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## Society <br> Meetings and Events

## 2013

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Regional Meeting,
Swansea
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2014
Friday 28 February
Mary Cartwright Lecture, York

Monday 31 March Northern Regional Meeting, Durham
Friday 15 April
Women in Maths Day, London

## NEWSLETTER ONLINE:

newsletter.Ims.ac.uk

## GOLDBACH NO LONGER OPEN TO CONJECTURE

Mathematician Harald Helfgott of the École Normale Supérieure in Paris, France and 2010 LMS Whitehead Prize winner has demonstrated the solution to a 271-year-old problem in number theory.

In 1742 the mathematician Christian Goldbach suggested that every even number greater than 2 is the sum of two (not necessarily different) primes. This is known as Goldbach's strong or binary conjecture and it immediately leads to his weak or ternary conjecture - ie that every odd number greater than 5 is the sum of 3 primes (to see this, just subtract the prime 3 from each odd number and you get an even number which, by the binary conjecture, you should be able to write as the sum of 2 further primes). Now Helfgott has shown that Goldbach's ternary conjecture does indeed hold.

Number theorists have been working on this problem for many years and there have been some notable pieces of work that have helped towards Helfgott's proof. In 1923 Hardy and Littlewood found that if the Generalised Riemann Hypothesis (GRH) is true then for large enough numbers Gold-

bach's ternary Conjecture is true. Fourteen years later the Russian mathematician Ivan Vinogradov showed that even without GRH, ternary Goldbach holds for 'sufficiently large' odd numbers.. This became known as the Vinogradov Theorem but what constituted 'sufficiently large' was not known until Borozdkin showed in 1956 that 106,846,169 will do. In 2002, Ming-Chit and Tian-Ze reduced 'sufficiently large' to about $2 \times 10^{1,346}$ but this is still way out of reach computationally. Meanwhile in 1997, and assuming GRH once again, Deshouillers, Effinger, te Riele and Zinoviev managed to reduce 'sufficiently large' to the point they could eliminate the possible exceptions by
computer. Other progress has been made for example in 1995 Olivier Ramaré at Lille showed that every even number is the sum of at most 6 primes, which implies that every odd number is the sum of at most 7 primes, and in 2012 Terence Tao of the University of California, Los Angeles reduced that to 5 primes.
Helfgott's approach used the Hardy-Lit-tlewood-Vinogradov circle method to express the problem in terms of an integral, which can then be estimated analytically. By very careful management of this intricate process, Helfgott obtained a result that still relied on GRH, but only to a point, and which worked for 'sufficiently large' numbers but where sufficiently large was now (merely) $10^{30}$.

To verify that GRH did hold in the range required, Helfgott enlisted the help of Dave Platt at the University of Bristol. Us2 ing algorithms developed during his PhD under Andrew Booker, Platt was able to verify that 38 trillion zeros of Dirichlet L-functions all had real part exactly one half, which established GRH to the extent needed by Helfgott - and beyond. The
computation needed 400,000 CPU hours In the end the subset of the computation actually used by Helfgott took roughly 100,000 hours, but the fuller computation will be useful generally in analytical number theory.

The final piece of the jigsaw needed was to confirm that all odd numbers less than $10^{30}$ could indeed be written as the sum of three primes. Using a previous result of Thomás Oliviera e Silva of the University of Aviero and a further 40,000 hours of computation, Helfgott and Platt were able to confirm this as well.
As Dave Platt says, 'The computations were completed six weeks ago after 440,000 hours using computers in Bristol, Warwick and France. It is good to see the ternary conjecture proved. What Harald has achieved is a major coup and I am pleased to have contributed'.

With the ternary conjecture now established what are the chances of going onto the binary conjecture? Dave Platt's thoughts are that going to the binary conjecture 'will probably remain beyond us for a very long time'.

## LMS Newsletter

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ECONOMIC IMPACT REPORT LAUNCHED AT PRESTIGIOUS EVENT
The London Mathematical Society (LMS), as search is leading the way to UK economic part of the Council for the Mathematical Sciences (CMS), took part in the launch to mark the publication of a ground-breaking report by Deloitte on the economic benefits of mathematical science research in the UK. The Council for the Mathematical Sciences sponsored the prestigious launch at the House of Commons on Tuesday 4 June 2013, hosted by Andrew Miller MP, Dr Julian Huppert MP and Stephen Metcalfe MP.


The report entitled Measuring the Economic Benefits of Mathematical Science Research in the UK provides an independent study of the breadth of impact that the mathematical sciences have on the UK economy. It is the first study of its kind to provide quantitative insights into the value of mathematical research across all sectors and its far-reaching impacts.
The event brought together Members of both Houses, representative figures from industry as well as key members of the mathematical sciences community in recognition of how mathematical sciences re-

growth.

The host MPs along with Professor Frank Kelly (Chair, CMS) and Professor David Delpy (Chief Executive, EPSRC) addressed the reception. The speakers reiterated the importance of mathematics research to the economy, the need to encourage the next generation of mathematicians and the value of continued dialogue between CMS, EPSRC and Parliament.
Over 100 guests, from government (including the host MPs, Shadow Science Minister Shabana Mahmood, Shadow Minister, Cabinet Office Chi Onwurah, and representatives from BIS and EPSRC), academia, industry (including a large representation from the financial services), and a range of other STEM organisations had the opportunity to engage on the issues raised in the report and the issues that are confronting the mathematics community. The guests welcomed the publication of the report and felt that it was a very valuable resource to inform future discussions in furthering the cause of the mathematical sciences at all levels.

The report is available at www.cms.ac.uk/ files/Submissions/article_EconomicBenefits. pdf

If you would like a printed copy please contact Dr John Johnston, LMS Communications Officer (john.johnston@lms.ac.uk).


## LMS POPULAR LECTURES 2013

King Edward School, Birmingham - Thursday 26 September

## Professor Ray Hill

University of Salford

## Mathematics in the Courtroom

In this talk, Professor Ray Hill shows how the misuse of mathematics can lead to miscarriages of justice, and how the correct use of mathematics can help to prevent them.


## Dr Vicky Neale

 University of Cambridge
## Addictive Number Theory

For hundreds of years, mathematicians have asked intriguing questions about adding whole numbers, for example concentrating on whole numbers, for example concentrating on
particularly important sequences such as the prime numbers and the square numbers.

Dr Neale will discuss some of these problems (solved and unsolved), and some of the (solved and unsolved), and some of the elegant techniques from across mathematics problems.

Commences at 6.30 pm , refreshments at 7.30 pm , ends at 9.00 pm
Admission is free, with ticket. Register by Friday 20 September.
To register for tickets, please email popular.lectures@lms.ac.uk or visit the LMS website for abstracts and a registration form (http://www.Ims.ac.uk/events/popular-lectures)

## LMS PRIZES 2013

The winners of the LMS Prizes for 2013 were announced at the Society meeting on 5 July 2013. The Society extends its congratulations to these winners, and its thanks to all the nominators, referees and members of the Prizes Committee for their contributions to the Committee's work this year.

PROFESSOR JOHN THOMPSON, FRS of the University of Cambridge, is awarded a De Morgan Medal for his fundamental contributions to the understanding of the structure of finite groups, especially the finite simple groups.

PROFESSOR NICK TREFETHEN, FRS of the University of Oxford has been awarded the Naylor Prize and Lectureship in Applied Mathematics on account of his exceptional contributions to Numerical Analysis and his undoubted ability to communicate this fascinating and central subject to a wider audience.

PROFESSOR FRANCES KIRWAN, FRS of the University of Oxford, is awarded a Senior Whitehead Prize for her work on the geometric invariant theory and the geometry and topology of moduli spaces. Kirwan has introduced many fundamental techniques and applied them to solve several outstanding problems, particularly involving moduli spaces of bundles.

PROFESSOR LUIS ALDAY, of the University of Oxford, is awarded a Whitehead Prize for his work on properties of supersymmetric gauge theory, and its connections with two dimensional conformal field theory and with string theory in anti-de-Sitter space.

DR ANDRE NEVES of Imperial College is awarded a Whitehead Prize for his work in geometric analysis, and in particular, his resolution of the Willmore conjecture, jointly with Fernando Coda Marques.

DR TOM SANDERS of the University of Oxford and, from September 2013, the University of Cambridge, is awarded a Whitehead Prize for his spectacular results in additive combinatorics and related areas. In particular he is recognised for his paper obtaining the best known upper bounds for sets of integers containing no 3-term arithmetic progressions, for his work dramatically improving bounds connected with Freiman's theorem on sets with small doubling, and for other results in additive combinatorics and harmonic analysis.

DR CORINNA ULCIGRAI of the University of Bristol, is awarded a Whitehead Prize for her breakthrough results in dynamical systems.


## MATHEMATICS <br> POLICY ROUND-UP

## June 2013

## RESEARCH

## Launch of economic impact report

The London Mathematical Society (LMS), as part of the Council for the Mathematical Sciences (CMS), took part in the launch to mark the publication of a ground-breaking report by Deloitte on the economic benefits of mathematical science research in the UK - Measuring the Economic Benefits of Mathematical Research in the UK. The CMS sponsored the launch at the House of Commons on Tuesday 4 June 2013, hosted by Andrew Miller MP, Dr Julian Huppert MP and Stephen Metcalfe MP. The report is available at http://tinyurl.com/mol6gjk. A longer article appears elsewhere in the Newsletter.

## Presidents press the case for investment in

 researchThe Presidents of the four UK national academies - the Royal Society, the Royal Academy of Engineering, the Academy of Medical Sciences and the British Academy joined forces to press home to government the importance of investing in research and the science and engineering skills base to support economic regeneration.
At a meeting with the Chancellor of the Exchequer, the Rt Hon George Osborne, the four academy Presidents and a number of senior industrialists and academics discussed these matters in advance of the impending spending review. More information is available at http://tinyurl.com/ k8q3reu.

## EPSRC Centres for Doctoral Training

In February 2013 EPSRC invited outline proposals against its $£ 350$ million investment in Centres for Doctoral Training (CDT) to address priority areas. The Centres funded as a result of this call will equip future research leaders with the knowledge, skills
and creative approaches the UK needs for economic growth and social wellbeing.

EPSRC received an excellent response to the outline call with 356 proposals submitted from 56 universities. The total value of the submitted proposals was around £1.6 billion with leverage from industry and other partners in the region of $£ 1$ billion. The full list of those invited through to the next stage is available at http://tinyurl. com/lgkprlu.

## Institute of Physics publishes case studies

 Physics: Transforming lives is a series of case studies highlight the impact of advances in physics.Prepared by the Institute of Physics, in partnership with the Engineering and Physical Sciences Research Council and the Science and Technology Facilities Council, the case studies highlight both ways in which physics has already transformed our lives and ways in which investment in physics is likely to deliver more in the coming decades. The publication is available at http://tinyurl.com/k6j3qmw.

## SCHOOLS AND COLLEGES

## New GCSEs announced

Michael Gove, Secretary of State for Education has announced changes to GCSEs. From 2015, GCSEs will move from coursework and continuous assessment to exams at the end of two years.
From 2015, GCSEs will move from coursework and continuous assessment to exams at the end of two years. The key changes from autumn are:

- grading by numbers 8-1 rather than by the current letters A*-G;
- no more modular courses, instead full exams taken at the end of two years;
- controlled assessments (coursework done under exam conditions) will be scrapped;
- exams will be based on a more stretching, essay-based system; and
- pass marks to be pushed higher The changes to GCSEs in England were presented in two reports. Exam regulator Ofqual will explain how the exams will be structured and ministers will give details of the course content. The reforms will initially apply to a group of core subjects - English language and literature, mathematics, physics, chemistry, biology, combined science, history and geography.
The transcript of Michael Gove's announcement is available at http://tinyurl. com/m3rcnkl.

Ofqual has launched a consultation on GCSE reform. More information is available at http://tinyurl.com/l3pp2lv. The closing date for submissions is 3 September 2013.

## ACME's advice on GCSE Mathematics

ACME has published a briefing paper which draws together its advice and expertise on GCSE Mathematics from a variety of position statements, policy reports and consultation responses. The paper is available at http://tinyurl.com/m55w3uv.

## Review of A-level subject content

The Advisory Committee on Mathematics Education (ACME) has responded to a letter regarding the A-level reform process. ACME will be offering to:

- meet with the Awarding Organisations to discuss the evidence from their HE subject advisory groups before it is passed to the review committee;
- discuss with Ofqual the role ACME could play in its review process; and
- advise the Department for Education on the risk to participation in mathematics that may result from any changes to the qualification system.
The letter is available at http://tinyurl. com/knv8lcd and the ACME response is available at http://tinyurl.com/lvym2jx

Ofqual updates A-level refom web pages
These web pages give complete up to date information on where the process current-
ly stands and how this will progress. More information is available at http://tinyurl. com/m6slxzy.

Dr John Johnston
Mathematics Promotion Unit

## LMS COUNCIL DIARY

24 May 2013
A personal view
As customary, the main substance of the meeting began with the President's business. On this occasion, it was Graeme's report of the Abel Prize ceremony which caught Council's attention, in particular his remarks concerning the lack of UK participation in the Heidelberg Laureate Forum for young researchers in mathematics and computer science (www.heidelberg-laureate-forum. org). Given the unparalleled opportunity provided by the Forum to meet some of the world's most pre-eminent mathematicians and computer scientists, we all agreed that, as Graeme suggested, the Society should do what it can to help promote the Forum more widely in future.
As reported in the March diary, the Society has entered into partnership with the Clay Mathematical Institute (CMI) with respect to the funding of Research Schools for postgraduates. However, since the remit of the CMI meant it was not in a position to fund courses on as broad a spectrum of mathematical topics as the Society had previously, further partnership funding had been sought from the Heilbronn Institute for Mathematical Research. Council was very pleased to hear that the Heilbronn Institute had agreed to co-sponsor up to four courses per year, the courses funded not necessarily being those that the CMI could not fund.

We received updates on the work of three Committees. On behalf of the Computer Science Committee, Francis Clarke informed us that there was a healthy demand for Scheme 7 grants, and reminded us about the Knowledge Transfer papers, two of which are currently available on the website, with
more planned. He also mentioned that the Committee was keen to encourage a higher level of attendance from mathematicians at research meetings. For the Education Committee, the Education Secretary, Alice Rogers, reported that further to discussions at the Strategic Retreat, the Committee has decided to concentrate its efforts with respect to higher education on developing policies for MMath/Master degree requirements and standards, and also the measuring and recognition of teaching activity within higher education. And related to this we learnt that the Education Committee is considering the possibility of undertaking a data gathering exercise to establish the number of teaching-and-administration-only contracts in departments. Finally, as Librarian I had the task of reporting on behalf of the Library Committee. Key elements of the Library Committee's work at present are the on-going digitisation of the Council Minute Books and other items from the Society's archive, and developing a consistent catalogue of the Society's book collection at UCL. We are being assisted in this work by two undergraduate interns. This is a continuation of an intern scheme which we have run for the previous two years. The Committee is also responsible for reviewing the Society's journal exchanges. The latter is likely to be affected by open access and this will be a matter for discussion in due course.
As I reported last year, Council agreed to establish a prize in memory of Anne Bennett with the details of the prize to be worked out by the Women in Mathematics Committee. I can now report that the regulations for two prizes have now been agreed by Council and that the prizes will be launched in 2014.

Finally, Council warmly welcomed and agreed to a proposal made by the President Designate, Terry Lyons, to invite Graeme Segal to attend Council meetings during 2014 as a guest (the number on Council being dictated by the Charter, Statutes and By-laws).

## ONE HUNDREDTH DURHAM SYMPOSIUM

Summer of 2013 will see the one hundredth LMS-EPSRC Durham Symposium

In the early 1970s, the London Mathematical Society and the Mathematics Committee of the (then) Science Research Council showed great foresight in seeking to establish a series of world-class research symposia to reflect and enhance the excellence of British mathematics. Representatives of both bodies visited several British universities to decide on a suitable venue, and Durham University was chosen to host the symposia, initially for three years. One reason for this choice was the enthusiasm and commitment of Tom Willmore, Professor of Pure Mathematics at Durham. Tom often said that helping to bring these symposia to Durham was one of his most valuable contributions to mathematics. Since their inception, all the Symposia have been overseen by the LMS, and all but two of them have been funded by the EPSRC (or its predecessors).

The first Symposium, Global Riemannian Geometry, took place in July 1974. The organiser was Professor Sir Michael Atiyah FRS, thus setting the tone for the high academic level to which the series has always aspired. Since 1974 there has been at least one, sometimes two, but more often three, Symposia each year. Each Symposium aims to be timely and internationally leading, bringing together a group of active mathematicians (and other scientists, where appropriate) for about 10 days for a working research symposium, focused on a well-defined and carefully targeted theme of current scientific importance which may be chosen from the entire range of the mathematical sciences. Care is taken to ensure that there is a good balance between UK and overseas participants, so as to provide maximum benefit to UK science. A number of places are reserved for UK graduate students and other young researchers.

There have been many highlights. We have been careful not to mention any names (with two very honourable exceptions!) nor any particular Symposium (other than the first one).

We are eternally grateful to the LMS and our Scientific Organisers; they provide vision and sci-
entific expertise. Some organisers have done more than one - indeed, it is third time around for one of the Organisers of the 100th Symposium, and the second for another.

Durham is a small but beautiful city, which lends itself to a relaxed environment with few distractions. It is practical to walk anywhere in the city, and, (almost!) wherever you are, fields and trees are in view. Almost all participants of almost all of the Symposia have been housed in Grey College. It only takes about five minutes to walk from Grey to the lecture theatres, but, as most participants will remember, it takes at least 10 minutes to walk back! Luckily, the College dining room (with its glorious view of the world heritage site of Durham Cathedral and Castle) and the College bar provide suitable motivation and encouragement to get back up the hill!

Much mathematics has been done on various social outings; participants sometimes being even more inspired by their mathematics than by their surroundings during the traditional visit to Durham Cathedral. Many will also remember their mathematical discussions on the day trip, which is provided in mid-conference, supposedly to give the participants a day off! However, visits to, say, Hadrian's Wall, or Holy Island, or Whitby often merely provide a back-drop to further mathematical discussions. Some didn't even notice the time that the coach drove a very long way down a narrow dead-end road, and had to go cross-country to get back to a
main road! One of the more popular trips occurred when the coach broke down outside a Northumbrian country pub, and we had to wait about two hours (inside the pub, of course!) for a relief vehicle to arrive.
The symposia aim for high scientific impact, including timely dissemination of the benefits to people who are not participants. The extensive Durham Symposium website at www. maths.dur.ac.uk/lms provides a detailed and lasting account of each meeting. It gives information about all previous symposia including, in many cases, a list of participants, abstracts of talks and/or lecture notes, a symposium photograph (the earliest photographs we have are from 1976 and 1977 - please let us know if you have any earlier ones or any missing ones), and, for symposia since 2004, videos of the talks.

We in Durham are very honoured to be the hosts of this series, which has enhanced British and international mathematics since its inception in 1974. The British mathematical community owes a great debt to the LMS for overseeing the whole programme, the EPSRC for funding the programme, and the Scientific Organisers for their invaluable academic and administrative input. The greatest debt though, is due to the participants and the speakers. It is you who generate the ideas, enthusiasm and raison d'etre for the programme of Durham Symposia.

John Bolton, John R Parker, Dirk Schuetz


De Morgan House offers $40 \%$ discount on room hire to all Mathematical charities and $20 \%$ to all not for profit organisations. Support the LMS by booking your next London event with us.

CONFERENCE FACILITIES


Call us now on 02079270800 or email roombookings@demorganhouse.co.uk to check availability, receive a quote or arrange a visit to our venue

June Barrow-Green

## LONDON MATHEMATICAL SOCIETY/NUFFIELD FOUNDATION UNDERGRADUATE RESEARCH BURSARIES 2013

The London Mathematical Society is pleased to announce the list of successful applicants to its first round of Undergraduate Research Bursaries. For the 2013 round 27 awards were made to students from 12 different institutions to undertake a research project alongside a research supervisor. The purpose of the Bursaries is to enable undergraduates with research potential to experience research and to encourage them to consider a career in scientific research
The scheme has been run jointly with the Nuffield Foundation in 2013 and will be run solely by the Society for the next round in 2014.

| Institution | Research Supervisor | Student | Research Topic |
| :--- | :--- | :--- | :--- |
| Bristol | Dr Carl Dettmann | George Fullman | Mathematical billiards with cusps: an <br> analytical and numerical investigation |
| Bristol | Dr Thomas Jordan | Natalia Jurga | Self affine sets, Hausdorff dimension <br> and random perturbations |
| Durham | Dr Dzmitry Badziahim | Isabelle Hirst | p-adic Littlewood conjecture for <br> some collections of numbers |
| Durham | Dr Alexander Stasinski | Samuel Poulten | Similarity and commutators <br> of matrices over rings |
| Durham | Dr Fredrik Stromberg | James Caan | Maeda's conjecture for modular forms <br> with non-trivial Dirichlet characters |
| East Anglia | Dr Hayder Salman | Daniel Ratliff | Path-Memroy Induced Nonlocality <br> in Classical and Quantum Systems |
| East Anglia | Dr Robert Whittaker | Iain Dorrington | Optimisation of microfluidic traps <br> for testing C. botulinum spores |
| Glasgow | Dr Tara Brendle | Mante Zelvyte | Torelli Braid Groups |
| Glasgow | Professor Nicholas Hill | Ellen den Ouden | Structured tream models for <br> the pulmonary circulation |
| Glasgow | Dr Tereza Neocleous | Rose Henderson | Compositional data analysis <br> of forensic glass data |
| Imperial | Dr Eric Keaveny | Arshad Kamal | Spherical harmonic representations <br> of micro-particle surfaces for <br> hydrodynamic computations |
| Imperial | Professor Jeroen Lamb | Alex Holmes | Iterated Function Systems <br> with mixed behaviour |
| Leicester | Dr Alex Clark | Robert Sanders | Homogeneity properties <br> of Menger spaces |
| Liverpool | Professor Lasse <br> Rempe-Gillen | Zhaiming Shen | The Julia set of the complex <br> exponential function |
| Liverpool | Dr lan Thompson | Alexandra Duke | Periodic Green's functions <br> and reduction methods |


| Institution | Research Supervisor | Student | Research Topic |
| :--- | :--- | :--- | :--- |
| Liverpool | Dr Jonathan Woolf | Cordelia <br> Henderson-Moggach | Euler calculus and cosheaves |
| Nottingham | Dr Stephen Cox | Alessandro <br> Ogunshemi | Random pulse-width modulation |
| Nottingham | Dr Stephen Creagh | Luke Purnell | Boundary representation of waves |
| Nottingham | Dr Joel Feinstein | Paul Patrick | Removability of exceptional sets for <br> differentiable and Lipschitz functions |
| Nottingham | Dr Theodore Kypraios | Samuel Shelton | Statistical methods for <br> characterizing quantum devices |
| Nottingham <br> Trent | Dr David Chappell | Olle Hammarstrom | Level set methods for dynamic <br> interface tracking |
| Oxford | Mr Will Anscombe | Mihail Hurmuzov | Hyperreals, non-standard analysis <br> and Hilbert's Fifth Problem |
| Oxford | Dr Christopher Brav | Matt Booth | Fundamental domains for Calabi- <br> Yau monodromy groups |
| Oxford | Dr Alex Hodges | Christopher Nicholls | Computer graphics for <br> relativistic geometry |
| Oxford | Dr Christian Yates | Jonathan Harrison | A stochastic-deterministic hybrid model for <br> modelling reaction-diffusion equations |
| Oxford <br> Brookes | Dr Christiana Sebu | Rebecca Moorby | Mathematical modelling of morphological <br> structure of complex carbon materials |
| York | Dr Michael Bate | Peter Neuhaus | X-posets in reductive groups |

## CAMbridge

## The Maximal <br> Subgroups of the <br> Low-Dimensiona Finite Classical

## Groups

John N. Bray,
Queen Mary, University of London
Derek F. Holt,
University of Warvic
Colva M. Roney-Dougal,
Univesity of St Andrews, Scotlan

- Results are listed in clear and concise tables, easy to use and cite
- Some results presented within are not previously known

Brings together information on analysing representations
of quasisimple groups into one comprehensive source

Series: London Mathematical Society Lecture Note Series
Papertack | 9780521138604 | Jul $2013 \mid$ | 50.00
www.cambridge.org/Ims407

## Lambda Calculus with Types

Henk Barendregt,
Radou
, Wil Dekkers,
Wid Dekkers,
Radboud Universiteit Njimegen Richard Statman, Pensivanilon University pittsburgh

Presents three type disciplines
using a unified framework using a unified framework
Reveals many mathematical gems
through the simple definitions of terms and types
Introduces the reader to applications and includes
almost 300 exercises

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## LMS GRANT SCHEMES

Next Closing Date for Research Grant Applications: 15 September 2013

Applications are invited for the following grants:

## Conferences (Scheme 1)

Grants of up to $£ 7,000$ are available to provide partial support for conferences held in the United Kingdom. This includes a maximum of $£ 4,000$ for principal speakers, $£ 2,000$ to support the attendance of research students, and $£ 1,000$ to support the attendance of participants from Scheme 5 or former Soviet Union countries.

Celebrating new appointments (Scheme 1) Grants of up to $£ 600$ are available to provide partial support for meetings held in the United Kingdom to celebrate the new appointment of a lecturer at a UK university.

## Postgraduate Research Conferences

## (Scheme 8)

Grants of up to $£ 4,000$ are available to provide partial support for conferences held in the United Kingdom, which are organised by and are for postgraduate research students.

## Visits to the UK (Scheme 2)

Grants of up to $£ 1,500$ are available to provide partial support for a visitor to the UK, who will give lectures in at least three separate institutions. Awards are made to the host towards the travel, accommodation and subsistence costs of the visitor.

Joint Research Groups (Scheme 3)
Grants of up to $£ 2,000$ are available to provide support to research groups of mathematicians to enable them to engage in collaborative activities through holding regular meetings (the maximum award is for four meetings held in the academic year). Groups should be made up of mathematicians who are working in at least three different locations and who have a common research interest.

Joint Research Groups (Scheme 3) - Renewal procedure
ALL renewal applications MUST be accompanied by a Financial and Academic Report for the previous year's activities. Please note that full reports should always be submitted ('light touch' refers to the application procedure only).
Grant holders wishing to renew their application may use the Light Touch Application Form if:

The original or last full renewal application was made in the last TWO years, and NONE of the following have changed:

- the grant holder,
- the supporters, and
- the amount requested*
* Please note that with the increased maximum awards, grant holders may still apply using the Light Touch scheme and request the increased award per meeting ( $£ 500$ ), e.g. up to $£ 2,000$ for 4 meetings, provided that no other details have changed and that the number of meetings has not changed.

Grant holders MUST use the Full Renewal Application Form if:
The original or last full renewal application was made THREE years ago, and/or ANY of the following have changed:

- the grant holder,
- the supporters or
- the amount requested

If a renewal application is unsuccessful, normally the grant will be terminated at the end of the calendar year. A supplementary grant will be available to cover actual expenditure for a meeting held during the autumn term. This will normally be the equivalent of the grant awarded for one meeting, eg $£ 500$, and will not usually exceed one third of the previous year's grant.

## Research in Pairs (Scheme 4 )

Grants of up to $£ 1,200$ are available to support a visit for collaborative research either by the grant holder to another institution abroad, or by a named mathematician from abroad to the home base of the grant holder. Grants of up to $£ 600$ are available to support
a visit for collaborative research either by the grant holder to another institution within the UK, or by a named mathematician from within the UK to the home base of the grant holder.

## International Short Visits (Scheme 5)

Grants of up to $£ 3,000$ are available to support a visit for collaborative research by a named mathematician from a country in Africa (or countries where mathematics is in a similar position) to the home base of the grant holder. Grants of up to $£ 2000$ are available to support a visit for collaborative research by the grant holder to a country in Africa (or countries where mathematics is in a similar position).

For full details of these grant schemes, and to download application forms, visit the LMS website: www.Ims.ac.uk/content/ research-grants.

- Applications received by 15 September

2013 will be considered at a meeting in October.

- 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 and

Elizabeth Fisher and (tel: 0207291 9971/3 email: grants@lms.ac.uk).
Programme Secretary: Rob Wilson (r.a.wilson@qmul.ac.uk).

## OTHER LMS GRANTS AND FUNDING

## LMS-CMI Research Schools

The Society and the Clay Mathematics Institute offer funding of up to $£ 31,000$ (including honoraria for organisers) towards the cost of
running a one-week Research School which provides high quality training for postgraduate students in core areas of mathematics. For further information on Research Schools and how to submit a proposal, please visit: www. Ims.ac.uk/events/lms-cmi-research-schools.

## Research Workshop Grants

The Society offers grants to support 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.Ims.ac.uk/content/ research-workshops-grants.

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.
3. 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 provisiona dates for the visit.
Financial and academic reports will be re-
quired 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 budget

14 3. A brief description of the course of lectures.
4. 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.Ims.ac.uk/content/internationalgrants\#YBR. Applications received by 15 September 2013 will be considered at a meeting in October. Enquiries should be made to the Grants Administrators: Sylvia Daly and Elizabeth Fisher (tel: 0207291 9971/3, email: grants@lms.ac.uk).

## Spitalfields Days

Grants of up to $£ 1,000$ 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. Please see the website for further details: www.Ims.ac.uk/content/ spitalfields-days\#applications.

## 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 August 2013. Please see the website for further details: www.Ims.ac.uk/content/ small-grants-education.

## 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 15 November 2013. Please see the website 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. Please see the website for further details: www.lms.ac.uk/content/ childcare-supplementary-grants.

## LONDON MATHEMATICAL SOCIETY <br> SOUTH WEST \& SOUTH WALES REGIONAL MEETING

## Monday 16 December 2013

## Mathematics Department, College of Science, Swansea University

- Opening of the meeting
- S. Caenepeel (VUB, Brussels)
- S. Majid (QMUL)
- J.T. Stafford (Manchester)
- Wine Reception/Dinner

The meeting will be held in the afternoon. These lectures are aimed at a general mathematical audience. All interested, including nonmembers of the LMS, are most welcome to attend this event.

The meeting forms part of a workshop on Categorical and Homological Methods in Hopf Algebras from 16-19 December. The speakers of the workshop include: M. Aguiar, J. Bichon, A. Bruguieres, J. Gomez Torrecillas, U. Kraehmer, G. Militaru, C. Menini, D. Stefan (to be confirmed), K. Szlachanyi, M. Wambst and R. Wisbauer. The workshop will finish at lunchtime on 19 December.

For further details, to register for a place at the meeting and workshop and/or to reserve a place at the dinner, please contact Tomasz Brzezinski (t.brzezinski@ swansea.ac.uk).

There are funds available to contribute in part to the expenses of members of the Society or research students to attend the meeting and workshop. Requests for support, including an estimate of expenses, may be addressed to the organisers.

## SMUK 2013

## Report

The interaction between string theory and mathematics has proven to be an extremely fruitful one, leading to new developments both in pure mathematics and in theoretical physics. The UK is particularly strong in the sub-
jects at the intersection of these two fields. Thus, bringing together researchers in a workshop was a much overdue task. The first String-Maths UK meeting (SMUK henceforth), was held from 10 to 11 May 2013, at the University of Surrey. It brought together about 50 string mathematicians from the UK, including a strong attendance of PhD students and postdocs. The meeting was supported by an LMS conference grant and organised by David Berman (Queen Mary), Jock McOrist (Surrey), Sakura Schafer-Nameki (King's) and Martin Wolf (Surrey).
SMUK was structured around 3-4 one-hour talks per day, giving an overview of recent developments at the interface between mathematics and string theory, with plenty of time for discussion between the talks. The topics exemplified the breadth of the interaction between string theory with mathematics, ranging from applications in geometry, topology to number theory. Recent developments in supersymmetric gauge theories obtained by compactification of the so-called M5-brane theory were presented from different points of view by Sara Pasquetti, Brian Wecht, and Dario Martelli. The M5-brane theory is a six-dimensional supersymmetric theory, which has so far evaded a precise formulation. However, compactifying this theory on a Riemann surface has uncovered an interesting connection between two-dimensional conformal field theories and supersymmetric gauge theories in four dimensions. Pasquetti presented intriguing results on compactifications of the M5-brane theory on a three-manifold which gives a conjectured duality between complex Chern-Simons theory and three-dimensional supersymmetric gauge theories. Miranda Cheng gave an intriguing talk on the so-called umbral
moonshine, which constitutes a novel type of moonshine, first discussed in the context of the famous monstrous moonshine relating modular functions to the Monster group. Lionel Mason gave a beautiful exposition on the connection between gravity scattering amplitudes, twistor geometry, and twistor-string theory, an area that has lead to dramatic advances in our understanding of scattering theory in recent years. Ilarion Melnikov's talk re-emphasised that tools from supersymmetric gauge theories are really powerful in probing the quantum moduli spaces of string compactifications, in particular of heterotic strings on Calabi-Yau manifolds. An intriguing observation was made in Philip Candelas' talk, which uncovered patterns in the Hodge number plot for Calabi-Yau three-folds. Some of these patterns can be explained via the construction of the toric geometries from so-called 'tops' and 'bottoms', making the point that interesting structures in the Hodge-plot, which was the birthplace of Calabi-Yau manifolds within string theory, remain to be uncovered

Besides the plenary talks, the late afternoons were reserved for 20 -minute presentations by young researchers, giving both PhD students and postdocs a forum to present their results thereby stimulating many discussions.

As one of the speakers summarised, this was a 'smuk' inauguration workshop, kicking off the annual String-Maths meetings in the UK. SMUK 2014 is planned to take place at King's College, London in spring 2014.

David Berman (Queen Mary) Jock McOrist (Surrey) Sakura Schafer-Nameki (King's) Martin Wolf (Surrey)

EPSRC
Pioneering research
and skills

## Topology in Low Dimensions

## Durham University <br> 26-30 August 2013 <br> Organiser: Andrew Lobb

## Course outline

Low-dimensional topology has seen a proliferation of new invariants and techniques over the last decade or so which are intimately interrelated. The ideas behind them are approachable from a number of points of view: for example from algebraic geometry, differential geometry, algebraic topology, or from representation theory. The invariants include Khovanov homology and its offspring, Floer homologies, and various gauge theories.
It is important that the new generation of topologists and geometers becomes familiar with these techniques in which many disparate areas of mathematics are united. A problem in getting to grips with this area is that there are no good comprehensive written sources for students to study independently that give a sensible balance of the theory and the applications.
The course aims to present a broad selection of these ideas, covering the construction, the properties, and what can be done with them.
The three main lecture course topics are:

- Heegaard-Floer homology (Matthew Hedden, Michigan State University)
- Khovanov homology and its offspring. (Jacob Rasmussen, Cambridge)
- Contact 3-manifolds and holomorphic curves. (Chris Wendl, UCL)

These lecture courses will be supplemented by tutorial sessions.
For further information visit:www.maths.dur.ac.uk/~ddmb48/LMS Durham Short Course.html
Applications: Applications should be made using the registration form available via the Society's website at: www.Ims.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 $\mathbf{1 5}$ July 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 $\mathbf{£ 1 0 0}$. There will be no charge for subsistence costs.
UK-based postdocs will be charged a registration fee of $£ 250$, plus half the subsistence costs ( $£ 125$ ) $£ 400$ 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 16 August 2013.

MS-EPSRC Short Courses aim to provide training for postgraduate students in core areas of mathematics. Part of their success is the opportunity for studenc
number of leading experts in the topic.

LMS MIDLANDS REGIONAL MEETING 2013
Report
The 2013 LMS Midlands Regional Meeting was held at the University of Leicester on Tuesday 11 June and was followed by the workshop Advances in Surface Theory from 12 to 14 June, with both events being organised by Katrin Leschke (Leicester) and lan McIntosh (York). The meeting began with an introduction by the President, Dr Graeme Segal, where a list of new members were presented to the audience and any members at the meeting were invited to sign the prestigious membership book.

Katrin then introduced the first speaker of the afternoon, Frances Kirwan (Oxford), a former president of the London Mathematical Society, who spoke on Hyperkähler Implosion. The talk consisted of an overview of the subject from its beginnings in symplectic implosion, its relation to Mumford's Geometric Invariant Theory, and the latest results with collaborators Brent Doran, Andrew Dancer and Andrew Swann.
The second talk, given by Franz Pedit (Amherst, Tübingen) was on Constrained Willmore Tori: Theory and Experiment. The speaker focused on the integrable systems approach to constrained Willmore surfaces in Euclidean three space, which are critical points of the Willmore energy (or elastic energy) of immersed surfaces, under the constraint that the surface must remain in a fixed conformal class. The talk concerned recent work in con-
structing numerical examples of these objects, which are natural generalisations of constant mean curvature surfaces, hence there were many beautiful pictures as well as concrete conjectures concerning the constrained Willmore energy minimisers in genus one or the 'constrained Willmore conjecture'.
The final talk of the meeting Ricci Flow and Riemann Surfaces was given by Peter Topping (Warwick). In two dimensions the Ricci flow, an intrinsic flow of a Riemannian manifold, conformally deforms the initial metric -- and in the case of closed surfaces (after a suitable renormalisation) the flow finds the unique constant curvature metric in its conformal class. This talk concerned the state of the art results for the Ricci flow of non closed surfaces under the constraint of instantaneous completeness, developed in part with Gregor Giesen. For instance it was explained how one can always find an instantaneously complete Ricci flow starting with an arbitrary smooth Riemannian surface, and that the instantaneously complete Ricci flow is unique in this class.
The meeting ended with dinner at the local Kerala restaurant where we were joined by the LMS Membership and Activities Officer, Elizabeth Fisher.
The workshop had talks ranging in the area of integrable systems and geometric analysis, mainly in the study of minimal and constant mean curvature surfaces in ambient Riemannian manifolds. In order of appearance the speakers were; Mario Micallef, Sebastian Heller, Giuseppe Tinaglia, Martin Kilian, Rob Kusner, Frédéric Hélein, Jacob Bernstein, Pascal Romon, André Neves, Peter Topping, Felix Schulze and Franz Pedit. It remains for me to thank Katrin and lan for organising a very stimulating event with many experts present; it was a great opportunity to learn and discuss mathematics.

Benjamin Sharp Imperial College London

## RECORDS OF PROCEEDINGS AT LMS MEETINGS

## MIDLANDS REGIONAL MEETING

held on 11 June 2013 at Leicester University as part of the Regional Workshop on Advances in Surface Theory. Over 40 members and visitors were present for all or part of the meeting.

The meeting began at 2.00 pm with the President, Dr Graeme Segal FRS, in the Chair to open the meeting.
Nineteen members were elected to Ordinary membership: Diwin Amarasinghe, David Barnes, David Burton, Richard Golding, Julio Hernandez-Castro, Marianne Johnson, Timothy Logvinenko, Penelope Lynch, James McKee, Antonio Moro, Martin Palmer, Dmitri Panov, David Penman, Matteo Sommacal, Marika Taylor, Aaron Tikuisis, Nicola Timson, Corinna Ulcigrai, Konstantinos Zygalakis.
Nine members were elected to Associate membership: Michael Crabb, Katy Gaythorpe, Eugenio Giannelli, Charlotte Kestner, Marcin Krzywkowski, Katy Ling, Zuonaki Ongodiebi, Mairi Walker, Shuai Wang.
Two members were elected to Reciprocity membership: Joshua Egbon, Hung Tong-Viet. Five members signed the book and were admitted to the Society.
Dr Katrin Leschke introduced a lecture given by Professor Frances Kirwan, FRS, on Hyperkähler Implosion.
Dr Leschke then introduced a second lecture given by Professor Franz Pedit entitled Constrained Willmore Tori: Theory and Experiment.
After tea, Dr Leschke introduced a lecture given by Professor Peter Topping on Ricci flow and Riemann surfaces.
The President, Professor Segal, expressed the thanks of the Society to the local organisers for putting on such an interesting meeting.
Afterwards, a dinner was held at a local restaurant, Kayal.

## CLAY RESEARCH AWARD 2013

The Clay Mathematics Institute announces that the 2013 Clay Research Award has been made to Rahul Pandharipande (ETH, Zürich). Rahul receives the award for his recent outstanding work in enumerative geometry, specifically for his proof in a large class of cases of the MNOP conjecture that he formulated with Maulik, Okounkov and Nekrasov. The conjecture relates two methods of counting curves in an algebraic variety, one given by Gromov-Witten theory and the other by Don-aldson-Thomas invariants. By building in par-
ticular on joint work with Thomas on stable pairs, Pandharipande and his student Aaron Pixton proved the conjecture for many (possibly most) Calabi-Yau three-folds.
Aaron Pixton was awarded a 2013 Clay Research Fellowship (LMS Newsletter March 2013).

The Award will be presented at the Clay Research Conference in Oxford on 2 October 2013. For further information about the award visit the website at www.claymath. org/research_award.


After the success of last year's event, which attracted around 300 visitors to De Morgan House, the LMS is once again taking part in Open House London. De Morgan House will be open from 11 am till 4 pm on Sunday 22 September 2013 and visitors will be able to enjoy a guided tour of the building, and receive information about the London Mathematical Society and mathematics.

## OPERATOR ALGEBRAS

A five day conference entitled Classifying Structures for Operator Algebras and Dynamical Systems will be held at Aberystwyth University from 16 to 20 September 2013 to cover a wide range of topics relating to operator algebras, dynamical systems and the interplay between them, including:

- the classification of operator algebras statistical mechanical models and dynamical systems via graphs
- the classification of C*-algebras and dynamical systems via K-theoretic invariants
- characterising and identifying classifiable C*-algebras
- the interplay between number theory, operator algebras and dynamical systems
Talks will be given by:
- Ahmed AI-Rawashdeh (UAEU, AI-Ain, UAE)
- Edwin Beggs (Swansea, UK)
- Tomasz Brzezinski* (Swansea, UK)
- Joachim Cuntz* (Münster, Germany)
- Sřren Eilers* (Copenhagen, Denmark)
- George Elliott (Toronto, Canada)
- David Evans (Cardiff, UK)
- Rolf Gohm (Aberystwyth, UK)
- Tomasz Kania (Lancaster, UK)
- Eberhard Kirchberg (Berlin, Germany)
- Akitaka Kishimoto (Sapporo, Japan)
- Vladimir V. Kisil (Leeds, UK)
- Nadia Larsen (Oslo, Norway)
- Xin Li (Münster, Germany)
- Hiroki Matui (Chiba, Japan)
- Francesc Perera* (Bellaterra, Spain)
- Mathew Pugh (Cardiff, UK)
- Jean Renault (Orléans, France)
- Mikael Rřrdam* (Copenhagen, Denmark)
- Aidan Sims (Wollongong, Australia)
- Stuart White (Glasgow, UK)
- John D. Maitland Wright (Aberdeen, UK)
- Joachim Zacharias (Glasgow, UK)
* to be confirmed

All are welcome to participate and to propose an abstract for a talk. PhD students, whose registration fees are waived, are very much encouraged to attend. In addition, PhD students based in the UK without official funding for conference attendance are invited to email the conference organisers (dfe@aber.ac.uk) to request financial assistance with travel and/or accommodation. Visit the conference website http://users. aber.ac.uk/dfe/WIMCS-LMS-Aber2013/ for further information, including an updated list of participants, information on how to register and propose a talk, and guidance on travel and accommodation matters.

The conference organisers are Gwion Evans, Otgonbayar Uuye and Wilhelm Winter. Financial support has been received from the Wales Institute of Mathematical and Computational Sciences and the London Mathematical Society.

## HIGHER EDUCATION

ACADEMY
WORKSHOP AND SEMINAR SERIES 2013
The Higher Education Academy (HEA) is currently inviting all HEA subscribing institutions in the UK delivering higher education to be part of a workshop and seminar series for 2013-14. Funding has been provided to enable grants of $£ 750$ to be offered to institutions to host and deliver a workshop or seminar during the series and produce an associated report for the sector.

The disciplinary call which covers the Mathematics, Statistics and Operational

Research discipline is the STEM call, which can be accessed at www.heacademy.ac.uk/ seminar-series\#stem. Areas of particular interest identified in the call are:

- improving the employability skills of STEM graduates
- innovative approaches to teaching and assessing large classes
- giving effective feedback to students
- growing diversity in the student population
- practices in peer mentoring
- impact of information technology in learning and teaching
- students as partners

The deadline for submission of applications is 31 July 2013. For enquiries about applications in the Mathematics, Statistics and Operational Research discipline area contact Mary McAlinden (mary.macalin den@heacademy.ac.uk).
Successful applications will be required to demonstrate an alignment with the UK Professional Standards Framework (www. Heacademy.Ac.Uk/Ukpsf). Further information about the HEA Workshop and Seminar Series can be found at www.heacademy. ac.uk/seminar-series.

## THE MATHEMATICS OF CCC

Mathematical Physics with Positive Lambda

The Clay Mathematics Institute will hold a three-day workshop on The Mathematics of CCC at the Mathematical Institute of the University of Oxford from 11 to 13 Sep tember 2013. The workshop will bring together experts in the fields of relativity, geometry, partial differential equations, observational cosmology, and particle physics to explore in depth aspects of conformal cyclic cosmology (CCC).

CCC proposes that the Big Bang was not the universe's origin, but a conformal continuation of an earlier aeon, where aeons occur sequentially, each starting with a big bang and ending with an exponential expansion driven by positive. There is no early inflation, exponential expansion of the previous aeon serving instead. Emissions from previous-aeon black-hole encounters have observational implications, apparently supported in recent analyses of the CMB. Equations governing the transition from aeon to aeon imply creation of a dark material acquiring mass early in the new aeon, related to Higgs-type conformal symmetry-breaking.

This workshop will explore the many mathematical and astrophysical issues raised by CCC, including:

- the extension of Einstein's equations to the crossover between aeons
- geometrical aspects of conformal geometry
- galactic dynamics in the very far future
- the nature of gravitational wave emission from black-hole encounters
- conventional cosmology
- energy conservation in general relativity with positive $\wedge$
- particle physics at very high energy, and also at very low energy, in the presence of positive $\wedge$

Registration for the workshop is free, but to enable estimation of numbers participants are asked to register in advance. An optional dinner will be held on 11 September; the fee for dinner is $£ 40$. For more information and to register, visit the website at www. claymath.org/workshops/ CCC.

The organisers at the University of Oxford are Andrew Hodges, Lionel Mason, Roger Penrose, Paul Tod and Tsou Sheung Tsun.


## FINITE GROUPS AND RELATED TOPICS

John Thompson turned 80 in October 2012 and to celebrate the occasion a conference on Finite Groups and Related Topics will take place at the CMS in Cambridge from Monday 8 to Wednesday 11 September. The programme will consist of a series of lectures of one hour each. Talks will be given by: John Thompson, Michael Aschbacher, Inna Capdeboscq, George Glauberman, Radha Kessar, Gunter Malle, Geoff Robinson, Jean-Pierre Serre, Peter Sin, Stephen Smith, Ron Solomon, Pham Tiep and Richard Weiss
The conference dinner will take place on Tuesday 10 September at Sidney Sussex College. For further information and to register visit the website at: www.dpmms. cam.ac.uk/Seminars/Conferences/Thompson80. There will be support available for young mathematicians attending; for this you should contact Jan Saxl (J.Saxi@dpmms.cam.ac.uk).
The organisers are Bob Guralnick and Jan Saxl. The conference is supported by the DPMMS, NSA, NSF and an LMS Conference grant.

## STOCHASTIC ANALYSIS AND APPLICATIONS

A conference on Stochastic Analysis and Applications will take place at the OxfordMan Institute and Mathematical Institute, University of Oxford from 23 to 27 September 2013.
The conference will mark the 60th birthday of Professor Terry Lyons, FRSW, FRSE, FRS, Wallis Professor of Mathematics, University of Oxford.
Stochastic Analysis is the branch of mathematics concerned with the study of randomly evolving systems. It emerged as a core area of mathematics in the late 20th century and has grown rapidly to establish a leading position in both theory and applications.

The meeting will bring together many of the main contributors to recent advances in the field. It will provide an overview of the current state of the area as well as of its ongoing developments. In addition, there will be a component which focuses on Financial Mathematics, a substantial area of application. This meeting will constitute a springboard for future collaborations between researchers, both established and newcomers, interested in the theory and applications of stochastic analysis.
The speakers are: Shigeki Aida (Tohoku); Dominique Bakry (Toulouse); Martin Barlow (UBC); Gérard Ben Arous (NYU); Jean Bertoin (UZH); René Carmona (Princeton); Ana Bela Cruzeiro (UTL); Mark Davis (Imperial); David Elworthy (Warwick); Hans Föllmer (HU Berlin); Peter Friz (TU Berlin); Masatoshi Fukushima (Tohoku); Martin Hairer (Warwick); loannis Karatzas (Columbia); Yves Le Jan (Paris-Sud); David Nualart (University of Kansas); Etienne Pardoux (Aix-Marseille University); Edwin Perkins (UBC); Michael Röckner (Bielefeld); Marta Sanz-Solé (UB); Ronnie Sircar (Princeton); Nizar Touzi (École Polytechnique, Paris); Nicolas Victoir (J.P. Morgan); Marc Yor (Université Paris); Ofer Zeitouni (University of Minnesota).
For further details and online registration visit www.oxford-man.ox.ac.uk/ events/stochastic-analysis-and-applica tions. The meeting is partially supported by an LMS Conference grant.

## COLLINGWOOD

 MEMORIAL PRIZEThe 2013 Collingwood Memorial Prize has been awarded to James Martin Salter, St Cuthbert's Society, Durham University. The Collingwood Memorial Prize, established in memory of Sir Edward Collingwood FRS, President of the Society 1969-70, is awarded to a final-year mathematics student at the University of Durham who intends to continue to a higher degree in mathematics at Durham or any other university.

Clay Mathematics Institute:

## Clay Research

 Conference
## Mathematical Institute Opening Conference

September 29 - October 4, 2013
University of Oxford
Mathematical Institute
Radcliffe Observatory Quarter


Clay Research Conference | Wednesday, October 2

- Peter Constantin (Princeton University)
- Lance Fortnow (Georgia Institute of Technology)
- Fernando Rodriguez Villegas (University of Texas at Austin)
- Edward Witten (Institute for Advanced Study)

Associated workshops will be held throughout the week of the conference:
29 Sept-1 Oct: The Navier-Stokes Equations and Related Topics
30 Sept - 4 Oct: New Insights into Computational Intractability
30 Sept-4 Oct: Number Theory and Physics
30 Sept - 4 Oct: Quantum Mathematics and Computation
For more information and to register, visit www.claymath.org/CRC13/

Mathematical Institute Opening Conference | Thursday, October 3
To celebrate the opening of its new building, the Mathematical Institute of the University of Oxford is sponsoring a one-day conference.

- Ingrid Daubechies (Duke University)
- Raymond Goldstein (University of Cambridge)
- Sir Andrew Wiles (University of Oxford)

For more information and to register, visit www.maths.ox.ac.uk/opening
www.claymath.org
www.maths.ox.ac.uk

INTERNATIONAL CONGRESS OF MATHEMATICIANS 2014


Greetings from the Organizers of ICM 2014
The next International Congress of Mathematicians will take place at COEX in Seoul, Korea, from Wednesday 13 August through to Thursday 21 August 2014. The pre-registration process for the ICM 2014 is underway. If you have not yet pre-registered, please do so by following the simple instructions at the homepage: www.icm2014.org/. The ICM eNews is being circulated to the people who pre-registered for the congress. We strongly recommend that you visit the homepage regularly for updated information and ICM related activities

## In the center of Seoul!

Korea, with a five-millennia-long history, is an attractive place to visit. And, Seoul, the capital of Korea for over 600 years, is a vibrant modern city with a population of 11 million, where the traditional culture and cutting-edge trends coexist side-by-side in perfect harmony. With a low crime rate and a state-of-the-art subway system, it is one of the safest cities in the world. The congress venue, COEX, is at the heart of downtown Seoul, located right next to a subway station. There are over 7,500 hotel rooms within 5 km from COEX.

## Family-friendly ICM

Seoul is filled with great family-friendly activities. For the ICM participants accompanying family members, an on-site childcare facility will be available. And we recommend some of Seoul's best destinations for traveling family from a day at a theme park to youth-focused outdoor events and countless playgrounds in the heart of downtown. Three Disney-style theme parks (LOTTE WORLD, SEOUL LAND,
and EVERLAND) are around 10 min to 1 hour bus/subway ride from central Seoul. Especial ly during summer season, all the theme parks are open until late at night performing fantastic laser shows and fireworks. Bring your family to Seoul ICM, and experience wonderful festivals and magnificent shows at the theme parks in Korea! Family-friendly ICM will make your journey all the more special.

## Solidarity in Mathematics, NANUM 2014

To make the congress a true world-wide gathering, the Organizing Committee places special emphasis on supporting mathematicians from developing countries. Members of the Korean Mathematical Society fully acknowledge the gracious support received from the international mathematical community in the 70's and 80's, and hope more countries can share in the benefits. This has motivated the theme of "Solidarity in Mathematics", and 1,000 mathematicians from developing countries will be invited to Korea during ICM 2014. Many of these mathematicians would not have been able to visit an ICM otherwise, and stand to bring the ICM excitements and new knowledge back to their home countries. The Seoul ICM Travel Fellowship Fund was set up for this purpose, and the fund is expected to receive over US\$2 million by 2014 mainly from global corporations and individual donors. By collaborating with IMU/CDC, we are developing selection guidelines for this travel assistance program, called "NANUM 2014." NANUM is a Korean word meaning "gracious and unconditional sharing." A selection policy integrating age, gender and geographical balance is being carefully crafted.

## NANUM 2014 in detail

The financial support will be granted in three categories:

- $45 \%$ senior mathematicians
- $45 \%$ junior mathematicians
- $10 \%$ advanced graduate students

The applications will be reviewed by five review committees covering the following five regions:

- Africa
- East and Southeast Asia including China and North Korea
- South and West Asia including Indian subcontinent
- Eastern Europe including North Asia
- Central and South America

A timeline of the application and selection procedure has been set:

- February 28, 2013: Selection international NANUM ambassadors
- March 15, 2013: Selection software (beta-version)
- April 30, 2013: Selection software (final)
- June10, 2013 - Aug. 31, 2013: Applica tions received
- December. 31, 2013: Review of Applications completed
- January. 2014: Notification of acceptance

MENAO 2014 (Mathematics in Emerging Nations: Achievements and Opportunities) The MENAO event, which features about 100 participants/ discussants and is open to an additional 350 observers, will take place on the day immediately preceding the opening of the congress. The goal of the MENAO event is:

- To listen to the voices of mathematicians and aspiring advanced students of mathematics from the developing world
- To share success stories of development via partnerships between the local mathematical communities, their governments, and international agencies and foundations
- To review the current status of those efforts and future needs
A detailed program will be developed and distributed by the IMU.

Invited plenary, sectional, and special lectures at the ICM
The privilege of sending the invitations belongs to the Organizing Committee whereas it is the privilege of the Program Committee to select the invited plenary and sectional speakers for the congress. Plenary lectures are invited one-hour lectures to be
held without other parallel activities. The lectures should be broad surveys of recent major developments, aimed at the entire mathematical community. Sectional lectures are invited 45-minute lectures. Several sectional lectures are scheduled in parallel. The series of Emmy Noether lectures honors women who have made fundamental and sustained contributions to mathematics. And the Emmy Noether lecturer has been chosen by a committee appointed by the IMU EC. All the invitations have been sent out by the OC, and hopefully they have them in hand by now.

We look forward to welcoming you at the congress in Seoul, Korea.

Hyungju Park
Chairman, ICM 2014 Organizing
Committee

## BRITISH SCIENCE FESTIVAL 2013

This is organized by the British Science Association (a.k.a. the British
 Association for the Advancement of Science) and takes place this year in Newcastle from Saturday 7 to Thursday 12 September with the theme Making Waves.

Saturday 7 September, 11:00-12:00 and 14:30-15:30
The Maths and Computing Magic Show, Matt Parker and Peter McOwan (QMUL)
Magic tricks and fun with a basis in mathematics or computer science.

## Saturday 7 September, 13.30-14.30

PrimeGrid, Iain Bethune (EPCC, University of
Edinburgh)
Join in the search for a world record prime number

## Sunday 8 September, 10:30-12:00

The Randomness Show, Steve Humble (Dr Maths, University of Newcastle)

Numbers, patterns and mathematical magic tricks hidden in the randomness.

## Weekend, 7-8 September

Slide into the Maths Museum
What is the shape of the slide that allows a body to slide the fastest from top to bottom? The UK's first museum entirely dedicated to Mathematics is also asking what you would like to see at MathsWorIdUK.

## Wednesday 11 September, 13:30-14:30

Be a Maths Millionaire, Sara Santos (MathsBusking), Ehrhard Behrends (Freie Universität Berlin), Jorge Buescu (Universidade de Lisboa). Are equations useful? Can they make you rich? Would you fight over it? The secrets of Google, the rules of nature and duels over equations.

Wednesday 11 September 14:30-17:30 Do the Maths: potential and challenges of the digital age Mathematics Presidential Lecture by Celia Hoyles (Institute of Education) Should computers be used in the teaching and learning of mathematics? Followed by a wine reception sponsored by the Institute of Mathematics and its Applications

## Thursday 12 September, 10:00-12:00

Climate Change: Does it All Add Up? Chris Budd (Universty of Bath), Peter Cox (University of Exeter) and Vicky Pope (Met Office) How do climate models work, are they reliable and how are they used?

Can the Angel of the North Fly? Robin Johnson (Newcastle) presenting in the Young Persons' (Schools') Programme, Monday to Thursday.

In the City Centre: Maths Busking trained the Street Scientists team in Newcastle to deliver mathematics alongside science in their street entertainment routines.

Any queries should be directed to the Chair of the Mathematical Sciences Section, Peter Giblin (pjgiblin@liv.ac.uk). For full details of the Festival visit the website at www.britishscienceassociation.org/ british-science-festival.

## FESTIVAL 2014

For the 2014 Festival in Birmingham (6 11 September) the Mathematical Sciences Section is keen to hear from anyone with a possible idea for a mathematics, statistics, operational research or computing based event. The mission of the British Science Association is to communicate the excitement and relevance of science, including mathematics, to the wider public. Thus the 'unexpected usefulness of mathematics' is a strong theme. The programme for 2014 will be discussed by the Section in the autumn of 2013. Any ideas or offers of help should be sent to Peter Giblin (pjgiblin@ liv.ac.uk).

## FUNCTION THEORY

## MEETING

A one day Function Theory Meeting will take place at De Morgan House in London on 2 September 2013. This annual event brings together the function theory community, including complex analysts and dynamicists. The principal invited talks will be given by Professor Alan Beardon and Professor Walter Bergweiler, both distinguished researchers who also enjoy reputations as popular lecturers. The full list of speakers is:

- Alan Beardon (Cambridge)
- Walter Bergweiler (Kiel)
- Nada Alhabib (Liverpool)
- Tom Carroll (Cork)
- Davoud Cheraghi (Warwick)
- Aimo Hinkkanen (Illinois)
- Dave Sixsmith (Open)

There is no need to register in advance for the meeting. There is a $£ 10$ registration fee payable on the day, which is waived for those who are retired or unemployed. Some funding is available to contribute to the travel expenses of research students. For further information, see the meeting website https://sites.google.com/site/functiontheorymeeting/ or contact the organiser, Dan Nicks, at odftm.mail@gmail.com. The meeting is supported by an LMS Conference grant.

## PARALLEL PROGRAMMING

## IN GAP

A workshop on Parallel Programming in GAP will be held at the University of St Andrews from Monday 19 to Friday 23 August 2013. The workshop is organised by the Centre of Interdisciplinary Research in Computational Algebra of the University of St Andrews and is supported by the EPSRC project HPC-GAP: High Performance Computational Algebra and Discrete Mathematics that aims at reengineering the GAP system to take advantage of computer architectures suitable for parallel computations.

The workshop will comprise of lectures and tutorials given by the participants of the HPC-GAP project, and case studies sessions where we intend to look at some particular GAP packages and estimate main tasks needed to adapt them to HPC-GAP.
Further details can be found at www.gap system.org/hpcgap2013/.

## FROM SPECTRAL GAPS TO PARTICLE FILTERS

A two-day workshop on transfer operators and non-linear filtering will be held at the Nike Lecture Theatre, Agriculture Building, University of Reading from 17 to 18 September 2013. This workshop is designed to provide a forum to exchange ideas and talk about new developments concerning the analytical aspects of transfer operators (17 September) on the one side and applications to stochastic processes and statistical methodology (18 September) on the other side. The invited speakers include:

- Dan Crisan (Imperial College London)
- E. Brian Davies, FRS (King's College London)
- Gianluigi Del Magno (Universidade Tecnica de Lisboa)
- Gersende Fort (TELECOM ParisTech)
- Mark Holland (University of Exeter)
- Bas Lemmens (University of Kent)
- Theodore Kypraios (University of Nottingham)
- Kody Law (KAUST)
- Ronnie Loeffen (University of Manchester)
- Beatrice Pelloni (University of Reading)

This workshop is being held to celebrate the appointment of four new lecturers Jochen Broecker, Richard Everitt, Martin Kolb, Mladen Savov - to the Department of Mathematics and Statistics, who are the local organisers and will each give a talk.
Please register to attend the workshop by sending an email to specpart@reading.ac.uk giving your name and institution, and stating which days you would like to attend. There is a registration fee of $£ 15$ per day. Lunches, tea and coffee are provided to participants. Further information can be found on the webpage www.personal.reading. ac.uk/~pt904209/Ims_workshop/main.html. The meeting is supported by an LMS Conference grant.

## A DAY IN ANALYSIS AND <br> GEOMETRY AT WARWICK

A half-day event, A Day in Analysis and Geometry, will be held at the University of Warwick on Friday 27 September 2013. The meeting will take place in the Mathematical Institute, with talks starting in the early afternoon and followed by a reception and dinner. Speakers will be:

- Michael Singer (University College London) - John Toland (Newton Institute,

Cambridge)

- Andrea Malchiodi (University of Warwick)

If you are interested in attending this event or would like further information, please send an email to Andrea Malchiodi (A.Malchiodi@warwick.ac.uk). For organisational purposes, it will be helpful if you could confirm your participation. A (very) small amount of funding to support travel (by rail) for graduate students and young researchers might be available.

Further details can be obtained at the webpage www2.warwick.ac.uk/fac/sci/maths/ people/staff/andrea_malchiodi/. The meeting is supported by an LMS grant scheme to celebrate new appointments.

## VISIT OF QENDRIM GASHI

Dr Qendrim Gashi (Pristina, Kosovo) will be visiting the University of Edinburgh from 27 August to 26 September 2013. His work is on Representation Theory and Algebraic Geometry, and in particular the links between Kazhdan-Lusztig theory and the affine Deligne-Lusztig varieties of Kottwitz and Rapoport. For further information email lain Gordon (igordon@ed.ac.uk). The visit is supported by an LMS Scheme 5 grant.

## BRITISH TOPOLOGY <br> meeting

The 28th British Topology Meeting is an annual event bringing together topologists of all kinds from Britain and further afield. This year's conference takes place at the University of Aberdeen from Monday 9 to Wednesday 11 September 2013. The speakers are:

- Mohammed Abouzaid (Columbia

University)

- Natalia Castellana (Universitat Autňnoma de Barcelona)
- Jonny Evans (University College London)
- Lars Hesselholt (University of

Copenhagen)

- Mark McLean (University of Aberdeen)
- Vera Vértesi (Université de Nantes)
- Ergun Yalcin (Bilkent University)

There is also space in the schedule for contributed talks, and young researchers are especially encouraged to offer a talk. Some funds may be available to support postgraduates and postdocs who wish to attend the meeting. Further information is available at http://homepages.abdn.ac.uk/btm2013/ and queries can be sent to BTM2013@abdn. ac.uk.

The conference is organised by Richard Hepworth. The meeting is supported by the Edinburgh Mathematical Society, the Glasgow Mathematical Journal Learning and Research Support Fund and an LMS Conference grant.

## OBITUARIES

DONALD BURKHOLDER
Donald Lyman Burkholder, who was elected a member of the London Mathematical Society on 10 July 1958, died on 14 April 2013, aged 86.
Rodrigo Banuleos, Burgess Davis and Renming Song write: Don received his PhD in mathematical statistics in 1955
 under the direction of Wassily Hoeffding at the University of North Carolina, Chapel Hill. That same year he joined the Mathematics Department at the University of Illinois, Urbana, where he remained until his retirement in 1998.
Most of Don's work involved martingales. A paper of Burkholder and Gundy, which followed Burkholder's seminal 1966 paper Martingale Transforms, proved the famous BurkholderGundy martingale inequalities and developed a method which shows how certain integral inequalities between two nonnegative functions follow from inequalities concerning only parts of their distributions. This seemingly simple but incredibly elegant method, often called simply the good lambda method, is now used in many areas of mathematics which involve integrals and operators. Shortly after this paper was written, Burkholder, Gundy, and Silvestein used the Burkholder-Gundy inequalities to complete work, concerning $H^{\rho}$ spaces that Hardy and Littlewood had began some forty years earlier. This was a revolutionary result. While it was known at the time that there were strong connections between probability and harmonic analysis, this paper convinced many analysts to study probability.
Burkholder's influential work on the geometry of Banach spaces arose from his extension of martingale inequalities to settings beyond Hilbert spaces where the square function approach used in his earlier work fails. The wider implications of his work in the eighties and nineties on sharp martingale inequalities only began to be fully understood in recent years with its connections to problems dealing with sharp $L^{p}$ bounds of certain singular integrals operators and rami-
fications in quasiconformal mappings, and in the theory of calculus of variations dealing with rank-one convex and quasiconvex functions.
Don was editor of the Annals of Mathematical Statistics (1964-67) and president of the Institute of Mathematical Statistics (1975-76). He was elected to the National Academy of Sciences in 1992, and was a Fellow of the American Academy of Arts and Sciences, the Society for Industrial and Applied Mathematics, and the American Association for the Advancement of Science. He was among the first class named as Fellows of the American Mathematical Society in 2012.
Don will be remembered not only for his profound contributions to mathematics, but also for the kind and decent ways in which he interacted with everyone he met, and for his encouragement and support to so many young mathematicians who had the great fortune of crossing paths with him.
Don is survived by his wife Jean, sons Peter and William, and granddaughter Sylvie. He was preceded in death by his daughter Kathleen.
KENNETH APPEL
Kenneth Ira Appel, best known as half of the Ap-pel-Haken partnership that proved the four-colour theorem in 1976, died on 19 April 2013, aged 80 .

Kenneth Appel was born in Brooklyn, New York, on 8 October 1932. He gradu-
ated from Queens' College, New Yok, befo receiving his doctorate from the University of Michigan for a dissertation on the application of mathematical logic to some problems in algebra. An experienced computer programmer, he gained further experience in programming during a summer placement with Douglas Aircraft. After working at the Institute for Defense Analysis at Princeton for two years, he settled at the University of Illinois at Champaign-Urbana where he met Wolfgang Haken.
In 1972 Haken gave a lecture on the fourcolour problem in which he claimed that experts had told him that his ideas on the problem could not be programmed. Appel told Haken
that he believed this to be nonsense, and the rest is history, with Appel taking the lead on the computer-assisted parts of the proof. Following ideas of Heinrich Heesch, they based their proof on finding 'an unavoidable set of 1482 reducible configurations': every map must contain at least one of these, yet none can appear in a minimal counter-example to the theorem. Over three years later, and after 1200 hours of computer assistance, their proof was complete (see [1], [2]).

In October 2002 the LMS held a joint meeting with the BSHM to celebrate the 150th anniversary of the problem, first posed by a student to Augustus De Morgan in 1852. Among the speakers at this enjoyable meeting were Appel and Haken, who outlined some ideas from their proof.

Robin Wilson
The Open University

## Reference

1. K. Appel and W. Haken, Every planar map is four colourable, Bull. Amer. Math. Soc. 82 (1977), 711-12
2. Robin Wilson, Four Colours Suffice, Allen Lane 2002; revised colour edition Princeton University Press, to appear.

## REVIEWS

FindthePerfectPartner4u.com by Charlotte Cory A Goldhawk production for BBC Radio 4.
This four part comedy serial is a bit of fun, especially I suspect for those of us closely connected with the academic world. It follows on from the author's Thinking of Leaving your Husband which was aired earlier this year.

Our hero is an unworldly and somewhat harmless professor of applied mathematics working at the University of East Greenwich and Lewisham Combined or EGLC, who lost his wife a few years ago. 1 found the juxtaposition of the tragic early death of his much-loved wife with the frivolity of what follows rather disconcerting, but it was of course necessary to

the plot that he should be an eligible and once more-single man.
Professor Tony, as he is known throughout, is pestered by the relentless match-making efforts of the Vice Chancellor's wife Arabella who holds regular Friday evening soirees at which she attempts to foist sundry widows, divorcees, and long-term single ladies on the defenceless innocent abroad. At the same time his over-bearing sister-in-law Marjory is equally persistent in dragging him along to dances at the Royal Greenwich Ballroom, despite his clearly possessing two left feet.

This pattern of life is disrupted when he bumps into an ex-pupil, Miles King, an altogether dodgy character who obtained his degree by cheating in some unfathomable way and has gone on to make buckets of money as an estate agent. Miles signs Tony up for internet dating on FindthePerfectPartner4u.com and the fun begins. Tony, who has now become Midnight Magic, meets a variety of predatorial ladies: the floozy who just wants to be wined and dined in expensive restaurants (despite the shabbiness of his attire Tony seems perfectly willing to spend on a single meal enough to make a Treasurer wince!); the psychotherapist who is simply trying to find patients; and the Gilbert and Sullivan enthusiast who kidnaps men as she is short of male voices. When the VC attempts once more to coerce him back to Arabella's dinners, Tony escapes by claiming that his internet dating activities are part of his mathematical research and that it may lead to an influx of new overseas research-students to EGLC. His hand forced, Tony delivers a keynote lecture on The Mathematics of Internet Dating at a conference in Norway at which, his reputation having gone ahead of him, he has a number of hilarious escapades. A fellow researcher suggests that he could increase the size of his database if he went into speed-dating and he decides to follow up on this advice.
Throughout, a potential date calling herself Moody 2-Shoes
 Moody 2-Shoes to whom he has spoken on the 'phone but never met, lurks in the back-
ground. He can recognise her supposedly anonymous registration number at a speed-dating evening as it is apparently "the largest Fermat prime". They meet up and find that they already know one another, and that they are indeed the perfect partners for one another. We can assume that they both live happily ever after.

Thankfully for once the mathematician is not presented as a weird geek, but rather as a kindly if somewhat shabby and nadive individual. The programme makes pleasant listening.

Rob Curtis
University of Birmingham
YOKO ONO'S MELTDOWN 22-23 June 2013
For the past 20 years, the Southbank Centre in London has been holding an annual festival it calls Meltdown. A distinguished musician is asked to invite their favourite artists to perform and exhibit their work. This year's guest director was Yoko Ono, who chose a wide range of performers including her own Plastic Ono Band, Patti Smith, Iggy Popp and the Stooges, Siouxsie, Peaches and many more.

Yoko Ono has always been known for her unusually wide range of interests, so there were also talks and debates on a variety of subjects, among them the Arctic, activism, feminism -and mathematics.

Marcus du Sautoy explained how mathematics gives us the power to predict the future. He then went on to an important idea that fewer people understand, that this power has its limits, and that mathematics itself allows us to understand those limits. In keeping with the spirit of the festival he led us into the idea of chaos by getting some members of the audience to dance on the stage and then jump off it. (The jumping was because he was also demonstrating the origin of the well-known myth about lemmings.)
Eric Weinstein set out to convey an idea of how mathematicians see the world, to open what he referred to as a portal, like the rabbit
hole that leads into Wonderland, or platform 9l' at King's Cross. I don't know if anyone went home able to imagine objects in four dimensions, apart from those of us who already could when we arrived. But I'm sure many of the audience did gain some insight into how mathematicians can think about such things, and even how concepts like fibre bundles might help us solve problems in the real world.
As I left the Queen Elizabeth Hall, the foyer was full of people waiting to see Boy George. They looked rather different from the people I'd just been with and I have no idea how many attended both performances. Yoko Ono's idea of bringing together a collection of apparently disparate events did seem to work, however, if only by reminding all of us that the bit of the world we are most interested in isn't the only one worth looking at, and our usual way of thinking about it isn't the only one worth considering.

Peter Saunders King's College London

THE FRACTALIST: MEMOIR OF A SCIENTIFIC MAVERICK by Benoit B. Mandelbrot, Pantheon Books, 2012, $324 \mathrm{pp}, \$ 30.00$, ISBN 978-0-307-37735-7.
Benoit Mandelbrot was born in Warsaw on the 20th November 1924 of Lithuanian Jewish parents. The year, the city and the faith are the initial conditions which resulted in his family's move in 1936 to France to avoid the rise of antiSemitism, first to Paris, then with the outbreak of World War II, to Tulle and then to Lyon, finally back to Paris in 1944. Mandelbrot evocatively describes the chaos and wanton destruction of war: the levelled housing, the old neighbours who vanished as part of the Holocaust, the fear of discovery in occupied France: 'The war, with its fears and deprivations, left a mark on me that would never wear away. That mark persists in the obvious big things that have shaped my life. It also persists in small things - I still can't throw away paper that might someday find a use' ( p . 79). Or again, 'The last community where I did not have to question "belonging" was my childhood's Warsaw' (p 37).

This second quote is, in a sense, borne out
by the wide range of place, job and scientific interest which made up Mandelbrot's made up Mandelbrot's career. After studying at the École Polytechnique (he was also accepted for the even more prestigious École Normale Supérieure, but stayed for only one day!), he carried out postgraduing), then went back to Paris for a PhD (on the frequencies of words in text), and then on to post-doctoral work at MIT and the Institute for Advanced Study at Princeton. During his 35 year career at IBM Mandelbrot also held appointments at Harvard, MIT and Yale, with his fizzing and ambitious mind working on a whole range of topics - price variation in economics, the distribution of galaxies, the shape of coastlines, and of course, the famous Mandelbrot set.

This is a wonderful memoir. It is personal, occasionally opinionated, at times beautifully written, and with a narrative encompassing a wide range of times, places and people. There are brief walk-on parts for many great names in twentieth century science and mathematics, including Jacques Hadamard, Robert Millikan, Max von Laue, E.T. Bell, Norbert Wiener, John von Neumann, Andrei Kolmogorov and Stephen Jay Gould. All this makes the book not only an important document for those interested in Mandelbrot, but also provides an enjoyable source of background information for readers interested in the wider culture of modern science and academia.

If there is one thing that this book has a little too much of, it is perhaps Mandelbrot's ego. For those familiar with Mandelbrot's life and writings this will come as no surprise. But it still strikes a discordant note, and reveals that even unassailably eminent scientists fret about their reputations and legacies. When it comes to egos, size and fragility are often directly proportional.

Mark McCartney
School of Computing \& Mathematics University of Ulster

THE JOY OF X: A GUIDED TOUR OF MATHEMATICS FROM ONE TO INFINITY by Steven Strogatz, Atlantic Books, 2013, 336 pp, $£ 20$ hardback, ISBN: 9781848878433.
Steven Strogatz is Jacob Gould Schurman Professor of Applied Mathematics at Cornell University. He is widely known in maths and physics, notably for a 1998 Nature paper with his graduate student Duncan Watts, entitled The collective dynamics of small world networks. This classic has accumulated almost 20,000 citations, clocking up an extra mention once every six hours. The small world effect is a cultural icon, providing the theory of Kevin Bacon and Erdös numbers. Whether in movies or mathematics, we are all mutually connected by a frighteningly small number of links.
Strogatz also has an impres sive reputation as a math ematical populariser. A tour of the mathematical section of YouTube shows why his engaging sense of humour and sharp mind have penetrated depths unplumbed by ordinary mathematics teachers. Here he shows that his mastery extends also to the printed word. The book contains a series of snappily-titled short essays, most of which first appeared as columns in the New York Times, divided logically according to broad mathematical themes. Each essay addresses, in a self-contained manner, a key mathematical concept, bread-and-butter to most present readers, but less so to New York Times readers. The result is a narrative which succeeds in communicating the essence of mathematical ideas (and the joy we receive from them!) across that cultural divide which most of us find so difficult to penetrate.
As an example 'From fish to infinity' addresses counting: why isolate a 'sixness' apart from the six of something being counted? 'Location location location' discusses advantages of the Arabic number system, compared to the previous Latin numerals. 'Take
it to the limit' discusses Archimedes's argument for the circle area formula $A=$ wr2, anticipating the invention of calculus by two thousand years, and breathing life into an otherwise formal exercise. 'Square dancing' dramatically reminded me of a long-forgotten geometrical proof of Pythagoras's theorem. 'Hilbert Hotel' explains countability, while 'The loneliest numbers' discusses prime number theorems.
Most readers will be horrified by the innumeracy of our ruling classes, and their apparent inability to understand data analysis. A separate section is devoted to this subject. 'Untangling the web' discusses Google's pagerank algorithm, and 'Chances are' the Prosecutor's Fallacy. As examples of poor mathematical reasoning by $\mathrm{m}^{\prime}$ learned friends, Strogatz exposes nadive statistical arguments adduced by both prosecution and defence in the celebrated O.J. Simpson murder case.

Readers of this review will want this book more to use in their outreach work, or as gifts for family members, than to buy for their own use. The style is 'North-American-folksy', and recalls that of Feynman. Some may find it irritating, but others will find it an essential aid to overcome their dyscalculia. The more technical notes at the back of the book are well-written and illuminating. $£ 20$ (advertised price) is a bit steep, although Amazon offers it at $£ 12$ (but use your local bookseller!). A paperback edition is also projected at a more reasonable price. A Kindle edition is also on sale at $£ 8.15$. Recommend!

Tim Sluckin
Professor of Applied Mathematics University of Southampton

Tim Sluckin is co-author (with David Dunmur) of Soap, science and flat screen TVs, a history of liquid crystals (OUP 2011).

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of integrating the hot topic of cryptography into their cover age. It gradually increases the level of difficulty of material and "Check Your Understanding" sections offer a tutorial approach for students. ISBN: 978-1-4822-1441-3

## 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.Ims.ac.uk/content/calendar). Please send updates and corrections to calendar@Ims.ac.uk

## JULY 2013

1-2 Spectral Analysis and Differential Equations Meeting, Cardiff (425)
1-2 Bifurcation Theory, Numerical Linear Algebra and Applications, Bath (424) 1-4 Postgraduate Group Theory Conference, Manchester (426)
1-4 Dense Granular Flows 2nd IMA Conference, INI, Cambridge (416)
1-5 Number Theory, Geometry and Cryptography Workshop, Warwick (425) 3-12 Polylogarithms as a Bridge between Number Theory and Particle Physics LMS-EPSRC Durham Symposium, Durham (426)

4-5 Quantum Information and Control Meeting, Nottingham (425)
5 LMS Meeting, London (426)
6-8 Greek Stochastics Meeting, Kalamata, Greece
8-9 Biological Dynamics Workshop, Surrey (426)

8-10 Combinatorics, Algebra, and More: A Conference in Celebration of Peter Cameron, Queen Mary, University of London (425) 8-12 Intelligent Computer Mathematics 2013 Conferences, Bath (426)
8-12 Discrete Integrable Systems INI Follow-up Workshop, Cambridge (424) 8-12 O-Minimality and Diophantine Geometry, LMS-EPSRC Short Course, Man chester (425)
8-12 Modern Nonlinear PDE Methods in Fluid Dynamics, LMS-EPSRC Short Course,

## Reading (425)

8-12 Banach Algebras and $C^{*}$-algebras Meeting, IMPAN, Warsaw (423)
15-19 Polynomial Optimisation Summer School and Workshop, INI, Cambridge (420) 15-25 Graph Theory and Interactions LMS-EPSRC Durham Symposium, Durham (426)

29-2 Aug Computational Group Theory, LMS-EPSRC Short Course, St Andrews (426) 29-2 Aug Mathematics of Climate Change Workshop, CIMAT, Guanajuato, Mexico

## AUGUST 2013

3-11 Groups St Andrews 2013, St Andrews (426)

6-12 International Mathematics Competition, Blagoevgrad, Bulgaria (424) 12-15 Mathematical Models in Ecology and Evolution Meeting, York (426)
12-22 Geometric and Cohomological Group Theory LMS EPSRC Durham Symposium,
Durham (426)
14-16 Postgraduate Combinatorial Conference, Royal Holloway, University of London (426)

19-21 Fundamentals of Computation Theory Symposium, Liverpool (426) 19-23 Random Graphs, Geometry \& Asymp totic Structure LMS-EPSRC Short Course,
Birmingham (426)
19-23 Parallel Programming in GAP Work shop, St Andrews (427)
26-30 Topology in Low Dimensions LMSEPSRC Short Course, Durham (427)

## SEPTEMBER 2013

2 Function Theory Meeting, De Morgan House, London (427)
2 Heilbronn Day, Groups and Their Representations, Manchester (423)
2-4 Advanced Decomposition Methods for Partial Differential Equations Minisymposium, Kingston (424)

2-5 Algebra, Combinatorics, Dynamics and Applications Workshop, Queen's University Belfast (426)
2-6 New Mathematical Directions for Quan tum Information INI Workshop, Cambridge (423)

3-6 Brauer's Problems in Representation Theory - 50 years on, Manchester (423)
4-7 British Logic Colloquium and Dummett Day, Leeds (426)
7-12 British Science Festival, Newcastle (427) 8-11 Finite Groups and Related Topics Conference, CMS, Cambridge (427)
9-11 British Topology Meeting, Aberdeen (427)

9-13 Spectral Geometry, Chaos and Dynamics, Loughborough (426)
10-11 Next Steps CETL-MSOR 2013 Conference, Coventry (425)
11 The Mathematics of CCC, Oxford (427) 11-13 Mathematics of Surfaces 14th IMA Conference, University of Birmingham (416) 15-21 Quantum (semi)groups and (co)actions Meeting, Leeds (423)
16-20 Holography: From Gravity to Quantum Matter INI Workshop, Cambridge (424) 16-20 Operator Algebras Conference, Aberystwyth (427)
17-18 From Spectral Gaps to Particle Filters Conference, Reading (427)
22 De Morgan House Open Day, London (427)

22-25 Zeta Functions of Groups and Related Algebraic Structures Workshop, University of Padova, Italy (426)
22-27 Heidelberg Laureate Forum, Heidel berg (422)
23-27 Stochastic Analysis and Applications, Oxford-Man Institute and Mathematical Institute University of Oxford (427)
26 LMS Popular Lectures, Birmingham (427) 27 A Day in Analysis and Geometry Meeting, Warwick (427)
29-1 Oct The Navier-Stokes Equations and Related Topics Clay Research Workshop,

## Oxford (425)

30-4 Oct New Insights into Computationa Intractability Clay Research Workshop, Oxford (425)
30-4 Oct Number Theory and Physics Clay Research Workshop, Oxford (425)
30-4 Oct Quantum Mathematics and Computation Clay Research Workshop, Oxford (425)

## OCTOBER 2013

2 Clay Research Conference, Oxford (425) 3 University of Oxford's Mathematical Institute Opening Conference (425) 14-18 Quantum Marginals INI Workshop, Cambridge (425)
24 Mathematics in Defence IMA Conference, Tom Elliot Conference Centre, Qinetiq
29 Oct - 1 Nov Non-Equilibrium Statistical Mechanics and the Theory of Extreme Events in Earth Science INI Workshop, Cambridge (424)

## NOVEMBER 2013

15 LMS AGM, London
16 Early Career Mathematicians' IMA Autumn Conference, University of Strath clyde, Glasgow

## DECEMBER 2013

16 LMS South West \& South Wales Regional Meeting, Swansea (427)
16-19 Categorical and Homological Methods in Hopf Algebras Workshop, Swansea (427) 17-19 Cryptography and Coding IMA Conference, St Anne's College, Oxford

## FEBRUARY 2014

28 Mary Cartwright Lecture, York

## MARCH 2014

31 LMS Northern Regional Meeting,
Durham

Partial Differential Equations, $12-23$ July 1976, organised by D.E. Edmunds and L.E. Fraenkel

Homological and Combinatorial Methods in Group Theory, 6-16 September 1977, organised by C.T.C. Wall


[^0]:    Series: Perspectives in Logic
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