



LMS MEMBERS AMONG NEW ROYAL SOCIETY FELLOWS

The Royal Society has released details of its newly-appointed Fellows, among whom were LMS members Professors **Martin Bridson** (University of Oxford), **Marcus du Sautoy** (University of Oxford) and **Caroline Series** (University of Warwick). Other elected Fellows included Professors Christl Donnelly (Imperial College London), Artur Ekert (University of Oxford) and Lakshminarayanan Mahadevan (Harvard University).

German mathematician Professor Gerd Faltings (Max Planck Institute, Bonn) was elected a Foreign Member.

The Fellowship of the Royal Society is made up of the most eminent scientists, engineers and technologists from or living and working in the UK and the Commonwealth. Fifty new Fellows and ten Foreign Members were announced this year.

Professor Simon Tavaré, President of the London Mathematical Society and himself a Fellow of the Royal Society, said of the announcement, "It is wonderful to see so many mathematical scientists elected this year, a real tribute to the strength and importance of our discipline".

Professor Tavaré, congratulated the new fellows on their election on behalf of the London Mathematical Society.

For the full list of new Royal Society Fellows visit <https://royalsociety.org/news/2016/04/new-fellows-2016/>.

The new Fellows

Martin Bridson is Whitehead Professor of Pure Mathematics at Oxford and a fellow of Magdalen College. He received his PhD from Cornell and subsequently held positions at Princeton, Geneva, and Imperial College London. A recipient of the London Mathematical Society's Whitehead Prize and the Royal Society's Wolfson Research Merit Award, his research spans geometry, topology and group theory. He played a leading role in establishing geometric group theory as a major field of mathematics, proving landmark theorems and solving long-standing problems in adjacent areas. <http://people.maths.ox.ac.uk/bridson/>

Marcus du Sautoy is the Simonyi Professor for the Public Understanding of Science and Professor of Mathematics at the University of Oxford and a Fellow of New College. His research uses classical tools from number theory to explore the mathematics of symmetry. In 2001 he was awarded the London Mathematical Society's Berwick prize.

He is author of four popular science books: *The Music of the Primes* (2003), *Finding Moonshine* (2008), *The Number Mysteries* (2010) and *What We Cannot Know* (2016). He has presented numerous radio and TV series including a four part landmark TV series for the BBC called *The Story of Maths*. In 2009 he was awarded the Royal Society's Faraday Prize, the UK's premier

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- 8 July: Hardy Lecture & Society Meeting, London [page 18](#)
- 21 July: Society Meeting at the 7ECM, Berlin [page 17](#)
- 15 September: Midlands Regional Meeting, Birmingham [page 31](#)
- 21 September: Popular Lectures, Birmingham [page 11](#)
- 11 November: Graduate Student Meeting, London
- 11 November: Annual General Meeting, London
- 20 December: SW & South Wales Regional Meeting, Bath



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award for excellence in communicating science. He received an OBE for services to science in the 2010 New Year's Honours List. In 2014 he received the joint LMS/IMA Christopher Zeeman Medal for his contributions to the public understanding of the mathematical sciences. <http://people.maths.ox.ac.uk/dusautoy/>.

Caroline Series is a pure mathematician known for her work on symbolic coding of geodesics on hyperbolic surfaces and for novel contributions to the study of three dimensional hyperbolic manifolds via their fractal limit sets. She was a Kennedy Scholar at Harvard and was awarded a Junior Whitehead Prize by the London Mathematical Society in 1987 and its first Senior Anne Bennett Prize in 2014. <http://homepages.warwick.ac.uk/staff/C.M.Series/>

Christl Donnelly is a statistician and epidemiologist studying the spread and control of infectious diseases, with a particular interest in outbreaks. She studied mathematics at Oberlin College and biostatistics at Harvard School of Public Health. Following a lecturer position at the University of Edinburgh she joined the Wellcome Trust Centre for the Epidemiology of Infectious Diseases at University of Oxford. Since 2000, she has worked at Imperial College London. www.imperial.ac.uk/people/c.donnelly.

Artur Ekert is Professor of Quantum Physics at the Mathematical Institute, University of Oxford. His research looks at information processing in quantum-mechanical systems. His invention of entanglement-based quantum cryptography encouraged research efforts worldwide and continues to inspire new research directions. He was awarded the 1995 Maxwell Medal and Prize by the Institute of Physics and the 2007 Hughes Medal by the Royal Society. www.arturekert.org/

Lakshminarayanan Mahadevan is a professor at Harvard University. His work attempts to understand the geometrical and dynamical patterns of shape and flow in physical and biological matter, particularly at the observable scale of "middle earth". He started his independent career at MIT, and was then the inaugural Schlumberger Chair in Complex Physical Systems at Cambridge University and a Professorial Fellow at Trinity, before coming to Harvard University, where he has been since 2003. www.seas.harvard.edu/softmat/

Foreign Member

Gerd Faltings is a mathematician at the Max Planck Institute for Mathematics. His first mathematical work was in commutative algebra. He later became interested in Arakelov theory and his first result was a Riemann-Roch theorem for arithmetic surfaces. Later the Mordell conjecture for number

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fields could be shown, using p-adic Galois representations.

Later he replaced certain ad hoc arguments about compactifications of moduli spaces and p-adics by systematic treatments. Also in diophantine equations he extended ideas of

Vojta about diophantine approximation to higher dimensions. Finally inspired by lectures of E.Witten he got interested in vector bundles on curves. He has received various awards, including the Fields Medal in 1986. www.hcm.uni-bonn.de/people/profile/gerd-faltings/.

GENERAL MEETING

There will be a General Meeting of the Society on Friday 8 July 2016 at 3.30 pm, to be held at JZ Young Lecture Theatre, University College London, Anatomy Building, Gower Street, London WC1E 6BT. The business shall be:

- 1) the appointment of Scrutineers
- 2) to approve the minutes of the Special General Meeting held on 5 February 2016
- 3) announcement of Council's recommenda-

tion for Election to Honorary Membership
4) announcement of LMS prize winners for 2016

The General Meeting, at which Professor Jacob Lurie will give a talk, will be followed by a Society meeting. It is hoped that as many members as possible will be able to attend.

Fiona Nixon
Executive Secretary

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HYPERBOLIC CROCHET AT THE UNIVERSITY OF SHEFFIELD

An exhibition on *Hyperbolic Geometry via Crochet* will be presented in Sheffield from the 14 to 25 September 2016, in the context of the *Festival of the Mind*. Following ideas from Daina Taimina (Cornell), a forest floor will be recreated in crochet and knitting, demonstrating the hyperbolic shape of many mushrooms, flowers, leaves that appear in nature.

Visit the website www.jotz-lean.staff.shef.ac.uk/hyperbolic_crochet.html if you are interested or if you wish to contribute as a crafter. Crafters will not be remunerated but donations will be made to charities of their choice. This event will be funded by the University of Sheffield and supported by staff from the School of Mathematics and Statistics in collaboration with local artist Kerry Rose.



MATHEMATICS POLICY ROUND-UP

May 2016

RESEARCH

Clause in government grants

Earlier in 2016 the government stated that a new clause was to be inserted into all new and renewed grant agreements 'to make sure that taxpayer funds are spent on improving people's lives and good causes, rather than lobbying for new regulation or using taxpayers' money to lobby for more government funding'.

Universities and Science Minister, Jo Johnson MP has responded recently to a statement in the House of Lords on the clause in government grants to confirm that it is not the government's intention for the Research Councils, the Higher Education Funding Council for England (HEFCE) or the National Academies to be covered by the clause. More information is available at <http://tinyurl.com/h62w6jb>.

The Cabinet Office has now stated that it is 'pausing the implementation [of the clause] pending a review of the representations made and will take a decision on the form of the clause following this review'.

SCHOOLS AND COLLEGES

Teacher survey: professional development learning journeys

The Advisory Committee on Mathematics

Education (ACME) has convened an expert panel to develop a project on professional development learning journeys for all teachers of mathematics, from primary through to Further Education. The Expert Panel will produce guidance for teachers and senior leaders and for those that commission and provide professional development. As part of the project the expert panel launched a teacher survey to find out more about the professional development experiences of teachers around England. The survey closed in mid-May. More information is available at <http://tinyurl.com/jqq9qh8>.

OTHER

Institute for Fiscal Studies report

The report titled *How English domiciled graduate earnings vary with gender, institution attended, subject and socio-economic background* looks at the link between earnings and students' background, degree subject and university attended. One of the key findings is that 'subjects like medicine, economics, law, mathematics and business deliver substantial premiums over typical graduates'. The full report is available at <http://tinyurl.com/h8nsb5y>.

Dr John Johnston

Joint Promotion of Mathematics

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EUROPEAN NEWS

Bull Prize 2015

The *Bull-Joseph Fourier Prize* 2015 has been awarded to Victorita Doléan, Pierre Jolivet, Frédéric Hecht, Frédéric Nataf and Pierre-Henri Tournier for their work on ultra-fast medical diagnosis of brain aneurysms by means of new medical imaging technologies. The second prize was awarded to Antoine Levitt, researcher at INRIA, for his work on optimization of the performances of software dedicated to molecular modelling in order to create new materials. Further information is available on the website <http://tinyurl.com/hcwrbjd>.

SIAM Fellow

Maria J. Esteban from the French CNRS and the University of Paris-Dauphine, former president of the French learned society SMAI and currently president of ICIAM, was nominated *SIAM Fellow* of the class of 2016 for 'distinguished research in partial differential equations and for advancing the profile of applied mathematics internationally'. A list of all nominated SIAM Fellows 2016 is available on the website <http://tinyurl.com/haw2d5k>.

David Chillingworth
LMS/EMS Correspondent

PRINCIPIA

It was a normal busy summer day at Woolsthorpe Manor nearly two years ago when a visitor brought in a carrier bag containing two old books. She was bequeathing them to the National Trust at her late father's request.

On closer inspection the two old books turned out to be something very special: two volumes of the first English translation by Andrew Motte of Isaac Newton's great work *Principia Mathematica*, dated 1729.

Principia is a collection of Newton's important work carried out during his 'Year of Wonders' (1665/66) - when he returned to Woolsthorpe to escape the plague in Cambridge. Motte's English edition was the first time more people could read and share Newton's ideas.

Thanks to the generosity of the Grantham Association (a local National Trust support group), their donation has enabled us to have the two volumes restored. The books have been re-bound with one new cover and the gold lettering transferred from the original bindings.

They are now back at Woolsthorpe Manor and on display alongside a third edition *Principia* (in Latin), dated 1726 to mark the start of our celebrations of the 350th anniversary of the 'Year of Wonders'.

As well as a chance to see the restored *Principia*, Woolsthorpe Manor is trying out some new ideas that are a very different way to experience Isaac Newton's story. Or maybe just spend some time out in the historic orchard near the famous tree that inspired Newton's theory of gravity.

Woolsthorpe Manor was the birthplace of Isaac Newton and where he developed some of his best known works, including the theory of gravity and experiments on splitting light.

Find out more at www.nationaltrust.org.uk/woolsthorpe-manor.

Margaret Winn
Conservation Manager
Woolsthorpe Manor

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The apple tree



Woolsthorpe Manor



Principia before restoration



Principia after restoration



LONDON
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LMS GRADUATE STUDENT MEETING

**London (UCL, JZ Young, Lecture Theatre,
Gower Street, London)**
8th July 10.00 - 15.30

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

Speakers: Ian Grojnowski (Cambridge) and Ambrus Pal (Imperial College)

Student Talks (Six slots available)

Students are invited to give short talks (15 minutes) aimed at a general mathematical audience. Prizes will be awarded for the best two talks. If you would like to give a talk, please email Anthony Byrne (lmsmeetings@lms.ac.uk) by 24 June.

To register, please email Anthony Byrne (lmsmeetings@lms.ac.uk) by email by 1 July. Places are free and all refreshments including lunch will be provided.

Travel grants of up to £50 are available for students who attend both the Graduate Student Meeting and the LMS General Meeting.

The LMS General Meeting is a Society Meeting, which is open to all.

Tony Scholl (Cambridge) will give the first lecture on *Plectic Structures in Number Theory and Geometry*. **Jacob Lurie (Harvard)** will give the **2016 Hardy Lecture**; *Weil's Conjecture for Function Fields*.

The meeting will also be held at the JZ Young Lecture Theatre, UCL.

After the Society Meeting, there will be a reception at De Morgan House, 57-58 Russell Square WC1B 4HS.

For further details see: www.lms.ac.uk/content/society-meetings

CLAY RESEARCH AWARDS 2016

The Clay Mathematics Institute announces two 2016 Clay Research Awards.

The joint award to **Mark Gross** (Cambridge) and **Bernd Siebert** (Hamburg) is made in recognition of their ground breaking contributions to the understanding of mirror symmetry, in joint work generally known as the 'Gross-Siebert Program.' It has its origins in surprising predictions of non-perturbative dualities in string theory: that the properties of certain interesting geometries, notably Calabi-Yau manifolds, are reflected in counter-intuitive ways in partner geometries ('mirror manifolds').

The award to **Geordie Williamson** (Bonn) is made in recognition of his groundbreaking

work in representation theory and related fields. In particular, the award recognises two major breakthroughs. First, his proof, with Ben Elias, of Soergel's conjecture on bimodules associated to Coxeter groups. The second is the construction (building on earlier work with Ben Elias and Xuhua He) of counterexamples to the expected bounds in Lusztig's conjectured character formula for rational representations of algebraic groups in positive characteristics that grow exponentially with the rank of the group.

The awards will be presented at the 2016 Clay Research Conference at the University of Oxford on Wednesday 28 September 2016.

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Mark Gross



Bernd Siebert



Geordie Williamson

ROLLO DAVIDSON PRIZE 2016

The Rollo Davidson Trustees have pleasure in announcing the award of the 2016 Rollo Davidson Prize jointly to:

Omer Angel (University of British Columbia) for his many contributions to stochastic geometry and in particular to random maps and triangulations

Jean-Christophe Mourrat (ENS Lyon) for significant new results in stochastic homogeni-

zation and in singular stochastic partial differential equations and associated scaling limits

Hendrik Weber (University of Warwick) for a series of significant new results in the theory of singular stochastic partial differential equations and associated scaling limits.

See photos at the top of the page opposite.



Omer Angel



Jean-Christophe Mourrat



Hendrik Weber

Further details of the Rollo Davidson Trust may be found at www.statslab.cam.ac.uk/Rollo/.

FERRAN SUNYER I BALAGUER PRIZE 2017

The Ferran Sunyer i Balaguer Prize will be awarded for a mathematical monograph of an expository nature presenting the latest developments in an active area of research in mathematics. The prize consists of €15,000

and the winning monograph will be published in Birkhäuser series *Progress in Mathematics*.

Deadline for submission is **1 December 2016**. For further information visit the website at <http://ffsb.iec.cat>.

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BRITISH MATHEMATICAL COLLOQUIUM 2016

Report

What impact do we as mathematicians have on the world around us? How can we increase and communicate that impact? These questions are of especial interest to UK mathematicians and naturally came to one's mind during the 2016 edition of the British Mathematical Colloquium, held in Bristol from 21 to 24 March. This year's BMC was proudly organized by Tim Dokchitser and Lynne Walling in partnership with the LMS, as well as the University of Bristol, the Clay Institute, and the Heilbronn Institute. Roughly 250 participants from the UK and the rest of the world came out to see the talks, including two public lectures by Professors Kristin Lauter of Washington/Microsoft

Research and Hendrik Lenstra of Leiden.

Lauter's talk dared us to dream big in our search for impact. For years, biology's appetite for new mathematical techniques has been increasing. More than just statistics, areas like knot theory and algebraic geometry have found applications. Lauter described how she and her team discovered a new application for their work. There are now companies who will sequence your genome for an ever-decreasing rate. But to whom do you trust your DNA? Do you want to keep it secure while uploaded to the cloud? If so, you need homomorphic encryption so that basic operations can be performed on your DNA without decrypting it. Lauter's team

won a contest on homomorphic encryption, and international acclaim along with it. There was an interesting side-story about interfacing with non-mathematicians and how much rigour they like. Suffice it to say that commutative diagrams are not as reviled as you might expect.

To be sure, not every talk dealt with impact or direct applications. Take for instance Lenstra's talk on profinite number theory. Lenstra quipped at one point that since retirement the application he'd been trying hardest to advance was his own amusement. In his talk, Lenstra described a ring that he called 'zet-hat' or 'the pro-finite completion of the integers'. This may sound daunting, but he managed it with only factorial series of integers. Lenstra made this ring into a topological space and considered its analytic functions. The analytic functions here are very different from real- or complex-analytic functions, but this other type of analysis has found many applications in areas like the Langlands programme. Lenstra did not



LMS stand

pursue this path, instead showing how the function defining the Fibonacci numbers is analytic in this context.

This year's BMC gave a wide view of mathematics in the UK from algebraic to analytic, engaging with the public while deepening connections within mathematics. Until next year when the BMC goes to Durham.

Jim Stankewicz
University of Bristol



Professor Kristin Lauter



Signing the Membership Book



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LMS Popular Lectures 2016

LONDON (UCL Institute of Education)

29th June 19:00

BIRMINGHAM (University of Birmingham)

21st September 18:30

Heather Harrington (University of Oxford) - *The shape of data in biology*. In recent years, areas of pure mathematics (maths for maths' sake) such as algebra, geometry and topology, are being applied to problems in biology. Dr Harrington will describe how to understand living systems using cutting-edge mathematics.

Julia Wolf (University of Bristol) - *One, Two, Red, Blue*. Ever wondered why noughts and crosses always results in a draw? In this talk Dr Wolf will explore the surprisingly deep mathematics behind this popular game and its variants.

LONDON: Commences at 7.00 pm, refreshments at 8.00 pm, ends at 9.30 pm

Admission is free, with ticket. Register by Thursday 23 June.

BIRMINGHAM: Commences at 6.30 pm, refreshments at 7.30 pm, ends at 9.00 pm

Admission is free, with ticket. Register by Thursday 15 September.

Register for tickets online at:
www.lms.ac.uk/events/popular-lectures

THE INAUGURAL LMS HIRST LECTURE

Report

Wednesday 20 April 2016 in St Andrews, Scotland

As part of the London Mathematical Society 150th birthday celebrations in 2015, Council created a new prize, the **Hirst Prize and Lectureship for the History of Mathematics**. It is awarded in recognition of original and innovative work in the history of mathematics. The name commemorates Thomas Archer Hirst, FRS (1830–1892). One of the founding fathers of the LMS, he served as its first Vice-President, worked on its Council for twenty years, as Honorary Treasurer for much of that time, and served as President 1872–74. The first award was made at this meeting by Professor Ken Brown, Vice-President, to Dr John O'Connor and Professor Edmund Robertson for their creation, development and maintenance of the MacTutor History of Mathematics web site, hosted at St Andrews.

There were about 60 members and guests present to hear a lovely programme of two lectures on topics in the history of mathematics, both focused very appropriately on biography. The warm-up act (as he himself described it) was a talk by Dr Mark McCartney (University of Ulster) titled *Sir Edmund Taylor Whittaker (1873–1956): Laplace's Equation, Silver Forks and Vogue*. We learned of Whittaker's huge breadth

of scholarship, in science, mathematics, astronomy, philosophy, religion, history of physics and mathematics, and gardening. We learned of his great influence as a teacher, and of his introduction of numerical analysis into the syllabus. We learned also of his extensive public persona. How his success at giving a general solution of Laplace's Equation was not only published three times in mathematical and physical learned journals, but also made it into regional newspapers, such as *The Yorkshire Evening Post*, where it appeared on the front page in gloriously garbled form. And his writings on Christianity appeared in *The Listener*, in *Vogue*, and in other organs that one does not usually associate with great mathematicians. And silver forks? This referred to an episode where Whittaker's silver forks were taken and auctioned to pay the rates which, as a highly religious man of principle, he had refused to pay because of a disagreement with his local council.

After an agreeable break for refreshments and discussion, we had the Hirst Lecture itself, *History of Mathematics: Some Personal Thoughts*, delivered on behalf of both prize-winners by Professor Robertson.



Mark McCartney



Edmund Robertson



Reception

Their interest in history of mathematics had been stimulated by their teaching, by their wish to show students where the subject came from, but also that the polish of modern presentations of syllabus topics hides the difficulties of mathematical discovery. Professor Robertson focussed on the difficulties of doing history of mathematics. Where evidence is feeble, as is the case for much ancient history, historians cannot be certain and must agree to disagree. There are several theories about

Euclid, for example. Was this one ancient philosopher or a group? If a group, what was the mechanism for producing *The Elements*? Insofar as evidence exists it is mostly circumstantial, and to some extent contradictory.

And what is "truth" in history of mathematics? Most complaints about the MacTutor biographies concern nationality. Should Lagrange be described as Italian or French? National claims focus on different aspects of his life and work. Similarly, Eurocentric bias has been rife for a very long time. A most interesting case is that of Charles Whish (1795–1833), an employee of the East India Company, whose discoveries that sophisticated computations of the number π had been made from series expansions many years before that was done in Europe, but was told by his superiors who did not respect Indian people that this was "too ridiculous to deserve attention". Whish's Euroscepticism is now accepted as fully justified.

This was as promised, a delightfully personal lecture and an excellent inauguration of the Lectureship, which Council has now decided to continue to award, every two years from 2018.

Peter Neumann
The Queen's College, Oxford



Reception

LMS WOMEN IN MATHEMATICS DAYS 2016

Reports

The Women in Mathematics Day is an annual event organised by the London Mathematical Society for women in mathematics to meet together for a day of talks and discussion groups. This year the Women in Mathematics Committee arranged two LMS Women in Mathematics Days – at Microsoft Research in Cambridge on 15 April and at the International Centre for Mathematical Sciences in Edinburgh on 22 April. The events were intended to demonstrate to early career women mathematicians the different possibilities for mathematical careers in academia and industry. The Society was very grateful to receive sponsorship for the events from the International Centre for Mathematical Sciences, Microsoft Research and Wiley. See photos on the back page.

LMS Women in Mathematics Day Cambridge, 15 April 2016

This year the LMS Women in Mathematics Day took place on 15 April at the Microsoft Research Centre in Cambridge. The day highlighted success stories by women in mathematics. Sara-Jane Dunn from Microsoft Research Cambridge welcomed us all to a day of celebration and a programme packed with excellent female speakers and their accomplishments.

The morning session contained two main speakers. Phillippa Hiscock from Roke Manor Research Limited started the session with a talk about her career path in Operational Research and her achievements. She finished her talk with an encouragement to women in mathematics to be self-confident. The second speaker was Apala Majumdar from University of Bath giving the Anne Bennett

Prize talk. She told a very clear success story about staying in academia doing very theoretical work.

After the morning session we had a nice lunch in the foyer of the Microsoft Research Centre. During lunch there was a poster session and everyone could vote for the best poster. At the end of the day it was revealed that Milena Kremakova from the University of Warwick won this year's poster prize with her poster on *Mathematicians in Love: Are there solutions to the two (and more) body problem?* (Milena's winning poster is included on pages 20–21.)

The lunch break also featured a photo session. David Martí Pete and Vasiliki Evdoridou from the Open University in Milton Keynes made portrait photos of the participants for their individual success stories in mathematics which will be on the LMS webpage.

The afternoon session consisted of early career research contributed talks. Farkhanda Afzal from Baihang University, Joanne Andrade from Imperial College London, and Rachael Bonnebaigt from the University of Cambridge all gave short contributed talks giving insight into their research topics and their achievements. The talks gave inspiration for the panel discussion which followed. The panel discussion raised questions such



Milena Kremakova (University of Warwick), poster competition winner, and Eugenie Hunsicker, Chair of the Women in Maths Committee

as which career path to choose and how to collaborate with private companies outside academia. The day was closed by Nicola Richmond from GlaxoSmithKline who gave insight into how ideas from mathematics can be relevant to pharmaceutical research.

During the day we got a good overview of how different career paths in mathematics may look. We were inspired to stay self-confident and to celebrate our own success. As

one of the organisers Eugenie Hunsicker said: "Just to be at the Women in Mathematics event is a success". I will definitely encourage other women and also men to attend these meetings to find out more about being a woman in mathematics and how to enjoy even small achievements.

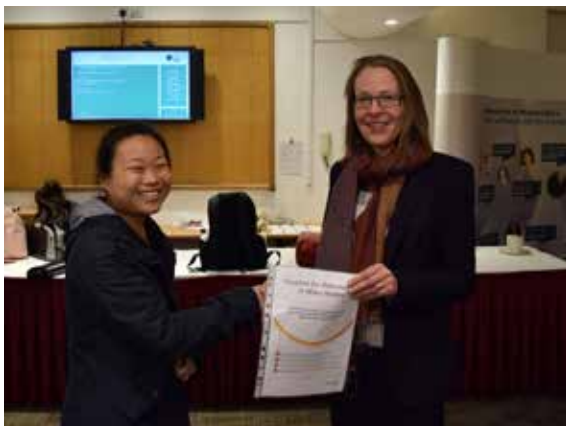
Marie Foged Schmidt
Visiting PhD student at DAMTP, University
of Cambridge

LMS Women in Mathematics Day Edinburgh, 22 April 2016

On 22 April, we had the pleasure of attending the LMS Women in Mathematics Day 2016 in the beautiful city of Edinburgh. This was a first for both of us, despite it being an annual event, and we thoroughly enjoyed it. After a warm welcome and introduction by Tara Brendle from the University of Glasgow, we entered a day full of interesting talks by women from a wide range of mathematical disciplines.

The morning featured two very different talks: Sabrina Blackwell from TWI Ltd began the day by telling us about her own career path and how a PhD in mathematics prepared her for a career in engineering, before Susan Sierra, from the University of Edinburgh, gave us a glimpse into her work in noncommutative algebraic geometry. In spite of the contrasting content of the talks, there were some key themes running through both which set the tone for the day: the passion both speakers have for their work, the personal stories of the women behind interesting mathematics (both the speakers themselves, and the sequence of mathematical women who had contributed to Susan's field, most notably Emmy Noether), and how following their own individual interests had led to unexpected opportunities – mathematically or professionally – for both speakers.

During lunch, we had the opportunity to



Wei En Tan (University of Birmingham), poster competition winner, and Tara Brendle, LMS Council member

study the candidates for a poster competition sponsored by Wiley. The posters were contributed by various participants of the event and covered a range of topics, from positional games and noncommutative geometry to stability of partial differential equations. After a close round of voting, Wei En Tan, from the University of Birmingham, was awarded a £150 Wiley book voucher for her poster entitled *Waiters, Clients and the Probabilistic Intuition*.

The afternoon programme began with three diverse contributed talks. Rachel Boyd, from the University of Aberdeen, showed us how to calculate the homology of Coxeter groups, Smita Sahu, from the University of Durham, introduced us to an efficient filtered scheme for Hamilton-Jacobi equations, and Kitty Meeks,

from the University of Glasgow, revealed how we can use graph theory to save cows.

We then entered into a career panel discussion, where Sabrina Blackwell, Anne Taormina (University of Durham), Susan Sierra, Kitty Meeks and Lynsey Thornton (Tesco Bank) answered questions from participants. The discussion was friendly and encouraging and it was invaluable to hear women mathematicians who love what they do talk about their experiences and impart important careers advice to us all.

Anne Taormina rounded off the day with a somewhat cryptically entitled talk on *Mathieu Moonshine*. While she kept us guessing how

to interpret the title until the very end, we were taken on an exciting tour through some of her work in string theory, before the grand reveal in which we learnt of a surprising and beautiful connection between group theory and theoretical physics.

Overall, the event was a wonderful opportunity to meet and get to know other women from all over the country, pursuing mathematics in both industry and academia. We highly recommend this event to mathematicians at any stage of their career and hope to attend again next year.

Kitty Meeks, University of Glasgow
Wei En Tan, University of Birmingham

VISIT OF ALEXANDER SCHUSTER

16

Professor Alexander Schuster (San Francisco State University, California) whose visit was originally taking place in June, will instead be visiting the UK from 9 to 19 July 2016. His research consists of the study of spaces of a single complex variable and operators that act on them with emphasis on functions analytic in the unit disk, entire functions, Bergman, Bloch and Fock spaces, and concrete operators such as multiplication, composition, Hankel and Toeplitz operators. During his visit Professor Schuster will visit and lecture at:

- University of Reading, Monday 11 July (contact Jani A. Virtanen: j.a.virtanen@reading.ac.uk)
- King's College London, Tuesday-Wednesday 13-14 July (contact Alexander Pushnitski: alexander.pushnitski@kcl.ac.uk)
- Leeds University, Friday 15 July (contact Vladimir V. Kisilv: kisilv@maths.leeds.ac.uk)

For further details contact Jani A. Virtanen (j.a.virtanen@reading.ac.uk) or see www.reading.ac.uk/math-and-stats/news/math-seminars.aspx. The visit is supported by an LMS Scheme 2 grant.



www.demorganhouse.org.uk

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



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LONDON
MATHEMATICAL
SOCIETY
EST. 1865

Society Meeting & Reception

At the 7ECM, Berlin, Germany Thursday 21 July 2016

Lecture Theatre, Main Building, TU Berlin

4.30 Opening of the meeting, **Terry Lyons (Oxford)**

From Hopf Algebras to Machine learning via Rough Paths

Rough path theory aims to build an effective calculus that can model the interactions between complex oscillatory (rough) evolving systems. At its mathematical foundations, it is a combination of analysis blended with algebra that goes back to LC Young, and to KT Chen. Key to the theory is the essential need to incorporate additional non-commutative structure into areas of mathematics we thought were stable. At its high points, there are the regularity structures of Martin Hairer that allow robust meaning to be given to numerous core nonlinear stochastic pdes describing evolving interfaces in physics.

Classic results, by Clark, Cameron and Dickinson, demonstrate that a nonlinear approach to the data is essential. Rough path theory lives up to this challenge and can be viewed as providing fundamentally more efficient ways of approximately describing complex data; approaches that, after penetrating the basic ideas, are computationally tractable and lead to new scalable ways to regress, classify, and learn functional relationships from data. One non-mathematical application that is already striking is the use of signatures on a daily basis in the online recognition of Chinese Handwriting on mobile phones.

6.00 Reception (Ticket required)

LMS members will have the opportunity to sign the Membership Book which dates back to 1865. For a ticket to the reception, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk)

The London Mathematical Society is the UK's learned society for mathematics. Founded in 1865 for the promotion and extension of mathematical knowledge, the Society has a membership of over 2500 drawn from all parts of the UK and overseas. Its principal activities are the organisation of meetings and conferences, publication of journals and books, provision of financial support for mathematical activities, and contribution to public debates on issues related to mathematics, research and education.
London Mathematical Society, De Morgan House, 37-58 Russell Square, London WC1B 4HS.
Tel +44 (0)20 7637 3686; Fax: +44 (0)20 7323 3655; Email: lms@lms.ac.uk; Web: www.lms.ac.uk; Registered charity no. 252660



LONDON
MATHEMATICAL
SOCIETY
EST. 1865

General Society Meeting & Hardy Lecture 2016

Friday 8 July 2016

BMA House, Tavistock Square, London (Nearest Tube: Euston)

- 3.30 Opening of the meeting and LMS business, including the announcement of the 2016 Prize winners (open to all)

Tony Scholl

Plectic Structures in Number Theory and Geometry

Abstract: Many spectacular results in number theory have been obtained through the study of Shimura varieties. These are algebraic varieties, defined initially as quotients of Hermitian symmetric spaces by arithmetic groups, which have a very rich arithmetic structure. Joint work with Jan Nekovář suggests that there a large class of Shimura varieties which even more symmetry. This "plectic structure" should have striking arithmetic consequences. In this talk we will describe this (for now largely conjectural) picture.

- 4.45 Tea/Coffee

- 5.15 Jacob Lurie (Harvard) – Hardy Lecture

Weil's Conjecture for Function Fields

Abstract: Let q be a positive definite quadratic form with integer coefficients. We say that another such quadratic form q' is in the genus of q if, for every positive integer n , the quadratic forms q and q' differ by a change of variable when reduced modulo n . Up to a change of variables, there are only finitely many quadratic forms in a genus. Moreover, there is a formula (the "mass formula" of Smith-Minkowski-Siegel) which counts the number of quadratic forms within a genus. This mass formula was reformulated by Tamagawa and Weil as a statement about the volume of certain adelic homogeneous spaces for the special orthogonal group $SO(n)$. This led Weil to conjecture an analogous statement for the volumes of homogeneous spaces for other groups, which he verified in a number of cases and has subsequently been proven by Langlands, Lai, and Kottwitz. In this lecture I'll describe joint work with Dennis Gaitsgory which establishes the function field analogue of Weil's conjecture, using techniques inspired by algebraic topology.

- 6.30 Reception at De Morgan House

- 7.30 Society Dinner to be held at a venue TBC.

These lectures are aimed at a general mathematical audience. All interested, whether LMS members or not, are most welcome to attend this event. To register for your place at the meeting, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk). If you would like to attend the Society Dinner, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk). The cost to attend the Society Dinner is £35.00 per person (inclusive of wine).

LMS HARDY LECTURE TOUR 2016



G.H. Hardy, LMS President 1926–1928 and 1939–1941
Photo Courtesy of Master and Fellows of Trinity College
Cambridge



Jacob Lurie (Harvard) Hardy Lecturer 2016

The 2016 LMS Hardy Fellow is **Professor Jacob Lurie** (Harvard).

The Hardy Lectureship was founded in 1967 in memory of G.H. Hardy in recognition of outstanding contribution to both mathematics and to the Society. The Hardy Lectureship is a lecture tour of the UK by a mathematician with a high reputation in research.

Jacob Lurie will visit the UK in June and July 2016 and he will give talks at:

Oxford

20 June

Organiser: *Ulrike Tillmann*

Southampton

22 June

Organiser: *Jelena Grbic*

Aberdeen

24 June

Organiser: *Assaf Libman*

Glasgow

27 June

Organiser: *Andy Baker*

Leicester

30 June

Organiser: *Frank Neumann*

Sheffield

5 July

Organiser: *John Greenlees*

Cambridge

6 July

Organiser: *Julius Ross*

Hardy Lecture, London

Weil's Conjecture for Function Fields

8 July at 3.30 pm, London

Organiser: *London Mathematical Society*

For further information on attending each lecture, please contact the local organisers.

For general enquiries about the Hardy Lectures, please contact Elizabeth Fisher (lmsmeetings@lms.ac.uk).

Mathematicians in Love:

Are there real solutions to the 'two-body problem'?

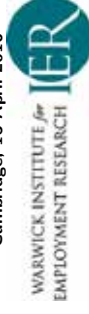
Dr Milena Kremakova

Institute for Employment Research, University of Warwick

IGK re:work (Work and Lifecycle in Global History), Humboldt University Berlin

m.kremakova@warwick.ac.uk www.mattersmathematical.wordpress.com

LMS Women in Mathematics Day
Cambridge, 15 April 2016



The Leverhulme Trust

The study: How are mathematicians made? (Leverhulme ECF2013-622)

This poster is part of a bigger ongoing study of PhD mathematicians' careers (3 years, 97 interviews=48(Germany)+49(UK)). **The 'two-body problem' came up as a common issue!**
Research approach: Grounded theory (Glaser & Strauss): systematic analysis, theory created out of data (not verifying or falsifying existing theory using data). More data collected and re-reviewed → themes are coded → codes are grouped into categories → basis for explanation.

Strengths & Limitations: Qualitative methodology: exploratory study, statistically unrepresentative results (small n, non-random sample) BUT reveals a broad range of careers, basis for future quantitative research. Allows capturing experiences, complex lifetimes, how mathematicians themselves understand and talk about their careers and lives instead of imposing pre-determined categories.

Method: Semi-structured in-depth interviews about becoming a mathematician, career trajectory, intersection of work and life. ('life story interview': loose list of themes, informal chat).

Background: changing university and scientific job market

- **The university today is changing: 'neoliberalism' and 'marketisation'** of higher education = education is a service and not a public good; universities and academics are service-providers; students are consumers. 'Publish or perish', ideal academic has to 'sell herself' and attract funding. The impact agenda: emphasis on applied science. General 'acceleration' of academia.
- **Academic jobs:** increasingly international, precarious, more PhDs = increased competition;
- **Traditional [white male academic] career model** is built on the assumption of **individual independence and freedom to be mobile. No longer the norm BUT the university has not adapted:** Academic careers are STILL structurally best suited to people with no relationships, dependents or care responsibilities.

This creates problems for individual academic scientists:

- **'Work-life balance':** balancing career with personal life (relationships, family, children, caring responsibilities e.g. for ageing parents, own health (disability), long-term plans, quality of life ...)
- **Mobility and migration:** moving for work can be exciting, but only if it's your choice!
- **Female scientists** much more likely to be partnered with academics, often in the same field.

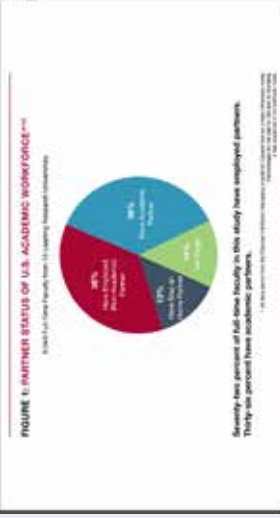


Fig.3. Partner status of the US academic workforce, 2008 [1]. Women are more likely than men to have academic partners (40% of female faculty versus 34% of male faculty). [...] rates of dual hiring are higher among women respondents than among men respondents (13% vs 7%). This means that couple hiring becomes a particularly relevant strategy for the recruitment and retention of female faculty. [...] 30% of minority women and 32% of minority men are partnered with another academic' [...] Same-sex couples have partnering patterns similar to those of heterosexual couples. [...] Gay men do better than lesbians. We need similar data for UK mathematicians!

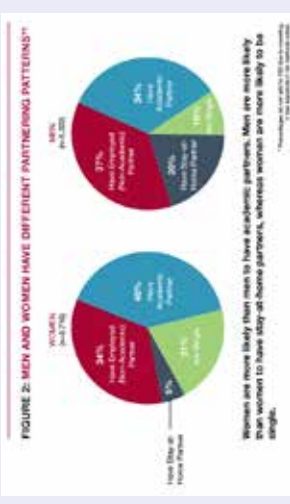


Fig.4. Partner patterns of men and women faculty in US academia, 2008 [1].

5. Conclusions

The two-body problem is complex and has no easy or standardisable solutions. It is solvable on an ad hoc basis requiring commitment from both partners, open dialogue in the relationship, both parties being ready for compromise or temporary solutions (a sense of humour helps). Much better dual-hire practices needed! Raising the issue during interviews remains controversial.

References

- 1 Londa Schiebinger, Andrea Davies Henderson, Shannon K. Gilmartin (2008) "Dual-Career Academic Couples: What Universities Need to Know". Clayman, Michelle R. *Institute for Gender Research Stanford University.* <http://www.stanford.edu/group/gender/Publications/index.html>

Concept history

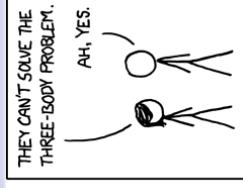
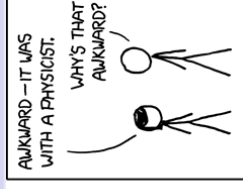


Fig.1. In physics, the three-body problem (special case of the n-body problem, 'taking an initial set of data that specifies the positions, masses and velocities of three bodies for some particular point in time and then determining the motions of the three bodies') is unsolvable. [<http://xkcd.com/613>]

Definition

In sociology, the **'two-body problem'** is the **problem of maintaining a committed relationship between two individuals who are trying to have careers (with one or both working in academia)**. Variations: **three-(or more)-body problem** involves children or other dependants. The **one-body problem**: a single mathematician in search for a relationship, but the bumpy academic job market poses obstacles. The two-body problem is similar to, but not exactly the same as, the **'dual-earner family/partnership'** problem. It is exacerbated by the increased internationalisation of the academic job market, the increasingly precarious job options open to early-career academics (e.g. the frequency of short-term (1-3 year) contracts), low wages compared to similarly intense career paths, and the fact that people tend to form relationships/families in their 20-40s exactly when the career pressure is the strongest. When unsolved, it is sometimes called **'academic scattering'**.

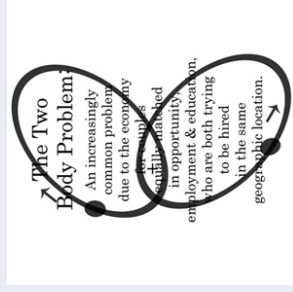


Fig.2. The 'two-(or more)-body' problem in academic careers, susanhense1ga1lery.blogspot.co.uk/2012

(Research findings): Types of Real Solutions and What Helps



Fig. 5. Image: Mathematics Department, Technical University Berlin.

- **Partners, especially with full-time jobs and careers, are far less portable than children.** 'Kathrin Zippel'
- **Living together:**

- 2 academics employed at same university OR daily commutable distance
- 2 academics employed in different universities in the same country, 'weekend commutes'
- 2 working in industry
- 1 academic & 1 working full-time in industry, civil service or teaching
- 1 academic & 1 working part-time (more common in older generations but STILL common)
- 1 working & 1 stay at home (usually with children) (more common in older generations but STILL common)

• Living apart:

- In same country
- In ≠ (or even continents). Skype, Facetime, low-budget airlines: 'relationship savers'!
- **Dual-hire practices** common in US and Australia, much less in UK, Europe and elsewhere. BUT mainly for tenure(track)-level faculty positions, not for postdocs, PhD researchers or students. Problem: increasingly common serial postdocs!
- **Compromise:** sacrificing your career (more common for women in opposite-sex couples)
- **Hard for both BUT younger partner, and/or the one at earlier career stage, and/or less ambitious one, usually suffers more** (BUT compromise sometimes opens new options!)
- **Becoming parents** shifts the balance in favour of the male partner
- **Same-sex partners** have similar patterns of partnering but more equal inter-couple career balance. Gay men do slightly better than lesbian couples in dual-hiring.
- **Couple communication crucial**
- **No ready-made solutions!**

RECORDS OF PROCEEDINGS AT LMS MEETINGS

INAUGURAL HIRST LECTURE AND ORDINARY MEETINGS: 20 APRIL 2016

held at the School of Mathematics and Statistics, St Andrews University, as part of the Inaugural Hirst Lecture. Over 50 members and guests were present for all or part of the meeting.

The meeting began at 3.30 pm with the Vice-President, Professor Ken Brown, in the Chair.

There were 26 members elected to Membership at this Society Meeting.

One member signed the Member's Book and was admitted to the Society.

Professor Ken Brown asked all present whether the Records of Proceedings for two previous Society Meetings – the Meeting of 28 November 2015 and the Meeting of 10 December 2015 – were a true and accurate record of what happened, and signed the Records of Proceedings as accurate.

Dr Colva Roney-Dougal introduced Dr Mark McCartney, of Ulster University, who gave the opening lecture titled *Sir Edmund Taylor Whittaker (1873-1956) Laplace's Equation, Silver Forks and Vogue*, after which there was a coffee break.

Emeritus Professor Edmund Robertson FRS, of St Andrews, then gave the inaugural Hirst Lecture titled *History of Mathematics: Some Personal Thoughts*.

Professor Brown warmly thanked the organisers of the meeting, Dr Colva Roney-Dougal and Mrs Valerie Sturrock, for organising a fascinating event and for providing a delightful day.

The meeting closed at 6.30 pm, and was followed by a wine reception in the Institute of Mathematics and Statistics, and a Society Dinner in The Vine Leaf in St Andrews.

RECORDS OF PROCEEDINGS AT LMS MEETINGS

ORDINARY MEETING, 21 MARCH 2016

held at the Wills Memorial Building, University of Bristol, as part of the British Mathematical Colloquium (BMC) 2016. Over 200 members and guests were present for all or part of the meeting.

The meeting began at 5.00 pm with The President, Professor Simon Tavaré FRS, in the Chair.

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

Thirteen members signed the Member's Book and were admitted to the Society.

Professor Iain Stewart gave a presentation about the activities of the Society over the past 12 months since the last Society Meeting at the B(A)MC in Cambridge in 2015.

Professor Tavaré thanked the organisers of the BMC, Professor Lynne Walling and Professor Tim Dokchitser, for organising the Society Meeting and the BMC.

Professor Walling introduced the public lecture given by Professor Kristin Lauter of Microsoft Research on *How to Keep Your Genome Secret*.

Professor Walling expressed warm thanks to Professor Lauter and invited the audience to ask questions during the reception.

Afterwards, a wine reception and dinner were held in the Wills Memorial Building.

Sadleirian Professorship of Pure Mathematics

The Board of Electors to the Sadleirian Professorship of Pure Mathematics invite applications for this Professorship from persons whose work falls within the general field of Pure Mathematics to take up appointment as soon as possible.

The Professor will be based in Cambridge. A competitive salary will be offered.

Further information on how to apply is available at:

www.admin.cam.ac.uk/offices/academic/secretary/professorships/

or contact the Academic Secretary (email: ibise@admin.cam.ac.uk).

Closing Date: 25th July 2016



UNIVERSITY OF
CAMBRIDGE

GRADED GEOMETRY AND APPLICATIONS TO PHYSICS

The fourteenth edition of the conference *Géométrie et Physique: Séminaire Itinérant* will be held at The University of Sheffield from 8 to 12 August on the theme Graded Geometry and Applications to Physics.

This meeting will bring to Sheffield a diverse and international range of researchers in differential geometry, graded geometry, Poisson geometry, derived geometry, Lie groupoid and algebroid theory, etc., and will promote interactions between these scientists from around the world and UK scientists. Many of the speakers have a background in or special interest in mathematical physics, and will enhance interactions between mathematicians and physicists. One important aim of this conference is to provide new perspectives and new connections in the areas above for the young researchers in differential geometry and mathematical physics in the UK, by allowing them to meet the speakers and international guests, and to have discus-

sions with them in a rather informal environment.

There will be three mini courses led by:

- Kirill Mackenzie (Sheffield)
- Jonathan Pridham (Edinburgh)
- Maxim Zabzine (Uppsala)

There will be 12 plenary lectures and also a number of contributed talks by postgraduate students and postdocs, and a poster session. A walk in the Peak District followed by a conference dinner will take place on Wednesday 10 August.

Childcare support for this event might be available on request to Madeleine Jotz Lean (m.jotz-lean@sheffield.ac.uk). There is still some funding available for the travel and accommodation of UK postgraduate students. The conference website can be found at: www.geometryandphysics.org/gapxiv/.

This event is supported by an LMS Conference grant, American National Science Foundation, Jotz Lean's Vice-Chancellor's fellowship, School of Mathematics and Statistics at the University of Sheffield and by Penn State University.

QUANTUM ROUNDTABLE



The *Quantum Roundabout* is a postgraduate student conference on the mathematical foundations and applications of quantum

physics, taking place at the University of Nottingham, from Wednesday 6 to Friday 8 July 2016. This event intends to bring together PhD students and postdoctoral researchers, working at the crossroads between physics and applied mathematics, providing them with the opportunity to network and interact with their peers in related areas, as well as with top recognised experts.

Three invited speakers will give a tutorial and a research talk each, on three respective main themes:

- Karol Życzkowski (Jagiellonian University and Polish Academy of Sciences) *Geometry of Quantum Entanglement*
- Sabrina Maniscalco (Turku University) *Mathematical Description of Open Quantum Systems*
- Susana Huelga (Institute of Theoretical Physics, Ulm) *Foundations of Quantum Metrology*

The conference is open to early career researchers from universities all over the UK, Europe, and overseas. A flexible programme with room for up to 24 short talks and a dedicated poster session has been devised to encourage an active contribution from all participants. Prizes for the best contributed talk as well as the best poster will be awarded (sponsored by J. Phys. A: Math. Theor.).

The conference is supported by an LMS Postgraduate Research Conference grant (Scheme 8), the School of Mathematical Sciences at the University of Nottingham, the Institute of Physics Mathematical and Theoretical Physics Group, the International Association of Mathematical Physics, by the Institute of Mathematics and its Applications, and the Journal of Physics A: Mathematical and Theoretical.

For more information visit the website: <http://quantumroundabout.weebly.com/> or contact the organisers Rosanna Nichols (pmxnr1@exmail.

[nottingham.ac.uk](mailto:pmxbr@nottingham.ac.uk)), Bartosz Regula (pmxbr@nottingham.ac.uk) and Pietro Liuzzo-Scorpo (pmxpl2@exmail.nottingham.ac.uk).

O-MINIMALITY AND DIOPHANTINE GEOMETRY

A one day meeting on *O-minimality and Diophantine Geometry* will be held at the University of Manchester on Wednesday 7 September 2016. The meeting will take place in the Alan Turing Building, with talks in the afternoon and lunch beforehand. The speakers are:

- Jonathan Pila (Oxford)
- Margaret Thomas (Konstanz)
- Gareth Jones (Manchester)

Anyone interested is welcome to attend. Some funds may be available to contribute to the expenses of those who wish to attend the meeting. For more details see <http://personalpages.manchester.ac.uk/staff/Gareth.Jones-3/onedaymeeting.html> or contact Gareth Jones (gareth.jones-3@manchester.ac.uk). The meeting is supported by an LMS conference grant.

RANDOM MATRIX THEORY

A one-day workshop on *Random Matrix Theory: Perspectives and Applications* will be held at the School of Mathematics, Statistics and Actuarial Science, University of Kent at Canterbury on Tuesday 13 September 2016. It will consist of four talks that will explore recent developments and different perspectives of random matrix theory, as well as connections with integrable systems, special functions, Riemann-Hilbert problems, asymptotic analysis and probability theory. The speakers are:

- Arno Kuijlaar (University of Leuven)
- Tamara Grava (University of Bristol and SISSA, Trieste)
- Nicholas Simm (University of Warwick)
- Alfredo Deaño (University of Kent)

For further information visit the website at <https://www.kent.ac.uk/smsas/events/matrix-theory.html> or contact the local organiser Alfredo Deaño (A.Deano-Cabrera@kent.ac.uk). The workshop is supported by an LMS Confer-

ence grant Celebrating New Appointments and the University of Kent Faculty of Sciences Research Fund.

GALWAY TOPOLOGY COLLOQUIUM

The 19th *Galway Topology Colloquium* will take place at the University of Leicester on Monday 1 August 2016, preceding the Summer Conference on Topology and its Applications. The one day event is aimed at PhD students and early career researchers.

Topics include Topology and Foundations, Algebraic Topology, Asymmetric Topology, and Topological Methods in Algebra and Analysis with talks from Kystyna Kuperberg and Anatoly Grynolow and two parallel sessions of extended lectures being given by Ieke Moerdijk, Boaz Tsaban, Paul Gartside and Jean Goubault-Larrecq. There will be an opportunity for all participants to present an elevator-style pitch to encourage networking. There will also be a chance to ask questions and advice at an academic careers panel being chaired by experts with long and successful careers in mathematics.

For further information, visit the website <https://sites.google.com/site/summertopology/galway-colloquium>. The colloquium is supported by an LMS Postgraduate Research Conference grant (Scheme 8).

MANCHESTER STOCHASTIC NETWORKS DAY

The *Manchester Stochastic Networks Day*, being held on 13 June 2016, is intended as an informal - yet - collaborative meeting between researchers interested in probability and networks both inside and outside the University of Manchester.

The talks will discuss mathematics techniques used to understand and analyse network phenomenon in different application areas: epidemics, chemical reaction networks, Internet advertising, call centres and network congestion.

For more information visit the website at <http://tinyurl.com/hfjrx7e>. The workshop is supported by an LMS Conference Grant Celebrating New Appointments.

INVARIANT SUBSPACES AND BANACH ALGEBRAS

A meeting, *Invariant Subspaces and Banach Algebras*, in memory of Charles Read (1958-2015), will take place at the University of Leeds from 1 to 2 September 2016. The confirmed speakers include:

- David Blecher (Houston)
- Béla Bollobás (Cambridge and Memphis)
- Garth Dales (Lancaster)
- Eva Gallardo-Gutiérrez (Madrid)
- Fereidoun Ghahramani (Manitoba)
- Richard Loy (Canberra)
- George Willis (Newcastle, Australia)

For more information see the website <http://is.gd/isba16>. There is some financial support available for UK-based research students. The meeting is supported by an LMS Conference grant and the University of Leeds.

CLAY RESEARCH CONFERENCE AND WORKSHOPS

The 2016 *Clay Research Conference* will be held on 28 September at the Mathematical Institute of the University of Oxford. The plenary speakers are:

- David Ben-Zvi (Austin)
- Manjul Bhargava (Princeton)
- Tom Ilmanen (ETH Zürich)
- János Kollár (Princeton)

Associated workshops will be held throughout the week of the conference, from 26 to 30 September:

- Geometric Representation Theory and Beyond (Iain Gordon, Kobi Kremnitzer, Raphael Rouquier)
- Algebraic Geometry: Old and New (Alessio Corti, János Kollár, Miles Reid, Nick Shepherd-Barron)
- Mean Curvature Flow (Tobias Colding and Bill Minicozzi)
- Recent Developments on Elliptic Curves (Manjul Bhargava, Henri Darmon, Chris Skinner)

Registration for the Clay Research Confer-

ence is free but required. Participation in the workshops is by invitation; a limited number of additional places is available. Limited accommodation is available for PhD students and early career researchers. For more information email Naomi Kraker at admin@claymath.org. For full details, including the schedule, titles and abstracts when they become available, see www.claymath.org.

KRONECKER COEFFICIENTS

A five-day meeting on *Kronecker Coefficients and their Applications to Complexity Theory and Quantum Information Theory* will be held at City University London from 5 to 9 September 2016. The speakers are as follows:

- Christine Bessenrodt (Hannover)
- Matthias Christandl (Copenhagen)
- Christian Ikenmeyer (Texas)
- Michčle Vergne (Paris)
- Laurent Manivel (Marseille)
- Rosa Orellana (California)
- Rowena Paget (Canterbury)
- Igor Pak (UCLA)
- Greta Panova (Pennsylvania)
- Nicolas Ressayre (Lyon)
- Mercedes Rosas (Seville)
- Steven Sam (Wisconsin)
- John Stembridge (Michigan)
- Ernesto Vallejo (Mexico City)
- Mark Wildon (London)

Anyone interested is welcome to attend. Some funds may be available to contribute to the expenses of research students who wish to attend the meeting. Further details can be obtained from the webpage <http://tinyurl.com/gtkhmm4>. The meeting is supported by an LMS Conference grant and EPSRC.

PDE SOFTWARE FRAMEWORKS

PDE Software Frameworks 2016 (PDESoft) provides a forum for the developers and users of open source tools solving the diverse stages of the numerical PDE process to exchange the latest developments and discuss future ideas.

PDESoft 2016 will be held at the Univer-

sity of Warwick. The main conference will run from 4 to 6 July, while 7 and 8 July are dedicated as coding days, where developers can work on joint projects. The following have agreed to give the Keynote talks:

- Chris Cantwell (Imperial College London)
- Stéphanie Chaillat-Loseille (ENSTA, Paris)
- Katy Huff (Berkely)
- Andreas Klöckner (University of Illinois)

For more information visit <http://warwick.ac.uk/pdesoft2016>. This forum is supported by an LMS Conference grant.

ECMTB 2016

The Centre for Mathematical Medicine and Biology of the University of Nottingham will host the 2016 joint meeting of the European Society for Mathematical and Theoretical Biology and the Society for Mathematical Biology, from 11 to 15 July 2016. The conference will bring together researchers from around the world to present and learn about cutting-edge research at the interface between mathematics and the life sciences.

The Society for Mathematical Biology will run a workshop on careers and interdisciplinary positions for students, postdocs and faculty on the afternoon of 10 July. The Plenary Speakers are:

- Ruth Baker (University of Oxford)
- Sander van Doorn (University of Groningen)
- Julia Gog (University of Cambridge)
- Leah Edelstein-Keshet (University of British Columbia)
- Johan van de Koppel (Royal Netherlands Institute for Sea Research)
- Hisashi Ohtsuki (Kanagawa)
- Johan Paulsson (Harvard University)
- John Rinzel (NYU) SMB Winfree Prize lecture
- Adelia Sequeira (University of Lisbon)

The local organising committee is led by Professor Markus Owen and further information is available at www.ecmtb2016.org. Support includes that from an LMS Conference grant, details being given at the conference website.

MATHEMATICAL COMMUNICATION DURING THE COLD WAR

This meeting will take place at the Oxford Mathematical Institute on Friday 8 July 2016, with talks from 2 pm to 5 pm, followed by a drinks reception. It will be devoted to issues surrounding international communications (or lack thereof) in Cold War mathematics. The goal will be to gain a deeper understanding of the ways in which the political climate of the twentieth century both helped and hindered the development of mathematics. The speakers will be:

- Helena Durnová (Masaryk University, Brno)
- Snezana Lawrence (Bath Spa)
- Christopher Hollings (Oxford)

This event is organised with the British Society for the History of Mathematics, and is supported by the Oxford Mathematical Institute, and by an LMS Conference grant. It is free to attend, and will be accessible to all. Some funding is available to support the travel of research students; to apply, please contact Christopher Hollings (christopher.hollings@maths.ox.ac.uk). The full programme is available at: www.bshm.ac.uk/events/mathematical-communication-during-cold-war.

BRITISH TOPOLOGY

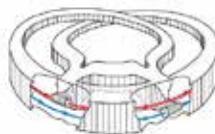
The 31st *British Topology Meeting* will be held in the University of Glasgow from 29 to 31 August, 2016. This is the primary annual meeting among British topologists. The meeting will cover a broad range of topics including algebraic topology, low-dimensional topology, geometric group theory, and more. Invited speakers are:

- Agnès Beaudry (Chicago)
 - Jesper Grodal (Copenhagen)
 - Aditi Kar (Southampton)
 - Erwan Lanneau (Institut Fourier)
 - Sarah Rasmussen (Cambridge)
 - Victor Snaith (Sheffield)
 - Véra Vertesi (Strasbourg)
- There will also be further contributed

talks. Some funds may be available to help cover the expenses of contributing speakers, students, and early career researchers. To submit a talk or for other information, visit the website: www.maths.gla.ac.uk/~btm31/.

The meeting is supported by LMS Conference grant, the Edinburgh Mathematical Society, the Glasgow Mathematical Journal Trust and the School of Mathematics and Statistics at the University of Glasgow.

TOPOLOGY AND ITS APPLICATIONS



The 31st summer conference on *Topology and its Applications* will take place at the University of

Leicester from 2 to 5 August 2016. Its aim is to encourage new collaborations and connections between different areas of topology. There will be five parallel special sessions (with around 20 speakers each) and the following invited plenary and semi-plenary speakers:

- Will Brian (Baylor University)
- Anna Giordano Bruno (University of Udine)
- Steven Frankel (Yale University)
- Paul Gartside (University of Pittsburgh)
- Jean Goubault-Larrecq (École Normal Supérieure de Cachan)
- Mike Hill (UCLA)
- John Hunton (Durham University)
- Steve Hurder (University of Illinois at Chicago)
- Ieke Moerdijk (Utrecht University and University of Sheffield)
- Jimme Lawson (Louisiana State University)
- Ulrike Tillmann (University of Oxford)
- Boaz Tsaban (Bar-Ilan University)

For further information, visit the website <https://sites.google.com/site/summertopology/home>. The conference is supported by an LMS Conference grant (for the Algebraic Topology special session), the Leverhulme Trust and the National Science Foundation.



BAYESIAN NETWORKS AND ARGUMENTATION IN EVIDENCE ANALYSIS

26 – 29 September 2016

in association with the Isaac Newton Institute programme
Probability and Statistics in Forensic Science
(18 July – 21 December 2016)

This workshop will be devoted to investigating the use of Bayesian networks in evidence analysis models for actual criminal cases ranging from the simplest (with very little evidence) to more complex ones. It will be partially structured around producing satisfactory BN models for some key well-known cases, for example those of Sally Clark and Barry George (use of probability for considering probative value of specific individual pieces of evidence and combinations of evidence), since in such cases it is known that all previous attempts to properly model these have not been complete.

Further information available from the website
www.newton.ac.uk/event/fosw02

Closing date for receipt of applications 27 June 2016.

PRIVACY: RECENT DEVELOPMENTS AT THE INTERFACE BETWEEN ECONOMICS AND COMPUTER SCIENCE

28 October 2016

in association with the Isaac Newton Institute programme
Data Linkage and Anonymisation
(4 July – 21 December 2016)

Recent years have witnessed the tremendous growth in privacy research in economics, statistics and computer science. This workshop aims to highlight recent developments in privacy research at the intersection of those fields. It will bring together academics from different horizons: those working on the privacy issues in the handling of economic research data as well as those analysing how privacy affects the incentives and behaviour of economic agents. Privacy research in economics requires novel approaches that go beyond traditional techniques and incorporate ideas from statistics and computer science. The broad objective workshop is to provide an interactive environment to discuss and learn those ideas and approaches.

Further information available from the website
www.newton.ac.uk/event/dlaw04

Closing date for receipt of applications 28 July 2016.



LONDON
MATHEMATICAL
SOCIETY
EST. 1865

Northern Regional Meeting

The University of Manchester 23 June 2016

- 12.50 pm - Opening
- 1.00 pm - Plenary speaker 1: Professor Sanju Velani (The University of York)
- 2.00 pm - coffee break
- 2.30 pm - Plenary speaker 2: Professor Julien Barral (Paris 13)
- 3.30 pm - minibreak
- 3.45 pm - Public lecture: Henna Koivusalo (The University of York)
- 4.45 pm - Wine reception (Alan Turing Building)
- 7.00 pm - Dinner at EastZeast

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

For further details and to register and to reserve a place at the dinner, please visit <http://personalpages.manchester.ac.uk/staff/jonathan.fraser/LMSregionalmeeting16.html>

The meeting forms part of a workshop on *Dynamical systems, ergodic theory and applications* from 23-24 June 2016. There will be talks on Thursday morning and all day Friday with plenary lectures from Ian Melbourne and Dejun Feng.

For further details visit:

<http://personalpages.manchester.ac.uk/staff/jonathan.fraser/LMSregionalmeeting16.html> or contact the organisers. (Jonathan Fraser; jon.fraser32@gmail.com)

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

The London Mathematical Society is the UK's learned society for mathematics. Founded in 1865 for the promotion and extension of mathematical knowledge, the Society has a membership of over 2500 drawn from all parts of the UK and overseas. Its principal activities are the organisation of meetings and conferences, publication of journals and books, provision of financial support for mathematical activities, and contribution to public debates on issues related to mathematics, research and education. London Mathematical Society, De Morgan House, 37, 58 Russell Square, London WC1B 4HS. Tel +44 (0)20 7637 3686; Fax: +44 (0)20 7323 3655; Email: lms@lms.ac.uk; Web: www.lms.ac.uk; Registered charity no. 252660



Heilbronn
Institute for
Mathematical
Research

Heilbronn Annual Conference

15–16
September
2016

The 2016 Heilbronn Annual Conference will be held at the University of Bristol. A number of distinguished mathematicians are invited to present lectures, intended to be accessible to a mixed audience of mathematicians.

This year's invited speakers are:

Graham Cormode
Warwick

Amir Dembo
Stanford

Alex Kontorovich
Rutgers

Bryna Kra
Northwestern

James McKernan
UC San Diego

Kavita Ramanan
Brown

Martin Wainwright
Berkeley

Anton Zorich
Institut Mathématiques de Jussieu

Venue
Lecture Theatre Two, Chemistry Building

There is no registration fee, but to enable estimation of numbers, please complete the online registration form on the events page at heilbronn.ac.uk.

UK graduate students and postdoctoral fellows who would like to attend and need support should contact us via the email below by **15th August 2016**.

heilbronn-coordinator@bristol.ac.uk
heilbronn.ac.uk

We are pleased to announce that we are able to award funding to offer support for child care costs for dependants under the age of 14. Please contact us via the email below for further details.

The final programme and additional details will be confirmed in due course.

LMS Midlands Regional Meeting
and Workshop on
**Interactions of
Harmonic Analysis and
Operator Theory**

Birmingham, 13-16 September 2016

MINI-COURSES

Kaj Nyström
Uppsala Universitet

Javier Parcet
Instituto de Ciencias Matemáticas

SPEAKERS

Pascal Auscher
Université Paris-Sud

Charles Batty
University of Oxford

Tony Carbery
University of Edinburgh

Andrea Carbonaro
Università degli Studi di Genova

Martin Dindoš
University of Edinburgh

Véronique Fischer
University of Bath

Dorothee Frey
Delft University of Technology

José María Martell
Instituto de Ciencias Matemáticas

Sylvie Monniaux
Aix-Marseille Université

Detlef Müller
Christian-Albrechts-Universität zu Kiel

Fulvio Ricci
Scuola Normale Superiore

Maria Vallarino
Politecnico di Torino

Jim Wright
University of Edinburgh

Organisers: Alessio Martini and Andrew Morris (Birmingham)



**UNIVERSITY OF
BIRMINGHAM**
School of Mathematics



**LONDON
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SOCIETY**
EST. 1865

SBORNIK MATHEMATICS



Highlights from the past **150 years**

Special collection

This year we are celebrating the 150th anniversary of *Matematicheskii Sbornik*, and to mark the occasion, we have put together a collection of the most influential work published in the English translation of the journal, *Sbornik: Mathematics*, in 1967–2015.

Free to read in 2016

Visit iopscience.org/msb to discover first-class research in mathematics.

DEREK WILSON



Derek H. Wilson, who was elected a member of the London Mathematical Society on 17 January 1952, died on 8 April 2016, aged 87. He was also a member of the Institute of Mathematics and its Applications

from its inception in 1964.

John Bolton writes: Derek Wilson was employed for most of his life (over 50 years, in fact!) in the Department of Mathematical Sciences at Durham University. Before that, he spent six years at universities in Africa, where he met and married Rachel, who helped and supported him most ably until she sadly died in 2013. He finally stopped teaching in Durham in 2009 at the age of 80, when worsening arthritis meant he could no longer travel to the department.

Derek had a very agile mind, and a great sense of humour. He loved helping people and would go out of his way to do so. These were among the attributes that made him so good at the job he loved.

His area of research was hydrodynamics, on which he wrote a book and several papers. This was not his real academic love, however; he was much more interested in staff and students, and their academic and pastoral care. As an example of this, he carried out the bulk of the Mathematics Department exam administration at Durham for many years - exam timetable, room allocation (all in the maths department to make it as easy as possible for staff and students), assigning invigilations, organising marking of scripts, etc. This probably should have been done by the university central administration, but they could see that Derek did a much better job than they could, and they were sensible enough to leave him to it (or maybe Derek was stronger than they were!)

Derek was a pastoral tutor at one of the university's colleges, Grey College, from 1970 to 2010, and was also Sub-Dean of the Faculty of Science for five years. In these roles, he helped literally hundreds of students. When they first arrived in Durham, he was often part of the reception committee at the railway station. During their university career, he would counsel and tutor them, sometimes at his house if he thought that escape from the university environment would help. Indeed, some of the more stressed out ones stayed at his house over the exam period; some even sat their exams at his house! Finally, he would be there to congratulate the students when they got their final degree.

Because he cared so much for the students, and helped so many of them, he had many visits from past students. He also received many Christmas cards and letters each year from around the country and, indeed, around the world.

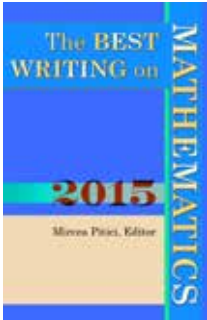
He was also heavily involved with the lecturers' union, AUT then UCU, throughout his career; many years as Treasurer. Through his active role with the union, he helped foster the careers of many academics at Durham.

He had nicknames for many of the people and places at the university (some apocryphal, some appropriate, many both!). You certainly had to be quick to keep up with Derek - and you needed to know his special vocabulary! Derek also had a nickname (bestowed by others!). He was known as 'The Scourge of the Administration'; he was very proud of this extremely apt soubriquet!

In summary, he worked tirelessly for the university, the Mathematics Department, Grey College and UCU to provide support and help for both staff and students. Derek had a phenomenal memory, and remembered very many of his students; they, and all his colleagues, certainly remember him with great affection and gratitude.

Derek is survived by his daughter, Barbara, his son and daughter-in-law, Ian and Ann, and grandchild Amanda.

THE BEST WRITING ON MATHEMATICS 2015 edited by Mircea Pitici, 2015, Princeton University Press, 392 pp, £18.95, ISBN: 978-0691169651.



A Princeton University Press blog entry announced this sixth edition of Pitici's 'Best of' series, as though it were some prestigious award, under the heading "PUP congratulates writers chosen for The Best Writing on Mathematics 2015." Accordingly, there

followed much back-slapping on social media (not in itself very significant since all backs are slapped on social media except when they are stabbed) and, I dare say, updating, in all modesty, of *curricula vitae*.

While laurels may well equate with being anthologised, Pitici's 'best of' theme cannot be found to bestow garlands equally. The articles which I would read again for the *skill of the writing* were very few. Mark Balaguer's on philosophy of mathematics I thought was beautifully written; Marianne Freiberger on chaos; Scott Aaronson on randomness; Steven Strogatz on writing popular mathematical articles; these I admired as literature. At the other extreme were several articles which I found to be jargon-laden or silly or just plain gobbledygook.

Many of the articles in between are decent accounts of elementary mathematical topics, aimed at a popular audience. Strogatz gives a classification of this readership which I found helpful: a potential reader may be (A) traumatised by hostile teaching, (B) perplexed by indifferent teaching, or (C) left hungry by insufficient teaching. He rightly points out that the great majority of popular writing in mathematics is aimed at C ('the naturals', in Strogatz's words). Pitici has selected a good deal of this.

Arthur Benjamin and Ethan Brown on magic squares is an example. C will immediately get the point, will try out the constructions and might even think of some embellishments. They will congratulate Pitici on his choice. B will read for

a couple of pages and then think 'All very clever but I'm never going to remember any of this nor use it if I did.' A will just think 'Uh-oh! Geek alert!' Colm Mulcahy and Dana Richards on Martin Gardner's legacy also falls into this category. Vi Hart and Henry Segerman on group actions and Conway and Ryba on Steiner–Lehmus are so very C-oriented as to fall within the interests of this newsletter's readership.

Ironically, a different choice of medium shows these uniquely gifted individuals reaching all three of Strogatz classes: online videos and, better still, live performances have a charisma and stagecraft that carries the day. For some audiences, writing, best or not, is second best.

But C-centric writing by no means predominates. There are articles relating to education, history, art, psychology and the physical sciences. Pitici's is an impressively broad-spectrum editorship. And in my opinion, his 'best' means 'most of interest to the general educated reader of today'. One might say western, or even American, reader: of just over fifty authors selected, nearly forty are based in North America. Still, Guili Zhang is partly based in China and her article with Miguel Padilla on Chinese vs. US mathematics education is an example of Pitici's editorial skill: he has found exactly the right authoritative article to exactly address one of the concerns of today's general educated (western) reader.

In this respect, Gelman and Loken on abuse of p -values deserves mention: published in 2014 ('2015' is the collection, not the contents) it is the early rumblings of a storm which has continued to brew, so strongly as to prompt a weather alert from classy AMS blogger Evelyn J. Lamb (blogs.ams.org/blogonmathblogs, March 21st, 2016). She features Gelman prominently: Pitici has selected presciently and well.

With one exception (Freiberger, from two plus math.org postings, bolted together into a slightly disjointed whole), the articles in the book are reproduced from print but there has been some adaptation. For example, the colour images in Burkard Polster's article on constant-width curves from *Mathematical Intelligencer* are repro-

duced in greyscale, and unfortunately the text annotates the shading incorrectly. The decision has been made to collect a number of colour images within a dozen or so pages in the middle of the book. I think this is a mistake: it presumably adds to the price of the book and mostly you do not derive enough benefit from the coloured versions for it to be worth hunting for them. A webpage accompanying the book lists internet sources (not clickable, strangely) and many of the colour images could be accessed in this way. In fact Polster's article itself directs the reader to a website where they can see *animated* images.

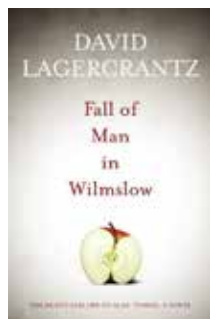
The relationship of books such as this with the internet deserves editorial attention. Another little example: a chapter on the history of the pigeonhole principle lists David Singmaster's

superb *Sources in Recreational Mathematics* as 'unpublished'; the next chapter, on Nim, gives a web link for Sources, but it is broken (it currently resides at www.puzzlemuseum.com).

Decidedly, Princeton University Press is doing the mathematical community a great service in producing 'Best Writing' and it is hard to imagine that anyone could edit the series better than does Pitici. I was disappointed not to get more out of the book myself but then LMS members are not the intended audience. You can confidently recommend the book to your C students and you will find things in it to tempt your B and even your A students, if such you have.

Robin Whitty
Queen Mary, University of London

FALL OF MAN IN WILMSLOW - THE DEATH AND LIFE OF ALAN TURING by David Lagercrantz, trans. George Goulding, Quercus Books, 2015, pp 368, £18.99, ISBN 978-0857059895.



Many creative writers and artists have been inspired by the life of Alan Turing. This has resulted in a number of plays, films, novels etc. of varying quality especially since the centenary year of 2012. Perhaps the best is the play/TV drama *Breaking the Code* by Hugh

Whitmore (1985) and starring Derek Jacobi as Turing. This is worth mentioning here as it is available for all to see on YouTube.

However, one of the best is this novel under review. It is a work of fiction although some of the characters other than Turing are real-life people. The main character is a fictitious policeman Detective Constable Leonard Corell. He works in Wilmslow Cheshire. He was called to a house where Alan Turing has just committed suicide. It soon became apparent to Corell that the authorities were taking a lot of interest in this case. Also, he had found a medal in the house,

(Turing's OBE) and Corell became very interested in the victim. He found out that he had been prosecuted for committing homosexual acts and that he had done some important war work. A turning point of the novel is the inquest. The coroner makes some rather fatuous comments about Turing's death talking about "that type of man". Corell then implies that the coroner does not know what he is talking about and thus getting into trouble with his superiors. After the inquest, Corell is approached by a stranger who says he is a logician, an ex-colleague of Turing's at Cambridge. The logician tells Corell about Turing's mathematics and there is a chapter which mentions the work of Gödel, Frege, Russell, Wittgenstein, Hilbert's *Entscheidungs* problem and Turing's paper on *Computable numbers*. Also, his work on Turing machines. We are a long way from your standard police novel!

The novel takes place in the early 1950s. Two aspects of life then were the intolerant attitude to homosexuality and cold war nervousness, both of which play a role in this novel. Being in the police force, Corell found that most of his fellow officers were very insulting about homosexuality. At first Corell himself felt the usual prejudice, especially

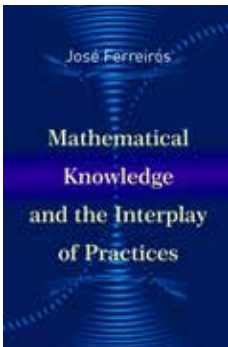
as his aunt was a lesbian, but as the novel progressed he became more tolerant. As for the cold war, this was the time of Burgess and Maclane and there was a feeling that Turing's homosexuality might have been a security risk, as he had done some secret work during the war. After his talk with the logician Corell guessed that Turing might have built a machine to decipher the German codes and mentions this to a member of the security forces; not a good idea!

A few words about the author. He is from Sweden and this book has been translated from Swedish. This is quite remarkable because there

is a very convincing picture of 1950s Britain. Lagercrantz is most famous for continuing Steig Larssen's Millennium series featuring the computer hacker Lisbeth Salander. Larssen wrote three books in this series which were phenomenal bestsellers. He then died at the age of 50. The publishers wanted the series continued and hired Lagercrantz to write a fourth novel in the series. He wrote *The Girl in the Spider's Web*, this book actually has some mathematics, dealing with elliptic curve cryptography.

David Singerman.
University of Southampton

MATHEMATICAL KNOWLEDGE AND THE INTERPLAY OF PRACTICES by José Ferreirós,
Princeton University Press, 2016, pp 360, £34.95, \$45.00, ISBN: 978-0691167510.



Over the last decade or so, the philosophy of mathematical practice has emerged as a sub-field of the philosophy of mathematics – either as a supplement to the previously existing philosophical options or as a challenge to them, depending on whom you ask.

The typical slogans of this movement are that “mathematics is a human activity” and that philosophers should attend to “what mathematicians actually do”. Guided by these lights, philosophers of mathematical practice hope to find new perspectives on the old questions about mathematics and to open some new lines of enquiry. This movement now has a canonical text (a collection of essays edited by Paolo Mancosu) and an international association (www.phil-mathpractice.org/). Until now, it has not had many big monographs that develop the slogans into methods that might plausibly show how philosophers of mathematical practice might deliver on their promises.

José Ferreirós is well placed to fill this deficiency. A founding member and former president

of the Association for the Philosophy of Mathematical Practice, he has been at the centre of this community since its inception. However, his written contributions so far have been principally historical rather than philosophical. In this book, he moves from studies of specific episodes and developments in mathematics to offer a general philosophical outlook.

Mathematics has a strange sort of objectivity. At the most basic level, it seems to present us with facts that obtain independently of us. Whole-number arithmetic is an inflexible reality for anyone having to distribute an odd number of sweets among an even number of children. Something very much like Euclidean geometry imposes itself on carpet fitters. At the top end of pure mathematics, in contrast, mathematicians are in principle free to investigate the properties of any structures that they care to define. How are these two extremes related? Is there a gradual rise in liberty as one passes from the former to the latter, or is there a Rubicon? Further, how much latitude do mathematicians really have to define their subject matter? Given that from a formal point of view they could study any structure, it's interesting that they seem to make quite conservative choices about what to investigate. This suggests that there are constraints on their definitions in addition to formal consistency. If this book has a single aim, it is this: to account for the feeling of objectivity associated with even

the purest, most abstract mathematics, without recourse to Platonism.

Ferreirós spends the first few chapters assembling the ingredients of his account. It is already commonplace to insist on the diversity of practices (both mathematical and otherwise). Ferreirós's innovation is to focus on the relations between them – the interplay of the book's title. According to him, it is these relations that motivate and constrain advanced pure mathematics and give it the sense of objectivity that seems mysterious when regarded from a solely logical point of view. Counting, reckoning and number theory are related, but not as dialectical successors or as theory-to-phenomena. Rather, they are distinct practices that somehow interrelate. Other parts of the book's apparatus are symbolic frameworks (ideograms and diagrams, technical expressions, and symbolic methods), theoretical frameworks (statements, proofs, methods, and problems and conjectures), and, crucially, people. The interplay of practices happens because mathematicians also distribute sweets, measure carpets, knit, program computers, solve problems in empirical science and are otherwise active in a world full of pattern and iteration – including the many varieties inside mathematics. The symbolic frameworks are meaningful because mathematicians use them and thereby come to understand them. This insistence on the distinctive role of the human agent sets Ferreirós's view apart from perspectives in science studies such as the writings of Andrew Pickering and Bruno Latour. In his fourth chapter, Ferreirós argues for his outlook by pointing to the phenomenon of intended models of formal systems. What does it mean to say that there is a standard model of the Peano axioms, and why is it that one rather than any other? The answer, for Ferreirós, is not found in any property of natural numbers nor in the mind of the mathematician (such as Kant's pure intuition of time), but rather in the interplay between this bit of mathematics and all the other activities (mathematical and otherwise) that have inductive structure built in.

A further feature of Ferreirós's view is the hypothetical character of advanced mathematics. For him, there is a Rubicon, a clear border between basic mathematics that can be known with certainty and about which we have no choice, and

mathematics that is shaped by choices which are motivated and rational but not inevitable. On the first side he finds the basic arithmetic of natural numbers in their usual order with addition, multiplication and exponentiation (formally speaking: the first-order theory of Peano Arithmetic). Also on the non-hypothetical side are the rational numbers and some elementary metrical notions. Just about everything else in mathematics is on the hypothetical side. This hypothetical mathematics depends on choices of hypotheses, but, Ferreirós insists, these choices are constrained by interrelations with the non-hypothetical mathematics, with measuring, time-keeping, empirical science and other such practices.

For example, the geometry expounded in the first four books of Euclid is hypothetical because it requires us to posit dimensionless points, breadthless lines, perfectly sharp angles and so forth. These do not exist in nature (nor in the practice of carpet-fitting) and have to be introduced in an act of decision – though these decisions are intelligible only in the light of the practical geometry that preceded and coexisted with Euclid's theory. Similarly, the standard account of the continuum as a non-denumerable set of points depends on decisions that might have gone otherwise – for all that logic constrains us, we might have settled on Brouwer's view as the orthodoxy. We have the standard continuum, according to Ferreirós, because at the moment of decision at the end of the nineteenth century, mathematics was dominated by the great continent of mathematical practices that came to be jointly called 'analysis', and this together with the uses of mathematics in natural science gave mathematicians a strong sense of what 'continuous' ought to mean. Ferreirós's chief example is set theory. In the final chapters, he identifies and explores the founding decisions (in his terms, hypotheses) that determine what kind of set theory we have. The iterative conception of set may seem obvious or natural now – it may feel like a discovery rather than an invention – but it had to be chosen. It is, in Ferreirós's terms, a hypothesis. 'Hypothesis' here does not mean 'guess at the truth' but rather something like 'informed judgment about which mathematical structures we would do well to study'.

What this sketch cannot convey is the wealth of detail that Ferreirós brings to the case he makes. In the final chapters especially, he deploys his detailed knowledge of the history of set theory and logic (see references below for some of his prior publications) to show how choices that seem free from a logical point of view were closely constrained by internal and external factors.

There are, of course, critical questions one can ask. The material on set theory and the continuum in the final chapters is heavily historical and in places it seems as though the philosophical approach described in the opening chapters gives way to a more orthodox narrative. Sometimes there is more detail about dates and documents than the advertised practice-based approach ought to need. That said, these details are always interesting even if they do signal some methodological backsliding. If Ferreirós sometimes slips into writing regular narrative history, it's because he is very well practised at it and knows this material inside out. Moreover, there are places in the final chapters where he explicitly puts the apparatus described in the first four chapters to use. The discussion of the V-shaped diagram of the iterative universe of sets is a study of the way that ideograms, symbols, specialised language and theoretical frameworks can form a dense practical nexus with constraining and enriching links to other practices. It may

offer a methodological model to others working on similar lines.

Ferreirós's view may have pedagogical consequences. If abstract mathematics makes sense only in virtue of the interplay of practices, then perhaps this should be built into the way it is taught. Rather than trying to motivate students by peddling the fiction that an understanding of Euclid will make them better at fitting carpets, we might try the idea that fitting carpets helps a person to understand Euclid – not because carpets are Euclidean (they are not) but because these two activities stand in a complex, agent-mediated relationship that permits the former to lend intelligibility to the latter.

Brندان Larvor
University of Hertfordshire

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CALENDAR OF EVENTS

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

JUNE 2016

- 1 p -adic L -functions Day, Cambridge (458)
- 1 Combinatorics at Oxford (457)
- 6-9 Computational and Analytic Problems in Spectral Theory, Cardiff (457)
- 6-10 Quantum Physics and Logic, Strathclyde (457)
- 6-10 From the Continuum to the Tectonic INI Workshop, Cambridge (455)

9-10 Scottish Partial Differential Equations Colloquium, Dundee (457)

10 Interactions of Operator Theory with Quantum Processes, Newcastle (458)

10-11 ICFT 2016, King's College London (458)

11 Sir Christopher Zeeman: A Celebration, Warwick (458)

13 Manchester Stochastic Networks Day, Manchester (459)

13 Recent Advances in Discontinuous Galerkin Methods, Reading (458)

13-14 ECSTATIC 2, Imperial College London (457)

15-16 Celebrating the New Probability Group at Lancaster University (458)

19-24 Random Interacting Systems, Bath (457)

20-24 Spatially Distributed Stochastic Dynamical Systems in Biology INI Workshop, Cambridge (456)

20-24 New Trends in Nonlinear PDEs, Cardiff (456)

23-24 LMS Northern Regional Meeting and Workshop, Manchester (459)
 24 Representations of Quantum Groups and Cherednik Algebras, Newcastle (458)
 27-1 July General Relativity: From Geometry to Amplitudes INI Workshop, Cambridge (456)
 28-1 July Postgraduate Group Theory Conference, Imperial College London (457)
 29 LMS Popular Lectures, London (459)

JULY 2016

4-8 PDE Software Frameworks 2016, Warwick
 4-8 Modern Topics in Nonlinear PDE and Geometric Analysis, Reading (458)
 4-8 Modelling, Analysis and Simulation: Crime and Image Processing, Oxford (457)
 5-8 Data Linkage and Anonymisation INI Workshop, Cambridge (457)
 6-8 The Stone-Cech Compactification, Cambridge (458)
 6-8 Quantum Roundabout, Nottingham (459)
 8 LMS Graduate Student Meeting, London (459)
 8 Hardy Lecture & LMS Meeting, London (459)
 8 Mathematical Communication during the Cold War, Oxford (459)
 11-15 Graph Limits and Statistic INI Workshop, Cambridge (457)
 11-15 ECMTB, Nottingham (459)
 11-25 Algebraic Combinatorics and Group Actions, Herstmonceux Castle, East Sussex (456)
 13-15 Representation Theory of Algebraic Groups in honour of Stephen Donkin, York (457)
 15 Mathematical Foundations in Bioinformatics, Kings College London
 18-22 Representation Theory and Physics Workshop, Leeds (458)
 18-22 7ECM, TU Berlin (456)
 20 Mathematical Foundations in Bioinformatics, King's College London (458)
 21 LMS Meeting at the 7ECM, Berlin (459)
 25-27 Bayesian Methods for Networks INI Workshop, Cambridge (457)
 25-31 International Mathematics Competition for University Students, Blagoevgrad, Bulgaria (455)

AUGUST 2016

1 Galway Topology Colloquium, Leicester (459)
 1-4 Young Researchers in Mathematics Conference, St Andrews
 2-5 Topology and its Applications, Leicester (459)
 8-12 Graded Geometry and Applications to Physics, Sheffield (459)

25-26 Caucasian Mathematics Conference, Turkey (453)
 29-31 British Topology, Glasgow (459)
 30-2 Sep The Nature of Questions Arising in Court that can be Addressed Via Probability and Statistical Methods INI Workshop, Cambridge (458)

SEPTEMBER 2016

1-2 Invariant Subspaces and Banach Algebras, Leeds (459)
 5-8 Hitchin 70, Aarhus (458)
 5-9 Combinatorics and Operators in Quantum Information Theory LMS Research School, Belfast (458)
 5-9 Kronecker Coefficients and their Applications to Complexity Theory and Quantum Information Theory, City University London (459)
 6-7 Transpennine Topology Triangle, Manchester (458)
 7 O-Minimality and Diophantine Geometry, Manchester (459)
 9-11 Hitchin 70, Oxford (458)
 12-16 Hitchin 70, Madrid (458)
 12-16 Data Linkage: Techniques, Challenges and Applications INI Workshop, Cambridge (458)
 13 Random Matrix Theory: Perspectives and Applications, Canterbury (459)
 13-16 LMS Midlands Regional Meeting and Workshop, Birmingham (459)
 15-16 Heilbronn Annual Conference, Bristol (459)
 16-17 Mathematical Biography, A MacTutor Celebration, St Andrews (458)
 18-23 Heidelberg Laureate Forum (454)
 21 LMS Popular Lectures, Birmingham (459)
 26-29 Bayesian Networks and Argumentation in Evidence Analysis INI Workshop, Cambridge (459)
 26-30 Clay Research Workshops, Oxford (459)
 28 Clay Research Conference, Oxford (459)

OCTOBER 2016

28 Privacy: Recent Developments at the Interface between Economics and Computer Science INI Workshop, Cambridge (459)

NOVEMBER 2016

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

DECEMBER 2016

20 LMS South West & South Wales Regional Meeting, Bath

WOMEN IN MATHEMATICS DAYS 2016

(reports on pages 14–16)

15 April at Cambridge University



Apala Majumdar
(Anne Bennett Prize Winner)

22 April at Edinburgh University



Rachael Boyd
(Early Career Speaker)



Joanna Andrade
(Early Career Speaker and Grace Chisholm Fellow)



Smita Sahu
(Early Career Speaker)



Panel discussion



Panel discussion