

LONDON MATHEMATICAL SOCIETY EST, 1865

NEWSLETTER

No. 467 March 2017

MATHEMATICIAN RECEIVES TOP HONOUR

Professor Martin Hairer FRS, University of Warwick, has been awarded an honorary KBE. The award of Knight Commander, The Most Excellent Order of the British Empire rewards 'contributions to the arts and sciences, work with charitable and welfare organisations, and public service outside the Civil Service' and is given in an honorary capacity to foreign nationals.

Professor Hairer works in the field of stochastic analysis. He is currently Regius Professor of Mathematics at the University of Warwick, having previously

held a position at the Courant Institute of Mathematical Science, New York University.

He is a leader in the field of stochastic partial differential equations in particular, and in stochastic analysis and stochastic dynamics in general. By bringing new ideas to the subject he has made fundamental advances in many important directions.

He has also received several other prestigious awards and honours. He was awarded the Fields Medal in 2014 and was elected a Fellow of the Royal Society in the same year. He



has been awarded both the LMS Whitehead (2008) and Fröhlich (2014) Prizes. He has also received the Philip Leverhulme Prize, Leverhulme Trust (2008) and Wolfson Research Merit Award, Royal Society (2009).

Professor Hairer also presented the LMS Popular Lectures during its 150th Anniversary year in 2015 and was one of nine prominent mathematicians interviewed for the LMS 150th Anniversary film *Thinking Space*. Short clips from the film are available at https:// www.lms.ac.uk/library/frames-of-mind.

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- 30 June: Graduate Student Meeting, London
- 30 June: Society Meeting, London
- 10 November: Graduate Student Meeting, London
- 10 November: Annual General Meeting, London
- 11 December: SW & South Wales Regional Meeting, Cardiff



http://newsletter.lms.ac.uk

LMS NEWSLETTER

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FERMAT PRIZE 2017

Call for Nominations

The Fermat Prize for Mathematics Research rewards the research work of one or more mathematicians, less than 45 years old, in fields where the contributions of Pierre de Fermat have been decisive:

- Statements of variational principles, or more generally partial differential equations.
- Foundations of probability and analytical geometry.
- Number theory.

The spirit of the prize is focused on rewarding the results of research accessible to the greatest number of professional mathematicians within these fields. The amount of the award is €20,000 granted every two years by the Région Occitanie Pyrénées-Méditerranée. For more information, and how to apply, visit the website www.math.univ-toulouse.fr/PrixFermat. Closing date for applications is 30 June 2017.

Previous laureates are: A. Bahri, K.A. Ribet (1989), J.-L. Colliot-Thélène (1991), J-M. Coron (1993), A.J. Wiles (1995), M. Talagrand (1997), F. Bethuel, F. Hélein (1999), R.L. Taylor, W. Werner (2001), L. Ambrosio (2003), P. Colmz, J-F. Le Gall (2005), C. Khare (2007), E. Lindenstrauss, C. Villani (2009), M. Bhargava, I. Rodnianski (2011), C. De Lellis, M. Hairer (2013), L. Saint-Raymond, P. Scholze (2015).

OSTROWSKI PRIZE 2017

Call for Nominations

The aim of the Ostrowski Foundation is to promote the mathematical sciences. Every second year it provides a prize for recent outstanding achievements in pure mathematics and in the foundations of numerical mathematics.

The jury invites nominations for candidates for the 2017 Ostrowski Prize. Nominations should be sent to the Chair of the jury for 2017, Gil Kalai, Hebrew University of Jerusalem, Israel (kalai@ math.huji.ac.il) by 15 May 2017.

WOLF PRIZE 2017

Charles Fefferman (Princeton University) and Richard Schoen (University of California, Irvine) have been named the winners of the 2017 Wolf Prize in Mathematics for 'their striking contributions to analysis and geometry'. The two will share the US\$100,000 prize.

Editorial team

http://newsletter.lms.ac.uk

Editorial office London Mathematical Society, De Morgan House, 57–58 Russell (a.mann@gre.ac.uk) Square, London WC1B 4HS (t: 020 7637 3686; f: 020 7323 3655)

Events calendar Updates and corrections to calendar@lms.ac.uk

Articles Send articles to newsletter@lms.ac.uk

Advertising

For rates and guidelines see newsletter.lms.ac.uk/rate-card **General Editor** Mr A.J.S. Mann

Reports Editor Professor I. A. Stewart (i.a.stewart@durham.ac.uk)

Reviews Editor Professor D. Singerman (d.singerman@soton.ac.uk)

Administrative Editor S.M. Oakes (newsletter@lms.ac.uk)

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Charity registration number: 252660.

ABEL PRIZE DIARY 2017

The Abel Prize was established on 1 January 2002. The purpose is to award the Abel Prize for outstanding scientific work in the field of mathematics. The prize amount is NOK 6 million (about \in 7675,000, £578.00) and was awarded for the first time on 3 June 2003.

Abel Prize announcement

21 March 2017 at 12:00

The Norwegian Academy of Science and Letters

The name of the 2017 Abel Laureate will be announced by Ole M. Sejersted, President of the Norwegian Academy of Science and Letters. The chair of the Abel committee John Rognes will then give the reasons for the awarding of the prize, followed by a popular science presentation of the prize winner's work by Terrence Tao. The announcement will as previous years be filmed and can be watched as a live webcast at the Abel prize website http://www.abelprize.no/.

Wreath-laying ceremony at the Abel Monument

22 May 2017 at 17:00 Royal Palace grounds, Oslo

The Abel Laureate will honour Niels Henrik Abel by laying a wreath at the Abel Monument. Kristian Ranestad, chair of the Abel board, will give a speech. Musical performances. The event is open to the public.

Dinner in honour of the Abel Laureate 22 May 2017 at 18:00

The Norwegian Academy of Science and Letters

The Norwegian Academy will host a dinner in honour of the Abel Laureate. Among the invited guests will be members of the Abel committee and the Abel board, members of the Academy's mathematics group and visiting mathematicians from many countries. By invitation only.

Abel Prize Award Ceremony

23 May 2017 at 14:00 University Aula, Oslo, Norway

The Abel Laureate will receive the Abel Prize at an award ceremony in the University Aula in Oslo, Norway. The ceremony will be followed by a reception and an interview with the Abel Laureate in front of a live audience at a nearby theatre, Det Norske Teatret.

The Abel Banquet

23 May 2017 at 19:00 Akershus Castle, Oslo

The Norwegian government hosts a banquet in honour of the Abel Laureate at Akershus Castle. By invitation only.

The Abel Lectures 2017

24 May 2017 at 10:00 Georg Sverdrups Hus, University of Oslo

The Abel Laureate will give their prize lecture at the University of Oslo followed by two Abel Lectures, usually on topics related to the prize winner's work. For some years now a popular science lecture has also been part of the program.

ICIAM PRIZES 2019

Call for Nominations

ICIAM (International Council for Industrial and Applied Mathematics) is the world organisation for applied and industrial mathematics. The ICIAM Prize Committee for 2019 calls for nominations for the five ICIAM Prizes to be awarded in 2019 (the Collatz Prize, the Lagrange Prize, the Maxwell Prize, the Pioneer Prize and the Su Buchin Prize).

The deadline for nominations is **15 July 2017**. Nominations should be made electronically through the website https://iciam prizes.org/.

The Leverhulme Trust

2017 PHILIP LEVERHULME PRIZES IN MATHEMATICS AND STATISTICS

Philip Leverhulme Prizes recognise the achievement of outstanding researchers whose work has already won international recognition and whose future is exceptionally promising. In 2017 there are thirty prizes available across six broad subject areas, with up to five prizes offered for researchers in Mathematics and Statistics.

Prizes offer £100,000 over two or three years and may be used for any purpose that advances the prize-winner's research, with the following exceptions: salary costs for the prize-winner, capital costs, and institutional overheads.

To be eligible, applicants must hold a post in a UK university or research institution and must have received their highest degree no earlier than 16 May 2007 (exceptions will be considered where applicants have had a distinct career break).

Applicants must be nominated by their head of department (or equivalent). Applicants may be nominated in one subject area only. Full details of the nomination process are available on the Leverhulme Trust website.

Closing date: 4pm on 16 May 2017

The prizes commemorate the contribution to the work of the Trust made by Philip Leverhulme, the Third Viscount Leverhulme and grandson of the William Hesketh Lever, the founder of the Trust.

For further details please visit the Trust's website: www.leverhulme.ac.uk/funding

For more information call 020 7042 9862 or email grants@leverhulme.ac.uk





To register please contact Katy Henderson on womeninmaths@lms.ac.uk by Friday 28 April The reception will be followed by dinner at a local restaurant tbc, at a cost of £35 per person

1865 - 2017



BMC 2017: 3–7 April 2017 including LMS Society Meeting Monday 3 April Durham

3:45 pm LMS Society Meeting

Plenary Lecture: Isabelle Gallagher (Université Paris-Diderot, IMJ-PRG)

This Society Meeting is part of the British Mathematical Colloquium 2017. The full conference will also include a public lecture by **Noam Elkes** (Harvard), and plenaries given by **Eva Bayer-Fluckiger** (ÉPFL), **Kenji Fukaya** (Kyoto University/Simons Center), **Laurent Lafforgue** (IHÉS), **Jacob Lurie** (Harvard University) and **George Lusztig** (MIT).

MORNING SPEAKERS

Alessandra Bernardi, Gérard Besson, Tara Brendle, Jan Bruinier, Olivia Caramello, Alexander Grigor'yan, Fanny Kassel, Ari Laptev, Diane Maclagan, Oscar Randal-Williams, James Robinson.

Workshops (Tue & Wed afternoon)

Algebra, organiser: Emilie Dufresne Analysis, organisers: Norbert Peyerimhoff, Ari Laptev Geometry, organiser: John Parker Number Theory, organiser: Jens Funke Topology, organiser: Dirk Schuetz

The plenary and morning talks will take place in the Calman Learning Centre (CLC) on the Science Site. The tea/coffee and lunches will be served in the Earth Sciences (ES) building, adjacent to the CLC. Rooms E101 and E102 are in the Engineering building and CM101 is in the Maths building.

The **cost of registration** is \pm 50 (early bird until 28 February 2017; \pm 80 thereafter). The registration fee for postgraduate students is \pm 50. The conference dinner is \pm 50.

The accommodation is in Collingwood College, which is a 10 minute walk from the Science Site, where the conference will take place.

For further information and to register: http://www.maths.dur.ac.uk/bmc2017/index.xhtml Early bird registration is now open. 8

LMS NEWSLETTER

THE VERBLUNSKY MEMBERS' ROOM

LMS members are warmly invited to visit De Morgan House in Russell Square, London and make use of the LMS Members' Room, or Verblunsky Room. Named after Samuel Verblunsky, a generous benefactor and long standing LMS member (1929-1996), the LMS Members' Room offers a quiet and comfortable space to work and relax in the midst of the London hubbub.

With free wi-fi, networked computers and complimentary tea and coffee in the nearby kitchen,

members are welcome to use the room during office hours; Monday to Friday, 9-5. An appointment is not required, just ring the buzzer at the main entrance; No. 58 Russell Square. Directions to De Morgan House can be found here: http://demorganhouse.org.uk/content/ our-location.

The Verblunsky Members' Room also houses two special collections; the Hardy Collection and the Philippa Fawcett Collection. The Hardy Collection, named after the Society's former President, contains over 300 volumes from G.H. Hardy's personal library of books, which were used by him at various points throughout his career. As such, one can get a glimpse of the authors who influenced his thinking or caught his attention. Many of these volumes contain Hardy's signature and in some cases they also contain a dedication.



For further information about the Hardy Collection, go to https://www.lms.ac.uk/library/special-collections#hardy.

The Philippa Fawcett Collection, named after the first woman to come top in the finals examination at Cambridge and an early member of the LMS, is a wide-ranging library of books written by and about women who studied or worked in mathematical subjects in the nineteenth and first part of the twentieth century. or earlier. The Collection was donated to the London Mathematical Society by one of its members, Dr A.E.L. Davis. It is hoped that the books will be a useful resource to scholars of the history of women in mathematics as well as an inspiration to female mathematicians of the future. For further details visit the website at: https://www.lms.ac.uk/library/specialcollections#fawcett.



Armada chess set



Fawcett and Hardy Special Collections

newsletter@lms.ac.uk

Other treasures on display include a porcelain tea set gifted by the Moscow Mathematical Society, an Armada chess set, a collection of 90th birthday messages presented to Sir Christopher Zeeman and a facsimile of the LMS Members' Book from 1865-1990. If you have not yet signed the original Members' Book, you can do so at one of our Society Meetings (www.lms.ac.uk/events/society-meetings). Don't forget to look out for the Society's Royal Charter, Royal Society Athena Medal and gifts from other Societies on display in the reception area of De Morgan House. De Morgan House itself is situated on Russell Square within the creative heart of Bloomsbury and a short walk from the West End. With University College London (UCL) only a 10 minute walk away, members can also take advantage of their complimentary use of the LMS Library that is housed at UCL. For details on how to register/renew as a UCL Library user, please visit: https://www.lms.ac.uk/library/how-register.

We look forward to welcoming you at De Morgan House soon and are happy to answer any queries in the meantime: membership@lms. ac.uk.

ANNUAL ELECTIONS TO LMS COUNCIL

The Nominating Committee is responsible for proposing slates of candidates for vacancies on Council and vacancies on its own membership. The Nominating Committee actively welcomes suggestions from the membership.

Anyone who wishes to suggest someone for a position as an Officer of the Society or as a Member-at-Large of Council (now or in the future) is invited to send their suggestions to Professor John Toland, the current Chair of Nominating Committee (nominations@lms. ac.uk). Please provide the name and institution (if applicable) of the suggested nominee, his/her mathematical specialism(s), and a brief statement to explain what s/he could bring to Council/Nominating Committee.

Nominating Committee seeks to maintain a balance in gender, subject area and geographical location when drawing up its list of prospective nominees, and LMS members should bear in mind that it is to the benefit of the Society that Council is balanced and represents the full breadth of the mathematics community. Further details about the work of the Nominating Committee are on the LMS website at www.lms.ac.uk/about/nomi nating-committee.

Nominations should be received by **Friday 28 April 2017** in order to be considered by the Nominating Committee.

In addition to the above there exists the

option for members to make direct nominations for election to Council or to the Nominating Committee. Direct nominations must be sent to the Executive Secretary's office (nominations@lms.ac.uk) to arrive before noon on 1 September 2017. Nominations can be submitted in hard copy or via email. All nominations must bear the signatures of the nominator and three seconders and of the nominee. For hard copy, a letter with the relevant names and signatures is sufficient or submissions can be made via a form available from the LMS website at http:// tinyurl.com/q28lrvp. For email submissions nominations and statements from seconders. must be sent from a verifiable email address to nominations@lms.ac.uk. Members considering making a direct nomination are asked to bear in mind the desirability of Council being balanced with regard to the full range of mathematical specialisms, UK regions and aender.

The slate proposed by Nominating Committee, together with other direct nominations received up to that time will be posted on the LMS website in early August for members to see before deciding whether they wish to make any further direct nominations.

Further nominations will be posted onto the website as they are received.



LMS INVITED LECTURER 2017 Professor Jim Agler (UCSD)

Function Theory by Hilbert Space Methods

18-22 April 2017, Herschel Building, Newcastle University

Our topic will be a powerful machinery that has been developed in the last 60 years both to discover and to prove theorems about analytic functions in one and several complex variables through the construction of operators on Hilbert space.

The lectures will begin with expositions of the elementary operator theory that is required to achieve interesting results in function theory.

Next we will show how a number of classical results in the theory of analytic functions in one variable, when cast in a Hilbert space setting, can be proved by operator-theoretic methods which are largely algebraic in nature. These results will include the Herglotz Representation Theorem, the Carathéodory and Pick Interpolation Theorems, Nevanlinna's Representation Theorems, the Carathéodory-Julia Theorems, and Loewner's Theorem.

The remainder of the talks will focus on how the operator-theoretic proofs of these one- variable theorems can be generalized to yield a variety of new results in several complex variables.

Guest Lectures

There will also be supplementary lectures by:

Professor John McCarthy (Washington University in St. Louis, USA) Research interests: Analysis, especially Operator Theory and one/several Complex Variables Associate Professor Greg Knese (Washington University in St. Louis, USA) Research interests: Complex Function Theory, Operators, Harmonic Analysis Assistant Professor Kelly Bickel (Bucknell University, Lewisburg, PA, USA)

Research interests: Multivariate Operator Theory, Several Complex Variables, Harmonic Analysis

Accommodation, Travel Funding and Registration

Accommodation will be provided at the Osborne Hotel.

Limited financial support is available with preference given to UK research students. Please contact the organiser for further details: Zinaida Lykova zinaida.lykova@newcastle.ac.uk. **Deadline for funding:** I April 2017.

For further details and how to register for the 2017 Invited Lectures please visit: http://www.mas.ncl.ac.uk/~nek29/Imslectures2017/function_theory.html

University of Kent



ORTHOGONAL POLYNOMIALS & SPECIAL FUNCTIONS

LMS Research School

University of Kent, Canterbury, UK; 26-30 June 2017

Organisers: Peter Clarkson (Kent) and Ana Loureiro (Kent)

Course outline

Modern developments in theoretical and applied science depend on knowledge of the properties of various mathematical functions, from elementary trigonometric to the multitude of orthogonal polynomials and special functions. These lectures cover various aspects of orthogonal polynomials and special functions of current interest and undergoing rapid development.

The three main lecture course topics are:

- Properties of Orthogonal Polynomials, Kerstin Jordaan (University of Pretoria, South Africa)
- Discrete Painlevé Equations, Nalini Joshi (University of Sydney, Australia)
- Multiple Orthogonal Polynomials, Walter Van Assche (KU Leuven, Belgium)

These lecture courses will be supplemented by tutorial sessions.

Guest lectures

- Adri Olde Daalhuis (University of Edinburgh, UK)
- Andrei Martinez-Finkelstein (University of Almería, Spain)

Apply online; see details below. Research students, post-docs and those working in industry are invited to apply. All applicants will be contacted within three weeks after the deadline; information about individual applications will not be available before then*

Fees

Research students: £150 (no charge for subsistence costs). Early career researchers: £250 (no charge for subsistence costs).

Other participants: £250 (plus subsistence costs).

Research students who will not have not completed their PhDs by the start of the Research School and who would otherwise be unable to attend can apply for financial aid.

Fees are not payable until a place at the Research School is offered but will be due by 26 May 2017.

Further information: https://blogs.kent.ac.uk/opsf-summerschool

Apply online at www.surveymonkey.co.uk/r/RS31OrthogonalPolynomialsApplicationForm by 31 March 2017

MATHEMATICS POLICY ROUND-UP

March 2017

RESEARCH

Investment in science, research and innovation

Business and Energy Secretary Greg Clark has announced that the government is backing 125 cutting-edge research and development projects across the country.

Through Innovate UK, the UK's innovation agency, the government is supporting a widerange of cutting edge innovations and businesses with the awarding of ± 15 million in grants to business-led, commercial ideas for research and development projects.

The Industrial Strategy Green paper is available at http://tinyurl.com/jv64b5b.

Science Minister Jo Johnson has also announced that Professor Sir Mark Walport will be appointed as Chief Executive Designate of UK Research and Innovation (UKRI), leading on the establishment of UKRI and ensuring it 'plays a central role at the heart of the Industrial Strategy'. More information is available at http://tinyurl.com/ jzf4n9v.

HIGHER EDUCATION

Review recommends changes to higher education sector agencies

Universities UK has published recommendations of its review looking at the higher education sector agencies.

A review group was established by Universities UK in February 2016 to consider the effectiveness and the responsibilities of the current sector agencies that support higher education institutions.

The review considered the following higher education agencies:

- Equality Challenge Unit (ECU)
- Higher Education Academy (HEA)
- Higher Education Careers Services Unit (HECSU)
- Higher Education Statistics Agency (HESA)
- Jisc
- Leadership Foundation for Higher Education
 (LFHE)

- Office for the Independent Adjudicator for Higher Education (OIAHE)
- Quality Assurance Agency (QAA)
- Universities and Colleges Admissions Service (UCAS)
- Universities and Colleges Employers Association (UCEA)

There are a number of recommendations in the report including seeing the number of core agencies taking subscriptions from institutions (particularly in England) reduced from nine to six over the next two years. Most significantly, a new body is proposed that will bring together the functions of the Equality Challenge Unit (ECU), the Higher Education Academy (HEA) and the Leadership Foundation for Higher Education (LFHE).

The core functions of the Equality Challenge Unit (ECU), the Higher Education Academy (HEA) and the Leadership Foundation for Higher Education (LFHE) should be merged into a single body to create a new, more responsive agency supporting institutions in relation to equality and diversity, learning and teaching, and leadership and governance A transition group should be established to help coordinate the delivery of the proposed merged body. The report is available at http://tinyurl.com/h2snlxs.

OTHER

CaSE concern for UK science

The Campaign for Science and Engineering (CaSE) has written to the Prime Minister to highlight the longstanding and mutually beneficial partnership between the UK and US scientific communities and warn that those ties may be eroded by the President's executive order on immigration and a wider restrictive approach to migration, both in the UK and US, to the detriment of the UK's scientific strength. The letter is available at http://tinyurl.com/jfw4e6t.

Dr John Johnston Joint Promotion of Mathematics

SIMON DONALDSON AWARDED DOCTOR HONORIS CAUSA

Sir Simon Kirwan Donaldson FRS, Professor in Pure Mathematics at Imperial College London (UK), and permanent member of the Simons Center for Geometry and Physics at Stony Brook University (US), has received the honorary degree Doctor Honoris Causa by Universidad Complutense de Madrid (Spain) on 20 January 2017.

Professor Donaldson is a Fellow of the Royal Society and a member of the LMS. He obtained the Whitehead Prize and the Pólya Prize from the London Mathematical Society, and the Royal Medal of the Royal Society. He has also received the Fields Medal, the Crafoord Prize, the Shaw Prize and the Breakthrough Prize.

The ceremony was presided by His Excellency the Rector, Carlos Andradas, who is also a Professor in Algebra at Universidad Complutense de Madrid. Vicente Muńoz, former PhD student of Simon Donaldson at Oxford University, and now Professor in Geometry and Topology at UCM, was in charge of reading the Laudatio, reviewing the mathematical achievements of Professor Donaldson. It was followed by a speech from the laureate in which he delved into the connections between Geometry, Algebra, and Space. Finally, the Rector gave the new doctor honoris causa several symbols of the magisterium and finished



Simon Donaldson (left) and Carlos Andradas (right) during the ceremony

with a speech in which he praised the high scientific merits of Professor Donaldson.

The ceremony took place in the Faculty of Mathematics of UCM. This was the first time that such an event has been hosted in this relatively new building. This allowed for a large affluence of undergraduate and postgraduate students, and served to commemorate the 25th anniversary of the Faculty building. The ceremony can be viewed at www.youtube.com/ watch?v=xoC53Smg-WI. A report (in Spanish) can be found in tribuna.ucm.es/43/art2605.php.

Vicente Muñoz Universidad Complutense de Madrid

EUROPEAN NEWS

Oberwolfach Library and Elsevier

The Mathematisches Forschungsinstitut Oberwolfach Library cancelled all subscriptions to online journals provided by Elsevier Publishing. From January 2017, the current issues of all Elsevier journals will no longer be accessible online.

The cancellation came about during negotiations with Elsevier which were being conducted by the DEAL project group. The DEAL Project represents more than 100 negotiation mandates by German universities and research institutions. In close consultation with the DEAL project group, some 60 German academic and research institutions decided against prolonging their individual contracts with Elsevier after 2016. For background details see www.mfo.de.

> David Chillingworth LMS/EMS Correspondent

THE IMPACT OF HUMAN INTERACTIONS IN MATHEMATICS

The current consultation on the REF (Research Excellence Framework), and EPSRC's forthcoming *Review of Knowledge Exchange in the Mathematical Sciences*, have once again got the UK mathematics community thinking about impact.

The impact of mathematics in every walk of life is astounding. Deloitte estimate that 10% of all UK jobs and 16% of total UK GDP is a direct result of mathematics - and EPSRCs analysis of the 2014 REF shows the unique breadth of that impact. Yet mathematics scores less well than other sciences on standard measures of knowledge exchange, such as patents and contract research, a concern to administrators in an increasingly metrics-conscious world. Mathematicians have long argued that the impact of mathematics is long term, hard to predict, and often happens via interdisciplinary work, and that artfully constructed case studies may earn high REF scores, but miss the bigger picture. Some have gone further, arguing vehemently against the very concept of "impact", and pointing out that the biggest impact of all, ignored by the REF, comes through effective education of students.

A recent paper by Laura Meagher, a senior research evaluator, and me, a computer scientist (and formerly a pro-vice chancellor, REF/RAE panel member and a member of LMS Council), used the qualitative methods of social policy researchers, and the trove of material provided by the 2014 REF, to dig into 209 published REF case studies of the impact of UK mathematics and statistics and 52 REF impact templates, complementing this with surveys, focus groups and in-depth interviews. We considered two basic questions – what kinds of impact does mathematics have, and how does that impact come about.

We drew on a categorisation of impacts originally developed for the human

sciences which includes, alongside direct "instrumental impacts" of a particular piece of work in a particular application, the "conceptual impacts" that can reshape a whole field, "capacity building" impacts through education and training, "attitude or cultural change" and the "enduring connectivity " of long term relationships with research users. While interviewees often felt that the RFF drove them towards the "instrumental" impacts, which indeed dominated the case studies, our research showed that the broader categorisation was a good fit to mathematics, and indeed such broader themes were represented in the REF auidelines of some other disciplines.

Turning to mechanisms for impact, we identified the importance of mathematics focussed "knowledge intermediaries", who build bridges between the academic mathematics community and users of research. Examples include the Industrial Mathematics KTN, the long running OCIAM study groups with industry, and individual mathematicians with the experience and human skills to nurture and develop trusted long term relationships with external users of research, so that the right academic colleagues can be brought in guickly when an opportunity arises. Our study confirms the importance of such long term informal relationships, often via another discipline, as vectors for impact. Indeed, reading across the case studies emphasises that they are windows onto a complex ecosystem of research and research users: the more complex the system, the easier it is likely to be to extract linear narratives, but the less representative of the true picture such narratives will be.

Our work reinforces the crucial role of universities in developing a culture supportive of research and the generation of impacts which reinforces the distinctive but all-pervasive nature of mathematics, and we hope

newsletter@lms.ac.uk

we have contributed to a robust evidence base for Government, universities and the mathematics community to ensure that the distinctive nature of mathematics is recognised in allocating support, ensuring that any future REF addresses mathematics impact effectively. Finding new ways to tell the stories of impact has the potential to open up the richness and power of mathematics in new ways for practitioners and the wider community.

Professor Ursula Martin, CBE University of Oxford Ursula.Martin@cs.ox.ac.uk

Slightly dirty maths: The richly textured mechanisms of impact, Laura R Meagher and Ursula Martin Research Evaluation (2017). Published online ahead of print, 18 January 2017: http://bit.ly/2krMiYm

PROMYS EUROPE

The PROMYS (Program in Mathematics for Young Scientists) summer school for high school students was set up by Glenn Stevens in Boston, USA, in 1989. It has been the starting point for many a stellar career in mathematics. A mirror programme, PROMYS Europe, was launched in Oxford in 2015, as a partnership between PROMYS, the Mathematical Institute, Wadham College, and the Clay Mathematics Institute, with support from Oxford alumni. It ran verv successfully for the second time last summer: 24 students and seven counsellors from some 15 countries spent six weeks tackling challenging number theory problems, formulating and proving their own conjectures, and really getting a taste for what it is to work as a mathematician.

This July pre-university students from across Europe will once again arrive in Oxford to participate in PROMYS Europe. First-year students will focus primarily on a series of very challenging problem sets, daily lectures, and exploration projects in number theory. There will also be a programme of talks by guest mathematicians and PROMYS Europe counsellors, on a wide range of mathematical subjects, as well as courses aimed primarily at students who are returning to PROMYS Europe for a second or third time. Participants will find a richly stimulating and supportive community of fellow first-year students, returning students, undergraduate counsellors, research mentors, faculty, and visiting mathematicians.

Selection is highly competitive, but is needsblind, with costs covered for those who would otherwise be unable to attend. For further details visit the website at http://pro mys-europe.org.



PROMYS Europe 2016 participants





Algebraic Topology of Manifolds LMS-CMI Research School

Oxford 11 – 15 September 2017

Organiser: Ulrike Tillmann (Oxford)

Manifolds are at the centre of much of geometry and topology, and through the influence of axiomatic topological quantum field theory they have become an important organising force in category and representation theory.

Classically, in the 1960s, algebraic topology was at the heart of their classification theory in form of characteristic classes and numbers, cobordism theory, surgery theory, and later Waldhausen's K-theory of manifolds. We are now experiencing a renaissance of the field as well as a paradigm shift where manifolds not only are the objects of study but become the tools.

The school aims at inspiring the next generation with this exciting success story of interwoven ideas bouncing between different fields, and giving the participants the tools to contribute to this lively research area.

Lecture Courses

Dan Freed (Austin, USA) Topological Quantum Field Theory

Oscar Randall-Williams (Cambridge, UK)

Characteristic classes & moduli spaces of manifolds

Greg Arone (Virginia, USA)

The Goodwillie–Weiss embedding calculus

Nathalie Wahl (Copenhagen, Denmark)

Homological stability

These lecture courses will be supplemented by tutorial sessions. In addition there will be guest lectures.

For further information, please visit: https://people.maths.ox.ac.uk/tillmann/ATM-SCHOOL.html

Apply online (www.surveymonkey.co.uk/r/RS33-ATManifoldsApplicationForm) by **16 June 2017**. Research students, post-docs and those working in industry are invited to apply. *All applicants will be contacted within three weeks after the deadline; information about individual applications will not be available before then*

Fees

Research students: £150. There will be no charge for subsistence costs. Early career researchers: £250. There will be no charge for subsistence costs. Other participants: £250 plus subsistence costs.

Research students who will not have completed their PhDs by the start of the Research School and who would otherwise be unable to attend can apply for financial aid to cover their travel costs. Fees are not payable until a place at the Research School is offered but will be due by 21 July 2017.





Introduction to Geometry, Dynamics, and Moduli in Low Dimensions LMS-CMI Research School

Warwick 11 – 15 September 2017

Organisers: J. Aramayona (Madrid), S. Schleimer (Warwick), J. Smillie (Warwick)

Course outline

The Research School will offer a broad introduction to low-dimensional geometry, topology, and dynamics. Experts in the field will each deliver a mini-course devoted to a particular sub-area. The mini-courses will be accompanied by problem sessions, supervised by tutors. The School is the opening event of the EPSRC-Warwick Symposium "Geometry, dynamics, and moduli in low dimensions" to be held at Warwick during the academic year 2017-18. Participants of the School are also invited to apply to the other workshops of the symposium.

Lecture Courses

Yael Algom-Kfir (Haifa) Free groups as fundamental groups of graphs Tara Brendle (Glasgow) Description of Teichmüller space in terms of hyperbolic geometry Nathan Dunfield (UIUC) Methods for computation of geometric structures and invariants Erwann Lanneau (Grenoble) Teichmüller dynamics

Julien Marché (Paris VI) Geometric structures viewed in terms of representations

These lecture courses will be supplemented by tutorial sessions.

For further information, please visit: www2.warwick.ac.uk/fac/sci/maths/research/events/2017-18/ symposium/igdm/

Apply online (https://tinyurl.com/gwgv8lr) by 16 June 2017. Research students, post-docs and those working in industry are invited to apply. A reference is also required: https://tinyurl.com/ jcmgffk

All applicants will be contacted within three weeks after the deadline; information about individual applications will not be available before then.

Fees

Research students: £150. There will be no charge for accommodation and subsistence costs.

Early career researchers: £250. There will be no charge for accommodation and subsistence costs. Other participants (e.g. those working in industry): £250

Research students who have not completed their PhDs by the start of the Research School and who would otherwise be unable to attend can apply for financial aid.

Fees are not payable until a place at the Research School is offered but will be due by 11 August 2017.

SUBLIME SYMMETRY: THE MATHEMATICS BEHIND DE MORGAN'S CERAMIC DESIGNS

Report

On 13 January 2017, mathematicians and art historians joined together at De Morgan House, headquarters of the London Mathematical Society, to listen to talks at the symposium Sublime Symmetry: The Mathematics behind De Morgan's Ceramic Designs.

Of course, Augustus De Morgan, first President of the LMS is extremely well known. His work on logic, algebra and ultimately De Morgan's laws have been a great influence on modern mathematics. He is also well known for popularising mathematics in the Victorian period, through his extensive writing and publishing in the Athenaeum Magazine and in the Penny Cyclopaedia.

Perhaps less commonly known to mathematicians today is the work of De Morgan's son William, perhaps the most inventive and exciting ceramic designer of the Victorian period. William began creating ceramics shortly after his introduction to the great Arts and Crafts protagonist William Morris, with whom he had a life-long friendship. Many contemporaries of the De Morgan's, and scholars since, have commented on the similarities between Augustus and his son William. They had a very similar wit and imagination, both using satire in notes and letters to illustrate their ideas and both covering their letters in doodles and drawings of fantasy creatures.

Being raised by one of the most prominent mathematicians of the time clearly had an influence on William; he once commented that Euclid Book I was the 'most entrancing novel in literature'. Whilst a student at University College, where his father was Professor of Mathematics, William would have studied geometry and algebra and clearly had a real interest in the subject.

William De Morgan's designs are exquisite. He borrows patterns and motifs from sources as diverse as Medieval and Islamic design, but



June Barrow-Green's talk on Augustus De Morgan It is easier to square the circle than to get around a mathematician (June expressed her thanks to Adrian Rice for his contributions to her talk)

newsletter@lms.ac.uk

within them he employs a clear geometric structure that affords them a clarity and beauty. Sublime Symmetry is a touring exhibition organised by the De Morgan Foundation which explores William De Morgan's use of mathematical devices in his work. The symposium was held to celebrate the success of this touring exhibition, which has attracted 50,000 visitors to date. The LMS and the De Morgan Foundation welcomed contributors to present their research into the connections between mathematics and art.

Speakers on the day covered topics of the De

Morgan Foundation's collection of ceramics and paintings, William De Morgan's place in the Victorian Art World and interest at the time in the idea of Divine Numbers, Augustus De Morgan and mathematics in the Victorian period, using art to teach mathematics and the problems presented by the study of symmetry.

The day was a huge success and we are very grateful to all who came. Notes from the event can be downloaded here: www.demorgan. org.uk/sublime-symmetrytouring-exhibition

> Sarah Hardy Exhibition Curator, Sublime Symmetry

NINTH YOUNG THEORISTS' FORUM CONFERENCE Report

The Ninth Young Theorists' Forum (YTF) conference took place at Durham University from 11 to 12 January 2017. YTF is an annual conference organised by a collaboration of PhD students from the Centre for Particle Theory, which has members in the departments of Physics and Mathematical Sciences at Durham University. The purpose of the conference is to bring together post-graduate students working in theoretical physics, providing them with the opportunity to present their work to a friendly audience.

With 72 registered attendees this was a vibrant event – succeeding in its aim of fostering development of early career researchers and encouraging collaboration between different universities. The conference had two parallel streams of talks: one phenomenological, and one more mathematically formal. The topics of the phenomenology sessions were:

- Beyond the Standard Model (BSM) Theory and Lattice
- Neutrinos
- BSM Phenomenology
- Dark Matter

The topics of the more mathematical talks were:

- String Theory
- Holography
- · Gravity and Gauge Theories
- Gravity and Cosmology

Overall, 29 PhD students had the opportunity to present a 20 minute talk on their research, with each talk being followed by a brief discussion session. Attendees also had a chance to present their research at a pizza and poster session, taking place at the end of the first day.

The plenary talk was given by Dr Donal O'Connell of the University of Edinburgh. Entitled *Physics in 2017: Something's funny*? the talk focused primarily on the double copy for calculating gravity amplitudes from Yang Mills amplitudes.

The conference was supported by an LMS Postgraduate Research Conference grant (Scheme 8), the Institute of Physics, the Scottish Universities Physics Alliance, the Durham Centre for Academic, Researcher and Organisation Development, the Durham University Centre for Particle Theory and the Durham University Institute for Particle Physics Phenomenology.

Maciej Matuszewski, PhD student Dept of Mathematical Sciences Durham University

No. 467 March 2017





Microlocal Analysis and Applications LMS-CMI Research School Cardiff 26 – 30 June 2017

Organisers: S. Eswarathasan (Cardiff), C. Guillarmou (ENS, Paris), R. Schubert (Bristol)

Microlocal analysis is a study of partial differential equations through the lens of symplectic geometry and Fourier analysis. The field has a wide range of applications towards, and not limited to, spectral theory, scattering theory, inverse problems, and dynamical systems. The purpose of this school is to introduce graduate students and young researchers to both its foundations and recent applications.

Lecture Courses

Alexander Strohmaier (University of Leeds) and Jared Wunsch (Northwestern University) Basic ideas in Microlocal Analysis

Stéphane Nonnenmacher (Université Paris-Sud, 11) and **Andrew Hassell** (Australian National University)

Scattering Theory and Spectral Theory

Viviane Baladi (Institut de Mathématiques de Jussieu) and Colin Guillarmou (CNRS, Université Paris-Sud, 11)

Pollicott-Ruelle Resonances, Mixing in Dynamical Systems, and X-Ray Transform

These lecture courses will be supplemented by tutorial sessions.

Distinguished Speakers

Maciej Zworski (Spectral Theory, University of California, Berkeley) Gunther Uhlmann (Inverse Problems, University of Washington, Seattle) Mark Pollicott (Dynamical Systems, University of Warwick)

Click here for further information: https://sureshes.wordpress.com/lms-cmi-research-school/

Apply by 31 March 2017: https://www.surveymonkey.co.uk/r/RS-32-MicrolocalAnalysis. A reference will also be required so your referee should complete this form: https://www.surveymonkey.co.uk/r/RS-32RefereeForm.

All applicants will be contacted within three weeks after the deadline; information about individual applications will not be available before then.

Fees

Research students: £150. There will be no charge for subsistence costs.

Early career researchers: £250. There will be no charge for subsistence costs.

Other participants (e.g. those working in industry): £250 plus subsistence costs.

Research students who will not have completed their PhDs by the start of the Research School (who would otherwise be unable to attend under the title of "research student") can apply for financial aid.

Fees are not payable until a place at the Research School is offered but will be due by 26 May 2017.





New Trends in Representation Theory -The Impact of Cluster Theory in Representation Theory

LMS-CMI Research School University of Leicester 19 – 23 June 2017

Organisers: Karin Baur (U Graz) and Sibylle Schroll (Leicester)

The focus of the course is on recent advances that have emerged in representation theory through cluster theory: n-representation theory, integrable systems and friezes, and silting and infinite dimensional representations. These areas of mathematics are enriched by their interactions with other areas of mathematics such as category theory, dynamical systems and mathematical physics.

Lecture Courses

Peter Jorgensen (Newcastle) *n*-representation theory

Sophie Morier-Genoud (Paris) Integrable systems and friezes

Lidia Angeleri-Hügel (Verona) Infinite dimensional representations

These lecture courses will be supplemented by tutorial sessions.

Guest lectures: M. Herschend (Uppsala), P-G. Plamondon (Orsay) and M. Prest (Manchester) For further information, please visit: https://sites.google.com/site/clustertheoryinreptheory/

Apply by 24 March 2017: www.surveymonkey.co.uk/r/RS-28-NewTrendsInRepresentationTheory. A reference will also be required so your referee should complete this form: https://www.surveymonkey.co.uk/r/RS-28RefereeForm. Research students, post-docs and those working in industry are invited to apply.

All applicants will be contacted within three weeks after the deadline; information about individual applications will not be available before then.

Fees

Research students: £150. There will be no charge for subsistence costs.

Early career researchers: £250. There will be no charge for subsistence costs.

Other participants (e.g. those working in industry): £250 plus subsistence costs.

Research students who have not completed their PhDs by the start of the Research School and who would otherwise be unable to attend can apply for financial aid.

Fees are not payable until a place at the Research School is offered but will be due by 19 May 2017.

Heilbronn Institute for Mathematical Research



VISIT OF DAVIDE CATANIA

Dr Davide Catania will be visiting the Department of Mathematics, Surrey University from 22 April to 3 May 2017. Dr Catania is a member of the Research Group of Mathematical Analysis of the University of Brescia. His recent research activity concerns partial differential equations of fluid dynamics or magnetohydrodynamics (MHD), that model physical or engineering problems. During his visit Dr Catania will give lectures at:

- University of Sussex, 24 April (contact Gabriel Koch: G.Koch@sussex.ac.uk)
- University of Oxford, 27 April (contact Angkana Ruland: ruland@maths.ox.ac.uk)
- University of Surrey, 2 May (contact Michele Bartuccelli)
 For further details contact Michele Bartuc-

celli (m.bartuccelli@surrey.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISIT OF KENNETH DAVIDSON

Professor Kenneth Davidson (Waterloo University) will be visiting the UK between 25 April and 7 May 2017. His areas of research include operator theory and C*-algebras. During his visit Professor Davidson will lecture on:

- 27 April, Lancaster University, Department of Mathematics and Statistics (contact Steve Power: s.power@lancaster.ac.uk)
- 2 May, Newcastle University, School of Mathematics and Statistics (contact Evgenios Kakariadis: evgenios.kakariadis@ncl.ac.uk)
- 5 May, Queen's University Belfast, Pure Mathematics Research Centre (contact Ivan Todorov: i.todorov@qub. ac.uk)

For further details contact Evgenios Kakariadis (evgenios.kakariadis@ncl.ac.uk). The visit is supported by an LMS Scheme 2 grant.





CECIL KING TRAVEL SCHOLARSHIP

The London Mathematical Society annually awards a £5,000 Cecil King Travel Scholarship in Mathematics, to a young mathematician of outstanding promise. The Scholarship is awarded to support a period of study or research abroad, typically for a period of three months. Study or research in all areas of mathematics is eligible for the award.

The award is competitive and based on a written proposal describing the intended programme of study or research abroad, and the benefits to be gained from such a visit. A shortlist of applicants will be selected for an interview during which they will be expected to make a short presentation on their proposal.

Applicants must be nationals of the UK or the Republic of Ireland, either registered for or having completed a doctoral degree within 12 months of the closing date.

Applications should be made using the form available on the Society's website (https://www.lms.ac.uk/prizes/cecil-king-travel-scholarship) or by contacting education@lms.ac.uk. The closing date for applications is **Friday 31 March 2017**. It is expected that interviews will take place in London in late May or early June.

The Cecil King Travel Scholarship was established in 2001 by the Cecil King Memorial Fund. The award is made by the Council of the London Mathematical Society on the recommendation of the Cecil King Prize Committee, nominated by the Society's Research Meetings Committee.

The London Mathematical Society is a registered charity for the promotion of mathematical knowledge.

MATHEMATICAL PHYSICS DAY

The 49th North British Mathematical Physics Seminar (NBMPS) one-day meeting will take place at the ICMS, Edinburgh on Wednesday 8 March 2017 from 11 am. Speakers include:

- Vasilis Niarchos (Durham)
- Lucia Rotheray (Glasgow)
- Panagiota-Maria Adimopoulou (Heriot-Watt)
- Severin Bunk (Heriot-Watt)

The meeting is open to all. Full details are available at www.macs.hw.ac.uk/~anatolyk/ NBMPS49.html.

Three NBMPS meetings are held each year, supported by an LMS Joint Research Groups in the UK Scheme 3 grant, bringing together Mathematical Physics groups from Durham, Edinburgh, Glasgow, Heriot-Watt, Newcastle, Nottingham and York. Further details about the NBMPS meetings are available at https://empg.maths.ed.ac.uk/ NBMPS/.

NOVEL MATHEMATICAL APPROACHES FOR MODELLING EVOLUTION IN COMPLEX LIVING SYSTEMS

A workshop on mathematical and computational models in evolutionary biology will take place in the Department of Mathematics in University of Leicester from 4 to 7 April 2017. The workshop will explore new mathematical and computational approaches which are currently being developed to cope with the existing and newly emerging challenges in modelling evolution and adaptation in different biological systems ranging from biomolecules to human societies. Mathematically, the approaches will include (but will not be limited to) game theory, optimisation, system complexity reduction, reinforcement learning, networks modelling, data mining, agent-based simulation and their combinations. Intensive debates are planned to discuss the universality of newly developed approaches to tackle various aspects of biological evolution, which might go well beyond the initial area of implementation of the suggested methods. The list of keynote speakers includes:

- Troy Day (Canada)
- Alexander Gorban (UK)
- Eva Kisdi (Finland)
- Hanna Kokko (Switzerland)
- Philip Maini (UK)
- Sylvie Meleard (EcoleFrance)
- John McNamara (UK)
- Hans Metz (Netherlands)
- Kalle Parvinen (Finland)
- Karl Sigmund (Austria)

To register for this event email the main organizer Dr Andrew Morozov (am379@ leicester.ac.uk). For further information visit the website at http://tinyurl.com/ jt6kcwy. There will be a limited support for young researchers (UK based research students). The meeting is supported by an LMS Conference grant and the University of Leicester.

UCLAN MATHEMATICS SOCIETY SEMINAR



The UCLan Mathematics Society will be hosting its second seminar of the year taking place at The University of Central Lancashire on Tuesday 7 March. The seminar will be given by Jessica Banks, Lecturer in Mathematics at the University of Hull. Jessica's research is on low dimensional, geometric topology, particularly 3-manifold topology and knot theory, as well as connections to graph theory.

The talk will be accessible to undergraduates in mathematics and related sciences and it is free to attend. Refreshments will be provided before the seminar and a question and answer session will be scheduled for afterwards. For more information consult the Mathematics Society Facebook page (https://www.facebook. com/groups/UCLanMathSoc/) or contact the organizer Rimsha Tariq (rtariq@uclan. ac.uk).

The conference is supported by an LMS Funding for Undergraduate Mathematical Society Meetings.

MATHEMATICAL MODELLING OF RANDOM MULTICOMPONENT SYSTEMS

The first Mathematical Modelling of Random Multicomponent Systems (MMRMS) workshop in the 2017 series will take place at the Department of Mathematics, University of Swansea, on Monday 27 and Tuesday 28 March. The meeting, which is open to all, will highlight topics in analysis of infinite particle systems. The speakers are:

- Ostap Hryniv (Durham)
- Tobias Kuna (Reading)
- Alex Daletskii (York)

The meeting is supported by an LMS Joint Research Groups in the UK Scheme 3 grant and the Department of Mathematics, University of Swansea. For further information visit the website at http://tinyurl.com/h6uy37n or contact Professor Eugene Lytvynov (e.lytvynov@swansea.ac.uk).

SCOTTISH OPERATOR ALGEBRAS RESEARCH

The Scottish Operator Algebras Research (SOAR) meeting will take place at the University of Glasgow from 24 to 25 March 2017 on operator algebras and applications. The speakers are:

- Sarah Browne (Sheffield)
- Jan Cameron (Vassar)
- Erik Guentner (Hawaii)
- Simon Henry (Paris)
- Vaughan Jones (Vanderbilt)
- Andy Monk (Glasgow)
- Karen Strung (IMPAN)
- Gábor Szabó (Aberdeen)

Vaughan Jones will be giving an additional Edinburgh Mathematical Society lecture on 24 March, after the SOAR meeting talks for that day. Participants from across the UK and beyond are most welcome. The meeting is supported by the Glasgow Mathematical Journal Trust. Full details of the meeting can be found at http://tinyurl. com/hnarxph.

HARMONIC ANALYSIS AND PDE NETWORK

The Harmonic Analysis and PDE Network is hosting its first workshop in the 2017 series at the School of Mathematics, University of Birmingham on Tuesday 14 March 2017 from 11:00 to 17:00. The meeting, which is open to all, will focus on topics in harmonic analysis and related areas. The international speakers are:

- Tuomas Hytönen (University of Helsinki)
- Shohei Nakamura (Tokyo Metropolitan University)
- Carlos Pérez (Universidad del Pais Vasco, BCAM)
- Brett Wick (Washington University, St Louis)

Funding may be available to support the attendance of research students. Enquiries should be addressed to Maria Reguera (m.reguera@bham.ac.uk). The meeting is supported by an LMS Joint Research Groups in the UK Scheme 3 grant, the School of Mathematics, University of Birmingham and the consolidator ERC grant entitled *Transversal Multilinear Harmonic Analysis*. Further information about the workshop is on the website at http://web.mat.bham. ac.uk/~dxb378/meeting.html.

A MATHEMATICIAN'S JOURNEYS: OTTO NEUGEBAUER AND MODERN TRANSFORMATIONS OF ANCIENT SCIENCE

eds Alexander Jones, Christine Proust, John M. Steele, Springer, 2016, pp 342, £74.50, ISBN 978-3319258638.



Otto Neugebauer (born 1899 in Innsbruck, Austria, died 1990 in Princeton, New Jersey) was one of the first major researchers in the history of pre-Greek mathematics and astronomy. His work shaped the way we perceive the history of ancient science even today by convincingly

demonstrating that the birth of science did not happen out of nothing in ancient Greece. Instead, he showed that ancient Greek mathematicians and astronomers had an impressive corpus of knowledge to draw from in the form of Egyptian and even more cuneiform texts that enabled them to create what we associate with the term Greek science. In addition. any modern historian of pre-Greek astronomy or mathematics will encounter the work of Neugebauer, since several of his outstanding publications have since become the standard text editions of many pre-Greek astronomical and mathematical source texts. Also of interest. Neugebauer was deemed "unacceptable" by the Nazi students of the Göttinger mathematical institute, which led to a three-year appointment in Copenhagen followed by his expulsion from Europe and his move to Brown University. To anyone who is interested in Neugebauer's life and work (about which information is not always easy to obtain), with any of the current state of the fields to which Neugebauer so fruitfully contributed, A Mathematician's Journeys provides a collection of chapters that highlight various aspects of Neugebauer's life, work, and the historical subjects in which Neugebauer was interested (for a short overview cf. also the obituary by Noel Swerdlow which can be found online at http://www.nasonline.org/publications/ biographical-memoirs/memoir-pdfs/neugebauer-otto.pdf). The volume edited jointly by Alex-

ander Jones, Christine Proust and John M. Steele contains the revised contributions of a conference held in 2010 at the Institute for the Study of the Ancient World at New York University in honor of the 20th anniversary of the death of Otto Neugebauer. While the titles of the individual contributions seem to indicate that they may fall in two groups - dealing with biographical aspects of Otto Neugebauer or the subjects that Neugebauer had contributed so fruitfully to, many of them are necessarily a combination of both. This is because the life and works of Otto Neugebauer guite obviously are mutually dependent, for instance, his being at Göttingen with its specific setting at the mathematical institute. Furthermore, at Göttingen the Egyptology Department was headed by Kurt Sethe who has written the standard monograph on ancient Egyptian numbers. This must of course be taken into account when it comes to looking at the thesis that Neugebauer wrote on ancient Egyptian fraction reckoning. Likewise, the contributors' personal connection to Neugebauer is reflected in the individual chapters focusing on e.g. the background of the mathematical life at Göttingen (David Rowe), Neugebauer and the Nazi regime (Reinhard Siegmund-Schultze), his time at Copenhagen (Lis Brack-Bernsen), his work on ancient Egyptian mathematics (Jim Ritter), his work on Mesopotamian mathematics (Jens Høyrup), and his work on Babylonian astronomy (John M. Steele, Mathieu Ossendriiver). These all lead to a certain overlap concerning specific events in Neugebauers life and works in between individual articles, but are seen from different perspectives thus giving a more detailed picture of the event.

The book opens with the contribution by David Rowe, "From Graz to Göttingen: Neugebauer's Early Intellectual Journey" which draws a picture of the early career of Otto Neugebauer from its beginnings, when he was a student of physics in Graz, followed by an interlude as a student of mathematics, ending with his disser-

tation about Egyptian fractions and his Habilitation about the Babylonian sexagesimal system and his vision about how to research the early history of mathematics. Within Rowe's account, the scene at the Göttingen Institute takes center stage, thus giving much detail about the institutional background of Otto Neugebauer's career. The following chapter by Reinhard Siegmund-Schultze: "'Not in Possession of Any Weltanschauung': Otto Neugebauer's Flight from Nazi Germany and His Search for Objectivity in Mathematics, in Reviewing, and in History", also centers on the biographical side, through an analysis of the work of Otto Neugebauer in the time of the Nazis and the "extremist ideologies and dictatorships" (p. 63) that he was faced with. These of course stood in stark contrast to the ideals that Göttingen science had formerly espoused and upheld.

The two stavs of Neugebauer at Copenhagen are detailed in the contribution of Lis Brack-Bernsen: "Otto Neugebauer's Visits to Copenhagen and His Connection to Denmark". Of his two visits the first one vielded his only mathematical publication in collaboration with Harald Bohr, and also his review of the edition of the Rhind Mathematical Papyrus by Thomas Eric Peet, which is seen by several contributors of the volume as one key point in the development of Neugebauer's interest in Egyptian mathematics. During his second stay in Copenhagen, Neugebauer, who was then firmly based in the field of pre-Greek mathematics, collaborated with the Danish Egyptologists Aksel Volten and Hans Lange (resulting in the edition of Papyrus Carlsberg I, one of the most important Egyptian astronomical papyri). Here he also acquired his first doctoral student. Olaf Schmidt.

The following chapter "Otto Neugebauer and Ancient Egypt" by Jim Ritter takes a closer look at the first of the ancient cultures that Neugebauer worked on, and traces how Neugebauer came to become a historian of Egyptian mathematics. While this chapter begins geographically - like the first chapter by David Rowe - in Göttingen, the focus is much more on the person of Otto Neugebauer himself, resulting in two chapters (Rowe's and Ritter's) that are worthwhile to be read in combination. Ritter

presents the source situation for Egyptian mathematics in the time of Otto Neugebauer (which. as he points out hasn't changed all that much since then) and then gives a thorough overview of the writings of Neugebauer on Egyptian mathematics and astronomy. This section is followed by Jens Høyrup's analysis of Neugebauer's contribution to the historiography of Mesopotamian mathematics "As the Outsider Walked in: The Historiography of Mesopotamian Mathematics Until Neugebauer" - and again, this and the previous chapter by Jim Ritter make good complementing chapters to illuminate the contribution of Neugebauer to each field and how they were received, respectively. While Neugebauer remained more of an outsider to Egyptology (he is probably best known in Egyptology for his edition of the Egyptian astronomical texts in collaboration with Richard Parker and his edition of Papyrus Carlsberg I in collaboration with Hans Lange), his mark on Mesopotamian mathematics and astronomy has been much more striking (his Mathematische Keilschrifttexte in 3 volumes and his Mathematical Cuneiform Texts still being the point of departure for anyone working on Mesopotamian mathematics). The contribution by Béatrice André-Salvini "Francois Thureau-Dangin and Cuneiform Mathematics" gives a biographical account of the assvriologist contemporary to Neugebauer who worked on cuneiform mathematical texts. This is followed by Christine Proust's "Mathematical and Philological Insights on Cuneiform Texts. Neugebauer's Correspondence with Fellow Assyriologists". Proust sheds further light on the painstaking efforts that Neugebauer took in his work on cuneiform sources. The appendix A of that chapter presents examples of letters (German letters in English translation) that Neugebauer once wrote to his colleagues or received from them. In the chapter "After Neugebauer: Recent Developments in Mesopotamian Mathematics", Duncan Melville presents his assessment of the current state of the field of the history of Mesopotamian mathematics. The final three contributions deal with the other interest of Otto Neugebauer: Babylonian astronomy. This section begins with the chapter

by Teije de Jong "Babylonian Astronomy 1880-1950: The Players and the Field" which tells the early history of the rediscovery and research into Babylonian astronomy. This is followed by John Steele's appreciation of Neugebauer's contribution "Neugebauer's Astronomical Cuneiform Texts and Its Reception", which "defined the field of Babylonian astronomy for most of the second half of the twentieth century" (p. 303). Steele traces the genesis of the book from Copenhagen to its publication twenty years later before discussing its reception among assyriologists and historians of astronomy. The book ends with the chapter "Translating Babylonian Mathematical Astronomy: Neugebauer and Beyond" by Mathieu Ossendrijver, who analyses the principles that Neugebauer used in establishing his translations.

summaries may have indicated, this volume offers a rich variety of information on the life and works of Otto Neugebauer. The editors have successfully chosen contributors who shed light on the key issues in the life and work of Otto Neugebauer. The reviewer would have wished for an additional final section by the editors that could have been used to draw together the various strands that appear in the individual contributions. Throughout, the book uses copies of Neugebauer's unpublished documents. This made this reviewer wish that his Nachlass was subjected to an edition that could then tell the whole story of the life and works of Otto Neugebauer of which this book gave these individual insights.

> Annette Imhausen Historisches Seminar Goethe-University Frankfurt

As the brief (and I'm afraid incomplete)

GALLERY OF THE INFINITE

by Richard Evan Schwartz, American Mathematical Society, 2016, pp 187, US\$29.00, ISBN 978-1470425579.



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This is a beautiful book. The pictures keep the reader engaged in a colourful mathematical journey. It is written in an engaging style suitable for over 11's but also contains ideas that are likely to interest most adults (without the need for a refresher

course, since the book does a good job of being self-contained). If you would like to get an idea of Schwartz's presentation style, there is a book trailer for his second illustrated book *Really Big Numbers* available on YouTube. Although a mathematician would likely be aware of many of the concepts the book presents, I would still recommend it both as a tool to intrigue others (it makes a great 'coffee table' book) and also since it contains many imaginative explanations and original arguments. The illustrations and narrative keep the reader entertained and make the book hard to put down.

You are at a dinner party, and are ambushed

by people asking you what you do. What would you say? Or how would you explain to them that mathematicians aren't just calculators? I had this challenge recently when I decided that mathematical stand-up comedy was a good idea and wanted to show people some 'real' mathematics. I chose Cantor's diagonal argument because I thought it would be understandable but thought provoking. Since Schwartz's book is on infinity it's not surprising that it also contains Cantor's diagonal argument, which is done in binary by using black and white boxes. It also contains Cantor's argument that the cardinality of a non-empty set is less than the cardinality of its power set. I'll describe Schwartz's approach to this proof as an example of the neat explanations, though I can't demonstrate the seamless flow of the book nor how the illustrations aid the reader. Let A be a set consisting of various different animals. We can think of the power set of A as the collection of all group photographs of these animals. For these two sets to have the same size, we must be able to construct a matching between all of the animals and all of the photographs. For the moment let us imagine

that there is such a matching. We'll consider an animal happy if it is contained within the photograph it receives. Now consider the collection of all of the animals that are not happy. Since we are assuming there is a matching, exactly this (potentially infinite) collection of unhappy animals appears in one of the photographs and this photograph is received by some animal. Considering whether the animal that receives this photograph is happy or unhappy yields the contradiction. After showing a different argument from the book to people at the University of Southampton, I heard many exclamations along the lines of 'That really made my day/week/year'. The illustrations do a particularly good job of assisting the prose and help to visualise the main ideas.

The book starts at an elementary level, and is cautious not to race ahead with the difficult concepts and to give the reader time to digest what they've seen (through its colourful and whacky illustrations). The notion of set is introduced in a concrete and well-motivated way, as are the notion of the empty set and the construction of the natural numbers starting with just the empty set. In fact, because of the pictures and the writing style, all of the concepts introduced feel natural. And just to give you an idea of how whacky it is, if you buy this book (which I very much recommend you do) you'll meet a chicken with infinitely many teeth, an infinite rational shark, and a man with the most unbelievably curious fingers. I suppose this

leads me to my only criticism: there's not more! I think the current format is excellent in being approachable for almost anyone, and because of the pictures it is definitely possible to reread it many times, but I'd really liked to have seen a few more arguments before signing off. It's still a gem of a book and one that I hope will bring plenty of joy as it intrigues and educates those grabbed by its colourful pages.

The book says that it is not suitable for under 11's, and I would agree with that. The writing style and pictures are humorous, but could be scary for younger readers. Also the concepts are wonderfully explained, but the patience and language skills required may be beyond a younger reader. I would claim (much in the spirit of the topic of the book) that there is no limit on the age at which one could enjoy this book. I have shown the book to quite a few non-mathematicians (reviewing this book around Christmas time was useful for this) and all of them have been enthralled by the pictures and punchy, but clear, writing style.

There are two previous illustrated books exploring mathematics by Schwartz. The first was You Can Count on Monsters which looks at primes and factoring, especially for the first 100 numbers, and the second was *Really Big Numbers*. This book continues the trend of increasing difficulty and I feel that it's the most suitable of the three for an older audience.

> Charles Garnet Cox University of Southampton

THE ASCENT OF MARY SOMERVILLE IN 19TH CENTURY SOCIETY

by Elisabetta Strickland, Springer, 2016, pp 102, €59.49, ISBN 978-3319491929.



The book *The Ascent* of *Mary Somerville in 19th Century Society* by Elisabetta Strickland beautifully follows the life and work of the distinguished British scientific writer Mary Fairfax Somerville (1790-1872), from her wild and carefree childhood in rural Scotland to her unprecedented rise as a strong mathematical mind with a unique insight into the latest scientific discoveries of her time, leading to a Honorary Fellowship of the Royal Astronomical Society (1835), to her colourful and exciting nomadic life in Italy (1840-1872). By paying attention to both the ups and downs of her personal life and the efforts and rewards of her scientific work, Mary Somerville is portrayed not as a historical figure, but rather as a real person with a complex and charming personality capable of inspiring generations to

come. In this book, Mary Somerville's love for science and mathematics in particular, which led her to public and international recognition, is matched by that for her family and friends. For her parents, whose efforts as far as Mary's education was concerned meant preparing her for a good marriage, she felt that "they had been misled by conventional points of view about women and their intellectual pursuits" (p. 5). For her second husband, Dr William Somerville, FRS (1771-1860), who endeavored to support Mary's scientific work by introducing her to important social circles, copying and critically reviewing her manuscripts and maintaining on her behalf the correspondence with male scientists who would find writing directly to her socially unacceptable, she chose to move to Italy where his health would benefit from a warmer climate. Her husband's deteriorating health also meant that the income generated by Mary Somerville's scientific disseminations eventually became the main source of family income. Mary's love for her family further manifested in wanting to give to her children something she never had, the opportunity to learn as much as possible from an early age. She would however not be spared the pains that many parents had to endure at a time when common infectious diseases cut short the lives of many young children, but perhaps her strong self-discipline and love for scientific investigation also constituted a source of strength in overcoming such personal tragedies. Her open and approachable personality is also captured through a glimpse into her friendship with with Ada Lovelace (1815-1852), Lord Byron's daughter, who became the first computer programmer as she was the only person who understood the importance of the analytical engine designed by Charles Babbage (1791-1871): "When Ada encountered difficulties in some calculations, she would walk to Mary Somerville's house and they would straighten the matter up over a cup of tea" (p. 16). Her first book, entitled "On the Mechanism of the Heavens" (1931), was commissioned by Lord Henry Brougham (1778-1868), the founder of the Society for the Diffusion of Useful Knowledge in Edinburgh, on account that "no more than twenty people

knew the contents of Newton's Principia and Laplace's Mechanique Céleste, and no more than a hundred knew them even by name" and thought that "Mrs. Somerville could add two cyphers to each of those figures". With characteristic modesty, Mary Somerville wanted to decline the invitation, but accepted in the end "upon the condition of secrecy, so that if she failed, the manuscript could be put on fire" (p. 18). This should be a humbling lesson in self-criticism for many scientific authors even today. The book was completed and published when Mary Somerville was fifty-one years old, and was an international success, as it clarified and enhanced Laplace's work through many independent calculations and detailed diagrams, which were missing from the original. Three other major books followed: "On the Connexion of the Physical Sciences" (1834), "Physical Geography" (1848), and "On Molecular and Macroscopic Science" (1869), and Mary Somerville's love and care for the scientific work which she continued to support enthusiastically and interpret for the benefit of others rewarded her with many valuable friends who were only too happy to keep her up-dated on their latest scientific discoveries, unlike in the earlier stages of her investigations when she drew all the information through extensive and assiduous reading. To offer a direct insight into Mary Somerville's clear and poetic style, Elibetta Strickland's book concludes with substantial extracts from the preface entitled "Preliminary Dissertation" of "On the Mechanism of the Heavens", written for a broad audience and printed separately to entice the uninitiated to "Science, regarded as the pursuit of truth, which can only be attained by patient and unprejudiced investigation, ... whether it be in the discovery of a world, or of a new property of numbers" (pp. 84-85). This new book on Mary Somerville's long and rich life is therefore a very welcome addition to the existing biographies of this polyhedric personality and should serve as an inspiration to all those who wish to learn more about her scientific work and pioneering dissemination.

> Angela Mihai Maths Department, University of Cardiff



LMS WOMEN IN MATHEMATICS DAY Birkbeck, University of London 30 March 2017

A London Mathematical Society Women in Mathematics Day will be held on 30 March 2017 as part of the Winton Women Trailblazers in Mathematics conference hosted by Winton and organised by Birkbeck, University of London.

The event is aimed in particular at postgraduates, final year undergraduates, postdocts and others at an early stage in their career. The Women in Mathematics Day provides an opportunity to meet and talk with women who are active and successful in mathematics. Participants from previous meetings have found this opportunity useful and beneficial. While women are especially encouraged to attend this day, men are not excluded from these events.

There will be a range of talks from women mathematicians during the day. There is a poster session and to encourage high quality submissions, there will be a prize for the best Women in Mathematics Day poster. There will also be short presentations by postgraduate students.

The conference is free, and there is also funding from the LMS to assist with participants' travel costs, with priority given to supporting UK PhD students.

For more information, and to register, visit the conference page https://www.eventbrite.co.uk/e/women-in-mathematics-day-tickets-31248322574





LMS DURHAM SYMPOSIA 2018 CALL FOR PROPOSALS

The London Mathematical Society and Durham University invite proposals for LMS Durham Symposia in 2018 and intend to support two Symposia to take place in August 2018.

The Symposia began in 1974, and have now become an established and recognised series of international research meetings. They provide an excellent opportunity to explore an area of research in depth, to learn of new developments, and to instigate links between different branches. The format is expected to allow substantial time for interaction and research. The meetings are by invitation only and held in August, lasting 5 days, with up to 50 participants, roughly half of whom will come from the UK. They are held at the University of Durham.

Prospective organisers should send a formal proposal to the Durham Representative, Dirk Schuetz (dirk.schuetz@durham.ac.uk) by **Monday 10 April 2017**.

Proposals should include:

- A full list of proposed participants, divided into specific categories (please see the guidance on submission of proposals at www.lms.ac.uk/events/durham-symposia for more details). Proposers are encouraged to actively seek to include women speakers and speakers from ethnic minorities, or explain why this is not possible or appropriate.
- A detailed scientific case for the symposium, which shows the topic is active and gives reasons why UK mathematics would benefit from a symposium on the proposed dates.
- Details of additional support from other funding bodies, which will be sought if the application is successful, with the view to increase the number of participants and/or the number of days.

The Durham Representative will provide an estimated cost for accommodation for the symposium and estimated travel costs for participants.

For further details about the Durham Symposia, please visit the Society's website: www.lms.ac.uk/events/durham-symposia.

Before submitting: Organisers are welcome to discuss informally their ideas with the Durham Representative (dirk.schuetz@durham.ac.uk) and/or the Chair of the Research Meetings Committee, Professor Chris Parker (RMC.Chair@lms.ac.uk).

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LMS – NZMS AITKEN UK LECTURE TOUR 2017

The Society is delighted to announce that the 2017 LMS-NZMS Aitken Lecturer is Professor Hinke Osinga FRSNZ (University of Auckland).

Hinke Osinga, Professor of Applied Mathematics at the University of Auckland in New Zealand, is the fourth Aitken Lecturer to visit the UK. She is an expert in dynamical systems and its applications. Her publications, illustrations, animations and outreach activities have made her famous worldwide in the mathematics and arts communities.

In 2017, there will be two Aitken Lecture Tours taking place. In May 2017, Professor Osinga will visit Bath, Cambridge, Exeter and Oxford. She will then return to in October 2017 to visit Bristol, Kent, Newcastle and Warwick.



She will give lectures on "Chaos and wild chaos in Lorenz-type systems," "The art of computing global manifolds," and "Shaken but not stirred: Using mathematics in earth-quakes."







The Aitken Lectureship scheme is part of Forder-Aitken Lectureship exchange, which is a collaboration between the London Mathematical Society and the New Zealand Mathematical Society. Each Society invites an eminent mathematician from the other country to give lectures at different universities around the country.

The Aitken Lectureship, named after Professor A. Aitken - one of New Zealand's great mathematicians, is a Lecture Tour around the UK undertaken by a mathematician from New Zealand. The Forder Lectureship, named after Professor H. G. Forder (formerly of the University of Auckland and a benefactor of the London Mathematical Society) is a Lecture Tour around New Zealand undertaken by a mathematician from the UK. For further details about the Aitken Lectureship, please visit https://www.lms.ac.uk/events/lectures/forder-and-aitken-lectureship#Aitken

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CALENDAR OF EVENTS

This calendar lists Society meetings and other mathematical events. Further information may be obtained from the appropriate LMS Newsletter whose number is given in brackets. A fuller list is given on the Society's website (www.lms.ac.uk/content/calendar). Please send updates and corrections to calendar@lms.ac.uk.

MARCH 2017

2 Computing for the Future of the Planet, Royal Society, London (466) 7 UCLan Mathematics Society Seminar. University of Central Lancashire (467) 8 North British Mathematical Physics Seminar, ICMS, Edinburgh (467) 10–11 North British Functional Analysis Seminar, Birmingham (466) 14 Harmonic Analysis and PDE Network, Birmingham (467) 20-24 Young Geometric Group Theory Meeting, Oxford (465) 22 Maths, Teamwork and Googlies, Rob Eastaway, Christopher Zeeman Medal Lecture, London (466) 24–25 Scottish Operator Algebras Research Meeting, University of Glasgow (467) 27-28 Mathematical Modelling of Random Multicomponent Systems, Swansea (467) 29-31 Young Functional Analysts' Workshop, Glasgow (465) 30 Spectral Geometry, Leeds (465) 30 LMS Women in Mathematics Day, Birkbeck, University of London (467)

APRIL 2017

3 Society Meeting at BMC, Durham (467) 3-6 BMC, Durham (463) 4-7 Novel Mathematical Approaches for Modelling Evolution in Complex Living Systems, Leicester (467) 10 Developing Efficient Methodologies for Modelling Stochastic Dynamical Systems in Biology, Bath (465) 10-12 BAMC, Surrey (463) 18–21 Research Students Conference, Durham (465) 18–22 Function Theory by Hilbert Space Methods, Jim Alger, LMS Invited Lecturer, Newcastle (467) 25 Reforms to Mathematics Oualifications Westminster Education Forum Seminar, London 27-28 Mathematical Ecology Workshop, Swansea (464)

MAY 2017

2 Rough Paths in Probability and Statistics, Reading (466)
5 Mary Cartwright Lecture, London (467)
8–12 Approximation, Deformation, Quasification INI Workshop, Cambridge (464)
22–24 Gregynog Welsh Mathematics Colloquium, Gregynog Hall, Newtown, Powys (466)

JUNE 2017

1 LMS Northern Regional Meeting, York 19–23 Group Actions and Cohomology In Non-Positive Curvature, INI Cambridge (465) 19–23 New Trends in Representation Theory LMS–CMI Research School, Leicester (467) 26–30 Quantum Topology and Categorified Representation Theory, INI Cambridge (465) 26–30 Orthogonal Polynomials and Special Functions LMS-CMI Research School, Kent (467) 26–30 Microlocal Analysis and Applications LMS– CMI Research School, Cardiff (467) 30 LMS Graduate Student Meeting, London 30 LMS Society Meeting, London

JULY 2017

3–7 Scalable Statistical Inference, INI Cambridge (466)
3–7 BSDEs, SPDEs and their Applications
Workshop, Edinburgh
3–7 British Combinatorial Conference,
Strathclyde (464)
10–12 Mathematical Models in Ecology and
Evolution Conference, City, University of London (466)
10–14 Computer-aided Mathematical Proof, INI
Cambridge (466)
10–19 Foundations of Computational
Mathematics Conference, Barcelona (461)
31–5 Aug International Mathematics
Competition, Blagoevgrad, Bulgaria (466)

SEPTEMBER 2017

10–15 Mathematics Education for the Future Decade, Balatonfüred, Hungary (460) 11–15 Algebraic Topology of Manifolds LMS-CMI Research School, Oxford (467) 11–15 Introduction to Geometry, Dynamics, and Moduli in Low Dimensions LMS-CMI Research School, Warwick (467) 11–15 Scientific Computation and Differential Equations, Bath (466) 24–29 Heidelberg Laureate Forum (465)

LMS-FUNDED MEETING NINTH YOUNG THEORISTS' FORUM CONFERENCE

held at Durham University from 11 to 12 January 2017

(see report on page 19)



Azaria Coupe, PhD student (University of Southampton) Hunting for Minimal Walking Technicolor using Z'/Z" searches at the LHC



Sam Fearn, PhD student (Durham University) Moonshine: Unexpected Symmetries in String Theory



Ronald Rogers, PhD student (University of Southampton) A First Law for Entanglement Rates



Isobel Nicholson, PhD student (University of Edinburgh) Black Holes and the Double Copy

