LONDON MATHEMATICAL SOCIETY

NEWSLETTER

No. 439 September 2014

Society Meetings and Events

2014

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LMS AGM
London

Wednesday 17 December
SW & South Wales Meeting
Plymouth

NEWSLETTER ONLINE:
newsletter.lms.ac.uk

HIGHEST HONOUR FOR UK MATHEMATICAN

Professor Martin Hairer, FRS, University of Warwick, has become the ninth UK based mathematician to win the prestigious Fields Medal over its 80 year history. The medal recipients were announced on Wednesday 13 August in a ceremony at the four-yearly International Congress for Mathematicians, which on this occasion was held in Seoul, South Korea.

See page 4 for the full report.

LMS ANNOUNCES SIMON TAVARÉ AS PRESIDENT-DESIGNATE

The London Mathematical Society is pleased to announce Professor Simon Tavaré, FRS, FMedSci, University of Cambridge, as President-Designate. Professor Tavaré will take over from the current President, Professor Terry Lyons, FRS, in November 2015. Professor Tavaré is a versatile mathematician who has established a distinguished international career culminating in his current role as Director of the Cancer Research UK Cambridge Institute and Professor in DAMTP, where he brings his understanding of stochastic processes and expertise in the data science of DNA se-

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quencing to understand cancer biology.

Simon Tavaré obtained his PhD in probability and statistics in 1979 from the University of Sheffield. He then began his research career in the US where he held positions at the University of Utah and Colorado State University, moving to the University of Southern California (USC) where he held a professorship in mathematics as well as the Kawamoto Chair in Biological Science.

In 2003 Professor Tavaré returned to the UK from his distinguished chair at USC to take up joint roles at the University of Cambridge as Professor in the Department of Applied Mathematics and Theoretical Physics and Professor of Cancer Research (Bioinformatics) in the Department of Oncology. In 2006 he was appointed to the Cambridge Research Institute, which became the Cambridge Institute when it merged with the University in January 2013. In February 2013, Professor Tavaré became Director of the new Institute. In 2009 Professor Tavaré was elected as a Fellow of the Academy of Medical Sciences (FMedSci) and in 2011 he was elected a Fellow of the Royal Society (FRS).

Professor Tavaré would be the first to acknowledge that his current work relies on strong training in combinatorics and probability theory; in his earlier years he published papers in the *Annals of Probability* and the first volume in the *EMS Monographs in Mathematics* series.

Simon Tavaré is recognised as an internationally excellent communicator. He is invited to give this year's Einstein Lecture to the American Mathematical Society, one of the most prestigious of the AMS lectures; other recent speakers were Tao and Simons.

Professor Tavaré said "I am honoured to be the next President of the LMS. An important role for the office is promoting the central importance of mathematics in society and the necessity of ensuring the overall health of the discipline, and, with the help of the LMS members and the wider mathematical community, I hope to continue Terry's efforts in this direction."

Professor Lyons said "I am delighted that Simon has accepted the nomination to become the next LMS President. Simon personifies the way that mathematics can contribute to the wider society at a high level; he brings deep expertise in data science, and a strong background in rigorous mathematics, to his research into critical questions in cancer. He is a tremendous communicator and has experience in making the case for Mathematics with ministers and funders. I am confident that his presidency will bring a great deal to the society, to our members, and to the wider mathematical communities."

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HIGHEST HONOUR FOR UK MATHEMATICAN

Professor Martin Hairer FRS, from the University of Warwick, has become the ninth UK-based mathematician to win the prestigious Fields Medal over its 80 year history. The medal recipients were announced on Wednesday 13 August in a ceremony at the four-yearly International Congress for Mathematicians, which on this occasion was held in Seoul, South Korea.

The President of South Korea, Geun-hye Park, was present for the announcements and presented Professor Hairer with the medal. The Fields Medal has an equivalent standing within mathematics as the Nobel Prize has within other areas of science and is awarded every four years to at most four of the most outstanding mathematicians under 40 years of age at the beginning of the year.

Martin Hairer works in an area of mathematics known as stochastic analysis; it provides conceptual and computational toolkits for rigorously modelling the interactions within high dimensional random systems.

A smouldering rag is a difficult system to think about mathematically. There is an interaction between highly non-uniform heat pattern, heat dependent and heat producing chemical reactions, and the ever changing state of the underlying rag as more of it turns to ash. It is an example of an important class of problems around modelling randomly evolving interfaces. Although common in nature and important, they have challenged mathematicians for decades. The combination of randomness, singularity, and nonlinearity simply do not fit well together with existing mathematical tools (eg partial differential equations).

Martin Hairer works on this interface between probability theory and partial differential equations; and has created a body of work that is widely recognised as having revolutionised an entire field of research.

Hairer was able to give, for the first time, a rigorous intrinsic mathematical meaning to a number of different classes of random interface arising in physics. These problems have been a focus of attention for decades.

Professor Terry Lyons, FRS, President of the London Mathematical Society, commented, 'We are all very excited that Martin Hairer's incredible and ground shaping achievements have been recognised by the international community through the award of a Fields Medal. The Fields Medal has, for many years, been recognised as being at the highest level; the Nobel Prize for mathematics. As a result of Martin Hairer's spectacular work and precise definitions, a new field is effectively opened up and validated through a range of deep, distinctive, and challenging applications. In addition to his great science, Martin Hairer is a major contributor to the wider mathematical community. On behalf of the LMS, I congratulate Martin and I am confident this congratulatory message is shared across the whole UK community and beyond'.

Professor Hairer said that "The award of a Fields Medal is of course an extraordinary recognition of the work in analysing singular stochastic partial differential equations, which goes well beyond anything I ever dared to imagine. It also provides recognition to this very broad interface between probability theory and analysis, sometimes collectively referred to as 'stochastic analysis', as a very active area of modern mathematics with a fascinating range of deep open problems still waiting to be explored. This is also an opportunity to thank my wife Xue-Mei, my parents, and the many friends and colleagues on both sides of the Atlantic who provided continuous inspiration, encouragement and support over the years".

Three other outstanding young mathematicians also received the Fields Medal:

Maryam Mirzakhani (Stanford University) for her outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces **and made history as the first woman to win a Fields Medal**.

Artur Avila (Centre National de la Recherche Scientifique) for his profound contributions to dynamical systems theory, which have changed the face of the field, using the powerful idea of renormalization as a unifying principle.

Manjul Bhargava (Princeton University) for developing powerful new methods in the geometry of numbers, which he applied to count rings of small rank and to bound the average rank of elliptic curves.

A number of other prizes were awarded at the ceremony, details of which can be found at http://www.mathunion.org/general/prizes.

LMS HONORARY MEMBERSHIP 2014

Professor Donald Dawson

The London Mathematical Society has elected **Professor Donald Dawson**, of Carleton University and McGill University, and **Professor Cheryl Praeger**, of the University of Western Australia, to Honorary Membership of the Society.

Donald Dawson has played a leading role in the development of probability as a tool connecting analysis with applications, and is particularly known for his work on the class of measure valued processes now universally known as the Dawson-Watanabe super-processes.

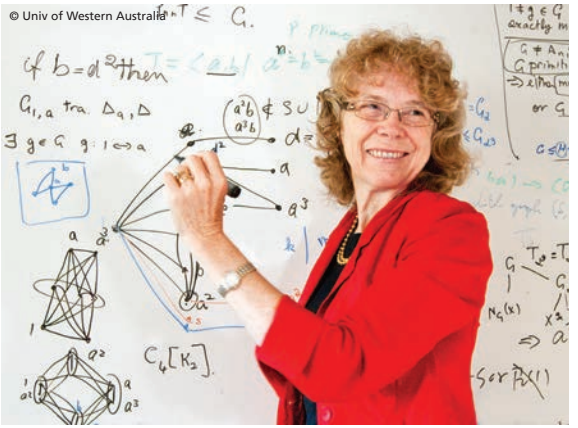
These processes are solutions to nonlinear stochastic partial differential equations and have proved extraordinarily natural for modelling genetic diversity; they generalise to the continuum the concept of critical branching and break completely new ground mathematically. The 'solutions' are randomly evolving measures which, if the evolution is in a dimension greater than one, have no density to the usual volume element.

Cheryl Praeger has made a leading contribution spanning many areas of pure mathematics, particularly group theory, combinatorics and geometry, as well as serving the mathematical community both nationally and internationally.

Her work on permutation groups, and for example her 1983 proof, together with Peter Cameron, Jan Saxl and Gary Seitz of Sims' conjecture mentioned that there exists an integral function f such that for any finite primitive permutation group G, the order of a point stabilizer G_α is bounded above by f(d), where d is the length of a non-trivial orbit of G_α. Further key results in the theory of group actions including her 1988 generalization (with Martin Liebeck and Jan Saxl) of the O'Nan-Scott Theorem are outstanding.

She has made an especially significant contribution to the development of mathematics in China, the Philippines, Iran and the Gulf States, and has been a role model for many mathematicians.

Full citations for Professor Dawson and Professor Praeger will appear in the LMS *Bulletin*.



Professor Cheryl Praeger

LMS NEWSLETTER ONLINE

We are delighted to announce the launch of our improved online LMS Newsletter (www.lms.ac.uk/newsletter) which we hope you find informative and easy to use. The layout has been completely redesigned with simplicity, ease of use and a strong focus on content delivery in mind. Email newsletter@lms.ac.uk if you experience any problems using the new website or if you have any suggestions.

The online Newsletter will be updated continuously and will also include the current and past PDF issues available for download, accessible at http://newsletter.lms.ac.uk/site/issue-select/. Anyone who wishes to stop receiving a paper copy can choose to receive instead an email alert at the beginning of each publication month, containing a direct link to the current PDF issue. To do so, email membership@lms.ac.uk.

HEA STEM STRATEGIC PROJECT

The Higher Education Academy (HEA) has published five discipline reports as outputs from the HEA STEM strategic project: *Skills in Mathematics and Statistics in the Disciplines and Tackling Transition*. The disciplines in question are: Chemistry, Geography, Economics, Sociology and Business & Management. These reports informed the Mathematical Transitions report that was launched at the Royal Society on 23 June 2014.

All of the reports can be accessed via the link www.heacademy.ac.uk/resources/detail/stem-project-info. Direct links to individual reports and the Mathematical Transitions report are embedded in the website.

Please note that the HEA website is currently undergoing development. If you have problems accessing any of the reports please email enquiries@heacademy.ac.uk to obtain assistance.

NEW INTERNATIONAL WOMEN IN MATHEMATICS WEBSITE

In March 2013 the Executive Committee of the International Mathematical Union (IMU) approved the establishment of an Advisory Group for Women in Mathematics, charged with creating and overseeing a section of the IMU website entitled Women in Mathematics (WiM). Opportunities for women vary widely from country to country and a main aim is to enhance the participation of women in all mathematical communities. The new WiM site will be launched at the International Congress of Women Mathematicians on 12 August 2014 just prior to the International Congress of Mathematics, at the address www.mathunion.org/wim/ .

The site includes information about organizations, people, events, resources and initiatives of interest to women mathematicians world-wide. In order to maximize the usefulness of this site, suggestions from the community are welcome. Indeed, advice concerning items for inclusion is important. The Advisory Group may be contacted at info-for-wim@mathunion.org.

The WiM Advisory Group: Ingrid Daubechies (Chair) (USA), Petra Bonfert-Taylor (USA), Carla Cedarbaum (Germany), Nalini Joshi (Australia), Sunsook Noh (Korea), Marie-Françoise Ouedraogo (Burkina Faso), Dušanka Perišić (Serbia), Claudia Sagastizábal (Brazil), Caroline Series (UK), and Carol Wood (USA).

MATHEMATICS POLICY ROUND-UP

August 2014

SCHOOLS AND COLLEGES

A-level Content Advisory Board (ALCAB) report

ALCAB has published the report from the Mathematics and Further Mathematics Panel and the correspondence to the DfE from the chair of this panel, Professor Richard Craster. The report is available at http://tinyurl.com/k8c9ncm.

Subject content consultations

The Department for Education (DfE) announced the publication, for consultation, of new subject content for a further set of GCSEs and A-levels, which will be first taught in 2016. Details of the publications are included below. The consultations will close on 19 September.

The consultation documents are available at http://tinyurl.com/q94fv5g, level mathematics subject content is available at http://tinyurl.com/qychltx and the GCE AS and A-level further mathematics subject content is available at http://tinyurl.com/kvrnz2h.

Ofqual is also consulting on the recommendations for assessment: *Developing new GCSE, A level and AS qualifications for first teaching in 2016*. More information is available at http://tinyurl.com/po2zlks.

Vision for science and mathematics education

'All students should study science and mathematics until age 18 as part of a new baccalaureate according to a report published by the Royal Society, which is a product of a major programme of work over the past two years, led by a committee chaired by Sir Martin Taylor, FRS'.

The report sets out a roadmap for radically transforming our education systems, with particular focus on mathematics and science, over the next 20 years.

The report, which has been written by a committee including scientists, education experts, teachers and a former Secretary of State for Education, also calls for:

- the status of teaching to be raised and increased support for the professionalism of teachers through subject-specific professional development, which should be a requirement for career progression;
- rigorous new post-16 courses and qualifications in mathematics, science, engineering and technology to engage students who are studying arts and humanities subjects.
- new, independent, expert bodies in England and Wales to set curriculum; and assessment, providing stability, increasing innovation and bringing to an end the turmoil that teachers currently suffer as a result of constant changes.

The full report is available at http://tinyurl.com/lgk9ml5.

OTHER

Labour Green Paper on Science Policy

'Labour will use a long-term plan for research funding to help create high-wage jobs, ending uncertainty in science policy created by the coalition'. This is the position set out by Labour in a Green Paper inviting views on the party's science policy.

The Green Paper is available at http://tinyurl.com/lf5z24h.

Dr John Johnston
Joint Promotion of Mathematics

LMS GRANT SCHEMES

Next Closing Date for Research Grant Applications: 15 September 2014

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 who are studying at universities in the UK, 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 **£2,000** 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, please visit the LMS website: www.lms.ac.uk/content/research-grants.

- Applications received by 15 September 2014 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 (tel: 020 7291 9971/3, email: grants@lms.ac.uk).
- Programme Secretary: Rob Wilson (r.a.wilson@qmul.ac.uk).

OTHER LMS GRANTS AND FUNDING

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. The maximum award is **£10,000**, but a typical award is in the range of **£3,000-£5,000**. Applications for partial support of workshops with other sources of support will be considered. Applications should normally be submitted 12 months in advance of the proposed workshop. For further information visit: www.lms.ac.uk/content/research-workshops-grants.

Young British and Russian Mathematicians Scheme
Next Deadline: 15 September 2014.

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:

- 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).
- A brief CV (no more than one side of A4).
- A brief budget.
- A letter of invitation from the head of the host department in Russia, which must state explicitly that your accommodation and subsistence expenses will be met by them. This should include provisional dates for the visit.

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

Visits to Britain
Under this Scheme, applications may also be made by any mathematician in Britain wishing to host a visit by a young Russian postdoctoral mathematician who wishes to spend a few weeks in Britain giving a series of survey lectures on the work of their Russian seminar. The LMS is offering grants to the host institution to meet the visitor's actual travel and accommodation costs of up to **£1,500**. Applications should include the following:

- Name and brief CV of the visitor
- A brief budget
- A brief description of the course of lectures
- A letter or email of agreement from the head of the host department, including the proposed dates of the visit.

Financial and academic reports will be required after the visit.

Further details of the Scheme can be found on the LMS website: www.lms.ac.uk/content/international-grants. Applications received by 15 September 2014 will be considered at a meeting in October. Enquiries should be made to the Grants Administrators: Sylvia Daly and Elizabeth Fisher (tel: 020 7291 9971/3, email: grants@lms.ac.uk).

Spitalfields Days
Next Deadline: 15 September 2014
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.lms.ac.uk/content/spitalfields-days.

Grace Chisholm Young Fellowship
The Society offers two fellowships of **£1,000** (consisting of **£500** personal support and **£500** contribution to a host institution) each year to mathematicians who need support when their mathematical career is interrupted by family responsibilities, relocation of partner, or other similar circumstance.

These fellowships, named after Grace Chisholm Young, aim to provide some support, making possible some continuous mathematical activity, so enabling the fellow to be in a position to apply for posts when circumstances allow. The Fellowship will give an endorsement of the holder's status as a mathematician, so that the break in formal employment should not prevent them from resuming a career as a mathematician at a later stage. Please see the website for further details: www.lms.ac.uk/grants/grace-chisholm-young-fellowships.

Small Grants for Education
Next Deadline: 30 November 2014
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. Please see the website for further details: www.lms.ac.uk/content/small-grants-education.

Computer Science Small Grants (Scheme 7)
Next Deadline: 15 November 2014
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. 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.

LMS ELECTIONS 2014

Members will recall that in 2012 and 2013, the Society introduced an e-voting option for elections to Council and Nominating Committee. In both years the turn out in the elections were considerably higher than for years where voting was paper only. In 2013 almost three quarters of votes cast were online. All members who are registered for electronic contact and who are eligible to vote will receive an email with instructions on how to vote, paper copies will not now be sent automatically to those so registered. However paper copies can still be requested. Members eligible to vote who are **not** registered for electronic communication will be sent a paper copy, though such members are encouraged to vote online.

Members are asked to regularly check their post/email in October for communications regarding the elections from the Electoral Reform Society.

Prior to this, a communication will be sent by the Society to all members who are registered for electronic communication informing them that they can expect to shortly receive some election correspondence from the ERS. Those not registered to receive email correspondence from the LMS will receive all communications in paper format, both from the Society and from the ERS.

The Society will also host an Elections Blog on the LMS website for use by candidates and members.

It is hoped as many members as possible will vote in the 2014 LMS Elections. Results will be announced at the Society's AGM to be held on Friday 14 November 2014.

Ensure that your details are current

All members are strongly encouraged to ensure that their email and postal contact details registered with the Society are up-to-date to enable the election process to run smoothly. Members may now electronically update their personal contact details on the members' section of the LMS website and all members are encouraged to use this facility. Any changes to personal details would be required no later than **16 September 2014** for election purposes.

Fiona Nixon
Executive Secretary

COLLINGWOOD MEMORIAL PRIZE

The 2014 Collingwood Memorial Prize has been awarded to Kate Mackintosh Vokes, St Mary's College, Durham University. The Collingwood Memorial Prize, established in memory of Sir Edward Collingwood FRS, President of the Society 1969-1970, is awarded to a final-year mathematics student at the University of Durham who intends to continue to a higher degree in mathematics.

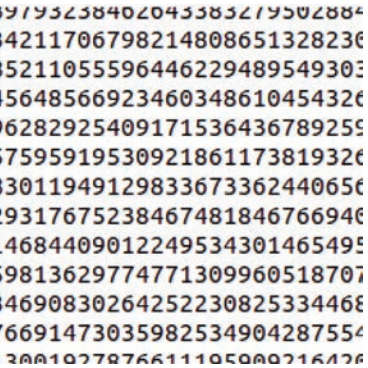
LONDON MATHEMATICAL SOCIETY
POPULAR LECTURES 2014

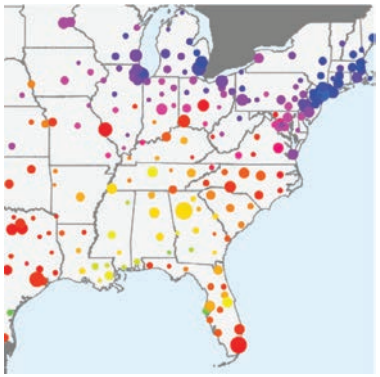
University of Birmingham – Wednesday 24 September

Professor Kevin Buzzard
Imperial College London

What's in a number?

Much of our work and our leisure interests are now stored in digital format -- i.e., as numbers. This has weird consequences: for example some numbers are now copyrighted, and other numbers are illegal.
Professor Buzzard will explain some of these stories, and also what happens if one tries to digitise mathematics itself.





Dr Julia Gog
University of Cambridge

Epidemics and viruses: the mathematics of disease

Dr Gog will look at how mathematics has been applied to help understand and control infectious diseases, from the scale of a single virus particle through to a global influenza pandemic, and considers some mathematical challenges for the future.

Commences at 6.30 pm, refreshments at 7.30 pm, ends at 9.00 pm. Admission is free, with ticket. **Register by Thursday 18 September.**

To register for tickets, please email popular.lectures@lms.ac.uk or visit the LMS website for abstracts and a registration form (www.lms.ac.uk/events/popular-lectures).

OPEN HOUSE 2014

The LMS will again open its doors to the public as part of this year's Open House London event. De Morgan House will be open on Sunday 21 September from 11 am until 4 pm. Visitors will be given a tour of the building and there will be a presentation on mathematics through the years. Over 300 people visited the building in 2013; we hope to continue this success in 2014.

LMS COUNCIL DIARY

4 July 2014
A personal view

The routine formal business of minutes etc. over, the President reported that he had recently represented the CMS on a Parliamentary Links Day panel on the theme of 'Establishing Trust in Science'. This had been a welcome opportunity to raise the profile of mathematics. From the meeting of European Mathematical Society's council in San Sebastián, which he had attended together with three other Council members, he reported that the low level of Brussels funding for mathematics was judged to reflect a lack of applications. Among other events he had attended on behalf of the Society was the ceremony in Oslo where the Abel Prize was awarded to Yakov Sinai.

Much of the work of Council follows regular cycles. At this meeting we considered income and expenditure for the third quarter, both of which were on target, the budget for 2014–15, and also planning figures up to 2019. Treasurer Rob Curtis explained that we were budgeting for a deficit next year because of the increased activity associated with the 150th anniversary, but we planned to return to a balanced budget very soon after. The Treasurer reminded Council that there is extra uncertainty beyond 2016 due to the expiry of the main journal contract — tendering for the new contract is already under way and will be completed in 2015. Moreover the Postdoctoral Mobility Grants were, on current plans, to cease in 2017, likewise the Undergraduate Research Bursaries, previously funded by Nuffield, will not continue beyond 2015. In addition, the Research Schools involved shared funding which might not always be available. He concluded by saying that the Society was coming to the crunch: either more money would have to be raised from other directions, or we would have to concentrate our minds on which activities should be continued into the future. Thinking about prioritising will be on the agenda at next year's Council retreat.

Council had a presentation from Diana Garnham, Chief Executive of the Science Council. She described the Science Council as an umbrella group for professional bodies and learned societies within science. The Science Council was established in 2003 as a reaction to criticisms from government about the functioning of some professional societies. They were perceived as anachronistic, with narrow interests and poor governance, and did not see themselves as serving the public interest. On the other hand there was a lack of understanding in government about what learned societies did. Her view was that there was more recognition within Parliament of the importance of science than was generally believed. Often quoted figures on the number of MPs with a science background only counted those with PhDs. But those with an undergraduate science degree amounted to around 20% of MPs, which is about the same as for Law.

After an earlier than usual finish, a short walk in the sunshine took us to the premises of the British Medical Association for an excellent General Meeting at which Hardy Lecturer Percy Deift and Nina Snaith were the speakers.

Francis Clarke

University of Glasgow | School of Mathematics & Statistics

The Chair of Mathematics

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LMS Advancing Mathematics London Mathematical Society

LMS SOCIETY MEETING
MATHEMATICS AND THE FIRST WORLD WAR

Saturday 6 September 2014

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

10:00	Coffee and Registration
10:30	**Reinhard Siegmund-Schultze** (Agder) *German and Austrian mathematical efforts during the First World War*
11:30	**David Aubin** (Paris) *The Total War of Paris Mathematicians*
12:15	**June Barrow-Green** (Open University) *What did Cambridge mathematicians do during the First World War?*
1:00	*Lunch*
2:15	**Rossana Tazzioli** (Lille) *The reaction of Italian mathematicians to the entrance of Italy in the First World War*
3:00	**Deborah Kent** (Drake University) *Developing a theory of ballistics from experimentation and mathematics: O. Veblen, F.R. Moulton, and the Aberdeen Proving Ground Project*
3:45	*Tea*
4:15	**Joseph Dauben** (CUNY) *The international diplomacy of G.H. Hardy*
5:15	Close of meeting. Wine Reception
7:00	Society Dinner

To register contact Elizabeth Fisher (lmsmeetings@lms.ac.uk) by **Monday 1 September**. Late registrations for places may still be accepted, subject to availability.

The reception will be followed by a dinner at venue (tbc), at a cost (tbc) per person, inclusive of wine. If you would like to attend the dinner, please contact Elizabeth Fisher (lmsmeetings@lms.ac.uk) by **Monday 1 September**.

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

EUROPEAN NEWS

EMS council elects new officers

Pavel Exner (EMS President)

At its meeting on 28 June 2014, the council of the EMS elected three officers who will take over at the very beginning of 2015.

- *EMS President*: Pavel Exner, Academy of Sciences of the Czech Republic
- *Secretary*: Sjoerd Verduyn Lunel, Utrecht University, The Netherlands
- *Treasurer*: Mats Gyllenberg, University of Helsinki, Finland

Also Volker Mehrmann, TU Berlin, Germany, was re-elected as member-at-large of the EMS executive committee. For full details see www.euro-math-soc.eu/.

Changes to the EMS Website

The EMS website has recently been updated. The new layout and appearance is designed to make the website work well on mobile and tablet devices, as well as providing much more inherent structure to the website's content. For full details see www.euro-math-soc.eu/news/14/06/28/changes-ems-website.

AMS-EMS-SPM International Meeting

The joint meeting of the American Mathematical Society, the European Mathematical Society and the hosting Portuguese Mathematical Society will be held in the UNESCO world heritage city of Porto from 10 to 13 June 2015. For all details (including plenary speakers and special sessions) see aep-math2015.spm.pt/ .

Committee for Developing Countries

The book donation scheme, where documents are collected and sent to libraries in countries where the documentation is either non-existent or very limited, continues. One difficulty is the postage costs. The Committee for Developing Countries (CDC) welcomes donations of books and journals and financial support for the transport. Books are preferred to journals.

One of the recent and successful initiatives of the committee is the creation of the label Emerging Regional Centres of Excellence (ERCE). This label recognizes the important role played by the awarded institution in education at the Master level in its region. By now, three centres have been awarded the ERCE label: the Abdus Salam School of Mathematical Sciences (ASSMS) in Pakistan (2011), the Centro de Investigación en Matemáticas (CIMAT) in Mexico (2013), and the Vietnam Institute for Advanced Studies in Mathematics (VIASM) in Vietnam (2013). In the last annual meeting of the committee in April 2014, two more centres were recommended to be awarded the ERCE label.

The committee participated at the event *Mathematics in Emerging Nations: Achievements and Opportunities* (MENAO) in Seoul (Korea) just before the ICM.

The committee provides some financial support for the travel expenses of young students from developing countries to participate in training activities, to PhD students to pursue studies in ERCE centres and to the organization of some workshops. The Chair of the Committee is Michel Waldschmidt. For more information see euro-math-soc.eu/EMS-CDC/index.php.

David Chillingworth
LMS/EMS Correspondent

EUROPEAN MATHEMATICAL SOCIETY

Meeting of Council 27-28 June 2014 Report

The Council of the European Mathematical Society meets every two years. The LMS sent a full delegation to the recent Council, consisting of the President (Terry Lyons), the Programme Secretary (Rob Wilson) and two Members at Large of Council (Colva Roney-Dougal and Cathy Hobbs).

The meeting was held over a weekend in the elegant surroundings of the Carlos Santa Maria Center, University of the Basque Country, San Sebastián, Spain. The out-going President of the EMS, Marta Sanz-Solé chaired the meeting very effectively, ensuring that all presentations kept to time but that discussion could flourish. Chief items of business included preparations for the next European Congress of Mathematics, to be held in Berlin, July 2016, and the election of a new President for the EMS as well as two other Officers. Pavel Exner, Scientific Director of the Doppler Institute for Mathematical Physics and Applied Mathematics in Prague was elected as the new President. Our own Stephen Huggett retired as Secretary of the EMS after several years of excellent service to the EMS. Marta, Stephen and the out-going Treasurer Jouko Väänänen were thanked heartily for the work they have done.

Items of particular interest on the agenda included a report from the Editor of ZentralBlatt MATH, the longest running abstracting and reviewing service. ZbMATH has a new web interface and is free to individual members of the EMS. It supports the work of the EMS Committee for Developing Countries through providing two years' free access to mathematicians in developing countries, and through reviewers donating their honorariums to the CDC's work.

The EMS Applied Mathematics Committee reported on the EMS summer school programme in applied maths (ESSAM) which provides wide-ranging opportunities for early-career researchers.

A very informative presentation was given by Jean-Pierre Bourguignon from his perspective as the current President of the European Research Council. He noted that only 2% of ERC grants go to mathematicians, though by proportion of eligible applicants mathematicians make up about 6%. This is chiefly due to the number of grants awarded in an area being proportional to the number of applications received. Mathematicians need to submit more ERC grant applications!

Overall the impression was of a flourishing EMS, which encourages contribution from all areas of mathematics and across the widest remit of what can be considered as Europe.

Cathy Hobbs

EMS Council Meeting attendees

RECORDS OF PROCEEDINGS AT LMS MEETINGS

JOINT ORDINARY MEETING WITH THE ROYAL METEOROLOGICAL SOCIETY

held on *16 April 2014* at Blackett Lecture Theatre, Imperial College London, as part of a joint meeting with the Royal Meteorological Society. Over 70 members and visitors were present for all or part of the meeting.

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

No London Mathematical Society members were elected to membership.

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

Professor Lyons introduced a lecture given by Professor Chris Jones on *Models come in all shapes and sizes*.

The second lecture was given by Professor Ian Roulstone on *Mathematics and modelling the carbon cycle*.

Before tea, the Chair introduced Professor Chris Budd on *Adaptive mesh methods for data assimilation*.

After tea, Professor Lyons expressed the thanks of the Society to the speakers for giving wonderful lectures and also expressed thanks to Ian Roulstone for organising the meeting.

Professor Lyons then handed over the Chair to the President of the Royal Meteorological Society, Professor Brian Golding, OBE.

Professor Golding introduced the fourth lecture by Professor Ted Shepherd on *The role of mathematics in understanding the atmospheric circulation response to climate change*.

The fifth lecture was given by Dr John Taylor on *Mathematical models of phytoplankton blooms*.

The Chair then introduced Dr Emily Shuckburgh on *The application of scientific evidence in climate-related policy*.

Professor Golding expressed the thanks of both societies to the speakers for giving wonderful lectures and also expressed thanks to Ian Roulstone for organising the meeting.

RECORDS OF PROCEEDINGS AT LMS MEETINGS

ORDINARY MEETING

held on *16 June 2014* at Loughborough University, as part of the Midlands Regional Meeting and Workshop on *Scattering Theory & Wave Equations*. Over 35 members and visitors were present for all or part of the meeting.

The meeting began at 2.00 pm with the Programme Secretary, Professor Robert Wilson, in the Chair.

Eleven members were elected to Ordinary membership: Michael Butler, Victorita Dolean Maini, Derek Harland, Michael Idowu, Mohammad Mahdi Jalali, Mohammad Reza Jalali, Henrik Jensen, Andras Juhasz, Barnaby Martin, Daniel Paulusma and John Prendergast.

Three members were elected to Associate membership: Joanna Hutchinson, Zia Ullah Khan and Martin Ruben.

There were no members elected to Reciprocity membership.

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

Professor Wilson then handed over to Alexander Strohmaier who introduced a lecture given by Professor Werner Müller on *Scattering theory and automorphic forms*.

A second lecture was given by Professor Gigliola Staffilani on *Dispersive PDE: Deterministic and probabilistic approaches*.

After tea, the final lecture was given by Professor Alexander Pushnitski on *Spectral Theory of Schrödinger and Hankel operators: analogies and differences*.

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

The Chair also expressed thanks to Claudia Garetto, Eugenie Hunsicker and Alex Strohmaier for organising a successful meeting.

MIDLANDS REGIONAL MEETING 2014

Report

The 2014 LMS Midlands Regional Meeting was held at Loughborough University on Monday 16 June. It was followed by the workshop *Scattering Theory and Wave Equations* from 17 to 18 June. Both events were organised by Claudia Garetto, Eugenie Hunsicker and Alexander Strohmaier, all from Loughborough University. The meeting began with an introduction by the LMS Programme Secretary, Professor Robert Wilson (Queen Mary University of London). A list of new members were presented to the audience and any members at the meeting who had not signed the prestigious membership book before were invited to do so.

Eugenie then introduced the first speaker of the afternoon, Werner Müller (Bonn), who spoke on *Scattering Theory and Automorphic Forms*. The purpose of this talk was to discuss some aspects of the theory of automorphic forms relating to spectral theory, number theory and harmonic analysis.

The second talk, given by Gigliola Staffilani (MIT) was on *Dispersive PDE: Deterministic and Probabilistic Approaches*. The talk presented the study of the periodic semi-linear Cauchy problem from several viewpoints: Fourier and harmonic analysis, analytic number theory, probability, dynamical systems and symplectic geometry.

The final talk of the meeting, *Spectral Theory of Schrödinger and Hankel Operators: Analogies and Differences,* was given by Alexander Pushnitski (King's College London), who marked the occasion by signing the prestigious membership book (after many years of unsigned membership). Alexander succeeded in presenting an accessible – albeit precise – description of several spectral properties of various operators to a quite diverse group of mathematicians. This was appreciated by experts and non-specialists alike.

After a wine reception in the Department of Mathematical Sciences, the meeting ended with dinner at Burleigh Court restaurant where we were joined by the LMS Membership and Activities Officer, Elizabeth Fisher.

The topics of the talks of the workshop on the following two days ranged from spectral theory, with an emphasis on scattering theory, to harmonic analysis and PDEs with various forms of the wave equations. In order of appearance, the speakers were: Beatrice Pelloni (Reading), Pieter Blue (Edinburgh), myself, Michael Levitin (Reading), Michael Ruzhansky (Imperial), Mirko Tarulli (Pisa), Nicola Visciglia (Pisa), Vesselin Petkov (Bordeaux), Luc Nguyen (Oxford), Aram Karakhanyan (Edinburgh). It remains for me to thank Claudia, Eugenie and Alex for organising a very stimulating event with the participation of many experts in various domains of analysis; it was a great opportunity to learn and discuss mathematics.

Veronique Fischer
Imperial College London

LMS POPULAR LECTURES 2014

Report

On 9 July 2014 at the Institute of Education in London, for the first of the 2014 LMS Popular Lectures, an audience of over 300 people, including many students, enjoyed an evening

Kevin Buzzard and Alice Rogers
(Chair of the LMS Education Committee)

Julia Gog (University of Cambridge)

of mathematics with topics ranging from prime numbers to the flu virus.

Professor Kevin Buzzard, from Imperial College London, introduced us to the uses of pure mathematics with *What's in a number*. He compared analogue communications e.g. vinyl records, photographs, letters and books, with the digital versions e.g. mp3 players, jpegs, emails and e-books. He described how digital communication works through the use of codes like ASCII to store text, photographs, movies, etc. as very large numbers for ease of electronic communication. He went on to show the importance of big numbers for copyright and how DVD encryption can lead to illegal prime numbers.

In his individual, quirky style, Kevin led us through a discussion of how very basic pure mathematics with ideas from early natural philosophers has led to the most modern ideas in applied mathematics.

After the break, Dr Julia Gog from the University of Cambridge introduced a very modern discipline in the form of mathematical biology with her talk *Epidemics and viruses: the mathematics of disease*. She started by explaining how a simple virus transmits itself between cells in the human

Kevin Buzzard (Imperial College London)

body and went on to show that in order to control epidemics such as the 20th Century influenza pandemic in the USA, we need to be able to understand what's happening before we can control it.

Julia's talk explained epidemic theory and how probability is used to model it. Using each member of the audience as an individual cell, she demonstrated in a practical way how viruses flow.

Julia Gog (University of Cambridge)

The evening was extremely enjoyable and informative. I'm sure everyone who attended appreciated how traditional mathematics is being used in the modern world and how the new discipline of mathematical biology is being used to help solve old problems, in particular epidemics.

Diane Crann
Clothworkers' Fellow in Mathematics
The Royal Institution

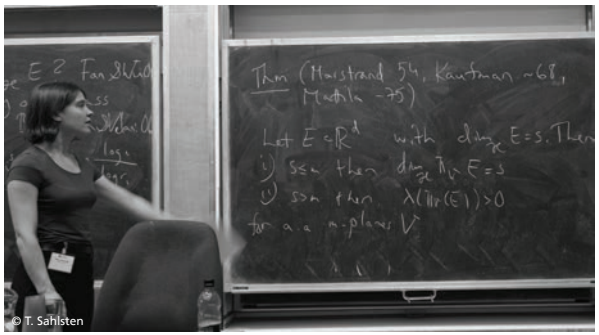
PROJECTION AND SLICING THEOREMS IN FRACTAL GEOMETRY

Report

The meeting *Projection and Slicing Theorems in Fractal Geometry* took place from 17 to 18 July 2014 at the University of Bristol. The meeting marked 60 years since John Marstrand's (a retired professor at Bristol) seminal papers on the behaviour of Hausdorff dimension under orthogonal projection and intersection with hyperplanes. The aim of the meeting was to showcase how much research this has led to and the fact that it is still very much an ongoing subject of research. To this end the meeting featured both talks which gave a historical overview and talks on current research. While the original papers are very much in geometric measure theory the results are also important in the theory of dynamical systems, and probabilistic methods are also very important. In addition to the talks on these papers Geoffrey Grimmett gave an excellent lecture on a fundamental paper of his with John Marstrand on percolation.

Károly Simon uses boxes of teabags to illustrate an argument about the projection of fractal percolation

The survey talks were given by Francois Ledrappier, Kenneth Falconer and Pertti Mattila and gave details about connections to the geodesic flow, details of several subsequent results on projections and slicing, including digital sundials, and some recent outstanding progress using scenery flows (in particular work of Hochman and Shmerkin inspired by previous work of Furstenberg). In the more specialised talks we heard how Marstrand's results combined with Ledrappier-Young theory from dynamical systems can be used to partially solve the long standing open question of the dimension of Weierstrass's function (Romanowska). There were some significant breakthroughs on restricted families of projections (Orponen). We had three talks about how stronger projection results can be obtained for randomly defined sets (Koivusalo, Rams, Simon) which included a demonstration with a box of tea bags balanced on the speaker's head. Finally there were more talks about applications to dynamical systems and fractal geometry (Tseng and Kempton) as well as some more classical geometric measure theory (Kaufman, Maleva).



Henna Koivusalo states Marstrand's Projection Thoerem with some subsequent developments

John Marstrand himself was able to come in for a short period on Wednesday afternoon and was able to talk with old colleagues and friends including Kenneth Falconer, Geoffrey Grimmett, Pertti Mattila, John Shepherdson and Roy Davies. I think he was surprised and happy to see how much subsequent research his papers have led to. Despite this work starting sixty years ago it would have been easy to have had a full week's workshop of talks on related results. As well as the formal lectures there was plenty of time for informal discussion over tea and coffee and during the conference dinner on the Thursday evening. Abstract for all the talks and slides for the talks given by data projector are available on the meeting webpage, www.maths.bris.ac.uk/~matmj/projections.html.

John Marstrand, Pertti Mattila, Kenneth Falconer and Roy Davies have a discussion during a tea break

The meeting was supported by an LMS Conference grant and the Heilbronn Institute for Mathematics Research.

Thomas Jordan
University of Bristol

SPECTRAL ANALYSIS AND DIFFERENTIAL EQUATIONS

Report

A conference on *Spectral Analysis and Differential Equations* was held in Cardiff University from Thursday 15 to Saturday 17 May 2014, which commemorated the life and work of W.N. (Norrie) Everitt. About 40 participants came from far and wide to pay tribute to Norrie; apart from the UK and European contingents, there were some from Japan, Russia and the US. The focus of the meeting was on self-adjoint and non-self-adjoint operators associated with ordinary and partial differential equations, which were areas close to the interests of Norrie, and in which he made significant contributions. The lectures covered a wide range of topics, including spectral inequalities (in particular, the HELP inequality and its descendants), the Titchmarsh-Weyl m-function and abstract analogues, inverse problems, the Camassa-Holm equation, exceptional orthogonal polynomials, spectral properties and the non-existence of zero modes of Dirac operators, and computer assisted proofs. The programme was full, with lectures from 10.00 until 17.30 on each of the first two days, and from 10.00 until 16.30 on the third day. However ample time was allowed in the coffee and lunch breaks for discussion. On the first day, there was also an evening talk by one of Norrie's sons, Tim Everitt, who gave a fascinating portrayal of Norrie's remarkable life outside mathematics. This was followed by a wine reception. The conference dinner was held in the 'Casanova' restaurant in the centre of Cardiff on the second day.

The invited speakers were Christer Bennewitz (Lund), Malcolm Brown (Cardiff), Des Evans (Cardiff), Hubert Kalf (Munich), Lance Littlejohn (Baylor, Texas), Tomas Johansson (Linkoping and Aston), Heinz Langer (Vienna), Marco Marletta (Cardiff), Michael Plum (Karlsruhe), Sasha Pushnitski (King's College, London), Karl Michael Schmidt (Cardiff), Christiane Tretter (Berne), Tomio Umeda (Hyogo, Japan), Ian Wood (Canterbury). Another invited speaker, Andrey Shkalikov (Moscow), was unable to obtain a UK visa in time to attend.

We thank the LMS, The Cardiff University School of Mathematics and WIMCS for their financial support.

Malcolm Brown and Des Evans
Cardiff University

Attendees

REPRESENTATIONS OF HECKE ALGEBRAS

Report

A workshop on *Representations of Symmetric Groups, Hecke Algebras and KLR Algebras* was held at the University of Birmingham from 14 to 16 July 2014. This area of research contains a number of classical open problems, such as that of finding the dimensions of simple modules for symmetric groups or, more generally, the so-called decomposition numbers. Approximately half of the talks featured Khovanov–Lauda–Rouquier algebras, which were discovered just five years ago and have since generated a lot of interest from several different perspectives, not least due to applications to open problems of this nature. The workshop provided the participants with an excellent survey of the most recent research on KLR algebras and their representations. A broad range of other topics was covered, including representations of Cherednik algebras, use of Hecke algebras to construct knot invariants, and problems on representations of symmetric groups in characteristic zero, such as those on plethysm. Several talks featured interesting combinatorial constructions, which were clearly illustrated by the speakers through well-prepared diagrams (notwithstanding occasional technical issues with the data projector).

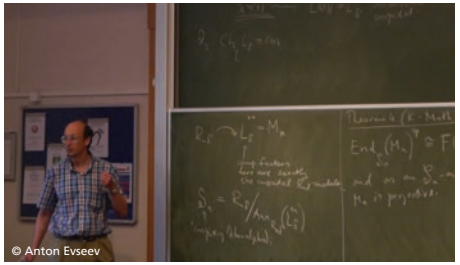
In total, there were 13 talks, two of which were given by PhD students. The speakers included several internationally renowned experts in the area. Among the 33 participants there were many mathematicians at early stages of their careers, including 11 research students. It is clear that the interest in representations of Hecke and KLR algebras is on the increase in the UK, especially among the younger generation of mathematicians. It is reasonable to hope that the workshop will help inspire exciting future research in the area.

The workshop took place in a friendly and relaxed atmosphere. A number of speakers were questioned vigorously on their talks by interested participants long after the talks had finished. The regular coffee breaks provided many opportunities for informal discussion and for building professional contacts. So did the conference dinner held in the city centre on Tuesday evening.

The invited speakers were Christine Bessenrodt (Leibniz Universität Hannover), Joseph Chuang (City University London), Matthew Fayers (Queen Mary University of London), Nicolas Jacon (Université de Reims Champagne-Ardenne), Alexander Kleshchev (University of Oregon), Sinéad Lyle (University of East Anglia), Ivan Marin (Université de Picardie Jules Verne), Andrew Mathas (University of Sydney), Vanessa Miemietz (University of East Anglia), Eric Vasserot (Université de Paris 7), and Mark Wildon (Royal Holloway, University of London). The workshop was organised by David Craven and Anton Evseev.

The organisers thank the LMS and the Anglo-Franco-German representation theory network for financial support.

Anton Evseev
University of Birmingham



Alexander Kleshchev (University of Oregon)

Vanessa Miemietz (University of East Anglia)

BIANCHI AND SIEGEL MODULAR FORMS

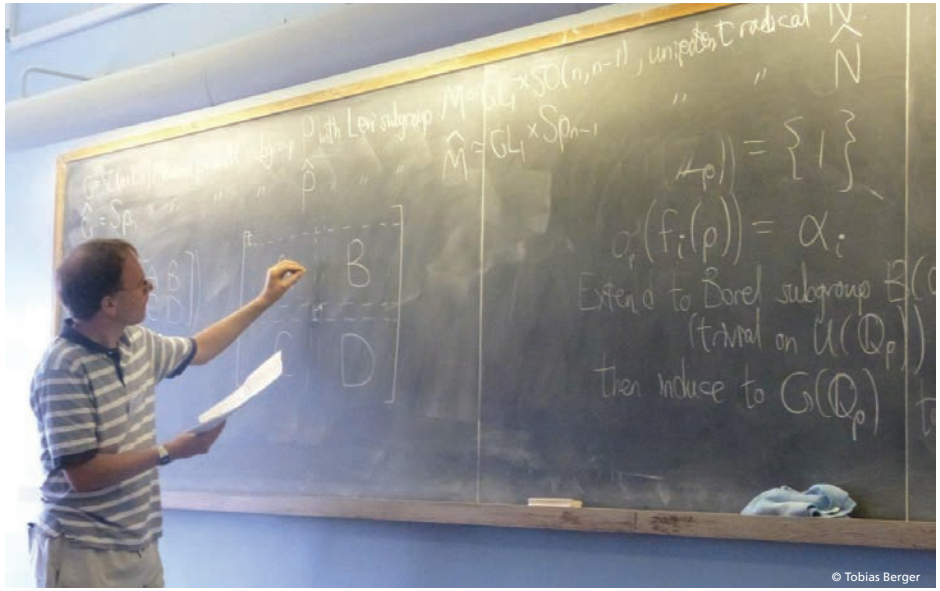
Report

A workshop on *Bianchi and Siegel Modular Forms* was held at the School of Mathematics & Statistics at the University of Sheffield from 14 to 16 July 2014 supported by an LMS Conference grant.

Following great progress in automorphic forms over totally real fields, there has recently been renewed interest in the case of automorphic forms over imaginary quadratic fields (aka Bianchi modular forms). One way to study their arithmetic properties is to lift them to Siegel modular forms via the theta correspondence between O(3,1) and Sp(4).

This workshop brought together experts on automorphic forms, Galois representations and computational number theory to present their work on different aspects of Bianchi and Siegel modular forms and the connections between them. There were a total of 26 participants from institutions in the UK (19), US (4) and one each from France, Germany and Ireland. The schedule included 13 talks, a dedicated discussion session and extended breaks to allow plenty of time for discussions and an informal exchange of information between the participants.

Haluk Şengün (Sheffield) and Abhishek Saha (Bristol) gave introductory talks on Bianchi and Siegel modular forms, respectively. Abhishek highlighted particularly Böcherer's conjecture and its generalisations in terms of Bessel periods, a topic that was to come up in several other talks and discussions. Another "theme" was the Paramodular conjecture of Brumer-Kramer, which was discussed in talks by Jolanta Marzec (Bristol) on *Non-vanishing of fundamental Fourier coefficients of Siegel modular forms* and Lassina Dembélé (Warwick) on *Theta lifts of Bianchi modular forms and application to paramodularity*. Ameya Pitale (Oklahoma) presented a talk on *Local and global Maass relations* which included a (very convincing!) sales pitch for representation theoretic methods.



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Neil Dummigan (Sheffield)
Langlands functoriality and Harder's conjecture

All speakers had been asked to make sure that at least part of their talks was accessible to the eight PhD students attending. To help the students get the most out of the workshop and introduce themselves to the other participants they were also given the opportunity for short presentations early on in the programme. Like the other talks these led to further conversations and discussions over coffee and lunch breaks in the common room. A highlight of the workshop was the discussion session at the end of the second day in which the PhD students were encouraged to ask questions. 'Volunteers' had to be chosen for the first questions, but soon this turned into a very open exchange between all the participants which provided further explanations on topics of the workshop and generated some new research ideas.


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Alexander Rahm (Galway)
Bianchi modular forms of varying discriminant, level and weight

On the second day Alexander Rahm (Galway) explained how to compute *Bianchi modular forms of varying discriminant, level and weight* and reported on progress in publishing these results as part of www.lmfdb.org. Lynne Walling (Bristol) presented recent results on *Diagonalising spaces of Siegel Eisenstein series of general genus and for arbitrary levels*. The arithmetic of L-values played a more or less explicit role in many talks, for example in Thanasis Bouganis' (Durham) presentation *On special values of L-functions attached to half-integral weight Siegel modular forms*. The relationship between L-values and congruences of automorphic forms featured strongly in the talks by Neil Dummigan (Sheffield) on *Langlands functoriality and Harder's conjecture*, Siegfried Böcherer (Mannheim) on *Congruence primes via higher L-functions* and Jim Brown (Clemson) on *The Ikeda ideal and a conjecture of Katsurada*. To complete the overview of themes of the workshop, Galois representations associated to both Bianchi and Siegel modular forms were discussed in the presentations of H. Şengün, Kris Klosin (CUNY) on *Congruences and R=T theorems* and Jacques Tilouine (Paris) on *Big Image of Galois representations and congruence ideals*.


© Tobias Berger

Audience

The latter talk brought the friendly and informal meeting to a close. Many participants commented that the focus of the workshop on these particular automorphic forms was very useful and allowed them to develop new ideas and contacts.

The organizer gratefully acknowledges financial support for this event by the LMS and EPSRC.

Tobias Berger
University of Sheffield

VISIT OF MAHYA GHANDEHARI

Dr Mahya Ghandehari (Department of Pure Mathematics, University of Waterloo, Canada) will be visiting the UK in October 2014. Her interests lie in non-abelian harmonic analysis, in particular the Fourier and Fourier-Stieltjes algebras of locally compact groups, and in geometric graph theory. Dr Ghandehari will give lectures at:

- Newcastle University, 7 October
  Induced representations, coefficient spaces, and applications to Fourier algebras
  (contact Zinaida Lykova: Zinaida.Lykova@ncl.ac.uk)
- University of Oxford, 14 October
  Derivations on the Fourier algebra of the Heisenberg group
  (contact Charles Batty: charles.batty@sjc.ox.ac.uk)
- University of Birmingham, 15 October
  Derivations on the Fourier algebra of the Heisenberg group
  (contact Jonathan Bennett: j.bennett@bham.ac.uk)
- Lancaster University, 22 October
  Geometric graph embeddings and graph limits
  (contact Yemon Choi: y.choi1@lancaster.ac.uk)

Dr Ghandehari will be based at Lancaster University during her visit. Further details can be obtained from Yemon Choi (y.choi1@lancaster.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISIT OF ANDREW PUTMAN

Professor Andrew Putman will be visiting the UK from 6 to 17 October 2014. His expertise is in geometric group theory and low-dimensional topology, particularly in mapping class groups of surfaces and related areas. During his visit Professor Putman will give lectures as follows:

- Wednesday 8 October at 16:00, Mathematics Building, University of Glasgow (contact Tara Brendle: tara.brendle@glasgow.ac.uk)
- Wednesday 15 October at 16:00, Centre for Mathematical Sciences, Cambridge University (contact Henry Wilton: h.wilton@ucl.ac.uk)
- Thursday 16 October at 15:00, Zeeman Building, Mathematics Institute, University of Warwick (contact Saul Schleimer: s.schleimer@warwick.ac.uk)

For further details contact Tara Brendle (tara.brendle@glasgow.ac.uk). The visit is supported by an LMS Scheme 2 grant.

CLUSTER ALGEBRAS AND PREPROJECTIVE ALGEBRAS

A workshop on *Cluster Algebras and Preprojective Algebras* will take place at the School of Mathematics, Cardiff University from Friday 17 to Saturday 18 October 2014. The purpose of this workshop is to explore further the connections between cluster algebras, (higher rank) preprojective algebras and some of the other applications mentioned above such as quiver representations, Calabi-Yau algebras and categories, discrete integrable systems and tropical geometry. It aims to bring together experts in these fields from the UK and overseas. Speakers include:

- Karin Baur (Graz)
- Raf Bocklandt (Amsterdam)
- Anna Felikson (Durham)
- Alastair King (Bath)
- Philipp Lampe (Bielefeld)
- Idun Reiten (Trondheim)

There is a £30 registration fee (£15 per day) to cover coffee/tea and lunches. Funds are available to contribute to the expenses of research students to attend the workshop. For further details contact the organiser (PughMJ@cardiff.ac.uk). Further information and registration forms are available from the website at http://mathsevents.cf.ac.uk/clusterworkshop.

The meeting is supported by an LMS Conference grant and by the Wales Institute of Mathematical and Computational Sciences.

CERME 9

The Ninth Congress of European Research in Mathematics Education (CERME) will take place at the Charles University, Prague from 4 to 8 February 2015. The plenary talks will be given by:

- Jarmila Novotná (Faculty of Education, Charles University in Prague) *Research in teacher education and innovation at schools – Cooperation, competition or two separate worlds?*
- Carmen Batanero (Department of Mathematics Education, Universidad de Granada) *Understanding randomness: Challenges for research and teaching*

The thematic working groups are:

- Argumentation and proof
- Arithmetic and number systems
- Algebraic thinking
- Geometrical thinking
- Probability and statistics education
- Applications and modelling
- Mathematical potential, creativity and talent
- Affect and mathematical thinking
- Mathematics and language
- Diversity and Mathematics Education: Social, cultural and political challenges
- Comparative studies in Mathematics Education
- History in Mathematics Education
- Early Years Mathematics
- University mathematics education
- Teaching mathematics with resources and technology
- Student's learning mathematics with resources and technology
- Theoretical perspectives and approaches in mathematics education research
- Mathematics teacher education and professional development
- Mathematics teaching practices and resources for teaching

For further information about CERME 9 visit the website at www.cerme9.org.

Of particular relevance to the teaching and learning of mathematics at university level is Working Group 14.

CERME 9: WORKING GROUP 14

Research on university level mathematics education is a relatively young field, which embraces a growing range of theoretical approaches and research designs. Working Group 14 (WG14) was launched at CERME7. After CERME8, its leader team – in collaboration with WG14 participants and others – worked towards a Research in Mathematics Education Special Issue (*Institutional, sociocultural and discursive approaches to research in university mathematics education*, July 2014) which focused on research that is conducted in the spirit of the following theoretical frameworks: the *Anthropological Theory of the Didactic*, the *Theory of Didactic Situations, Instrumental and Documentational Approaches, Communities of Practice* and *Inquiry and the Theory of Commognition*. In CERME9 the Working Group wish to cement and further this work but also welcome contributions from across the board of research approaches.

Call for papers and poster proposals

Research-based papers (maximum 10 pages) and poster proposals (two pages) primarily on:

- the teaching and learning of advanced university mathematics topics;
- mathematical reasoning and proof in university mathematics;
- transition issues 'at the entrance' to university mathematics, or beyond;
- challenges for, and novel approaches to, teaching mathematics at university level (including the teaching of students in non-mathematics degrees);
- the role of ICT tools (e.g. CAS) and other resources (e.g. textbooks, books and other materials) in the teaching and learning of university mathematics;
- assessing the learning and teaching of mathematics at university level;
- the preparation and training of university mathematics teachers;
- collaborative research between university mathematics teachers and researchers in mathematics education; and,

- theoretical approaches to research into the teaching and learning of university mathematics.

Papers and poster proposals should use the CERME word template, and conform to the guidelines at www.cerme9.org/guidelines/guidelines-for-authors/. Email your paper as a WORD document and a PDF version to Elena Nardi (E.Nardi@uea.ac.uk), and at the same time to the conference secretariat (submission@cerme9.org). Deadline for submission of papers is **15 September 2014**.

ANALYSIS DAY

An *LMS-WIMCS Analysis Day* (third workshop in the series) will take place at the Department of Mathematics, Swansea University on Thursday 25 September 2014 from 10:00 - 17:30. The meeting, which is open to all, will provide an opportunity to early career researchers in analysis, numerical methods and applications to present their recent results. The speakers are:

- Aurelio Arranz Carreno (Swansea)
- Mikhail Cherdantsev (Cardiff)
- Jonathan Eckhardt (Cardiff/Vienna)
- Michael Nieves (Liverpool)
- Juan Reyes (Cardiff)
- Adam Vellender (Aberystwyth)

For further information visit the meeting webpage at http://math.swansea.ac.uk/staff/vm/WIMCS-LMS-2014/. There is no registration fee associated with attending the event; however those planning to attend are asked please to register by **22 September 2014**, see the meeting webpage for details. The meeting is supported by an LMS Joint Research Groups in UK Scheme 3 grant and the Wales Institute of Mathematical and Computational Sciences.

BRUHAT-TITS BUILDINGS

A winter meeting on *Bruhat-Tits Buildings* will be held at Imperial College London from Tuesday 6 to Friday 9 January 2015. Bruhat-Tits buildings can be viewed as a geometric interpretation of semisimple linear algebraic groups over fields with a non-Archimedean valuation. In particular, they are strongly linked to number theory and arithmetic geometry. They also form an interesting and important class of examples of spaces of nonpositive curvature, and as such have implications also for geometric group theory.

The meeting consists of a five lecture series on recent developments in Bruhat-Tits theory, given by world-leading experts on the theory of Bruhat-Tits buildings. The speakers are:

- Linus Kramer (Münster) *Metric aspects of Euclidean buildings*
- Bernhard Mühlherr (Giessen) *Descent in Bruhat-Tits buildings*
- Anne Parreau (Grenoble) *Non discrete Euclidean buildings and asymptotic cones of symmetric spaces*
- Bertrand Rémy (Paris) *Integral structures in Bruhat-Tits theory*
- Guy Rousseau (Nancy) *Images of line segments by retractions and application to representation theory*

The organisers have limited support for young researchers (in particular for UK based research students). The deadline for applying for support is **10 October 2014**. For more information visit the website: www.jschillewaert.wix.com/bruhat-tits or contact the organizers, Jeroen Schillewaert and Adam Thomas by email (btmeeting2015@gmail.com).

The meeting is supported by an LMS Conference grant and by Imperial College London.

CONTINUED FRACTIONS AND GEOMETRY OF LATTICES

A meeting on *Continued Fractions and Geometry of Lattices* will take place in the Department of Mathematical Sciences at the University of Liverpool on Wednesday 8 October 2014.

It is aimed to bring together researchers interested in geometry of numbers. Traditionally a subject of number theory, continued fractions appear in dynamical systems, algebraic geometry, topology, and even celestial mechanics. It is known that geometry of continued fractions can be described in terms of lattice invariants. In the framework of this conference we plan to discuss and develop links between

the lattice geometry and geometric aspects of continued fractions. The meeting will cover several applications to various questions of Diophantine approximation, algebraic number theory, and toric geometry. The speakers are:

- Imre Barany (University College London)
- Ian Short (Open University, Milton Keynes)
- Radhakrishnan Nair (University of Liverpool)
- Oleg Karpenkov (University of Liverpool)

There are no registration fees. Some funding is available to contribute to the travel expenses of research students. For more information see the meeting website: http://pcwww.liv.ac.uk/~karpenk/conference2014/cf2014.html, or contact Oleg Karpenkov (karpenk@liv.ac.uk). The meeting is supported by an LMS Conference grant under the Celebrating New Appointments scheme and the Department of Mathematical Sciences of the University of Liverpool.

DERIVED CATEGORIES INTRODUCTORY SCHOOL

An *Introductory School on Derived Categories* will take place at the University of Warwick from Monday 8 to Friday 12 September 2014. This school is aimed at a broad audience, including PhD students, early postdocs and specialists in neighbouring areas. It is the opening event of the 2014-2015 Warwick EPSRC symposium *Derived Categories and Applications*, serving as an introduction and an essential technical preparation. The school comprises three lecture courses, several stand-alone talks and a number of exercise sessions. The invited speakers are Dominic Joyce (Oxford) and Hiraku Nakajima (RIMS). The mini-courses are:

- Tom Bridgeland (Sheffield) *Introduction to derived categories and stability conditions*
- Alexander Kuznetsov (Steklov Institute) *Semiorthogonal decomposition of derived categories*
- Timothy Logvinenko (Cardiff) *Introduction to DG-categories*

For further information visit the website at: www.cf.ac.uk/maths/subsites/logvinenko/2014-wrwsym/01-intro.html or contact one of the organisers: Miles Reid (Miles.Reid@warwick.ac.uk), Timothy Logvinenko (LogvinenkoT@cardiff.ac.uk).

There will be several related activities at Warwick immediately following the school: the workshop *McKay correspondence, orbifolds, quivers*, 15-19 September 2014, organisers: Alastair Craw (Bath), Timothy Logvinenko (Cardiff), Miles Reid (Warwick) and the first meeting of *BrAG* (*British Algebraic Geometry*), 22-24 September 2014, organisers: Arend Bayer (Edinburgh), Milena Hering (Edinburgh), Diane Maclagan (Warwick) and Balázs Szendrői (Oxford).

Some financial support is available for graduate students and early postdocs. The school is supported by an LMS Conferences grant and the University of Warwick.

VALEDICTION TO JEREMY GRAY

A two-day meeting to mark Jeremy Gray's retirement from the Open University and celebrate his achievements will take place from 11 to 12 September 2014 at the Mercure Parkside House, Woughton-on-the Green, Milton Keynes. The speakers are:

- June Barrow-Green (Open University)
- Umberto Bottazzini (University of Milan)
- Karine Chemla (University of Paris)
- Leo Corry (Tel Aviv University)
- Moritz Epple (University of Frankfurt)
- Jeremy Gray (Open University)
- Nicolo Guicciardini (University of Bergamo)
- Snezana Lawrence (Bath Spa University)
- Jesper Lützen (University of Copenhagen)
- Erhard Scholz (University of Wuppertal)

For further information see https://sites.google.com/site/grayvalediction/ or contact June Barrow-Green (june.barrow-green@open.ac.uk). The meeting is supported by an LMS Conference grant, the British Society for the History of Mathematics and the International Commission on the History of Mathematics.

Isaac Newton Institute
for Mathematical Sciences

ENGINEERING AND CONTROL OF NATURAL AND SYNTHETIC MICROBIAL COMMUNITIES

26 - 28 November 2014

in association with the Newton Institute programme
Understanding Microbial Communities; Function, Structure and Dynamics
(11 August – 19 December 2014)

Workshop theme: The importance of microbial communities for health, industry and the natural environment cannot be overstated. Powerful new tools in molecular microbial ecology are being brought to bear on these systems in the anticipation of new technologies and treatments. However, our lack of theoretical understanding of their function, structure, and dynamics represents a strategically important lacuna in our knowledge. It is unlikely that we will ever be able rationally design very large and very complex natural or "synthetic" communities without an appropriate mathematical description of how they work. Thus, a better understanding of microbial communities will increase our ability to harness the power of the microbial communities in biotechnology and to manipulate such communities to promote health and well-being.

Closing date of the receipt of applications is **28 September 2014**.

Further information and application forms are available from the website at
www.newton.ac.uk/programmes/UMC/umcw04.shtml

PERIODIC, ALMOST-PERIODIC, AND RANDOM OPERATORS

Introductory School

5 – 16 January 2015

in association with the Newton Institute programme
Periodic and Ergodic Spectral Problems
(5 January -26 Jun 2015)

The winter school *Periodic, Almost-periodic, and Random Operators* opens the six month programme *Periodic and Ergodic Spectral Problems*. The aim of this winter school is to offer several mini-courses which will serve as an introduction to the subject matter of the semester programme. These mini-courses will present background information and an overview of the most important results and open questions in the areas of periodic, almost periodic, and random operators. The school is aimed at an audience primarily consisting of graduate students and recent PhD recipients. Attending these mini-courses will allow the participants to get a general feeling for the area and it will facilitate interactions with the experts that are present at the institute during the winter school and/or later parts of the programme period. It will also make the talks in the three subsequent workshops and various working groups more accessible to the junior participants.

Closing date of the receipt of applications is **28 September 2014**.

Further information and application forms are available from the website at
www.newton.ac.uk/programmes/PEP/pepw01

Isaac Newton Institute
for Mathematical Sciences

In association with the Newton Institute programme

Random Geometry

(12 January - 3 July 2015)

INSTRUCTIONAL WORKSHOP FOR YOUNGER RESEARCHERS

12 - 23 January 2015

Background: The aim of this workshop is to provide introductory background on random geometry, that could serve participants during their stay for the Programme at Newton Institute. The workshop will consist of several courses, lasting roughly six to eight hours each, on the following topics: Gaussian Free Field, random planar maps, SLE, Gaussian multiplicative chaos, and discrete complex analysis. The level of the presentations will be mainly at the graduate and early post-doc level, but researchers at all levels of seniority will be welcome.

Closing date of the receipt of applications is **28 September 2014**.

Further information and application forms are available from the website
www.newton.ac.uk/programmes/RGM/rgmw01

CONFORMALLY INVARIANT SCALING LIMITS

26 - 30 January 2015

Background: This workshop will focus on recent developments in the area of conformally invariant random processes, including rigorous results on two-dimensional models from statistical mechanics, Liouville quantum gravity, quantum Loewner evolutions (QLE), Schramm-Loewner Evolution (SLE), conformal loop ensembles (CLE), Gaussian multiplicative chaos and multifractal analysis.

Closing date of the receipt of applications is **28 September 2014**.

Further information and application forms are available from the website
www.newton.ac.uk/programmes/RGM/rgmw02

Organisers: Itai Benjamini (Weizmann Institute), Nathanaël Berestycki (Cambridge), Jean-François Le Gall (Paris Sud) and Scott Sheffield (MIT).

Formal Aspects of Computing Science Specialist Group

BCS-FACS Evening Seminar
Joint event with the London Mathematical Society

Wednesday 22nd October 2014, 6:00pm

Professor Joel Ouaknine
(University of Oxford)

Decision Problems for Linear Recurrence Sequences

Linear recurrence sequences (LRS), such as the Fibonacci numbers, permeate vast areas of mathematics and computer science. In this talk, Professor Ouaknine considers three natural decision problems for LRS, namely the Skolem Problem (does a given LRS have a zero?), the Positivity Problem (are all terms of a given LRS positive?), and the Ultimate Positivity Problem (are all but finitely many terms of a given LRS positive?). Such problems (and assorted variants) have applications in a wide array of scientific areas, such as theoretical biology (analysis of L-systems, population dynamics), economics (stability of supply-and-demand equilibria in cyclical markets, multiplier-accelerator models), software verification (termination of linear programs), probabilistic model checking (reachability and approximation in Markov chains, stochastic logics), quantum computing (threshold problems for quantum automata), discrete linear dynamical systems (reachability and invariance problems), as well as combinatorics, statistical physics, formal languages, etc.

Perhaps surprisingly, the study of decision problems for LRS involves advanced techniques from a variety of mathematical fields, including analytic and algebraic number theory, Diophantine geometry, and real algebraic geometry.

The venue is the London Mathematical Society, De Morgan House 57-58 Russell Square, London WC1B 4HS. Refreshments will be available from 5.30pm.

The seminar is free of charge and open to everyone. If you would like to attend, please register at computerscience@lms.ac.uk.

BRIAN HARTLEY MEMORIAL DAY

There will be a one day meeting on algebra to commemorate the 20th anniversary of Brian Hartley's death while walking in the Lake District. The meeting will be held at the School of Mathematics, Alan Turing Building, University of Manchester, on Wednesday 8 October 2014, from 12 to 5 pm, followed by a wine reception and dinner. The speakers are

- Alex Zalesski (Minsk)
- Mahmut Kuzucuoğlu (Ankara)
- Dan Segal (Oxford)

All are welcome. There is no registration fee. Limited funding is available to support UK postgraduate travel expenses. For more details including programme, registration, and application for funding, visit www.maths.manchester.ac.uk/news-and-events/events/brianhartleyday/

The meeting is supported by an LMS Conference grant.

PARTIAL DIFFERENTIAL EQUATIONS

The Department of Mathematics at the University of Sussex is hosting an international conference on *Partial Differential Equations: Geometric Analysis, Calculus of Variations, Harmonic Analysis* from 15 to 17 September 2014. Confirmed plenary speakers include:

- Stefano Bianchini (SISSA)
- Diego Cordoba (ICMAT)
- Maria Esteban (CEREMADE)
- Alexander Grigor'yan (Bielefeld)
- Francois Hamel (Marseille)
- Emmanuel Hebey (Pontoise)
- Frédéric Hélein (Paris)
- Jan Kristensen (Oxford)
- Ari Laptev (Imperial)
- Yanyan Li (Rutgers)
- Giuseppe Mingione (Parma)
- Nikolai Nadirashvili (Marseille)
- André Neves (Imperial)
- Henrik Shahgholian (KTH)
- Alex Sobolev (UCL)
- Jim Wright (Edinburgh)

For registration and further information visit the conference website www.sussex.ac.uk/apde/pde/index. The deadline for registration is **6 September**.

EVOLUTION EQUATIONS

Maxwell Institute Graduate School on Evolution Equations will be held in Edinburgh from 8 to 10 October 2014. Jointly organized by Heriot-Watt University and the University of Edinburgh, the school aims to expose postgraduate students and interested faculty to some of the recent developments in the analysis of evolution equations and prepare them for research in these fields.

Erwan Faou (INRIA & ENS Paris) will give a short course on the analysis of stochastic evolution equations and Christian Lubich (Tübingen) on the long-time behaviour of oscillatory Hamiltonian ODEs and PDEs and their numerical discretizations. The lectures will be complemented by talks of senior participants and advanced students.

Some limited funding for British postgraduate students, and in particular for students from Scottish universities will be available. Further information is available at www.macs.hw.ac.uk/~hg94/evo14.

The event is supported by an LMS Conference grant, the Edinburgh Mathematical Society and the Glasgow Mathematical Journal Trust Fund.

MULTISCALE PDE SYSTEMS

A meeting on *Multiscale PDE Systems of Fluid Models and Applications in Geophysics* will take place in the Department of Mathematics at the University of Surrey on Friday 31 October 2014. It aims to foster conversation and collaboration in addressing challenges from multiple temporal and spatial scales in PDE systems modelling fluid motions. The speakers include:

- Bin Cheng (Surrey)
- Mike Cullen (Met Office)
- John Norbury (Oxford)
- Beatrice Pelloni (Reading)

- Endre Suli (Oxford)
- Beth Wingate (Exeter)

There is a £10 registration fee. Some funding is available to contribute to the travel expenses of research students. For more information, including how to register, see the meeting website http://personal.maths.surrey.ac.uk/st/bc0012/PDE2014, or contact the organiser, Bin Cheng by email (b.cheng@surrey.ac.uk). The meeting is supported by an LMS Conference grant and the Department of Mathematics, University of Surrey.

INTEGRABLE SYSTEMS IN NEWCASTLE

The second edition of the two-day meeting *Integrable Systems in Newcastle* will take place from 26 to 27 September 2014 at the Department of Mathematics and Information Sciences of Northumbria University, Newcastle upon Tyne. The workshop will focus on new developments in the fields of nonlinear waves and discrete integrability and will promote interactions between leading UK and international researchers. The speakers include:

- F. Nijhoff (Leeds University)
- R. Halburd (University College London)
- A. Doliwa (Warmia and Mazury University)
- Y. Yomada (Kobe University)
- K. Khusnutdinova (Loughborough University)
- T. Grava (Bristol University and SISSA)
- D. Gomez-Ullate (Univ Complutense de Madrid and ICMAT)

There is no registration fee for this event and support for the expenses of research students may be available. For further information visit the website at http://group28.northumbria.ac.uk/IS/ or contact Benoit Huard (benoit.huard@northumbria.ac.uk). The meeting is supported by an LMS Conference grant and by Northumbria University.

READERS' OPINIONS ..... have your say

All opinions submitted to this section are strictly those of the contributor and do not necessarily represent the views of the London Mathematical Society. If you would like to respond to any of the opinions published below, or have a separate contribution which you would like published on matters relevant to mathematics, please contact newsletter@lms.ac.uk. Items are accepted at the discretion of the Editor and subject to available space in any given edition.

Fall in numbers of applications by foreign students to UK universities

Toni Beardon OBE (retired from University of Cambridge NRICH/MMP - http://mmp.maths.org - and African Institute for Mathematical Sciences Schools Enrichment Centre (AIMSSEC) - http://aimssec.aims.ac.za)

I was moved by the notice, in the June *LMS Newsletter* (p. 5), about the House of Lords Science and Technology Committee findings on the effect of the new immigration regulations and practices, and the hostile media voice (particularly in social media), in deterring foreign students from applying to the UK. As a result I have set up a petition to the Home Secretary and new Minister of Education https://you.38degrees.org.uk/p/foreignstudents asking them to implement the House of Lords Science & Technology Report recommendations http://tinyurl.com/nbqbvca. I hope that readers of this *Newsletter* will sign this petition and ask others to do so.

It is clearly a controversial matter. I have been saddened by the torrent of hostile, bitter and ill informed comments it has generated.

I received a very supportive email from Lord Martin Rees, a member of the House of Lords Committee, in which he says "There is clearly tension between BIS and the Home Office on this issue. The Government is in the absurd position that the easiest way to cut overall immigration figures is by cutting the categories that benefit us most! And there is a counter-productive reluctance to include students separately in the immigration figures".

Dr Bogdan Roman, an academic with joint affiliation in the Department of Applied Mathematics and Theoretical Physics and The Computer Laboratory in Cambridge, and who is involved in the University outreach programme, and in the undergraduate admissions and teaching at several Cambridge Colleges, said: "This issue has been exploited politically. One aspect is that even though many politicians themselves may not be against immigration, it is an easy vehicle to gain votes and support and they are now trapped, having to play this tune a (good) while longer. A problem is that we stand to lose by missing out on outstanding talent coming from international applicants. We must realise that the strong and talented applicants have more options and they actually do take into account the 'welcoming' aspect. We need more authoritative voices such as Lord Martin Rees' to raise awareness of the risks involved."

Amongst the authoritative voices already speaking out on these issues is that of the Cambridge Vice Chancellor Professor Sir Leszek Borysiewicz, see www.theguardian.com/uk-news/2014/jun/02/cambridge-vice-chancellor-leszek-borysiewicz.

Challenges for UK Mathematical Scientists in Higher Education

Chris Linton (Loughborough University)

I am writing in response to Ken Brown's article in the *LMS Newsletter* (July 2014, pp 10-11) in which he sought views about a number of issues affecting the mathematics community. I have served as a head of a maths department for six years and also as a more senior university manager for the past 5 years. I thus have experience relating to the issues that Ken raises from both a subject and an institutional point of view. The emphasis below is on the management perspective and my remarks are intended to shed some light on university-level thinking which I hope is useful.

Most senior managers in universities are not mathematicians and don't understand the world in which mathematicians operate. My advice to any mathematician interested in the issues that Ken has raised is to engage with senior managers at every opportunity. It is only by talking constructively that sensible decisions are reached.

I will address each of Ken's nine points (reprinted in italics):

1 & 2. Award of sabbatical leave only to those winning Research Council (RC) grants; allocation of PhD students only to those winning RC grants

As a specific management tool these sound like very blunt instruments. Sabbatical leave, or any other form of benefit that is designed to provide an academic with dedicated time to focus on some activity, is clearly valued by mathematicians for whom one the biggest barriers to research success is lack of time. PhD studentships are also a great way of supporting mathematicians. If it helps people develop into better academics then these mechanisms are also valued by managers. The problem is that the academic and their manager may differ on what the word better refers to. In my experience, mathematicians (more so than most other academics) wish for other mathematicians to be the exclusive judge of how good they are and see no room in that assessment for their employer to make value judgements about the relative merits of, say, publishing a journal article, applying for an EPSRC grant, or being an effective admissions tutor. Where you end up with a blunt interpretation of this like the ones Ken articulates is in my view because there is no real engagement between the academics

and their managers over how an appropriate balance should be struck.

3. Supervision of research student(s) a necessary condition for promotion

This is a thorny issue, because the availability of students and the nature of PhD student supervision differs hugely across the academy. The desire for equity and transparency in promotion procedures is very strong, but as soon as you write down specific criteria designed to cover more than a narrow section of a university one finds problems. I think supervising a PhD student to completion should be a necessary condition for promotion in mathematics, but recognise that this is sometimes unfair. A good process should always have the capacity to spot serious unfairness and make an exception.

4. Substantial external research income a necessary condition for promotion

I think this is reasonable (in a research-intensive university) provided the word substantial can be interpreted within a disciplinary context. One argument that frustrates me (made by academics from many disciplines) is the following: "I don't need external income to do my research, therefore why should I apply for any?". In the next breath they will say they don't have enough time to do research. Of course I understand that an academic may not need an RA to write quality papers, but they do need someone to pay their salary for the time they need to devote to this. QR income earned from the RAE/REF is unlikely to pay for a significant proportion of the time that staff want to spend doing research. How much is it reasonable for this time to be subsidised from (in England) student fees? If your department brings in a few big grants every year there will be overhead income which oils the wheels and frees up time. So everyone should be applying. There is still the problem of how to accommodate varying expectations across disciplines but provided there is a culture in which people apply for funding on a regular basis then this is usually manageable. If such a culture does not exist then there is usually less of a tendency to compromise.

5. Move to "tenured" status dependent on winning external income and/or PhD supervision

I assume that Ken is referring here to passing a probationary period and being confirmed in post, in which case I would be uncomfortable with a requirement for a completed PhD supervision (though it depends how long the probationary period is). On the external income side this seems reasonable provided one is not expected to land a substantial EPSRC grant in your first three years.

6. Non-submission of an individual's outputs to the REF, despite availability of a full set of internationally-published outputs

Submission or otherwise to the REF should not matter in any way (all universities have signed up to this no detriment clause). However, non-submission to the REF must be for a reason and that reason may be one that justifiably has other consequences.

7. Departmental decisions on number of outputs submitted to the REF influenced by the number of sufficiently strong impact statements

Impact is an area where mathematics lost out in the design of REF2014 and we should work to make things right next time. We should embrace the impact agenda but argue strongly that impact on other academic disciplines is just as valuable for mathematics (as an underpinning discipline) as impact outside academia. I think there may be some sympathy with this view within HEFCE provided the mathematics community doesn't portray itself as anti-impact per se. With the rules that we had to deal with this time I think many departments struggled to produce lots of high-quality impact statements and I am sure that some people were left out of the REF as a result. However, if this was the only reason for their exclusion there should be no detriment.

8. Decisions on research fields to support or appointments to make dependent on likelihood of future impact statements being generated

Why is there an impact agenda? Because the government wants to redirect funds to those areas of academia where impact of research is most likely. So what Ken describes is exactly what government hopes will happen. Might this lead to decisions which are not in the best interests of mathematics as a whole? I doubt it (and we'll never know because there's no control sample to measure against). Mathematics is a long game. The current economic imperative won't exist for ever. The expansion of higher education in the UK over the past 20 years means that there is far more mathematics research going on now than there was in 1990 and this is vastly more significant than the effect of the impact agenda on mathematics.

9. Loss of service teaching leading to reduced student FTE numbers and reductions in staffing

The service teaching issue is one that we resolved well (roughly 10 years ago) at my own institution: mathematics is taught by mathematicians (or maths education specialists). The quid pro quo is that everyone understands that the departments that are being served are partners in the delivery and have a say in how things are done and that the quality of the provision must be excellent (as judged by the receiving department). Too often mathematics service teaching has been seen as a right, with all the control in the hands of the provider, rather than what it is - a service - with the needs of the users paramount.

Challenges for UK Mathematical Scientists in Higher Education: Response

Terry Lyons (LMS President)

Ken Brown's article in the *LMS Newsletter* (July 2014, pp 10-11) should have given us all food for thought. And it is good to see Chris Linton responding to it in such a direct and thoughtful manner. I would like to add an extra personal response into the discussion. I hope that others will feel able to join the dialogue in future editions of the newsletter.

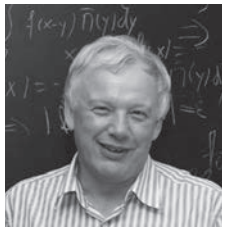
One area where I agree strongly with Chris is the following. I believe that it is important, even essential, to engage and understand the perspectives of senior management and other stakeholders if mathematics is to thrive. One reason Chris might consider for sabbatical leave and encouraging research activity has to be that paradoxically it yields as a key outcome energised and motivated staff who stay up to date and deliver sustained high quality teaching. Thus it seems reasonable to suppose that in many major research universities it is the research that subsidises high quality teaching, in the sense that delivering that quality teaching for extended periods without the input of research active staff would be extremely difficult if not impossible.

A mathematics department can, and in most cases should, play a vital role in university life. There are many successful examples around the country where quite small groups of mathematicians thrive and add great value to their institutions. Every university should be in this place. Each university should understand why it has a mathematics department, what it brings to the institution, and how to take the partnership further. With this in mind, the LMS is trying to collect a series of best practise examples of the system working well from both sides that can be shared with other managers and mathematicians. It can be very difficult to visualise the value until one sees examples. If readers could bring examples of effective practise to the attention of the LMS this would be of great value.

Mathematics is special, the Deloitte report demonstrates the huge wider role mathematics research plays in our society; the successfully embedding of mathematics throughout the higher education system can add real value to the UK that is likely far in excess of the cost of a few sabbaticals.

OBITUARIES

DAVID BROOMHEAD



Professor David S. Broomhead, who was elected a member of the London Mathematical Society on 19 January 1990, died on 24 July 2014, aged 63.

Mark Muldoon writes: Dave was an influential applied mathematician who delighted in using different areas of mathematics in novel ways. With Greg King he developed techniques to determine whether an experimental time series had been generated by a deterministic chaotic system by combining the pure mathematical results on topological embedding due to Takens with the engineering method of singular value decompositions. In 1989 he was awarded the John Benjamin Memorial Prize for work with David Lowe and Andrew Webb that exploited an analogy between neural networks and interpolation using the newly developed radial basis functions from numerical analysis. More recently he had been working on biological signaling processes. In 2013 he was made an Honorary Fellow of the Institute for Mathematics and its Applications.

Dave was born on 13 November 1950 in Leeds. He attended Aireborough Grammar School in Guisley, finishing in 1969. Dave then spent a year in Uganda, studying and teaching, before moving to Merton College, Oxford, where he read Chemistry and met his wife Eleanor. Laboratory work proved not to be Dave's forte, but he found his métier doing research on quantum mechanics during a Part III project with the physical chemist Peter Atkins. He stayed in Peter's lab for his DPhil, completing his thesis, *Molecules in Electromagnetic Fields* (on the classical theory of relaxation in nonlinear intramolecular modes), in 1976.

After a year as a postdoc at Harwell, Dave took up a two-year SERC/NATO fellowship at Kyoto University in Professor K. Tomita's group. It was here that he began to work seriously on applied nonlinear dynamics and chaos, topics that underpinned his research for the rest of his career. On his return to the UK he took up a postdoc with George Rowlands in the Physics Department at the University of Warwick. They became great friends and enjoyed a tremendously productive collaboration, not least because they solved the problem associated with Dave's funding within a few months and so had the best part of three years to work on whatever they liked. Dave also made fruitful connections to the Dynamical Systems group in Warwick's Department of Mathematics including Robert MacKay, David Rand and Christopher Zeeman.

In the summer of 1983 Dave moved to the Signal Processing group at the Royal Signals and Radar Establishment (RSRE, now QinetiQ) in Great Malvern. There he wrote his influential papers on delay embedding and on neural networks.

In 1995, dismayed by the deteriorating intellectual environment in the soon-to-be-privatised research establishments, Dave moved to Manchester as a Professor of Applied Mathematics, initially at UMIST and then after 2004, at the new University of Manchester. Working in a university environment allowed him greater interactions with younger scientists, and he enjoyed the process of supervising PhD students enormously. By all accounts the enjoyment was reciprocated. At Manchester he became increasingly interested in applications to biology, working initially on eye movement control with Richard Abadi and later, with Doug Kell, on large-scale models of metabolism and with Mike White's group on the dynamics of intracellular signaling cascades. In recent years he developed a deep interest in hybrid systems and asynchronous processes, leading a large, lively interdisciplinary group as head of Manchester's CICADA project.

I first met Dave in the autumn of 1989. He struck me as unpretentious, warm and funny and a hugely imaginative scientist and I thought I'd landed the best postdoc position in the world. Some 25 years later I still feel that way: he taught me, and many others, a great deal about how to live a good life, in science and beyond.

He is survived by his wife Eleanor, son Nathan and his mother.

S. SANKARAN

Dr S. Sankaran, known as 'Shanky', died on 30 January 2014, after a short illness.

Steve Selesnick writes: He was born in Madras (now Chennai) on 23 May 1923, the youngest of a large family. He attended Presidency College Madras attaining an M.A and M.Sc. In 1953 he obtained a scholarship to study at Columbia University as part of the group around Claude Chevalley. There he came under the influence of such other leading lights as Harish-Chandra and I.E. Segal, but seems to have taken his research into his own hands. In New York he met his future wife Veronica, a daughter of E.M.W. Tillyard, the influential scholar of early modern English literature. They married in 1958 and moved to England, before he had obtained an official Columbia PhD. With the support of F. Smithies he obtained a lectureship at the University of Hull, filling the post vacated by Hanna Neumann, who moved to Manchester. His PhD was awarded by the University of Hull on the basis of papers already published. In 1963 he moved to Queen Elizabeth College, London, where he remained, through its amalgamation with King's College in 1985, until his retirement in 1988. His early publications, on operator algebras, extend and complement the classical theory of Murray and von Neumann in various ways, and include a paper on the then virtually untouched topic of unbounded operators. His encyclopaedic knowledge of the area was a useful resource for London physicists, and others, in the 60s and 70s. His interests shifted later more specifically to group representations, and he found many hitherto unexpected connections between some of the fundamental results of this theory. His output, and indeed his teaching, was characterized by elegance of presentation and beauty of result. He maintained his enthusiasm for mathematics, as well as for cricket and for European classical music, up to the end of his life. His patience, kindness and subtle wit are remembered with great affection by his friends and students. He is survived by his wife, son (Professor G.K. Sankaran) and three grandchildren.

Thanks to: Katherine and Norman Alling, A. Astaneh, Mary O'Neill, G.K. Sankaran and I.W. Selesnick.

REVIEWS

RADICAL GEOMETRY: MODERN ART OF SOUTH AMERICA

Royal Academy of Arts, London: 5 July – 28 September 2014

Wassily Kandinsky was very much inspired by the structure of Euclid's Elements when in 1924 he published the book *Point and Line to Plane* in which Kandinsky attempts to develop a scientific theory of the emotional value of geometric building blocks like the point, the line, the plane etc. Geometry and art have, of course, always been intimately connected not least at a technical level at which the artist makes use of geometry to, say, develop a sense of three dimensional perspective. Kandinsky believed there was a much more profound relation at a deep spiritual level between geometry and art. For me the exhibition *Radical Geometry* at the Royal Academy very much seems to support this proposition. Paintings from 1930s to 1970s by a number of influential artists from Argentina, Uruguay, Brazil, and Venezuela show how an interest in pure geometri-

cal form can lead to some emotionally very moving paintings. The artwork produced by the Sao Paolo based artists in the fifties reminds one of figures from geometry books, although perhaps these paintings stir the mind more effectively than the typical Euclidian geometrical shapes. Nevertheless the construction of Cordeiro's Visible Idea is constructed with mathematical precision letting triangular shapes evolve along two spirals. With similar mathematical rigor Fiaminghi creates a dizzying sensation of interference by use of two sets of red and grey interspaced elongated rhombi. These are examples of geometry that although stern and painstaking conveys warm poetic sentiments.

Waldemar Cordeiro's *Visible Idea* (1956)

Does mathematics really have an emotional dimension? Who should visit this exhibition? Anybody with a curiosity about the relationship between mathematics and art will certainly find a visit worthwhile. I have in a couple of publications (available at www2.imperial.ac.uk/~hjjens/) argued that mathematics possess similarities at a subtle conceptual level beyond the immediate technical relations such as geometrical aspects of perspective drawing or mathematical analysis of how paint is distributed across the surface, say in Polack's paintings.

Hermelindo Fiaminghi's *Alternated 2* (1957)

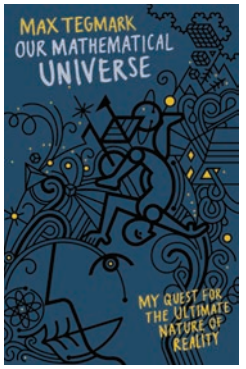
Clearly one can easily – as sometimes pointed out to me by mathematicians – do mathematics without feeling an emotional attachment to the concepts studied. However, it is certainly also possible to feel that beauty, which, I would claim, always entails emotion, is of great importance when doing mathematics. Dirac is famously quoted for saying: *If one is working from the point of view of getting beauty into one's equation, ... one is on a sure line of progress*.

Most of us don't regularly create new areas of mathematics, like Dirac did, and may in our daily dealings with mathematics only encounter the technical solidity which makes mathematics so wonderfully trustworthy and is the reason why we dare board an airplane or dare to expect that when we purchase a smart phone it will function. So for many mathematicians a visit to *Radical Geometry* may stimulate one to ponder facets of mathematics we normally don't think much about. This is likely to be an enriching experience and one that might in fact influence how we ourselves relate to mathematics and, not least, how we present mathematics to non-mathematicians.

Henrik Jeldtoft Jensen
Imperial College London

OUR MATHEMICAL UNIVERSE: MY QUEST FOR THE ULTIMATE NATURE OF REALITY

by Max Tegmark, Allen Lane, 2014, pp 432, £25, ISBN 978-1846144769.



Max Tegmark has done excellent work in observational cosmology by combining cosmic microwave background radiation observations with analyses of massive data sets on the distribution of galaxies, in order to observationally test the nature of the physical universe. He is also a very adventurous thinker who spends some of his time contemplating the deep mysteries of existence, and in particular the relation between mathematics, physics, and cosmology. This intriguing book sets out to describe both these aspects of his personal journey, and in doing so engages in some extravagant speculations on the nature of existence.

The first part of the book describes his adventures in observational cosmology, and are of an engaging personal nature - the kind of thing you might lend a student to inspire them to consider a career in mathematical physics or astronomy. The second half presents increasingly outlandish speculations on the nature of ultimate reality. In particular he proposes existence of four levels of multiverse, each more distant from possible observational test than the previous one. This part of the book is in effect a series of speculations about the relation between pure mathematics, applied mathematics, theoretical physics, and the physical universe. His key proposal is existence of four types of multiverse:

- A level I multiverse involves different regions of spacetime that are unobservable, but have the same effective laws of physics; this is uncontroversial, because causal and visual horizons limit what we can see or have causal contact with in cosmology.
- A level II multiverse involves different regions of spacetime in a chaotic inflationary universe that are unobservable, and have different effective laws of physics in different expanding bubbles; this is an extension of the standard inflationary universe model that is not proven and is probably not testable.
- A level III multiverse involves different parts of quantum Hilbert Space (this is the Everett many-worlds interpretation of quantum physics); this is a controversial view of quantum theory that is strongly held by a small group pf quantum cosmologists.
- A level IV multiverse involves existence all possible mathematical structures, corresponding to different fundamental laws of physics. This is highly speculative and there is no possibility whatever of testing it, despite some claims made in this regard by the author.

A key issue here is the distinction between what is tested physics, or at least a testable hypothesis about physical reality, and what are untestable hypotheses. The book is good in that it tries to clearly distinguish between what is well established and what is speculative. The problem is that he espouses the Everett multiverse interpretation of quantum physics (his Level III multiverse) as if it is the norm. However those espousing this view are outliers in the world of quantum physics, and it is by no means the broadly accepted view. It certainly is not an experimentally tested, or even testable, proposal.

The problem with his level IV proposal is that he suggest not merely that there is a multiverse out there that instantiates all possible mathematical structures – a proposal that is not remotely testable - but that the universe **is** a mathematical structure (the Mathematical Universe Hypothesis). This is a category mistake, confusing the existence of abstract realities characterised by equivalence classes of mathematical entities (he is a mathematical Platonist) with the possible existence of instantiations of those structures. This is an extreme case of a problem with many theoretical physicists: forgetting the cautionary note by Aurthur Stanley Eddington in his Gifford Lectures (*The Nature of the Physical Universe*, 1927) that equations are

partial and incomplete representation of the richness of physical reality. They believe their equations are more real than reality. Amongst the many problems this proposal raises is that these mathematical structures are eternal and unchanging, whereas the physical universe undergoes physical processes and is evolving. He fails to address this key problem with his extravagant proposal. He adds further layers of untestable hypotheses by then considering the idea that maybe the universe is constituted only of only computable mathematical structures (the Computable Universe Hypothesis). This introduces the popular idea that physical reality is to do with computations, which confuses equations with algorithms – which are quite different kinds of entities, quite apart from the issue of who decides what algorithm to use for which equation, how algorithmic computation of physical laws is carried out by natural systems, and how the halting problem will be avoided.

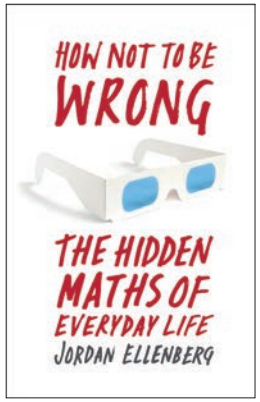
His discussion does have many interesting aspects, including his rejection of infinities in the physical universe – an idea that I (following David Hilbert) completely agree with. However most of his proposals are way beyond the bounds of testability, hence what he presents is not science, but very speculative philosophy. Nevertheless questioning the foundations in this way is a stimulating and worthwhile venture: it is a welcome contrast to the "shut up and calculate" school of physics. For that reason it can be recommended as a worthwhile read, provided one does not get irritated by some of the wilder speculations (such as talking about simulations of the Universe by short computer programs).

A final comment: it is a pity the publishers have reproduced the interesting illustrations in such a small, hardly readable form. I hope future printings will present them more clearly.

George Ellis
University of Cape Town

HOW NOT TO BE WRONG

Jordan Ellenberg, Allen Lane, 2014, £20, 468 pp, ISBN 978-1-8461-46787.



If Jordan Ellenberg's *How Not to Be Wrong* has a motto, it is that "Mathematics is the extension of common sense by other means". Ellenberg wants to show his readers how they can use mathematics to make good decisions in situations where their intuition fails them, how to ward against fallacious reasoning – in their own arguments and in the arguments of others. How, in other words, not to be wrong.

The book comprises five broad topics of linearity, inference, expectation, regression and existence. The chapters under each of these headings discuss some aspect of the topic applied to a real-world example. A major strength of the book is that the examples given are never artificial, except when they are intended to be so: toy examples designed to illustrate the general case. Students learning about percentages, who ask "when am I going to use this?", probably don't want to hear about how they can calculate their monthly spend on food as a percentage of their monthly income. They may well though be interested to know how President Obama can say that the majority of Americans support the Affordable Care act, his opponents can say that the majority of Americans oppose the Affordable Care act, and how *they can both be* (technically) *correct*. Arguably, the more people that understand this kind of advanced citizenship, the more power they hold over their governments and media not to lie to them.

Other examples discussed are: when (if ever) it is advisable to play the lottery, why so many research papers have results at significance levels clustered around p = 0.05, and how early to arrive at the airport*. Most of the mathematics in the book is introductory probability and statistics, but the applications are profound and understandable to anybody. That said, maths is not a spectator sport and, as Ellenberg warns, the lay reader can expect to work a little. Occasionally Ellenberg, a pure mathematician, cannot help but digress onto more abstract problems such as Buffon's Needle. These digressions into pure maths usually have some significance later in the text though, and they felt natural to me. However, I am also a pure mathematician, so I cannot say what effect these sections might have on the average reader.

Ellenberg has written numerous articles for non-technical publications such as *Slate* and the *Believer* over the last decade, which has honed his skill at communicating mathematics to an intelligent lay reader. As well as this, he is the author of a well-regarded literary novel, and it shows: his writing is a pleasure to read. Though his style is conversational, Ellenberg is serious about his subject and is an articulate champion of its utility, as well as its beauty. Some readers may find his chattiness and pop culture references annoying, but I am not one of them. To those readers who suspect the mathematician of being an automaton, fluent in a language that is impenetrable to mere mortals, it will surely be comforting to learn that Ellenberg too has seen (and presumably enjoyed) *Mean Girls*.

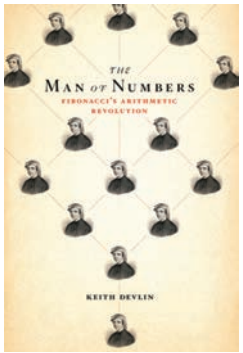
Given the venue of this review, I should perhaps also say something about what's in this book for the working mathematician. Most readers of this newsletter will not need reminding about linearity of expectations or regression to the mean, so a lot of *How Not to Be Wrong* may be redundant for them. On the other hand, Ellenberg has many interesting things to say that may not have occurred to all readers – the relationship between formalism in law and axiomatic geometry, for example. Any mathematician who would like a model for how to communicate mathematics clearly to a general audience would benefit from reading this book. Anybody interested in using mathematics to be less wrong should read it as well.

Tom Harris
University of Southampton

*This chapter is a somewhat less serious case study to illustrate the idea of units of utility. The *Daily Mail* reported it with the headline 'Spend hours in duty free or risk missing a flight? Mathematician says he has hit upon the optimal time to arrive at an airport'. The Wrong are among us.)

THE MAN OF NUMBERS: FIBONACCI'S ARITHMETIC REVOLUTION

by Keith Devlin, Walker & Company, 2014, pp 192, hb £18.99, pb £8.99,
ISBN: 978-1-4088-1576-2.



This book describes the life and work of Leonardo Pisarno (better known today as Fibonacci), who was one of the first to introduce to Europe the Hindu-Arabic numeral system in which numbers are represented in the now familiar way using ten numerals, usually 0,1,2,3,4,5,6,7,8,9. Devlin leads us through what little is known about Leonardo's life, and explains the great impact of Leonardo's work on mathematics.

Leonardo was born around 1170CE, probably in Pisa, and spent some of his youth in North Africa, where he learned a method of arithmetic that was superior to the methods based on abacuses and Roman numerals that were used in Italy. In 1202, he wrote a six-hundred page text *Liber abbaci*, the `Book of calculation', with the objective of making accessible this powerful form of arithmetic to ordinary people in his homeland -- particularly business people who carried out arithmetic as part of their work. It contained the rules of arithmetic, much as we know them today, and a wealth of practical examples. Symbolic algebra had yet to be developed, so all the examples were explained at great length in words, written as if they were

spoken from one person to another.

The excellence of *Liber abbaci*, and the effectiveness of the new system of numbers, gave Leonardo a level of prestige throughout Italy. He produced several other accomplished works, and a wealth of derivative texts by other authors followed *Liber abbaci*, each of them discussing the new form of arithmetic. By the end of the sixteenth century, the new system had spread throughout Europe, and eventually people took it for granted.

Although the main ideas of *Liber abbaci* were unoriginal, taken from many Arabic sources, Leonardo deserves credit for popularizing the new arithmetic system, which was crucial for the development of mathematics, and underpins many features of modern society. Devlin says

"Every age produces a few individuals who are both very much ahead of their time and also of their time -- the former to imagine what is possible, the latter to make it happen. Figures such as Archimedes, Copernicus, Galileo, Kepler, Newton, and Einstein. Leonardo Pisarno, Fibonacci, deserves to be in their midst."

Despite his impressive contributions to mathematics, Leonardo is today commonly called `Fibonacci' (derived from the Latin phrase *filius Bonacci*, which means `son of Bonacci') and he is often remembered for one problem from *Liber abbaci* about the growth of a rabbit population. The solution to this problem gives a well-known sequence of integers which we call the `Fibonacci numbers'.

Devlin's account of Leonardo is short (about 150 pages of actual text) and well written. It is suitable for all: even those without knowledge of or much interest in mathematics. The reader learns some of the history of the number system widely used today, and also the little history we know of Leonardo himself. Devlin makes a strong case for the greatness of Leonardo's achievements, but I need more convincing that he deserves quite the level of credit that Devlin gives him. Nonetheless, this is an attractive and thoroughly researched work, sure to appeal to historians and mathematicians alike.

Ian Short
Open University

CALENDAR OF EVENTS

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

SEPTEMBER 2014

1 Function Theory Meeting, London (438)
2–3 British Logic Colloquium PhD Day, University of Central Lancashire (438)
3–5 British Logic Colloquium, University of Central Lancashire (438)
3–5 Stable Homotopy Theory Conference, Manchester (437)
3–5 Numerical Linear Algebra and Optimisation IMA Conference, Birmingham (438)
3–5 Jordan Geometric Analysis and Applications, Queen Mary, University of London (432)
3–5 Operator Theory Workshop, Queen's University, Belfast (435)
5–6 Caucasian Mathematical Conference Tbilisi, Georgia
6 Mathematics and the First World War, LMS Meeting, London (439)
6–11 British Science Festival, Birmingham (438)
8–10 British Topology Meeting, Southampton (438)
8–12 Generalized Functions, Southampton (438)
8–12 Derived Categories Introductory School, Warwick (439)
10–12 Interdisciplinary Approaches to Understanding Microbial Communities INI Workshop, Cambridge (437)
10–12 Mathematical Modelling of Fluid Systems IMA Conference, Bristol (438)
11–12 Valediction to Jeremy Gray, Open University (439)
11–12 Recent Advances in Discontinuous Galerkin Methods, Reading (438)
11–12 Heilbronn Annual Conference 2014, Bristol (438)
12 Limit Theorems, Probability Approximations and Related Areas Workshop, Heriot-Watt University (438)
15–17 Partial Differential Equations: Geometric Analysis, Calculus of Variations, Harmonic Analysis Conference, Sussex (439)
15–19 UK Probability Meeting from Microscopic Randomness to Macroscopic Phenomena, Imperial College London (438)
17–19 Huxley Meeting on Analytic Number Theory, Cardiff (438)
18 Additive Combinatorics Meeting, Bristol (437)
18 Recent Advances in Orthogonal Polynomials and its Interactions with Integrable Systems Meeting, University of Kent (437)
18–19 Post-Quantum Research Workshop, INI, Cambridge (438)
22–24 British Algebraic Geometry Meeting, Warwick (438)
22–26 Bounded Gaps Between Primes, LMS–CMI Research School, Oxford (437)
24 LMS Popular Lectures, Birmingham (439)
25 LMS–WIMCS Analysis Day, Swansea (439)
26–27 Integrable Systems in Newcastle Meeting, Northumbria University (439)
28–2 Oct Advances in Probability Clay Research Workshop, Oxford (436)
29–3 Oct Analytic Number Theory Clay Research Workshop, Oxford (436)
29–3 Oct Functional Transcendence around Ax–Schanuel Clay Research Workshop, Oxford (436)
29–3 Oct Symplectic Topology Clay Research Workshop, Oxford (436)

OCTOBER 2014

1 Clay Research Conference, Oxford (436)
8 Brian Hartley Memorial Day, Manchester (439)
8 Continued Fractions and Geometry of Lattices Meeting, Liverpool (439)
8–10 Maxwell Institute Graduate School on Evolution Equations, Edinburgh (439)
17–18 Cluster Algebras and Preprojective Algebras Workshop, Cardiff (439)
22 Decision Problems for Linear Recurrence Sequences, BCS–FACS Evening Seminar, London (439)
27–29 Methods for Mathematical and Empirical Analysis of Microbial Communities INI PhD Summer School, Cambridge (438)
30 History of Statistics, BSHM–Gresham College Joint Meeting, London (437)
30–31 Structure, Function and Dynamics in Microbial Communities INI Workshop, Cambridge (438)
31 Multiscale PDE Systems of Fluid Models and Applications in Geophysics, Surrey (439)

NOVEMBER 2014

14 LMS AGM, London
22 Early Career Mathematicians' Autumn IMA Conference, Queen Mary University London (438)
26–28 Engineering and Control of Natural and Synthetic Microbial Communities, INI Workshop, Cambridge (439)

DECEMBER 2014

8–10 Applications of Game Theory IMA Conference, Oxford (438)
15–17 Maths in Signal Processing IMA Conference, Birmingham (438)
16–17 Mathematical Challenges of Big Data IMA, Woburn House, London (438)

JANUARY 2015

5–16 Periodic, Almost-Periodic, and Random Operators Introductory School, INI, Cambridge (439)
6–9 Bruhat-Tits Buildings Winter Meeting, Imperial College London (439)
9 Research in Mathematics and its Applications IMA Conference, Bath (438)
12–23 Random Geometry Instructional Workshop for Younger Researchers, INI, Cambridge (439)
26–30 Conformally Invariant Scaling Limits, INI Workshop, Cambridge (439)

FEBRUARY 2015

4–8 CERME 9, Prague (439)

MARCH 2015

19 Mathematics 2015 IMA Conference, Mary Ward House, London (438)
30–31 Flood Risk Assessment IMA Conference, Swansea (438)
30–2 Apr Joint Meeting of the BMC and BAMC, Cambridge (438)

APRIL 2015

20 Mathematical Education of Engineers IMA Conference, Loughborough (438)

JUNE 2015

10–12 Barriers and Enablers to Learning Maths IMA International Conference, Glasgow (438)
10–13 AMS–EMS–SPM International Meeting, Portugal (439)
18–19 Mathematics in Finance IMA Conference, Manchester

JULY 2015

13–17 Conference on Stochastic Processes and their Applications, Oxford

SEPTEMBER 2015

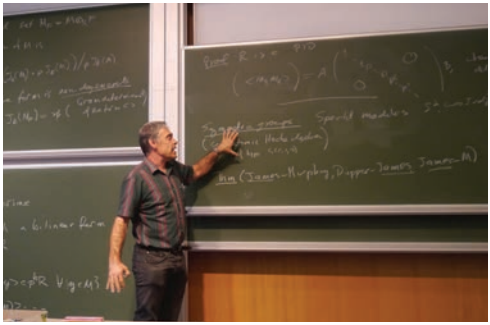
1–4 Numerical Methods for Simulation IMA Conference, Oxford
9–11 Mathematics of Robotics IMA Conference, Oxford

LMS-FUNDED MEETING

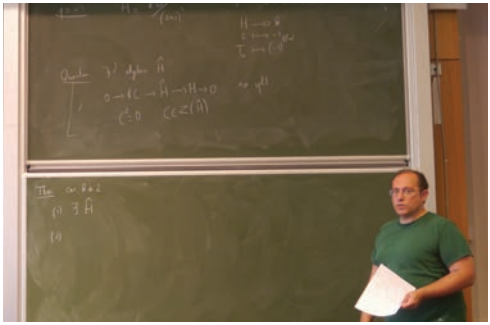
Representations of Symmetric Groups, Hecke Algebras and KLR Algebras

held at the University of Birmingham from 14 to 16 July 2014

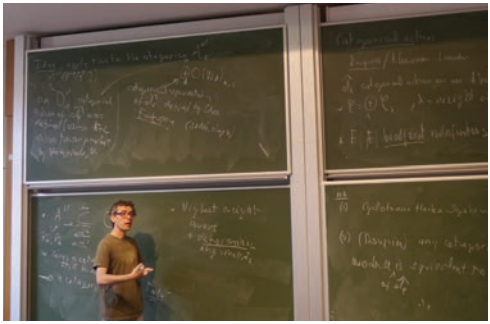
(report on page 25)



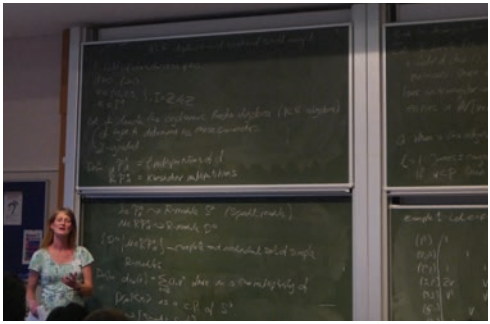
Andrew Mathas (University of Sydney)
Jantzen filtrations for cyclotomic Hecke algebras



Ivan Marin (Université de Picardie Jules Verne)
A central extension of the Hecke algebra at q=-1



Eric Vasserot (Université de Paris 7)
Categorical actions and Cherednik algebras



Sinéad Lyle (University of East Anglia)
Blocks of KLR algebras of small defect

Attendees