LMS HONORARY MEMBERS 2015

The London Mathematical Society has elected the following people to Honorary Membership of the Society in its 150th Anniversary year:

Professor **Joan Birman,** Barnard College, Columbia University

Professor **Robert Calderbank,** Duke University

Professor **Shafi Goldwasser,** Massachusetts Institute of Technology and Weizmann Institute of Science

Professor **Donald Knuth,** Stanford University

Professor **Robert Langlands,** Institute of Advanced Study, Princeton University

Professor **Maryam Mirzakhani,** Stanford University
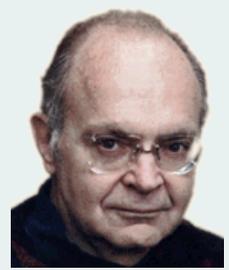
Clockwise from top left: Joan Birman, Robert Calderbank, Shafi Goldwasser, Donald Knuth, Maryam Mirzakhani and Robert Langlands

SOCIETY MEETINGS AND EVENTS

NEWSLETTER ONLINE: newsletter.lms.ac.uk

@LondMathSoc

Contents
No. 450 September 2015

Professor Birman has revealed deep and surprising connections between fields. She has played a leading role in 3-manifold topology, knot theory, and geometric group theory.

Professor Calderbank discovered that classical mathematical objects (such as the quaternions, and more generally solutions to the Radon—Hurwicz matrix equations) could be used to improve significantly the capacity and reliability of mobile phone networks. This used the notion of space-time block codes, which he developed with Vahid Tarokh and Hamid Jafarkhani. Their two papers each collected more than 7000 citations.

Professor Goldwasser's work has had a tremendous influence on computational complexity and modern cryptography. She, together with her co-author Silvio Micali, established the principle of probabilistic encryption. Their formulation of the concept of security of encryption as an adversarial game has become a de facto standard in modern cryptography and has revolutionized the field.

Professor Knuth is one of the world's greatest computer scientists, whose works have had a profound influence on the subject for the past half-century. His research covers diverse areas of mathematics and computer science, including structure in random graphs, word problems in universal algebras, pattern matching in strings, prefix codes and binary search trees.

Professor Langlands secured his place in history of mathematics as the proposer (in 1967) and first developer of the eponymous research programme. The deep results and visionary conjectures of the Langlands Programme relate the core themes in number theory and representation theory.

Professor Mirzakhani has done brilliant and highly original work which spans the fields of Teichmüller theory, hyperbolic geometry and dynamics. Her award of the Fields Medal in 2014 marked a turning point for female mathematicians, for whom she has been an inspiration worldwide.

Full citations for all the new Honorary Members will appear in the *LMS Bulletin*.

OPEN HOUSE IN 2015

For the past four years De Morgan House has featured as part of Open House London. Over 1,500 people have visited and heard about the Society and about mathematics. On 20 September 2015 the Society will once again open its doors to the public with special displays and exhibitions celebrating the 150th Anniversary.

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MATHEMATICAL SCIENCE AND THE REF

Report by the LMS Research Policy Committee

As REF 2014 starts to fade from the memory, REF 2020 is already lumbering over the horizon. It is absolutely certain that HEFCE and the other UK Funding Councils will soon be opening consultations on the format of the next REF, so we should be ready as a community to submit well-considered responses which reflect the views of the majority of UK mathematical scientists as fairly and forcefully as possible. The LMS, in association with the CMS and HoDOMS, will shortly send a survey to all mathematical science departments in UK HE, whether or not they submitted to REF 2014. We will be seeking views on the issues (positive and negative) raised by the REF. Analysis of REF 2014 from the perspective of mathematical science is of course important, but perhaps even more important is to think ahead to the next REF. For example:

- What are the main dangers for UK mathematical science in the next REF, and how can we best avoid these dangers, or at least minimise them?
- What are the key opportunities for us, and how can we seek to exploit them?
- How can any negative aspects for mathematics of the format of REF 2014 be adjusted to our benefit in REF 2020?

Here are some observations, comments and queries relating to these questions, informed by discussions in the Research Policy Committee of the LMS and supported by data analysis by staff in De Morgan House. We've focussed for the most part on issues that are particular to the mathematical sciences. Other, more generic topics, are also very important, of course – for example, the selective submission of some research active staff, and the exclusion of others, is something which rightly concerns many. But since this is already well-aired in many places, we don't consider it further here.

Mathematical Sciences Quality

If one takes the REF evaluation at face value, the evidence is clear (Figure 1) that UK mathematical sciences research is performing very well. There is of course a debate to be had over the extent to which these FTE-weighted averages are comparable with those for other subject submissions, and also over whether they permit any meaningful international comparisons to be made within mathematical sciences.

	4*	3*	2*	1*	U/C
Overall	29	55	15	1	0
Outputs	22.7	59.7	16.8	0.6	0.2
Impact	35.9	46.6	14.1	2.3	1.1
Environment	44.2	47.4	8.1	0.3	0

Figure 1
Average overall quality profile for the Math Sciences UoA (FTE weighted)
(Reproduced with permission from HEFCE)

The same HEFCE-produced data gives UK-wide information about PhD numbers in the REF period (Figure 2) and for external research income (Figure 3). We see, for instance, that submitting mathematical sciences UoAs had almost exactly 500 PhD graduates per year across the REF period.

The impact of Impact

(i) Quality and make-up: We in the UK mathematical science community were perhaps surprised to find that there was a close correlation between the average profiles for Outputs and for Impact, especially taking the sum of 4* and 3* (see Figure 1 again). Of course this hides quite large variations between UoAs, and the Impact part of the submission surely presented very serious problems for departments which lacked a strong component of applied mathematics and – even more so – statistics, as detailed analysis of the Impact Case Studies in math science has shown. Is this likely to affect the composition of the UK's mathematical science departments in coming years? If so, should we be concerned?

(ii) Gaming the numbers: There is strong statistical evidence to support the belief that the number of FTEs submitted by many mathematical science UoAs was tuned to accord with the number of good Impact Case Studies available. And no doubt the same is true for other UoAs. It is hard to see this as anything other than a highly undesirable side-effect of the format, potentially very unfair and very damaging to individuals. How can the structure of the REF be changed to discourage this practice? Many have argued in the past that everyone should be submitted, a solution rejected mainly because of alleged difficulties in defining ``everyone" and/or policing behaviour. Can these problems be overcome? Is there any other solution?

Doctoral research degrees awarded				
2008–09	2009–10	2010–11	2011–12	2012–13
398	498	520	499	600

Figure 2
Math sciences PhDs awarded by submitting Math Science UoAs
(Reproduced with permission from HEFCE)

Total external research income, including income-in-kind (£M)				
2008–09	2009–10	2010–11	2011–12	2012–13
57.84	65.54	69.06	72.75	76.85

Figure 3
External research income won by submitting math. sciences UoAs
(Reproduced with permission from HEFCE)

(iii) Growing departments: Although we don't have evidence to support this, it seems possible that the Impact agenda proved particularly difficult for departments whose staff numbers have increased substantially in the past 25 years, given the likely reliance on research done in the previous millennium, and the required reliance on research done in the UoA. It would be very useful to have specific examples where this issue arose. Can anything be done to prevent the same problem occurring in 2020? For example, should some or all Impact Cases be allowed to travel between UoAs as staff move (as is the case for outputs)?

Correlation of environment with submission size:
In contrast to the good correlation between the Output and Impact Profiles discussed above, the Environment Profile for submissions

in mathematical science was often well out of line with the other parts. In fact, Figure 4 shows striking evidence that, for Mathematical Science at least, the environment scores were often a proxy reward for size. There are suggestions that the methodology for assessing environment imposed by HEFCE on REF subpanels had a lot to do with this outcome. This is clearly a key issue for the next REF. Is it simply the case that big departments offer a better research environment? Or should the methodology be adjusted to give more scope for smaller submissions to shine?

Geographic concentration
(i) The golden quadrilateral: The figures are stark – the ``big four'', Cambridge, Oxford, Imperial, Warwick submitted 497 Category A FTE in mathematical science to REF 2014, over 25% of the total of 1924 FTEs submitted. This total figure is almost identical to the 1930 FTEs submitted to the three mathematical sciences subpanels in RAE 2008, whereas the

quadrilateral's numbers are 12% up on their totalled 2008 submissions. This raises a host of questions: Is this process inevitable? Is it to be welcomed? And then further questions, depending on how you answer those two.
(ii) Scotland: While the total number of submitted Category A FTEs in mathematical science remained constant from 2008 to 2014, in Scotland there was a decline of 5.5% (Figure 5). The suspicion is that this is due to differences in the funding formula between Scotland and the rest of the UK; in particular the research cost weight is 1.2 for mathematical sciences in Scotland, as compared with 1.6 for the other STEM disciplines in Scotland, and 1.6 for most mathematical science in the rest of the UK. Incidentally, while looking at Figure 5, you might note that there was a 9.1% increase in submitted UK FTE numbers for Panel B subjects as a whole between 2008 and 2014, so the level submission figures for mathematical sciences may not be as rosy as we would like to think.
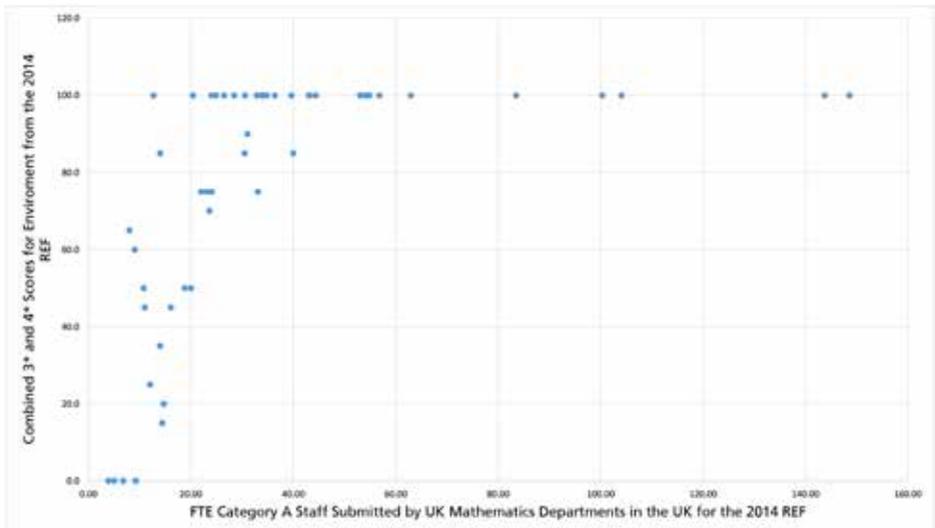
Figure 4
FTE Category A Staff Submitted to the 2014 REF for UK Mathematics Departments
vs
Resultant Combined 3* and 4* Environment Scores

Cat A staff (FTE)	RAE 2008	REF 2014	% change
Panel B – UK	12,234	13,352	9.1%
Math Sci – UK	1,924	1,931	0.3%
Math Sci – Scot	249	235	−5.5%

Figure 5
Staff volume (RAE 2008 and REF 2014)
(Reproduced with permission from HEFCE)

Evaluation of interdisciplinary research
Were mathematical science components of interdisciplinary research assessed fairly in the REF? There have been suggestions that the pressure to write interdisciplinary papers in a style accessible to a wide audience results in a downplaying of the mathematical content, with a consequential under-rating of the work if included in a mathematical science REF submission. We don't have any evidence for this, and it's hard to see how any could be obtained, but perhaps it is something which HEFCE needs to think about?

To recap what was said at the start: we will issue a questionnaire on the REF to mathematical sciences departments shortly. But in the meantime I would very much welcome input from as many people as possible, individuals or groups, either by email to the LMS at duncan.turton@lms.ac.uk or – even better – by contributing to the LMS blog, at http://discussions.lms.ac.uk/members/.

Ken Brown
LMS Vice President

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STOCHASTIC DYNAMICAL SYSTEMS IN BIOLOGY: NUMERICAL METHODS AND APPLICATIONS

Isaac Newton Institute for Mathematical Sciences

OPENING WORKSHOP
18 – 22 January 2016
in association with the Isaac Newton Institute programme
(4 January – 24 June 2016)

The aim of this opening workshop is to introduce participants to the different subject areas of the programme. In particular, this workshop will include a number of mini-courses aimed at senior graduate and postgraduate students, together with high level overview talks, given by world experts, which will highlight some of the major open problems in the different areas of the programme

The following mini-courses have been confirmed (more to follow):
- Stochastic Simulation of Models Arising in the Life Sciences I (non-spatial models): David Anderson (Wisconsin)
- Stochastic Simulation of Models Arising in the Life Sciences II (spatial models): Samuel Isaacson (Boston)
- Narrow escape theory, first passage time to a small hole and applications to modelling cell biology processes: David Holcman (Paris)

Further information and application forms are available from the website
www.newton.ac.uk/event/sdbw01

Closing date for the receipt of applications **11 October 2015**.

MATHEMATICS POLICY ROUND-UP
August 2015

RESEARCH

Science Budget Inquiry
The new Science and Technology Select Committee has launched its first inquiry into the Science Budget. Speaking at the Committee's first evidence hearing on Wednesday 15 July, BIS Minister, Jo Johnson MP, refused to be drawn on whether the future budget would continue to be ring-fenced. More information is available at http://tinyurl.com/nzczkw6.

Dowling Review
The final report of Professor Dame Ann Dowling's review of business-university research collaborations has been published. The report is available at http://tinyurl.com/pmhy3o5.

REF report
An independent report by Technopolis Group has been published that provides a 'comprehensive insight into the varied costs and benefits arising from participation in the 2014 REF'. The report is available at http://tinyurl.com/qgsdaco.

HIGHER EDUCATION

Mathematics and statistics support in higher education
In 2013, HEFCE funded the sigma Network to further embed mathematics and statistics support across the HE sector in England. A key part of this work was to explore existing and future high-level needs, including the assistance institutions might welcome from HEFCE and the sigma Network in ensuring appropriate provision. The investigation has collected and analysed senior management perspectives on mathematics and statistics support needs. The resulting report, *Senior Management Perspectives on Mathematics and Statistics Support in Higher Education: A Research Report* is available at http://tinyurl.com/pdkydvq.

SCHOOLS AND COLLEGES

Study on East Asian teaching method
A new study led by UCL Institute of Education and the University of Cambridge has found that introducing a Singaporean 'mastery' teaching approach in English schools leads to a relatively small but welcome improvement in children's mathematics skills and offers a potential return on investment, after one year.

The study evaluated the impact of Maths Mastery (MM) – a Singaporean-inspired teaching programme – after it was implemented in a selection of England's schools for one academic year. The research involved more than 10,000 students in Year 1 (5-6 years) and Year 7 (11-12 years) in 90 primary schools and 50 secondary schools. More information is available at www.ioe.ac.uk/newsEvents/113590.html.

British Academy urges UK government to address numeracy crisis
'A dramatic improvement in the UK population's mastery of basic numeracy and statistics needs to happen if the country is to take advantage of the data revolution now sweeping the globe.' That's the verdict of a major British Academy report *Count Us In: Quantitative Skills for a New Generation*. More information is available at http://tinyurl.com/ol3z4m2.

OTHER

Membership of new Science and Technology Select Committee
The House of Commons has formally appointed the members of the Science and Technology Committee. More information is available at http://tinyurl.com/pkaja85.

Education and skills survey
According to this year's CBI/Pearson Education and Skills survey, 'the demand for higher-level skills in British industry is set to grow in the years ahead, with sectors central to future growth, including manufacturing and construction, science, engineering and technology particularly hard-pressed'. More information is available at http://tinyurl.com/q93gytd.

Dr John Johnston
Joint Promotion of Mathematics

LONDON
MATHEMATICAL
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150 YEARS

LMS 150th Anniversary
Popular Lectures 2015

Save The Date!

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

• **Birmingham** 23 September at 6.30 pm (Bramall Music Building, University of Birmingham)
  Martin Hairer: *The mathematics of randomness*
  Ben Green: *A good new millennium for prime numbers*

• **Glasgow** 21 October at 6.30 pm (Main Auditorium, Technology and Innovation Centre, University of Strathclyde)
  Hannah Fry: *Patterns in human behaviour*
  Ruth King: *How many......? (Estimating population sizes)*

• **Leeds** 11 November at 6.30 pm (The Great Hall, University of Leeds)
  Hannah Fry: *Patterns in human behaviour*
  Ben Green: *A good new millennium for prime numbers*

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

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

LMS 150TH ANNIVERSARY
GEORGE BOOLE LOCAL HERO CELEBRATION

One of the "Local Heroes" events linked to the Celebration of the 150th Anniversary of the London Mathematical Society took place in the University of Lincoln on 16 July 2015. This was an opening of an exhibition celebrating the bicentenary of George Boole, one of the founding fathers of mathematical logic, who was born and lived for the first half of his life in Lincoln.

The launch event in the University of Lincoln Library was a very warm and dignified event, it was welcoming back one of the city's most famous sons. I felt privileged that I had a chance to take part in this celebration as a representative of the London Mathematical Society.

The exhibition was formally opened by Deputy Vice-Chancellor Professor Scott Davidson. His short speech was touchingly personal: he told how he and his colleagues in the Law Department, when using one of the first computerized databases in 1980s, had to learn Boolean operators "and", "or", "not", and, what was especially challenging, bracket arrangements. But Professor Davidson also told the guests about the tremendous progress of the University of Lincoln in recent years.

George Boole

University Librarian Ian Snowley outlined the story behind the exhibition and thanked all the parties contributing to its success. Again, it was a story of the University's growth, advancement and aspiration. I hope the George
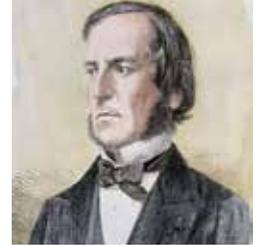
Sasha Borovik, LMS Trustee; Ian Snowley, University of Lincoln Librarian; Mark Hocknull, Canon Chancellor of Lincoln Cathedral; Scott Davidson, University of Lincoln Deputy Vice Chancellor (Teaching Quality & Student Experience)

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Exhibition stand

It was written for humans, not for machines — after all, computers remained non-existent for another century.

In his research in what later became mathematical logic, George Boole extracted the most basic and fundamental laws of thought, so simple that they are now used by computers.

By discovering the algebra of thought — now implemented in computers and electronic devices all around us – Boole changed the course of human civilization.

Boole celebrations will help its fledging Physics and Mathematics Department (it was opened last year) to put themselves on the map.

I made a short speech that can be found at http://tinyurl.com/ps4f2h6. I focused on the social aspect of George Boole's life and work. George Boole was a local hero in his everyday life; in Lincoln, he taught at the Mechanics Institute, fought for the improvement of working conditions of shop workers, founded a building society.

George Boole's famous book *An Investigation of the Laws of Thought* was very down-to-earth, it was a textbook of practical thinking.

These messages were clearly communicated by the exhibition itself, prepared with love and care at the University College Cork where George Boole spent the later part of his life. The exhibition was an example of clarity and quality in the promotion of mathematics.

Alexandre Borovik
LMS Trustee

Further reading:
See http://ow.ly/PemFq for the article in *The Lincolnshire Echo* about the city's tribute to computer genius George Boole to mark 200th anniversary of his birth.
Also the Lincoln Boole Foundation http://www.lincolnboolefoundation.org/

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LMS 150TH ANNIVERSARY
ROBERT RECORDE LOCAL HERO

Tenby Museum Events

As part of the LMS 150th Anniversary Local Heroes project, Tenby Museum has a seven-week exhibition called *Robert Recorde: All Angles Covered*, and is hosting the following lectures:

- 18 September: *Robert Recorde*; Gordon Roberts, author of *The Life and Times of a Tudor Mathematician*
- 9 October: *Robert Recorde and the History of Science*; John Tucker, Computer Science Department, Swansea University
- 23 October: *Robert Recorde: A Man of Principle in a Turbulent Age;* Gareth Roberts, Bangor University

There will also be events specifically for schools, including a one-man show on the life of Recorde and a demonstration on the use of geometry in art.

The exhibition on the Tenby-born inventor of the equals sign runs from 7 September until 23 October 2015. Further details can be obtained from Mark Lewis, Collections Manager, Tenby Museum & Art Gallery (info@tenbymuseum.org.uk).

GCHQ

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LMS 150th Anniversary
Computer Science Colloquium at the Royal Society

Venue: Royal Society, 6-9 Carlton House Terrace, SW1Y 5AG
17 September 2015, 10am - 5pm, followed by a wine reception

Algorithms and Cryptography - Apology Accepted

G H Hardy ended his 1940 essay *A Mathematician's Apology* by declaring that, along with other like-minded mathematicians, he has never done anything 'useful'. Algorithms and cryptography provide the greatest examples disproving this claim, as the existence and non-existence of algorithms solving basic problems of pure maths underpin e-commerce and the security of encrypted digital data. In this colloquium, three illustrious innovators from each of these fields will reflect on the practical importance in our modern digital society of the purely mathematical ideas on which their subjects are based.

Speakers

Mike Paterson (University of Warwick)
The Bent Coin: Tales of the Expected and Unexpected
Jon Kleinberg (Cornell University)
Bursts, Cascades and Hot Spots: Mathematical Models of the Online World
Adi Shamir (Weizmann Institute of Science)
New Connections Between Randomness, Hardness and Security

Nigel Smart (University of Bristol)
It's Good to Talk
Shafi Goldwasser (MIT & Weizmann Institute of Science)
The Cryptographic Lens: Past, Present and Future
Lance Fortnow (Georgia Tech)
The P v NP Problem in the Era of Fast Computing

Register at www.lms.ac.uk/events/computer-science-day. The day is free of charge for PhD students. All other attendees are asked to pay a £5 charge. Travel support is available for PhD students attending the event from outside London. Email lmscomputerscience@lms.ac.uk for details.

1865 - 2015

LONDON
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150 YEARS

LMS 150th Anniversary
Annual General Meeting

The Great Hall, BMA House, Tavistock Square, London (nearest tube: Euston)
13 November 2015, 3pm - 6pm

Programme

- Bill Cook (Waterloo)
  Title: TBA

- Tea/Coffee

- Announcement of Election Results

- Terry Lyons (Oxford)
  Presidential Address

The meeting will include the presentation of certificates to all 2015 LMS
Prize-winners. This will be followed by a reception at De Morgan House,
Russell Square, as well as the Society's Annual Dinner at the Montague Hotel, 15
Montague Street, London, WC1B 5BJ. The cost to attend the dinner will be £53
per person.

Those wishing to attend the dinner should contact Carol Chessis
(AnnualDinner_RSVP@lms.ac.uk) by Friday 30th October.

For further details about the AGM, please contact Elizabeth Fisher
(lmsmeetings@lms.ac.uk)

1865 - 2015

LMS 150TH ANNIVERSARY
DEPARTMENTAL CELEBRATIONS

These events are part of a series of receptions being hosted across the UK by mathematics departments, celebrating the 150th Anniversary of the LMS. For further details, and to see if such an event has been organised for your department, visit www.lms.ac.uk/2015-events-listing.

   Third and final call for departmental celebrations: If your department is interested in taking part in the Departmental Celebrations Grant Scheme, please contact Dept.Celebrations@lms.ac.uk, or look online at www.lms.ac.uk/grants/dept-celebrations for more information on how to apply.

UNIVERSITY OF CAMBRIDGE

Members of the Department of Pure Mathematics and Mathematical Statistics (DPMMS) got together on 12 June to mark the Fourth Rollo Davidson lecture and the announcement of a linked lectureship between Murray Edwards College and DPMMS generously made possible by Nick Corfield. It was during these dual celebrations that we raised a glass to wish the LMS happy 150th birthday.

UNIVERSITY OF SURREY

The Mathematics Department at the University of Surrey hosted its celebration for the 150th Anniversary of the LMS on 27 March. The event was very well attended by the department members, both past and present. We were very happy that Donald Keedwell was able to join the party, and while not a member for all 150 years, he has been an LMS member now for 50 years, which the department is very proud of. The event was topped off by an amazing homemade and decorated cake by Margo and Ellen Bridges complete with Greek letters and Laplace equation. We all in the Mathematics Department at the University of Surrey wish the LMS all the best as it now strides towards its 200 year anniversary.
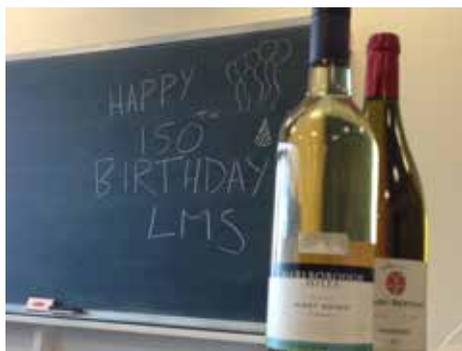
UNIVERSITY OF STRATHCLYDE

The Mathematics and Statistics Department at the University of Strathclyde used this award to part-fund a light lunch for all staff on 22 June (to immediately follow a Departmental meeting). Professor Iain W. Stewart (Head of Department) raised a toast to the health of the LMS and mathematics, and also to the future of the Department. After several years of declining staff numbers we have recently made four new academic appointments, and the lunch was also a great opportunity to welcome some of the new staff members.

READING UNIVERSITY

On 28 April, following our departmental seminar, we celebrated the 150th Anniversary of the London Mathematical Society with a drinks and lunch reception (sponsored by the LMS). Staff and postgraduate students raised a glass in appreciation of the Society's role in advancing and promoting mathematical knowledge, both nationally and internationally.

IMPERIAL COLLEGE LONDON

Imperial College Mathematics Department on 26 June held in the Senior Common Room a toast to the LMS and the continued success of the UK Mathematical community was made. A successful and happy occasion that also marked the end of teaching, marking and examinations for this academic year. .

UNIVERSITY OF BATH

Dr Antal Jarai gave an introduction to the Hardy Lectureship presentation by Professor Nalini Joshi. He recalled G.H. Hardy's efforts to have the importance of pure mathematics recognized in the UK alongside applied mathematics. Hardy regarded all beautiful mathematics important, including contributions by physicists Einstein and Maxwell, and some of his work found unexpected applications in physics. Therefore, his view of supporting beautiful mathematics regardless of immediate scope for applications was very much in line with the LMS' efforts to promote a unity of mathematics. The topic of Professor Joshi's lecture fit in very well with these ideas: the Painlevé equations, as well as other non-linear integrable systems, are both beautiful objects worthy of study in their own right, and also have applications in physics, engineering, and other fields of mathematics.

A wine reception was held following Professor Nalini Joshi's Hardy Lectureship Tour presentation on 19 June. As the topic of the talk spanned a number of groups in our department, there was interest from several people, including from the areas of applied analysis, algebra, geometry and probability. Several PhD students also attended. There was particularly strong interest from the algebra and geometry group, who exchanged ideas with the speaker. Conversations during the reception also mentioned Hardy's famous anti-war quote about no mathematics to be abused to anyone.

In a speech during the reception, Antal recalled some of the history of the LMS: its founding at UCL, how it quickly attracted eminent mathematicians from across the country and established itself as a national society for mathematics. He also recalled the LMS' precursors: the Spitalfields Society and the Royal Astronomical Society, quoting De Morgan "instead of strong beer we have a fermentation of symbols; and we do not serve the light stuff!" Coming to present day efforts of the LMS, he mentioned, among other things, the various grant schemes by which the LMS supports conferences and young mathematicians, the prizes by which it recognizes outstanding contributions, as well as its role as a major scientific publisher providing low cost journals. Jonathan Dawes encouraged the younger attendees to join the LMS. In a toast glasses were raised to celebrate the LMS's 150th birthday.

CELEBRATING 150 YEARS OF THE LONDON MATHEMATICAL SOCIETY

LONDON
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SOCIETY
150 YEARS

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

DEPARTMENTAL CELEBRATIONS
Aberdeen, TBC
Birmingham,18 September
Lancaster, 30 September
Liverpool, 21 September
Nottingham, TBC
Oxford, TBC
Portsmouth, TBC
Queen Mary, 12 October
Southampton, TBC
St Andrews, TBC

LOCAL HEROES EXHIBITIONS
Banff Museum in Scotland dates TBC
Carrickfergus 26 September – 31 October
Dundee 22 August – 1 November
Kensington Central Library dates TBC
Lincoln University Library and Lincoln Cathedral 5 July – 6 September (see page 10)
Tenby 7 September – 23 October (see page 11)

LMS-NZMS AITKEN LECTURE TOUR
Steven Galbraith (University of Auckland) (see page 21)
13 October Royal Holloway, London
20 October, Open University
22 October, Oxford
23 October, Bristol
28 October, Sheffield
29-30 October, Loughborough

SEPTEMBER
LMS-CMI Research School
Computational Algebraic Topology
7-11 September, Oxford
LMS-CMI Research School
Diophantine Equations
15-19 September, Hay-on-Wye
Computer Science Colloquium
17 September, The Royal Society, London (see page 12)

Joint Anniversary Mathematical Weekend Meeting with the European Mathematical Society
18-20 September, University of Birmingham (see page 26)
Open House
20 September, De Morgan House, London (see page 3)
Popular Lectures Birmingham
23 September (see page 9)

OCTOBER
Popular Lectures Glasgow
21 October (see page 9)
Bloomsbury Festival
22-25 October, London

NOVEMBER
Popular Lectures Leeds
11 November (see page 9)
LMS Anniversary Prize Giving
AGM and Society Meeting
BMA House, London
13 November (see page 13)
Annual Dinner
Montague Hotel, London
13 November (see page 13)
Mathematics Festival @ The Science Museum
24-29 November, London
Joint Meeting with the Institute of Physics and Royal Astronomical Society
28-29 November, QMUL, London (see page 38)

DECEMBER
Joint Meeting with the Edinburgh Mathematical Society
10-11 December, ICMS, Edinburgh
Enhanced South West and South Wales Regional Meeting
14-17 December, University of Southampton
LMS Prospects in Mathematics
15-16 December, Loughborough

LMS 150TH ANNIVERSARY
LMS HANDBOOK AND LIST OF MEMBERS

A special commemorative 150th Anniversary edition of the Society's *Handbook and List of Members* will be published in 2016. The Society's *Handbook and List of Members* will contain information about the Society's activities including the Anniversary celebrations, publications, grants and events as well as a list of its members and their details; name, address, email, degrees, fields of interest, year of election to the Society.

The *150th Anniversary Handbook and List of Members* will be available to all members, both in print and online via the LMS website. The printed version will be available to members only. The online version will also be available to the general public and will continue to exist from 2016 onwards.

The Society intends to include as many of its members as possible in the published *150th Anniversary Handbook and List of Members* and its online counterpart. Members not wishing to be included have the opportunity to "opt out".

All members are asked to check and amend (if needed) their information on their online membership record, which can be accessed via the Society's website: www.lms.ac.uk/user (Members' usernames are their emails addresses, as registered with the Society. Members without passwords should request a new password). Members without email addresses will be sent paper forms to complete.

Please note that when checking their information, members will have the opportunity to "opt out" of any information that they do not wish to be included in either the printed *150th Anniversary Handbook and List of Members* and/or the online *List of Members*.

The Society would like to include as many members as possible in the *150th Anniversary Handbook and List of Members* and asks that all members confirm their details and their permissions no later than **31 October 2015**.

The *150th Anniversary Handbook and List of Members* will be available in early 2016.

Any queries regarding the *150th Anniversary Handbook and List of Members* should be directed to membership@lms.ac.uk.

Elizabeth Fisher
Membership & Activities Officer.

LMS 150TH ANNIVERSARY
UCL PUBLISHES LMS EXHIBITION ONLINE CATALOGUE

University College Library Services has recently published an online catalogue (http://tinyurl.com/pvzeqjs) for Queen of the Sciences: A Celebration of Numbers and the London Mathematical Society.

The exhibition, which has been open to the public since February 2015 and will remain open until December 2015, is located in the UCL Main Library and features a range of early documents and photographs from the LMS archives, supplemented by material from the UCL Special Collections.

Highlights include a student's sketch of the LMS founding President Augustus De Morgan, a sketch of an early LMS logo by Sophia de Morgan, and a letter from George de Morgan and Arthur Cowper Ranyard inviting Thomas Archer Hirst to the inaugural meeting of the Society in 1865.

For more information, visit www.ucl.ac.uk/library/exhibitions or call the UCL Library reception on +44 (0)20 7679 7793.

LMS 150th Anniversary

LMS – NZMS Aitken UK Lecture Tour 2015

The 2015 LMS Aitken Lecturer is Prof Steven Galbraith (University of Auckland)

The Forder-Aitken lectureship scheme is a collaboration between the London Mathematical Society and the New Zealand Mathematical Society in which each Society invites an eminent mathematician from the other country to give lectures at different universities around their country.

Steven Galbraith is the third Aitken Lecturer to visit the UK and he will give talks on Linear Algebra with *Errors, Coding Theory, Cryptography and Fourier Analysis on Finite Groups* and *Kangaroos, Card Tricks and Discrete Logarithms* at:

Royal Holloway, University of London
13 October
Organiser: Simon Blackburn
s.blackburn@rhul.ac.uk

Open University
20 October
Organiser: Phil Rippon
p.j.rippon@open.ac.uk

Oxford
22 October
Organiser: Alan Lauder
lauder@maths.ox.ac.uk

Bristol
23 October
Organiser: Neil Saunders
neil.saunders@bristol.ac.uk

Sheffield
28 October
Organiser: Kirill Mackenzie
k.mackenzie@sheffield.ac.uk

Loughborough
29/30 October
Organiser: Alexandre Veselov
a.p.veselov@lboro.ac.uk

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

1865 - 2015

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LMS ELECTIONS 2015

Voting for the LMS 2015 Elections will open on 8 October. All members who are registered for electronic contact and who are eligible to vote will receive an email with instructions on how to vote, paper copies will not now be sent automatically to those so registered. Paper copies may be requested. Members eligible to vote who are not registered for electronic communication will be sent a paper copy, though such members are able to vote online and are encouraged to do so.

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

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

The Society will also host an Elections Forum on the LMS website for use by candidates and members. All members are encouraged to make use of the Forum.

It is hoped as many members as possible will vote in the 2015 LMS Elections. Results will be announced at the Society's AGM to be held on 13 November 2015.

Ensure that your details are current

All members are strongly encouraged to ensure that their email and postal contact details registered with the Society are up-to-date to enable the election process to run smoothly. All members can electronically update their personal contact details on the Members Section of the LMS website and all members are encouraged to use this facility. Any changes to personal details would be required no later than 9 September 2015 for election purposes.

Fiona Nixon
Executive Secretary

LMS GRANT SCHEMES

Next Closing Date for Research Grant Applications: 15 September 2015

Applications are invited for the following grants:

Conferences (Scheme 1)
Grants of **up to £7,000** are available to provide partial support for conferences held in the United Kingdom. This includes a maximum of £4,000 for principal speakers, £2,000 to support the attendance of research students who are studying at universities in the UK and those on a career break, and £1,000 to support the attendance of participants from Scheme 5 or former Soviet Union countries.

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

Visits to the UK (Scheme 2)
Grants of **up to £1,500** are available to provide partial support for a visitor to the UK, who will give lectures in at least three separate institutions. Awards are made to the host towards the travel, accommodation and subsistence costs of the visitor.

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

Joint Research Groups (Scheme 3) – Renewal procedure

ALL renewal applications MUST be accompanied by a Financial and Academic Report for the previous year's activities. Please note that full reports should always be submitted ('light touch' refers to the application procedure only). Grant holders wishing to renew their application may use the Light Touch Application Form if the original or last full renewal application was made in the last TWO years, and NONE of the following have changed:

• the grant holder
• the supporters, and
• the amount requested*

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

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

• the grant holder
• the supporters or
• the amount requested

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

Research in Pairs (Scheme 4)

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

International Short Visits (Scheme 5)

Grants of **up to £3,000** are available to support a visit for collaborative research by a named mathematician from a country in Africa (or countries where mathematics is in a similar position) to the home base of the grant holder. Grants of **up to £2,000** are available to support a visit for collaborative research by the grant holder to a country in Africa (or countries where mathematics is in a similar position).

Postgraduate Research Conferences (Scheme 8)

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

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

• Applications received by **15 September 2015** will be considered at a meeting in October.
• Applications should be submitted well in advance of the date of the event for which funding is requested.
• Normally grants are not made for events where insufficient time has been allowed for processing of the application. In addition, grants are not awarded retrospectively.
• Grant applicants must be mathematicians based in the UK. For applicants who are not members of the LMS, you will need to ask an LMS member to support your application.

   Queries regarding applications can be addressed to the Grants Administrator or the Programme Secretary who will be

pleased to discuss proposals informally with potential applicants and give advice on the submission of an application.

- Grants Administrator: Anthony Byrne (tel: 020 7927 0807, email: grants@lms.ac.uk).
- Programme Secretary: Professor Iain A. Stewart (i.a.stewart@durham.ac.uk).

OTHER LMS GRANTS AND FUNDING

Research Workshop Grants
The Society offers grants to support Research Workshops held in the UK. Requests for support (for travel and subsistence of participants, and reasonable associated costs) in the range **£1,000-£10,000** will be considered. The maximum award is **£10,000**, but a typical award is in the range of **£3,000 - £5,000**. Applications for partial support of workshops with other sources of support will be considered. Applications should normally be submitted 12 months in advance of the proposed workshop. For further information visit: www.lms.ac.uk/content/research-workshops-grants.

Young British and Russian Mathematicians Scheme
The Young British and Russian Mathematicians Scheme is coming to a close at the end of 2015, and as such is no longer accepting applications.

Spitalfields Days
Next deadline: 15 September 2015
Grants of **up to £1,000** are available to support an LMS Spitalfields Day, which have been run since 1987 and are in honour of the Society's predecessor, the Spitalfields Mathematical Society (1717-1845). A Spitalfields Day is a one-day meeting, which is usually associated with a long-term symposium on a specialist topic at a UK university. Selected participants, often distinguished experts from overseas, give survey lectures (or other types of lecture accessible to a general mathematical audience) on topics in the field of the symposium. Please see the website for further details: www.lms.ac.uk/content/spitalfields-days.

Grace Chisholm Young Fellowship
Next deadline: 31 December 2015
The Society offers two fellowships of **£1,000** (consisting of £500 personal support and £500 contribution to a host institution) each year to mathematicians who need support when their mathematical career is interrupted by family responsibilities, relocation of partner, or other similar circumstance.

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

Small Grants for Education
Next deadline: 30 November 2015
Funding for grants **up to £800** is available to stimulate interest and enable involvement in mathematics from Key Stage 1 (age 5+) to Postgraduate level and beyond. Anyone working/based in the UK is eligible to apply for a grant. If the applicant is not a member then the application must be countersigned by an LMS member or another suitable person such as a Head teacher or senior colleague. Please see the website for further details: www.lms.ac.uk/content/small-grants-education.

Computer Science Small Grants (Scheme 7)
Next deadline: 15 November 2015
Funding for grants **up to £500** is available to support a visit for collaborative research at the interface of Mathematics and Computer Science either by the grant holder to another institution within the UK or abroad, or by a named mathematician from within the UK or abroad to the home base of the grant holder. Please see the website for further details: www.lms.ac.uk/content/computer-science-small-grants-scheme-7.

Childcare Supplementary Grants
Next deadline: 15 September 2015
Grants of **up to £200** are available to parents working in mathematics to help with the cost of childcare when attending a conference or research meeting. The Society believes that all parents working in mathematics should be able to attend conferences and research meetings without being hindered by childcare costs. Institutions are expected to make provision for childcare costs and parents are encouraged to make enquiries. However, where this is not available, the Society administers a Childcare Supplementary Grants Scheme. Please see the website for further details: www.lms.ac.uk/content/childcare-supplementary-grants.

PERIGAL ARTEFACTS

The London Mathematical Society has been given by Daniel Miskow some items which once belonged to Henry Perigal, an LMS member famous for his proof of Pythagoras's Theorem by dissection. The items include a collection of index cards containing the diagrams from Euclid's Elements, and a beautifully-dec-orated envelope made by folding paper. The envelope contains six cardboard triangles and five quadrilaterals, as well as three pieces of blueish paper, carefully cut and folded. The members of the Library Committee have been unable to deduce their purposes and would welcome elucidation from members.

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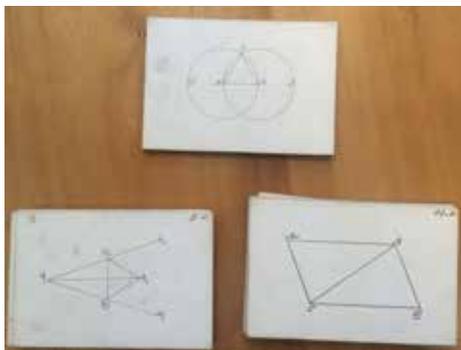
Joint Anniversary Weekend
LMS-EMS Mathematical Meeting

Birmingham, 18-20 September, 2015

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

We hope to see you in Birmingham.

Plenary speakers

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

Organising Committee
Chris Parker, Anton Evseev, Maria Reguera Andrew Treglown

Scientific Committee
Gabriel Navarro, Valencia
Angelika Steger, Zürich
Ana Vargas, Madrid

Invited Special Lecture Speakers

Algebra Special Lectures

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

Analysis Special Lectures

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

Combinatorics Special Lectures

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

History Special Lectures

*   Niccolò Guicciardini, Bergamo

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

EPSRC
Engineering and Physical Sciences
Research Council

Durham University

LONDON MATHEMATICAL SOCIETY
150 YEARS

LMS-EPSRC DURHAM SYMPOSIA

CALL FOR PROPOSALS

The London Mathematical Society invites proposals for Durham Symposia in 2017 and beyond.

The LMS and the EPSRC intend to support at least two Durham Symposia in 2017.

The Symposia began in 1974, and have now become an established and recognised series of international research meetings. They provide an excellent opportunity to explore an area of research in depth, to learn of new developments, and to instigate links between different branches. The format is designed to allow substantial time for interaction and research. The meetings are by invitation only and held in July and August, usually lasting 10 days, with up to 70 participants, roughly half of whom will come from the UK. They are held at the University of Durham.

Prospective organisers should send a formal proposal to the Durham Representative, Dirk Schuetz (dirk.schuetz@durham.ac.uk) by **Friday 20 November 2015**.

Proposals should include:
• A full list of proposed participants, divided into specific categories (please see the guidance on submission of proposals at www.lms.ac.uk/events/durham-symposia for more details). Proposers are encouraged to actively seek to include women speakers and speakers from ethnic minorities, or explain why this is not possible or appropriate.
• A detailed scientific case for the symposium, which shows the topic is active and gives reasons why UK mathematics would benefit from a symposium on the proposed dates.
• Details of additional support from other funding bodies.
• Where appropriate, prospective organisers should consider the possibility of an 'industry day'.

The Durham Representative will provide an estimated cost for accommodation for the symposium and estimated travel costs for each participant.

For further details about the Durham Symposia, please visit the Society's website: www.lms.ac.uk/events/durham-symposia.

Before submitting: Organisers are welcome to discuss informally their ideas with the Durham Representative (dirk.schuetz@durham.ac.uk) and/or the Chair of the Research Meetings Committee, Professor Beatrice Pelloni (RMC.Chair@lms.ac.uk).

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LMS ANNUAL SUBSCRIPTION 2015-16

Members are reminded that their annual subscription, including payment for publications, for the period November 2015-October 2016 is due on **1 November 2015** and payment should be received by 1 December 2015.

Membership subscription rates
The annual subscription to the London Mathematical Society for 2015-16 is:

Ordinary membership	£70.00	US$140.00
Concessions on ordinary membership:		
Reciprocity	£35.00	US$70.00
Career break or part-time working	£17.50	US$35.00
Associate membership	£17.50	US$35.00

Please note that new members, who were elected at a Society Meeting in 2015 and who have set up a direct debit to pay their subscription fees, will be entitled to a 50% discount on the above prices (excluding concessionary membership).

LMS journal prices
The prices of the Society's periodicals for 2016 are:

	Online only	Print & online	
Bulletin	Free	£81.00	
Journal	Free	£400.00	
Proceedings	Free	£400.00	
		Rest of world*	North America*
Nonlinearity	Free	£400.00	£400.00 (US$640.00)
JCM (electronic)	Free (http://tinyurl.com/o8qb3c8)		

*current subscribers only

We would like to draw members' attention to the following changes regarding the Society's journals:

1. The Society now offers free online access to the *Bulletin, Journal* and *Proceedings of the London Mathematical Society* and to *Nonlinearity* for personal use only. To receive free electronic access for personal use, please note this on your subscription form when returning it to the Membership Department.

2. Please note that for online journal subscriptions it is essential that members provide the Society with an up-to-date email address as the email address will be passed to:

   i. Oxford University Press for subscriptions to the *Bulletin, Journal* and *Proceedings of the London Mathematical Society.*

   ii. Institute of Physics for subscriptions to *Nonlinearity*.

   The relevant publisher will then contact members with further details about their subscription.

3. Council has agreed the Society will continue to offer the "Print & online" option for *Nonlinearity* to current subscribers only from 1 January 2016.

Subscription rates for the European Mathematical Society and Journal of the European Mathematical Society via the LMS

Members also have the option to pay their European Mathematical Society subscription via the LMS and subscribe to the Journal of the EMS:

EMS subscription (via the LMS)	£22.00	US$44.00
JEMS subscription (via the LMS)	£120.00	US$240.00

Renewal and payment

Members can now renew and pay for their Society membership online via the Society's website: http://lms.ac.uk/user

Members can now log on to their LMS user account and make changes to their contact details and journal subscriptions. Please note members may not change their membership type e.g. from Ordinary to Reciprocity without first contacting Membership (membership@lms.ac.uk; 020 7927 0807; 020 7291 9973).

A subscription form will be sent by email or post to all members for reference and/or to complete and return with payment. If you do not receive your subscription form by 30 September 2015, please contact Membership (membership@lms.ac.uk; 020 7927 0807; 020 7291 9973).

Payment by Direct Debit

Setting up a direct debit: new direct debit payers

The Society encourages payment by direct debit. If you do not already pay by this method and would like to set up a direct debit (this requires a UK bank account), please visit the LMS website to download *Guidance on Setting Up a Direct Debit*: www.lms.ac.uk/membership/paying-your-subscription for further information on setting up a direct debit online with GoCardless.com

Setting up or making changes to a direct debit: current direct debit payers

If you do already pay by direct debit and would like to make changes or set up a new direct debit (this requires a UK bank account), please visit the LMS website to download *Guidance on Setting Up a Direct Debit* (current direct debit payers): www.lms.ac.uk/membership/paying-your-subscription for further information on making changes or setting up a direct debit online with Go Cardless.com

Payment by credit/debit card

The Society now accepts payment by credit/debit card online via its website.

Payment by cheque

The Society also accepts payment by cheque either in GBP or USD.

Please note that subscriptions become due on 1 November 2015 and payment should be received by 1 December 2015. Payments received after this date may result in a delay in journal subscriptions being renewed.

Elizabeth Fisher
Membership & Activities Officer

BSHM NEW WEBSITE

The British Society for the History of Mathematics (BSHM) has recently unveiled a new website, which features a bright and easily-navigable interface, information on the history of mathematics, and links to news updates and upcoming events. The website can be found at www.bshm.ac.uk.

BRITISH SOCIETY
FOR THE HISTORY
OF MATHEMATICS

RECORDS OF PROCEEDINGS AT LMS MEETINGS
GENERAL MEETING, 3 JULY 2015

held at BMA House, London. Over 70 members and visitors were present for all or part of the meeting.

The meeting began at 3.30 pm with the President, Professor Terry Lyons, FRS, in the Chair.

On a recommendation from Council it was agreed to elect Professor Chris Lance and Professor Rodney Sharp as scrutineers in the forthcoming Council elections. The President invited members to vote, by a show of hands, to ratify Council's recommendation. The recommendation was ratified unanimously.

Twenty people were elected to Ordinary Membership: Christian Beck, Andy Brighouse, Miroslav Chlebik, Omole Ezekiel, Shelly Fell-Bowers, Maribel Fernandez, Farzaneh Golboni, David Hopkins, Patrick Isiuwe, Gareth Jones, Alessio Martini, Gennady Mishuris, Adil Naveed Asim, Robert A. Penfold, Amarpreet Rattan, Mohammed Salim Jbara Al-Bahadeli, Felix Schulze, Asim Shafiq, Steven Tobias, László Végh.

Fourteen people were elected to Associate Membership: Hussain Ahmed M. Albarhrani, Mirzaman Ch, Sam Chow, Stamatis Dimopoulos, Salvish Goomanee, Clement Goulet, Mareike Haberichter, Emma Harris, Thomas Oliver, Luka Rimanic, Marius Sampid, James Stankewic, Kenneth Uda, Muhammad Zeshan.

Three people were elected to Reciprocity Membership: Vinod Kumar, Rakesh Parmar, Kishor Shinde.

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

The President, on Council's behalf, proposed that the following people be elected to Honorary Membership of the Society in its 150th Anniversary year:

Professor Joan Birman, Professor Emerita at Barnard College, Columbia University

Professor Robert Calderbank, the Charles S. Sydnor Professor of Computer Science at Duke University

Professor Shafi Goldwasser, Massachusetts Institute of Technology and Weizmann Institute of Science

Professor Donald Knuth, Professor of Arts & Computer Programming at Stanford University

Professor Robert Langlands, Institute of Advanced Study, Princeton University

Professor Maryam Mirzakhani, Stanford University

This was approved by acclaim. The President read a short version of the citations, to be published in full in the *LMS Bulletin*.

The President then announced the awards of the prizes for 2015:

Pólya Prize: Professor Boris Zilber (University of Oxford)

Shephard Prize: Professor Keith Ball, FRS (University of Warwick)

Senior Whitehead Prize: Professor Robert MacKay, FRS (University of Warwick)

Naylor Prize & Lectureship in Applied Mathematics: Professor Stephen Jonathan Chapman (University of Oxford)

Berwick Prize: Professor Pierre-Emmanuel Caprace (Université Catholique de Louvain) and Professor Nicolas Monod (Ecole Polytechnique Federale de Lausanne) – joint award

Whitehead Prizes: Professor Peter Keevash (University of Oxford); Dr James Maynard (University of Oxford); Professor Christoph Ortner (University of Warwick); Professor Mason Porter (University of Oxford); Professor Dominic Vella (University of Oxford); Dr David Loeffler (University of Warwick) and Dr Sarah Zerbes (University College London) – joint award

Anne Bennett Prize: Dr Apala Majumdar (University of Bath)

The President then announced the awards of the special 150th Anniversary Prizes for 2015:

Hirst Prize & Lectureship: Dr John O'Connor and Professor Edmund Robertson (both of the University of St. Andrews) – joint award

Communication Prize: Professor Chris Budd (University of Bath)

The President read short versions of the citations, to be published in full in the *LMS Bulletin*.

The President introduced a lecture given by Professor Marta Mazzocco (University of Loughborough) on *Cluster algebras and Painleve's equations*.

Following a break for tea, the President introduced the 150th Anniversary Hardy lecture by Professor Nalini Joshi (University of Sydney) on *Symmetry through geometry*.

At the end of the meeting, the President thanked both speakers for their brilliant lectures.

The President also thanked Rod Halburd (University College London) for organising the Graduate Student Meeting in the morning and Sara Lombardo (University of Northumbria) and Frank Nijhoff (University of Leeds), who gave talks at the Graduate Student Meeting.

After the meeting, a reception was held at De Morgan House, followed by a dinner at the Blue Door Bistro in the Montague on the Gardens Hotel.

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

held at the Mathematics Institute, University of Warwick, as part of the Enhanced 150th Anniversary Midlands Regional Meeting and formed part of the regional conference on *Finite Simple Groups and Related Topics*. Over 60 members and visitors were present for all or part of the meeting.

The Midlands Regional Meeting was held on the occasion of the 70th birthday of Professor Richard Lyons of Rutgers University.

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

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

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

Professor Terry Lyons asked all present whether the Records of Proceedings for two previous Society Meetings – the Meeting of 1 April 2015 and the Meeting of 9 May 2015 – were a true and accurate record of what happened, and signed the Records of Proceedings as accurate.

Professor Inna Capdeboscq introduced a lecture given by Professor Robert Guralnick of the University of Southern California on the *Application of the Classification of Finite Simple Groups*.

After a coffee break, Professor Capdeboscq introduced a lecture given by Dr Colva Roney-Dougal of St Andrews on *Generation of Finite Groups*.

The President, Professor Lyons, expressed the warm thanks of the Society to the speakers and Inna Capdeboscq, Robert Guralnick, Christopher Parker, John Shareshian and Ronald Solomon for hosting such an amazing and energetic event.

Professor Christopher Parker then introduced a Poster Presentation by PhD students.

Afterwards, a wine reception and dinner were held in the Mathematics Institute of the University of Warwick, at which Dr Peter Neumann of The Queen's College, University of Oxford, gave a speech titled *A Few Words about The London Mathematical Society for its Birthday*.

LMS MIDLANDS REGIONAL MEETING

Report

The 2015 enhanced LMS Midlands Regional meeting took place at the University of Warwick on Tuesday 7 July. It was attended by over 80 mathematicians from the UK and worldwide. The regional meeting was followed by a three day conference on *Finite simple groups and related topics* held to celebrate the 70th birthday of Professor Richard Lyons and his seminal contribution to the theory of finite groups.

The local organizer of the meeting introduced the President of the LMS Professor Terry Lyons, who launched the meeting by warmly welcoming the participants. Following a long-standing tradition, the President then invited members of the Society who had not signed the Membership Book to do so. The first talk was given by Professor Robert Guralnick (University of Southern California), who discussed several exciting applications of the Classification of Finite Simple Groups in group theory and other areas of mathematics. After a short break, the second talk was delivered by Dr Colva Roney-Dougal (St Andrews). She considered various questions related to the generation of finite groups, with a special focus on finite simple groups.

The next scientific event was a postgraduate poster presentation session; it was preceded by an introduction by Professor Chris Parker (University of Birmingham) who introduced 12 graduate students (eight of whom came from British universities, while the remaining four had come from Russian institutions for the event), and briefly explained the focus of the posters that each of the students had prepared. All the participants then moved to the first floor of the Mathematics Institute where the posters had been displayed in preparation for the session. The poster presentation, which lasted over an hour, was vibrant and stimulated interesting discussions centred around the themes of the displays.

The poster session was followed by a wine reception. Dr Peter Neumann (University of Oxford) gave a short talk about the history of the LMS and proposed a toast to the LMS in commemoration of its 150th Anniversary. The day was concluded by a dinner served in the lounge of the Warwick Mathematics Institute.

The next three days were filled by a series of fascinating talks cataloguing recent developments in the study of the algebra surrounding the finite simple groups. The talks covered a very large spectrum, from the history of the subject with Dr Peter Neumann's talk about Galois and the birth of finite simple groups, to current frontier topics with Professor Michael Aschbacher's (Caltech) talk on Fusion systems and recent developments in his new programme aimed at simplifying the classification of finite simple groups of component type.

The speakers in alphabetical order were Professor Michael Aschbacher, Professor Andrew Chermak (Kansas State University), Professor Robert Griess (University of Michigan), Dr Ellen Henke (University of Aberdeen), Professor Martin Liebeck (Imperial College London), Dr Justin Lynd (Rutgers University), Dr Peter Neumann , Professor Chris Parker, Professor Gary Seitz (University of Oregon), Professor John Shareshian (Washington University in St Louis), Professor Ronald Solomon (Ohio State University), Professor Gernot Stroth (Universitĺt Halle), Professor John G. Thompson (University of Cambridge).

The meeting and the conference were organized by Dr Inna Capdeboscq (University Warwick), Professor Robert Guralnick, Professor Chris Parker, Professor John Shareshian and Professor Ronald Solomon. It was made possible due to the generous support of the LMS, together with the help of the NSA, Rutgers University and the Mathematics Institute of the University of Warwick.

Inna Capdeboscq (University of Warwick)
Chris Parker (University of Birmingham)

Richard Lyons and Terry Lyons

Robert Guralnick's talk

Colva Roney-Dougal's talk

Poster discussions

Peter Neumann's toast to the LMS

LMS GRADUATE STUDENT MEETING

Report

The London Mathematical Society Graduate Student Meeting was held on the 3 July 2015 at BMA House, London. The meeting was immediately followed by a General Meeting of the Society which included the 150th Anniversary Hardy Lecture by Nalini Joshi (University of Sydney) as well as a lecture by Marta Mazzocco (Loughborough)

The graduate student meeting was a great opportunity for students from different universities to get to know each other and to give short talks in a friendly environment. It was also a useful way of encouraging PhD students to attend the General Meeting and Hardy Lecture and to feel a part of the Society's 150th celebrations. To this end the student meeting included two invited speakers, both of whom offered lectures related to the two talks mentioned above.

The first invited speaker was Sara Lombardo (Northumbria), who spoke on *Automorphic Lie algebras and root system cohomology*. This talk touched on two of the main themes of Professor Joshi's talk: root systems and integrability. The talk was a study of some of the important algebraic properties that arise in the linear problems (Lax pairs) that underlie the integrability of many equations.

Dr Lombardo's talk was followed by twelve short talks by PhD students, divided in two parallel sessions. The topics ranged from the very pure to the very applied. The first session included several talks on integrable systems (Gregorio Benincasa, UCL; George Berkeley,

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Leeds; Bjorn Berntson, UCL; and Pierpaolo Calligaris, Loughborough). There were also talks on mathematical biology and mathematical physics (Tahani Al-Karkhi and Omar Karakchi, both from the University of Essex).

The second session included talks on group theory (Chimere Anabanti, Birkbeck), supergravity (Andrea Fontanella, Surrey), dynamical systems (Clément Goulet, Paris 1, Panthéon-Sorbonne), fluids (Mohammad Mahdi Jalali and Mohammad Reza Jalali, both from Edinburgh) and finance (Arnaud Trébaol, Paris 1, Panthéon-Sorbonne).

After lunch, prizes were awarded for the best talk in each session with both awards proving very difficult decisions. The prize for the first group was awarded to Gregorio Benincasa (UCL) and the prize for the second group went to Andrea Fontanella (Surrey). The prizes were handed out by the 150th Anniversary Hardy Lecturer, Nalini Joshi.

The meeting closed with a talk by the second invited lecturer, Frank Nijhoff from the University of Leeds, who spoke on *Lagrangian multiform theory - A new variational approach for integrable systems*. The talk explored Lagrangian structures for integrable systems that reflect the multidimensional consistency of these systems.

The student meeting had a relaxed atmosphere and was an ideal warm-up to the 150th Anniversary Meeting and Hardy Lecture.

Rod Halburd
University College London

Photographs of this meeting are on the back page of this *Newsletter*

FUTURE PLANS FOR ALAN TURING INSTITUTE

The Alan Turing Institute has announced the appointment of Professor Andrew Blake, currently Director of Microsoft Research Cambridge, as its first Director. Professor Blake will join the Institute in October. Along with the announcement of its new Director the Institute has marked its first few days of operations with the confirmation of £10 million of research funding from Lloyd's Register Foundation, a research partnership with GCHQ, a collaboration with Cray Inc. and EPSRC, and its

first research activities.

The Institute is a joint venture between, the universities of Cambridge, Edinburgh, Oxford, UCL, Warwick and the Engineering and Physical Sciences Research Council (EPSRC) and has its headquarters at the British Library. The Institute is being funded over five years with £42 million from the UK government. The university partners are contributing £5 million each, totalling £25 million. In addition, the Institute is seeking to

partner with other business and government bodies. The creation of the Institute has been coordinated by the Engineering and Physical Sciences Research Council (EPSRC).

The Institute will promote the development and use of advanced mathematics, computer science, algorithms and big data for human benefit. Research work will begin this autumn with a series of data summits for commerce, industry and the physical and social sciences and scoping workshops for data and social scientists to inform

and shape the Institute's research agenda.

The Council for the Mathematical Sciences (CMS) welcomes the announcement of the appointment of the Alan Turing Institute's first Director and the outline for the Institute's future activities. Mathematical sciences underpin our 21st century technology, economy and society and the Institute will play a vital role in advancing areas of research that can provide opportunities across the entire mathematical sciences landscape.

LMS COUNCIL DIARY
3 July 2015
A personal view

The July meeting of Council finished early, in time for a Society Meeting, this year including Nalini Joshi's Hardy Lecture. Nevertheless there was a particularly full agenda, which has required this diary to be even more selective than usual.

The most important issue at the meeting was financial. The third-quarter review suggested that the current year would be within budget. The anticipated deficit (largely due to extra 150th Anniversary activities) was likely to be somewhat smaller than predicted, in part because of better than expected publication income.

In introducing the budget for next year, and planning figures for the succeeding years, Treasurer Rob Curtis reminded Council that to maintain financial stability we intended by 2020 to restore the Society's assets to a level comparable to where they had been before the erosion associated with the economic crisis. Thus far we were on target to achieve this, but now, particularly taking into account the move to a new publisher, it was necessary to make some savings. He proposed, and Council accepted, with, of course, some reluctance, a range of cuts to budgets. Almost half of the savings were accounted for by an annual reduction of £50,000 (around 12%) to the Scheme Grants awarded by the Programme Committee. Of course such grants have only ever been a contribution towards funding conferences, research visits, etc. Also significant, and painful, was a halving of spending on the Undergraduate Bursary Scheme. It was hoped that either external sponsorship or

departmental contributions might fill the gap. The Treasurer confirmed that the Postdoctoral Mobility Grants could not be extended beyond the three years previously agreed.

A recurring theme in the President's update on his activities at each Council has been a report of a meeting which laid a strong emphasis on mathematics, but at which he had been the only mathematician. In this case it was a House of Lords breakfast meeting to launch the British Academy's report *Count Us In: Quantitative Skills for a New Generation*. The presentation had emphasized the importance of mathematics to the social sciences. It was hoped that we might arrange a joint meeting on this theme.

As well as agenda items for discussion, Council papers always include a number of 'matters for noting'. Such matters only get discussed if raised by a Council member, and this happens rather rarely, but the papers are often worth reading. A recurring such item is the report from the MathJax Consortium, of which the Society is a supporter. MathJax provides the successor technology to jsmath enabling web pages to display mathematics, and is used by several of our journals. This time the report contained some material which I found interesting: a discussion of improving accessibility, and a method of producing "collapsed" forms of mathematical expressions for reading on small screens; at http://codepen.io/pkra/full/GJJoWJ there is a demonstration.

Francis Clarke

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**Formal Aspects of Computing
Science Specialist Group**

LONDON MATHEMATICAL SOCIETY
150 YEARS

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

Tuesday 3rd November 2015, 6:00pm

Professor Roland Backhouse
(University of Nottingham)

The Mathematics of Program Construction

The Mathematics of Program Construction is the title of a series of conferences that was initiated by Jan van de Snepscheut and Professor Backhouse in 1989 and is how he has described his research since round about that time. Its goal is to improve the reliability and dependability of computer software by developing mathematical theories and methods focused on the process of constructing software. In this talk Professor Backhouse will give a personal view on what the mathematics of program construction is about.

Software construction is underpinned by abstraction and calculation. Abstraction is the process of modelling the real world and calculation is used to construct implementations that achieve desired effects based on those models. Choosing the right abstractions and developing the calculational method are therefore fundamental to developing the mathematics that supports software construction. Professor Backhouse will sketch a number of algebraic systems that, in his view, play a central role in software development. These include regular algebra, relation algebra, fixed-point calculus and category theory. He will also argue that a greater focus on articulating the calculational method can make a significant contribution to improving our constructive problem-solving skills.

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

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

IINII Isaac Newton Institute for Mathematical Sciences

THE ROLE OF THE HIGHER INFINITE IN MATHEMATICS AND OTHER DISCIPLINES

14 – 18 December 2015

in association with the Isaac Newton Institute programme
Mathematical, Foundational and Computational Aspects of the Higher Infinite
(19 August – 18 December 2015)

The objective of the programme *Mathematical, Foundational and Computational Aspects of the Higher Infinite* is to stimulate the exchange of ideas among researchers pursuing different approaches to infinity: mathematical, foundational, and computational.

Traditional set theory has been rather inwards-looking for many decades, dealing with the difficult and rewarding technical problems that the field provided. This has changed in the last decade, and set theorists have been eager to see the connections between their work and what is done in other fields of mathematics as well as outside of mathematics. Examples are the study of infinite games in the social sciences and theoretical computer science, the use of strong logics in data base theory, and the use of ideas from infinite combinatorial set theory in the design and analysis of efficient computer algorithms.

Our final workshop will highlight this network of applications of the higher infinite in mathematics and beyond.

As part of this meeting, we are also celebrating the 50th birthday of one of the three programme organisers, Mirna Dzamonja. During one afternoon of the workshop (organized together with Jouko Väänänen), we shall have a number of talks concerned with her work.

Further information and application forms are available from the website
www.newton.ac.uk/event/hifw03

Closing date for the receipt of applications **27 September 2015**.

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Einstein's Legacy

celebrating 100 years of general relativity

28th -29th November 2015

The Great Hall, Queen Mary,
        University of London

Invited speakers:
Alessandra Buonanno (Max Planck Institute)
Mihalis Dafermos (Cambridge/Princeton)
Michael Duff (Imperial)
Pedro Ferreira (Oxford)
Stephen Hawking (Cambridge)
James Hough (Glasgow)
Ramesh Narayan (Harvard)
Katy Price (Queen Mary)
Sir Roger Penrose (Oxford)
Andrew Robinson (London)
Richard Staley (Cambridge)

Register at: http://astro.qmul.ac.uk/einstein

Image credit: NASA

ETH *zürich*

Assistant Professor of Mathematics

→ The Department of Mathematics at ETH Zurich (www.math.ethz.ch) invites applications for an assistant professor position in mathematics (non-tenure track).

→ Candidates should hold a PhD or equivalent and have demonstrated the ability to carry out independent research work. Willingness to teach at all university levels and to participate in collaborative work within or outside the school is expected. The new professor will be expected to teach undergraduate (in German or English) and graduate courses (in English) for students of mathematics, natural sciences and engineering.

→ Assistant professorships have been established to promote the careers of younger scientists. The initial appointment is for four years with the possibility of extension to six years.

→ **Please apply online at www.facultyaffairs.ethz.ch**

→ Applications should include a curriculum vitae, a list of publications, and a statement of future research and teaching interests. The letter of application should be addressed **to the President of ETH Zurich, Prof. Dr. Lino Guzzella. The closing date for applications is 30 September 2015.** ETH Zurich is an equal opportunity and family friendly employer and is further responsive to the needs of dual career couples. We specifically encourage women to apply.

EUROPEAN NEWS

2015 Shaw Prize to Faltings and Iwaniec

The 2015 Shaw Prize in Mathematical Sciences is awarded to Gerd Faltings, Max Planck Institute for Mathematics in Bonn, and Henryk Iwaniec, Rutgers University, for "their introduction and development of fundamental tools in number theory, allowing them as well as others to resolve some longstanding classical problems". The two will share equally in the US$1,000,000 prize.

Scholze Awarded 2015 Ostrowski Prize

Peter Scholze, who holds a Hausdorff Chair at the University of Bonn, has been awarded the 2015 Ostrowski Prize for his breakthrough work in arithmetic algebraic geometry, specifically "for developing the theory of perfectoid spaces and successfully applying the theory to address a number of difficult open questions". The prize carries with it a monetary award of 100,000 Swiss Francs (approximately US$109,000). Scholze has received the Cole Prize in Algebra (2015), the Clay Research Award (2014), the SASTRA Ramanujan Prize (2013), and the Prix Peccot of the Collège de France (2013), and was an invited speaker at the International Congress of Mathematicians in Seoul in 2014. The Ostrowski Prize is awarded every other year by the Ostrowski Foundation for outstanding achievements in pure mathematics or in the foundations of numerical mathematics.

ERC and Marie Curie Actions saved

The European Commission has announced it will cut €500M less from the Horizon 2020 research programme. The Commission gave in to members of the European parliament and to scientists who said a proposed €2.7 billion trim to the Horizon 2020 programme was too much. The money was to constitute a major part of the guarantee supplied by the EU to Jean-Claude Juncker's European Fund for Strategic Investments (EFSI). Three Horizon 2020 budget lines, the European Research Council (ERC), the Marie Skłodowska-Curie Actions and the 'widening participation' programme have had their budgets ring-fenced. The concessions are seen as a response to committed lobbying by scientists to members of parliament, culminating in a meeting on 13 May between Juncker, research commissioner Carlos Moedas and six Nobel laureates.

These items are from the EMS webpage www.euro-math-soc.eu/news.

David Chillingworth
LMS/EMS Correspondent

CLAY AWARD

The first Clay Award for Dissemination of Mathematical Knowledge has been made to **Étienne Ghys** in recognition of his own important contributions to mathematical research and for his distinguished work in the promotion of mathematics.

Étienne Ghys is a CNRS *Directeur de Recherche* at ENS, Lyon. He has published outstanding work in his own fields of geometry and dynamics, both under his own name and under the collaborative pseudonym *Henri Paul de Saint Gervais*—contributions recognised by invitations to speak at the International Congress in 1990 and by his elevation to the French *Académie des Sciences* in 2004. He has also given invaluable service to the international mathematical community in many contexts, as a member of the programme committee for the ICM in Hyderabad, as a member of the Fields Medal committee in 2014, and through service on many other bodies.

Étienne Ghys

But it is through his work in the promotion of mathematics in France and elsewhere that he has become a legend. He has given numerous carefully crafted lectures to audiences ranging from school children

to delegates at the International Congress in 2006, when he gave a beautiful and exceptionally clear plenary lecture on Knots and Dynamics. He has enthusiastically embraced modern technology to aid the exposition of deep ideas, for example during his editorship of *Images des mathématiques*, which he transformed to an online publication in 2009, and which received more than five million visits over his five-year term of office. He himself has written more than 90 articles for *Images*, as well as a monthly column in *Le Monde*.

He created with others the *Maison des mathématiques et informatique* in Lyon and co-founded, with Dierk Schleicher, the *International summer school of mathematics for young students*. His series of films, produced with Aurélien Alvarez and Jos Leys and published as DVDs and online in many languages, has had a huge impact on high school students. The first, *Dimensions*, has been downloaded more than a million times.

The award will be presented after a public lecture by Professor Ghys in Oxford on 1 October 2015. Register at external-relations@maths.ox.ac.uk.

VISIT OF MILEN YAKIMOV

Professor Milen Yakimov (Louisiana State University) will visit the UK from 5 to 18 October 2015. He is an expert on quantum groups and cluster algebras. During his visit he will give talks at:

- University of Edinburgh, 6 October
  (contact Michael Wemyss: m.wemyss@ed.ac.uk)
- Newcastle University, 8 October
  (contact Peter Jřrgensen: peter.jorgensen@ncl.ac.uk)
- University of Leeds, 13 October
  (contact Robert Marsh: marsh@maths.leeds.ac.uk)

For further details contact Peter (peter.jorgensen@newcastle.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISITS OF MARIA FRAGOULOPOULOU AND ALEXANDER HELEMSKII

Professor Maria Fragoulopoulou (University of Athens) and Professor Alexander Helemskii (Moscow State University) will be visiting the UK during September and October 2015. They will give lectures as follows:

- Monday 28 September, University of Sussex, as part of a one-day meeting on *Breaking boundaries between analysis, geometry and topology*
  Fragoulopoulou's talk is *The Shirali-Ford theorem as a consequence of Ptak theory for hermitian Banach algebras* and Helemskii's is *Homologically best modules in classical and quantum functional analysis*
  For further information see: www.sussex.ac.uk/maths/research/ or contact Ali Taheri (A.Taheri@sussex.ac.uk)
- Wednesday 30 September
  University of Lancaster
  Fragoulopoulou's talk is *Some recent results on Allan's GB*-algebras* and Helemskii's is *Two tensor products of spaces, intermediate between classical and quantum spaces, and tensoring on L1 and L2*
  The programme will be from 15.00 to 17.30 in the A54 Lecture Theatre, Postgraduate Statistics Centre, followed by a reception to mark the 150th Anniversary of the LMS and to toast its future (contact H.G. Dales: g.dales@lancaster.ac.uk)
- Tuesday 6 October
  University of Newcastle-upon-Tyne
  Fragoulopoulou's talk is *Uniqueness of the standard topology of certain function algebras* and Helemskii's is *Various concepts of projective, injective and flat modules in functional analysis*
  The programme will be from 15.00 to 17.30 in the Herschel Building (contact Evgenios Kakariadis: Evgenios.Kakariadis@newcastle.ac.uk)
- Tuesday 13 October, University of Leeds
  Fragoulopoulou's talk is *Conditions under which an enveloping pro-C*-algebra is a genuine C*-algebra*, and Helemskii's is *Proto-quantum spaces, their projective tensor product and tensoring on L1*
  The programme will be from 15.00 to 17.30

(contact C. Read: C.J.Read@leeds.ac.uk)
- Tuesday 20 October
  Queen Mary University of London
  Helemskii's talk is *Homologically best modules in classical and quantum functional analysis* at 15.00 in room M103 (contact C.-H. Chu: c.chu@qmul.ac.uk)

The visits of Professors Fragoulopoulou and Helemskii are supported by an LMS Scheme 2 grant awarded to Professor H.G. Dales (Lancaster).

VISIT OF NIKOLAI SAVELIEV

Professor Nikolai Saveliev (Department of Mathematics, University of Miami) will be visiting the UK from 25 October to 7 November 2015. His research interests are in low-dimensional topology and gauge theory. Professor Saveliev will give lectures as follows:
- King's College London, 27 October
  Index theory of the de Rham complex on manifolds with periodic ends
  (contact Jason Lotay: j.lotay@ucl.ac.uk)
- Loughborough University, 28 October
  End-periodic index theory and metrics of positive scalar curvature
  (contact Alexander Strohmaier: A.Strohmaier@lboro.ac.uk)
- University of Reading, 3 November
  End-periodic index theory and non-Kahler surfaces
  (contact Michael Levitin: M.Levitin@reading.ac.uk)
- University College London, 5 November
  Index theory of end-periodic Dirac operators
  (contact Leonid Parnovski: L.Parnovski@ucl.ac.uk)

Professor Saveliev will be based at University College London during his visit. For further details contact Dmitri Vassiliev (D.Vassiliev@ucl.ac.uk). The visit is supported by an LMS Scheme 2 grant.

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MATHEMATICAL AND COMPUTATIONAL MODELLING

A workshop on *Mathematical and Computational Modelling of Biological Systems* will take place at the Department of Mathematics, University of Chester on Wednesday 23 September 2015.

The main aspiration of the workshop is to gather some leading scientists and active young researchers within the UK, whose research focuses on the fields of Mathematical Biology and Immunology. The meeting consists of a series of lectures on recent developments in Mathematical Biology and Immunology. Speakers include:
- Raluca Eftimie (Dundee)
- Nikos Kavallaris (Chester)
- Eun-Jin Kim (Sheffield)
- Anotida Madzvamuse (Sussex)
- Mark McAuley (Chester)
- Carmen Molina-Paris (Leeds)
- Jason Roberts (Chester)

There is a £15 registration fee to cover coffee/tea and lunch. Registration is free for students and postdoctoral researchers within three years of the completion of their PhDs. PhD students and postdoctoral researchers are invited to take part in a poster session. For further details contact the organizer Dr Nikos Kavallaris (n.kavallaris@chester.ac.uk) or visit the website at www.chester.ac.uk/node/31662. The meeting is supported by an LMS Conference grant and by the University of Chester.

END OF THE YEAR LONDON GEOMETRY CONFERENCE

A conference on the latest developments in *Geometric Analysis* will take place in London at King's College from Monday 14 to Friday 18 December 2015. The main aim is to bring to the UK some of the main experts in the field of Geometric Analysis to discuss and tackle outstanding problems and to engage UK-based research students in stimulating interactions. This is a joint conference between Imperial College, King's College and University College London, and it will further strengthen relations between their geometry groups. Speakers include:
- Spyros Alexakis (Toronto)
- Lucas Ambrozio (Imperial College London)
- Otis Chodosh (Stanford University)

- Simon Donaldson (Imperial/SCGP)
- Anna Fino (Torino)
- Dominic Joyce (Oxford)
- Dan Ketover (Princeton)
- Ben Lambert (Konstanz)
- Reto Müller (QMUL)
- Barbara Nelli (Aquila)
- Johannes Nordström (Bath)
- Magdalena Rodriguez (Granada)
- Melanie Rupflin (Leipzig)
- Simon Salamon (King's College London)

Funds are available to contribute to the expenses of research students to attend the conference, and interested students are encouraged to contact the UCL organiser Jason Lotay (j.lotay@ucl.ac.uk) for details. Further information is also available by contacting the KCL organiser Giuseppe Tinaglia (giuseppe.tinaglia@kcl.ac.uk) or the Imperial organiser André Neves (a.neves@imperial.ac.uk) or visiting the website at http://tinyurl.com/orwp9vt.

The meeting is supported by an LMS Conference grant and EPSRC.

POSTGRADUATE CONFERENCE IN COMPLEX GEOMETRY

A conference for PhD students and postdocs is being held in the University of Cambridge from 9 to 11 September 2015. Topics will include diverse areas of complex algebraic and analytic geometry, including Kähler-Einstein metrics, birational geometry, mirror symmetry, moduli problems and positivity questions. The main aim is to enable Geometry PhD students to meet each other and learn about geometry research across the UK. There will be two senior speakers:

- Mark Gross (University of Cambridge)
- Julius Ross (University of Cambridge)

The organisers, Ruadhaí Dervan and Julius Ross, hope that most participants will give short talks. There is a registration fee of £25, and financial support towards accommodation and partial travel is available. For more information see http://tinyurl.com/q9xn7c4 or email Ruadhaí Dervan (rd430@cam.ac.uk). The conference is supported by an LMS Postgraduate Research Conference grant (Scheme 8) and Foundation Composotio Mathematica.

INTEGRABLE SYSTEMS IN NEWCASTLE

The third edition of the meeting *Integrable Systems in Newcastle* will take place over two half days, from 9 to 10 October 2015, at the Department of Mathematics and Information Sciences of Northumbria University, Newcastle upon Tyne. The workshop will focus on exploring new connections between integrability and physics and will promote interactions between leading researchers in both areas. The list of speakers will include:

- Pierre-Philippe Dechant (York)
- Beatrice Pelloni (Reading)
- Davide Proment (East Anglia)
- Noel Smyth (Edinburgh)
- Iain W. Stewart (Strathclyde)

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

SHEFFIELD PROBABILITY DAY

Sheffield Probability Day will take place on Thursday 24 September 2015. The speakers are:

- Andrew Wade (Durham) at 2.15 pm
  Convex hulls of planar random walks
- Remco van der Hofstad (Eindhoven) at 3.45 pm, The 2015 Applied Probability Trust Lecture: *Competition and diffusion in random graphs*

All lectures will take place in Lecture Theatre 7, Hicks Building. Tea and coffee will be available at 3.15 pm in Room I15, Hicks Building. All are welcome. For further information contact Ursula McGuone (tel. 0114 222 3752, email: u.mcguone@sheffield.ac.uk) or visit the website at: http://tinyurl.com/pfz7rj2. The meeting is sponsored by the Applied Probability Trust.

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OBITUARIES

YURI SAFAROV

Professor Yuri Safarov, who was elected a member of the London Mathematical Society on 21 January 1994 and awarded a Whitehead Prize in 1996, died on 2 June 2015 aged 57.

Dmitri Vassiliev writes: Yuri was a leading specialist in the spectral theory of partial differential operators.

Yuri's work was largely concerned with the study of the counting function (number of eigenvalues below a given lambda) of a semi-bounded differential operator on a compact manifold with a boundary, as well as the spectral function (integral kernel of the spectral projection). Both these objects involve a parameter lambda and it is natural to seek explicit asymptotic formulae when lambda tends to plus infinity. This is a classical subject initiated by Hermann Weyl in the beginning of the 20th century. An important issue in this subject area is singling out the second asymptotic term, a mathematical problem which is usually referred to as `Weyl's conjecture'. The study of the second asymptotic term involves delicate mathematics with strong geometric and number theoretic flavours. Yuri was particularly interested in the situation when the partial differential operator has a lot of symmetries, i.e. when the corresponding billiard flow has a large set of periodic trajectories. Here the principal symbol of the differential operator plays the role of the Hamiltonian which generates the billiard flow.

Yuri did his undergraduate studies at Saint Petersburg (Leningrad) State University, from which he graduated in 1980. Upon graduation, he was appointed Research Fellow at the Saint Petersburg Branch of the Steklov Mathematical Institute. The Institute awarded him a PhD in 1984 and a DSc (habilitation) in 1990. In 1993 Yuri was awarded a SERC Advanced Fellowship and moved to King's College London. He became a professor in 1997. Yuri continued working at King's until his untimely death.

Outside of mathematics Yuri's passion was chess. As a youngster, participating in a tournament he played against the future world champion Garry Kasparov and that game ended in a draw. Even though Kasparov was five years younger than Yuri, this was a remarkable achievement. Later, as a young man, Yuri played for the chess team of Leningrad. At some point in his life Yuri had to decide whether to pursue a professional chess career or become a professional mathematician. Fortunately for the subject of spectral theory he chose the latter.

Yuri's most influential mathematical results are contained in the book *The Asymptotic Distribution of Eigenvalues of Partial Differential Operators* (AMS, 1997 hardcover, 1998 softcover) written jointly with the author of this obituary. Lars Hörmander, who reviewed the book for the *LMS Bulletin*, summarised his review as follows: "In the reviewer's opinion, this book is indispensable for serious students of spectral asymptotics".

JOHN SHEPHERDSON

Professor John Shepherdson, who was elected a member of the London Mathematical Society on 19 January 1950, died on 8 January 2015, aged 88.

Philip Welch writes: John Shepherdson, who died just a few days short of his 65th anniversary of election to the LMS, was a longstanding member of the University of Bristol which he joined at the age of 20 directly from his undergraduate degree in 1946 from Cambridge.

John stayed in Bristol for the entire length of his academic career, and many of the UK's logicians trained or passed through there. He made major contributions to mathematical logic, and he proposed in 1970, and then became a co-founder of, the British Logic Colloquium.

His first work was in set theory and the results of Kurt Gödel in this field. Having explicated in a series of papers Gödel's methods there, he

moved into another of the areas of Gödel's fame: the incompleteness phenomena, and later on his work involved models of arithmetic. In general his research was marked by deep thought over lengthy periods of time: writing seminal papers that were later to be standard references. He would then move on to pastures new. He worked on computable algebra (a paper with Fröhlich). Whilst studying the Incompleteness phenomena, he invented an alternative conception to Alan Turing's machine (now called the *Shepherdson-Sturgis Register machine*) which was much simpler to reason about and to 'program'. A theorem with Myhill in Recursion Theory is named after them jointly. His later work before retirement was on the computer language PROLOG. He was recognised for his work through a Fellowship of the British Academy.

He was a man of great kindness and modesty: the last person to push (or even volunteer) his opinion in seminars, his attitude was the opposite of dogmatic. I felt he had a particular sensitivity to people junior to him, that must have been unthreatening in his quiet manner: he had female collaborators in the 1960's, including two from India and Japan, not countries noted for their support of women in mathematics back then (was the UK?), but who nevertheless came to Bristol to work with him successfully, and have fond memories of that time and of him.

TIM LISTER

Dr Tim Lister, who was elected a member of the London Mathematical Society on 2 February 1986, died on 13 January 2015, aged 74.

Derek Goldrei writes: Tim was amongst the first mathematicians employed by the Open University (OU) and played a key role in shaping curriculum and the teaching of tens of thousands of students of mathematics and computing.

Tim was brought up in South Africa. He obtained a double first in Pure Mathematics and Physics from the University of Natal in Durban in1962 and went on to postgraduate study under Professor Hanno Rund in Pretoria. Tim moved to the UK because of the political situation in South Africa.

In 1970 he became one of the first Staff Tutors in Mathematics at the OU. Located in the East Midlands, his role was to appoint, train, develop and manage Associate Lecturers in mathematics and, later, computing. Alongside his regional work, Tim was influential in the Faculty, creating and presenting courses. Tim worked on mathematics courses ranging from the very first Foundation Course in Mathematics which started in 1971, which was studied by all new OU mathematics students, through introductory pure mathematics, to more advanced courses in complex analysis and mechanics. His interest in programming and mathematical software, for instance using Cabri to teach geometry, culminated in his leading the production of the discrete mathematics course M263, Building Blocks of Software, which supported the computing curriculum from 2004 till 2013. By devising and chairing M263, Tim was a key influence on the teaching of more than 500 students every year. At any one time Tim managed more than 50 Associate Lecturers, having worked to establish the OU's high standards for supporting students in the early 1970s, and he himself taught groups of students and at summer schools, where he was an inspired teacher and mentor of others. His teaching of mathematics and computing has been truly influential.

The OU's courses are written and maintained by teams of academics and designers, and Tim was a notable on all his teams for his creativity, dedication, incisiveness, charm, warmth and wit. In a similar manner Tim led and guided his teams of tutors, who held him in the highest and fondest regard. His great passion was for bringing an understanding of mathematics to adult students and to the founding principles of the OU, which was undiminished throughout his career and beyond his retirement in 2005.

His leaves his wife Pat, son TJ and daughter Tamsin, who followed her father into the OU, and grandchildren Tommy and Ted.

REVIEWS

MATHEMATICS WITHOUT APOLOGIES: PORTRAIT OF A PROBLEMATIC VOCATION by Michael Harris, Princeton University Press, 2015, 464 pp, £19.95, ISBN: 9780691154237.

This book is an addition to the genre of insider-reports on the mathematical life written by distinguished mathematicians. It's much more than that, though, because Michael Harris is more than a mathematician; he is a Parisian intellectual. His suspicion of high-falutin' talk might cause him to resist that title, but he makes good jokes about Lacan, explores philosophical themes through literary analysis, treats popular culture as seriously as he does high culture, fills his book with references and allusions, argues by telling stories, reflects on the narrative conventions of those stories and is deeply suspicious of high-falutin' talk. If it walks like a duck and playfully explores the motives hidden beneath highly serious quacking like a duck, it's a duck. What must be maddening for all the other Parisian intellectuals is that he does it rather well.

The title itself contains two allusions: to *Hardy's Mathematician's Apology* and to *Weber's Science as a Vocation*. This book resembles Weber's lecture on the values that animate scientists and the place of those values in the wider culture rather more than it resembles insider-reports such as Cédric Villani's *Birth of a Theorem*. Hardy's apology is a source of puzzles: why would one even try to justify mathematics to non-mathematicians? Why did Hardy go for the justification he chose? What other options are available? Harris observes that justifications of the material resources spent on pure mathematics usually refer to one or more of utility, truth and beauty. This, Harris claims, is a "Faustian" pact between mathematicians and their paymasters. "We promise Golden Geese, immutable truths, ineffable beauty. We collude in the misrepresentation of our values and our intentions." (p. xii). Routinely and publicly misrepresenting the deep motives of one's life's work results in

alienation from oneself. This sense that there is something bogus about the apologies routinely offered for mathematics is the book's core problem and requires for its solution the Parisian activity of disclosure through juxtaposition and paradox. This may all come as an affront to those mathematicians who believed themselves to be perfectly sincere in offering Golden Geese, immutable truths and/or ineffable beauty to the non-mathematical world.

Harris appeals to Alasdair MacIntyre's distinction between the internal and external goods of a tradition. The external goods of a tradition are those that one might gain in other ways, such as money or fame. The internal goods are those that one can only gain by practicing the tradition and are usually difficult for non-practitioners to discern. Mathematicians, according to Harris, pursue an internal good, namely, pleasure "of an elusive, but nevertheless specific kind" (p. xi). Harris and Villani both reveal autobiographically that status-anxiety is also very important, but this does not undermine Harris's founding claim that there is something bogus about all that talk about utility, truth and beauty. Pure mathematics, he claims, is a 'relaxed field', which means that it has no strong motives outside itself. (As Villani's book makes vivid, the field may be relaxed but the mathematicians are not.) It is and must be free to develop according to its own internal lights and imperatives. That is why the talk about utility, truth and beauty are bogus—these would be external motives, were mathematicians to take them seriously. Mathematicians indulge in this talk because they normally pursue their researches at someone else's expense and you can't tell your funding agency that the point of the exercise is a rare kind of pleasure available only to the participants. MacIntyre's framework helps here because it supplies words to explain that the mathematician's pleasure is not just a subjective buzz, but rather an affective response to an objective good (the internal goods of a practice are as objectively real as goods of any other sort, however invisible they may be to non-

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practitioners). Mathematicians, we must believe, would not be interested in a pill that somehow gave them that elusive, specific mathematical pleasure without doing any mathematics.

This brings us to the sections in which Harris attempts to explain some number theory at a dinner party. The dinner guest on the receiving end is a performing artist. The fact that she has her own vocation with its own internal goods allows her to interrogate Harris's explaining number theorist about his tradition. They end their dialogue with a discussion of audience participation. The number theorist suggests, "Maybe the audience comes to watch you care about Nora (the protagonist of Ibsen's *A Doll's House*)". The performing artist retorts that "…the audience wants to care about Nora,… not just to [watch] some performer caring. Are you saying that the author [of this book about mathematics] expects readers to pick up the book just in order to watch mathematicians care about the Birch-Swinnerton-Dyer conjecture?" Faced with this challenge, the number theorist replies, "it's no small thing to be able to care about

something like that" (p. 320). This is as much as he can say, because Harris also insists that solved problems and proven theorems do not offer the rare and specific pleasure for the sake of which mathematicians do mathematics. Nothing less than the current frontier will do, but that is only for professional practitioners.

The preface of this book starts with a quotation from Felix Hausdorff, or rather from his literary alter ego, Paul Mongré, on the subject of how difficult it is for a problematically self-aware 'modern' writer to write a preface. The final chapter briefly expounds Hausdorff's anti-metaphysical philosophy, with its Nietzschean worry that devotion to the truth might be bad for us, its claim that our reality only seems important to us because it is ours, and its insistence on the importance of the free play of thought. Harris uses an arch, jocular tone in much of the rest of the book to distance himself from the bogus pieties under discussion. This tone is eloquently absent from this chapter.

Brendan Larvor
University of Hertfordshire

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THINGS TO MAKE AND DO IN THE FOURTH DIMENSION by Matt Parker, Hardback: Particular Books (an imprint of Penguin Books), 2014, pp 455, £16.99, ISBN 9781846147647; Paperback: Penguin Books, 2015, pp 465, £9.99, ISBN 9780141975863.

Matt Parker describes himself as a stand-up mathematician. From his webpage "Matt is the only person to hold the title of London Mathematical Society Popular Lecturer while simultaneously having a sold-out comedy show at the Edinburgh Festival Fringe, Matt is always keen to mix his two passions of mathematics and stand-up."

In chapter zero he describes maths as being one big game, professional mathematicians are playing. The goal of the book is to open up this world and give you the freedom to play with maths. Everything starts with things that you can really make and do.

One thing that the book is not about, except in one chapter, and that is four-dimensional space. There are nineteen chapters of which one is on four-dimensional space and one on even higher dimensions.

But let me start by reviewing chapter 10 on four-dimensional space, one of the best. He starts by pointing out how all-powerful and frightening a four dimensional monster would be to us in three dimensions. He then has a nice discussion about four dimensional cubes and how to visualise them. The best section of this chapter is the description of the four-dimensional regular solids, namely the four dimensional analogues of the Platonic solids plus the 24-cell. He includes very nice diagrams of all six of these. Perhaps I will mention the diagrams more generally. A lot of these look hand-drawn and even some of the algebra is just written down by hand which looks a bit strange in these Tex days. However, this adds a certain charm to the book.

This book feels like a labour of love. The author writes about the mathematics that excites him and he manages to convey his enthusiasm very well. He covers a wide cross-section of mathematics, from prime numbers, knots, graph theory. Bernouilli numbers, Riemann hypothesis, surface topology, computing, infinity and many other topics. Even though this is very much a popular maths book, I am sure that every professional mathematician will learn something new in this book. He writes with a lot of humour and includes a lot of mathematical stories, some well known like the one about Hardy, Ramanujan and the taxi and others less well-known. For example, Frank Nelson Cole gave a wordless lecture to the American Mathematical Society. On one board he found all powers of two until 2 to the power 67. On another board he multiplied by hand 193,707,721 by 761,838,257,287 and then showed that $2^{67}-1$ is not prime, thus disproving a statement that Mersenne had made 259 years before. He says that the crowd went wild!

In the chapter on computers he describes the Antikythera Mechanism, the sophisticated calculating machine invented by the ancient Greeks to do astronomical calculations, and also tells us how to build a computer using dominoes with some nice pictures of the domino computer he built with many others at the Manchester Science Festival in 2012.

There are a few disappointments. Pure mathematics is about proofs, and this book includes almost no proofs. For example he could have shown us that if 2^n-1 is prime then n is prime. Some calculations and a few simple proofs are relegated to a final section
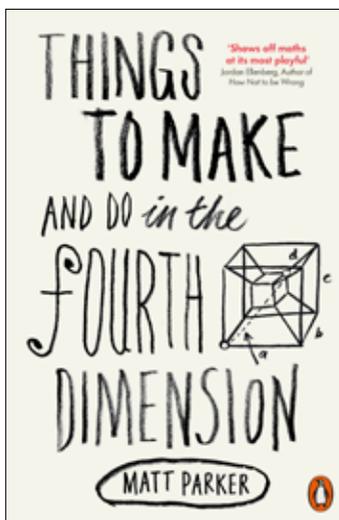
called "The answers at the back of the book". Also, he himself admits that he needs to learn more about group theory and the small section on groups, leading up to the Monster, would be very difficult to follow without prior knowledge.

But in total this is a book I enjoyed a lot. Everyone will learn something, and youngsters just starting on maths will learn a great deal and have fun at the same time.

David Singerman
University of Southampton

THE FASCINATING WORLD OF GRAPH THEORY by Arthur Benjamin, Gary Chartrand, Ping Zhang, Princeton University Press, 2015, pp 344, £19.95, $29.95, ISBN978-0-691-16381-9.
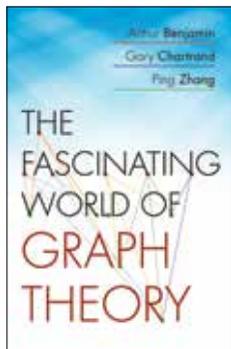
Here is a book with an enjoyable mix of mathematics and its applications, spiced with liberal amounts of history and anecdote. The reader must not expect a straight path, rather a winding trail with many diversions.

An example will illustrate the authors' approach. The chapter on 'Encircling Graphs' begins with a short biography of Hamilton. We are led, via the quaternions, to his later system of non-commutative algebra, the icosian calculus, and thence to the so-called Hamiltonian cycles on the dodecahedron. Then we learn that Kirkman had studied a more general version of this problem, and that the recreational problem of the knight's tour is another example. Modern work on Hamiltonian cycles is represented by the theorems of Dirac and Ore, together with an account of the travelling salesman problem.

This approach is echoed in a total of twelve chapters that cover the main aspects of elementary graph theory. In the chapter on 'Traversing Graphs' we have a good historical account of Euler's work on the Seven Bridges, followed by a discussion of the basic results and the associated Chinese Postman problem. The chapter on 'Factoring Graphs' brings together the theorems of Petersen, Konig, Hall, and Tutte. In 'Orienting Graphs' we begin with Robbins' theorem on strong orientations, and lead on to tournaments and voting procedures.

In *Coloring Graphs* we have the curious story of the Four Colours, followed by Brooks' Theorem, and the link between vertex-colouring and timetabling. The final chapter on *Synchronising Graphs* deals with edge-colouring and Ramsey numbers, concluding with the 'Road Coloring Problem' about the existence of synchronising sequences in digraphs of a certain kind.

Your reviewer is probably not a typical reader of the book, since he has some knowledge of the mathematics and its history. He was therefore naturally attracted by the numerous snippets of gossip that enliven the text. The golfing prowess of P.G. Tait's son is perhaps not of great interest to the mathematical community, but some of the anecdotes are. The background to Courant and Robbins' famous book *What is Mathematics* is a little surprising, and the origins of the Putnam Competition are surely of wider interest, in the now-fashionable context of 'unintended consequences'. And the story of how Instant Insanity conquered the world makes good reading.

It would be easy to write about what some might see as the book's weaknesses, such as the fact that not all the main results are proved. But we should not criticise a book for what it does not aim to do. The authors state clearly in their prologue that they did not set out to write a textbook, although they have provided a collection of exercises in case anyone wishes to try using the book in that way. The value of books like this is that they make mathematics come alive to a broad range of readers who might not look twice at a textbook or monograph.

Norman Biggs
London School of Economics

CALENDAR OF EVENTS

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

SEPTEMBER 2015

1-4 Numerical Methods for Simulation IMA Conference, Oxford (448)
2-4 British Logic Colloquium, Cambridge (448)
6-10 Dynamic Days Europe, Exeter (447)
7 One-Day Function Theory Meeting, De Morgan House, London (449)
7-8 Calculus of Variations, PDE and Geometric Measure Theory, Sussex (449)
7-9 British Topology Meeting, Belfast (447)
7-10 British Science Association, Bradford (449)
7-11 Computational Algebraic Topology LMS-CMI Research School, Oxford
7-11 Cauchy Problem in Kinetic Theory, Imperial College London (447)
9-11 Mathematics of Robotics IMA Conference, Oxford (448)
9-11 Postgraduate Conference in Complex Geometry, Cambridge (450)
10 A Posteriori Error Control and Mesh Adaptivity for Time Dependent and Nonlinear Problems, University of Chester (448)
10-11 Challenges in Nonlinear Systems, Manchester (448)
11 Approximate Dynamic Programming, Essex (448)
14-16 Non-Combinatorial Combinatorics, Warwick (448)
14-18 Cell Mechanics, Morphogenetics and Pattern Formation INI Workshop, Cambridge (448)
15-19 Diophantine Equations LMS-CMI Research School, Hay-on-Wye (448)
17 Interfaces in Fluids, Birmingham (449)
17 Algorithms and Cryptography, LMS Computer Science Colloquium, The Royal Society London (450)

17-18 Algebraic and Geometric Aspects of Integrable Systems PGR Workshop, Loughborough (449)
18 Robert Recorde, Tenby Museum (450)
18-20 LMS/EMS Joint Anniversary Mathematical Meeting, Birmingham (450)
20 Open House, De Morgan House, London (450)
21 Moduli Spaces and their Applications, Liverpool (448)
22 Operator Algebras and Dynamical Systems, Queen Mary University of London (449)
23 LMS Popular Lectures, Birmingham (450)
23 Mathematical and Computational Modelling of Biological Systems, Chester (450)
23 Sheffield Probability Day, Sheffield (450)
30 Clay Research Conference, Oxford (447)

OCTOBER 2015

9 Robert Recorde and the History of Science, Tenby Museum (450)
9-10 Integrable Systems in Newcastle (450)
13 LMS-NZMS Aitken Lecture, Steven Galbraith, Royal Holloway, London (450)
20 LMS-NZMS Aitken Lecture, Steven Galbraith, Open University (450)
21 LMS Popular Lectures, Glasgow (450)
22 LMS-NZMS Aitken Lecture, Steven Galbraith, Oxford (450)
22 Challenges for the Next 25 Years, EMS Meeting, Institut Henri Poincaré, Paris (448)
23 LMS-NZMS Aitken Lecture, Steven Galbraith, Bristol (450)
23 Robert Recorde: A Man of Principle in a Turbulent Age, Tenby Museum (450)
26-28 Women in Applied Math & Soft Matter Physics, Mainz, Germany
28 LMS-NZMS Aitken Lecture, Steven Galbraith, Sheffield (450)
29-30 LMS-NZMS Aitken Lecture, Steven Galbraith, Loughborough (450)

NOVEMBER 2015

3 The Mathematics of Program Construction, BCS-FACS Evening Seminar, London (450)
11 LMS Popular Lectures, Leeds (450)

13 LMS AGM, London (450)
26 Mathematics in Defence IMA Conference,
Harwell, Oxford (448)
28-29 Einstein's Legacy, Celebrating 100 years
of General Relativity, Joint Meeting with IOP
& RAS, QMUL, London (450)

DECEMBER 2015
7-11 Combinatorial Mathematics and
Combinatorial Computing Australasian
Conference, Brisbane, Australia (445)
7-11 New Mathematical and Computational
Problems, INI Workshop, Cambridge (449)
9-10 Ada Lovelace 200 Symposium:
Celebrating the life and legacy of Ada
Lovelace, Oxford
10-11 LMS Joint Meeting with the Edinburgh
Mathematical Society, Edinburgh (443)
14-17 LMS South West & South Wales
Regional Meeting and Workshop,
Southampton (450)
14-18 Geometric Analysis, King's College
London (450)
14-18 The Role of the Higher Infinite in
Mathematics and other Disciplines, INI
Workshop, Cambridge (450)
15-16 LMS Prospects in Mathematics,
Loughborough
15-17 Cryptography and Coding IMA
Conference, Oxford (448)

JANUARY 2016
18-22 Stochastic Dynamical Systems in
Biology, INI Opening Workshop, Cambridge
(450)

MARCH 2016
21-24 BMC 2016, Bristol

APRIL 2016
5-8 BAMC 2016, Oxford

JULY 2016
18-22 7ECM, TU Berlin

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LONDON
MATHEMATICAL
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150 YEARS

LMS GRADUATE STUDENT MEETING
held on Friday 3 July 2015
(see report on page 34)

Frank Nijhoff (invited speaker)

Andrea Fontanella (student prize winner)

Arnaud Trébaol (student speaker)

Tahani Al-Karkhi (student speaker)

Gregorio Benincasa (student prize winner)

Sara Lombardo (invited speaker)