LONDON MATHEMATICAL SOCIETY

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LMS COUNCIL DIARY

12 October 2012
A personal view

The meeting opened with a few moments silence in remembrance of Anne Bennett. Anne had provided important support to Council, as well as to the many Committees which came under her wing, and we all benefited from the extraordinary amount of work she did to ensure the smooth running of Society business. As Fiona Nixon so eloquently described in her tribute to Anne (which appeared in the previous *Newsletter*), Anne made a real difference both to the Society and to the staff at DMH with whom she worked. Council will feel her loss very keenly. We agreed that a fitting way to remember Anne would be to establish a Women in Mathematics Prize in her name, with the details of the prize to be worked out by the Women in Mathematics Committee.

The most substantial business matter of the day was to consider and approve the Trustees' Report and Annual Accounts so that they can be presented at the AGM. Rob Curtis, the Treasurer, who fluently guided us through the papers, congratulated Ephrem Belay for the excellent work he had done in preparing the accounts, noting too that the auditors were full of praise for Ephrem's work. Overall, the Society's finances are in reasonable shape – taking inflation into account, the Society effectively broke even – but there is no room for complacency, especially when considering the current discussions around academic publishing. In addition, as Rob pointed out, there is the salutary fact that the Society's invested assets now are nominally worth roughly the same as they were worth a decade ago, excluding the current value of De Morgan House. At the May Council meeting, Rob had made a compelling argument for exploring the possibility of the Society investing in property, and at today's meeting he presented the worked-up business case. After a thoroughgoing discussion, we agreed to the purchase of residential rental property in central London as part of the Society's investment portfolio.

Rob Curtis also reported on the results of the Members Survey which took place over the summer. Just over 40% of members responded to the survey, with 83% voting in favour of expanding the criteria for Ordinary Membership and 71% voting in favour of expanding the criteria for Associate Membership. It was gratifying to see such a conclusive outcome and one that will contribute towards expanding the reach of the Society. We agreed the appropriate amendments to

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the criteria for membership, and these will be reported at the AGM.

With the advent of the option of electronic voting in the forthcoming Society Elections, we spent some time discussing the election procedures. For this item we had the benefit of the presence of the Scrutineers, Don Collins and Peter Saunders, which was extremely helpful. While we felt that a move to electronic only voting was a desirable aim, it was agreed that this should not be rushed and that while it was hoped that members would take up the option of electronic voting, the option to vote by paper should be maintained for the time being.

The Society's website made its customary appearance on the agenda. However, this time the main item for discussion was a proposal from an outside organisation. Plus (http://plus.maths.org/content), a free online magazine produced by the Millennium Mathematics Project, directed by Professor John Barrow at Cambridge, would like to produce content for the website. We all thought it seemed a promising proposal – there is a strong desire among Council members for the site to contain more actual mathematics! – and encouragement was given to the President, who had introduced

the item, to commission a sample article.

Finally, as a member of the 2015 Celebrations Committee, I was very happy to report that plans for celebrating the 150th anniversary of the Society are progressing well. The Celebrations Committee is working closely with other Committees of the Society and many ideas are already either under way or under consideration (fireworks have not yet been excluded!). It was pleasing to note that the BMC - which is going to be held in Cambridge in 2015 - contacted the Committee about the anniversary even before the Committee had had a chance to contact them.

June Barrow-Green

CONGRATULATONS

Congratulations to **Professor Abolghassem Ghaffari** (elected an LMS member 22 May 1957) who celebrated his 105th birthday earlier this year.

Also this year **Dame Kathleen Ollerenshaw** (elected an LMS member 25 January 1945) and **Professor Joseph Lehner** (elected an LMS member on 16 February 1950) both celebrated their 100th.

LMS PRIZES 2013

Call for Nominations
The London Mathematical Society welcomes nominations for the 2013 prizes to recognise and celebrate the achievements in and contributions to all aspects of mathematics, including applied mathematics, mathematical physics and mathematical aspects of computer science. In 2013, the LMS Council expects to award:

- The **De Morgan Medal**. the Society's premier award; the only grounds for the award of the Medal are the candidate's contributions to mathematics.
- The **Senior Whitehead Prize** for work in, influence on or service to mathematics, or recognition of lecturing gifts in the field of mathematics.
- The **Naylor Prize** and Lectureship for work in, and influence on, and contributions to applied mathematics and/or the applications of mathematics, and lecturing gifts.
- The **Berwick Prize** in recognition of an outstanding piece of mathematical research actually published by the Society during the eight years ending on 31 December 2012.
- The **Whitehead Prizes** for work in and influence on mathematics.

For further information and nomination forms, please visit the LMS website (www.lms.ac.uk/content/nominations-lms-prizes) or contact Duncan Turton, Secretary to the Prizes Committee at the Society (tel: 020 7927 0801, email: prizes@lms.ac.uk).

The Prizes Committee is keen to increase the number of nominations it receives and, in particular, the number of nominations for women, which are disproportionately low each year. The prize regulations refer to the concept of 'academic age'—rather than date of birth—in order to take account more fully of broken career patterns.

The closing date for nominations is **Friday 18 January 2013**.

LMS INVITED LECTURES SERIES 2014

Proposals for the 2014 lectures are sought from any member who, in addition to suggesting a topic and lecturer, would be prepared to organise the meeting at their own institution or a suitable conference centre.

The annual Invited Lectures series consists of meetings at which a single speaker gives a course of about ten expository lectures, examining some subject in depth, over a five day period (Monday to Friday) during a University vacation. The meetings are residential and open to all interested.

It is intended that the texts of the lectures given in the series shall be published. In addition to full expenses, the lecturer is offered an honorarium for giving the course. A grant is also given to the host department to support attendance at the lectures.

For further details, visit the Society website: www.lms.ac.uk/content/invited-lecturer-proposals.

Enquiries about the Invited Lectures should be directed to the Programme Secretary at the Society (grants@lms.ac.uk). The deadline for the submission of proposals is **Friday 7 February 2013.**

Recent previous lecturers have been:
2012 A. Borodin (MIT)
Determinantal Point Processes and Representation theory
2011 E. Candes (Stanford)
Compressed Sensing
2010 M. Bramson (University of Minnesota)
Stability of Queuing Networks

The LMS Invited Lecturer 2013 will be Fedor Bogolomov (Courant Institute, NYU) who will give lectures on *Birational Geometry and Galois Groups*. See poster on page 21 of the *Newsletter*.

LMS CONFERENCE FACILITIES

Organising a conference in central London? Meeting rooms and catering are available in De Morgan House. For terms and availability, please call 020 7927 0800 or email roombookings@demorganhouse.co.uk.

LMS GRANT SCHEMES

**Next Closing Date for Research
Grant Applications: 31 January 2013**

Applications are invited for the following grants:
- Conferences and postgraduate research conferences held in the UK (Schemes 1 and 8)
- Celebrating new appointments (Scheme 1
- Visits to the UK (Scheme 2)
- Joint Research Groups (Scheme 3 – see below about renewal of Scheme 3 grants)
- Research in Pairs (Scheme 4)
- International short visits with the main focus on Africa (Scheme 5)

For full details of these grant schemes, and to download application forms, visit the LMS website: www.lms.ac.uk/content/research-grants.
- Applications received by **31 January 2013** will be considered at a meeting in February.
- Applications should be submitted well in advance of the date of the event for which funding is requested.
- Normally grants are not made for events which have already happened or where insufficient time has been allowed for processing of the application.

Queries regarding applications can be addressed to the Grants Administrators or the Programme Secretary (see below) who will be pleased to discuss proposals informally with potential applicants and give advice on the submission of an application.

Grants Administrators: Sylvia Daly, Elizabeth Fisher, Barbara Graczyk (tel: 020 7291 9971 / 3, and 0207 927 0808, email: grants@lms.ac.uk).

Programme Secretary: Rob Wilson (r.a.wilson@qmul.ac.uk).

Other LMS Grants & Funding

Computer Science Small Grants (Scheme 7)
Funding for grants **up to £500** is available to support a visit for collaborative research at the interface of Mathematics and Computer Science either by the grant holder to another institution within the UK or abroad, or by a named mathematician from within the UK or abroad to the home base of the grant holder. The next deadline for applications is **31 January 2013** – see the web-site for further details: www.lms.ac.uk/content/computer-science-small-grants-scheme-7.

Childcare Supplementary Grants
Grants of **up to £200** are available to parents working in mathematics to help with the cost of childcare when attending a conference or research meeting. The Society believes that all parents working in mathematics should be able to attend conferences and research meetings without being hindered by childcare costs. Institutions are expected to make provision for childcare costs and parents are encouraged to make enquiries. However, where this is not available, the Society administers a Childcare Supplementary Grants Scheme. Further details can be found on the LMS website: www.lms.ac.uk/content/childcare-supplementary-grants.

Small Grants for Education
Funding for grants **up to £800** is available to stimulate interest and enable involvement in mathematics from Key Stage 1 (age 5+) to Postgraduate level and beyond. Anyone working/based in the UK is eligible to apply for a grant. If the applicant is not a member then the application must be countersigned by an LMS member or another suitable person such as a Head teacher or senior colleague. The next deadline for applications is **31 January 2013**. Please see the website for further details: www.lms.ac.uk/content/small-grants-education.

LMS-EPSRC Short Courses
The Society and EPSRC offer funding of **up to £12,200** (including honoria for organisers) towards the cost of running a one-week Short Course which provides high quality training for postgraduate students in core areas of mathematics. For further information on Short Courses and how to submit a proposal, please visit: www.lms.ac.uk/content/short-course-organisers.

Research Workshop Grants
The Society offers grants to support for Research Workshops held in the UK. Requests for support (for travel and subsistence of participants, and reasonable associated costs) **in the range £1,000-£10,000** will be considered. For further information and application forms, visit: www.lms.ac.uk/content/research-workshops-grants.

Spitalfields Days
Grants of **up to £500** are available to support an LMS Spitalfields Day, which have been run since 1987 and are in honour of the Society's predecessor, the Spitalfields Mathematical Society (1717-1845). A Spitalfields Day is a one-day meeting, which is usually associated with a long-term symposium on a specialist topic at a UK university. Selected participants, often distinguished experts from overseas, give survey lectures (or other types of lecture accessible to a general mathematical audience) on topics in the field of the symposium. Further details can be found on the LMS website: www.lms.ac.uk/content/spitalfields-days#applications.

Young British and Russian Mathematicians Scheme

Visits to Russia
Applications are invited from young British postdoctoral mathematicians who wish to spend a few weeks in Russia giving a series of survey lectures on the work of their school.

The LMS is offering grants of **up to £500** to meet the travel costs, while the host should apply to the Russian Academy of Sciences for funding towards local expenses for accommodation and subsistence. Please contact Sylvia Daly (grants@lms.ac.uk) for information before contacting the Russian Academy of Sciences for funding. Applications to the LMS should include the following:
1. A brief academic case for the visit, including a description of your current research interests, and an outline of your planned work during the visit (no more than one side of A4).
2. A brief CV (no more than one side of A4).
3. A brief budget.
4. A letter of invitation from the head of the host department in Russia, which must state explicitly that your accommodation and subsistence expenses will be met by them. This should include provisional dates for the visit.

Financial and academic reports will be required after the visit.

In exceptional circumstances, applications may be considered from strong research students who are close to finishing their doctorates. Applications should include a strong case and the student should obtain a letter of recommendation from his/her supervisor.

Visits to Britain
Under this Scheme, applications may also be made by any mathematician in Britain wishing to host a visit by a young Russian postdoctoral mathematician who wishes to spend a few weeks in Britain giving a series of survey lectures on the work of their Russian seminar.

The LMS is offering grants to the host institution to meet the visitor's actual travel and accommodation costs of **up to £1,500**. Applications should include the following:
1. Name and brief CV of the visitor.
2. A brief description of the course of lectures.
3. A letter or email of agreement from the head of the host department, including the proposed dates of the visit.

Financial and academic reports will be required after the visit.

Further details of the Scheme can be found on the LMS website: www.lms.ac.uk/content/international-grants#YBR. Applications received by **31 January 2013** will be considered at a meeting in February.

Enquiries should be made to the Grants Administrators: Sylvia Daly, Elizabeth Fisher and Barbara Graczyk (tel: 020 7291 9971/3, and 0207 927 0808, email: grants@lms.ac.uk).

LMS SUBSCRIPTION

Reminder

Members are reminded that their annual subscription, including payment for publications, for the period November 2012 – October 2013 was due on 8 November 2012, and should be paid by **8 December 2012** at the latest.

In the case of members who already have a direct debit set up, no action need be taken. All members should now have received a reminder via email or letter, detailing how to pay their subscription. If you have not received a reminder please contact the Membership Department (email: membership@lms.ac.uk; tel. 020 7291 9973 or 020 7927 0808).

Subscription forms, direct debit mandate forms and further information can be downloaded from the LMS website at www.lms.ac.uk/content/paying-your-subscription.

LONDON MATHEMATICAL SOCIETY

## MARY CARTWRIGHT LECTURE AND SOCIETY MEETING

Friday 1 March 2013

De Morgan House, 57-58 Russell Square, London WC1B (Nearest tube: Russell Square)

Programme:

3.30   Opening of the meeting

     Jeff Lagarias (University of Michigan)
     From ABC to XYZ

4.30   Tea

5.00   **Mary Cartwright Lecture**
     Margaret Wright

     (Courant Institute, New York University)
     *A Mathematical Journey
     in Non-Derivative Optimization*

Courtesy of the South Wales Evening Post.
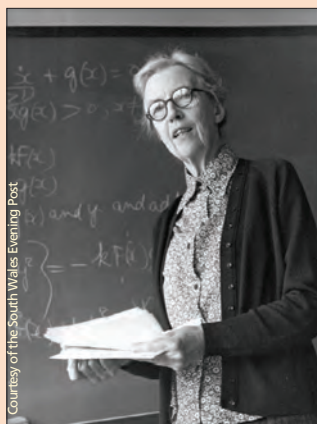
Mary Cartwright giving a lecture at Swansea University

To register, please contact Elizabeth Fisher/Katy Henderson (womenin-maths@lms.ac.uk) by **Friday 22 February**. Late registrations for places may be still be accepted, subject to availability.

The reception will be followed by a dinner at the DoubleTree by Hilton London West End, at a cost of £35 per person, inclusive of wine. If you would like to attend the dinner, please contact Elizabeth Fisher/Katy Henderson (womeninmaths@lms.ac.uk) by **Friday 22 February**.

There are limited funds available to contribute in part to the expenses of members of the Society or research students to attend the meeting. Please contact Elizabeth Fisher/Katy Henderson (womeninmaths@lms.ac.uk) for further information.

The 2013 David Crighton Lectures and Medal Presentation

Thursday 14 March 2013
The Royal Society, Carlton House Terrace, London, SW1Y 5AG

The lectures will start at 6.30 pm, with Registration from 6.00 pm. A reception will be held after the lectures

**Dr Peter Neumann OBE
(University of Oxford)**
Tout ce gâchis: why edit the mathematical manuscripts of Évariste Galois?

**Professor Arieh Iserles
(University of Cambridge)**
The future of life, mathematics and everything

To register contact Duncan Turton at the LMS (email duncan.turton@lms.ac.uk) or De Morgan House, 57-58 Russell Square London WC1B 4HS by 1 March 2013

Attendance is free of charge and is on a first come, first served basis.

ANDREI GONCHAR

Andrei Gonchar died on 10 October 2012, at the age of 81. He was born in Leningrad (now St Petersburg), graduated from school in Yerevan (Armenia), and enrolled in Moscow State University in 1949. From 1954 to 1957 he was a postgraduate student at the same university, with Sergei Mergelyan as his advisor, and he taught there from 1957 to 1991. Since 1964 he was also a research fellow and a head of department at the Steklov Mathematical Institute. He was a member of the Soviet (now Russian) Academy of Sciences since 1987 (a corresponding member since 1974) and held high administrative posts at the Academy for some period of time. From 1992 to 1993 he was the Organizing Director of the Russian Foundation for Basic Research, a newly formed government agency supporting fundamental research.

Gonchar's interests in mathematics were focused on rational approximation of functions. He was one of the central figures in the development of the modern theory of Hermite-Padé approximations and orthogonal polynomials with varying weight. He brought forward a radically new method of solution of classical problems in rational approximation, which is based on vector equilibrium problems of potential theory in the presence of an exterior field. Now this method is widely used in theoretical and practical investigations. With its help Gonchar solved Varga's famous '1/9' problem. He reported on this result at the International Congress of Mathematicians in Berkeley in 1986 and it received ample recognition.

He paid much attention to publishing activities of the Academy. For 25 years he was the editor-in-chief of *Matematicheskii Sbornik*, the oldest Russian mathematical journal. Thanks in part to Gonchar's warm relations with Sir Michael Atiyah, a partnership in journal publishing between the Russian Academy of Sciences, the London Mathematical Society and Turpion Ltd has been actively developing since the mid-1990s.

Nikolai Kruzhilin and Sergei Suetin
Steklov Mathematical Institute, Moscow

RUSSELL SMITH

Dr Russell Alexander Smith, who was elected a member of the London Mathematical Society on 18 November 1965, died on 19 August 2012, aged 86.

Lorna Smith writes: Russell was born in Katoomba in New South Wales, Australia. He studied for a BSc at New England University College Armidale and Sydney University where he was awarded a University Medal in Mathematics. In 1948 he was awarded the Barker Travelling Scholarship and came to St John's College, Cambridge where he took the Cambridge Mathematical Tripos and then continued to a PhD supervised by Dame Mary Cartwright. After the PhD Russell returned to Australia, to a lectureship at Sydney University, but he then came back to the UK in 1954, to a lectureship at Durham University. Russell stayed at Durham University throughout the rest of his career, progressing first to Senior Lecturer and then to Reader in 1968, a role he held until his retirement in 1990. In 1985 he was awarded an ScD by the University of Cambridge.

Russell's research interests concentrated around the theory of Ordinary Differential Equations. He published papers in number theory relating to sums of squares and worked on the functional equations of *L*-series related to quadratic forms and the distribution of rational points on hypersurfaces, as well as improving an error term in a result of Ramanujan concerning squares of the sum of the divisors of integers. The breadth of his interests also enabled him to contribute to a range of interdisciplinary areas, including collaborating with mathematical physicists working on string theory.

Russell was a dedicated teacher who gave very clear and well-presented lectures. Both students and colleagues benefitted from his helpfulness and the encouragement that he gave. He always had time to listen, and gave well thought-out and sympathetic advice.

Russell was devoted to his wife Katherine, who died sadly in 2001. He is survived by four children, five grandchildren and eight great-grandchildren.

JORAM LINDENSTRAUSS

Professor Joram Lindenstrauss, who was elected a member of the London Mathematical Society on 17 October 1974, died on 29 April 2012, aged 75.

David Preiss writes: Joram Lindenstrauss was professor of the Hebrew University of Jerusalem, member of the Israeli Academy of Sciences, foreign member of the Austrian Academy of Sciences, recipient of the Israel Prize in Mathematics, Banach's medal winner, teacher and adviser of numerous outstanding mathematicians and founder of a powerful school of modern functional analysis. He was born in Tel Aviv in 1936 and educated at the Hebrew University of Jerusalem, where he was deeply influenced by his teacher Aryeh Dvoretzky. He held longer term visiting positions at the Yale University, University of Washington, University of California, University of Texas and Texas A&M University and a number of other shorter term positions. Via his deep results, books, lectures, survey papers and collaborations (for the luckiest of us) he enormously influenced the development of modern mathematics.

It is impossible to describe Joram's main discoveries in a brief note. Without any attempt for serious investigation, I quickly asked several colleagues what they think should be mentioned. The most popular answers were Johnson-Lindenstrauss Lemma, Lindenstrauss-Tzafriri characterization of the Hilbert space as the unique Banach space all of whose closed subspaces are complemented, Lindenstrauss-Pelczynski version of Grothendieck's 'Fundamental Theorem' and its applications, Lindenstrauss-Rosenthal local reflexivity,.... His book *Classical Banach Spaces* written jointly with Lior Tzafriri, became the basic reading for everyone interested in the theory of Banach spaces, and the more recent *Geometric Nonlinear Functional Analysis* written jointly with Yoav Benyamini, is becoming similarly influential.

Like so many others, I was deeply influenced by Joram's work. A referee called me 'a mathematician of Lindenstrauss's school' long before political situation allowed us to meet and work together. When this barrier was finally broken, we jointly investigated the still puzzling problems of Fréchet differentiability. It became a very enjoyable long term 'on and off project' (as Joram called it), developed during his visits to London, Warwick and Prague (where Jaroslav Tišer joined our work), but mainly during my two longer and many shorter visits to Jerusalem. In spite of that, we would probably never be finished were it not for the support of Joram's family and especially of his wife, Naomi. We finally managed to put all the bits and pieces together in Autumn 2011 when Joram was already seriously ill, and he still saw the appearance of our research monograph *Fréchet Differentiability of Lipschitz Functions and Porous Sets in Banach Spaces* in February 2012. In spite of his deteriorating health, after finishing this work we still discussed directions in which further research may go.

MICHAEL EASTHAM

Professor Michael Stephen Patrick Eastham, FRSE, who was elected a member of the London Mathematical Society on 19 December 1963, died on 27 October 2012, aged 74.

Malcolm Brown and Desmond Evans write: Michael Eastham will be remembered as a leading mathematical analyst who contributed extensively to the theory of ordinary differential equations.

Michael was born in London on 2 December 1937. After attending Manchester Grammar School, he entered Merton College, Oxford in 1956 and graduated in 1959 with double first class honours in Mathematics. He then was a research student of the eminent analyst Professor E.C. Titchmarsh and obtained his DPhil in 1962; during 1959-61, he was a Domus Senior Scholar at Merton College. He was admitted to the Degree of Doctor of Science of Oxford University in 1974. After lectureships in Reading (1962-65) and Southampton (1965-69), he spent the years 1969-88 in the University of London, at Chelsea and then King's Colleges, being promoted to Professor in 1980. He received the Keith Prize and Gold Medal of the Royal Society of Edinburgh in 1978 and was elected

to a Fellowship of the Royal Society of Edinburgh in 1982. From 1988 until 1991 he was Professor of Mathematics in Bahrain and was Honorary Research Professor at Cardiff University School of Computer Science and Informatics from 1995.

Michael was a widely acknowledged authority on the spectral theory of differential equations, and was particularly well-known for his analytical skills. He made many significant contributions to such topics as the asymptotics of solutions of linear differential systems, the deficiency index problem, periodic problems, spectral concentration and resonances. He was the author of 124 research publications and five books.

Michael is survived by his widow, Heather, two sons and four granddaughters. He was a dear friend and will be greatly missed by all who knew him.

ISAAC NEWTON INSTITUTE

Call for Proposals

The Institute invites proposals for research programmes in all areas of the mathematical sciences and their applications. The Scientific Steering Committee usually meets twice each year to consider proposals for programmes (of 4-week, 4-month or 6-month duration) to run two or three years later. Proposals to be considered at these meetings should be submitted by **31 January** or **31 July** respectively. Details on submitting proposals are available on the website (www.newton.ac.uk/callprop. html).

Anyone interested in making a proposal is encouraged to contact the Director, John Toland, by telephone or email, for advice and informal feedback (tel: 01223 335980, email: director@newton.ac.uk).

The Isaac Newton Institute is a national research institute based in Cambridge, UK. It attracts scientists from all over the world to research programmes in *all areas of the mathematical sciences.* At any time there are two visitor programmes at the Institute, each with about twenty participants. For more information see www.newton.ac.uk

MATHEMATICS IN THE NEW ELIZABETHAN AGE

(60 Years of British Mathematics)

This article arose from a discussion meeting organised by the Parliamentary and Scientific Committee entitled British Scientific Achievement over the Last 60 Years, which took place in July 2012. A number of distinguished speakers were invited to present at the meeting: Professor Brian Cox, Professor Dame Nancy Rothwell, President, Society of Biology and Professor Lesley Yellowlees President, Royal Society of Chemistry. The audience included several mathematicians and the Council for the Mathematical Sciences (CMS) was asked by the Secretary of the Parliamentary and Scientific committee to contribute this article to the meeting report, which was first published in the autumn issue of *Science in Parliament magazine.*

In June 1993 Andrew Wiles gave a series of seminars at the newly-created Isaac Newton Institute for Mathematical Sciences in Cambridge. In the final minutes of the last seminar he claimed to have solved a 350 year old mathematical problem: Fermat's Last Theorem. This became headline news across the world because of the romance in the story (lone British mathematician solves ancient mystery), and also because the problem itself is relatively easy to state. The interest generated by this achievement is rare for mathematics, though many other developments in mathematical science over the last 60 years are on a par with it. This is partly because mathematics is often seen as too abstruse or specialised for 'ordinary people'; and partly because major advances in applied mathematics and statistics are often sub-plots of bigger stories in biology, physics, economics or engineering.

In this article we want to redress this invisibility and stress the key international role played by British mathematics. Mathematics has changed enormously over the new Elizabethan age, and this has been a global effort.

However, the UK has played an important role in most of these changes – a far greater role than its relative size would suggest. Thus, for the period 1998–2008, Scotland and England were respectively second and fourth in the world for citations per paper published in the mathematical sciences[1]. Although we concentrate on research in the rest of this article, it is worth remembering that most researchers are also teachers, and we rely on them to pass on the intellectual thrill of the discipline and to create the skilled workforce needed in the banking, computing, engineering and pharmaceutical industries.

The rise of computers and the ubiquity of smart technology form one of the greatest changes to our lives since 1952. The early prototypes of this technology were developed by Alan Turing and others at Bletchley Park (to decode the German ENIGMA machine) and then at the National Physical Laboratory (NPL) and the University of Manchester. Turing committed suicide in 1954, so he only just makes it into the new Elizabethan age, but his achievements in computing, logic and mathematical biology have had an immense influence. As computers began to be used to solve complex engineering problems in industries such as aeronautics, the UK contribution was key to creating a new mathematical discipline, numerical analysis, which emerged to ensure that these large computations – computations that can now be done on a laptop! – were reliable. Here we mention two examples. James Wilkinson worked with Turing on the early computers at the NPL in Middlesex, where he discovered ways of analysing floating point arithmetic that enable the accuracy of computer calculations to be understood. His methods remain as valid as ever for today's largest supercomputers[2] and he went on to develop other now standard tools in algebraic manipulation. In many industrial and scientific problems some quantity needs to be optimised. In the 1970s such concerns prompted the UK mathematicians Roger Fletcher and Mike Powell to develop methods for solving optimisation problems numerically that are still the basis for many

of today's techniques. UK mathematics underpins computer simulations all over the world!

The speed and memory size of computers grew rapidly and it became much easier to collect data. But while data can now be gathered on a massive scale, it is much harder to work out what to do with it. Many of the fundamental ideas behind the mathematical treatment of data sets, *statistics*, were formulated in the 1920s at Rothamsted by Fisher. This tradition of excellence in statistics within the UK has continued during the new Elizabethan age, making it possible to analyse the effect of new drugs, or the meaning of the human genome, much more efficiently, and also to analyse models of systems with uncertainty (financial markets, spread of epidemics, life expectancy of smokers ….). Perhaps the most influential statistical contribution of the jubilee years has been Sir David Cox's 1972 paper[3] allowing mathematical models to be built on actuarial life tables, so permitting causal inferences based on sparse data. This work has been fundamental to countless medical and actuarial studies. In a related later development, the former Director General, Knowledge and Innovation, at BIS, Sir Adrian Smith, showed how useful information could be obtained from probabilistic models [4]. This technique, called Markov Chain Monte-Carlo inference (or MCMC for short), is now ubiquitous throughout the sciences.

The internet and world wide web brought computers into our daily lives, with new possibilities and problems. The method used to process secure financial transactions on-line is based on number theory, specifically the difficulty of finding the prime factors of large numbers. The RSA algorithm at the heart of this method was first developed by Clifford Cocks, a number theorist working at GCHQ. Unfortunately no one at GCHQ appreciated its potential (it was filed as 'secret') and the algorithm is now known by the initials of the US-Israeli team that patented the method in 1978!

Not all new mathematics is immediately applicable, and a fundamental development

of the new Elizabethan age has been the renaissance of geometry. Geometry and physics have been intertwined through most of their history, but drifted apart in the 60 years leading up to 1980. However, starting from discussions between Sir Michael Atiyah and the American physicist Ed Witten, the picture has changed greatly over the last 35 years, and now the connecting road is a motorway. Atiyah is one of the six UK Fields medallists (the mathematical equivalent of the Nobel Prize) – only France and the US have more – and has been a central figure in world mathematics during the new Elizabethan age. The maths-physics motorway is not just one-way: in the striking example of mirror symmetry from string theory, Philip Candelas, now at Oxford, and his collaborators were able to use the amazing intuition of the physicists to predict the solution of a century-old problem in classical geometry ("counting the number of rational curves in the quintic").

Mathematical physics itself (quantum theories and relativity) has also changed dramatically. Stephen Hawking and Roger Penrose, both working in mathematics departments, described the mathematical structure of black holes, stars so massive that even light cannot escape their gravitational pull. Hawking went on to show that there is a sense in which black holes actually do emit radiation! The existence of the Higgs particle that may have been observed recently and which is responsible for mass in quantum theory was predicted by Peter Higgs at the University of Edinburgh, with others including Tom Kibble at Imperial College, using mathematical arguments.

With advances in both methods and computing power, the scope of what mathematicians can model has expanded. This has led to changes in the way that weather forecasting is reported (using ideas from chaos theory) and the increasing use of mathematics in modelling financial markets. The sophistication of computer models is such that a model of the human heart at Oxford can be used to make predictions about heart treatments without using a living subject. Often, in such

applications to the life sciences, mathematicians now work in teams with other scientists as equal partners. Mathematical modelling is also used to inform policy decisions: strategies for the foot and mouth outbreak of 2001, the distribution of vaccines, and the safety of air flights through volcanic ash clouds in 2010, were all assessed using mathematics.

So what lessons can we learn from the success of UK mathematical science in the jubilee years? Here are some observations from the chalk-face.

- Structures must be flexible enough to allow many flowers to bloom: nobody can predict what the next breakthrough will be, far less from where it will appear.
- The time between formulation of a seminal mathematical idea and its application may be brief (as in Cox's 1972 work on regression analysis) or very long (as in Turing's 1936 discussion[5] of thinking machines, now at the heart of Artificial Intelligence). It is misguided to aim to reward only a fast pay-off. Worse, even with the best intentions this policy tends to lead to incremental research rather than real innovation, which is inherently unpredictable.
- The openness and non-hierarchical structure of British culture allows new ideas to gain a foothold, new talent to find a ready audience.
- Diversity (of scale of organisation, of mode of research – solo/team, interdisciplinary/narrow, applications-focused/blue skies) is key.

All the above features of UK mathematical science have been massively aided by the **dual support system** for funding research, allowing new ideas to start with small first steps, new talent to develop from a wide base (it is worth remarking that the Cambridge mathematician and Fields Medallist Sir Tim Gowers has never held a research council grant).

The key message from the last 60 years is that most progress has been through glorious surprises. No one except a few crazy science fiction writers could have predicted the way computers would come to pervade our lives, nor the way that new mathematics would be

needed to facilitate this. Modern statistical methods allow information to be extracted from data in previously unimagined ways. The deep interconnections between different areas of mathematics, and between mathematics and the sciences, that have emerged are similarly mysterious and could not have been foreseen in 1952. This does not mean that all future developments are unpredictable – it is clear that the mathematisation of the biological sciences will continue apace and holds some exciting prospects, and understanding climate change provides a challenge – but it does make it likely that the next real innovations will, by definition, be surprises.

The UK has been at the forefront of change over the past 60 years, and we need to ensure it remains at the cutting edge of progress for the next 60 years. Not just for the intellectual excitement of discovery, but also for its societal impact. How will the next 60 years go? All we can say is: watch this space!

Acknowledgements: We are grateful to

Penny Davies, Patrick Dorey, Jerome Gauntlett, Nick Higham, Oliver Jensen, Stephen Senn, Richard Thomas and Mike Titterington for helpful guidance, some of which we ignored due to lack of space.

Ken Brown, University of Glasgow
Paul Glendinning, University of Manchester

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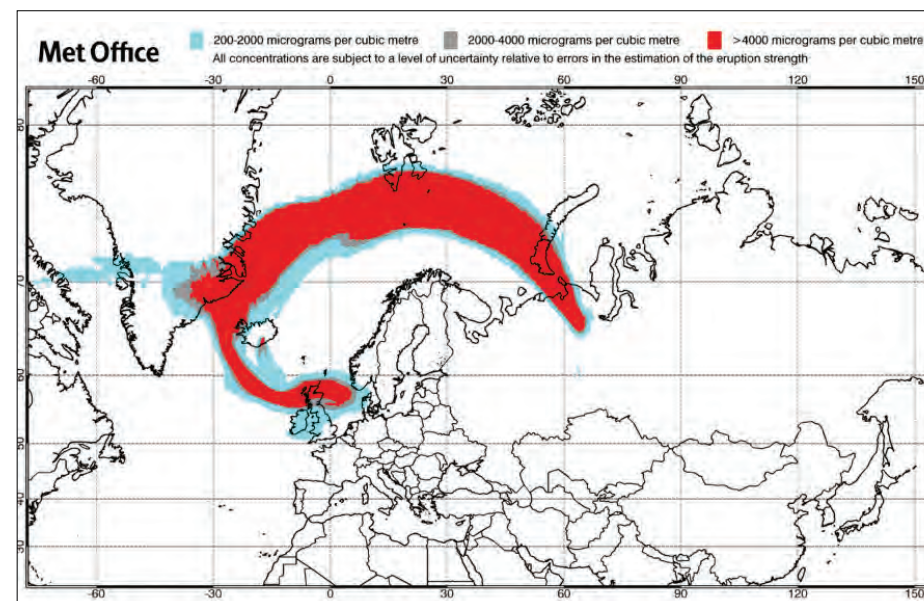
A computer generated prediction by the Met Ofice of the position of a volcanic ash cloud (Crown Copyright)

LONDON MATHEMATICAL SOCIETY

NORTHERN REGIONAL MEETING

Monday 18 March 2013

Herschel Building, Newcastle University

Programme:

2.00 pm	Opening of the meeting
	Volodymyr Mazorchuk (Uppsala)
3.15 pm	**Ivan Smith** (Cambridge)
4.30 pm	Tea/Coffee
5.15 pm	**Bernhard Keller** (Paris 7)
6.30 pm	Reception and Buffet at The Penthouse

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, please visit www.mas.ncl.ac.uk/triangulations/index.php?p=6. Registration closes on **31 January 2013**.

The Society Meeting forms part of the workshop on Triangulations and Mutations from 18-22 March. For further details visit: www.mas.ncl.ac.uk/triangulations/index.php?p=6.

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 (peter.jorgensen@ncl.ac.uk).

LMS Advancing Mathematics — London Mathematical Society

Nuffield Foundation

London Mathematical Society/Nuffield Foundation
Undergraduate Research Bursaries in Mathematics
2013

Nature of Awards

The purpose of the awards is to give experience of research to undergraduates with research potential and to encourage them to consider a career in scientific research.

The awards provide support for the student at a rate of £180 per week (or £190 per week in London), for a period of between six and eight weeks.

The closing date for receipt of applications is 5 pm Friday 8 February 2013.

Eligibility

- Open to Undergraduate Students in the **intermediate years (i.e. 2/3, 2/4 or 3/4)** of their undergraduate degree to undertake the project during the summer vacation between their intermediate years. (*Applications on behalf of first- or final-year undergraduates, or graduates, will* **not** *be considered.*)
- **Mature students** are eligible to apply, but must not have a previous degree in any subject.
- Students must be registered at a **UK institution** for the majority of their undergraduate degree.
- Bursaries will **not** be awarded for projects that are a **part of degree work**, or that take place overseas for more than 50% of the project time.
- Researchers in Mathematics at universities and research institutions within the UK are eligible to apply. Interdisciplinary projects will be considered providing the project has significant mathematical content.
- **Postdoctoral researchers** and **new lecturers**, early in their careers are also encouraged to apply, and should note this on the application form.
- Only **one** application should be submitted by a supervisor.
- Normally no more than **four** awards will be made to an individual department or subject area within multidisciplinary departments or schools. Please bear in mind that this is a national scheme with a limited number of bursaries.
- Bursaries will only be granted for the student named on the application form; awards are not transferable between students.

How to apply

- Application Forms can be downloaded from the Society's website: www.lms.ac.uk/content/grants.
- Applications must be made by the project supervisor on behalf of the student, and <u>not</u> the student.
- Applications should be discussed with the nominated student, who should also contribute to the project design.
- Applications should include the student's CV and a supporting statement from his/her academic tutor.
- Applications must be signed by the Head of Department to confirm his/her approval for the award to be administered by the department. (*Awards are not offered directly to individual researchers but to the institutions to which they belong*).

Further information including the *Guidelines on How to Apply* are available from the Society website: www.lms.ac.uk/content/grants. Queries may also be addressed to Katy Henderson (urb@lms.ac.uk).

MATHEMATICS POLICY ROUND-UP

November 2012

HIGHER EDUCATION

Postgraduate Education

The Higher Education Commission has published its report on *Postgraduate Education*. The Council for the Mathematical Sciences (CMS) responded in April 2012 to a call for evidence to inform this report. The final report calls for 'the postgraduate sector to be brought in from the cold and fully embraced as part of an integrated education system. It identifies policy shifts which will be needed to ensure that Britain remains a competitive place to do research and do business. It also explores access to postgraduate education, "the next frontier of widening participation", and makes recommendations on how postgraduate provision should be funded in the future'. The full report is available at http://tinyurl.com/ctcdrc4.

Segregation of HE sector

A report - *The Future of English Higher Education: Two Scenarios on the Changing Landscape* designed specifically to look at where the coalition reforms to higher education would lead the sector over the next decade has been published. The report concluded that 'research will be focused in just 25 universities by 2025 as the UK sector becomes more stratified'. The full report is available at http://tinyurl.com/c3ezlre.

The cost of the Government's reforms of the financing of higher education

A recent Higher Education Policy Institute (HEPI) report argues that the 'government has seriously underestimated the cost to the public purse of its HE policies'. The report concludes that 'the government's assessment of the cost of its HE policies still depends on highly uncertain and optimistic assumptions and remains too low'. More information is available at http://tinyurl.com/dybecz8.

SCHOOLS AND COLLEGES

Cambridge to support teaching of new mathematics A-levels

A new maths education programme is being launched by the University of Cambridge which aims to provide innovative, rich and stimulating materials to help support and inspire teachers and students of advanced post–16 mathematics. The £2.5m programme is funded by the Department for Education, initially for three years.

It will be led by Professor Martin Hyland, Head of the Department of Pure Mathematics and Mathematical Statistics, and Lynne McClure, Director of NRICH, part of the University's Millennium Mathematics Project. More information will be available in due course.

New plans to boost computer science teaching

'As part of the government's mission to ensure Britain competes and thrives in the global race, Education Secretary Michael Gove has set out plans to boost the teaching of Computer Science by training up the first generation of outstanding new teachers'. More information is available at http://tinyurl.com/99vuz5f.

OTHER

Reinvest the 4G windfall in science and technology

The Campaign for Science and Engineering (CaSE) and the National Endowment for Science, Technology and the Arts (Nesta) have launched a new campaign called 4Growth. The campaign calls on the government to invest the proceeds from the forthcoming 4G spectrum auction. Leading figures from science and technology have signed an online petition supporting the campaign. These include:

- Brian Cox – physicist and broadcaster
- Lord Martin Rees – former President, Royal Society and Astronomer Royal
- Andre Geim – Nobel laureate (Physics 2010)
- Lesley Yellowlees – President, Royal Society of Chemistry
- Lord William Waldegrave – former Chief Secretary to the Treasury and Science Minister
- Ben Goldacre – doctor and author of *Bad Science*, and *Bad Pharma*

A report on how the proposals could be implemented is available at www.nesta.org.uk/library/documents/4GROWTH.pdf.

'Serious deficit' in UK quantitative skills

A position statement – *Society Counts* – published by the British Academy says that 'the UK has a serious deficit in quantitative skills in the social sciences and humanities. This deficit threatens the overall competitiveness of the UK's economy, the effectiveness of public policy-making, and the UK's status as a world leader in research and higher education'. The full statement is available at www.britac.ac.uk/news/news.cfm/newsid/813.

Equal opportunities for boys and girls?

The new IOP report, *It's Different for Girls*, shows that many schools fail to ensure equal opportunity for boys and girls in A-level physics. The report is available at http://tinyurl.com/c8kow3z.

The National Numeracy Challenge

National Numeracy has launched a Challenge that aims to reduce the number of adults with low levels of numeracy by over one million in the five years from 2013–2018. The first phase of the Challenge will be a three-year collaborative project to improve work/life skills for 500,000 adults of working age in the UK by 2015. More information is available at http://tinyurl.com/c269dcn.

Dr John Johnston
Mathematics Promotion Unit

BRITISH MATHEMATICAL COLLOQUIUM 2013

The 65th British Mathematical Colloquium will take place at the University of Sheffield from 25 to 28 March 2013.

Plenary speakers:
- John Baez (Riverside)
- Ragni Piene (Oslo)
- Guy Henniart (Paris)
- Mikhail Kapranov (Yale)
- Laurent Saloffe-Coste (Cornell)
- Thomas Schick (Göttingen)

Professor Baez's lecture will be a public lecture on the subject of mathematics and the environment and will be a Mathematics of Planet Earth 2013 event.

Morning speakers will include:
- Konstantin Ardakov
- June Barrow-Green
- Tom Bridgeland
- Gavin Brown
- Tim Dokchitser
- Tony Dooley
- Tom Leinster
- Zinaida Lykova
- Lasse Rempe-Gillen
- Gesine Reinert
- Stuart White

Afternoon workshops:
- Category Theory
- History of Mathematics
- K-Theory and Analysis
- Mathematical Higher Education
- Noncommutative Algebra and Representation Theory
- Number Theory
- Probability
- Topology

There will be opportunities for contributed talks either by individuals or, in workshop format, by groups with a common interest. Proposals for contributed talks or workshops are particularly welcome from postgraduate students.

Anyone interested should contact Eugenia Cheng (e.cheng@sheffield.ac.uk) or David Jordan (d.a.jordan@sheffield.ac.uk).
For further information visit the website at www.sheffield.ac.uk/maths/bmc2013.

The colloquium is supported by an LMS Conference grant.

MANCHESTER 1824
The University of Manchester

LMS Advancing Mathematics
London Mathematical Society

LMS PROSPECTS IN MATHEMATICS MEETING

18-19 December 2012

School of Mathematics, University of Manchester
Oxford Road, Manchester M13 9PL

Photo: Nick Higham

All Finalist Maths Undergraduates, who are considering applying for a Maths PhD in 2013, are invited to attend the 2012 LMS Prospects in Mathematics Meeting.

The meeting will feature a range of speakers from a wide range of mathematical fields across the UK who will discuss their current research and what opportunities are available to you.

Confirmed Speakers include:

- Colm Caulfield (Cambridge)
- Anand Pillay (Leeds)
- Michael Wemyss (Edinburgh)
- Jane Hutton (Warwick)
- Chris Hughes (York)
- Nick Bingham (Imperial)
- Rob Scheichl (Bath)
- Sarah Whitehouse (Sheffield)
- Darren Crowdy (Imperial)
- Mark Holland (Exeter)
- Carmen Molina Paris (Leeds)

Information on funding and Doctoral Training Centres in Mathematical Sciences will be available too:

STOR-i: Statistics and Operational Research Doctoral Training Centre, Lancaster.
MASDOC - Mathematics and Statistics Doctoral Training Centre , Warwick.
CCA -- Cambridge Centre for Analysis, Cambridge.

50 places are available.

Funding is available to provide accommodation for around 50 participants and to help cover their cost of travelling to Manchester. All applicants are automatically considered for funding.

To apply: Please consult the conference webpage for instructions on how to register:
www.maths.manchester.ac.uk/~mheil/LMS_Prospects/

Application deadline is 2 December 2012.

(Late application will be considered at the organisers' discretion).

CECIL KING TRAVEL SCHOLARSHIP

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

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

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

Applications should be made using the form available on the Society's website (www.lms.ac.uk/content/cecil-king-travel-scholarship) or by contacting education@lms.ac.uk. The closing date for applications is **Friday 8 March 2013**. It is expected that interviews will take place in London in late April or early May.

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

SPRINGER BOOK ARCHIVES

The Springer Book Archives (SBA) project is an effort to breathe new life into older books published between 1842 and 2005 by making them available electronically and, if appropriate, in print. Many of these titles are currently out-of-print. SBA books will thus be preserved for future generations of scientists and need never go 'out-of-print' again.

Authors will have free access to their electronic version. They will receive royalties on both print and electronic sales.

If you were the author of a Springer or Birkhauser book published earlier than 2005, and have **not** already been contacted by Springer in this connection by email, please visit the page www.springer.com/SBAauthor and let us know about it. If you know someone who is potentially concerned, for instance a retired colleague or even the family of a deceased colleague, please alert them to this and ask them to contact us via www.springer.com/SBAauthor.

This article is included at the request of Springer.

LMS INVITED LECTURERS 2013

Professor Fedor Bogolomov (Courant Institute, NYU)

Birational Geometry and Galois Groups

10-14 June 2013
University of Edinburgh

The lectures will discuss the relation between the structure of the Galois group of algebraic closure of a field of rational functions and the structure of the field itself. More precisely, they will cover how to extract effectively birational invariants (i.e. geometric invariants of projective models of the field from the Galois group).

There will also be supplementary lectures by:

G. Brown (Loughborough) *Fano 4-fold hypersurfaces*
I. Cheltsov (Edinburgh) *Finite subgroups of Cremona group*
T. Logvinenko (Warwick) *Derived categories and birationality*

University and local Guesthouse accommodation will be available.

Limited financial support is available with preference given to UK research students. Please contact the organisers for further details (i.cheltsov@ed.ac.uk, J.Martinez-Garcia@sms.ed.ac.uk). Deadline for funding: **1 May 2013**.

For further details on the 2013 Invited Lectures please visit: www.maths.ed.ac.uk/cheltsov/fedya/

VISIT OF SIMOS MEINTANIS

Professor Simos Meintanis (National and Kapodistrian University of Athens, Greece) will be visiting the Department of Mathematical Sciences at Durham University within the period February to mid-March 2013. Professor Meintanis' recent research has focussed on the use of the empirical characteristic function (ECF) in order to tackle challenging inferential problems in Statistics. Research during this visit will particularly focus on goodness-of-fit testing for unsupervised learning techniques and on predictive inference using the ECF.

During his visit to the UK, Professor Meintanis will present three lectures (please check with the contact persons for further details):

- Newcastle University, 22 February
  Fourier-type inference for GARCH models with heavy-tailed innovations
  (contact Daniel Henderson: daniel.henderson@newcastle.ac.uk)
- Durham University, 25 February
  The probability weighted empirical characteristic function and goodness-of-fit testing (contact details below)
- University of Kent (Canterbury), 28 February
  Goodness-of-fit procedures for spherically symmetric distributions
  (contact Efang Kong: E.Kong@kent.ac.uk)

For further details contact Frank Coolen (frank.coolen@durham.ac.uk). This visit is supported in part by an LMS Scheme 2 grant.

ANALYSIS DAY

Analysis Day will be held on 7 January 2013 at the University of Bristol. The day will begin with coffee at 11 am with the first talk at 11.30 am. The last talk will end at 5.15 pm, followed by dinner. The speakers are:
- David Preiss FRS (Warwick) *Do we really know what Lebesgue null sets are?*
- Dorin Bucur (Université de Savoie) *Isoperimetric inequalities and free discontinuity problems*
- Peter Topping (Warwick) *Ricci flow on non-compact surfaces*
- Bernard Helffer (Orsay) *On nodal domains and spectral minimal partitions: a survey*

For more information email Michiel van den Berg (m.vandenberg@bristol.ac.uk) or Isaac Chenchiah (Isaac.Chenchiah@bristol.ac.uk) or visit the website at http://goo.gl/l9H3j.

WINTER COMBINATORICS MEETING

The 14th Annual Winter Combinatorics Meeting will take place at The Open University, Milton Keynes, on Wednesday 30 January 2013. It is intended that the talks will be of interest to all those working in combinatorics or related fields. The speakers are:
- Mireille Bousquet-Mélou (Université Bordeaux 1)
- David Conlon (University of Oxford)
- David Evans (University of East Anglia)
- Iain Moffat (Royal Holloway, University of London)
- Steven Noble (Brunel University)

For full details, including the schedule, titles and abstracts when they become available, see http://wcm.open.ac.uk. Anyone interested is welcome to attend. Some funds for travel expenses are available for research students who wish to attend the meeting: requests should be made to Robert Brignall (r.brignall@open.ac.uk).

The organizers are grateful for support of this event from the London Mathematical Society and the British Combinatorial Committee.

VISIT OF CRAIG EVANS

Postponed

This visit, announced in the November issue of the LMS *Newsletter* (page 14) has been postponed. For further information please contact the organiser Geoffrey Burton (G.R.Burton@bath.ac.uk).

STATISTICAL MECHANICS AND EXTREME EVENTS IN EARTH SCIENCE

A conference on *Non-equilibrium Statistical Mechanics and the Theory of Extreme Events in Earth Science* will take place at the University of Reading from 8 to 11 January 2013, part of the international initiative of the year of *Mathematics for Planet Earth 2013*. The conference will bring together mathematicians working in Non-equilibrium statistical mechanics, Random dynamical systems, Extreme events together with Earth Science.

Earth Sciences of fluid phenomena sparked an ever increasing interest scientifically and in the general public with subjects as climate change, weather prediction and in particular prediction of extreme and hence dangerous damaging and expensive weather events. With rare exceptions the qualitative theory of dynamical systems and statistical mechanics and the theory of extreme events developed without any contact with earth sciences and their paradigms and had, again with few exceptions, no influence on Earth Scientists. The aim of the conference is to bring Earth Sciences in contact with mathematicians working in the aforementioned areas. The list of speakers includes:
- Christian Beck (QMUL)
- Freddy Bouchet (Lyon)
- Ira Didenkulova (Tallinn)
- Ana Cristina Moreira Freitas (Porto)
- Jorge Miguel Milhazes de Freitas (Porto
- Davide Gabrielli (Roma)
- Christian Maes (Leuven)
- Michael Ghil (Paris)
- Rosemary Harris (QMUL)
- Mark Holland (Exeter)
- Giovanni Jona-Lasinio (Roma)

- Holger Kanz (Warwick)
- Jürgen Kurths (Potsdam)
- Mark Pollicott (Warwick)
- Catherine Rouvas-Nicolis (Bruxelles)
- Antonio Speranza (Camerino)
- Sandro Vaienti (Marseille)

Some funds for PhD-students are available. For further information contact Tobias Kuna (t.kuna@reading.ac.uk) or visit the website at www.personal.reading.ac.uk/~sms07kt/NeSEE. The meeting is supported by an LMS Conference grant and co-financed by the ERC-grant NA-MASTE - Thermodynamics of the Climate System.

LEGACY OF GOODSTEIN

His Centennial and the Wittgenstein Connection

There will be a one day meeting at the University of Leicester on Friday 14 December 2012 to commemorate the centenary of the birth of Reuben Louis Goodstein. The meeting will focus on Goodstein's mathematical research, particularly in logic and related areas, and the influence that this has had on subsequent research in mathematics (and related fields). The talks will be given by:
- Mathieu Marion (Université du Québec à Montréal)
- Mitsuhiro Okada (Keio University, Tokyo)
- Jan von Plato (University of Helsinki)
- Mike Price (University of Leicester)
- Mary Walmsley (University of Leicester)
- Harvey Rose (University of Bristol)
- Stan Wainer (University of Leeds)

Further details can be found on the web page http://www2.le.ac.uk/departments/mathematics/legacy-of-goodstein

Everyone is free to attend although we do require people to register; please go to the web page to do this. Whilst people can register on the day, it would be very helpful if people could register in advance wherever possible.

The meeting is supported by an LMS Conference grant. Included in this support is travel funding for PhD students to attend the meeting. If you are a PhD student and would like to apply for such funding, enter the details when you register.

VISIT OF RAFAEL BENGURIA

Professor Rafael Benguria (Pontificia Universidad Católica de Chile) will be visiting London, Bristol and Reading from 19 January to 2 February 2013. He will give the following talks:
- London Analysis Seminar, Imperial College, 24 January
  Estimate for the indirect coulomb energy for two and three dimensional atoms
- Bristol, 28 January
  Exact asymptotic behavior of the Pekar–Tomasevich functional
- Reading, 29 January
  Rigorous results for the minimal speed of Kolmogorov–Petrovskii–Piscounov monotonic fronts with a cutoff

For further information contact Professor Leonid Parnovski, University College London (leonid@math.ucl.ac.uk). The visit is supported by an LMS Scheme 2 grant.

BSHM NEUMANN BOOK PRIZE

The British Society for the History of Mathematics (BSHM) is pleased to announce the biennial Neumann Prize for 2013. The prize is awarded for a book in English (including books in translation) dealing with the history of mathematics, aimed at a broad audience and published in 2011 or later. The prize is named in honour of Peter M. Neumann, OBE, a former BSHM President and longstanding contributor to the Society. The value of the prize is £600.

Nominations for the prize are invited from individuals and publishers. Nominations should be sent to the chair of the judging panel, Norman Biggs (n.l.biggs@lse.ac.uk). Publishers should send three copies of their nominated book(s) to Professor Norman Biggs, Chair: BSHM Neumann Prize, Department of Mathematics, London School of Economics, Houghton Street, London WC2A 2AE, United Kingdom.

SHEFFIELD PROBABILITY DAY

Sheffield Probability Day will take place in Lecture Theatre 7, Hicks Building, University of Sheffield on Wednesday 30 January 2013. The speakers are:

- James Norris (Cambridge) at 2.15 pm
  A consistency estimate for Kac's model of elastic collisions in a dilute gas

- Jean Bertoin (ETH, Zürich) at 3.45 pm
  The 2012 Applied Probability Trust Lecture
  Almost giant clusters for percolation on large trees with logarithmic heights

Tea and coffee will be available at 3.15 pm in Room I15, Hicks Building. All are welcome. For further information contact Chris Drew (tel: 0114 222 3763, email: spd@sheffield.ac.uk). The meeting is sponsored by the Applied Probability Trust.

Isaac Newton Institute
for Mathematical Sciences

SUMMER SCHOOL AND WORKSHOP

15 – 19 July 2013

in association with the Newton Institute programme
Polynomial Optimisation
(15 July - 9 August 2013)

Organisers: (Chair) Adam Letchford (Lancaster University), Joerg Fliege (Southampton University) Jean-Bernard Lasserre (CNRS Toulouse) and Markus Schweighofer (Konstanz University).

Optimisation problems that involve polynomials are currently receiving a great deal of attention, due to their generality, their challenging nature and their wide range of practical applications. These two events provide an opportunity for researchers to learn more about this new, exciting and growing field.

The Summer School will begin in the morning of Monday 15 July and finish at lunchtime on Wednesday 17 July. It will consist of a series of tutorials from the following five internationally respected invited speakers:

- Emmanuel Candès (Stanford University)
- Michal Kocvara (University of Birmingham)
- Jesús De Loera (University of California, Davis)
- Tim Netzer (Leipzig University)
- Bernd Sturmfels (University of California, Berkeley)

The workshop will begin at lunchtime on Wednesday 17 July and finish in the afternoon on Friday 19 July. It will consist of a series of contributed talks, and a poster session for PhD students and post-docs.

Further information and application forms are available from the website at
www.newton.ac.uk/programmes/POP/popw01.html
Closing date of the receipt of applications is 28 February 2013.

EPSRC
Pioneering research and skills

LMS Advancing Mathematics
London Mathematical Society

Modern nonlinear PDE methods in fluid dynamics

LMS-EPSRC Short Course
University of Reading
8-12 July 2013
Organisers: Beatrice Pelloni & Eugen Varvaruca

Course outline

The course aims to give the opportunity to a new generation of UK PhD students to attend high quality lectures on the analysis of PDE in fluid dynamics, delivered by leading international experts. The four courses are broadly divided in two strands. The first, containing the courses given by Luigi Ambrosio and Yann Brenier, deals with applications in fluid dynamics of optimal transport methods, more specifically the variational approach to the incompressible Euler equations, and the monotone rearrangement and convection theory for the Navier-Stokes and semi-geostrophic equations. The second, containing the courses of Adrian Constantin and Georg Weiss, deals with methods specific to free-boundary problems in fluid dynamics, addressing respectively the bifurcation theory approach to existence of large-amplitude steady water waves with vorticity, and the use of blow-up techniques in the study of regularity and behaviour at singularities in free boundaries.

The four main lecture course topics are:

- *Variational models for incompressible Euler equations* (**Luigi Ambrosio**, Scuola Normale Superiore, Pisa)
- *Monotone rearrangement and convection theory* (**Yann Brenier**, University of Nice)
- *Bifurcation theory in the context of steady water waves* (**Adrian Constantin**, King's College, London)
- *Analysis of singularities in free-boundary problems* (**Georg Weiss**, Heinrich Heine University, Düsseldorf)

Guest lectures will be given by **Mike Cullen** (Met Office) and **Camillo De Lellis** (University of Zürich).

For further information please visit: www.reading.ac.uk/maths-and-stats/news/LMS-EPSRC-Shortcourse-Reading.aspx

Applications: Applications should be made using the registration form available via the Society's website at: **www.lms.ac.uk/content/short-instructional-courses**. Research students, post-docs and those working in industry are invited to apply.

The closing date for applications is **Monday 27 May 2013.** Numbers will be limited and those interested are advised to make an early application.

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

In the event of over-subscription preference will be given to UK-based research students

Fees

All research students registered at a UK university will be charged a registration fee of **£100. There will be no charge for subsistence costs**.
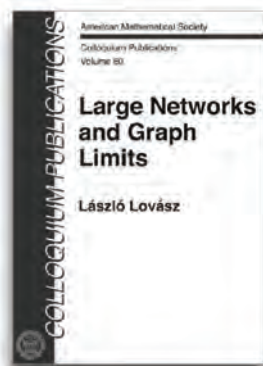
UK-based postdocs will be charged a registration fee of £250, plus half the subsistence costs (£140) **£390** in total.

All others (overseas students and postdocs, those working in industry) will be charged a registration fee of £250 plus the full subsistence costs (£280) **£530** in total.

All participants must pay their own travel costs (for EPSRC funded students, this should be covered by their DTA). Fees are not payable until a place on the course is offered but will be due by Friday 28 June.
LMS-EPSRC Short Courses aim to provide training for postgraduate students in core areas of mathematics. Part of their success is the opportunity for students to meet other students working in related areas as well as the chance to meet a number of leading experts in the topic.
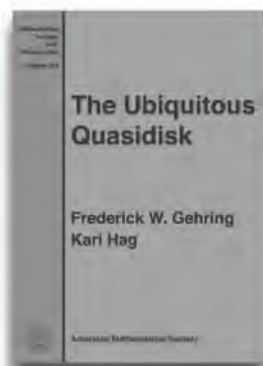

EPSRC
Pioneering research and skills

LMS Advancing Mathematics
London Mathematical Society

Computational Group Theory

LMS-EPSRC Short Course
University of St. Andrews
29 July – 2 August 2013
Organisers: Alexander Konovalov, John McDermott, Angela Miguel & Max Neunhöffer

Course outline
The course will introduce students to the four main areas of Computational Group Theory: permutation groups, soluble and p-groups, matrix groups and finitely presented groups. The course will cover typical problems and standard algorithms, along with the analysis of these algorithms and their practical use on a computer. In the practical sessions there will be some emphasis on using the computer algebra system GAP, a world wide open source project established in 1988. After this course the participants will have a good understanding of what computers can and cannot do with groups and will be able to use GAP to answer their own group theoretic questions. The course aims to appeal to a broad spectrum of students from areas such as Algebra, Topology, Combinatorics and Graph Theory.

The four main lecture course topics are:

- *Permutation Groups* (**Alexander Hulpke,** Colorado State University)
- *Soluble Groups and p-Groups* (**Bettina Eick**, Technische Universität Braunschweig)
- *Matrix Groups/Constructive Recognition* (**Derek Holt**, University of Warwick)
- *Finitely Presented Groups* (**Max Neunhöffer**, University of St Andrews)

These lecture courses will be supplemented by tutorial sessions.

For further information please visit: http://www-circa.mcs.st-andrews.ac.uk/cgt2013

Applications: Applications should be made using the registration form available via the Society's website at: **www.lms.ac.uk/content/short-instructional-courses**. Research students, post-docs and those working in industry are invited to apply.

The closing date for applications is **Monday 17 June 2013.** Numbers will be limited and those interested are advised to make an early application.

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

In the event of over-subscription preference will be given to UK-based research students

Fees

All research students registered at a UK university will be charged a registration fee of **£100. There will be no charge for subsistence costs**.

UK-based postdocs will be charged a registration fee of £250, plus half the subsistence costs (£125) **£375** in total.

All others (overseas students and postdocs, those working in industry) will be charged a registration fee of £250 plus the full subsistence costs (£250) **£500** in total.

All participants must pay their own travel costs (for EPSRC funded students, this should be covered by their DTA). Fees are not payable until a place on the course is offered but will be due by Friday 19 July.
LMS-EPSRC Short Courses aim to provide training for postgraduate students in core areas of mathematics. Part of their success is the opportunity for students to meet other students working in related areas as well as the chance to meet a number of leading experts in the topic.

RECORDS OF PROCEEDINGS AT LMS MEETINGS

SOUTH WEST & SOUTH WALES REGIONAL MEETING

held on 1 October 2012 at Bristol University as part of the Regional Workshop on *Quantum Probablistic Symmetries*. Over 50 members and visitors were present for all or part of the meeting.

The meeting began at 2.00 pm with the LMS Treasurer, Professor Robert Curtis, in the Chair.

No members were elected to membership.

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

Professor Trevor Wooley introduced a lecture given by Professor John Cremona on *Unusual modular curves and elusive isogenies*.

After tea, Professor Wooley introduced a lecture given by Professor Tony Scholl on *Special values of L-functions*.

Professor Wooley then introduced the final lecture given by Professor Karl Rubin entitled *Ranks of elliptic curves*.

The Treasurer, Professor Curtis, expressed the thanks of the Society to the local organisers for putting on such an interesting meeting.

Afterwards, a reception was held in the School of Mathematics, followed by dinner hosted at The Lido Restaurant.

POPULAR LECTURES 2012

Report

To mark the centenary year of Alan Turing's birth, the 2012 LMS Popular lectures were devoted to aspects of Turing's work.

On 29 September 2012, an excited audience of mathematicians, school students and interested members of the public gathered in the beautiful concert hall of the new Sir Paul and Lady Ruddock Performing Arts Centre, at King Edward's School, Birmingham to listen to two distinguished mathematicians speak about aspects of Turing's work.

Can anything be salvaged from the wreckage of Hilbert's Dream?
Sir Timothy Gowers, FRS, Royal Society Research Professor in the Department of Pure Mathematics and Mathematical Statistics at the University of Cambridge, started from the reas-suringly familiar territory of finding solutions for quadratic equations. He pointed out that for these and for other types of equation, we can describe a standard method for finding a solution and that they can therefore be solved mechanically, by a person or a computer simply following an algorithm, rather than by any mathematical understanding or intuition.

Hilbert's dream was that it might be possible to solve any mathematical problem mechanically. More specifically, he asked whether any algorithm existed for determining whether any arbitrary diophantine equation has a solution. (A Diophantine equation is an equation where only integer solutions are allowed.) Known as the Entscheidungsproblem (from the German for decision), this can be visualised as being a "black box" for which the input is an equation and the output is a proof or disproof.

Gödel's incompleteness theorems prove that

Timothy Gowers

there are some statements for which no proof or disproof exists. In the 1930s, Alan Turing and Alonzo Church independently decided that some functions are "non-computable".

Professor Gowers discussed modifications to the requirements of the hypothetical black box by changing the question to whether there was a proof within a specified length. This can be achieved but only by "brute force" solutions which are of no practical interest. He suggested that the expectation that a computer should solve all problems was unfair and that it might be amended to require 'reasonable proofs of interesting problems' that a human could solve.

To date no computer has passed the 'Turing Test' to solve a mathematical problem in the way that a human would. The human method involves inspiration and intuition based on experience and value judgements. Humans often reason visually whereas computers can only reason symbolically.

An example of a problem which is best solved visually concerned the removal of diagonally opposite squares from a grid of squares and then covering the remaining area with dominoes. Although humans learn standard methods, for example for long multiplication, they can often solve mental arithmetic problems by seeing shortcuts or 'tricks'.

Professional mathematicians would sometimes like to be portrayed as having had "flashes of genius" but, in fact, these are based on a great deal of unrevealed thought and acci-

dental observations. Problems can sometimes be solved by making use of vague similarities.

He concluded that recent advances in computing suggest that one day a computer might pass the amended Turing Test. However, no computer yet exists that can adequately understand and use natural language, learn from experience and recognise and solve interesting problems.

Professional mathematicians are not likely to become redundant in the near future!

Before the second lecture there was a break in which excellent refreshments were served and the audience had the opportunity to see a little more of the Arts Centre.

On Attempting to Model the Mathematical Mind: A Tribute to A. M. Turing on his Centenary

Sir Roger Penrose, FRS, Emeritus Rouse Ball Professor of Mathematics at the Mathematical Institute, University of Oxford presented his lecture as a tribute to Alan Turing, whom he had admired ever since he had first heard of him.

Although Alan Turing is now best known as the mathematician who cracked the Enigma code, this lecture referred to less well known aspects of his work, based on papers published in the late 1930s on computable numbers and systems of logic. A Universal Turing Machine is a theoretical concept of a finite state object with an infinite tape. A Universal Turing Machine can perform ANY computation.

Professor Penrose suggested that, when these papers were published, Turing was unhappy about trying to model the mathematical mind with a Universal Turing Machine, as the mind goes beyond the capabilities of a Turing machine. (By the 1950s he seemed to be more optimistic that a computer might one day be developed that would be powerful enough to model the human brain.)

In order to evade the limitations of Gödel's incompleteness theorem Turing suggested a system based on ordinal logic and oracles. The oracle should be able to say whether or not a given statement was true.

Professor Penrose suggested a model based

on a 'cautious oracle' which has, in addition to the options to reply 'True' or 'False', can reply that it does not know or might simply 'continue pondering indefinitely without ever providing an answer at all'. Gödel's theorem states that computational rules such as mathematical induction are not sufficient for establishing the perceivable truths of arithmetic. This was illustrated by using the example of Hercules and the Hydra quoted by Kirby and Paris.

Arguments against the possibility of using a machine to model the human mind are that:
1. Humans are fallible and make errors.
2. Algorithms for human understanding are so vastly complicated that Gödel statements are completely beyond reach
3. We do not know the algorithmic process, so cannot construct Gödel statements.

Human intelligence depends on awareness and understanding. If awareness and understanding can be shown to be beyond computation, then intelligence is not a matter of computation. Conscious brain action must depend on a physical process that is beyond computation. Quantum mechanics may help to explain brain processes. Recent research

Roger Penrose

into micro-tubules in the nerve synapses has produced some interesting results.

In his informative and inspiring lecture, Professor Penrose used diagrams and cartoons to tackle several very complex and controversial subjects in such a way as to convince the audience, at least briefly, that they could understand them.

Many thanks are due to the two distinguished speakers, to the LMS for organising the lectures and to King Edward's School for hosting the event.

Sheila Mawby

Editorial note: The lectures were also given in London on 26 June 2012. The lectures were recorded and are available from the LMS: a useful purchase for school and university mathematics departments seeking resources that will stimulate their students (information is available at www.lms.ac.uk/content/popular-lectures-dvds).

REVIEWS

Game Theory and the Humanities: Bridging Two Worlds by Steven J. Brams, 2012 (pb reprint), MIT Press, 336 pp, £12.95, ISBN: 978-0-262-51825-3.

This is a fascinating book on the application of game theory to philosophy, politics, law, literature and even the Bible. The author, Steven Brams, shows that real insight can be obtained into optimal strategies for dealing with some famous dilemmas

Game theory originated with John Von Neumann's famous 1928 paper, elaborated into a classic 1944 book by Von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior*. Von Neumann and Morgenstern showed that there are 78 structurally distinct 2x2 *ordinal games*: games in which two players are each given the option of two strategies, giving four states which can be ranked from best to worst.

There is much in this book to interest and attract. Brams is a professor of politics and does not fall into the trap of attempting to reduce complex dilemmas to oversimplified, meaningless games. Instead, he maintains the essential complexity of each situation and examines the possible moves in a commonsense manner,

revealing a richness of insight. There is plenty here to convince the sceptic that game theory is not just applied common sense, in particular the associated *theory of moves* (TOM), which allows players to change their strategies during a game on the basis of 'backward induction' (learning from initial outcomes).

Brams begins by surveying literary situations, from works such as Othello, Tosca and Sir Gawain and the Green Knight. Curiously, he skips lightly over detective fiction and classic games of move and counter move such as Holmes versus Moriarty. He concludes that the aspects of literature where game theory is relevant are those where a carefully constructed plot is uppermost, but that in much of literature human emotion and irrationality dominate proceedings, as in life.

The first intensive analysis is of Biblical dilemmas; specifically, Abraham's decision to obey God and sacrifice Isaac. Should Abraham have defied God? Game theory suggests that this might have been productive. Brams later deals with Moses persuasion of God not to punish the Israelites for the golden calf. By making God a player in these games, Brams sheds a new light on God's motives, allowing him to be scheming, manipulative, sometimes vengeful, but always a good player.

The biblical examples are followed by more complex dilemmas: the insoluble problem of achieving a fair division among competing goods, and how to resolve conflict by democratic means, including varied forms of voting.

Next up is the Law. We consider the game played between Nixon and the US Supreme Court, in the enforced disclosure of the White House tapes followed by Nixon's resignation; then the conduct of the Supreme Court in the 1930s, when Roosevelt depended, not always successfully, on its delicate balance of votes to approve his New Deal.

Brams then turns to situations that involve frustration and anger, his literary examples being Macbeth's dilemma as to whether to kill Duncan, and the strategy of withholding sex in Lysistrata. He looks at the aftermaths of wars including the Franco-Prussian war and the American Civil War to show that game theory
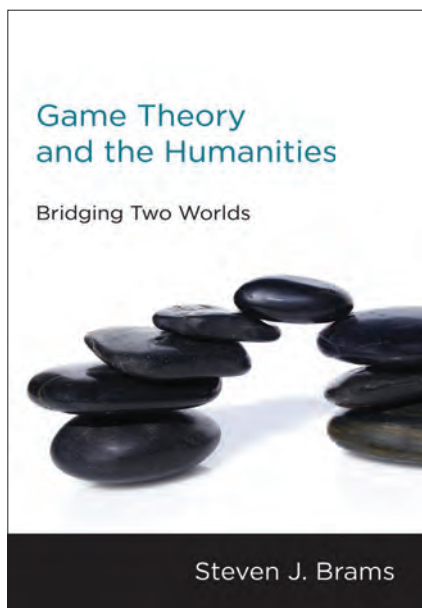
generally supports Churchill's maxim, 'In victory, magnanimity'.

Finally, Brams looks at two-player games with incomplete information, and where each player is trying to learn more about the other. Two classic cases are the Cuban missile crisis, where Kennedy and Khrushchev managed to resolve the game satisfactorily (fortunately for the human race), while in the Iran hostage crisis Carter did not, because of his misperception of Khomeini's motives. He finishes with Catch-22, and its many related parallels in the real world (e.g. the torture of witches to elicit confessions), and shows that 12 of Von Neumann's games are varieties of Catch-22.

Brams ends by stating 'Game theory and TOM will not, and should not, replace other modes of enquiry in the humanities' but that they are 'especially useful, and sometimes even indispensable, in elucidating the strategic role that conflict and cooperation play in human affairs'.

Peter Wadhams
DAMTP, Cambridge

A version of this review was first published in Plus magazine (http://plus.maths.org).

Taking Sudoku Seriously: The Math Behind the World's Most Popular Pencil Puzzle by Jason Rosenhouse and Laura Taalman, Oxford University Press, 2012, 226 pp, £13.99, ISBN: 978-0-19-975656-8.

If you enjoy solving sudoku-like puzzles this is the book for you, for among its pages you will find almost 100 puzzles that are sudoku-related – from traditional 9 × 9 puzzles to variations with such exotic names as Jigsaw Pi Sudoku, Worms, Just-What-I-Needed Sudoku, Argyle, Roku-Doku and Rainbow Wrap. Many of the sudoku patterns in this attractively presented book appear in full colour.

But the book is far more than an encyclopaedia of sudoku variations. After teaching the uninitiated how to solve such puzzles systematically, the authors clarify the underlying ideas and strategies in order to inspire and motivate their readers to appreciate what is meant by mathematical problem-solving. Using a range of sudoku-based puzzles as a vehicle, together with such familiar recreations as the four-colour problem, the 36 officers' problem, and the bridges of Königsberg, they manage to introduce a whole range of related

mathematical concepts, such as equivalence classes, modular arithmetic, matrices, graph colouring, polynomials, modular arithmetic, and groups of symmetries, explaining these with great clarity and persuading the reader of their relevance.

Particularly ambitious (and successful) is their chapter on counting, where their aim is to enumerate the number of different sudoku patterns. They begin with a careful analysis of the simpler problem of finding the total number of 4 × 4 sudoku patterns (called shidoku), and discover that of the 288 possible patterns, only three are 'fundamentally different'. They then begin their attack on the 9 × 9 problem, where the notion of 'fundamentally different' is more tricky to explain, by finding the number of ways of filling in the first three rows, and then estimating the number of ways of completing the remaining six rows. Although the problem is too difficult to solve in full, they manage to convey a good understanding of its complexity, and their estimate of 6.6571×10^{21} is astonishingly close to the correct answer of 6,670,903,752,021,072,936,960.

The book is already slightly out-of-date. A central open question, as to whether there exist any uniquely completable sudoku patterns with only 16 given cells (there are many thousands with 17), was answered in the negative early in 2012.

The historical remarks that feature throughout the book are interesting and mainly accurate, with the exception of the Königsberg bridges problem, where the incorrect spelling 'Königsburg' appears throughout and where the authors fall into the common trap of claiming that Leonhard Euler solved it by drawing a four-vertex graph representing the layout of the city; he didn't – the graph didn't appear until some 150 years later.
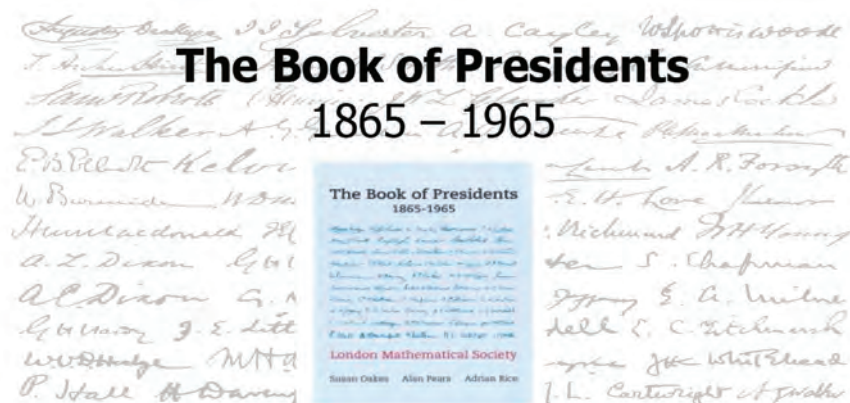
Apart from such infrequent lapses, this book is well written and provides an object lesson in how to present mathematical problem-solving to interested students. It can be warmly recommended.

Robin Wilson
Pembroke College, Oxford
Author of *How to Solve Sudoku*
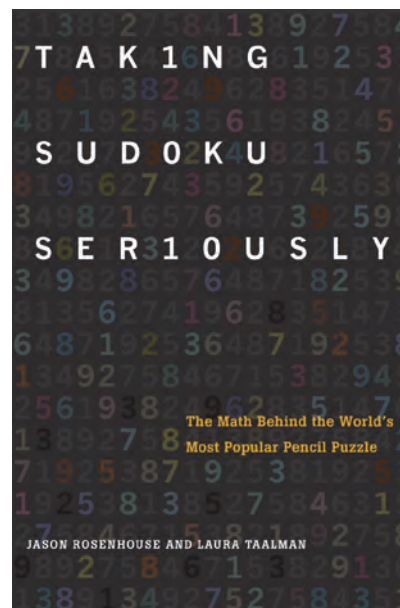
The Book of Presidents 1865 – 1965

The London Mathematical Society was established during the energetic and confident heyday of Victorian Britain. With over eighty photographs of previous presidents and De Morgan Medal winners, The Book of Presidents 1865-1965 looks at the first 100 years of the Society's existence. As the book traces the Society's evolution through its Presidents and De Morgan Medallists, we learn which branches of mathematics were in vogue at any particular time, and come to appreciate the Society's rich history.

"This lovely little book is one of the best the London Mathematical Society has published… This is a book that can – and should – both be read from cover to cover and dipped into… Dipping into it randomly one sees some of the quirks and oddities that make an important institution human" Peter M Neumann, Queen's College Oxford.

The Book of Presidents 1865-1965 is available from the London Mathematical Society.

- LMS Members price is £15.Full price is £19
- To order a copy; please download an order form from the LMS website: www.lms.ac.uk/content/history

Christmas Offer: 25% off & Free P&P
(normally £3 UK & Europe; £5 Rest of the World)

£11.25 for LMS Members (inc P&P)
£14.25 for non Members (inc P&P)

Quote: "Christmas Offer". Valid for orders received by 31 December 2012. Order by 12 December in time for Christmas.

Please note any orders received after 12 December will be dispatched by 11 January due to the holiday season.

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.
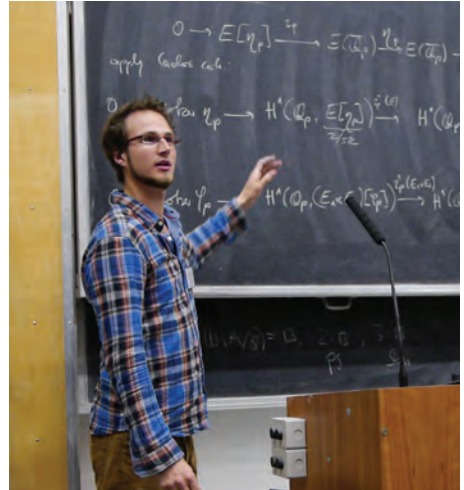
LMS South West and South Wales Regional Meeting and L-functions of Curves Workshop
held at the University of Bristol from 1 to 3 October 2012

Qing Lio (Bordeaux)
Congruence of models of elliptic curves

Abelian surfaces with Tate-Shafarevich group of order 5 times a square