LONDON MATHEMATICAL SOCIETY
EST. 1865

NEWSLETTER

No. 455 February 2016

LMS INAUGURAL HIRST LECTURE: PROFESSOR EDMUND F. ROBERTSON

The Society is pleased to announce that Professor Edmund F. Robertson (St Andrews) will give the inaugural Hirst Lecture at St Andrews on Wednesday 20 April 2016. Mark McCartney (University of Ulster) will give an accompanying lecture.

The Hirst Lecture celebrates the joint award of the Hirst Prize & Lectureship, in the 150th Anniversary year of the London Mathematical Society, to Professor Edmund Robertson (St Andrews) and Dr John O'Connor (St Andrews) for their creation, development and maintenance of the MacTutor History of Mathematics website (www-history.mcs.st-and.ac.uk).

Originally developed in the early 1990s to enrich the Mathematical MacTutor System that supports teaching mathematics to undergraduates, the MacTutor History of Mathematics website has now become an important resource for those interested in the history of mathematics. It contains over 2,800 biographies of mathematicians and is used across the world by schoolchildren, undergraduates, graduates and their teachers.

The Hirst Prize and Lectureship are named after Thomas A. Hirst, 5th President of the London Mathematical Society from 1872-1874. The prize is awarded in recognition of original and innovative work in the history of mathematics, which may be in any medium.

In 2015, the Council of the Society agreed to continue the Hirst Prize and Lectureship on a biennial basis with the next award to be made in 2018 and the lecture to be given at a Society Meeting in 2019.

Thomas A. Hirst
LMS President, 1872-1874

Edmund F. Robertson
Joint Hirst Prize-winner

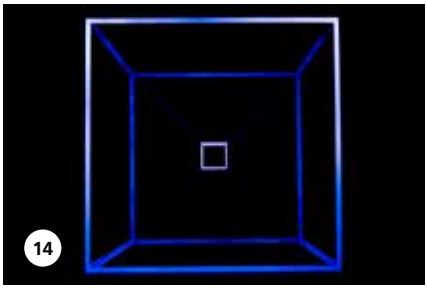
John O'Connor
Joint Hirst Prize-winner

SOCIETY MEETINGS AND EVENTS

- 26 February: Mary Cartwright Lecture, London *page 16*
- 21 March: Society Meeting at the BMC, Bristol *page 17*
- 21–25 March: LMS Invited Lectures, Loughborough *page 15*
- 20 April: Hirst Lecture & Society Meeting, St Andrews *page 25*
- 8 July: Graduate Student Meeting, London
- 8 July: Society Meeting, London
- 21 July: Society Meeting at the 7ECM, Berlin
- 11 November: Graduate Student Meeting, London
- 11 November: Annual General Meeting, London
- 20 December: South West & South Wales Regional Meeting, Bath

Contents

No. 455 February 2016



LMS 150TH ANNIVERSARY
DEPARTMENTAL CELEBRATIONS

These events were part of a series of receptions hosted across the UK by mathematics departments, celebrating the 150th Anniversary of the LMS.

THE OPEN UNIVERSITY

We held the LMS 150th Anniversary Celebration on 15 December 2015 during the Department's winter postgraduate research day, which included research talks by PhD students and a lecture on the philosophy of Hermann Weyl by Professor Jeremy Gray. The Anniversary Celebration featured prosecco, mince pies and a huge cake baked by one of the PhD students David Marti Pete, who is pictured cutting the cake. Also pictured are Jeremy Gray and PhD students Rosie Cretney and Mairi Walker. At the event, Professor June Barrow-Green said a few words about the LMS and, after the toast, we all sang 'Happy Birthday' to the LMS, accompanied on the ukelele by former head of department Dr Toby O'Neil.

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QUEEN'S UNIVERSITY BELFAST

The Mathematics Department of Queen's University Belfast held a reception in the Old Staff Common Room on Friday afternoon 18 December 2015 to celebrate the LMS 150th anniversary. It was a small group but no less merry. The streaming from the LMS website of the launch event (we watched Robert Pieké's *Mathematics: Smoke and Mirrors*) added essentially to the gathering as it immediately stimulated discussions on the applications of partial differential equations to 'real life' problems. The support of the LMS is thankfully acknowledged.

ABERDEEN UNIVERSITY

The Department of Mathematics held a celebration of the 150th anniversary of the LMS on Friday 4 December 2015. The event was well attended by students and staff, and marked a welcome end to our Fall term.

Institute of mathematics & its applications

LONDON MATHEMATICAL SOCIETY EST. 1865

CHRISTOPHER ZEEMAN MEDAL 2016

CALL FOR NOMINATIONS

The Councils of the LMS and the IMA are delighted to invite nominations for the 2016 award of the Christopher Zeeman Medal, which is the UK award dedicated to recognising excellence in the communication of mathematics.

The IMA and the LMS wish to honour mathematicians who have excelled in promoting mathematics and engaging with the general public. They may be academic mathematicians based in universities, mathematics school teachers, industrial mathematicians, those working in the financial sector or indeed mathematicians from any number of other fields.

Most importantly, these mathematicians will have worked exceptionally to bring mathematics to a non-specialist audience, whether it is through giving public lectures, writing books, appearing on radio or television, organising events or through an entirely separate medium. The LMS and IMA want to celebrate the achievements of mathematicians who work to inspire others with their work.

The award is named after Professor Sir Christopher Zeeman, FRS, president of the LMS between 1986 and 1988. His notable career has been pioneering not only in the fields of topology and catastrophe theory but also because of his ground breaking work in bringing his beloved mathematics to the wider public. Sir Christopher was the first mathematician to be asked to deliver the Royal Institution Christmas Lectures in 1978, a full 160 years since they began. His Mathematics into Pictures lectures have been cited by many young UK mathematicians as their inspiration. In recognition of both his work as a mathematician and his contribution to the UK mathematics community, Sir Christopher received the LMS-IMA David Crighton Medal in 2006.

A form for nominations is available at www.ima.org.uk/zeeman2016nomination.html or from Alison Penry at: Institute of Mathematics and its Applications, Catherine Richards House, 16 Nelson Street, Southend-on-Sea, Essex, SS1 1EF; or email alison.penry@ima.org.uk.

Nominations must be received by **28 February 2016**.

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EST. 1865

LMS 150TH ANNIVERSARY POSTDOCTORAL MOBILITY GRANTS

2016-17 AWARDS

The London Mathematical Society will award grants of up to £7,200 plus a travel allowance to mathematicians of excellent promise. The purpose of the grants is to support a period of study and research in mathematics between three and six months in the academic year 2016-17 at one or more institutions other than the holder's home institution (the holder's home institution may be included for applicants with circumstances that make moving impractical, please visit the website for the full guidelines). They are intended to support promising researchers during the transitional period between having submitted their thesis and the start of their first post-doctoral employment.

The value of the grant will be calculated at £1,200 per month plus a travel allowance.

At the time of the closing date applicants have to be UK residents. Successful candidates must have submitted their thesis within twelve months before the start of their grant period. Grant holders are allowed to teach up to three hours a week. Otherwise they are expected to spend their working time on study and research.

Please read the full guidelines before applying, these are available on the website: lms.ac.uk/grants/postdoc-mobility-grants

Candidates are asked to provide with their application:

- **a completed application form**
- a **cover letter**;
- a **CV** including a list of publications (maximal two A4 pages);
- a **research proposal** including a rationale for the choice of institution(s) to be visited (maximal three A4 pages);
- at least **two letters of reference**, which applicants should request that referees email directly to the LMS (to the email address below) by the closing date;
- and **letter(s) of support** from the host(s) at the institution(s) where the proposed visit will take place; it is expected that host institutions provide the grant holder with office space and access to computing and library facilities.

These grants have been established by the LMS to mark its 150th Anniversary.

Applications should be sent by Thursday 31 March 2016 by email to: pmg@lms.ac.uk

Queries should be referred to Katy Henderson:
pmg@lms.ac.uk
Tel.: +44 (0)20 7927 0809

Applicants will be notified of the outcome of their application in late May 2016.

NEW YEAR HONOURS LIST 2016

The following have been recognised in the New Year Honours list:

Alison Allden, formerly chief executive, Higher Education Statistics Agency Limited, awarded OBE for services to Higher Education.

Margherita Biller, head of mathematics, York College, awarded MBE for services to Mathematics in Further Education.

Sue Black, Bletchley Park campaigner, awarded OBE for services to technology.

Lynn Churchman, founding trustee, National Numeracy awarded OBE for services to Mathematics and Numeracy Education.

Steve Humble, teaching fellow in PGCE mathematics, Newcastle University and freelance mathematics consultant, awarded MBE for services to Education.

Ruth Kaufman, president of the Operational Research Society, awarded OBE for services to Operational Research.

Emily Shuckburgh, mathematician and climate scientist at the British Antarctic Survey, awarded OBE for services to Science and Public Communication of Science.

FERMAT PRIZE 2015

The laureates of the Fermat Prize 2015 are:

Laure Saint-Raymond (École Normale Supérieure, Paris) for the development of asymptotic theories of partial differential equations, including the fluid limits of rarefied flows, multiscale analysis in plasma physics equations and ocean modeling, and the derivation of the Boltzmann equation from interacting particle systems.

Peter Scholze (Universität Bonn) for his invention of perfectoid spaces and their application to fundamental problems in algebraic geometry and in the theory of automorphic forms.

The prize-awarding ceremony of the Fermat Prize will take place on Tuesday 22 March 2016 in Toulouse. For further information visit the website at www.math.univ-toulouse.fr/spip.php?article648.

RECORDS OF PROCEEDINGS AT LMS MEETINGS

SOUTH WEST & SOUTH WALES REGIONAL MEETING

held on *14 December 2015* at the University of Southampton as part of the enhanced 150th Anniversary South West & South Wales Regional Workshop on *Aspects of Homotopy Theory*. Over 40 members and visitors were present for all or part of the meeting.

The meeting began at 2.00 pm with The Vice-President, Professor John Greenlees, in the Chair.

No members were elected to membership.

Five members signed the book and were admitted to the Society.

Dr Jelena Grbic introduced a lecture given by Professor Ralph Cohen on *Topological field theories and how to compare them*.

After tea, Dr Jie Wu gave a lecture on *Combinatorial approaches to classical homotopy*.

Following a second tea-break, Professor Ian Leary gave the final lecture on *Uncountably many groups of type FP*.

The Vice-President expressed the thanks of the Society to the local organisers for putting on such an interesting meeting.

Afterwards, a wine reception was held at Building 56, the Maths Student Centre. The conference dinner took place at Ceno on Tuesday 15 December 2015.

BRITISH TOPOLOGY MEETING

Report

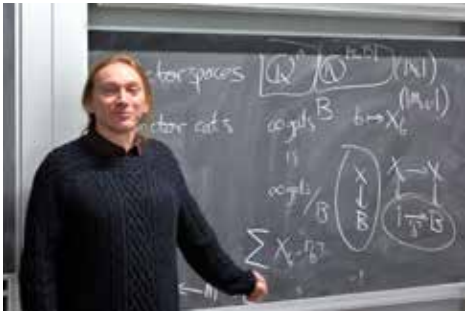
The 30th British Topology Meeting (BTM30) took place from 7 to 9 September 2015 at Queen's University Belfast. The main focus of this international research conference was on homotopy theory and its relation to other areas such as combinatorics and category theory.

Speakers from six different countries presented varied aspects of the subject, showcasing a wide range of interesting connections between homotopy theory, algebraic topology and areas further afield. Presentations were given by Carles Casacuberta (Barcelona, Spain), Boris Chorny (Haifa, Israel), Rosona Eldred (Münster, Germany), Graham Ellis (Galway, Ireland), Imma Gálvez Carrillo (UPC, Spain), Jarek Kędra (Aberdeen, UK), Alexandru Suciu (Northeastern, USA), and Andrew Tonks (Leicester, UK). The high quality of talks, the relaxed atmosphere and the international audience made the conference a highly successful event, beneficial for attending researchers and doctoral students alike.

The organisers would like to thank the LMS, EPSRC and Queen's University Belfast for their generous financial support.

Thomas Huettemann
Queen's University Belfast

Rosona Eldred (Münster, Germany)



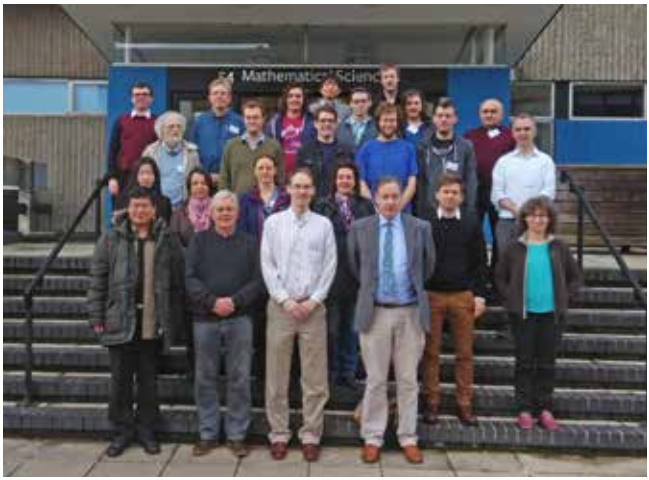
Andrew Tonks (Leicester, UK)

Participants

LMS SOUTH WEST AND SOUTH WALES REGIONAL MEETING

Report

The 2015 LMS South West and South Wales Regional Meeting took place at the University of Southampton on Monday 14 December. It was followed by the workshop *Aspects of Homotopy Theory* from 15 to 17 December 2015.



Some of the participants

The meeting started with an introduction by the LMS Vice-President, Professor John Greenlees. As is traditional, the Vice-President invited members of the Society who had not signed the Membership Book to do so.

The first talk was by Professor Ralph Cohen (Stanford University), who discussed exciting recent progress that identifies certain topological field theories. The second talk was by Professor Jie Wu (National University of Singapore) who gave an elegant account of a new combinatorial approach to classical problems in homotopy theory. The third talk was by Professor Ian Leary (University of Southampton), who described how a type of group that was thought to rarely exist in fact exists in abundance.

The talks were followed by a wine reception and buffet which was attended by representatives of the LMS, the meeting and workshop speakers, and a wide variety of other participants, including an abundance of postgraduate students. A toast to the 150th birthday celebration of the LMS was made by Professor Graham Niblo (Head of Mathematical Sciences, Southampton).

The subsequent workshop consisted of ten talks that stimulated considerable discussion and comment. They covered a wide spectrum of topics ranging across topology, geometry and algebra, demonstrating the scope and reach of homotopy theoretic ideas and methods. The speakers in alphabetical order were: Dr Piotr Beben (University of Southampton), Dr Alexander Berglund (Stockholm University), Professor Natalia Castellana (Universitat Autonoma de Barcelona), Professor John Greelees (University of Sheffield), Dr Brendan Owens (University of Glasgow), Dr Nansen Petrosyan (University of Southampton), Dr Oscar Randal-Williams (University of Cambridge), Professor Samson Saneblidze (A. Razmadze Mathematical Institute, Tibilisi), Professor Svjetlana Terzic (University of Montenegro) and Professor Sarah Whitehouse (University of Sheffield).

A workshop dinner held on the night of Tuesday 15 December was very well attended and strongly reinforced the warm collegial atmosphere. The meeting and workshop were organised by Dr Piotr Beben, Dr Jelena Grbic and Professor Stephen Theriault, all from the University of Southampton.

Dr Jelena Grbic
University of Southampton

MATHEMATICS POLICY ROUND-UP

January 2016

RESEARCH

Review of research funding

Universities and Science Minister Jo Johnson has launched a UK-wide review of university research funding.

The review will be chaired by the President of the British Academy and former World Bank Chief Economist Lord Nicholas Stern. He will be assisted by a high-level steering group of academic experts, including the Vice-Chancellor of Aston University, Professor Julia King, and the Past President of the Academy of Medical Sciences, Professor Sir John Tooke.

Lord Stern is due to report in Summer 2016. More information is available at http://tinyurl.com/hqf6k5c.

EPSRC REF analysis report

The Engineering and Physical Science Research Council (EPSRC) has reported that the 2014 Research Excellence Framework revealed 'comprehensive evidence of the sustained economic and social impact of EPSRC's investments in engineering and physical sciences (EPS) research'. The EPSRC has published a report and companion leaflet presenting the findings of an analysis of the REF EPS impact case studies, carried out by EPSRC. More information is available at http://tinyurl.com/pezcoy7.

New mathematics centres

Life Sciences Minister George Freeman has announced a £10 million investment in five new research centres around the UK that will explore how mathematics and statistics can help clinicians to tackle serious health challenges such as cancer, heart disease and antibiotic resistant bacteria. The centres will be located at universities in Liverpool, Glasgow, London, Cambridge and Exeter. More information is available at http://tinyurl.com/hs7poq6.

SCHOOLS AND COLLEGES

Improving schools in Scotland

A review of the *Curriculum for Excellence* (CfE) has been undertaken by the Organization for Economic Co-operation and Development (OECD). The review states that, 'Levels of academic achievement are above international averages in science and reading (as measured by the Programme for International Student Assessment, PISA) and close to average in maths'. The full review is available at http://tinyurl.com/goaopw2.

Dr John Johnston
Joint Promotion of Mathematics

INTERNATIONAL MATHEMATICS COMPETITION FOR UNIVERSITY STUDENTS

Preliminary Announcement

The 23rd International Mathematics Competition for University Students (IMC), being held from 25 to 31 July 2016, is organized by University College London and hosted by the American University in Bulgaria, Blagoevgrad, Bulgaria.

Every participating university is invited to send several students and one teacher. Individual students are welcome. The competition is planned for students completing their first, second, third or fourth year of university education and will consist of two sessions of five hours each. Problems will be from the fields of Algebra, Analysis (Real and Complex), Geometry and Combinatorics. The working language will be English. Over the previous twenty two competitions we have had participants from over two hundred institutions in over fifty countries.

The IMC is a residential competition and all student participants are required to stay in the accommodation provided by the hosts.

Groups: Although this is an individual event, the Universities traditionally divide their participants into groups of four each. The number of students in the teams is, however, not fixed. The professor who accompanies the students is expected to be a member of the Jury.

Selection of the Problems: The problems will be chosen at the Meeting of the Jury on July 26 from those received in advance by the President of the Jury, Professor John Jayne. The problems proposed should be precisely formulated and accompanied by a detailed solution. The problems should be in fields of Algebra, Analysis (Real and Complex), Geometry and Combinatorics. The problems given at the last twenty two competitions can give a general idea of the level expected (see the IMC website www.imc-math.org.uk). Additional topics may be also included.

Evaluation: The students' work will be evaluated by Team Leaders and other Professors and Assistant Professors using criteria provided by the Jury.

Necessary Information: Participants are invited to confirm their intention to participate, either by on-line registration or by email, by the end of May 2016, providing the following information: University: City, Country: Leader of the team (name, email address): Students (number): Mailing address: email address: Fax.

Visas: The participants from some countries will need a visa to enter Bulgaria. Contact your travel agent or the Bulgarian Consulate in your country for details. If necessary, the organizers will post formal invitations for participation in the Competition. You must begin the visa process early as it requires time.

Local Expenses: The competition fee, which will include accommodation and meals from dinner on the 25 July to breakfast on the 31 July, has not yet been finalized.

Send all confirmations of participation and arrival details to John Jayne (j.jayne@ucl.ac.uk). If you would like a copy of the competition poster, please sent your request with postal address to John Jayne. For further information visit the website at www.imc-math.org.uk.

EUROPEAN NEWS

EMS Newsletter

The December 2015 edition of the European Mathematical Society (EMS) Newsletter is now available online at http://tinyurl.com/hrpb4e3. It contains a list of 79 problems from the very elementary to the highly sophisticated taken from the book *Lectures and Problems: A Gift to Young Mathematicians* (AMS, 2015) by Vladimir Arnold, and an article on the classical additive eigenvalue problem (what can be said about the eigenvalues of A + B given those of A and B ?) by Shrawan Kumar, as well as one on George Boole and Boolean Algebra by Stanley Burris. There are lively interviews with Abel Laureate Louis Nirenberg and Fields Medallist Manjul Bhargava. In addition to the reminiscences on past ECMs, book reviews and so on there is also an extraordinary account by Sylvie Paycha of the *Summer School on Fourier Integral Operators and Applications* that took place in Ouagadougou in September 2014 during the danger and insecurity of an uprising and unsuccessful coup.

The following items are from the EMS webpage www.euro-math-soc.eu/recent-news.

Resonances

In his New Year message the European Mathematical Society (EMS) President Pavel Exner made the notable observation that not only has the EMS recently celebrated its 25th anniversary, but that "in a remarkable harmony some of our corporate members celebrated jubilees marked by integer multiples of the EMS's age - six for the *London Mathematical Society*, five for *Deutsche Mathematiker-Vereinigung*, and three for *Sociedade Portuguesa de Matemática*".

10th ICIAM Congress in 2023

The *International Congress on Industrial and Applied Mathematics* (ICIAM) is held every four years under the auspices of the International Council for Industrial and Applied Mathematics. The latest congress took place in Beijing in August 2015; the next congress will be held in Valencia, Spain in July 2019. Member societies are now invited to apply to hold the Tenth ICIAM Congress in 2023. Pre-proposals should be submitted to the ICIAM President Maria J. Esteban no later than **31 March 2016**. For details see iciam_bidfor2023.pdf. Note also that ICIAM has a new website: see http://iciam.org/.

New CRM director

The board of governors of *Centre de Recerca Matemàtica* (one of the ERCOM members) in Barcelona has approved the nomination of Dr Lluís Alsedà as a new director of CRM for a four-year mandate starting 1 January 2016 (see www.crm.cat).

ERC grants

Grants from the European Research Council: The deadline for advanced grants is 1 September 2016. Since this year, the funding for the different fields (for example PE1 Mathematics) depends strongly on the number of applications for the field. Unfortunately in the last calls, the number of applications significantly decreased. This will have a negative effect on the funding for mathematics. If the development continues, a drastic reduction of the budget for funding in mathematics has to be expected in the coming years. Here is some advice:

1. Colleagues with a good idea for a proposal should definitely apply.
2. One should apply for the full grant if the project really has the potential and need for such a large amount.
3. Most research projects in mathematics can get along with much smaller grants.
4. Do not follow the requests of university administrators if they urge you to go for the maximal possible grant sum.

For further information visit the website at http://tinyurl.com/gphh68c.

David Chillingworth
LMS/EMS Correspondent

NEW ZEALAND MATHEMATICAL SOCIETY NEWS

The 50th annual New Zealand Colloquium meeting was held at the University of Canterbury at the start of December. This saw the inaugural Butcher-Kalman lecture given by Adam Day of Victoria University of Wellington. This is a lecture by an early career speaker and has been generously supported by the Margaret and John Kalman Charitable Trust and New Zealand Mathematical Chronicle Funds. Other plenary speakers at the NZMS Colloquium were Rick Beatson of the University of Canterbury (NZMS Speaker), Claire Postlethwaite of the University of Auckland (ANZIAM speaker), Catherine Greenhill of the University of New South Wales and Ian Frigaard of the University of British Columbia. The New Zealand Mathematical Society awards were presented at the Colloquium dinner.

The NZMS Early Career Award winner for 2015 was Adam Day (Victoria University of Wellington) 'for fundamental contributions to the theory of algorithmic randomness and computability including the solution of the random covering problem'.

The 2015 Aitken Prize for the best spoken presentation by a student at the NZMS Colloquium went to Andrew Keane (University of Auckland) for his talk *Bifurcation Analysis of a Model for the El Niño Southern Oscillation*.

The 2015 ANZIAM poster prize for the best poster by an early career researcher at the NZMS Colloquium went to Andrus Giraldo (University of Auckland) for his poster *To Flip or Not to Flip?*

The NZMS Research Award winner for 2015 was Hinke Osinga of University of Auckland) 'for pioneering work on theory and computational methods in dynamical systems and its applications in biology and engineering'.

Honorary membership of the New Zealand Mathematical Society was awarded to David Gauld (University of Auckland) acknowledging his 'outstanding and sustained contribution to the Society, the New Zealand Mathematical Community and Mathematics'.

The following new Fellows of the New Zealand Mathematical Society were announced: Steven Galbraith (University

Hinke Osinga, New Zealand Mathematical Society Research Award winner, with Winston Sweatman, New Zealand Mathematical Society President

David Gauld, Honorary Member of the New Zealand Mathematical Society, with Winston Sweatman, New Zealand Mathematical Society President

of Auckland), Mick Roberts (Massey University) and Charles Semple (University of Canterbury).

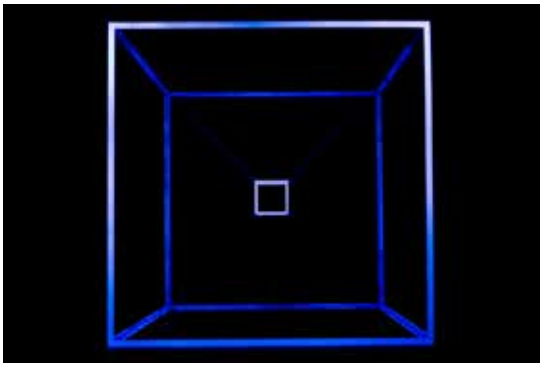
Earlier in the year three reciprocal lecture tours took place. In March and April, Endre Süli (University of Oxford) toured New Zealand as the LMS-NZMS Forder Lecturer. The reciprocal LMS-NZMS Aitken Lecturer was Steven Galbraith (University of Auckland) who toured the UK in October. In September, Ingrid Daubechies (Duke University) toured New Zealand as the AMS-NZMS Maclaurin Lecturer.

Winston Sweatman (Massey University) has now concluded his two-year term as NZMS President and is succeeded by Astrid an Huef (University of Otago).

Winston Sweatman

X&Y

The Vaults, Leake Street, Waterloo, SE1 7NN, 10-14 February 2016



It's not often you see an eminent professor reduced to zero on stage and then stuffed into a bag. But this is exactly what happens to Marcus du Sautoy, Simonyi Professor for the Public Understanding of Science and a Professor of Mathematics at Oxford, in his role as X in the Twin Prime production *X&Y*.

X&Y is a story of contrasting world views. X lives life through mathematical abstraction, lonely but happily confined to a cube he never leaves. Y, Victoria Gould, has spent her life exploring their known universe, hoping that she'll finally find an 'out' and an answer to the universal question: "Is there more than this?" When they meet they begin to argue about the shape of the world they live in and from here the plot unfolds into a story of mathematics, theatre and friendship.

This is not the first time that du Sautoy and Gould have worked together. A few years ago they helped develop *A Disappearing Number*, a play about the remarkable collaboration between the Cambridge mathematician G.H. Hardy and the Indian genius Srinivasa Ramanujan. It was a play about mathematicians, but inspired du Sautoy and Gould, to do a play about mathematics itself. This is not as strange as it sounds; theatre and mathematics are both imagined things that need to be consistent to work. And while mathematics is abstract it is also physical — there are patterns, rhythms, forms and shapes — and this can be conveyed on stage.

But what du Sautoy and Gould have produced, under the direction of Dermot Keaney, isn't abstract physical theatre. The dialogue is funny and sharp, there's a story being told which, with a couple of twists, explores the common ground of mathematics and theatre, and the friendship between two very different people.

Sean Harwood
Event's Press Officer
The Vaults

Editor's note: *X&Y* was performed at the Science Museum in 2013. A review appeared in the December 2013 issue of the *LMS Newsletter*.

LONDON MATHEMATICAL SOCIETY
EST. 1865

LMS Invited Lecturer 2016

Professor Edgar Knobloch (UC Berkeley)
Dynamics, Patterns and Spatially Localised Structures

21-25 March 2016
Loughborough University, Department of Mathematical Sciences

In a series of 10 lectures Professor Knobloch will describe and illustrate recent progress in understanding the origin and properties of spatially localised structures formed in dissipative, pattern-forming systems such as the Swift-Hohenberg equation. He will provide a mathematical and a physical explanation of homoclinic snaking of stationary states and related results for spatially localised temporal oscillations. He will use the theory to develop an understanding of similar phenomena observed in fluid dynamics, reaction-diffusion systems and nonlinear optics.

There will also be supplementary lectures by:

Daniele Avitabile (Nottingham), *Numerical computation of coherent structures in spatially-extended systems*
Claude Baesens (Warwick), *Bifurcations of flows on the two-torus*
Thomas Bartsch (Loughborough), *Introduction to transition state theory*
Anatoly Neishtadt (Loughborough), *Slow-fast dynamical systems*
Alastair Rucklidge (Leeds), *Introduction to pattern formation*
Uwe Thiele (Münster), *Dynamics of soft matter systems: evolution equations and the bifurcations of depinning transitions*

Participants are invited to contribute further lectures or posters.

University accommodation will be available. Also, limited financial support is available with preference given to UK research students. Please contact one of the organisers for further details: Thomas Bartsch (T.Bartsch@lboro.ac.uk), Andrew Archer (A.J.Archer@lboro.ac.uk) or Anatoly Neishtadt (A.Neishtadt@lboro.ac.uk). Deadline for funding: 19 February 2016

For further details on the 2016 Invited Lectures please visit www.lms.ac.uk/events/lectures/forthcoming-lms-invited-lecturer and www.lboro.ac.uk/lms-2016

LONDON MATHEMATICAL SOCIETY
EST. 1865

MARY CARTWRIGHT LECTURE AND SOCIETY MEETING

Friday 26 February 2016

De Morgan House, 57-58 Russell Square, London, WC1B 4HS

3.30 Opening Lecture
Lasse Rempe-Gillen (University of Liverpool)
Hairs, dreadlocks and Cantor bouquets

4.30 Tea

5.00 Mary Cartwright Lecture
Gwyneth Stallard (Open University)
Pits, gaps and spiders' webs

6.00 Wine reception

To register

For all event enquiries please contact Katy Henderson (womeninmaths@lms.ac.uk) by Friday 19 February. Late registrations for places may still be accepted, subject to availability.

The reception will be followed by a dinner at the Thistle Bloomsbury Park Hotel, at a cost of £35 per person, inclusive of wine.

There are limited funds available to contribute in part to the expenses of members of the Society or research students to attend the meeting.

LONDON MATHEMATICAL SOCIETY
EST. 1865

Society Meeting at the BMC 2016

University of Bristol, 21-24 March
5:15pm Society Meeting (21 March)
Public Lecture: Kirsten Lauter (Microsoft Research)
This Society Meeting is part of the British Mathematical Colloquium 2016. The full conference will also include a special lecture by Hendrik Lenstra and plenaries given by Robert Adler, Luigi Ambrosio, Maria Chudnovsky, Alex Lubotzky, Peter Sarnak and Amie Wilkinson.

Workshops (Tue & Wed afternoon)
Algebra (organisers: Tim Burness, Jeremy Rickard)
Analysis (organisers: Michiel van den Berg, John Mackay)
Combinatorics (organisers: Thomas Bloom, Julia Wolf)
Ergodic Theory (organisers: Thomas Jordan, Corinna Ulcigrai)
Number Theory (organisers: Andrew Booker, Tim Browning)
Probability (organisers: Márton Balázs, Bálint Tóth)

Speed talks (Wed 5-6pm) & posters
In the spirit of Radio 4's 'Just A Minute', there will be a session of 5-minute talks, allowing early career researchers, including PhD students, to showcase some of their mathematics. If you would like to give a speed talk, please apply at http://ow.ly/VmRkO. If you would like to present a poster at the BMC, please apply at http://ow.ly/VmRsD.

Satellite meetings (Thu afternoon), Research Groups supported by LMS Scheme 3 grants
Ergodic theory, organisers Thomas Jordan, Corinna Ulcigrai
COW Algebraic Geometry, organiser Hamid Ahmadinezhad
BLOC Representation Theory, organisers Neil Saunders, Jason Semeraro, Nicole Snashall
For further details and registration, please visit http://www.maths.bris.ac.uk/~matyd/BMC/ Early bird registration is now open and closes on 1 February 2016. The cost of registration will be £75 and £40 for students. The venue and time of the dinner is to be confirmed.

Accommodation in Bristol is also available, but it is advised you book early to avoid disappointment. A list of hotels can be found here: http://ow.ly/VmRA3

Modern topics in Nonlinear PDE and Geometric Analysis

LMS-CMI Research School, Reading, 4-8 July 2016

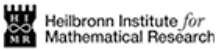
Organisers: Stefanos Aretakis (Princeton, USA) and Nikos Katzourakis (Reading, UK). For further information please visit: http://ow.ly/VA0cK. The three main lecture (6+2)-hour courses will be:

- Course 1: Nonlinear PDE and Calculus of Variations
  Lawrence C. Evans (Berkeley, USA) - *Nonlinear PDE and optimisation*
  Jan Kristensen (Oxford, UK) - *Convexity notions in the Calculus of Variations*
- Course 2: Geometric Hyperbolic PDE, General Relativity & Fluid Dynamics
  Mihalis Dafermos (Princeton, USA - Cambridge, UK) - *The stability problem for black holes*
  Gustav Holzegel (Imperial College, UK) - *The formation of shocks in three dimensional fluid dynamics*
- Course 3: Geometric Nonlinear PDE
  Bernard Dacorogna (EPFL, Switzerland) - *The pull-back equation for differential forms*
  Spyros Alexakis (Toronto, Canada) - *On dynamical stability of singular Ricci solitons under Ricci flow*
- The distinguished guest lecturers are **Robert Jensen** (Chicago, USA) and **Juan Manfredi** (Pittsburgh, USA)

Applications should be made by 11 April using the form at http://ow.ly/VA0i0. Research students, post-docs and those working in industry are invited to apply. Numbers will be limited and those interested are advised to make an early application. *All applicants will be contacted within two weeks after the deadline.

All research students will be charged a registration fee of £150 and all early career researchers will be charged a registration fee of £250. There will be no charge for subsistence costs fro these groups. All other participants (e.g. those working in industry) will be charged a registration fee of £250 plus the full subsistence costs.

All UK-based participants must pay their own travel costs. For overseas participants, support will be available to contribute towards travel costs. Fees are not payable until a place on the course is offered but will be due by Friday 27 May 2016.



Institute of mathematics & its applications

LONDON MATHEMATICAL SOCIETY EST. 1865

The David Crighton Lecture

Professor Frank Kelly CBE FRS

Thursday 12 May 2016 at 6.15 p.m. followed by a reception at The Royal Society, Carlton House Terrace, London, SW1Y 5AG

Registration will open at 5.45 p.m.

Mathematics and Financial Markets

Abstract: *A substantial proportion of mathematics graduates, at both first degree and doctoral level, enter the financial services sector. This is hardly surprising given the importance of the sector to the economy, and the role of mathematical modelling in the valuation of instruments and the assessment of risk. What is striking is that, with some notable exceptions, few mathematicians have been actively engaged in the design of financial markets. This is undoubtedly a serious challenge with parallels from other large-scale complex networks: to design a distributed system, linking self-interested and intelligent agents, so that the outcome is effective and efficient.*

How would an ideal market operate, to allow liquidity between long-term investors to be provided by short-term traders? In the second part of the talk I outline some preliminary work, joint with Elena Yudovina, on this question. I describe a simplified and analytically tractable model of a limit order book where the dynamics are driven by stochastic fluctuations between supply and demand. The model has a natural interpretation for a highly traded market on short time scales where there is a separation between the time scale of trading, represented in the model, and a longer time scale on which fundamentals change.

There has been considerable discussion recently of the effects of competition between multiple high-frequency traders, and of proposals aimed to slow down markets. A key issue is that traders may compete on the speed with which they can snipe an order rather than compete on price, and a proposed regulatory response is to use frequent batch auctions. Our model is clearly a caricature of a real limit order book, but it does provide insight into various high-frequency trading strategies (for example market-making, sniping and mixtures of these) and the impact on Nash equilibria when a market in continuous time is replaced by frequent batch auctions.

Professor Frank Kelly will be presented with the David Crighton Medal which is awarded biennially, for services both to mathematics and to the mathematical community, by the Institute of Mathematics and its Applications, and the London Mathematical Society.

Admission to the lecture and reception is by ticket only.
For tickets please contact Alison Penry at the IMA, Catherine Richards House, 16 Nelson Street, Southend-on-Sea, SS1 1EF or email alison.penry@ima.org.uk by 24 April 2016. Tickets are free of charge and will be allocated on a first come, first served basis.
Please confirm whether you wish to attend the lecture and reception, or the lecture only.

VISIT OF MIGUEL ORTEGA

Professor Miguel Ortega (Granada University) will be visiting Marie-Amélie Lawn at Imperial College London during February 2016. Professor Ortega's visit will be devoted to the mathematical problems of Translating Solitons in Lorentzian Manifolds. The study of Translating Solitons in Euclidean Space is currently a hot topic, so similar problems arise naturally in Lorentzian Manifolds, bearing in mind similarities and differences.

Professor Ortega will give a presentation on *Einstein 3-Sasakian homogeneous manifolds*.

For further information contact Marie-Amélie Lawn (m.lawn@imperial.ac.uk). The visit is supported by an LMS Scheme 4 Research in Pairs grant.

VISIT OF ARND SCHEEL

Professor Arnd Scheel (Associate Head of the School of Mathematics, University of Minnesota) whilst spending his sabbatical at the University of Münster will visit Dr Dave Lloyd at the University of Surrey around Easter 2016.

The objective of their project is to develop a theory of planar defect formation in pattern forming systems on growing domains. There is a significant amount of research looking at pattern formation in growing domains in biology and material science but there is little mathematical theory. A recent Nature Communications article on *Dynamic scaling of morphogen gradients on growing domains* in 2014 by Patrick Fried & Dagmar Iber highlights the timeliness of this project.

The project will build on the previous work of Scheel and his collaborators to look at planar grain boundary formation on one-sided growing planar domains with the aim of writing publications.

For further information contact Dave Lloyd (d.j.lloyd@surrey.ac.uk). The visit is supported by an LMS Scheme 4 Research in Pairs grant.

VISIT OF ASMA HASSANNEZHAD

Dr Asma Hassannezhad (Max-Planck Institute for Mathematics, Bonn) will visit the UK between 7 and 21 February 2016. Dr Hassannezhad works in geometric analysis and spectral geometry. During her visit, she will give talks at:

- Analysis seminar, University of Bristol, 8 February
  (contact: Michiel van den Berg, M.vandenBerg@bristol.ac.uk)
- London Analysis seminar, Imperial College, 11 February
  (contact: Leonid Parnovski, l.parnovski@ucl.ac.uk)
- Reading Analysis seminar, University of Reading, 12 February
  (contact: Michael Levitin, M.Levitin@reading.ac.uk)

For further details of the visit contact Michiel van den Berg or Michael Levitin. The visit is supposed by an LMS Scheme 2 grant.

VISIT OF SERGEY NABOKO

Professor Sergey Naboko (St Petersburg State University) will be visiting the UK in April and early May 2016. During this time, he will be largely based at the University of Kent. Professor Naboko is a leading expert on the spectral theory of both self-adjoint and non-self-adjoint operators. He will give talks on his operator and spectral theory at:

- University of Kent, Mathematics Colloquium, 5 April
  (contact Ian Wood: i.wood@kent.ac.uk)
- Cardiff University, Analysis Seminar, 18 April
  (contact Mikhail Cherdantsev: CherdantsevM@cardiff.ac.uk)
- University College London, London Analysis Seminar, 5 May
  (contact Leonid Parnovski: l.parnovski@ucl.ac.uk)

For further details contact Ian Wood (i.wood@kent.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISIT OF YVETTE KOSMANN-SCHWARZBACH

Professor Yvette Kosmann-Schwarzbach (Ecole Polytechnique, Palaiseau) will be visiting the UK for two weeks in March 2016. She is a senior figure in the areas between differential geometry and mathematical physics, in particular Poisson geometry, Lie algebroids, and the intricate bracket structures which arise in these subjects. Professor Kosmann-Schwarzbach will give the following talks:

- *Multiplicativity conditions for tensor fields and forms on Lie groupoids*
  Tuesday 8 March, University of Sheffield
- *The Jacobi identity from Jacobi to Loday and beyond*
  Wednesday 9 March, University of Sheffield
- *On the generalized geometry of Lie groupoids*
  Friday 11 March, Geometry and Topology Seminar, Imperial College, London
- *Courant algebroids and Dirac structures*
  Thursday 17 March, Geometry Seminar, Manchester

For further details of Professor Kosmann-Schwarzbach's lecture tour contact Kirill Mackenzie (K.Mackenzie@sheffield.ac.uk). The visit is supported by an LMS Scheme 2 grant.

EXPLICIT METHODS IN NUMBER THEORY

A conference on *Explicit Methods in Number Theory* in honour of John Cremona's 60th birthday will be held at the Mathematics Research Centre, University of Warwick from Monday 4 to Friday 8 April 2016. The invited speakers include:

- Barinder Banwait (Essen)
- Manjul Bhargava (Princeton)
- Bryan Birch (Oxford)
- Henri Cohen (Bordeaux)
- Tom Fisher (Cambridge)
- Hendrik Lenstra (Leiden)
- Ariel Pacetti (Buenos Aires)
- Soma Purkait (Kyushu)
- Haluk Sengun (Sheffield)
- Denis Simon (Caen)
- William Stein (Washington)
- Michael Stoll (Bayreuth)
- Drew Sutherland (MIT)
- Lynne Walling (Bristol)
- Don Zagier (MPIM Bonn)

Participants should register at: http://tinyurl.com/j9rzdfx. There is some limited support for UK PhD students, who should contact Samir Siksek (s.siksek@warwick.ac.uk). The meeting is supported by an LMS Conference grant and the EPSRC (Platform grant).

OPERATORS, OPERATOR FAMILIES AND ASYMPTOTICS

A conference on *Operators, Operator Families and Asymptotics* will be held from 16 to 19 May 2016 at the Department of Mathematical Sciences, University of Bath.

The conference is aimed at making an overview of the state of the art in a rapidly developing area of analysis concerned with application of the techniques of operator theory to the asymptotic analysis of parameter-dependent differential equations and boundary-value problems. Speakers will include:

- Yves Capdeboscq (Oxford)
- Giuseppe Cardone (Sannio)
- Tanya Christiansen (Missouri)
- Pavel Exner (Prague)
- Davit Haratyunyan (Utah)
- Rostyslav Hryniv (Lviv and Rzeszow)
- Ilia Kamotski (UCL)
- Alexander Kiselev (Kyiv)
- David Krejcirik (Rez)
- Pavel Kurasov (Stockholm)
- Zhongwei Shen (Kentucky)
- Stefan Neukamm (TU Dresden)
- Tatiana Suslina (St Petersburg)
- Jari Taskinen (Helsinki)

- Michael Vogelius (Rutgers)
- Ricardo Weder (UNAM)
- Ian Wood (Kent)

For more information, including the details of talks, visit tinyurl.com/OOFA-Info. Places are limited. Register as soon as possible or by **24 April 2016** at tinyurl.com/OOFA-Registration. The registration fee is £60, which includes lunches, tea and coffee. A limited amount of support is available for UK PhD students, including registration fee reimbursement.

The conference is supported by an LMS Conference grant, University of Bath (Global Mobility Scheme), EPSRC and Bath Institute for Mathematical Innovation.

YOUNG FUNCTIONAL ANALYSTS' WORKSHOP

The *Young Functional Analysts' Workshop* 2016 (YFAW) will take place at Queen's University Belfast from Wednesday 6 to Friday 8 April 2016. WFAW is an event aimed at early-stage researchers (postgraduates and postdocs) in functional analysis and related areas. YFAW offers participants an opportunity both to present their own work in front of a sympathetic audience, and to get to know less familiar areas of current research in functional analysis through talks given by other young researchers as well as invited talks from established researchers. The invited speakers are:

- Yemon Choi (Lancaster University)
- Cho-Ho Chu (Queen Mary University of London)
- Stanislav Shkarin (Queen's University Belfast)
- Tatiana Shulman (IM PAN, Warsaw)
- Aaron Tikuisis (University of Aberdeen)

All participants are encouraged to give a short talk. The registration fee is £30, and includes two nights' accommodation (if required) and the conference dinner. Some financial support towards travel expenses will also be provided. For more information visit the website: https://sites.google.com/site/yfawuk/about or contact the organizers Andrew McKee and Linda Mawhinney (yfaw2016@gmail.com). The conference is supported by an LMS Postgraduate Research Conference grant (Scheme 8).

HILBERT'S SIXTH PROBLEM

Hilbert in 1900

Hilbert's Sixth Problem Workshop will take place at the University of Leicester from 2 to 4 May 2016. The main aims are:

1. To facilitate interdisciplinary discussion across key mathematical and physical disciplines involved in solution of Hilbert's sixth problem about the state of art.
2. To synthetize an integral interdisciplinary point of view on Hilbert's sixth problem and renew the programmatic call in the light of the latest achievements.
3. To provide guidance to early career researchers via an indication of future research directions in Hilbert's sixth problem.
4. To disseminate the modern achievements and renewed programmatic call in a series of review publications.

Hilbert's 6th problem concerns the axiomatization of those parts of physics which are ready for a rigorous mathematical approach. Hilbert attracted special attention to the following aspects of this problem: (i) axiomatic treatment of probability with limit theorems for the foundation of statistical physics, and (ii) the rigorous theory of limiting processes 'which lead from the atomistic view to the laws of motion of continua'.

Hilbert's 6th problem gives a unique framework for collaborations of multiscale analysis with other fields of the mathematical sciences, from probability, logic and abstract algebra to mathematical physics.

A list of speakers and further information is available at http://tinyurl.com/j54sefg.

For further information email the organizers (Alexander Gorban, ag153@le.ac.uk). The meeting is supported by an LMS Conference grant, the EPSRC, the Institute of Mathematics and its Applications, and University of Leicester. The LMS grant supports PhD students traveling from the UK. Email the organizers if you fall in this category and wish to apply for funding.

POINT PROCESSES AND WARPING FUNCTIONS WITH STATISTICAL APPLICATIONS

The School of Mathematical Sciences at the University of Nottingham on 26 April 2016 will host a one-day workshop on exploring links between point processes and warping or deformation functions used in statistical shape and image analysis. The organisers hope to attract mathematicians and engineers, mainly from the United Kingdom, interested in the study of point processes and their use in engineering applications involving data analysis. Speakers include:

- Ian Jermyn (Durham)
- Sofia Olhede (UCL)
- Karthik Bharath (Nottingham)

There is a £20 fee for visiting academic staff and £10 fee for students. The meeting will be followed by a dinner (included in the registration fee). Details and registration information are available at http://tinyurl.com/z8yj887. The meeting is supported by an LMS Scheme 1 celebrating new appointment grant.

PROBABILISTIC COMBINATORICS

Celebrating Colin McDiarmid's Work

A two-day meeting on discrete mathematics in honour of Colin McDiarmid's retirement will be held at Corpus Christi College, University of Oxford on the weekend of 9 to 10 April 2016. The meeting will span Colin's research areas including probabilistic combinatorics, combinatorial optimisation, and graph colouring.

A list of invited participants and further information is available at www.stats.ox.ac.uk/~kang/colinworkshop/. Everyone is welcome to participate in the whole or part of the meeting. Funding for UK-based research students is available. Prospective participants should send a registration request to stefanie.gerke@rhul.ac.uk.

This meeting is supported by an LMS Conference grant, the British Combinatorial Committee, and the University of Oxford's Statistics Department.

THE HISTORY OF NUMBER THEORY

The History of Number Theory will take place at Birkbeck, University of London, on Saturday 21 May 2016 from 9:30 to 17:00. This is the second of what is hoped to be an annual day-long event organised by the British Society for the History of Mathematics (BSHM), and supported by the Department of Economics, Mathematics and Statistics at Birkbeck.

This year's event will trace the study of number theory from its ancient origins to the present day. The speakers are: Kevin Buzzard, Catherine Goldstein, Ben Fairbairn, Michalis Sialaros, Robin Wilson and Simon Singh.

For more information, and to register, visit http://tinyurl.com/bshmbbk2016 or navigate via the BSHM website: bshm.ac.uk.

WALES MATHEMATICS COLLOQUIUM

The 2016 colloquium will take place at Gregynog Hall, Tregynon, near Newtown, Powys beginning with tea at 4 pm on 23 May and run until after lunch on the 25 May. The Wales Mathematics Colloquium is a forum for the promotion and discussion of current research in mathematics in Wales. The invited speakers are:

- Darren Crowdy (Imperial)
- Anne Juel (Manchester)
- Tom Leinster (Edinburgh)

The Wales Mathematics Colloquia are organised jointly by the mathematics departments of universities in Wales, and most of the participants are expected to come from those departments. Any others who would like to attend will be very welcome. There are opportunities for contributed talks in any area of mathematics.

The Colloquium is partly supported by an LMS Conference grant. The registration fee is £200, to include all meals and accommodation. Further details are available at http://gregynog-maths-2016.dcs.aber.ac.uk/ or from Professor Simon Cox (sxc@aber.ac.uk).

MILNE ANDERSON

Professor Milne Anderson, who was elected a member of the London Mathematical Society on 17 January 1973, died on 20 November 2015, aged 76.

Aimo Hinkkanen writes: Milne did his PhD with Jim Clunie at Imperial College in 1963. After that, he spent time at ETH, Zurich, the University of Michigan and at Harvard, before becoming a Lecturer at University College London in 1965. There he was promoted to Reader in 1987 and to Professor in 1991.

Over the years Milne participated in collaborations with 48 co-authors resulting in many long term research visits. The universities he visited for at least a semester include Leningrad State University, the University of Illinois at Urbana-Champaign, the University of Virginia, the University of Texas at Austin, and the University of California at San Diego. He attended numerous conferences at Oberwolfach, and in both 2000 and 2009, I spent a three-week period with him there in the Research-in-Pairs programme.

Milne's mathematics was incredibly broad, yielding more than one hundred papers. In the early days most of his work was in the Nevanlinna value distribution theory and related questions, with several papers written with Clunie, which include sharp results for the characterization of Picard sets for entire functions. Milne's best known paper is the one from 1974 with Clunie and Ch. Pommerenke on Bloch functions, an important class of analytic functions defined in the unit disk. It features results on isomorphisms of certain function spaces, as well as on the distribution of zeros, the size of the coefficients, and the boundary behaviour of Bloch functions.

Milne worked extensively on probability theory with Loren Pitt, related to probabilistic aspects of analytic functions such as lacunary series, Bloch and univalent functions, and on functions in the Zygmund class and on Brownian motion.

Milne and I wrote altogether 16 papers, most of them on quasiconformal mappings, which was another frequent topic in Milne's work. Our collaboration also included a paper in complex dynamics of entire functions in 1998, concerning a problem of I.N. Baker on the boundedness of the components of the Fatou set of an entire function of sufficiently slow growth; the problem is still not completely solved. We developed the concept of self-sustaining spread to address many cases of this problem. This method has subsequently been used and extended by many authors.

Milne was keen on hiking and was a lifelong friend of classical music, particularly opera. He was a long-time regular visitor to Glyndebourne.

Milne was a delightful person and had many friends from all over the world. He hosted numerous visitors in his home in London. During any talk he gave, he always told a joke, often a Scottish one, and the audience were eagerly waiting for it. He will be greatly missed by his friends and colleagues.

LONDON MATHEMATICAL SOCIETY
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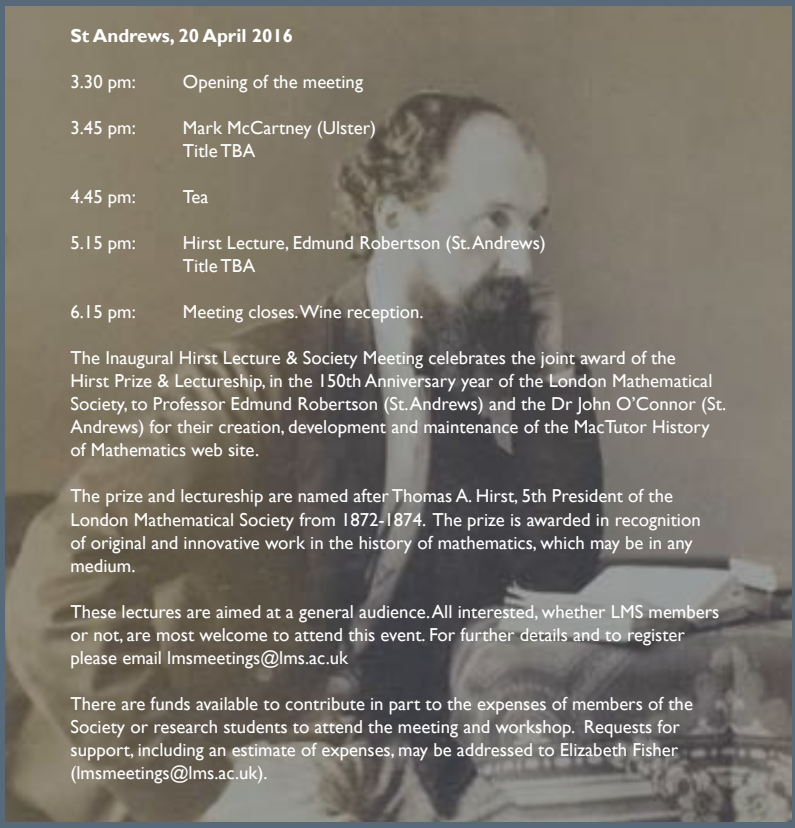
Inaugural Hirst Lecture & Society Meeting



St Andrews, 20 April 2016

3.30 pm:	Opening of the meeting
3.45 pm:	Mark McCartney (Ulster) Title TBA
4.45 pm:	Tea
5.15 pm:	Hirst Lecture, Edmund Robertson (St. Andrews) Title TBA
6.15 pm:	Meeting closes. Wine reception.

The Inaugural Hirst Lecture & Society Meeting celebrates the joint award of the Hirst Prize & Lectureship, in the 150th Anniversary year of the London Mathematical Society, to Professor Edmund Robertson (St. Andrews) and the Dr John O'Connor (St. Andrews) for their creation, development and maintenance of the MacTutor History of Mathematics web site.

The prize and lectureship are named after Thomas A. Hirst, 5th President of the London Mathematical Society from 1872-1874. The prize is awarded in recognition of original and innovative work in the history of mathematics, which may be in any medium.

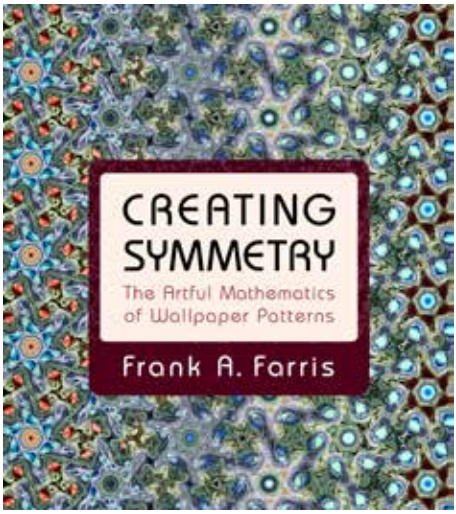
These lectures are aimed at a general audience. All interested, whether LMS members or not, are most welcome to attend this event. For further details and to register please email lmsmeetings@lms.ac.uk

There are funds available to contribute in part to the expenses of members of the Society or research students to attend the meeting and workshop. Requests for support, including an estimate of expenses, may be addressed to Elizabeth Fisher (lmsmeetings@lms.ac.uk).

1865 - 2015

CREATING SYMMETRY – THE ARTFUL MATHEMATICS OF WALLPAPER PATTERNS

by Frank A. Farris, Princeton University Press, 2015, £24.95, ISBN 978-0691161730



Every mathematician knows that there are 17 wallpaper patterns. Moreover most of us will own at least one book that includes a proof of this. We all know the drill: classify the symmetries of the plane, discover that symmetries form groups, classify the wallpaper groups. It is a lovely application of beautiful mathematics but can anything new be said about it? This book is about symmetry and wallpaper patterns, and I have to admit that I expected to be told a familiar story with perhaps the only difference being the high quality of the accompanying illustrations. I was wrong. Yes, the book does contain a proof that there are 17 wallpaper patterns, but its approach is completely different from what I have seen before.

This book is written by someone whose love for mathematics suffuses every page. He does a very good job of taking an idea for a walk. He starts with a very simple idea – what happens when we plot the curve:

$$f(t) = e^{it} + \frac{1}{2}e^{6it} + \frac{i}{3}e^{-14it}$$

in the complex plane? It turns out to have fivefold symmetry. But why? (The curve in question was one the author had chosen more or less at random as an exercise for calculus students studying parametric equations. The unexpected symmetry was the trigger that began the thoughts that ultimately resulted in this book.) The question of where the symmetry comes from leads to a discussion of how to encode reflections and rotations – complex conjugation and multiplication respectively, and a method of creating and classifying rosettes. When you have a rosette you can unfurl it to produce a frieze. And so on. By thinking of symmetries in terms of functions and waves, rather than of the figures in space these functions define, the author is able to employ the techniques of Fourier series, differential equations and other perhaps unexpected things. There are interesting diversions along the way, and I found many new ways of looking at familiar material which could be incorporated into exercises or challenges for interested students. The classification of the 17 wallpaper groups gets slightly repetitive (one might almost say periodic) but that probably can't be helped.

The style is chatty and informal, but proper mathematics is very definitely included and not brushed under the carpet. The author says he has three potential audiences in mind: the working mathematician, the advanced undergraduate and the "brave mathematical adventurer". I can certainly agree that the first two categories are well catered for. In particular there are exercises in each chapter with hints and solutions provided within a few pages, which guide the reader through the material in a helpful way. The brave mathematical adventurer will not get far without at least some calculus, but a bright sixth-former prepared to put in a bit of work would probably find it worth the effort.

The book itself is very nicely produced – a good clear layout with plenty of empty space; easy to read typeface and carefully edited text. The exercises and comments are clearly displayed at the side of the text. The

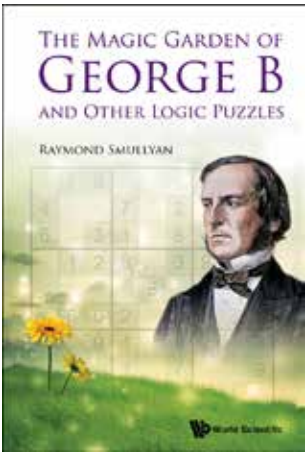
colour illustrations, produced by the author from his own photographs using the rosette, frieze and wallpaper functions he develops in the book, are very appealing. To steal from William Morris: put nothing in your book that you do not know to be useful or believe to be beautiful. The author of this book seems to have followed this precept. It would make a good addition to any university library.

Sarah Hart
Birkbeck, University of London

THE MAGIC GARDEN OF GEORGE B AND OTHER LOGIC PUZZLES

by Raymond Smullyan, World Scientific, 2015, pp 180, HB, £38.00, ISBN 978-9814675055, PB, £19.00, ISBN 978-9814678551, ebook, £14.00, ISBN 978-9814675079

The logician, philosopher, magician and concert pianist Raymond Smullyan, who is now 96, has been providing us with entertaining collections of logic puzzles ever since he published *What is the name of this book?* in 1978. This latest follows a similar format, offering a mixture of interesting puzzles, "monkey tricks" designed to catch the reader out, dreadful jokes, and insights into serious mathematics.



The book has two parts. The first presents a range of mathematical and logical puzzles, variations of the kind which will be familiar to readers of Smullyan's previous collections. I particularly enjoyed the headache-inducing Cornelius McSnurd. This curious fellow knows, on Mondays and Tuesdays, which propositions are true and which are false, but on Wednesdays and Thursdays he is confused and believes all and only those propositions which are false. Furthermore, on Mondays and Thursdays he always tells the truth, while on Tuesdays and Wednesdays he always lies (and on Fridays, Saturdays and Sundays he never speaks). We are asked, amongst other puzzles, how many questions we need to ask McSnurd (on one of his non-silent days) to ascertain what day of the week it is.

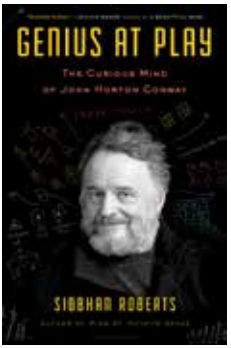
The second part gives the book its title. George B's garden is full of flowers, each of which on any given day is either red or blue. The garden has the property that, "For any flowers A and B – whether the same or different – there is a flower C which is red on those and only those days on which A and B are both blue." Smullyan then develops this ingenious floral version of Boolean algebra. It's a lovely idea, though in solving the problems I did tend to find myself mentally translating the statements about flowers into their Boolean equivalents.

The book's foreword is dated 2006 and the preface 2005, which suggests that it has been awaiting publication for some time. This is of significance only for a logical puzzle which requires one to use the information given to identify the partners in two married couples; the recent legalisation of same-sex marriage is a game-changer for such puzzles!

If you have enjoyed Smullyan's previous books, this one is self-recommending. If you're new to them, I'd suggest starting with *What is the name of this book?* And if you have a low tolerance for suggestions like Smullyan's easy way to tell the sex of a bird (offer the bird some seed, and if he eats it, the bird is male…) then this is probably not for you.

Tony Mann
University of Greenwich

GENIUS AT PLAY: THE CURIOUS MIND OF JOHN HORTON CONWAY
by Siobhan Roberts, Bloomsbury, 2015, £20.00, $30.00, ISBN: 9781620405932



This is a very interesting book. It paints a balanced (although not always flattering) picture of J.H. Conway's life and mathematics.

Unlike standard biopics, the book contains a great many verbatim quotes from Conway. Moreover, it often feels that Conway controls the narrative. It works very well but, at times, you are left doubting the story. In fact there are a few places in the book where Conway openly admits to embellishing the facts or even fabricating them completely. The famous story of Oliver Cromwell's head is a shining example. We also meet Conway's remarkable way (and obsession) with words, from his proud definition of promiscuous to his continuous worry that his peers will floccinaucinihilipilificate.

The superficial image of the protagonist fits the standard stereotype of the mathematician as the bearded sandal-wearing eccentric completely detached from real life. In this specific case, serial philandering and disregard for his friends and collaborators are thrown in the mix. On closer inspection however, we find much richer tones, for example in Conway's incredible dedication to the Mathcamp and the remarkable, somewhat surreal discussion with G. Odom about the importance of the cube in the Bible. And then you remember a quote from Act I: 'Roughly speaking, I was going to become the kind of person you see now. It was a free decision'.

The book is also teeming with brief portraits of a large numbers of mathematicians from K. Gödel to T. Tao. Some of these descriptions are almost soundbites. My favourite example is: 'Marshal Hall, an eminent group theorist with a southern drawl and an impressive collection of ancient coins'. I laughed at some of these and cringed at others.

There is a surprising amount of mathematics in the book. Some is deep and sophisticated, some rather trifling, most of it involves games of some kind, all of it is beautiful and enjoyable. My favourite chapter is *Snip, clip, prune, lop*, a quick description of surreal numbers and related matters. It is whimsical and clear at the same time; one can easily imagine Conway's own description 'when I found these things I really did go round in a daydream for a long, long time'.

Perhaps the main plot of the book is the love-hate relationship Conway has with *The Game of Life*. Not surprisingly, most people identify Conway with it. It is a beautiful construct and easy to describe to a layman (unlike say Conway's sporadic simple group or Monstrous Moonshine). At one point there is even a discussion on how much *The Game of Life* cost taxpayers owing to workplace hours lost by people watching Life evolve. Conway is at the same time proud and sick of it. He clearly enjoys the attention it generates but, understandably, deplores the idea that he will only be remembered for it rather than his deeper findings. One could easily think of worse fates.

In a way the book can be read as Conway's reminiscing about his (mathematical) life during a series of talks about the recent Conway-Kochen *Free Will Theorem*. As Conway describes it: 'if experimenters have free will, then elementary particles possess free will as well'. This is his latest brainchild and it fits so well in the structure of the book and Conway's attitude towards things. He makes it the interactions with the team of rather deterministic minded neurologists that measure his brain functions: 'what's preventing me from just thinking of sexual fantasies when I'm in the machine?'

Finally there is the discussion about

whether J.H. Conway's mathematics should have been more 'serious'. The book spends a significant amount of pages hinting at that. I think this is completely beside the point; mathematics should not be judged by its seriousness but rather by its beauty. J.H. Conway's mathematics shines in that regard.

I should mention that there are a few historical inaccuracies and omissions, which is a pity for a book so carefully researched. For example in describing the Moscow congress the author notes a pro Vietnam petition but fails to mention the famous S. Smale's press conference and subsequent arrest or A. Grothendieck's boycott. Also some of the main protagonists of the Classification theorem are barely mentioned in the book.

All things considered, this is a very intriguing and interesting book. I enjoyed it very much and learned a great deal from it. Thanks!

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University of Birmingham

Isaac Newton Institute for Mathematical Sciences

FROM THE CONTINUUM TO THE TECTONIC: THE MAGMA/MANTLE DYNAMICS OF PLANET EARTH

6-10 June 2016

in association with the Isaac Newton Institute programme
Melt in the Mantle
(15 February – 17 June 2016)

Plate-tectonic boundaries are the predominant (but not the only!) geological context for mantle melting. Global-scale tectonic forces acting on plates give rise to mantle flows. At divergent and convergent plate boundaries, these flows carry with them the energy required for partial melting, leading to extensive volcanism. The nature of the boundary imposes geometric and material aspects of the problem: in subduction zones, for example, melting takes place in a wedge of mantle rock that lies above the foundering tectonic plate and below the surface tectonic plate. This wedge is permeated with water, CO2, and other chemicals that are released from the foundering plate and that chemically react to trigger melting. Furthermore, the tectonic context shapes the observations that can be made, and which models should aim to reproduce: mid-ocean ridges, for example, are found beneath several kilometres of ocean, creating some challenges (and some advantages) for observationalists.

Models of magma/mantle dynamics that seek to match observations must respect the geometric and material influences of the tectonic context. For understanding the Earth, modelling the geological context may be as important as capturing the fundamental conservation principles and the material properties of a two-phase continuum.

These features impose the multi-scale nature of the phenomena and present significant challenges for numerical modelling. They are, however, crucial aspects of the system that should not be neglected in an attempt to explain observations.

One important class of observation that could constrain such models comes from measurements of seismic waves. When seismic waves have passed through the partially molten region and arrived at the surface, they carry some information about the properties of the medium. However, interpretation of such measurements in terms of those properties is not straightforward. Their analysis requires models of poro-(an)elasticity based-on grain scale physics, represented in terms of continuum theory, and informed by the meso-scale patterns that emerge from magma/mantle dynamics. There are many challenges in the development and use of such theory.

The aim of this workshop is therefore to bring together mathematicians and scientists working on multi-scale problems in numerical analysis, software, and modelling. In particular, the workshop will focus on measuring (seismically) and modelling magma transport through a porous medium, albeit one that is deforming viscously.

Further information and application forms are available from the website
www.newton.ac.uk/event/mimw03

Closing date of the receipt of applications **4 March 2016**.

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.

FEBRUARY 2016

4-5 From Symbolic Dynamics to Approximation Methods, King's College London (453)
5-6 Integrable Systems, Newcastle (454)
8 Why be Noncommutative? University College London (454)
26 Mary Cartwright Lecture, London (455)

MARCH 2016

16-20 Nordic Congress of Mathematicians, Stockholm (453)
21 LMS Meeting at BMC 2016, Bristol (455)
21-24 BMC 2016, Bristol (455)
21-25 LMS Invited Lectures, Edgar Knobloch (Berkeley), Loughborough (455)
29-1 Apr Algebraisation and Geometrisation in the Langlands Programme, Bristol (453)
30-2 Apr Singularities and Applications, Liverpool (454)

APRIL 2016

4-8 Explicit Methods in Number Theory in Honour of John Cremona's 60th, Warwick (455)
4-8 Easter Probability Meeting on Random Structures Arising in Physics and Analysis, Lancaster University (453)
5-8 BAMC 2016, Oxford
6-8 Young Functional Analysts' Workshop, Queen's University Belfast (455)
9-10 Mathematics Emerging, The Queen's College, Oxford (454)
9-10 Probabilistic Combinatorics, Oxford (455)
11-15 From the Grain to the Continuum, INI Workshop, Cambridge (454)
20 LMS Inaugural Hirst Lecture, St Andrews (455)
26 Point Processes and Warping Functions with Statistical Applications, Nottingham (455)

MAY 2016

2-4 Hilbert's Sixth Problem Workshop, Leicester (455)
12 The David Crighton Lecture, Professor Frank Kelly, The Royal Society, London (455)
16-19 Operators, Operator Families and Asymptotics, Bath (455)
18-20 The Dymamics of Complex Systems, Warwick (454)
20-21 Groups in Galway, National University of Ireland, Galway (454)
21 The History of Number Theory, Birkbeck, University of London (455)
23-25 Wales Mathematics Colloquium, Gregynog Hall, Powys (455)

JUNE 2016

6-10 From the Continuum to the Tectonic INI Workshop, Cambridge (455)
20-24 Spatially Distributed Stochastic Dynamical Systems in Biology INI Workshop, Cambridge (455)

JULY 2016

4-8 Modern Topics in Nonlinear PDE and Geometric Analysis, Reading (454)
8 LMS Graduate Student Meeting, London
8 LMS Meeting, London
18-22 7ECM, TU Berlin (451)
21 LMS Meeting at the 7ECM, Berlin
25-31 International Mathematics Competition for University Students, Blagoevgrad, Bulgaria (455)

AUGUST 2016

1-4 Young Researchers in Mathematics Conference, St Andrews
25-26 Caucasian Mathematics Conference, Turkey (453)

SEPTEMBER 2016

18-23 Heidelberg Laureate Forum (454)

NOVEMBER 2016

11 LMS Graduate Student Meeting, London
11 LMS Annual General Meeting, London

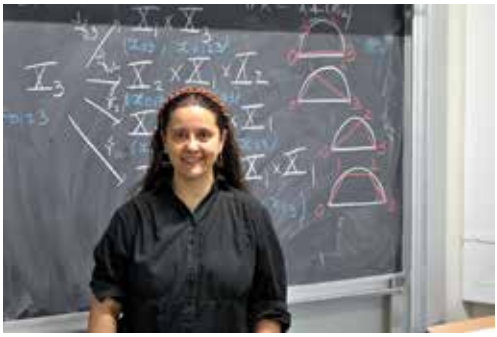
DECEMBER 2016

20 LMS South West & South Wales Regional Meeting, Bath

LMS-FUNDED MEETING: BRITISH TOPOLOGY MEETING

held at Queen's University Belfast from 7 to 9 September 2015

(see report on page 8)

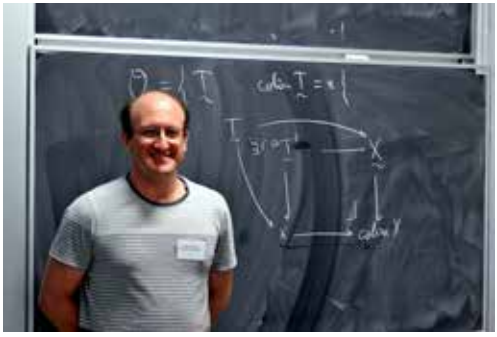


Imma Gálvez Carrillo (Catalonia, Spain)

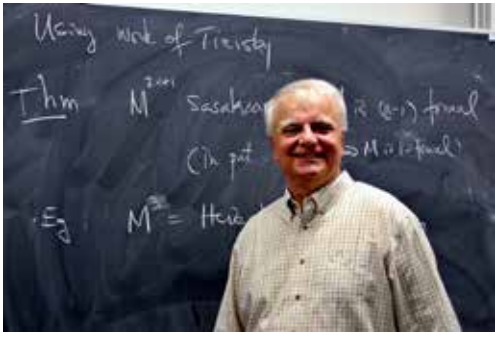
Jarek Kędra (Aberdeen, UK)

Carlos Casacuberta (Barcelona, Spain)

Graham Ellis (Galway, Ireland)



Boris Chorny (Haifa, Israel)



Alexandru Suciu (Boston, USA)