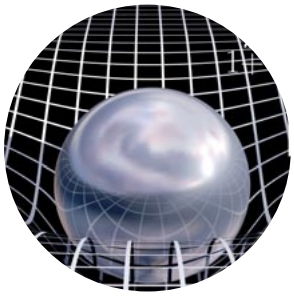
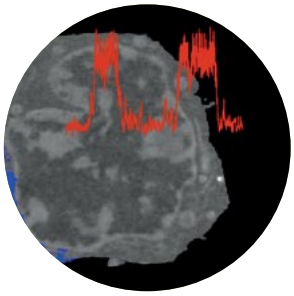
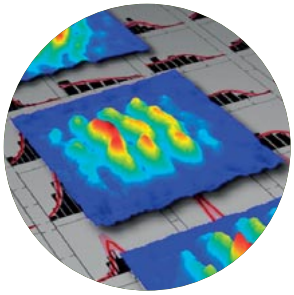
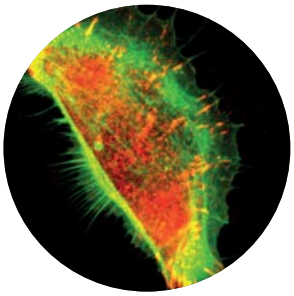
Isaac Newton Institute
for Mathematical Sciences

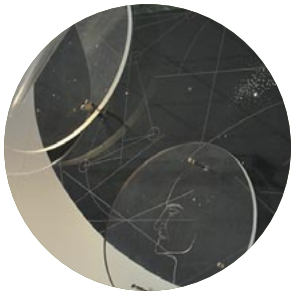


Annual Report 2015-16









Mission Statements

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 Turing 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.

Turing Gateway to Mathematics

The Turing Gateway to Mathematics (TGM) 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 TGM aims at widening 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

During my Directorship the transfer of public funding of INI from one research council to five has led to a notable increase in the scientific range of proposals, from the purest set theory to applied and statistical topics driven by the needs of business, technology, society and medicine. A concomitant increase in the number of submitted proposals led to a modest remodelling of the institute to accommodate additional participants, making possible three programmes rather than two, simultaneously.

Maybe as a result of these developments, a recent EPSRC analysis[1] of the UK mathematical sciences research infrastructure tellingly likened institutes such as this one to national laboratories or the large-scale shared facilities that are indispensable to other disciplines. In doing so it recognised the crucial role of INI in

- *creating new mathematics, keeping the UK abreast of mathematical developments and linking up mathematicians from diverse mathematical sub-areas;*
- *connecting mathematical scientists to groups in other fields who recognise a need for powerful existing mathematics in their research endeavours.*

Although these are quite different objectives requiring different skills and time scales, INI is committed to both: the first through original and timely programmes that are competitive with the world's best, and the latter through the Turing Gateway to Mathematics (TGM)[2], which is the impact acceleration initiative of INI.

Institutes such as this one are indispensable to other disciplines

Now at the end of my tenure I would like, on behalf of INI and the community it serves, to thank peer reviewers, and the many volunteers, past and present, on its boards and committees, for helping identify which activities to support from such a wide range of research areas and, of course, the organisers who came up with the ideas in the first place.

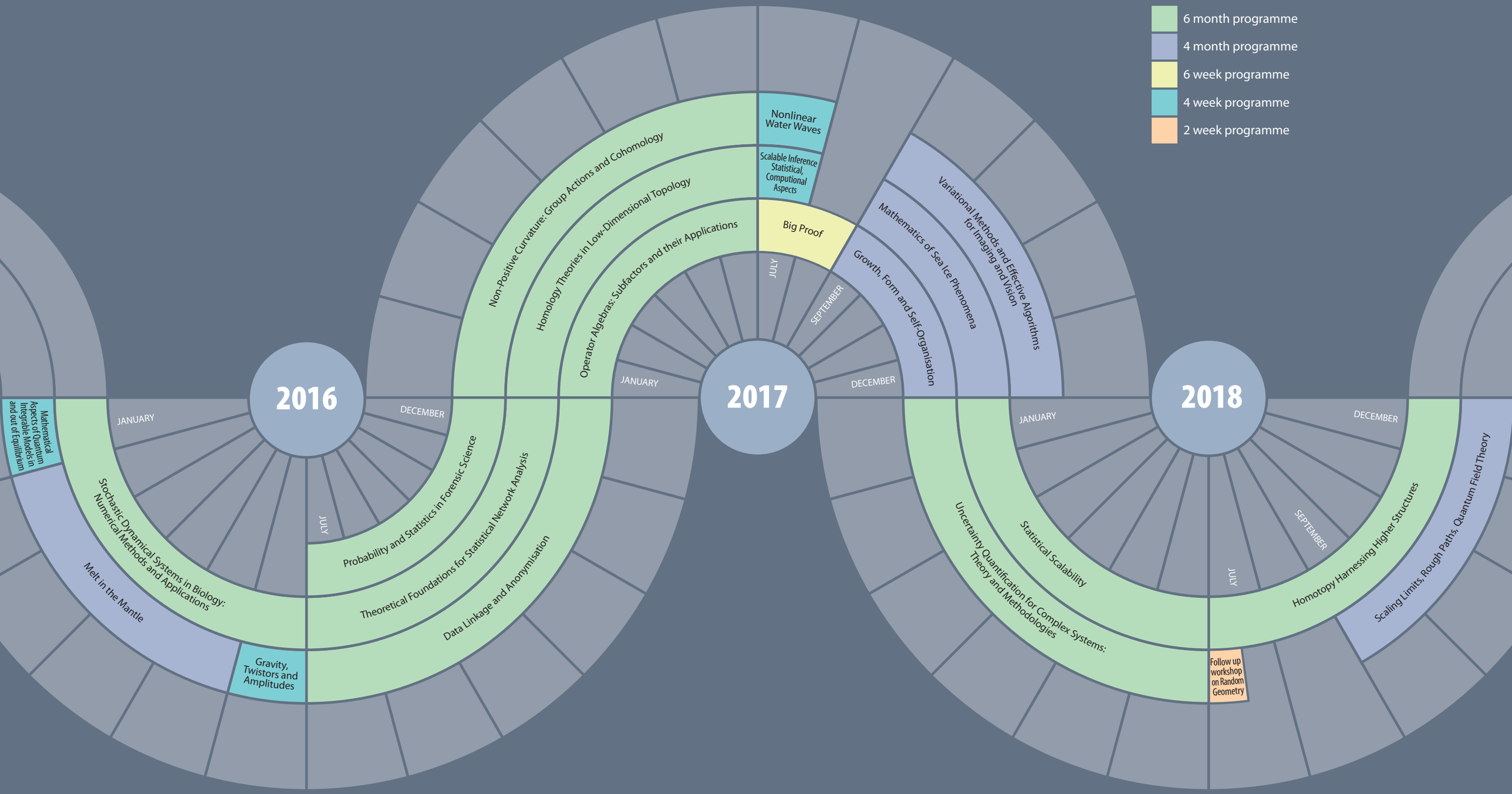
I must also thank most sincerely: my deputy, Dr Christie Marr; the chair of the Management Committee and the Development Board, Howard Covington; the chair of the Scientific Steering Committee, Professor Valerie Isham; the TGM Manager, Jane Leeks; the INI Administrator, Samantha Skehel; and of course the wonderful institute staff, all of whom kept me sane and cheerful.

I hope my successor David Abrahams has as much satisfaction from being Director as I have had.

John Toland,
Director – 2016

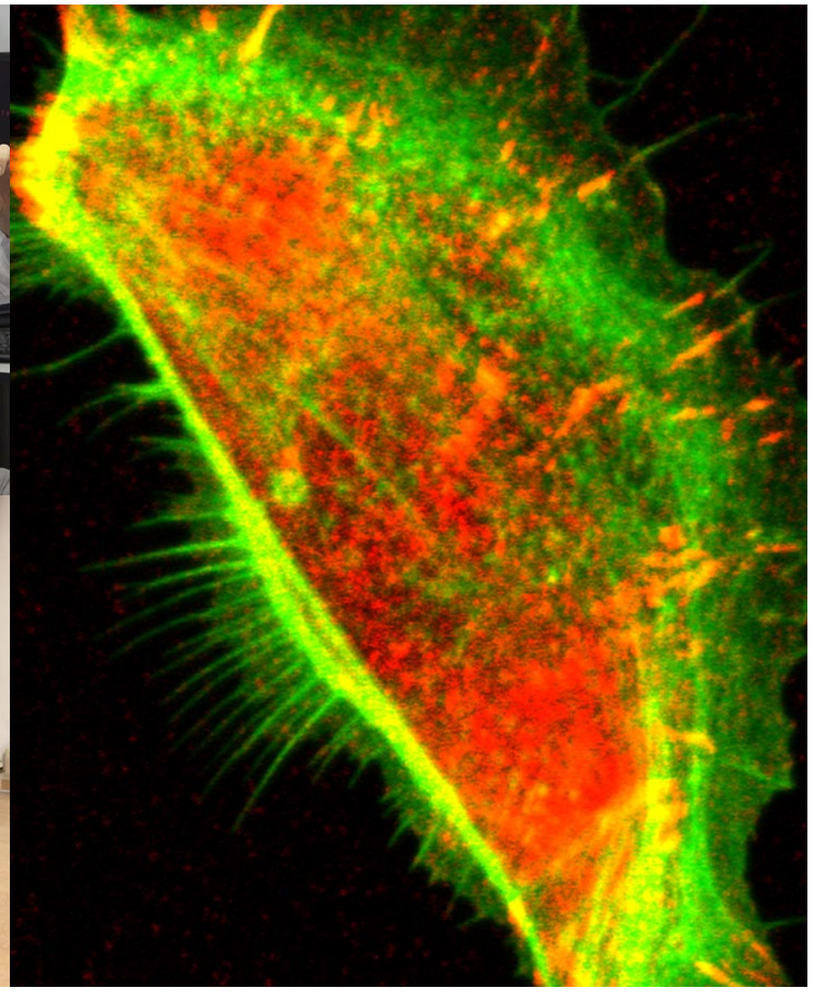
[1] *Review of Mathematical Sciences Infrastructure (December 2015) https://www.epsrc.ac.uk/newsevents/pubs/reviewmathsciinfrastructure/*
[2] *http://www.turing-gateway.cam.ac.uk/*

Programme Schematic



PROGRAMME HIGHLIGHTS

Coupling Geometric PDEs with Physics for Cell Morphology, Motility and Pattern Formation



ORGANISERS:
Rudolf Leube *(RWTH Aachen)*,
Anotida Madzvamuse *(Sussex)*,
Rudolf Merkel *(Forschungszentrum Jülich)*,
Hans Othmer *(Minnesota)*

This six-month programme on coupling geometric partial differential equations with physics for cell morphology, motility and pattern formation was the first of its kind to bring together world-leading theoreticians, experimentalists, bio-medical practitioners and statisticians with the goal of understanding how current mathematical techniques, including mathematical modelling and numerical and statistical analysis, can be used to formulate and analyse topical problems in cell motility and pattern formation and how diverse experimental results can be translated into predictive mathematical and computational models across several spatio-temporal scales.

Recent advances in cell motility and pattern formation, including high resolution imaging techniques in 3-dimensions, necessitate new mathematical and computational theories to help guide, suggest, refine and sharpen further experimental hypotheses. The programme laid out premises for topical research that seeks to couple molecular, cellular, tissue and fluid dynamics in a multiscale interdisciplinary environment thereby enabling the generation of new scientific knowledge across several disciplines.

"The laboratory experience was extraordinary, unique and extremely valuable"

An enormous challenge, but at the same time, the basis of the programme's success, was the wide spectrum of disciplines represented by participants some of whose attitudes about the role of mathematics were changed. They came to recognise for the first time that mathematics is not only a way to describe experimental observation but that it also can, through virtual models, produce experimental insights without the need for experiments. The programme demonstrated that for effective communication between disciplines it is not necessary to learn the tools of each other's trade.

A novel feature of the programme was a week-long visit by INI participants to laboratories at RWTH Aachen University and the Forschungszentrum Jülich in Germany, to see first-hand experimental techniques being used to analyse cell motility. This laboratory activity was beamed live to the INI seminar room and online, and participants' feedback was that the laboratory experience was extraordinary, unique and extremely valuable.

In the end perception of progress made, challenges remaining and perspectives developed differ, but there is a new understanding of the difficulties involved.

Outcomes of lasting impact were:

- The development of new mathematical and numerical methods (for example, keratin spatiotemporal organization, geometric PDEs for coupled bulk-surface dynamics for single and collective cell migration, coupling super-diffusion and keratin network organisation, coupled fluid-structure, fluid-fluid, tissue-fluid interaction models, new models on parameter identification, multiscale modelling of cancer invasion, tissue remodelling).
- The realisation that experimental data sets should be standardised, quantitative and freely available for effective interdisciplinary interaction.
- A special issue of the Royal Society's Interface Focus journal.
- Lectures from Australia by Prof Kerry Landman were beamed live to INI.
- Several network and research grant applications (Horizon2020 MSC-ITNs, EPSRC, Leverhulme Trust, London Mathematical Society, National Science Foundation, Royal Society) and follow-up meetings (Oberwolfach, Banff, Durham, etc.).

ROTHSCHILD FELLOWSHIPS:
Professor Charles Elliott

SIMONS FELLOWSHIPS:
Professor J King
Professor R Leube
Professor S Lubkin
Dr A Madzvamuse
Professor H Othmer
Professor N Tuncer
Professor A Voigt

GENDER BALANCE (F : M, %)

28	72

GEOGRAPHIC DISTRIBUTION (UK : NON-UK, %)

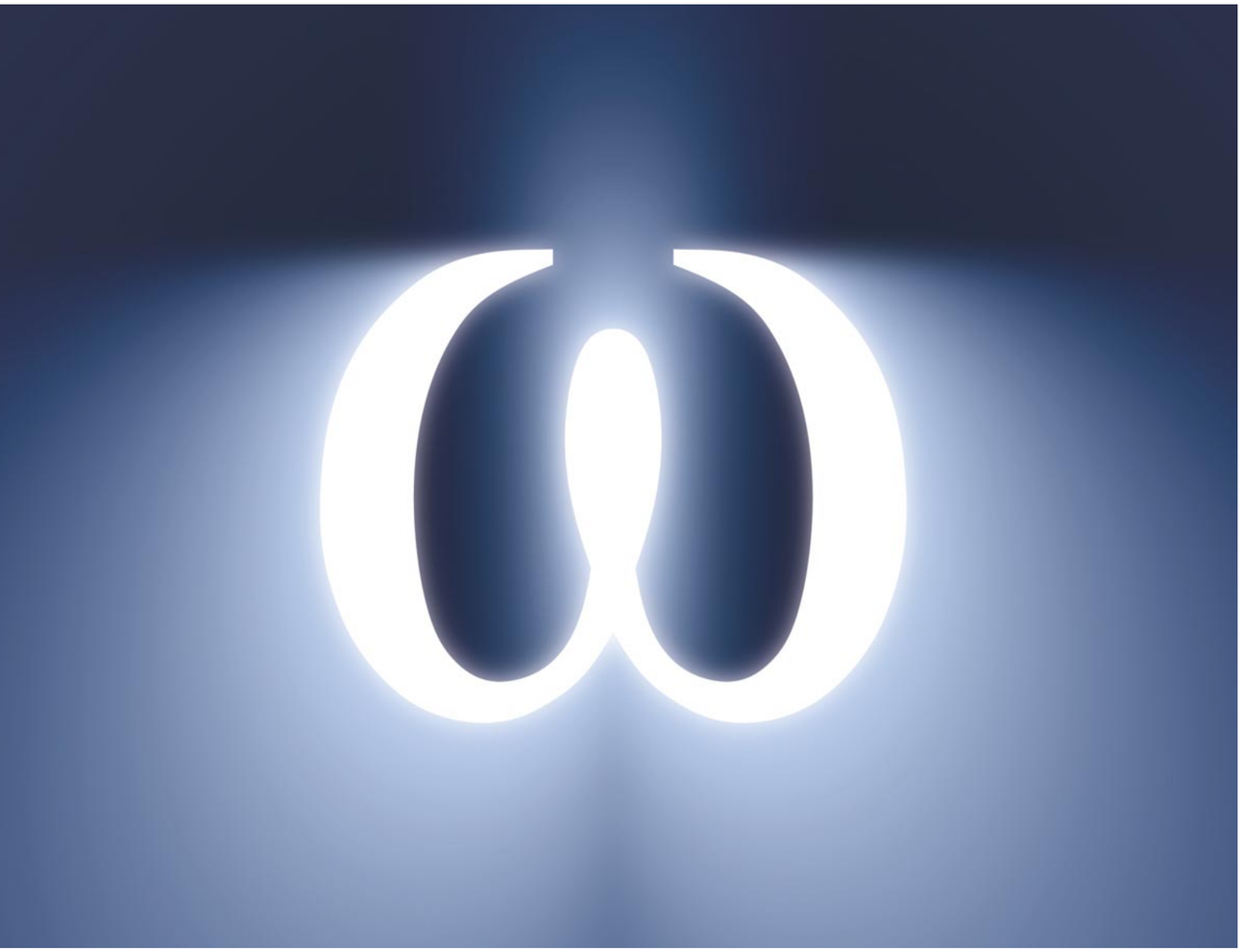
35	65

AGE DISTRIBUTION (≤29 : 30-49 : ≥50, %)

16	53	31

PROGRAMME HIGHLIGHTS

Mathematical, Foundational and Computational Aspects of the Higher Infinite



ORGANISERS:
Joan Bagaria *(ICREA and Barcelona)*,
Mirna Džamonja *(East Anglia)*,
Benedikt Löwe *(Amsterdam and Hamburg)*

In the late 19th century, Georg Cantor famously showed that there are infinite sets of different sizes by proving that the real numbers cannot be put in one-to-one correspondence with the natural numbers. In the years that followed Cantor's observation developed into a rich theory of infinities and is nowadays a mature area with sophisticated techniques such as Gödel's constructability and Cohen's forcing for the study of the Higher Infinite (HIF). In addition to being a research field in its own right, set theory provides a unified foundation for mathematics as a whole and has many applications in subjects such as theoretical computer science, and beyond.

This ambitious programme on the Higher Infinite brought together leading researchers worldwide, including Rothschild Fellow W. Hugh Woodin (Harvard), for a stimulating exchange of ideas about mathematical, foundational, and computational approaches to infinity, linking set theory to other parts of mathematics, mathematical logic, theoretical computer science, philosophy of mathematics, proof theory and constructive mathematics. In addition, many doctoral students and junior postdoctoral researchers greatly benefitted from working in direct contact with leaders in the field.

In a mathematical field where papers often take years to finish, it is remarkable that when the programme ended it had produced thirty-six preprints

The programme hosted the 5th European Set Theory Conference during which Ronald Jensen and John Steel were awarded the 2015 Hausdorff Medal for their work in set theory. It also hosted the annual British Logic Colloquium and a Satellite Workshop on *Independence Results in Mathematics and Challenges in Iterated Forcing* was held at the University of East Anglia.

A workshop on *The Role of the Higher Infinite in Mathematics and Other Disciplines* shone a spotlight on applications of set theory in other parts of mathematics and other disciplines. With talks highlighting links to topological dynamics, automata theory, infinite matroids and program analysis, the programme ended with a presentation proving (with techniques from descriptive set theory) that the question of whether two knots are the same is very difficult: a fitting final talk for a programme that positioned set theory centrally in the mathematical sciences.

In a mathematical field where papers often take years to finish, it is remarkable that when the programme ended it had produced thirty-six preprints, with topics ranging from the philosophical notion of restrictiveness for axiom systems of set theory, via descriptive set theory, combinatorial set theory, and cardinal arithmetic, to applications of set theory in measure theory or the theory of infinitary computation, and more are to come.

The programme was key to the consolidation of a European set theory research network with strong links to the leading researchers in North America and has served as a springboard for further actions, such as the upcoming research programme *Large Cardinals and Strong Logics* at the Centre de Recerca Matemàtica, Barcelona, in 2016.

ROTHSCHILD FELLOWSHIPS:
Professor W H Woodin

SIMONS FELLOWSHIPS:
Professor J Bagaria
Professor M Dzamonja
Professor B Löwe
Professor M Magidor
Professor J R Steel
Professor J Väänänen
Professor B Velickovic
Professor P D Welch

GENDER BALANCE
(F : M, %)

18	82

GEOGRAPHIC DISTRIBUTION
(UK : NON-UK, %)

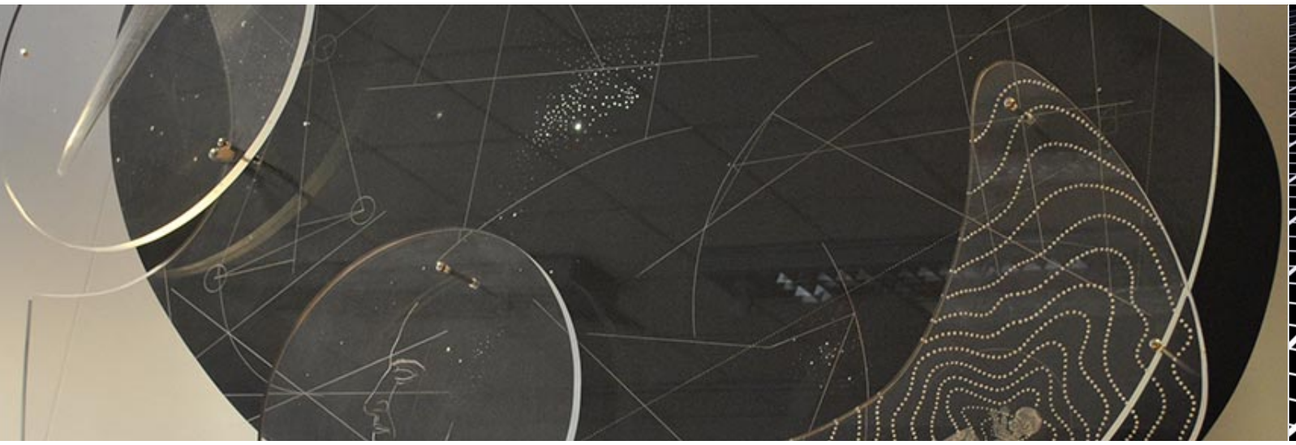
17	83

AGE DISTRIBUTION
(≤29 : 30-49 : ≥50, %)

21	44	35

PROGRAMME HIGHLIGHTS

Metric and Analytic Aspects of Moduli Spaces



ORGANISERS:
Sergey Cherkis *(Arizona)*, Nigel Hitchin *(Oxford)*, Rafe Mazzeo *(Stanford)*, Michael Singer *(UCL)*.

GENDER BALANCE (F : M, %)

12	88

GEOGRAPHIC DISTRIBUTION (UK : NON-UK, %)

32	68

AGE DISTRIBUTION (≤29 : 30-49 : ≥50, %)

10	60	30

The goal of this program was to draw together experts working on moduli spaces arising in geometric analysis and mathematical physics. The emphasis was on the application of new analytic and geometric techniques in such problems, as well as a survey of outstanding problems from mathematical physics.

Three main directions of research were represented: the classical Teichmueller and Riemann moduli spaces, various types of solitons and their moduli spaces, and the study of gravitational instantons and other Riemannian manifolds with special geometry. Important new progress was announced in each of these areas.

Breakthroughs were described uncovering the structure of the moduli spaces of Euclidean monopoles, Higgs bundles, and Riemann surfaces

For example, breakthroughs were described uncovering the structure of the moduli spaces of Euclidean monopoles, Higgs bundles, and Riemann surfaces.

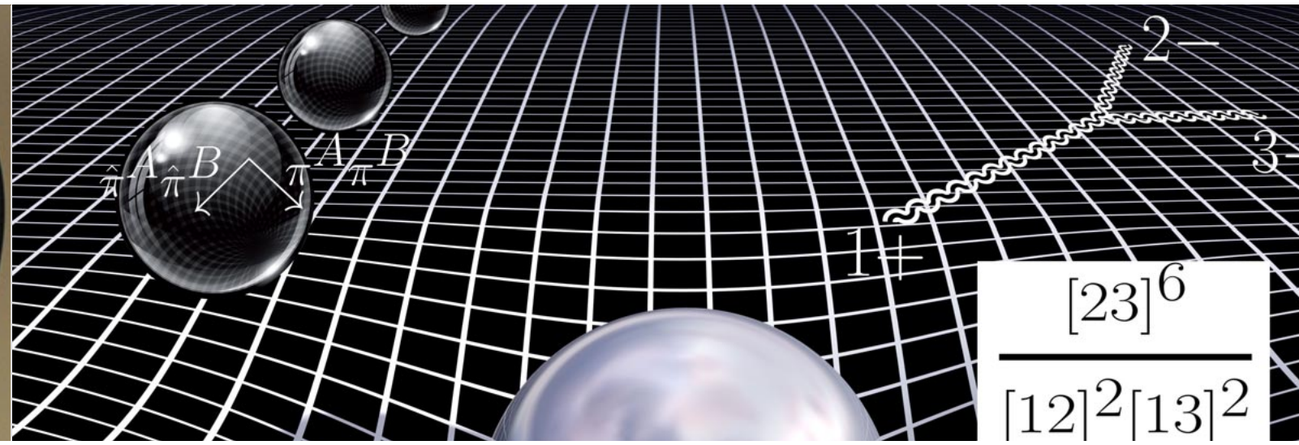
The last talk of the program was given by Greg Moore, shortly after the announcement that he had been awarded the 2015 Dirac Medal and Prize (shared with Kitaev and Read).

This was an inspiring event, which is certain to shape research on moduli spaces for many years to come.

The program was very successful in providing a clear view of the current state of these various problems, and even more importantly, of exposing researchers in one area to the important questions and advances in other areas. The exit survey provided evidence of numerous new interactions and collaborations which began during this program and a follow-up workshop will take place at the Banff International Research Station in August 2017.

PROGRAMME HIGHLIGHTS

Gravity, Twistors and Amplitudes



ORGANISERS:
Kirill K Krasnov *(Nottingham)*, Lionel L J Mason *(Oxford)*, David Skinner *(Cambridge)*.

GENDER BALANCE (F : M, %)

8	92

GEOGRAPHIC DISTRIBUTION (UK : NON-UK, %)

57	43

AGE DISTRIBUTION (≤29 : 30-49 : ≥50, %)

21	55	24

In 2003 Witten led research which resulted in a collection of formulae for tree-level n-particle scattering amplitudes in gravity and Yang-Mills theory. These formulae surprisingly involved maps from the Riemann sphere with marked points, to either twistor space in dimension 4 or complexified momentum space in arbitrary dimensions, suggesting a relation to string theory. However, although string theories exist that produce these formulae they are not the well-studied string theories that lead to field theory scattering amplitudes in the limit of infinite string tension.

With a view to understanding this dichotomy the programme brought together differential geometers and physicists specialising in amplitudes. The programme also focused on related topics such as double-field theory, ambi-twistor strings, scattering amplitudes in (constantly) curved space, and asymptotic symmetries.

The programme brought together differential geometers and physicists specialising in amplitudes

A further theme was exceptional geometry. In the late 80's Bryant and Salamon showed that the total space of an appropriate bundle over an (anti-) self-dual Einstein manifold can be given the structure of a manifold with an exceptional holonomy G2 which can be encoded in a sufficiently generic 3-form in 7 dimensions. Recently it has emerged that a special type of gravity has a 7-dimensional interpretation in which 4-dimensional theory arises as the dimensional reduction of 3-forms in 7 dimensions. Thus a significant part of the programme was devoted to G2 structures and their role in 4-dimensional gravity. This led to significant progress in understanding which G2 structures in 7D are likely to feature in classical 4D General Relativity.

Stochastic Dynamical Systems in Biology: Numerical Methods and Applications

ORGANISERS:
Konstantinos Zygalakis *(Edinburgh)*,
Radek Erban *(Oxford)*,
David Holcman *(CNRS Paris)*,
Samuel Isaacson *(Boston)*.

This programme, which focused on significant challenges arising in biology from the use of stochastic dynamical systems to model processes such as gene regulation, molecular signalling, cell division, molecular transport and cell motility, began by identifying the key mathematical issues involved, including:

- Development and software implementation of efficient methods for stochastic simulation over a vast range of spatial and temporal scales.
- Analysis of dynamical behaviour of biological models.
- Integration of data and models towards their successful parametrisation.

Significant progress was made across all the targeted areas: for example: the problem of incorporating more realistic biological features in models of cellular processes was addressed by improving the cell biology software package *Smoldyn*; the development of multiscale methods led to new collaborations on hybrid methods to resolve different portions of a biological system at different spatial and/or temporal scales; and two research workshops were focused on spatial and non-spatial stochastic processes.

Using analogies between modern computational modelling of molecular-based processes and a famous painting of Hieronymus Bosch, [Sarah Harris] explained how the interplay between order and chaos at the molecular level gives rise to the complex behaviour of biomolecules inside living cells.

Highlights were:

- The Rothschild lecture *Mathematics for Data-driven Modelling - the Science of Crystal Balls* in which Yannis Kevrekidis (Princeton) advocated the use of algorithms that "jump directly" from data to the analysis of models that are not available in closed form, so as to make predictions about their behaviour.
- An invited lecture by Nobel Prize winner James Rothman (Yale) who posed biological questions about mechanisms of communication between neurons for which new mathematical models are urgently needed.
- The satellite meeting in Edinburgh at which Sarah Harris (Leeds) delivered a popular lecture *Physics Meets Biology in the Garden of Earthly Delights*. Using analogies between modern computational modelling of molecular-based processes and a famous painting of Hieronymus Bosch, she explained how the interplay between order and chaos at the molecular level gives rise to the complex behaviour of biomolecules inside living cells.

Future activities are planned, including a training network for graduate students across Europe, follow-up workshops at the MATRIX Research Institute in Melbourne and the Institute for Computational and Experimental Research in Mathematics (ICERM) at Brown University, as well as a proposed three month programme at the Institut Henri Poincaré in Paris. A graduate course which was recorded is available on the web and in 2017 a book edited by the organisers to summarise the mathematics developed during the programme will be published by Springer.

ROTHSCHILD FELLOWSHIPS:
Professor Y Kevrekidis

SIMONS FELLOWSHIPS:
Professor D F Anderson
Professor S Andrews
Professor D Coombs
Professor M Erban
Professor D Holcman
Professor S Isaacson
Professor P Kramer
Professor R Kuske
Dr J Reingruber
Dr S Rüdiger
Dr K Zygalakis

GENDER BALANCE
(F : M, %)

F	M
17	83

GEOGRAPHIC DISTRIBUTION
(UK : NON-UK, %)

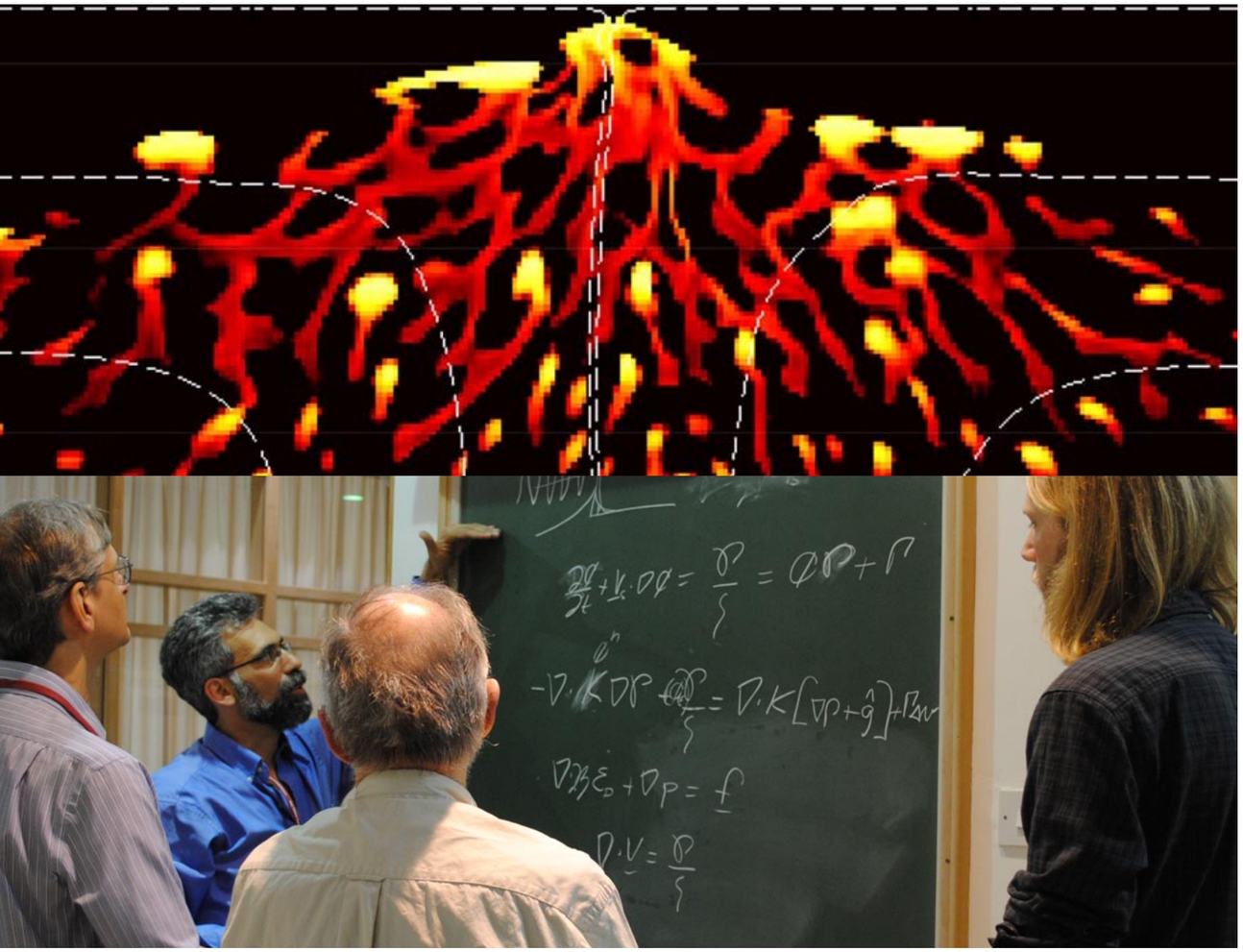
UK	NON-UK
39	61

AGE DISTRIBUTION
(≤29 : 30-49 : ≥50, %)

≤29	30-49	≥50
21	67	13

PROGRAMME HIGHLIGHTS

Melt in the Mantle



ORGANISERS:
John Rudge *(Cambridge)*,
Todd Arbogast *(Austin, Texas)*,
Arwen Deuss *(Utrecht)*,
Richard Katz *(Oxford)*,
Jerome Neufeld *(Cambridge)*,
Yasuko Takei *(Tokyo)*.

Deep beneath our feet lies the Earth's mantle, a 3000 km thick layer of rock that convects as fast as our fingernails grow. At plate-tectonic boundaries the mantle melts and that melt rises to fuel volcanism. Melt generation is well understood but much less is known about its transport. Particularly puzzling is how the rapid (geologically speaking!) rates of melt segregation, inferred from the chemistry of volcanic rocks, disagree with more modest rates of transport predicted by porous flow theory.

Mathematical modelling of melt transport presents significant challenges, of which two were of particular concern to this INI programme. First, it is intrinsically multi-scale: melt forms along boundaries between mineral grains at scales of millimetres but is transported over hundreds of kilometres. The question is how does physics at the grain scale yield observed behaviour at the tectonic scale? Second, how can melt transport at large scales be simulated numerically when optimal discretisation of the governing PDEs is not obvious and numerical solution of the discretised equations is problematic? Three workshops acted as focal points for these issues.

Melt forms along boundaries between mineral grains at scales of millimetres but is transported over hundreds of kilometres. The question is how does physics at the grain scale yield observed behaviour at the tectonic scale?

The first reviewed state-of-the-art continuum models of melt transport and identified areas where theory was lacking. Researchers from different fields discussed flow through porous rocks, of course, but also through glacial ice (and even through babies' nappies!).

The second brought together rock mechanicists with expertise in the behaviour of partially molten rock at laboratory scales, and mathematicians who were expert in homogenisation theory and up-scaling, with the aim of bridging the gap between grain-scale physical and macro-scale continuum models.

The third focused on melt transport at planetary scales, exploring theory and geophysical observations and relevant advances in numerical methods for PDEs.

Between workshops, seminars and a reading group brought participants together to discuss key challenges.

Notable achievements were:

- Progress in establishing the well-posedness of the McKenzie equations of magma dynamics that is fundamental for finite-element schemes in the limit of vanishing porosity.
- Adding melt migration to the mantle convection code ASPECT.
- Progress in coupling the thermodynamics software MELTS to numerical models of the dynamics of melt transport.
- Katz's new book *Introduction to the Theory of Magma/Mantle Dynamics* (Princeton University Press).
- Modelling the genesis and transport of carbon-rich melt at the tectonic scale of mid-ocean ridges.
- Development of more accurate and efficient finite-element formulations of the McKenzie equations.
- New models of the effect of melt on the thermal structure of subduction zones, key in focusing melt toward arc volcanoes.
- A new 3D grain-scale model of diffusion creep, rigorously quantifying the weakening effects of melt.
- A new anelasticity model of the mantle which allows a direct conversion from variations in seismic properties to mantle temperature.

ROTHSCHILD FELLOWSHIPS:
Professor N Ribe

SIMONS FELLOWSHIPS:
Professor H Majid
Professor G Ito
Professor Y Takei

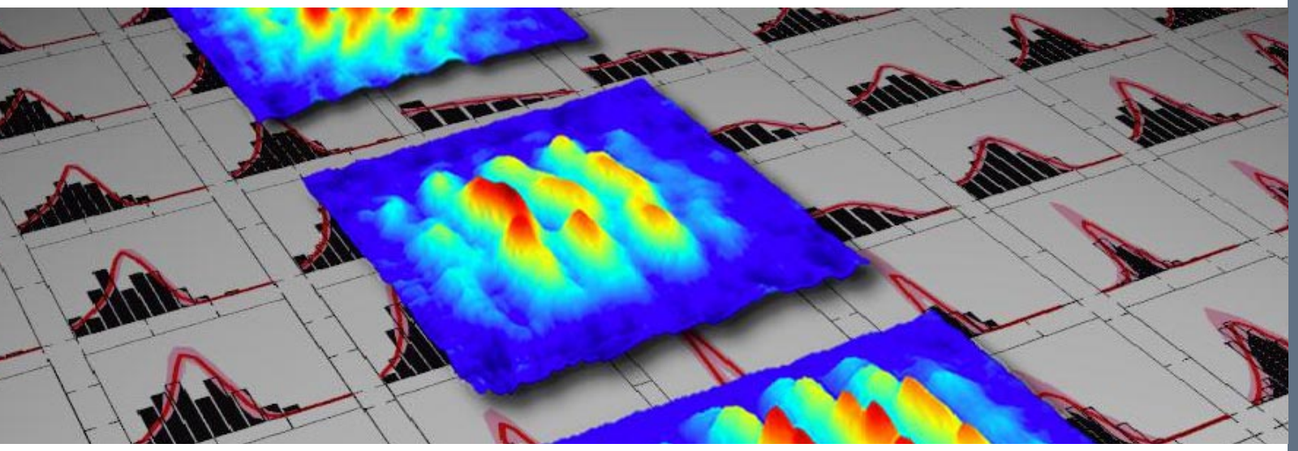
GENDER BALANCE
(F : M, %)

GEOGRAPHIC DISTRIBUTION
(UK : NON-UK, %)

AGE DISTRIBUTION
(≤29 : 30-49 : ≥50, %)

PROGRAMME HIGHLIGHTS

Mathematical Aspects of Quantum Integrable Models in and out of Equilibrium



ORGANISERS:
Denis Bernard *(Paris)*,
Fabian H L Essler *(Oxford)*,
Giuseppe Mussardo *(Trieste)*,
German Sierra *(Madrid)*.

GENDER BALANCE (F : M, %)

6	94

GEOGRAPHIC DISTRIBUTION (UK : NON-UK, %)

27	73

AGE DISTRIBUTION (≤29 : 30-49 : ≥50, %)

10	54	36

Quantum Theory provides the foundation of our understanding of Physics on the (sub) atomic level but many key applications face enormous computational complexity due to the huge number ($\approx 10^{23}$) of strongly interacting particles. Quantum integrable models (QIM) allow for exact solutions of such problems.

The programme advanced QIM methods addressing experimentally relevant questions in both equilibrium and non-equilibrium settings. It brought together theoretical physicists, mathematicians, and cold atom experimentalists to discuss issues including:

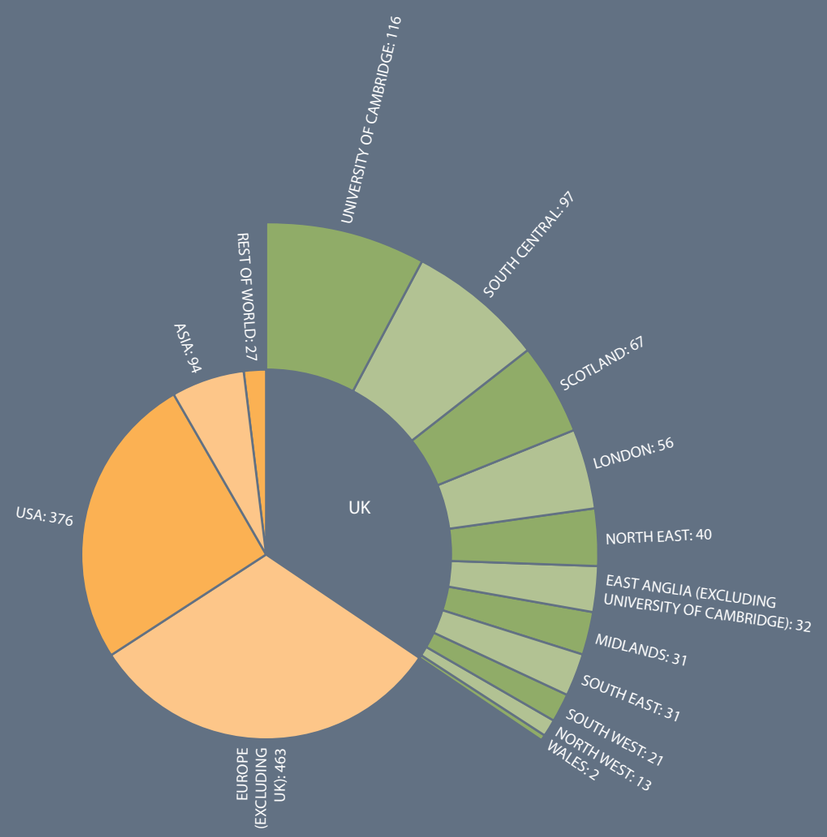
- ***Non-equilibrium time evolution.*** Constants of motion in QIM constrain their dynamics and lead to different statistical descriptions at late times. Progress was made on identifying which conservation laws most influence local properties, and how to characterise and construct statistical ensembles describing steady state properties.
- ***Return amplitudes.*** The probability amplitude for when a finite quantum system returns to its initial state has interesting properties. Initiatives were introduced to better understand why its non-analyticities can show surprising robustness with respect to changing system parameters.
- ***Mathematical aspects of QIM.*** The separation of variables approach was identified as a promising alternative to methods based on the Bethe ansatz. Avenues for further development were identified.
- ***Properties of entanglement entropies.*** How entanglement can characterise the spreading of correlations, and the use of tensor network methods to study relaxation in generic and integrable systems after quantum quenches were discussed.
- ***Quantum Transport.*** The crossover from ballistic to diffusive behaviour, non-equilibrium steady state properties of externally driven and inhomogeneous, quenched systems, and the shape of flow profiles in out-of-equilibrium systems were discussed in detail. Connections with the important problem of many-body localisation were addressed.

This finally permits the study of fundamental questions, first posed in the early days of Quantum Theory

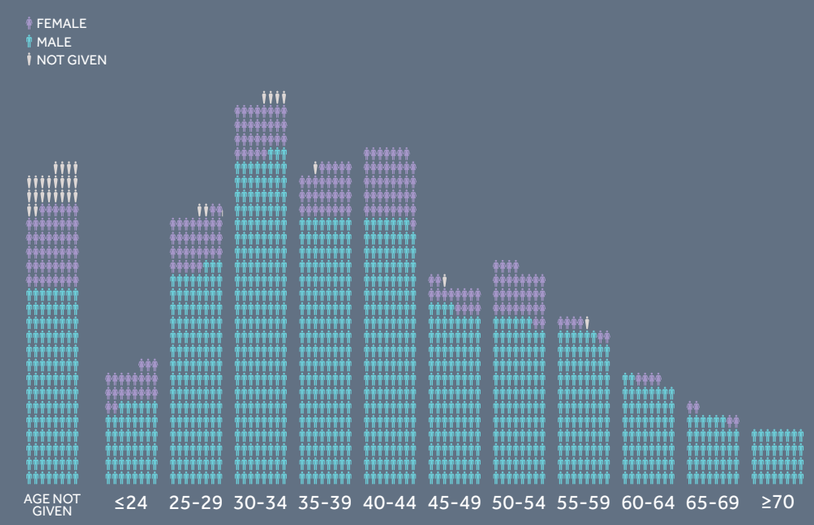
The programme led to numerous new collaborations as well as applications for related/follow-up events.

Statistics

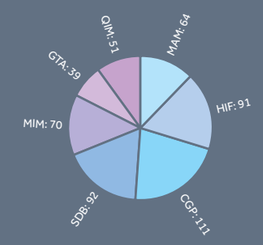
Worldwide Geographic Spread



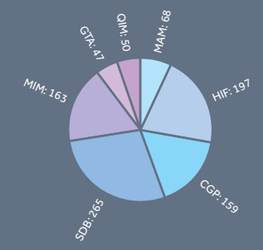
Gender and Age



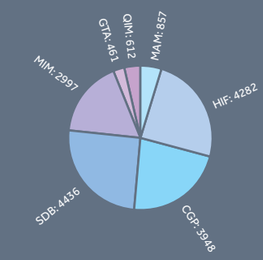
518
PROGRAMME PARTICIPANTS



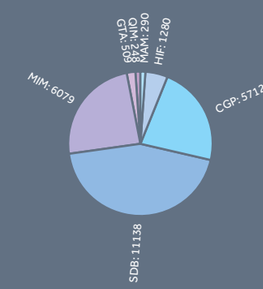
949
WORKSHOP PARTICIPANTS



17593
PROGRAMME PARTICIPANT DAYS



25256
WORKSHOP PARTICIPANT DAYS



Serving the UK Community

Deputy Director, Dr Christie Marr at the London Mathematical Society ▶

INI is ever mindful of its role as a National Institution and its responsibility to engage with those working in the mathematical sciences from across the UK. In this reporting year the 166 UK-based programme participants and 314 UK-based workshop participants came from 44 different UK Higher Education Institutions (HEIs) in addition to others from business and industry. They came from a broad cross spectrum of departments spanning mathematics and the physical sciences, the biological and medical sciences, and the environmental sciences.

Seminars in the UK

INI's "Talks Elsewhere" scheme, whereby long-term participants from overseas are encouraged to give seminars elsewhere in the UK, continues to flourish, with INI paying the participants' travel expenses and the host institution paying their local expenses. For further information about this scheme and for lists of future participants and the topics they would be happy to speak on see: www.newton.ac.uk/science/outreach/talks-elsewhere

Attendees at ICMS, Edinburgh ▶

Satellite Workshops

INI continues its tradition of incorporating Satellite Meetings remote from Cambridge into its schedule to ensure engagement with research groups working on a topic closely related to the theme of a programme or with those based in institutions far removed from INI. This reporting year Satellite workshops were held at: the University of East Anglia, Norwich; the University of Sussex, Brighton; and at the International Centre for Mathematical Sciences (ICMS), Edinburgh. For more information read this case study http://www.newton.ac.uk/node/1270973

Seminars on the Web

Seminar at Sussex University ▶

Subject to speaker permission, INI continues to stream all seminars live and to then make them available online in perpetuity. Over 400 seminars were added to the collection during this reporting year. These, and all other previous seminars, can be viewed here: http://www.newton.ac.uk/webseminars

Correspondents and Junior Members

With the recent appointment of a new Communications Officer, INI's Bulletins have been revamped – see an example here: http://ow.ly/kXAw305xWb8 . Correspondents will soon be informed of the date of the next Meeting of Correspondents were they will be invited to INI to meet new Director David Abrahams.

Cambridge Science Festival

INI has been involved for many years with this exciting event and last year was exceptional. Charles Simonyi, the Hungarian-born former Microsoft software developer, high-tech pioneer, philanthropist and space traveller, spoke about his time on the International Space Station. There was not a spare seat in the house. Feedback from attendees at the talk showed that Dr Simonyi certainly achieved his aim to inspire young people to a heightened interest in science, maths, and space. One attendee wrote: "*We've been attending the Cambridge Science Festival for more than 15 years and always find it enjoyable. This talk by Charles Simonyi is one of the most engaging I've ever attended*".

◀ Dr Charles Simonyi

INI on Social Media

Digital communications are becoming the principal means by which our audiences around the world engage with our work and social media channels are an important part of this. We encourage all those interested in INI activities to:

- like the Institute on Facebook: *https://www.facebook.com/newton.institute/*
- follow it on Twitter: *https://twitter.com/NewtonInstitute*
- and LinkedIn *http://lnked.in/inifms*

Finances

Accounts for August 2015 to July 2016

	2014/15 £'000	2015/16 £'000
Income		
Research Grants and Contracts[1]	1,591	1,904
Contribution from the University of Cambridge[2]	388	417
Donations[3]	219	146
Additional Workshop Income	98	167
Endowment and Investment Income[4]	203	248
Net Housing Surplus[5]	31	0
Other Income	3	1
Total Income	**2,533**	**2,883**
Expenditure		
Staff Costs	681	684
Travel and Subsistence[6]	1,312	1,015
Workshop Expenditure	162	169
Other Institute Activities[7]	12	-
Other Operating Expenses[8]	111	229
Overheads paid to University[9]	293	306
Total Expenditure	**2,571**	**2,403**
Surplus / (Deficit)	**(38)**	**480**

Notes to the Accounts

1. **Research Grants and Contracts.** The income breaks down as follows:

	2014/15 £'000	2015/16 £'000
EPSRC Salaries	247	351
EPSRC Travel and Subsistence	991	1,301
EPSRC Other Costs	14	1
EPSRC Estates and Indirect Income	339	251
Total	**1.591**	**1,904**

2. **Contribution from the University of Cambridge.** The amounts received break down as follows:

Rothschild Visiting Professorships (drawdown)	11	21
Rothschild Mathematical Sciences (income)	112	96
Contribution Towards Institute Operating Costs	265	300
Total	**388**	**417**

The University also provides the main and Gatehouse buildings and pays for all gas, electricity and rates, which have not been included.

3. **Donations.**

	2014/15 £'000	2015/16 £'000
Simons Foundation	-	56
Cambridge Philosophical Society	2	2
Garfield Weston Foundation	12	18
London Mathematical Society	33	36
Turner-Kirk Charitable Trust*	108	-
Others	63	34
Total	**219**	**146**

*A total sum of 100k was received from Turner-Kirk Charitable Trust, which was placed in investment income and is not included in this figure

4. **Endowment and Investment Income.** Income received from the Newton Trust fund, the Anonymous Donation Endowment, reserves and deposits.

5. **Net Housing Costs.**

Income	748	381
Expenditure	717	381
Total	**31**	**0**

6. **Travel and Subsistence.** Expenditure incurred by Programme Visitors including Junior Members. This figure is significantly higher for 2014/15 due to a one-off adjustment to synchronise INI accounting for research grants with University of Cambridge Financial Procedures

7. **Other Institute Activities.** These costs relate to *Open for Business* and fundraising activities as well as expenses from meetings of the Institute's committees, Institute Correspondents, programme organisers, and the travel expenses of overseas participants who visit other UK institutions to give seminars during their stay.

8. **Other Operating Expenses.**

Building maintenance*	52	177
Catering 17	17	15
Consumables 12	28	19
Computing and Audio Visual	9	8
Equipment and Furniture	1	1
Library 2	2	4
Publicity 1	2	5
Total	**111**	**229**

*These costs include the redevelopment of the Library into the new Admin Suite. The total cost for this project was £251,417, with a contribution from Cambridge University of £114,704

9. **Overheads Paid to University.** Includes Estates and Indirect costs on grants and overheads on Trust Funds.

Governance: Advisory Council

John Toland,
Director – 2016

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 2016 was as follows:

Name	Institution	End of Service
Mr Howard Covington (Chair)	General Board	31 Dec 2018
Dr Gabor Csanyi	Council of the School of Technology	31 Dec 2018
Prof. Mark Gross	Faculty of Mathematics	31 Dec 2018
Prof. Peter Haynes	Head, DAMTP, University of Cambridge	
Dr Philippa Hemmings	EPSRC	
Prof. Valerie Isham	Chair of the Scientific Steering Committee	31 Dec 2017
Dr Eric Lauga	Trinity College	31 Dec 2018
Prof Nick Manton	St John's College	31 Dec 2018
Dr Christie Marr (Secretary)	Deputy Director, Isaac Newton Institute	
Prof. Andy Parker	Council of the School of Physical Sciences	31 Dec 2018
Prof. Gabriel Paternain	Head, DPMMS, University of Cambridge	
Prof. Ulrike Tillman	London Mathematical Society	31 Dec 2018
Prof. John Toland	Director, Isaac Newton Institute	30 Sep 2016

Valerie Isham
Chair of the Scientific Steering Committee

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 2016 was as follows:

Name	Institution	End of Service
Professor J F Toland, Director		30 Sept 16
Professor M Kwiatkowska	Oxford	31 Dec 18
Professor Dame F Kirwan	Oxford	31 Dec 19
Dr E Shuckburgh	British Antarctic Survey	31 Dec 16
Professor S Cowley	Imperial College London	31 Dec 16
Professor V Isham (Chair)	University College London	31 Dec 17
Professor M Harris	Institut de Mathématiques de Jussieu	31 Dec 16
Professor P Glendinning	Manchester	31 Dec 19
Professor W Dahmen	Aachen	31 Dec 18
Professor S Tavaré	Cambridge	31 Dec 19
Professor S Jacka	Warwick	31 Dec 18
Professor H Byrne	Oxford	31 Dec 17
Professor I Gordon	Edinburgh	31 Dec 17
Professor C Villani	Institut Henri-Poincaré	31 Dec 16
Professor D Abrahams	ICMS Edinburgh	(in attendance)

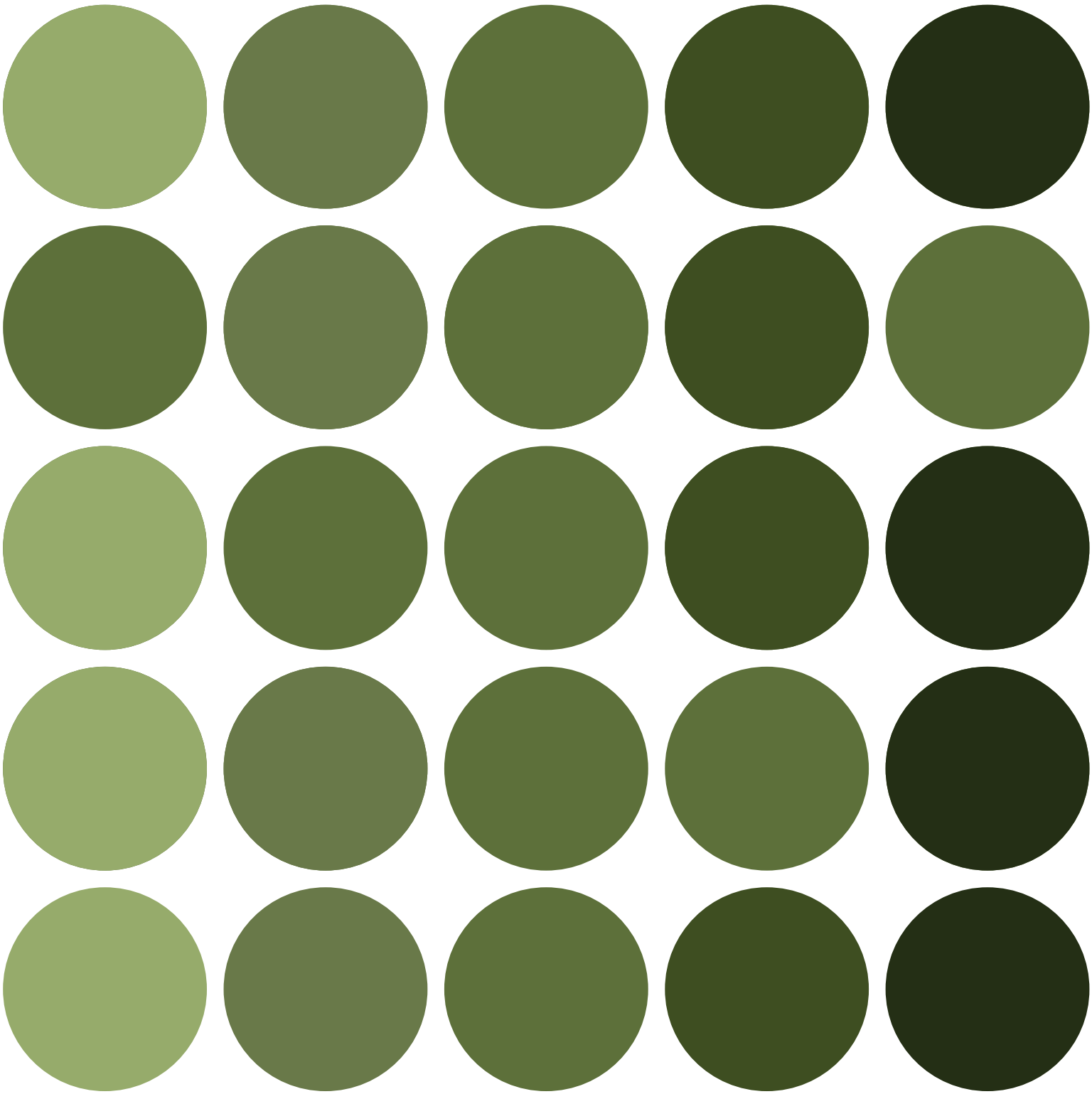
Cumulative Financial Grants and Donations above £10,000

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 • • Anonymous Donation •

How to Donate

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 Glen Whitehead at University Development and Alumni Relations (+44 (0)1223 330112 / gw366@cam.ac.uk).



UNIVERSITY OF CAMBRIDGE

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E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

Science & Technology Facilities Council