NEWSLETTER

SIR CHRISTOPHER ZEEMAN ARCHIVE

On 19 March 2015 the London Mathematical Society launched the Sir Christopher Zeeman Archive together with Sir Christopher's family at a small ceremony at Hertford College, University of Oxford. The online archive represents a lifetime of his work, including letters he wrote, papers and books he published and interviews he gave.

Sir Christopher Zeeman is widely considered an icon of modern mathematics and the LMS is delighted to be hosting the archive on its website, particularly as he is a Past President of the Society.

His contributions to mathematics range from geometric topology to dynamical systems, with applications across the sciences. He is known among the wider scientific public for his contribution to, and spreading awareness of Catastrophe Theory, and for the 1978 televised Christmas Lectures at the Royal Institution, from which grew the Mathematics Masterclasses for primary and secondary school children that now flourish around the United Kingdom.

Professor Terry Lyons, current President of the LMS, paid tribute to Sir Christopher at the ceremony, saying, "Christopher Zeeman's contribution to mathematical sciences is distinctive for its range, excellence and enormous achievement. It is a real pleasure to congratulate him on his 90th birthday and launch of the archive of his work".

The ceremony was attended by a number of Sir Christopher's family and friends – including Will Hutton and Walter Bodmer – and to especially mark the occasion a commemorative book was presented to him containing scores of messages and birthday wishes.

To access the archive, please visit www.lms.ac.uk/2015/zeeman_archive.

SOCIETY MEETINGS AND EVENTS

Contents

No. 448 June 2015

SIX MATHEMATICIANS AMONG NEW ROYAL SOCIETY FELLOWS

On 1 May 2015 the Royal Society released details of its newly-appointed Fellows, among whom were six mathematicians: Clifford Cocks, Alison Etheridge, Philip Maini, Jens Marklof, Jonathan Pila and Richard Thomas.

Appointed annually, Royal Society Fellowships are awarded to the most eminent scientists, engineers and technologists from or living and working in the UK and Commonwealth. 47 new Fellows were announced this year, bringing the total number of living Fellows to over 1,400.

Professor Terry Lyons, President of the London Mathematical Society and himself a Fellow of the Royal Society, said of the announcement, "This year's election makes me proud to be a mathematician and to see how profoundly mathematics permeates our society. The diversity of the contributions spans from the most fundamental work on encryption to the understanding of blood flow, from the special behaviour of biological organisms and from the foundations of logic through to the wonders of geometry, topology and mathematical physics."

Professor Lyons congrated the new fellows on their election on behalf of the London Mathematical Society.

For the full list of new Royal Society Fellows visit www.royalsociety.org/about-us/fellowship/new-fellows-2015/.

The mathematicians

- **Clifford Cocks** is the chief cryptographer at GCHQ who first discovered the widely-used RSA encryption algorithm in 1973. His discovery was not declassified until 1997 by which time the algorithm was assumed to have been discovered by Ron Rivest, Adi Shamir and Leonard Adleman. http://en.wikipedia.org/wiki/Clifford_Cocks
- **Alison Etheridge** is a professor of statistics at Oxford University whose recent work has focussed on population genetics. In 2011 she gave the London Mathematical Society's Mary Cartwright lecture on *Evolution in a spatial continuum*. www.stats.ox.ac.uk/people/academic_staff/alison_etheridge
- **Philip Maini** is head of the Centre for Mathematical Biology at Oxford's Mathematical Institute where he constructs mathematical models of spatiotemporal processes in biology such as self-organisation during embryonic development, normal and abnormal wound healing and cancer growth. In 2009 he was awarded the London Mathematical Society's Naylor Prize and Lectureship in Applied Mathematics. https://people.maths.ox.ac.uk/maini/
- **Jens Marklof** is a German professor of mathematical physics at the University of Bristol with interests in quantum chaos,

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dynamical systems and number theory. In June 2010 Marklof was awarded the London Mathematical Society's Whitehead Prize for his work on quantum chaos, random matrices and number theory.
www.maths.bris.ac.uk/~majm/

• **Jonathan Pila** is an Australian-born reader in mathematical logic at Oxford. In 2011 he was awarded the London Mathematical Society's Senior Whitehead Prize in recognition of his work on the Andre-Oort and Manin-Mumford conjectures. According-ing to the citation, "The approach he and his collaborators have developed, which combines analytic ideas with model theory, is entirely new and shows great promise for further applications."
www.maths.ox.ac.uk/people/jonathan.pila

• **Richard Thomas** is a professor of pure mathematics at Imperial College London working in several areas of geometry. He was awarded the London Mathematical Society's Whitehead Prize in 2004.
www.imperial.ac.uk/people/richard.thomas

GENERAL MEETING

There will be a General Meeting of the London Mathematical Society on Friday 3 July 2015 at 3.30 pm, to be held at the BMA House, Tavistock Square, London WC1H 9JP. The business shall be:

• the appointment of Scrutineers
• announcement of Council's recommendation for Election to Honorary Membership
• announcement of LMS prize winners for 2015.

The General Meeting will be followed by a Society meeting. It is hoped that as many members as possible will be able to attend.

Fiona Nixon
Executive Secretary

MATHEMATICS POLICY ROUND-UP

May 2015

SCHOOLS AND COLLEGES

Consulting on a new regulated qualifications framework
Ofqual has published a consultation proposing a new framework describing all regulated qualifications in England and vocational qualifications in Northern Ireland.

This consultation follows the decision to withdraw the rules governing the Qualifications and Credit Framework (QCF). The consultation runs until 17 June and more information is available at http://tinyurl.com/psmguqr.

Education manifesto
The think tank Policy Exchange has produced an education manifesto. This manifesto includes a section on *Maths to 18*. The opening statement reads, 'government should commit that all post 16 students, re-gardless of whether pursuing academic or technical qualifications, must complete a standalone maths qualification by the age of 18'. The full report is available at http://tinyurl.com/q2n5k9p.

OTHER

Earnings and employment
A report commissioned by the Department for Education – *The earnings and employment returns to A-levels* – to analyse the returns to A-levels indicates that compared to GCSEs/O-levels, there are strong positive wage returns to A-levels – irrespective of whether the individual goes on to complete further or higher qualifications. The key messages include:

• The wage returns are greater when a STEM A-level is undertaken compared to A-levels in other subjects; however, for those individuals with A-levels as their

highest qualification, there is no appreciable increase in earnings as further STEM specialisation occurs. In other words, for these individuals, some degree of subject breadth at A-level is associated with the greatest returns. In contrast, individuals who go on to attain further or higher qualifications see the greatest return associated with prior specialisation in STEM subjects.

• Compared to GCSEs/O-levels, for men whose highest qualification consists of a STEM A-level at grade A-C, this premium amounts to approximately £7,000 per annum between the ages of 29 and 42 (in 2014 prices). The corresponding estimate for women stands at £4,500 per annum. The full report is available at http://tinyurl.com/msbh74l.

Dr John Johnston
Joint Promotion of Mathematics

SET FOR BRITAIN

Three mathematicians on Monday 9 March 2015 won medals and awards at a competition in the House of Commons for the excellence of their mathematics research, walking away with a £3,000, £2,000 and £1,000 prize for Gold, Silver and Bronze respectively.

Dr Peter Buchak from Imperial College London, Dr Lorna Ayton from the University of Cambridge, and Dr Miho Janvier from the University of Dundee, each presented research to dozens of politicians and a panel of expert judges as part of the poster competition SET for Britain on Monday 9 March.

Dr Peter Buchak was awarded Gold for his poster titled, *Lighting the path: the mathematics of imaginary numbers in very real problems of holey optical fibre fabrication*, Dr Lorna Ayton won Silver for her research on reducing the sound generated by aeroengines, and Dr Miho Janvier won Bronze for her research on *Statistical studies of solar storm geometry for better space weather predictions*. The three winners were judged against 29 other shortlisted mathematicians and came out on top.

Professor Nicholas Woodhouse, President

Nick Woodhouse, Andrew Miller MP, Dame Celia Hoyles DBE, Miho Janvier, Lorna Ayton, Peter Buchak, Stephen Benn

of the Clay Mathematics Institute (CMI), sponsors of the Gold Mathematical Sciences award, said, "CMI is delighted to support the SET for Britain Mathematical Sciences exhibition. The Institute is dedicated to increasing and disseminating mathematical knowledge and supports the work of leading researchers throughout the world at various stages of their careers. The future of mathematics in the UK is both challenging and exciting and we believe it is essential to nurture the best technical talent".

Sir Adrian Smith, Chair of the Council for the Mathematical Sciences (CMS) said: "The CMS is delighted that the mathematical sciences have been involved in this prestigious event for the second, successive year; it is a wonderful opportunity to showcase the importance of the mathematical sciences to a wider audience. It is paramount to encourage early-career research scientists, engineers, technologists and mathematicians and the SET for Britain event is a very effective way of doing this. We have been encouraged by the enthusiastic response from early-career researchers in the mathematical sciences and feel sure this will continue in the future."

Andrew Miller MP, Chairman of the Parliamentary and Scientific Committee, said, "This annual competition is an important date in the parliamentary calendar because it gives MPs an opportunity to speak to a wide range of the country's best young researchers.

"These early career engineers, mathematicians and scientists are the architects of our future and SET for Britain is the best opportunity for politicians to meet them and understand their work."

The Parliamentary and Scientific Committee run the event in collaboration with the Society of Biology, the Council for the Mathematical Sciences, the Institute of Physics, the Physiological Society, the Royal Academy of Engineering, the Royal Society of Chemistry and the Society of Chemical Industry, with financial support from INEOS, BP, Essar, Clay Mathematics Institute, Warwick Manufacturing Group (WMG), Institute of Biomedical Science, Wiley and the Bank of England.

THE BSHM-LMS 150TH ANNIVERSARY DE MORGAN DAY
Report

De Morgan Day was aptly held at De Morgan House on 9 May 2015 in collaboration with the British Society for the History of Mathematics (BSHM) to celebrate the 150th Anniversary of the London Mathematical Society and to pay special respect to its founding President, Augustus De Morgan.

The day began with *An Introduction to the Life and Work of Augustus De Morgan* by Dr Adrian Rice (Randolph-Macon College, US) who gave an insightful account of De Morgan's life, his contributions to mathematics (particularly with regard to algebra and logic), and his work as the first professor of mathematics at University College London.

Dr Christopher Hollings (University of Oxford) went on to discuss *A Batch of Observations & Enquiries: The Correspondence of Ada Lovelace and Augustus De Morgan*. Detailing their correspondence between 1840 to 1841, Collings made the case that Lovelace had both a passion and genuine aptitude for mathematics – to some extent thanks to De Morgan – contrary to some previous assessments of her ability.

Professor Sloan Despeaux (Western Carolina University) gave the last of the morning's talks, titled *Augustus De Morgan's 'Budget of Paradoxes'*. Despeaux gave an engaging (and at one point musical) account of De Morgan's 1872 series of reviews on eccentric science. Highlighting some of its most humorous excerpts, Despeaux showed brilliantly why De Morgan's 1872 text continues to have such wide-ranging and lasting appeal.

After lunch, Dr John Heard talked methodically and in detail about *Augustus De Morgan and the Early History of the London Mathematical Society*. The talk was convincing in its insistence that De Morgan was responsible not only for the Society's foundation but also its early, rapid success. Heard looked at his continued involvement until his death in 1871 and considered whether his early hopes and expectations were realised during the succeeding three decades to the turn of the century.

Professor Ian Stewart (University of Warwick) next gave a talk on the long-standing friendship between Augustus De Morgan and George Boole, providing particular insight into their common interests in symbolic logic, symbolic algebra, probability, differential equations, and the eccentrics so central to De Morgan's *Budget of Paradoxes*. The talk provided a short trip through their interactions, including career advice as well as mathematics and more personal discussions, based on Desmond MacHale's *The Life and Work of George Boole*.

Lastly, Dr Wilfrid Hodges (formerly QMUL) talked about *The Influence of Augustus De Morgan*, arguing that De Morgan was perhaps not an outstandingly original or insightful mathematician but that he was certainly a determined and skilled educator, particularly in logic, and that his influence is widespread as a result. "He was one of the first people to bring to general attention some things that we now regard as fundamental," Hodges claimed, "for example mathematical induction, the De Morgan Laws and Boolean duality, quantifiers and their domains and relational logic."

Jesse Garrick
LMS Anniversary
Communications Assistant

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Augustus De Morgan exhibition, curated by Adrian Rice, displayed at the De Morgan Day meeting

LONDON
MATHEMATICAL
SOCIETY
150 YEARS

LMS 150th Anniversary

Hardy Fellow

The Society is pleased to announce Professor Nalini Joshi (Sydney) as the 2015 Hardy Fellow.

In celebration of the 150th Anniversary, the LMS is hosting a special Hardy Fellowship in 2015. The Fellowship was founded in 1967 in memory of G.H. Hardy in recognition of outstanding contribution to both mathematics and to the Society. The Hardy Fellowship is a lecture tour of the UK by a mathematician with a high reputation in research.

Nalini Joshi will visit the UK in June and July 2015 and she will give talks at:

Imperial	**Oxford**	**Bath**	**Glasgow**	**Lancaster**
17 June	18 June	19 June	22 June	24 June
Organiser:	Organiser:	Organiser:	Organiser:	Organiser:
John Gibbons	Lionel Mason	Antal Jarai	Jon Nimmo and Claire Gilson	Alexander Belton

Loughborough	**Leeds**	**Kent**	**London**
26 June	29 June	1 July	3 July
Organiser:	Organiser:	Organiser:	Organiser:
Marta Mazzocco	Frank Nijhoff	Peter Clarkson	LMS

For further information on attending each lecture, please contact the local organisers.
For general enquiries about the Hardy Lectures, please contact Elizabeth Fisher
lmsmeetings@lms.ac.uk

LONDON
MATHEMATICAL
SOCIETY
150 YEARS

LMS 150th Anniversary

Midlands Regional Meeting

University of Warwick

Schedule

- Opening of the meeting
- R. Guralnick (Los Angeles)
  Title TBC
- C. Roney-Dougal (St Andrews)
  Title TBC
- Tea/Coffee
- Poster Session
- Wine Reception and Dinner

7th July 2015

These lectures are aimed at a general mathematical audience. All interested, whether LMS members or not, are most welcome to attend this event. For further details and to register and to reserve a place at the dinner, please visit www2. warwick.ac.uk/fac/sci/maths/research/events/2014-15/nonsymposium/lmsreg/

The cost of the dinner is to be confirmed, but will include drinks.

The meeting forms part of a workshop on Finite Simple Groups and Related Topics from 8-10 July 2015. For further details visit www2.warwick.ac.uk/fac/sci/maths/ research/events/2014-15/nonsymposium/lmsreg/ or contact the organiser, Inna Capdeboscq.

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 the organisers.

CELEBRATING 150 YEARS OF THE LONDON MATHEMATICAL SOCIETY

LONDON MATHEMATICAL SOCIETY
150 YEARS

The following meetings and events are part of the year-long programme celebrating the 150th LMS Anniversary in 2015. Full details of the anniversary programme of activities are available on the LMS website at www.lms.ac.uk/2015.

DEPARTMENTAL CELEBRATION

University of Leicester, 3 June
Plymouth University, 12 June
University of Bath, 19 June
Oxford Brooks University, 22 June
University of Strathclyde, 22 June
University of Kent, 1 July
University of Chester, 3 July
University of Birmingham,18 September
University of Lancaster, 30 September
Queen Mary University, 12 October

LOCAL HEROES EXHIBITION

Dundee 22 August – 1 November
Tenby 7 September – 23 October
Carrickfergus 10-18 October

HARDY LECTURE TOUR

(see page 8)
Imperial College, 17 June
Oxford, 18 June
Bath, 19 June
Glasgow, 22 June
Lancaster, 24 June
Loughborough, 26 June
Leeds, 29 June
Kent, 1 July
London, 3 July

JUNE - AUGUST

Anniversary Dinner
18 June, Goldsmiths' Hall, City of London
Popular Lectures London
25 June *(see page 29)*
Royal Society Summer Science Exhibition
30 June – 5 July, London
LMS-CMI Research School
*Regularity and Analytic Method
in Combinatorics*
1-5 July, University of Warwick
LMS Graduate Student Meeting
3 July, London *(see page 21)*
LMS Meeting & Hardy Lecture: Nalini Joshi
3 July, London *(see page 20)*
LMS-CMI Research School
Developments in Modern Probability
5-10 July, University of Oxford
Enhanced Midlands Regional Meeting
7-10 July, University of Warwick

Durham Symposium
*Permutation Groups and Transformation
Semigroups*
20-30 July, Durham University
Durham Symposium
*New Moonshines, Mock Modular
Forms and String Theory*
3-12 August, Durham University
**Young Researchers in Mathematics
Conference**
17-20 August, University of Oxford

SEPTEMBER - OCTOBER

LMS-CMI Research School
Diophantine Equations
15-19 September, Hay-on-Wye
Computer Science Colloquium
17 September, The Royal Society, London
**Joint Anniversary Mathematical Weekend
Meeting with the European
Mathematical Society**
18-20 September, University of Birmingham
(see page 30)
Open House
20 September, De Morgan House, London
Popular Lectures Birmingham
23 September *(see page 28)*
Popular Lectures Glasgow
21 October *(see page 28)*
Bloomsbury Festival
22-25 October, London

NOVEMBER - DECEMBER

Popular Lectures Leeds
11 November *(see page 28)*
**LMS Anniversary Prize Giving
AGM and Annual Dinner**
13 November, London
Mathematics Festival @ The Science Museum
24-29 November, London
**Joint Meeting with the Institute of Physics and
Royal Astronomical Society**
28-29 November, QMUL, London
**Joint Meeting with the Edinburgh
Mathematical Society**
10-11 December, ICMS, Edinburgh
**Enhanced South West and South Wales
Regional Meeting**
14-17 December, University of Southampton
LMS Prospects in Mathematics
15-16 December, Loughborough

B(A)MC AND LMS MEETING

Report

The 2015 joint meeting between the British Mathematical Colloquium (BMC) and the British Applied Mathematics Colloquium (BAMC) was held at the University of Cambridge from 30 March to 2 April. The event was the fourth of its kind, succeeding previous joint meetings at the universities of Warwick (2002), Liverpool (2005) and Edinburgh (2010).

The B(A)MC this year included a day celebrating the London Mathematical Society's 150th Anniversary. As part of its year-long

Andrew Wiles

schedule of celebrations, on 1 April the Society held two plenary lectures in Lady Mitchell Hall and a reception prior to the conference dinner at Churchill College. Speaking of the success of the day's events, LMS President Professor Terry Lyons said, "The BMC and the BAMC are important annual landmarks for mathematicians in UK universities. It was tremendous that our 150th anniversary should coincide with the five-yearly cycle of joint meetings between the BMC and BAMC where the whole mathematical community comes together".

The first LMS plenary talk was given by

Professor Robert Calderbank (Duke University) on *The Art of Measurement*. Then, following an afternoon of workshops including some groups funded by LMS Scheme 3 grants and an LMS Society Meeting, a second plenary talk was given by Professor Sir Andrew Wiles titled *On the Arithmetic of Ideal Class Groups*. Speaking of the plenaries, Professor Terry Lyons said, "Our speakers, Robert Calderbank and Andrew Wiles, are both landmark contributors to the world of mathematics and they gave participants windows into pure and applied mathematics at the highest levels."

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Both plenary talks generated a great deal of discussion at the LMS drinks reception and dinner at Churchill College, which followed the conference. At the reception, a toast was given by Professor Terry Lyons and the dinner was followed by a speech by Professor Philip Nelson, Chief Executive of the Engineering and Physical Sciences Research Council (EPSRC).

Jesse Garrick
LMS Anniversary
Communications Assistant

Robert Calderbank

RECORDS OF PROCEEDINGS AT LMS MEETINGS
ORDINARY MEETING, 1 APRIL 2015

held at the University of Cambridge, during the fourth joint British Mathematical Colloquium – British Applied Mathematical Colloquium, as part of the Society's 150th Anniversary Day. Over 200 members and visitors were present for all or part of the meeting.

 The meeting began at 4.40 pm with The President, Professor Terry Lyons FRS, in the Chair.

 The Treasurer, Professor Robert Curtis, presented a report on the Society's activities.

 No members were elected to membership.

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

 Professor Lyons introduced a lecture given by Professor Sir Andrew Wiles FRS on *On the arithmetic of ideal class groups*.

 The Chair expressed the thanks of the Society to the speaker for giving a fascinating lecture.

 The Chair also expressed the thanks of the Society to Professor Robert Calderbank for giving an interesting lecture on *The Art of Measurement*, which took place earlier that morning as part of the Society's 150th Anniversary Day.

 The Chair thanked Rachel Camina, Stephen Cowley, Tom Fisher and Nigel Peake for organising a successful joint BMC - BAMC.

 The Chair then thanked all of the LMS Scheme 3 Workshop organisers and June Barrow-Green, who organised the *History of Mathematics Workshop*, for arranging an exciting selection of workshops to commemorate the Anniversary.

 Afterwards, a reception was held at Churchill College.

RECORDS OF PROCEEDINGS AT LMS MEETINGS
ORDINARY MEETING, 7 APRIL 2015

held at the University of Lancaster as part of the Enhanced 150th Anniversary Northern Regional Meeting and formed part of the regional workshop on *Homotopical Algebra and Geometry*. Over 45 members and visitors were present for all or part of the meeting.

 The meeting began at 2.00 pm with the President, Professor Terry Lyons FRS, in the Chair.

 There were no members elected to membership at this Society Meeting.

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

 Dr Jan Grabowski introduced a lecture given by Dr Peter Neumann on Aspects of *Algebra in Britain 1865 – 2015*.

 Dr Grabowski then introduced a lecture given by Professor Ieke Moerdijk on *The Homotopical Algebra of Operads and Trees*.

 After tea, Dr Grabowski introduced the final lecture given by Dr Michael Batanin, who stood in for Professor Dennis Sullivan due to the latter being unable to attend. Dr Batanin spoke on *Polynomial Monads and Homotopy Theory of Operads and Algebras*.

 The President, Professor Lyons, expressed the thanks of the Society to the speakers and to Jan Grabowski, Andrey Lazarev, Paul Levy and Mark MacDonald for putting on such a wonderful meeting.

 Afterwards, the reception and Society Dinner were held at The Gatehouse Restaurant.

RECORDS OF PROCEEDINGS AT LMS MEETINGS
ORDINARY MEETING, 9 MAY 2015

held at De Morgan House, 57-58 Russell Square, London, as a joint meeting with the British Society for the History of Mathematics (BSHM). The meeting formed part of the London Mathematical Society's programme of 150th Anniversary Celebrations and was dedicated to its first President, Augustus De Morgan. Over 65 members and visitors were present for all or part of the meeting.

The meeting began at 10.30 am with The President, Professor Terry Lyons FRS, in the Chair.

Professor Ian Stewart presented the London Mathematical Society with a gift of Augustus De Morgan's Book of Logarithms Tables, The cover bears the inscription "Logarithm book belonging to Prof. de Morgan given me by W. de Morgan 1892, S. Pickering."

Thirty-three members were elected to Ordinary membership: Dinesh Kumar A, Dimitra Antonopoulou, Andrew Apps, John Aston, Arend Bayer, Ines Bonacho dos Anjos Henriques, Chris Bowman, Ed Brambley, Chris Breward, Ruslan Davidchack, Aiman Elragig, Daniel Elton, Paul Glaister, Imededdine Jerbi, Baoguo Jia, Evgenios Kakariadis, Gechun Liang, Timothy Mabiza, Hadrien Montanelli, Ragavan Murugasan, Tri-Dung Nguyen, Chibuzor Nnanatu, Simona Paoli, William Parnell, Shaik Mohiddin Shaw, Sanasam Sarat Singh, Haleema Subzwari, Claude Warnick, Martin Wolf, James Woodcock, Yulei Wu, Pavlos Xenitidis, Zhong Zhong.

Four members were elected to Reciprocity Membership: Man Fung Lo, Israel Ncube, Georgios Vafeiadis, Dhurata Valera.

Twenty members were elected to Associate Membership: Nor Syahilla Abdul Aziz, Saed Adem, Ishan Agarwal, Imen Belmokhtar, Ross Creed, Melanie de Boeck, Manh Hong Duong, Jeffery Ezearn, Song Feng, Nurhidayah Hamdan, Ali Jizany, Anna Kalogirou, Michelle Kendall, Dimitra Kosta, Rex Liu, Kitty Meeks, Ogiugo Mike, Hao Ni, Amit Seta, Arnaud Trebaol.

Eight members were elected to Associate Membership for Teacher Training Scholars: Edward Delamare, Daniel Fox, Alisa Hickey, Oscar Lee, Mary Mayes, Katy McCrossan, Grant McWalter, Ali-John Mirsepassi.

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

Professor Lyons then handed over to the President of the BSHM, Professor Philip Beeley, who chaired the business for the BSHM.

Professor Beeley then handed over to Dr June Barrow-Green who introduced a lecture given by Dr Adrian Rice titled *An Introduction to the Life and Work of Augustus De Morgan*.

A lecture by Dr Chris Hollings on *A Batch of Observations & Enquiries: The Correspondence of Ada Lovelace and Augustus De Morgan* and a lecture by Professor Sloan Despeaux on *Augustus De Morgan's 'Budget of Paradoxes'* completed the morning session.

During lunch, there was an exhibition on Augustus De Morgan, which was curated by Dr Adrian Rice.

After lunch, Dr Barrow-Green introduced a lecture by Dr John Heard on *Augustus De Morgan and the Early History of the London Mathematical Society*. This was followed by a lecture given by Professor Ian Stewart on *Augustus De Morgan and George Boole*.

After tea, Dr Barrow-Green introduced a lecture given by Dr Wilfrid Hodges on *The Influence of Augustus De Morgan*.

The Chair expressed the thanks of the Society to the speakers for giving such insightful lectures.

The President thanked the organisers of the meeting for arranging an excellent and well-attended event, and declared the meeting closed.

After the meeting, a reception was held at De Morgan House, followed by a dinner at The Montague on the Gardens.

LMS NORTHERN REGIONAL MEETING 2015

Report

The 2015 Northern Regional Meeting of the London Mathematical Society was held at Lancaster University on Tuesday 7 April and was followed by a workshop on *Homotopical Algebra and Geometry* (from Wednesday 8 to Saturday 11 April). The meeting was attended by approximately 45 people, and the workshop similarly. The organisers were Dr Jan Grabowski, Professor Andrey Lazarev, Dr Paul Levy and Dr Mark MacDonald.

Participants were welcomed to Lancaster by the Pro-Vice Chancellor for Research, Professor Stephen Decent. The meeting was then formally opened by the LMS President, Professor Terry Lyons, who also invited members of the LMS who had not signed the Membership Book to do so. Five members took the opportunity to do so.

The first talk at the meeting was given by Dr Peter Neumann (University of Oxford), who

Peter Neumann

spoke about the development of algebra in Britain over the 150 year period of the LMS's existence. He highlighted the various shifts in style and topics of interest over the period, especially the transition that occurred in the early years of the 20th century.

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Attendees at the LMS Northern Regional Meeting 2015

Michael Batanin

Next, Professor Ieke Moerdijk (Radboud University Nijmegen/University of Sheffield) spoke about the homotopical algebra of operads and trees. He explained how homotopical algebra has recently been enriched with an entirely new way of looking at operads, as realisations of combinatorial structures built up from trees, which is in many ways inspired by and analogous to the way in which one studies topological spaces as realisations of combinatorial simplicial complexes.

Lastly Dr Michael Batanin (Macquarie University) introduced the notion of polynomial monads, examples of which include nonsymmetric and symmetric operads, cyclic and modular operads, n-operads, dioperads, properads and many others. In particular, he explained why polynomial monads and their algebras have special categorical properties suitable for explicit combinatorial calculations.

The Regional Meeting ended with a dinner at the Gatehouse restaurant in Lancaster city centre, attended by many of those present.

The subsequent workshop had twenty talks, given by participants from many different areas of mathematics with relations to homotopical algebra. The talks were very diverse and the relaxed open atmosphere meant participants felt comfortable to ask questions of the speakers throughout. A PhD student who attended the workshop commented that: "The conference was very well organised and enjoyable. This week has been a great opportunity to meet other students and academics interested in homotopical algebra and develop my knowledge of the subject. Lancaster University is a great campus and the atmosphere has been fantastic. Of particular interest to me was Muriel Livernet's talk on Massey operadic products and non-formality of operads. My main focus since starting my PhD has been regarding A∞-algebras, a topic on which Muriel herself has written several papers. A highlight of my experience at the conference was the opportunity to meet Muriel and discuss my research project with her."

A particular feature of the meeting and workshop was a Wikipedia editathon, run by Dr Mark MacDonald with help from volunteers from the Wikimedia Foundation. At the editathon, a mix of participants from the meeting and workshop were shown how to edit Wikipedia pages, with a particular focus on mathematical topics. In all, fourteen pages were created or improved during the two hours of the editathon, and several participants spoke of being enthused to continue to make further edits in the future.

Jan Grabowski
Lancaster University

Ieke Moerdijk

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LMS INVITED LECTURES 2015

Report

The LMS Invited Lectures 2015 were held at Durham University from 16 to 20 March. The event was organized by Pavel Tumarkin (Durham).

Professor Michael Shapiro gave 10 lectures on *Cluster algebras and integrable systems*. In the lecture course Michael presented a remarkable mixture of ideas and methods from combinatorics, Lie theory, geometry and integrable systems.

Michael started the lectures with motivational examples. He explained how totally positive matrices appear in the theory of small oscillations, and then how total positivity of upper triangular matrices can be understood via pseudoline arrangements and reduced decompositions of Coxeter elements. This gave an example of a cluster structure appearing naturally.

In the second day of the lectures Michael presented another motivational example, namely sequences Somos-4 and Somos-5, where the Laurent phenomenon allows one to observe immediately that the entries of both sequences are integers. This was followed by a formal introduction of cluster algebras, which was supported by another example of a naturally appearing cluster structure on the coordinate ring of a Grassmannian. The example was then used to introduce Y-dynamics and establish connections with Teichmüller Theory.

Michael Shapiro

The third day was devoted to descriptions of Poisson structures compatible with cluster structures, and to introducing coefficients of cluster algebras originating from surfaces via multi-laminations. In the subsequent lectures Michael discussed various combinatorial constructions related to cluster algebras, including Postnikov diagrams and their relations to Grassmannians, networks on discs and annuli and their relation to Poisson-Lie brackets, to Toda flow and to Backlund-Darboux transformations. The last part of the course was devoted to integrability of the Pentagram map and its generalizations.

The lecture course was supplemented by three short series of lectures given by Profes-
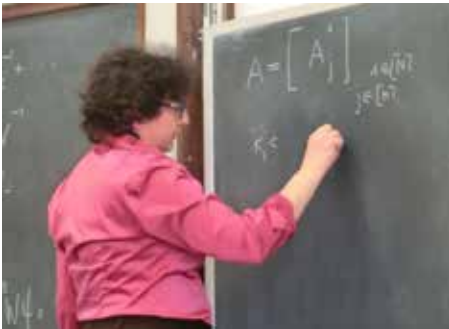
Simonetta Abenda

Alexander Veselov

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Sebastian Franco

Robert Marsh

Franco were devoted to topics in theoretical physics related to cluster algebras and to further constructions that have already shown up in lectures by other speakers. The lectures were also supplemented by an invited talk by Professor Simonetta Abenda (Bologna) on relations of totally positive Grassmannians and soliton solutions of the KP-hierarchy, and by two exercise sessions run by Anna Felikson (Durham), Michael Shapiro and Pavel Tumarkin.

sors Robert Marsh (Leeds), Alexander Veselov (Loughborough) and Sebastian Franco (City College, New York). Two lectures by Robert Marsh were devoted, respectively, to periodicity of mutations, and to Postnikov diagrams and relations to Grassmannians. Alexander Veselov gave two lectures on an introduction to integrability. Three lectures by Sebastian

More information about the lectures (including the complete program, abstracts, exercise problems and some slides) can be found at http://tinyurl.com/oumbzgl.

Pavel Tumarkin
Durham University

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Attendees at the LMS Invited Lectures 2015

STATISTICAL PROPERTIES OF DYNAMICAL SYSTEMS LMS-CMI RESEARCH SCHOOL
Report

During the week 13 to 17 April 2015 an LMS-CMI Research School on *Statistical Properties of Dynamical Systems* took place at Loughborough University. The school provided PhD students with knowledge and training on basic tools needed to study statistical properties of dynamical systems. Students were not assumed to have any knowledge in the subject. Three courses were delivered during the school by Professors Mark Demers, Carlangelo Liverani and Ian Melbourne. A three-hour tutorial support session was provided each afternoon (except Wednesday) by Drs Romain Aimino, Oliver Butterley and Dalia Terhesiu. In the first two days the lectures focused on general background and tools needed in the area. More

advanced topics, which are related to current advances in the area, appeared on the fourth and fifth day of the school. The school was a perfect opportunity for PhD students and early career researchers in dynamical systems. Indeed, 64 students, among which 11 are women, participated in the school. Participants came from 11 European countries and some came from Canada, Chile and the USA.

On Wednesday afternoon an LMS 150th Anniversary competition took place. Among fourteen submissions to take part in the competition, four students were selected to present their work. The selection committee consisted of the three lecturers and the invited speaker. The first prize, of £200, went to András Némedy Varga, while Kan Jiang,

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Attendees at the LMS-CMI Research School on *Statistical Properties of Dynamical Systems*

© Xiaolong Niu

(left to right, top to bottom) András Némedy Varga, Kan Jiang, Simon Rechberger, Rob Curtis (LMS Treasurer), Ian Melbourne, Johannes Kautzsch, Carlangelo Liverani and Mark Pollicott

Johannes Kautzsch and Simon Rechberger each received a £50 prize. Professor Rob Curtis, the LMS Treasurer, announced the prizes and the winner after his short presentation on the LMS goals and achievements. This was followed by the talk of Professor Mark Pollicott, the School's invited speaker.

The day ended with a reception and dinner at a local restaurant in Loughborough. More information on the School is available at: http://homepages.lboro.ac.uk/~mawb/LMS-CMI.html

Wael Bahsoun
Loughborough University

LONDON
MATHEMATICAL
SOCIETY
150 YEARS

LMS 150th Anniversary

Society Meeting and Hardy Lecture

3 July 2015
3:30pm

BMA House, Tavistock Square, London, WC1H 9JP

Schedule

3.30   Opening of the meeting and LMS business, including the announcement of the 2015 Prize winners (open to all)

Marta Mazzocco (Loughborough)
Title to be confirmed

4.45   Tea/Coffee

5.15   **Nalini Joshi (Sydney) – 150th Anniversary Hardy Lecturer**
Symmetry through Geometry

6.30   Reception at De Morgan House

7.30   Society Dinner

These lectures are aimed at a general mathematical audience. All interested, whether LMS members or not, are most welcome to attend this event.

To register for your place at the meeting, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk). If you would like to attend the Society Dinner, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk).

The cost to attend the Society Dinner is £35.00 per person (inclusive of wine).

LONDON
MATHEMATICAL
SOCIETY
150 YEARS

LMS 150th Anniversary

Graduate Student Meeting

3 July 2015
10:00am

BMA House, Tavistock Square, London, WC1H 9JP

Preliminary Programme

10.00	Coffee and Registration
10.30	Sara Lombardo (Northumbria)
	Automatic Lie Algebras and Root System Cohomology
11.30	Coffee/Tea
11.45	Graduate student talks
13.15	Lunch
13.55	Award prizes
14.00	Frank Nijhoff (Leeds)
	Lagrangian Multiform Theory - A New Variational Approach for Integrable Systems
15.00	Close of Meeting
15.30	LMS Society Meeting and Hardy Lecture (see below)

This meeting is intended as an introduction to the Society Meeting later in the day. All graduate students (and indeed any other mathematicians) will be very welcome.

Registration

To register, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk) by email by 18 June. Places are free and all refreshments including lunch will be provided.

Student Talks

Students are invited to give short talks (15 minutes) aimed at a general mathematical audience. Prizes will be awarded for the best two talks. If you would like to give a talk, please email Rod Halburd (r.halburd@ucl.ac.uk) by 7 June.

Funding for Travel and Accommodation

For students who attend both the Graduate Student Meeting and the LMS General Meeting, the Society can offer funding of up to £50 towards travel costs and funding of up to £50 towards travel costs and funding of up to £50 towards accommodation costs (for those travelling long distances).

LMS Society Meeting and Hardy Lecture

The LMS Society Meeting is open to all. Marta Mazzocco (Loughborough) will give the first lecture and Nalini Joshi (Sydney) will give the 150th Anniversary Hardy Lecture. The meeting will also be held at BMA House, and after the Society Meeting there will be a reception at De Morgan House (57-58 Russell Square). For further details see: http://www.lms.ac.uk/content/society-meetings

LIMIT THEOREMS IN PROBABILITY

Report

In celebration of the 70th birthday of N.H. (Nick) Bingham, the Department of Mathematics at Imperial College hosted a conference, open to all, on *Limit Theorems in Probability* from 23 to 26 March 2015. The meeting attracted enough participants to fill, and at times over-fill, the booked room, and the four-day format enabled extensive interaction between the 92 registered participants, reinforced socially by the conference dinner for 50 at a Mediterranean-themed restaurant in Gloucester Road.

Speakers interpreted the conference title in an appropriately wide-ranging sense, ranging over into statistics and mathematical finance, and reflecting the breadth of Nick Bingham's own contributions to the whole area. They comprised D.J. Aldous (Berkeley), D. Applebaum (Sheffield), S. Asmussen (Aarhus), N.H. Bingham (Imperial), D. Crisan (Imperial), R.A. Doney (Manchester), P. Embrechts (ETH), J.-F. Le Gall (Paris-Sud Orsay), P.E. Greenwood (UBC), G.R. Grimmett (Cambridge), J. Jacod (Paris VI), W.S. Kendall (Warwick), C. Klüppelberg (TU Munich), A.E. Kyprianou (Bath), T.J. Lyons (Oxford), T. Mikosch (Copenhagen), A.J. Ostaszewski (LSE), S.I. Resnick (Cornell), G.O. Roberts (Warwick), U. Stadtmüller (Ulm), Bálint Tóth (Bristol and Budapest), and A.R. Wade (Durham).

The conference was organised under the auspices of the Imperial Probability Centre by C.M. Goldie (Sussex), R. Kiesel (Duisberg-Essen) and A. Mijatović (Imperial). Financial support came from an LMS Conference grant, from the EPSRC and from the Department

Andreas Kyprianou

Nick Bingham and Paul Embrechts

Participants at the *Limit Theorems in Probability Conference*

of Mathematics at Imperial College; further, the meeting was sponsored by the Bernoulli Society for Mathematical Statistics and Probability. Registration fees received allowed a number of research students to be supported to attend.

Associated with the conference, a Festschrift is planned for 2016, to be published as a special volume of the journal *Advances in Applied Probability*.

Charles Goldie
University of Sussex

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ADA LOVELACE: CELEBRATING THE 200TH ANNIVERSARY OF A COMPUTER VISIONARY

In 2015 the University of Oxford will celebrate the 200th anniversary of the birth of computer visionary Ada Lovelace. The centre piece of the celebrations will be a display at the University of Oxford's Bodleian Library (13 October – 18 December 2015) and a Symposium (9 and 10 December 2015), presenting Lovelace's life and work, and contemporary thinking on computing and artificial intelligence.

Ada, Countess of Lovelace (1815–1852), is best known for a remarkable article about Charles Babbage's unbuilt computer, the Analytical Engine. This presented the first documented computer program, to calculate the Bernoulli numbers, and explained the core concepts of programming underpinning Babbage's machine – and the millions of computers and computer programs in use today. Going beyond Babbage's ideas of computers as manipulating numbers, Lovelace also wrote about their creative possibilities and limits: her contri-

Ada Lovelace

bution was highlighted in one of Alan Turing's most famous papers 'Can a machine think?' Lovelace had wide scientific and intellectual interests, and studied with scientist Mary Somerville, and with Augustus De Morgan, a leading mathematician and pioneer in logic and algebra, and founder of the London Mathematical Society.

The display, in the Bodleian's new Weston Library, will offer a chance to see Lovelace's correspondence with Babbage, De Morgan, Somerville and others, and her childhood exercises and mathematical notes. The Symposium, to be held in the Oxford Mathematical Institute from 9 to 10 December 2015, is aimed at a broad audience interested in the history and culture of mathematics and computer science, presenting current scholarship on Lovelace's life and work, and linking her ideas to contemporary thinking about computing, artificial intelligence and the brain. Confirmed speakers so far include Lovelace biographer Betty Toole; Charles Babbage expert Doron Swade; historians June Barrow-Green, Richard Holmes, Chris Hollings and Julia Markus; mathematicians and computer scientists Ursula Martin, Cheryl Praeger; Soren Riis, Marcus du Sautoy, Bernard Sufrin, and Moshe Vardi; women in science campaigners Charmian Anderson and Valerie Barr; and

graphic novelist Sydney Padua.

Other activities will include a workshop for early career researchers in the history of mathematics, a *Music and Machines* event, and a dinner in Balliol College on 9 December, the eve of Lovelace's 200th birthday, with after dinner speaker Dame Stephanie Shirley.

Oxford's celebration is led by the Bodleian Libraries and the University of Oxford's Department of Computer Science and Mathematics Institute, working with Oxford e-Research Centre, Somerville College, the Faculty of English and TORCH. Oxford has a remarkable history of programming research, with two winners of the Turing Award, the Nobel Prize for Computer Science, and the unique breadth and depth of Oxford's expertise brings a variety of perspectives to understanding Lovelace and the remarkable intellectual community around her, whose ideas underpin modern computing. We are grateful to the London Mathematical Society, Google, the ACM and the Clay Mathematics Institute for most generous support for the anniversary activities.

For more information or to register your interest see http://blogs.bodleian.ox.ac.uk/adalovelace/

Professor Ursula Martin, CBE
Professor of Computer Science
University of Oxford

LMS ANNIVERSARY FEATURES IN *THE GUARDIAN*

On 15 May 2015 the LMS was the subject of a photo feature in *The Guardian Higher Education Network* titled '150 years of mathematics in the UK – in pictures'. In only a few days it was shared almost 1,000 times from *The Guardian* website and has also been circulated widely on

social media. The Society received a number of congratulatory messages since the feature was published, and it has proved to be an excellent piece of media exposure not only for the LMS but also for the wider mathematical community as well. It can be found at http://ow.ly/N4JxJ.

CLARIFICATION

David Chillingworth's report on the LMS 150th Anniversary Launch Event (*Newsletter, March 2015*) implied that Frances Kirwan had stated Ada Lovelace to have been an early member of the LMS. However, Ada Lovelace died before the LMS was founded and could

not have been a member although, as Frances mentioned, Ada had studied earlier with the Society's first President Augustus De Morgan. We apologize for this confusion.

Frances Kirwan
David Chillingworth

ROLLO DAVIDSON PRIZE 2015

The Trust

The Trust was founded in 1975 in memory of Rollo Davidson, an accomplished mathematician of remarkable potential, and Fellow-elect of Churchill College, Cambridge, who died on the Piz Bernina in 1970. Initial funding from the Trust came from the royalties of two collections of papers published in 1973/74 by friends and colleagues of Rollo. The Trust awards an annual Prize for young probabilists and has benefited from the continuing association with the Davidson family. Further details of the Rollo Davidson Trust can be found at www.statslab.cam.ac.uk/Rollo/.

Rollo Davidson Prize 2015

The Rollo Davidson Trustees have awarded the 2015 Rollo Davidson Prize to **Nicolas Curien** (Université Paris-Sud) for outstanding work on random planar maps and related processes and to **Jason Miller** (MIT) for far-reaching results on the geometry of the continuum Gaussian free field.

Rollo Davidson Lecture

The Fourth Rollo Davidson Lecture, *Random Walk on the Random Graph*, will be given by Yuval Peres (Microsoft Research, Redmond). The Lecture will take place at 17:00 on Friday 12 June 2015, Meeting Room 2, CMS, Cambridge. A wine reception, held in the Central Core, CMS, will follow the lecture.

WOLF PRIZE 2015

James G. Arthur (University of Toronto, Canada) is the winner of the Wolf Prize in Mathematics for his monumental work on the trace formula and his fundamental contributions to the theory of automorphic representations of reductive groups. For further information about the Wolf Prize visit the website at: www.wolffund.org.il.

Previous winners:

2014: Peter Sarnak
2013: Michael Artin
2013: George Mostow
2012: Michael Aschbacher
2012: Luis Caffarelli

FERRAN SUNYER I BALAGUER PRIZE 2016

The Ferran Sunyer i Balaguer Prize is awarded annually for a mathematical monograph of an expository nature, written in English, which presents the latest developments in an active area of research in mathematics, in which advances have been produced recently. The prize consists of €5,000 and the winning monograph will be published in Birkhäuser Verlag's series *Progress in Mathematics*.

Deadline for submission is **3 December 2015**. For further information visit the website at http://ffsb.iec.cat.

chalkdust

Chalkdust is a new triannual mathematics magazine recently launched by a team of graduate, PhD and undergraduate students at UCL. The objective of the project is to create a space for mathematicians to share their interests in an exciting and engaging way. We aim to create interesting, fun and thought-provoking content in a way that is accessible to as many people as possible.

The magazine is fully available for free on our website at chalkdustmagazine.com, with puzzles, interviews, features and pictures. Our first issue has a range of fascinating articles; from how to optimally complete the game Pac-man, to the maths behind wormholes, to an article about how to analyse the similarities between friends on social networks. We also have an in depth interview with Hannah Fry, our fiendishly difficult Cross-number (with its £100 prize!); along with some more humorous articles:

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our agony aunt, for example, answers both your maths and relationship problems in our Dear Dirichlet column.

The feedback from the first issue has been overwhelmingly positive and we are hoping to produce an even better second issue, due out in September! Thus we are inviting submissions for articles and features for future editions of chalkdust. We welcome articles from anyone – from young mathematicians to university professors; from those without any training in mathematics but who have found themselves drawn to its beauty, to those who exploit its power in their day-to-day jobs. We want to share our and your appreciation and love of maths, and related sciences like statistics or physics, as widely as we can and so our only requirement is that your article be accessible to at least first year undergraduates, if not the general public. If you are interested in writing for us, please get in touch with us at contact@chalkdustmagazine.com.

<div align="right">Rafael Prieto Curiel
Editorial Director</div>

The Turing Gateway to Mathematics (TGM) is based at the Isaac Newton Institute at the University of Cambridge. It is an impact initiative, helping facilitate knowledge transfer between those working in mathematical sciences and potential users such as those in industry, commercial organisations, public sector and other academic disciplines. It helps to bridge the gap between sectors, by facilitating interactions and activities such as consultations, workshops, programmes of work, which enables engagement between individuals and organisations who were not previously working together.

Maths and Public Policy

The TGM has been delivering a programme of work and associated events on behalf of EPSRC which has brought together mathematical sciences researchers and policy makers to explore modelling and problem solving. Following a launch in December 2014, two workshops took place in March that further engaged stake-holders to help disseminate information and encourage a greater level of activity across the mathematics for public policy landscape.

The first workshop covered cross-cutting themes related to cities, transport, energy and environment. The second workshop focused on disease prevention, public health, ageing, disability, pensions and societal risk. Both illustrated examples of interactions between maths and policy development, highlighting challenges that policy makers face and how maths can help address these. Speakers reflected that complex modelling helps inform decisions made, so engagement with academics brings additional rigour to policy making. Feedback from delegates and speakers will be used to help identify the next steps that could be taken forward, through discussions with the TGM and EPSRC and to be kept informed, please contact the TGM.

Uncertainty Quantification

The ability to quantify uncertainty is becoming increasingly important in what seems to be an ever more uncertain world. Being able to do this across models of nature for instance is fundamental to many inference problems in science and engineering. Mathematics is key to addressing such issues and it aims to do this through Uncertainty Quantification (UQ) – the science of quantitative characterisation of uncertainties in applications. Applications of UQ can be found in all areas of physical and biological sciences and its importance has continued to grow in response to the need to assess risks more accurately. This has stimulated increased interest in the area resulting in a workshop in Edinburgh in June and is reflected in forthcoming events which are being developed. The TGM is working with the Warwick Centre for Predictive Modelling and the Knowledge Transfer Network to develop training and research workshops in order to address challenging mathematical and algorithmic problems in the interface of computational materials modelling and uncertainty quantification.

Further details on engaging with the TGM can be seen at www.turing-gateway.cam.ac.uk or contact Jane Leeks, the Knowledge Transfer Manager on 01223-765733.

UNIVERSITY OF CAMBRIDGE
FACULTY OF MATHEMATICS

ADAMS PRIZE

Applied Analysis

The University of Cambridge has announced the subject for one if its oldest and most prestigious prizes. The Adams Prize is named after the mathematician John Couch Adams and was endowed by members of St John's College. It commemorates Adams's role in the discovery of the planet Neptune, through calculation of the discrepancies in the orbit of Uranus.

The Chairman of the Adjudicators for the Adams Prize invites applications for the 2015-16 Prize which will be awarded this year for achievements in the field of Applied Analysis.

The prize is open to any person who, on 31st October 2015, will hold an appointment in the UK, either in a university or in some other institution; and who is under 40 (in exceptional circumstances the Adjudicators may relax this age limit). The value of the prize is expected to be approximately £15,000, of which one third is awarded to the prize-winner on announcement of the prize, one third is provided to the prize-winner's institution (for research expenses of the prize-winner) and one third is awarded to the prize-winner on acceptance for publication in an internationally recognised journal of a substantial (normally at least 25 printed pages) original article, of which the prize-winner is an author, surveying a significant part of the winner's field.

Applications (email and two hard copies), comprising a CV, a list of publications, the body of work (published or unpublished) to be considered, and a brief non-technical summary of the most significant new results of this work (designed for mathematicians not working in the subject area) should be sent to:

The Secretary of the Adams Prize Adjudicators,
Undergraduate Office, Centre for Mathematical Sciences,
Wilberforce Road, Cambridge, CB3 0WA
(Email: adamsprize@maths.cam.ac.uk)

The deadline for receipt of applications is 31st October 2015

EUROPEAN NEWS

EMS celebrates 25th anniversary at Institut Henri Poincaré

The European Mathematical Society was founded in 1990 at Mandralin near Warsaw in Poland. The Society will thus soon be 25 years old. To mark the anniversary, a one day event under the title *Challenges for the next 25 years* will be held at the Institut Henri Poincaré in Paris on 22 October 2015. Lectures with mathematical topics will be given by Hendrik Lenstra (Leiden), Laure Saint-Raymond (ENS Paris), László Lovász (Budapest) and Andrew Stuart (Warwick). A panel moderated by ERC president J.P. Bourguignon will discuss specific challenges for the mathematical sciences. It will consist of ICIAM president Maria Esteban, the director of the Institut Mittag-Leffler and previous EMS president Ari Laptev, Peter Bühlmann (ETH Zürich representing the Bernoulli Society) and Roberto Natalini (Istituto per le Applicazioni del Calcolo, Rome, and chairman of the EMS committee Raising the Public Awareness of Mathematics).

The new ECMI blog

The European Consortium for Mathematics in Industry (ECMI) is pleased to announce the ECMI blog is now online at http://ecmiindmath.org. It contains up-to-date information about events and opportunities in industrial and applied mathematics and will also feature the different ECMI centres. If you would like to spread information about workshops, conferences, study groups, jobs, project calls... anything of interest to the industrial and applied mathematics community, please send the text you would like to have posted to news@ecmiindmath.org. Note that you can subscribe to news by email, so that you need not worry about missing anything. To do so you just have to enter your email address in the field at the bottom of the page and click **FOLLOW**.

David Chillingworth
LMS/EMS Correspondent

LMS 150TH ANNIVERSARY POPULAR LECTURES 2015

LONDON MATHEMATICAL SOCIETY
150 YEARS

The London Mathematical Society Popular Lectures present exciting topics in mathematics (and its applications) to a wide audience. As a part of the celebrations to mark the LMS 150th anniversary there will be four popular lectures held this year rather than the normal two. For 2015, the popular lecturers are **Hannah Fry** (UCL), **Ben Green**, FRS (University of Oxford), **Martin Hairer**, FRS (University of Warwick) and **Ruth King** (University of St Andrews). Popular Lectures will take place at:

- **London** 25 June at 7.00 pm
  Logan Hall, Institute of Education
  Speakers are Ruth King and Martin Hairer
- **Birmingham** 23 September at 6.30 pm
  Bramall Music Building, University of Birmingham

  Speakers are Ben Green and Martin Hairer
- **Glasgow** 21 October at 6.30 pm
  Main Auditorium, Technology and Innovation Centre, University of Strathclyde
  Speakers are Hannah Fry and Ruth Kin
- **Leeds** 11 November at 6.30 pm
  The Great Hall, University of Leeds
  Speakers are Hannah Fry and Ben Green

Attendees are asked to register online. For full details including abstracts for the talks and to register on-line visit the LMS website at ww.lms.ac.uk/events/popular-lectures.

The Popular Lectures have proved to be a very successful series and we hope that as many members as possible will be able to attend in 2015.

LONDON
MATHEMATICAL
SOCIETY
150 YEARS

LMS 150th Anniversary

2015 Popular Lectures

Save The Date!

London - 25 June at 7pm

Logan Hall, UCL Institute of Education (nearest tube Russell Square)
Speakers: Martin Hairer and Ruth King

Professor Martin Hairer, FRS Regius Professor of Mathematics, University of Warwick

The mathematics of randomness

From the gambling machines in a casino to the predictions of next week's weather, the world that surrounds us is governed by seemingly random events. How do mathematicians make sense of this and what does it even mean to 'predict' something inherently random? We will explore these questions and see what are the main guiding principles of our modern understanding of randomness.

Dr Ruth King, Reader in Statistics, University of St Andrews (from 1 September, Thomas Bayes Chair of Statistics at the University of Edinburgh)

How many...? (Estimating population sizes)

The question of "How many...?" arises in many different fields. For many applications, however, it is not possible to simply count the members of the population of interest. For such cases Dr King will discuss mathematical tools that can be applied to provide an estimate of the total population size. Applications range from the number of webpages on the Internet on a given topic or the number of bugs in a computer code to the number of drug addicts or animals in a given area.

Image: By Calvinius [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

Entry is free with registration. Register at lms.ac.uk/events/popular-lectures

LONDON
MATHEMATICAL
SOCIETY
150 YEARS

Joint Anniversary Weekend
LMS-EMS Mathematical Meeting

Birmingham, 18-20 September, 2015

To celebrate the 150th year of the London Mathematical Society (LMS) and the 25th year of the European Mathematical Society (EMS) we are organising a mathematical weekend, to be held in Birmingham from Friday 18th to Sunday 20th September 2015. All mathematicians, from Europe and elsewhere, are warmly invited to participate.

We hope to see you in Birmingham.

Plenary speakers

- Noga Alon, Tel Aviv, Princeton
- Keith Ball, Warwick
- Béla Bollobás, Cambridge, Memphis
- Timothy Gowers, Cambridge
- Stefanie Petermichl, Toulouse
- Aner Shalev, Jerusalem

Organising Committee	**Scientific Committee**
Chris Parker, Anton Evseev, Maria Reguera Andrew Treglown	Gabriel Navarro, Valencia Angelika Steger, Zürich Ana Vargas, Madrid

Invited Special Lecture Speakers

Algebra Special Lectures

- Ben Klopsch, Düsseldorf
- Martin Liebeck, London
- Gunter Malle, Kaiserslautern
- Bob Oliver, Paris
- Cheryl Praeger, Western Australia
- Donna Testerman, Lausanne

Analysis Special Lectures

- Franck Barthe, Toulouse
- Tony Carbery, Edinburgh
- Tuomas Hytönen, Helsinki
- Sandra Pott, Lund
- Christoph Thiele, Bonn
- Luis Vega, Bilbao
- Julia Wolf, Bristol

Combinatorics Special Lectures

- Jozsef Balogh*, Illinois
- Mihyun Kang, Graz
- Michael Krivelevich, Tel Aviv
- Marc Noy, Barcelona
- Wojciech Samotij, Tel Aviv
- Mathias Schacht, Hamburg
- Benny Sudakov, Zurich

History Special Lectures

- Niccolò Guicciardini, Bergamo

To register, please visit web.mat. bham.ac.uk/emslmsweekend/spkrs. html

LMS-CMI RESEARCH SCHOOLS

SECOND CALL FOR PROPOSALS

The London Mathematical Society and Clay Mathematics Institute invite proposals for Research Schools in 2016.

Up to £31,000 is available per Research School which provides training for young researchers in a core area of mathematics. The new series of courses builds on the short courses, previously supported by the Society and EPSRC, and aims at the highest international standing by allowing for support of both international lecturers and participants. The Research Schools are also supported by the Heilbronn Institute for Mathematical Research.

The LMS and the CMI intend to support four Research Schools in 2016.

Prospective organisers should send an outline proposal to Elizabeth Fisher (Research.Schools@lms.ac.uk) by **Wednesday 10 June 2015**.

Outline proposals should discuss:

- The general mathematical area of the proposed Research School and its importance.
- The aims of the Research School, its appropriateness to the Research School programme and the likely level of demand for the Research School.
- The names and affiliations of the lecturers, titles of their courses and brief syllabuses.
- The provision for tutorial support.

Outline proposals should be no more than two A4 sides in length.

For further details about the Research Schools, please visit the Society's website:

www.lms.ac.uk/events/lms-cmi-research-schools.

Before submitting: Organisers are welcome to discuss informally their ideas with the Chair of the Research Meetings Committee (RMC.Chair@lms.ac.uk).

VISIT OF PROFESSOR JIM AGLER

Professor Jim Agler (University of California at San Diego) will visit the School of Mathematics and Statistics at Newcastle University from 17 June to 1 July 2015 for collaborative research with Dr Z.A. Lykova and Professor N.J. Young.

Professor Agler has made highly original contributions to several branches of mathematical analysis. His recent research is characterized by the effective use of operator-theoretic methods to strengthen and generalize classical results in several complex variables.

Further details can be obtained from Dr Lykova (Zinaida.Lykova@ncl.ac.uk). This visit is supported by an LMS Scheme 4 grant Research in Pairs and Newcastle University.

GEORGE BOOLE BICENTENARY

As part of the celebrations of George Boole's bicentenary, University College Cork will hold the George Boole Mathematical Sciences Conference from 17 to 28 August 2015. George Boole (1815-64) was the first professor of mathematics at Cork and his contributions to mathematical sciences have been far-reaching. The conference contains many thematic sessions and subconferences:

- *Quantum Information Theory* 17-20 August
- *Boole's Algebra of Logic to Boolean Algebra* 27-28 August
- *Complex and Boolean Networks* 24-26 August
- *Geometry and Visualization* 26-28 August
- *Harmonic Analysis* 19-22 August
- *Invariants from Moduli Spaces* 24-27 August
- *Mathematical Financial Modelling Post-Crisis* 25-28 August
- *Quantum Probabilistic Symmetries and Quantized Boolean Algebras* 20-25 August
- *Annual Meeting of the Irish Mathematical Society* 27-28 August
- *Domains XII*, 25-28 August
- *When Boole Meets Shannon* 1-2 September

Funding for travel and accommodation may be available for research students and junior researchers. For more information visit http://booleconferences.ucc.ie/gbmsc2015 or contact 2015GBMSC@ucc.ie. The conference is sponsored by University College Cork, the Irish Mathematical Society and Foundation Compositio Mathematica.

BRITISH LOGIC COLLOQUIUM

The 2015 meeting of the *British Logic Colloquium* (BLC) will be held in Cambridge from 2 to 4 September. It will be preceded by BLC PhD Day (1-2 September). This is a general Logic meeting covering a variety of topics within mathematical, philosophical and computer science logic. The meeting will include ten invited talks (speakers listed below) and a number of contributed talks. Anyone wishing to contribute a talk should send an abstract (of about 250 words) to blc-2015@cl.cam.ac.uk by **15 July 2015**. Invited speakers are:

- Andreas Blass (Michigan)
- Victoria Gitman (New York)
- Ian Pratt-Hartman (Manchester)
- Alexander Kechris (Pasadena)
- Jonathan Kirby (East Anglia)
- Agi Kurucz (London)
- Itay Neeman (Los Angeles)
- Arno Pauly (Cambridge)
- Andrew Pitts (Cambridge)
- Mehrnoosh Sadrzadeh (London)

There is a limited number of bursaries available for students who wish to attend. A bursary will provide a subsidy for travel and accommodation costs. Applications for bursaries should be accompanied by a short paragraph stating your affiliation, the name of your supervisor and a brief description of your research;

priority will be given to those contributing a talk in either the PhD day or the main BLC meeting. Deadline: **15 July**.

PhD Day

The BLC PhD Day provides an opportunity for postgraduates to meet and discuss their research or area of interest with fellow young logicians. If you wish to attend the PhD Day email blc-2015-phd@maths.cam.ac.uk, including your Name, Affiliation and whether or not you would like to present a talk or a poster.

The meeting is supported by an LMS Conference grant, the Isaac Newton Institute for Mathematical Sciences and Robinson College, Cambridge. Further information available at: www.newton.ac.uk/event/blc-2015.

APPROXIMATE DYNAMIC PROGRAMMING

A workshop on *Approximate Dynamic Programming* (ADP) will take place at the Department of Mathematical Sciences, University of Essex on Friday 11 September 2015. ADP is a powerful tool for handling the curse of dimensionality in stochastic control problems. This meeting is designed to bring together UK experts in Approximate Dynamic Programming together to share experiences and up-to-date progress, and attract more interest in this field by introducing this powerful optimization approach to young researchers in the UK Operational Research community. Speakers include:

- Peter Jacko (Lancaster) *Exploring and Exploiting MDP Formulations of Optimal Scheduling of Customers with Abandonment*
- Dong Li (York) *Dynamic Booking Control for Car Rental Revenue Management: a Decomposition Approach*
- Arne Strauss (Warwick) *Linear Programming Approximations of Dynamic Programmes in Revenue Management*
- Xinan Yang (Essex) *An Introduction to ADP and an Application in Telecommunication Network Control*

The workshop is free of charge. A reception with tea/coffee and refreshments will be provided. For registration or further details

contact the organizer Xinan Yang (xyangk@essex.ac.uk). The meeting is supported by an LMS Conference grant and the University of Essex.

NON-COMBINATORIAL COMBINATORICS

The workshop *Non-Combinatorial Combinatorics* will take place at the University of Warwick from 14 to 16 September 2015. The purpose of the workshop is to explore combinatorial applications of tools from other areas (such as, for example, algebraic, analytic, graph limit, spectral and topological methods) as well as interactions going in the other direction. The invited speakers are:

- Noga Alon (Tel Aviv)
- Keith Ball (Warwick)
- David Ellis (Queen Mary)
- Wojciech Samotij (Tel Aviv)
- Balázs Szegedy (Budapest)
- Julia Wolf (Bristol)

The workshop will also include contributed talks. The organisers have limited support for UK based research students and researchers from the former USSR countries. The deadline for proposing a contributed talk and/or applying for financial support is **20 July 2015**.

There is no registration fee however all participants are required to register online by **10 August 2015**. For more information, visit the workshop's website: http://warwick.ac.uk/ncc2015) or contact the organisers, Oleg Pikhurko and Konstantinos Tyros, by email (ncc2015@warwick.ac.uk).

The workshop is supported by an LMS Conference grant, the European Research Council and Warwick's Mathematics Institute.

FRACTAL GEOMETRY AND DIMENSION THEORY

A one-day meeting on *Fractal Geometry and Dimension Theory* will take place on Wednesday 22 July 2015 at the School of Mathematics, Alan Turing Building, University of Manchester. The meeting will aim to bring together mathematicians from across the UK with an interest in

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fractals. The meeting will commence with lunch and registration at 12.30 pm followed by three talks and a conference dinner in the evening. The confirmed speakers are:

• Mark Pollicott (University of Warwick)
• Kenneth Falconer (University of St Andrews)
• Jonathan Fraser (University of Manchester)

The conference webpage is http://tinyurl.com/n5s3m3q. For further information and to register email Jonathan Fraser (jon.fraser32@gmail.com). The meeting is supported by an LMS Conference grant celebrating new appointments.

CHALLENGES IN NONLINEAR SYSTEMS

A meeting to celebrate the 65th birthday of Tom Mullin

A two-day meeting will be held from 10 to 11 September 2015 at the Chancellors Hotel, Manchester to celebrate the 65th birthday of Professor Tom Mullin. Tom's research is at the forefront of a wide range of areas, including nonlinear dynamics, shear flow instabilities, fluid dynamics, soft matter, granular flows and suspensions. The scientific programme of the meeting is planned to reflect the breadth of his research interests.

The programme will consist of a series of 30-minute talks given by distinguished invited speakers including:

• Christophe Clanet (ESPCI and École Polytechnique, Paris)
• Eric Clément (ESPCI, Paris)
• Mike Gaster FRS (City University)
• Ray Goldstein FRS (University of Cambridge)
• John Hogan (University of Bristol)
• Rich Kerswell FRS (University of Bristol)
• Keith Moffatt FRS (University of Cambridge)
• Gerd Pfister (Christian-Albrechts-Universität)
• Olivier Pouliquen (Université Aix-Marseille)
• David Schaeffer (Duke University)
• Laurette Tuckerman (ESPCI, Paris)
• Fabian Waleffe (University of Madison-Wisconsin)
• Jane Wang (Cornell University)
• Wendy Zhang (University of Chicago)

There will be a poster session, for which the organisers invite contributions from all attendees. The conference fee is £135 (£85 for students), with an 'early-bird' discount of £20 for attendees registering prior to **30 June 2015**. This includes lunches and a conference dinner on the evening of 10 September. Accommodation can be booked with the meeting at a cost of £75/night. Funds are available to support the travel and subsistence costs of UK PhD students and UK early-career researchers.

Full details are available at the conference website www.mcnd.manchester.ac.uk/meeting. The meeting is supported by grants from the London Mathematical Society, the Institute of Mathematics and its Applications, the Institute of Physics, and the School of Mathematics at the University of Manchester through an EPSRC platform grant and the Manchester Institute for Mathematical Sciences.

MODULI SPACES AND THEIR APPLICATIONS

The University of Liverpool will host on Monday 21 September 2015 a conference on *Moduli Spaces and their Applications*. The organisers hope to attract mathematicians, mainly from the United Kingdom, interested in moduli spaces from different viewpoints and perspectives. A variety of different techniques and approaches will be represented: algebro-geometric, differential, topological, and combinatorial. The speakers are:

• Andrei Mustata (Cork)
• Nicola Pagani (Liverpool)
• Oscar Randal-Williams (Cambridge)
• Richard Thomas (Imperial College)

There is a grant to support a small number of PhD students traveling from the UK. Email Nicola Pagani (pagani@liv.ac.uk) if you fall in this category and wish to apply for (partial) fundings. The deadline for requesting support is **1 August 2015**. More details are on the website at https://sites.google.com/site/moduliandapplications/home.

The conference is supported by an LMS Conference grant celebrating new appointments and by the Department of Mathematical Sciences of the University of Liverpool.

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FINITENESS CONDITIONS IN TOPOLOGY AND ALGEBRA

A conference on *Finiteness Conditions in Topology and Algebra* will be held in the Pure Mathematics Research Centre of the School of Mathematics and Physics, Queen's University Belfast from Monday 31 August to Thursday 3 September 2015. The meeting will focus on finiteness properties arising in geometric topology, geometric group theory and homological algebra, Sigma-invariants of groups and spaces, Novikov homology, and interactions with other areas of mathematics such as toric topology, hyperplane arrangements and tropical geometry. Speakers include

- Martin Bridson (University of Oxford)
- Dan Burghelea (Ohio State University)
- Ross Geoghegan (Binghamton University)
- Dessislava Kochloukova (University of Campinas)
- Ian Leary (University of Southampton)
- Alexandra Pettet (University of British Columbia)
- Andrew Ranicki (University of Edinburgh)

More information on the programme and registration procedure can be found on the conference web page at www.northeastern.edu/suciu/Belfast2015/. The meeting is supported by Queen's University Belfast.

TOPOLOGICAL DATA ANALYSIS: NEW DEVELOPMENTS AND CHALLENGES

The conference *Topological Data Analysis: New Developments and Challenges* will take place at the Mathematical Institute, Oxford from 19 to 20 June 2015.

The purpose of this conference is to bring together international researchers working in topological data analysis and in particular persistent homology to discuss new developments and challenges for the future. The speakers are:

- Ulrike Bauer (Technische Universität München)
- Gunnar Carlsson (Stanford University)
- Frederic Chazal (INRIA Saclay)
- Claudia Landi (UNIMORE)

Proposals for contributed talks are invited. Please write to tillmann@maths.ox.ac.uk with a title and short abstract. For further information visit the conference website at https://people.maths.ox.ac.uk/tillmann/TDA2015.html.

INSTITUTE OF MATHEMATICS AND ITS APPLICATIONS

List of Upcoming Conferences

Barriers and Enablers to Learning Maths: Enhancing Learning and Teaching for All Learners
University of Glasgow, 10-12 June 2015
http://tinyurl.com/ot2lmcx

Mathematics in Finance
University of Manchester, 18-19 June 2015
http://tinyurl.com/kjers7r

Numerical Methods for Simulation
Formerly the ICFD Conference on Numerical Methods for Fluid Dynamics
Mathematical Institute, Oxford,
1-4 September 2015
http://tinyurl.com/ppxftvl

Mathematics of Robotics
St Anne's College, Oxford,
9-11 September 2015
http://tinyurl.com/nno279q

Mathematics in Defence
Satellite Applications Catapult, Harwell Oxford,
26 November 2015
http://tinyurl.com/le33ecb

Cryptography and Coding
University of Oxford, 15-17 December 2015
http://tinyurl.com/mdposxu

Visit http://tinyurl.com/aewbn2n to keep up to date with the conference programme. For further information or to register your interest any of the above conferences contact Lizzi Lake, Conference Officer, email: conferences@ima.org.uk, tel: +44 (0) 1702 354 020, fax: +44 (0) 1702 354 111.

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A POSTERIORI ERROR CONTROL

A workshop on *A Posteriori Error Control and Mesh Adaptivity for Time Dependent and Nonlinear Problems* will take place at the Department of Mathematics, University of Chester on Thursday 10 September 2015. The aim of the workshop is to bring together leading scientists and young researchers, mostly from the UK, working in the area of a posteriori error analysis and adaptive finite element methods for evolution and/or nonlinear PDEs in order to exchange ideas and initiate new collaborations.

The meeting consists of a series of lectures on recent developments in a posteriori error control and mesh adaptivity of time-dependent and/or nonlinear problems. Speakers include:

- Dimitra Antonopoulou (Chester)
- Andreas Dedner (Warwick)
- Peter Jimack (Leeds)
- Omar Lakkis (Sussex)
- Daniel Loghin (Birmingham)
- Tristan Pryer (Reading)
- Kris van der Zee (Nottingham)

There is a $15 registration fee to cover coffee/tea and lunch. Registration is free for students and postdoctoral researchers within three years of the completion of their PhDs. PhD students and postdoctoral researchers are invited to take part in a poster session. For further details contact the organiser Fotini Karakatsani (f.karakatsani@ chester.ac.uk) or visit the website www. chester.ac.uk/departments/mathematics/ workshop/lms. The meeting is supported by an LMS Conference grant and by the University of Chester.

IINI Isaac Newton Institute for Mathematical Sciences

CELL MECHANICS, MORPHOGENETICS AND PATTERN FORMATION: PERSPECTIVES FROM THE EXPERIMENTAL AND THEORETICAL POINTS OF VIEW

14 – 18 September 2015

in association with the Isaac Newton Institute programme *Coupling Geometric PDEs with Physics for Cell Morphology, Motility and Pattern Formation*

(13 July – 18 December 2015)

Organisers: Till Bretschneider (Warwick), Damir Khismatullin (Tulane), Sharon Lubkin (North Carolina State) and Christian Schmeiser (Vienna)

Workshop Theme: The mechanical characterisation of individual cells is complex and dynamic. Nonetheless, great progress has been made in understanding how the dynamics of subcellular structures leads to cell shape and motility. Static tissues have also been well characterised. It is at the level of morphogenesis where the bridging of scales between individual cell dynamics and tissue dynamics is least understood. This workshop aims to (1) present a framework for understanding what is already known about cell-level and tissue-level mechanics, (2) identify gaps in our understanding of how cells interact mechanically in tissues in order to actuate morphogenesis, (3) propose new collaborations to increase our understanding of the cell-tissue emergent dynamics. We will bring together experts in development, microscopy, image analysis, biomechanics, and modeling.

Further information and application forms are available from the website www.newton.ac.uk/event/cgpw02

Closing date of the receipt of applications **12 July 2015**.

OBITUARY

PHILIP HIGGINS

Professor Philip J. Higgins, who was elected a member of the London Mathematical Society on 18 December 1958, died on 25 March 2015, aged 88.

Vernon Armitage writes: Philip, who served as Secretary of the London Mathematical Society, as Vice-President, and as a member of Council, was respected throughout his field as an exemplary scholar and teacher of algebra and algebraic topology, and especially categories and groupoids. He possessed a remarkable gift for exposition, which not only significantly advanced our understanding of his subject, but prompted others to see applications of it outside the field, and even outside algebra itself. He was also a willing and unselfish collaborator in areas such as Nonabelian Algebraic Topology (with Ronald Brown) and Lie groupoids and Lie algebroids (with Kirill Mackenzie); the summary of his career which he wrote for a 2005 reprint of *Categories and Groupoids* (1971) is typically generous in praise for all his mentors and colleagues.

At Trinity College, Cambridge (he was the first member of his family to go to University) he rowed, played badminton for the College, and played the violin, and still found time to obtain a First in Mathematics. After wartime service with Rolls Royce, developing turbines for early jet engines, he returned to Cambridge to complete his PhD, and there he met his wife, Betty, whom he married in 1954. They had four sons.

Philip was elected a Fellow of Trinity, and following two years at Harvard and at Columbus, Ohio, he accepted a Lectureship at Queen Mary College, London, and then moved to King's College, London, where he was a Reader and then a Professor. In 1978, he was appointed to a Chair in Mathematical Sciences at the University of Durham, where he served as Head of Department and where he remained until his retirement in 1988, and where in 2007 he saw his son Christopher installed as Vice-Chancellor.

Violin-making was a craft which absorbed Philip all his life, and the violins, violas and cellos flowed from his workshop with increasing speed, until, Christopher tells me, he exhausted his supply of seasoned wood at the age of eighty-six. He made thirty-five instruments in all, many of which are now being played by his children and grand-children, and introduced the uninitiated to the joys of chamber music. Philip and Betty's summer music days became an annual event in the Higgins calendar, while all year round Durham Sinfonia benefited from Philip's passion for sharing music, just as his students and his many readers benefited from his gift for sharing mathematics. He will be fondly remembered by us all.

REVIEWS

BIRTH OF A THEOREM
by Cédric Villani, Bodley Head, 2015, pp 272, £18.99, ISBN: 978-1847922526.

"The function of a mathematician is … to add to mathematics, and not to talk about what he or other mathematicians have done." After seventy-five years G.H. Hardy's "melancholy experience" still resonates with, and presumably influences, the profession. Against this we have the fourth of Gian-Carlo Rota's *Ten Lessons I wish I had been Taught* (his well-known 1996 essay): "You are more likely to be remembered by your expository work". Very recently, three of those adding to mathematics at the highest level have bid for Rota's version of posterity. Edward Frenkel's *Love and Math* has just been published in French translation, Michael Harris's *Mathematics Without Apologies* is sure to follow suit; and Cédric Villani's *Théorème Vivant* has gone the other way and we have it in English.

Of the three Villani has the highest claim to what Harris calls 'charisma', having won a Fields medal in 2010. The citation is "for his proofs of nonlinear Landau damping and convergence to equilibrium for the Boltzmann equation." It is the former result which is the hero of his book. The medal ceremony at the International Congress of Mathematicians in Hyderabad is the climax and although there cannot be many readers unaware that Villani's story has a happy ending it is nevertheless a compelling trajectory. An essentially chronological diary format is used and this works well: we share Villani's frustration when childcare or needy colleagues interrupt his work, and his jitters over a seminar he feels he is not ready for; we worry with him that he will miss the strict age limit for a Fields medal; most of all we sympathise as yet another hole appears in yet another version of the enormous proof that is supposed to win the medal. Meanwhile, Villani's enthusiasm is infectious: he loves being at the Institute of Advanced Studies, he loves mixing with already famous scientists, he loves being back in France again, he even embraces the surely crushing commitment of running the Institut Henri Poincaré. Does this make Villani appear pompous or complacent, an obvious risk? Not a bit: certainly he is pleased with himself, but then, he is pleased with everything.

There are frequent short digressions to describe mathematical people and ideas which are related to the story (some less closely than others but a particularly timely aside describes the working relationship between the 2015 Abel prizewinners Nash and Nirenberg, both pioneers in Villani's field). In a less important book these digressions would have been expanded to make up the expected page count for a standard popular mathematics book. But this is not what Villani does.

Instead, and what has attracted most comment in Villani's book, there is the verbatim reproduction of dozens of pages of mathemati-

cal text, or in many cases TEX, which is patently unreadable for essentially all of his audience. And 'all' means 'all': interviewed in *Nouvelle Observateur* in September 2012, Villani said (our translation) "Rest assured, most mathematicians will skip these pages too, because they are only intelligible to the tiny minority who work in the exact same subject area as me."

This feature of the book certainly deserves comment. First and foremost the commentary should be Villani's, and he deserves to be quoted at length. Interviewed in October 2012 in *Les Echos* (equivalent to the UK's FT) he said of the mathematics (again our translation):

"It was an unusual editorial decision, adopted after careful consideration."

"At no point do I require of my readers to understand these formulae; they are there simply to act as testimony, like the rough sketches that litter an artist's studio."

"The goal of the book is to reveal to the reader a community, that of mathematicians, in all its sociological aspects: how they work, how and to whom they speak, through what passages of elation and dejection they pass, etc. I wanted above all to reveal their interactions with their colleagues, family, technology, that is everything involved in the forming of an idea, the success of the theorem. It must not be imagined that behind a good mathematical idea there is just a single mathematician who has solved a problem with their single brain: it is a complete ecosystem of human interactions which makes the result possible. If I do not explain the formulae in the book it is precisely because I want the reader *not* to try and understand but rather to focus all their attention on these sociological and human aspects."

Not least, the interaction depicted is that between Villani and Clément Mohout, his former student and coauthor in the proof of nonlinear Landau damping. It is hard to imagine credit sharing achieved with more integrity than is achieved by Villani's verbatim

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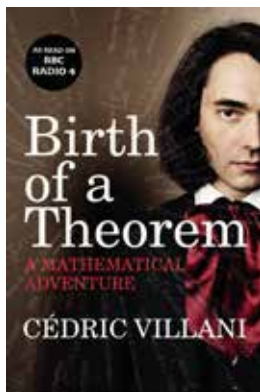
quoting of emails, TEX fragments and typeset mathematics.

A secondary commentary on Villani's structuring of his book must acknowledge his background in French scientific literature and French literature generally. His book bears witness (sometimes to the point of page-skipping at a level to match his formulae!) of an extensive and eclectic cultural background. He is avowedly indebted to Poincaré as a scientist but also as a communicator (Poincaré on science continues to be mainstream reading in France, with prefaces by mainstream modern French philosophers). Villani is following in the literary footsteps of Alain Connes: his *Mathématiques en liberté* (2012), coauthored with three other mathematicians and a philosopher of science, copying the template of Connes' *Matière à Pensée* (1989). In this context, Villani's presentation of mathematical life, rather than being dismissed as eccentric or self-indulgent, is to be judged as conceptual and innovative.

Even in France it is hard to imagine *Birth of a Theorem* remaining in print as long as has Poincaré. In themselves, his 'raw' mathematics and even his 'complete ecosystem' of mathematical interactions will inevitably come to seem very dated, although a gift to future historians of mathematics. But Villani's is a brave and ground-breaking book: it answers the non-scientist's "What do mathematicians do?" more honestly than anyone ever has. Yes, there are those dense pages where the answer is brutally honest! But Villani compensates with humanity and a strong narrative and a *joie de vivre* that will disarm all but the most resentful. We must pray that his commitments allow him to continue to pacify the spirit of G.H. Hardy and that we can look forward to *Birth of a Corollary*.

Robin Whitty
Queen Mary, University of London

X+Y - the movie

There are now an increasing number of movies where mathematics plays an important role. Usually we are let down by the parts featuring the maths because the makers of the film have little knowledge about our subject. So it is a real pleasure to review x+y a beautiful film where the mathematics is carefully done but not in a way that will put off a non-mathematical audience. The director is Morgan Matthews who also made the BBC4 documentary Beautiful Young Minds about the Mathematical Olympiad and the film is clearly based on this documentary. This documentary can be seen on YouTube. The main character is Nathan. From the BBC synopsis: *Preferring to hide in the safety of his own private world, Nathan struggles to connect with people, often pushing away those who want to be closest to him, including his mother, Julie. Without the ability to understand love or affection, Nathan finds the comfort and security he needs in numbers and mathematics.*

Even though there are similarities between this film and the documentary, the main story line is totally fictitious. Near the beginning,

Nathan, who has Asperger's syndrome, is involved in a car crash which kills his father to whom he was very close. He is then mentored by his maths teacher Martin Humphreys, who when young had taken part in the Mathematics Olympiad. He was diagnosed with multiple sclerosis but also has other problems to do with self-worth and soft drugs and ended up being a secondary school teacher.

Humphreys recognizes Nathan's abilities and persuades him to enter for the Olympiad. He goes to the preliminaries in Taipei.

One of the scenes where there is actual maths

is when Nathan is brought to the board to explain how to solve a problem. This involves playing cards which can be face up or face down. Nathan's solution is to model this with binary arithmetic involving 0s and 1s and he then turns the problem into an arithmetic one which is easy to solve.

In Taipei he meets Zhang Mei, a girl on the Chinese team. The film concentrates on two relationships. One between Nathan and Zhang Mei and the other between Martin Humphreys and Julie.

The scene moves from Taipei to Cambridge where the Maths Olympiad takes place.

There is real pathos in the final scenes. One where Nathan finally opens himself up to his Mother, and another when Nathan and Zhang Mei while travelling back from Cambridge by train see a rainbow and the viewer feels that their relationship will last. At last, Nathan feels and understands love and affection. Some critics have thought that this ending is too soupy, but if you see the documentary on which this film is based, the rainbow really was there!

One should also mention the excellent cast. Nathan was played by Asa Butterfield, Martin by Ralf Spall, Julie by Sally Hawkins and Zang Mei by Jo Yang.

A lovely film where mathematics plays a central role.

David Singerman
University of Southampton

MATHEMATICS, POETRY AND BEAUTY
by Ron Aharoni, 2015, Technion, Haifa, Israel, 272 pp, hb £55.00 ISBN: 978-981-4602-93-8, pb £24.00 ISBN: 978-981-4602-94-5, Ebook £18.00 ISBN: 978-981-4602-96-9.

"The mathematician's patterns, like the painter's or the poet's must be beautiful [...] Beauty is the first test: there is no permanent place in this world for ugly mathematics." These familiar words from G.H. Hardy's Mathematician's Apology, first published in 1940 during his second term as LMS President, perhaps sum up the message that this book aims to convey to a non-specialist readership.

The book contains over forty short, essentially self-contained, essays, each presenting a topic in a way that emphasises its underlying elegance. Many of the pieces illustrate fundamental mathematical notions, described in the simplest cases and illustrated by examples, such as those on properties of primes, the uncountability of the reals, and ideas from topology and combinatorics. Interspersed are sections that highlight corresponding features of poetry, for example 'Compression' or 'Content and Husk'. Other pieces, such as 'Paradoxes and Oxymorons' and 'To Discover or Invent', address poetry and mathematics side by side. Many easily appreciated theorems are explained and discussed in the context of elegance, though, unsurprisingly, there are few proofs. The essays include many short poems and quotations, some well-known and others less so; there are historical snippets, and the book is well-illustrated with diagrams and small photographs. The style is discursive and lively, but the central ideas are clearly communicated.

Readers of the *LMS Newsletter* will be very familiar with the mathematical topics covered in the book. Rather, it is aimed at the layperson who seeks an insight into how mathematicians think or who wonders why they can enthuse over the elegance of a mathematical argument or theorem in the way that others would over a painting, landscape or poem.

It is not always easy to portray the attraction of mathematics to friends or relatives, or to get across that the essence of mathematics is imagination and creativity rather than routine calculation or the mere manipulation of symbols. By highlighting parallels with poetry, the book may help break down such communication barriers. It may also provide youngsters, so often disillusioned by a prescriptive curriculum, with an insight into the true nature of mathematics.

Kenneth Falconer
University of St Andrews
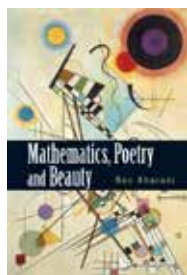
PROPORTIONS OF THE HEART: Poems that Play with Mathematics by Emily Grosholz, artwork by Robert Fathauer, published by Tessellations Publishing, Phoenix, Arizona, 2014, ISBN 1938664108.

Here is a poem from *Proportions of the Heart* by Emily Grosholz, a collection of poems with a mathematical theme. Emily wrote this poem when she was a research fellow at Clare Hall, Cambridge and was working on what became Chapter 8 'Leibniz and transcendental curves' in her 2007 OUP book *Representation and Productive Ambiguity in Mathematics and the Sciences*.

The Continuum: Trying to Describe the Reals in Cambridge

"For there are two labyrinths of the human
  mind,
One concerning the composition of the
  continuum,
And the other concerning the nature of
  freedom,
And they arise from the same source: infinity."
                     G.W. Leibniz, On Freedom

Draw the curtains! The curtains are always
  closed
On roses, rugby field, light variable
But waning along these tiered northern skies
Where ten o'clock's the apogee of day,
A full moon pewtering the cliffs of sunset.

I write in the wizened glow of my computer.

I write, the reals are really not like numbers
That we are used to count with, to begin
And go up stepwise. They are number flooded
By continuity, the line upbraided
By differential strands to labyrinth.
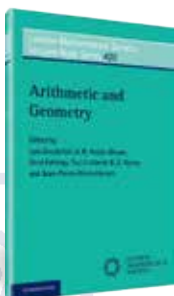They are the shape and cardinal of freedom.

Abysses along abysses along abysses,
Yet perfectly defined. As if we charted
A finest-grained Grand Canyon with passing
  walls
Through which a sourceless unplumbed river
  ran,
Like moonplate cumulant in tiers above
The river of waning sunlight. Draw the
  curtains!

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.

JUNE 2015

3-5 Cluster Algebras and Finite Dimensional Algebras, Leicester (447)
8-12 Relations between Banach Space Theory and Geometric Measure Theory Workshop, Warwick (444)
10-11 Geometric Rigidity, Lancaster (447)
10-12 Young Functional Analysts' Workshop, Imperial College London (447)
10-12 Barriers and Enablers to Learning Maths IMA Conference, Glasgow (448)
10-13 AMS-EMS-SPM International Meeting, Porto, Portugal (442)
11-12 ECSTATIC, Imperial College London (447)
12-13 Integrable and Conformal Field Theories, Durham (447)
14-15 UKMHD, Northumbria University (447)
15-19 Permutation Patterns, London (447)
15-19 Geometry of Random Walks and SLE, INI Workshop, Cambridge (445)
15-19 Fourier-Mukai, 34 Years On, Warwick (446)
17 Hardy Lecture, Imperial College (448)
18 Hardy Lecture, Oxford (448)
18-19 Mathematics in Finance IMA Conference, Manchester (448)
19 Hardy Lecture, Bath (448)
19-20 Topological Data Analysis: New Developments and Challenges, Oxford (448)
19-26 Groups, Representations, and Cohomology Workshop and Conference, Isle of Skye (446)
20 The Big Picture BSHM Conference, Oxford (466)
22 Hardy Lecture, Glasgow (448)
22-25 Mathematics and Computation in Music, Queen Mary, University of London (446)
22-26 Random and other Ergodic Problems INI Workshop, Cambridge (444)
23 Celebrating New Appointments in Mathematics, University of South Wales (447)
23-26 Hopf-Galois Theory and Galois Module Structure Workshop, Exeter (445)
24 Hardy Lecture, Lancaster (448)
25 Popular Lectures, London (448)
25 Model Theory, Topological Dynamics and Real Algebraic Geometry, Lancashire (447)
26 Hardy Lecture, Loughborough (448)
29 Hardy Lecture, Leeds (448)
30 Celebrating New Appointments in Mathematics, University of South Wales (447)
30-3 Jul Group Theory PostGraduate Conference, Bristol (447)

JULY 2015

1 Hardy Lecture, University of Kent (448)
1-5 Regularity and Analytic Methods in Combinatorics, LMS-CMI Research School, University of Warwick (446)
3 LMS Graduate Student Meeting, London (448)
3 Hardy Lecture, LMS Meeting, London (448)
5-10 Developments in Modern Probability LMS-CMI Research School, University of Oxford (446)
6-9 Symbolic and Algebraic Computation Conference, Bath (446)
6-10 Design and Analysis of Experiments in Healthcare INI Workshop, Cambridge (446)
6-10 British Combinatorial Conference, Warwick (447)
7 LMS Midlands Regional Meeting, Warwick (448)
8-10 Advances in Continuous Optimization, Edinburgh (447)
13 Iwasawa 2015, King's College London (447)
13-15 Simple Groups, Representations and Related Topics Conference, Cambridge (447)
13-17 Quantum Groups and Quantum Information Theory, Sussex (445)
13-17 Stochastic Processes and their Applications Conference, Oxford (446)
20-30 Permutation Groups and Transformation Semigroups LMS-EPSRC

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Durham Research Symposium, Durham (443)
20-31 LMS Undergraduate Summer School, Loughborough (444)
22 Fractal Geometry and Dimension Theory, Manchester (448)
27-31 Metric and Analytic Aspects of Moduli Spaces INI Workshop, Cambridge (446)
27-2 Aug International Mathematics Competition for University Students, Bulgaria (446)

AUGUST 2015
3-12 New Moonshines, Mock Modular Forms and String Theory LMS-EPSRC Durham Research Symposium, Durham (444)
17-20 Young Researchers in Mathematics Conference, Oxford
17-28 George Boole Mathematical Sciences Conference, Cork (448)
23-28 Heidelberg Laureate Forum, Heidelberg (444)
24-28 European Set Theory INI Conference, Cambridge (445)
30-1 Sep Modern Mathematical Methods in Science and Technology, Kalamata, Greece (445)
31-3 Sep Finiteness Conditions in Topology and Algebra, Belfast (448)

SEPTEMBER 2015
1-4 Numerical Methods for Simulation IMA Conference, Oxford (448)
2-4 British Logic Colloquium, Cambridge (448)
6-10 Dynamic Days Europe, Exeter (447)
7-9 British Topology Meeting, Belfast (447)
9-11 Mathematics of Robotics IMA Conference, Oxford (448)
7-11 Cauchy Problem in Kinetic Theory, Imperial College London (447)
10 A Posteriori Error Control and Mesh Adaptivity for Time Dependent and Nonlinear Problems, University of Chester (448)
10-11 Challenges in Nonlinear Systems, Manchester (448)
11 Approximate Dynamic Programming, Essex (448)

14-16 Non-Combinatorial Combinatorics, Warwick (448)
14-18 Cell Mechanics, Morphogenetics and Pattern Formation INI Workshop, Cambridge (448)
15-19 Diophantine Equations LMS-CMI Research School, Baskerville Hall, Hay-on-Wye (448)
17 LMS Computer Science Colloquium, The Royal Society London
18-20 LMS/EMS Joint Anniversary Mathematical Meeting, Birmingham (447)
21 Moduli Spaces and their Applications, Liverpool (448)
23 LMS Popular Lectures, Birmingham (448)
30 Clay Research Conference, Oxford (447)

OCTOBER 2015
21 LMS Popular Lectures, Glasgow (448)
22 Challenges for the Next 25 Years, EMS Meeting, Institut Henri Poincaré, Paris (448)

NOVEMBER 2015
11 LMS Popular Lectures, Leeds (448)
13 LMS AGM, London
26 Mathematics in Defence IMA Conference, Harwell, Oxford (448)
28-29 Joint Meeting with IoP and RAS, QMUL, London

DECEMBER 2015
7-11 Combinatorial Mathematics and Combinatorial Computing Australasian Conference, Brisbane, Australia (445)
7-11 New Mathematical and Computational Problems, INI Workshop, Cambridge
9-10 Ada Lovelace 200 Symposium: Celebrating the life and legacy of Ada Lovelace, Oxford
10-11 LMS Joint Meeting with the Edinburgh Mathematical Society, Edinburgh (443)
14-17 LMS South West & South Wales Regional Meeting, Southampton
15-16 LMS Prospects in Mathematics, Loughborough
15-17 Cryptography and Coding IMA Conference, Oxford (448)

150TH LMS ANNIVERSARY
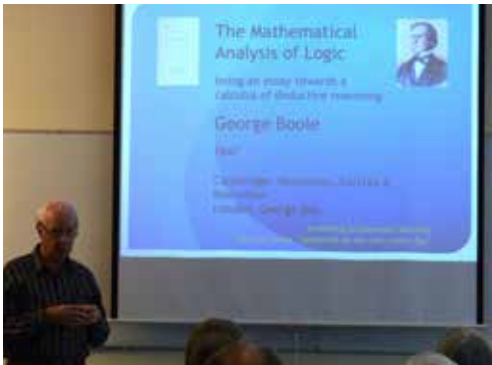## DE MORGAN DAY
(see report on page 6)

Wilfrid Hodges

John Heard

Ian Stewart

Sloan Despeaux

Attendees

Robin Wilson, Peter Neumann, Adrian Rice