



LMS 150TH ANNIVERSARY QUEEN OF THE SCIENCES: A CELEBRATION OF NUMBERS AND THE LONDON MATHEMATICAL SOCIETY



An exhibition of early documents and photographs from the LMS archives opened in February at the University College London (UCL) Main Library. The exhibition, displayed in three cabinets and across two floors of the library, is supplemented by material featuring the numbers 1 to 9 from UCL's own 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. Ad-

ditionally, a number of portrait photos of past Presidents are featured, as are tickets from early Society meetings and lectures. One ticket, in particular, reads: 'This ticket will admit one person into the Mathematical Society on Shrove Tuesday night, on paying the Bearer Six-pence.'

The exhibition is free, open to all, and will remain *in situ* for the remainder of 2015, allowing plenty of time to see and appreciate these rare and historic insights into the history of the LMS.

For more information visit www.ucl.ac.uk/library/exhibitions or call the UCL Library reception on 020 7679 7793.

SOCIETY MEETINGS AND EVENTS

- Wednesday 1 April: LMS 150th Anniversary Celebration Day at BMC-BAMC Joint Meeting, Cambridge
- Tuesday 7 April: Northern Regional Meeting, Lancaster page 24
- 14-17 April: Women in Maths Event, Oxford page 23
- 9 May: LMS-BSHM De Morgan Day, London page 25
- 3 July: Hardy Lecture LMS Meeting, London page 19
- 7 July: Midlands Regional Meeting, Warwick page 34
- 20-31 July: Undergraduate Summer School, Loughborough

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LMS 150TH ANNIVERSARY MATHEMATICS DEPARTMENTS JOIN IN THE ANNIVERSARY CELEBRATIONS

The Society is keen to involve as many of its members and the wider mathematics community as possible in celebrating such a momentous occasion. Through the LMS Representatives network it is asking mathematics departments across the UK to hold LMS 150th Anniversary receptions, either as a standalone activity or as part of another event already being organised.

To aid in this, the Society is offering grants of £100 towards the cost of wine and other supplies. The only conditions are that a toast is made to the continued health of the Society and mathematics and that pictures/webcasts/vox pops of the toasts are sent for inclusion on the website and/or in the *LMS Newsletter* (newsletter@lms.ac.uk). For information on this celebration, and to receive a copy of the grant form, please email 2015@lms.ac.uk.

LMS FUNDING FOR UNDERGRADUATE MATHEMATICAL SOCIETY MEETINGS 2015

Applications for Future Undergraduate Mathematical Society Meetings

In 2015, the LMS Research Meetings Committee has, so far, supported one Undergraduate Mathematical Society Meeting:

- *Application of Fluid Dynamics to Atmosphere and the Ocean*, Durham (see report on p12)

The LMS considers requests from Undergraduate Mathematical Societies to host a meeting and offers funding of up to **£500** for either full or partial support for travel and subsistence of a speaker(s), and reasonable costs for catering.

Applications can be made at any time but the deadline for applications in the current financial year is **Wednesday 1 July 2015**. There is limited funding and applications will be considered on a first-come, first-served basis.

Applicants should contact Elizabeth Fisher (lmsmeetings@lms.ac.uk) for an application form.

Applications should be counter-signed by the LMS Departmental Representative. For a list of LMS Representatives, visit: www.lms.ac.uk/membership/lms-representatives If your department does not have a LMS Rep, please contact Elizabeth Fisher (lmsmeetings@lms.ac.uk).

LMS-sponsored Undergraduate Mathematical Society Meetings held during 2014

In 2014, the LMS supported the following Research Workshops Undergraduate Mathematical Society Meetings:

- *Juggling: Theory and Practice*, St. Andrews
- *Mathematics in the World of Gaming*, King's College London

Editorial team

<http://newsletter.lms.ac.uk>

Editorial office

London Mathematical Society,
De Morgan House, 57–58 Russell
Square, London WC1B 4HS
(t: 020 7637 3686;
f: 020 7323 3655)

Events calendar

Updates and corrections to
calendar@lms.ac.uk

Articles

Send articles to
newsletter@lms.ac.uk

Advertising

For rates and guidelines see
newsletter.lms.ac.uk/rate-card

General Editor

Mr A.J.S. Mann
(a.mann@gre.ac.uk)

Reviews Editor

Professor D. Singerman
(d.singerman@soton.ac.uk)

Administrative Editor

S.M. Oakes
(newsletter@lms.ac.uk)

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MATHEMATICS POLICY ROUND-UP

March 2015

RESEARCH

Make the UK the best place to do research and innovation

The British Academy, in partnership with the Royal Society, the Royal Academy of Engineering and the Academy of Medical Sciences, has published a statement urging the new government to build on our strengths and help make the UK the best place in the world to do research and innovation. *Building a Stronger Future* sets out what the next government will need to do to ensure a strong research and innovation base that helps people in the UK lead healthier, fuller and better lives.

The National Academies urge the next government to adopt the following priorities to make the UK the location of choice for world class research, development and innovation.

- Place research and innovation at the heart of plans for long-term economic growth
- Secure prosperity by strengthening public investment in research and innovation
- Meet demand for research skills through a flexible and diverse workforce
- Strengthen policy by embedding expert advice across government

The statement calls on the next government to create an environment that attracts more industrial and charitable investment in research and innovation, in addition to that from government. It also emphasises the need for more teachers with specialist subject knowledge at all stages of education. More information is available at tinyurl.com/k4njrpw.

Nurse Review Advisory Group named

The Advisory Group that will support Sir Paul Nurse in his review of UK Research Councils has been announced. The Advisory Group of eight leaders will bring expertise from research, academia and industry.

The 'Nurse Review' will look at how the research councils, which invest around £3 billion of government funding per year, can work most effectively.

Details of the Advisory Group are available at tinyurl.com/n2txt9q.

The terms of reference of the Review are published at tinyurl.com/ocp5z8q.

Outcomes of the EPSRC Monitoring Portfolio Evolution Exercise 2014

Action plans in 16 of EPSRC's 113 Research Areas are now being implemented following a detailed assessment of its portfolio. The exercise aimed to identify trends and changes within the portfolio and help plan future activities. It was not intended to change decisions or strategies.

The exercise resulted in the development of action plans for sixteen of EPSRC's 113 Research Areas where:

- an area had moved along the wrong trajectory;
- the desired strategy was not being achieved sufficiently in an area; and
- the funding environment in an area had changed significantly

The action plans represent a joint approach between EPSRC themes and their Strategic Advisory Team members to address the points highlighted in each Research Area. The implementation of these action plans should be completed by the end of the current Delivery Plan period (March 2016).

Areas of interest to the mathematical sciences are mathematical aspects of operational research, maths of computing and number theory. More information is available at tinyurl.com/ms8mwoe.

Report identifies vulnerable research skills and capabilities in the UK

The Biotechnology and Biological Sciences Research Council (BBSRC) and Medical Research Council (MRC), in collaboration with the Society of Biology, have identified vulnerable skills and capabilities facing the UK bio-science and biomedical science research base. In consultation with academia, businesses and other research organisations, skills and capabilities within five areas were highlighted,

including 'maths, statistics and computation'.

Strengthening vulnerable skills and capabilities within these areas could help support UK researchers to deliver further impact for society and the economy. A survey was conducted in summer 2014 to identify vulnerable skills and capabilities, receiving over 120 responses. To evidence the need for more support, respondents were asked how they had been affected in the last five years by emerging or existing vulnerabilities. More information is available at tinyurl.com/o7dwqgx.

HIGHER EDUCATION

STEM accreditation reviews launched

The announcement of the government's science and innovation strategy in December included a commission to establish a general review of science, technology, engineering and mathematics (STEM) and a specific review

of computer science degree accreditation arrangements. The reviews will explore issues around graduate employability and consider options for how they could be addressed. More information is available at tinyurl.com/pfgev2f.

SCHOOLS AND COLLEGES

GCSE and A-level reform

Details are now available of the reforms being made to GCSEs, AS and A-level. More information is available at tinyurl.com/qzmyr6z.

Timeline of changes to GCSEs, AS and A-levels

Ofqual has published an overview of what changes will be made to GCSE, AS and A-level qualifications between 2014 and 2018. More information is available at tinyurl.com/mrc6m6n.

Dr John Johnston
Joint Promotion of Mathematics

LMS GRANT SCHEMES

Next Closing Date for Research Grant Applications: 15 May 2015

Applications are invited for the following grants:

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.

Conferences (Scheme 1)

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

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 institu-

tions. Awards are made to the host towards the travel, accommodation and subsistence costs of the visitor.

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).

How to apply: 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 May 2015** will be considered at a meeting in March.
- Applications should be submitted well in advance of the date of the event for which funding is requested.
- Normally grants are not made for events which have already happened or where insufficient time has been allowed for processing of the application.

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

- Grants Administrators: Anthony Byrne and Elizabeth Fisher (tel: 020 7927 0807 / 020 7291 9973, email: grants@lms.ac.uk).

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.

OTHER LMS GRANTS AND FUNDING

Research Workshop Grants

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

Young British and Russian Mathematicians Scheme

Next deadline: 15 May 2015

Visits to Russia

Applications are invited from young British postdoctoral mathematicians who wish to spend a few weeks in Russia giving a series of survey lectures on the work of their school. The LMS is offering grants of **up to £500** to meet the travel costs, while the host should apply to the Russian Academy of Sciences for funding towards local expenses for accommodation and subsistence. Please contact Anthony Byrne (grants@lms.ac.uk) for information before contacting the Russian Academy of Sciences for funding. Applications to the LMS should include the following:

1. A brief academic case for the visit, including a description of your current research interests, and an outline of your planned work during the visit (no more than one side of A4).
2. A brief CV (no more than one side of A4).
3. A brief budget.
4. A letter of invitation from the head of the host department in Russia, which must state explicitly that your accommodation and subsistence expenses will be met by them. This should include provisional dates for the visit.

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

Visits to Britain

Under this Scheme, applications may also be made by any mathematician in Britain wishing to host a visit by a young Russian postdoctoral mathematician who wishes to spend a few weeks in Britain giving a series of survey lectures on the work of their Russian seminar. The LMS is offering grants to the host institution to meet the visitor's actual travel

and accommodation costs of **up to £1,500**. Applications should include the following:

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

Financial and academic reports will be required after the visit.

Further details of the Scheme can be found on the LMS website: www.lms.ac.uk/content/international-grants. Applications received by **31 January 2015** will be considered at a meeting in March. Enquiries should be made to the Grants Administrators: Anthony Byrne and Elizabeth Fisher (tel: 020 7291 9971/3, email: grants@lms.ac.uk).

Spitalfields Days

Next deadline: 15 May 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: 30 June 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 mathemati-

cal 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.

Computer Science Small Grants (Scheme 7)

Next deadline: 15 April 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 May 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.

Small Grants for Education

Next deadline: 30 April 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.

Teacher CPD Grants

Next Deadline: 30 April 2015

Funding for grants **up to £400** is available to provide opportunities for mathematics teachers to attend training which is *specifically* mathematical. It is intended to facilitate mathematical professional development to

allow teachers in UK schools/educational institutions to:

- a) develop their subject knowledge
- b) engage in a deeper understanding of how to develop mathematical thinking
- c) appreciate the interconnectivity of mathematical topics
- d) update themselves on mathematics curriculum reform
- e) use technology when and where appropriate

Please see the website for further details: <http://www.lms.ac.uk/grants/teacher-cpd-grants>.

ANNUAL ELECTIONS TO LMS COUNCIL

The Nominating Committee is responsible for proposing slates of candidates for vacancies on Council and vacancies on its own membership. The Nominating Committee actively welcomes suggestions from the membership.

Anyone who wishes to suggest someone for a position as an Officer of the Society or as a Member-at-Large of Council (now or in the future) is invited to send their suggestions to Dr Penny Davies, the Chair of Nominating Committee (nominations@lms.ac.uk). Please provide the name and institution of the suggested nominee, his/her mathematical specialism(s), and a brief statement to explain what s/he could bring to Council/Nominating Committee.

Nominating Committee seeks to maintain a balance in gender, subject area and geographical location when drawing up its list of prospective nominees, and LMS members should bear in mind that it is to the benefit of the Society that Council is balanced and represents the full breadth of the mathematics community. Further details about the work of the Nominating Committee are on the LMS website at www.lms.ac.uk/about/nominating-committee.

Nominations should be received by **Friday 1 May 2015** in order to be considered by the Nominating Committee.

In addition to the above there exists the

option for members to make direct nominations for election to Council or to the Nominating Committee. Direct nominations must be sent to the Executive Secretary's office (nominations@lms.ac.uk) to arrive before **noon on 1 September 2015**. Nominations can be submitted in hard copy or via email. All nominations must bear the signatures of the nominator and three seconders and of the nominee. For hard copy, a letter with the relevant names and signatures is sufficient or submissions can be made via a form available from the LMS website at <http://tinyurl.com/q28lrpv>. For email submissions nominations and statements from seconders must be sent from a verifiable e-mail address to nominations@lms.ac.uk. Members considering making a direct nomination are asked to bear in mind the desirability of Council being balanced with regard to the full range of mathematical specialisms, UK regions and gender.

The slate proposed by Nominating Committee, together with other direct nominations received up to that time will be posted on the LMS website in early August for members to see before deciding whether they wish to make any further direct nominations.

Further nominations will be posted onto the website as they are received.



LONDON
MATHEMATICAL
SOCIETY
150 YEARS

Developments in Modern Probability

5th -
10th July
2015

LMS-CMI Research School, Oxford

The principal aim of the LMS-CMI Research School is to provide training and preparation for young researchers working both in Britain and further afield, many of whom will be attending SPA2015 the following week. The subjects of the courses represent some of the most exciting areas of current research in probability, and have been chosen to tie in with a subset of the plenary lectures for SPA.

Lecturers

- **Nathanael Berestycki**, Cambridge, *Two-dimensional Liouville quantum gravity and the Gaussian free field*
- **Paul Bourgade**, Courant Institute, NYU *Random matrices and PDEs*
- **Ivan Corwin**, Columbia University, *Integrable probability and the KPZ universality class*

These lecture courses will be supplemented by tutorial sessions. For further information please visit: www.stats.ox.ac.uk/events/lms-cmi_research_school

Applications

Research students, post-docs and those working in industry are invited to apply. Applications should be made using the registration form available on the Society's website at www.surveymonkey.com/s/JG93HFN

The closing date is 13 April 2015. Numbers will be limited and those interested are advised to make an early application.

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

Fees

Research students: £150. There will be no charge for subsistence costs.

Early career researchers: £250. There will be no charge for subsistence costs.

All other participants (e.g. those working in industry): £250 plus the full subsistence costs (£580); £830 in total.

All UK-based participants must pay their own travel costs. For overseas-based participants, support will be available to contribute towards travel costs.

Fees are not payable until a place on the course is offered but will be due by 1 June 2015.

HOLGATE LECTURES AND WORKSHOPS

The Holgate Lectures and Workshops sessions scheme provides session leaders who are willing to give a talk on a mathematical subject to groups of students or teachers. The sessions are of mathematical content and are not, for example, careers talks. Rather they are intended to enrich and enhance mathematical education, looking both within and beyond the curriculum. Holgate session leaders do not charge a fee for giving talks, but local organisers are expected to pay travel expenses and subsistence costs, together with any local costs of organising the session. The LMS will pay an annual honorarium to the session leaders.

The scheme is named in memory of Philip Holgate, who helped ensure the success of the LMS Popular Lectures.

The Society intends to re-launch the Holgate Lecture/Workshop sessions and invites applications from people who would like to become Holgate Session Leaders.

It is anticipated that, primarily, each session leader should offer a range of sessions for those in education outside of higher education. This could be at primary, secondary or A-Level or equivalent (including STEP/AEA). It may also cover adult education. The leader would also be free to offer sessions to other relevant groups, for example teachers of mathematics, to enhance their professional mathematical development.

It is anticipated that the majority of the sessions would be held in schools and applicants with strong contacts in schools are particularly welcomed. The LMS will advertise the sessions, however session leaders will be expected to promote themselves and the Holgate sessions they offer locally.

The local organiser of a session may be a school, or a group of schools, or a local branch of a mathematical organisation. Schools will be strongly encouraged to collaborate when hosting sessions. There is no required minimum or maximum attendance for the sessions, and appointees will be free to decide whether to accept or decline a request.

There will be no upper or lower bound on

the session leader's workload. As an indicative number it is anticipated that they will give three or four sessions during each academic year with the possibility of doing more, although proposals for alternative models will be considered.

Appointees will be asked to provide material for the LMS website such as titles/abstracts/descriptions of talks. They will also be asked to provide an email contact and a short profile, including areas of expertise, interests and experience. It is not intended that the sessions listed on the website would be comprehensive and session leaders would be encouraged to develop or adapt content in light of requests.

Applicants are asked to send a short (2-page) CV and a letter detailing what it is they think they could offer as a Holgate Session Leader, and what they believe that the Holgate sessions could offer as an educational experience. The Society is open to a wide range of proposals and applicants are encouraged to set out ideas. Applicants are asked to set out what contacts they have that will help them to reach those learning and/or teaching mathematics and those who would benefit from the Holgate Lectures and Workshops. **Applications should be received by 22 May 2015**, sent to duncan.turton@lms.ac.uk.

While there is no particular person specification, applicants should have a track-record in mathematics education, communicating with people learning and/or teaching mathematics outside of HE. They may be research-active mathematicians in a university department or be someone mathematically or statistically qualified based outside of academia. There is no requirement that applicants be members of the LMS.

Session leaders and local organisers will be asked to provide a short report on each session and will be paid £450 per year as an *honorarium*. Appointment will be for a three year term (August 2015 – August 2018) renewable by agreement. It is expected that Holgate session leaders will be drawn from all parts of the country to maximise geographical reach.

CELEBRATING 150 YEARS OF THE LONDON MATHEMATICAL SOCIETY



LONDON
MATHEMATICAL
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.

April - June

Celebratory Day at B(A)MC

1 April, University of Cambridge

Enhanced Northern Regional Meeting

7-10 April, Lancaster University (see page 24)

LMS-CMI Research School

Statistical Properties of Dynamical Systems

13-17 April, Loughborough University

Women in Maths Celebration: It All Adds Up

14-17 April, University of Oxford

(see page 23)

Exhibition of LMS Members'

Correspondence from the Archives of the Royal Society

1 May - 31 July 2015, The Royal Society, London

Joint LMS-BSHM De Morgan Day

9 May, De Morgan House, London

(see page 25)

LMS-Gresham Lecture: Reidun Twarock

20 May, The Museum of London

(see page 26)

Anniversary Dinner

18 June, Goldsmiths' Hall, City of London

Royal Society Summer Science Exhibition

30 June – 5 July, London

July - September

LMS-CMI Research School

Regularity and Analytic Methods in Combinatorics

1-5 July, University of Warwick (see page 27)

LMS Meeting and Hardy Lecture:

Nalini Joshi

3 July, London (see page 19)

LMS-CMI Research School

Developments in Modern Probability

5-10 July, University of Oxford

(see page 9)

Enhanced Midlands Regional Meeting

7-10 July, University of Warwick (see page 34)

Durham Symposium

Permutation Groups and Transformation Semigroups

20–30 July, Durham University

Durham Symposium

New Moonshines, Mock Modular Forms and String Theory

3-12 August, Durham University

Young Researchers in Mathematics Conference

17-20 August, University of Oxford

LMS-CMI Research School

Diophantine Equations

15-19 September, Baskerville Hall, Hay-on-Wye (see page 28)

Computer Science Colloquium

17 September, The Royal Society, London

Joint Anniversary Mathematical Weekend with the European Mathematical Society

18-20 September, University of Birmingham (see page 15)

Open House

20 September, De Morgan House, London

October - December

Bloomsbury Festival,

22-25 October, London

AGM and Annual Dinner

13 November, London

Joint meeting with the IOP and RAS

28-29 November

Mathematics Festival @ The Science Museum

25-29 November, London

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

DURHAM UNIVERSITY MATHEMATICAL SOCIETY UNDERGRADUATE COLLOQUIUM

Report



research into improving mathematical models for forecasting the weather. Such models are currently under-resolved so that estimates can be obtained within sensible times and hence often do not take into account the relatively fast, small-scale eddy processes as seen in storms in global climate models or in gravity waves in regional models. This encompassed various mathematical topics such as fluid dynamics and chaos theory.

Thirty members from Durham University Mathematical Society attended the talk, which was followed by informal drinks and refreshments – allowing students to ask Julian questions and discuss the talk in a relaxed setting.

Durham University Mathematical Society would like to take this opportunity to thank LMS for the grant they provided which was used to purchase a selection of refreshments and to cover Julian's travel costs to and from Edinburgh.

Eleanor Kershaw-Green
Publicity Officer

Durham University Mathematical Society

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On Wednesday 28 January 2015, Durham University Mathematical Society hosted a talk from guest speaker and ex-Durham mathematician Julian Mak, who is currently a Post-Doctoral Research Fellow at the School of Mathematics of the University of Edinburgh.

Julian spoke on *Eddies* and the ongoing

CECIL KING TRAVEL SCHOLARSHIP

Report



I used the 2014 Cecil King Travel Scholarship to visit Matthew Emerton at the University of Chicago for three months from September to December 2014. The primary purpose of the visit was to work with Matt on the 'local Langlands correspondence in families', whose existence has been conjectured by him and David Helm (this work is also joint with David and my advisor Toby Gee).

Following a suggestion of Matt's, I came up with a new approach to certain two-dimensional cases of the correspondence, combining representation theory of finite general linear groups with an understanding of the geometry

of certain Galois deformation rings. It remains to be seen whether this idea can be used to make progress in the n -dimensional case.

I also had the chance to meet with Frank Calegari, at Northwestern University, as well as to get to know many of the Chicago maths graduate students and postdocs. This will stand me in good stead when I take up

an L.E. Dickson Instructorship at Chicago in September.

I would like to express my great gratitude to the London Mathematical Society and the Cecil King Foundation for providing me with this wonderful opportunity.

Jack Shotton
Imperial College London

LMS STRATEGIC RETREAT FEBRUARY 2015

The LMS Council held a Strategic Retreat at De Morgan House beginning at 11:00 Friday 6 February, ending at 11:00 Saturday, 7 February; the Retreat was followed by a Council meeting on 7 February. The Retreat provided opportunity for extended informal discussion amongst Council members beyond what is normally feasible at Council meetings.

The agenda for the Strategic Retreat included reviewing, interpreting, and updating the Strategic Plan (formulated shortly after the previous Council Retreat held in 2013), as well as topics such as engagement with the mathematical community and with disciplines at the interface with mathematics, new activities, and the structure and function of the Council and Committees. Breakout groups considered various focus questions corresponding to each agenda item, and reported back to the full group for wider discussion. An LMS Development Activity Report on the delivery of the 150th Anniversary Legacy campaign was also presented to the meeting.

Discussion included questions of how to improve attendance at Society meetings, how to measure what we achieve through grants and how to prioritise applications, and whether Research Policy should include subject prioritisation. Limiting factors such as direct and indirect resources were considered. The specific question of whether or not to continue funding certain pilot activities was considered; there was fairly uniform agreement, for example, that the Undergraduate Research Bursaries were worth continuing if possible, as were Postdoctoral Mobility

Grants, possibly in a modified format.

Members also considered disciplines at the interface with mathematics, focusing on questions such as with what other subject areas should mathematics develop interfaces, and how to achieve this, and how the Council could benefit from further external input. The group also considered the question of improved engagement with the UK mathematical community and how to improve attendance at Society meetings, for example, by streaming talks to make them more widely accessible, or by expanding the types of activities that occur at Society meetings to include, say, panel discussions on various topics such as career progression or political aspects, as well as the usual mathematical talks.

There was also discussion about how to make better use of its membership, such as being more systematic in matching members' interests and skills to current needs and activities of the LMS. The idea of expanding Council membership to include external input from outside the immediate mathematical community was put forward, as was the possibility of adding a third Vice-President to share duties and increase diversity in leadership, although general concern was expressed at increasing the size of the Council (already at 20 members).

The format of the Retreat was felt to be useful for facilitating discussion and for "breaking the ice" for new Council members in advance of the formal Council meeting to follow. The suggestion was made to allocate a certain amount of time at future Council meetings for informal discussion.

The Retreat ended with an opportunity for each member to reflect on discussions and writing down five priority action items for the LMS. These will be compiled and used

to update the Strategic Plan by a subset of Council members in the upcoming months.

Tara Brendle
LMS Member-at-Large

LMS COUNCIL DIARY

7 January 2015

A personal view

I, at least, began this Council meeting with thoughts of how different things would have been 150 years earlier. An entirely male gathering, referring to each other by their surnames, back then, now succeeded by nine women and 11 men on first-name terms. Inkwells and nib pens (or perhaps even quills?) in 1865, while today most of us sit in front of laptops or tablets.

As always, the first substantive item was the President's Business. The President reported on a meeting between representatives of other scientific societies and Greg Clark who has replaced David Willetts as Minister for Universities, Science and Cities. The new minister was smart and supportive and seemed rather well informed.

The discussion of the First Quarter Financial Review was quickly over, because income and expenditure were very close to budget. Treasurer Rob Curtis explained that the bottom line, however, contained a lot of red figures; this was because of a predicted increase in spending related to the 150th anniversary.

Publications Secretary John Hunton updated us on the tendering process for a new publishing partner in 2017. Interviews with a shortlist of three potential partners were to be held later in the month, following which a final proposal would be made to Council's April meeting. The aim was that the new contract would be signed in November 2015.

Most of the business under Governance is usually uncontroversial, being typically concerned with approving recommendations for committee membership. However, a proposal, initiated by the Nominating

Committee, to revise the Framework for the selection of the President Designate gave rise to a divergence of views on Council. A main purpose of the changes was to incorporate principles which had up to now been unwritten rules: that the President should normally be a Fellow of the Royal Society (or equivalent) and that the new President should be from a different university, and work in a different area of mathematics, from the current President. There was no disagreement on this part of the document, but some Council members were concerned that the rules prescribed that President should have a casting vote on the Search Panel. After a discussion it turned out to be satisfactory to all to drop this clause and rely on another to the effect that the panel should aim to achieve a consensus.

Also under the Governance heading, Rodney Sharp who is one of the LMS Scrutineers (the other is Chris Lance) attended to present their report on the conduct of the 2014 elections. He said that entrusted to the Electoral Reform Society, the elections were in good hands. The possibility of voting in person at the AGM meant that an official from the ERS had to be present, which entailed an extra cost. This year no such votes had been cast (though this had happened in 2013). Rodney noted that the elections blog had contained the candidates' statements but afterwards been totally inactive. It was agreed that 'Elections Forum' would be a better name.

Council ended by congratulating Gwyneth Stallard on her award of an OBE in the recent New Year's Honours.

Francis Clarke



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

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



Organising Committee

Chris Parker
Anton Evseev
Maria Reguera
Andrew Treglown

Scientific Committee

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

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

GRAPH THEORY IN DESIGN AND EVALUATION OF ALGORITHMS AT LSD & LAW 2015

Report

A research meeting on *Graph Theory in Design and Evaluation of Algorithms* (GTA) was held at King's College London on Friday 6 February 2015. This meeting was a part of the annual two-day *London Stringology Day & London Algorithms Workshop* (LSD & LAW 2015). The aim of the GTA meeting was to explore graph theoretic aspects of modelling discrete computational problems, designing efficient algorithms and evaluating their performance, and to present some recent advances in algorithmic graph theory to the wider research community represented at LSD & LAW 2015. The GTA programme included three longer invited talks and six shorter talks, and attracted most of the participants of the LSD & LAW 2015 meeting, which was attended this year by a record number of over 75 researchers from 19 countries (representing all six continents).

The invited talk given by Thomas Erlebach (Leicester) discussed the *Queryable Uncertainty* framework for discrete optimisation problems, which is a recent alternative to the classical approach. While the traditional



© Department of Informatics, King's College London

Paul Spirakis discusses algorithmic problems on Temporal Graphs

focus has been on problems where exact input data is available, the new framework considers problems where input data is initially uncertain, but the exact values of individual input items can be obtained at a cost by executing a query. The talk gave a comprehensive overview of the Queryable Uncertainty methodology and its applications to graph problems, geometric problems and general set selection problems.

Paul Spirakis (Liverpool) explored in his invited talk some recent work on the complexity of computational problems on *Temporal Graphs*, where edges are available only at specified time points. The talk included both 'positive' results (for example, efficient algorithms for computing shortest paths in temporal graphs) and 'negative' results (for example, inapproximability of some exploration problems on temporal graphs), and highlighted directions for further research. This talk engaged the audience in a wider discussion of various possible models for temporal graphs to identify models which could be both significant for the practitioners and tractable for the theoreticians.



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Thomas Erlebach introduces the Queryable Uncertainty framework optimisation problems



Ljiljana Brankovic talks about de Bruijn graphs in genome assembly

Ljiljana Brankovic (Newcastle, Australia) discussed in her invited talk problem of identifying special cyclic structures, called ‘bubbles’ and ‘superbubbles’, in *de Bruijn graphs*. This class of directed graphs is the basis of an important algorithmic approach to genome assembly problems. The talk highlighted the challenges of designing appropriate graph models and developing efficient algorithms for those models, and provided a platform for research interactions between the participants working on algorithmic graph theory and the participants interested in algorithmic problems in bioinformatics (one of the traditional focus areas of the LSD

& LAW meetings).

Six shorter contributing talks discussed various problems falling into the intersection between graph theory, random graph processes and algorithms. Gregory Gutin and Mark Jones (Royal Holloway, University of London) presented their recent parameterized-complexity results for some types of Postman Problems in graphs. Robert Elsässer (Salzburg, Austria) discussed the eigenvalue-based approach to the graph isomorphism problem – one of the most prominent graph algorithmic problems whose computational complexity remains an open question. László Végh (LSE) presented

his recent discovery of the first strongly polynomial algorithm for the generalised network flow problem. Karen Gunderson (Bristol) and Nikolaos Fountoulakis (Birmingham) addressed the bootstrap percolation problems on infinite trees (Karen) and on finite preferential-attachment graphs (Nikolaos). A bootstrap process acts on the vertices of a graph, changing the status of a “healthy” vertex into “infected”, if it has at least r infected neighbours. The main question is whether the whole graph (or most of it) will eventually become infected, if each vertex is initially infected independently with a fixed probability p . The talks showed that threshold probabilities can be derived for some types of graphs.

The *Graph Theory in Design and Evaluation of Algorithms* meeting was supported by the LMS Conference grant and the Department of Informatics at King’s College London. The overall LSD & LAW 2015 meeting had additional support from Leverhulme Trust, British Council and Royal Society.

The next LSD & LAW meeting will be held at King’s College London in February 2016 (exact dates to be announced soon).

Tomasz Radzik
King’s College London



Informal discussion during coffee breaks



LONDON
MATHEMATICAL
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150 YEARS

LMS 150th Anniversary

Hardy Fellow

The Society is pleased to announce Professor Nalini Joshi (Sydney) as the 2015 Hardy Fellow.



In celebration of the 150th Anniversary, the LMS is hosting a special Hardy Fellowship in 2015. The Fellowship was founded in 1967 in memory of G.H. Hardy in recognition of outstanding contribution to both mathematics and to the Society. The Hardy Fellowship is a lecture tour of the UK by a mathematician with a high reputation in research.

Nalini Joshi will visit the UK in June and July 2015 and she will give talks at:

Imperial

17 June

Organiser: John
Gibbons

Oxford

18 June

Organiser: Lionel
Mason

Bath

19 June

Organiser: Antal
Jarai

Glasgow

22 June

Organiser: Jon
Nimmo and
Claire Gilson

Lancaster

24 June

Organiser: Alex
Belton

Loughborough

26 June

Organiser: Marta
Mazzocco

Leeds

29 June

Organiser: Frank
Nijhoff

Kent

1 July

Organiser: Peter
Clarkson

London

3 July

Organiser: LMS

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

For general enquiries about the Hardy Lectures, please contact Elizabeth Fisher

lmsmeetings@lms.ac.uk



LMS 150th Anniversary

Society Meeting and Hardy Lecture

3rd July
2015

3:30pm

BMA House, Tavistock Square, London (nearest tube: Euston)

Schedule

- 3.30 Opening of the meeting and LMS business, including the announcement of the 2015 Prize winners (open to all)

Marta Mazzocco (Loughborough)

Title to be confirmed

- 4.45 Tea/Coffee

5.15 **Nalini Joshi (Sydney) – 150th Anniversary Hardy Lecturer**

Title to be confirmed

- 6.30 Reception at De Morgan House

- 7.30 Society Dinner



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

To register for your place at the meeting, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk). If you would like to attend the Society Dinner, please email Elizabeth Fisher (lmsmeetings@lms.ac.uk).

The cost to attend the Society Dinner is £35.00 per person (inclusive of wine).

JORDAN GEOMETRIC ANALYSIS

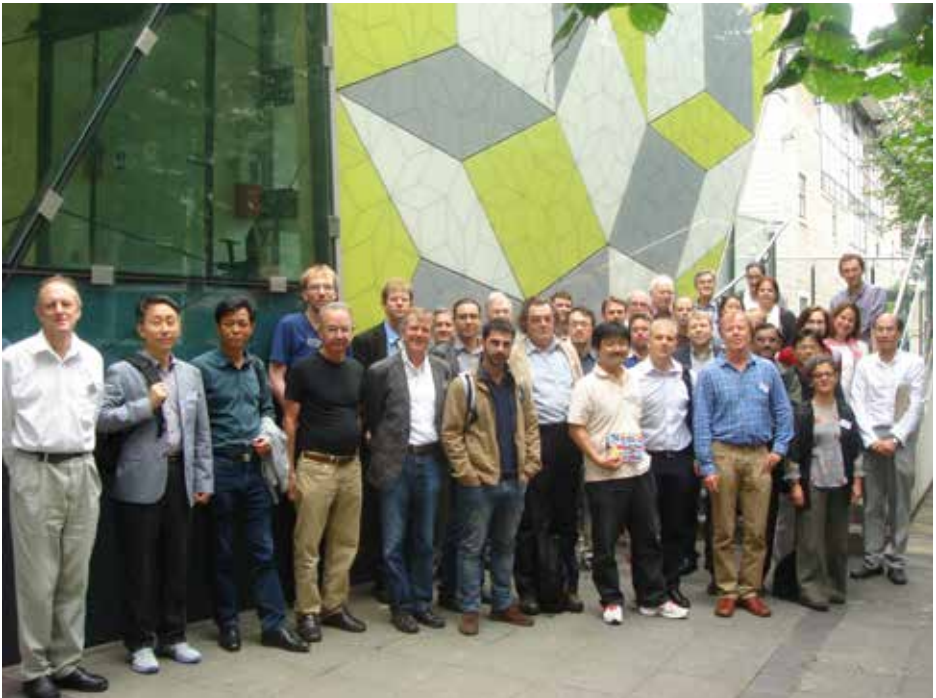
Report

From 3 to 5 September 2014, the School of Mathematical Sciences at Queen Mary, University of London, hosted a meeting on *Jordan Geometric Analysis and Applications*, with over 40 participants from Queen Mary, China, Germany, Hungary, Ireland, Japan, Korea, Portugal, Saudi Arabia, Spain, Taiwan and USA. The conference featured talks on Jordan theory and its recent diverse applications in complex geometry, infinite dimensional analysis and optimisation. They generated many exciting discussions and exchanges of idea, especially during the reception on the first day as well as the conference dinner the following evening at a Thai restaurant by the Regent's Canal.

Speakers included C. Boyd (Dublin), L.J. Bunce (Reading), C. Chen (Taichung), M. Gowda (Maryland), T. Honda (Hiroshima), A. Jimenez (Almeria), S. Kum (Chungbuk), B. Lemmens (Kent), Y. Lim (Sungkyunkwan), X. Li (Queen Mary), P. Mellon (Dublin), C-K. Ng (Nankai), L. Oliveira (Portugal), A. Peralta (Granada), F.J. Polo (Granada), M. Roelands (Kent), B. Russo (Irvine), O. Smirnov (Charleston), L. Stacho (Szeged), H. Upmeyer (Marburg), M.V. Velasco (Granada), M. Wortel (Kent) and J.D.M. Wright (Aberdeen).

The meeting was generously supported by an LMS Conference grant and the School of Mathematical Sciences at Queen Mary.

Cho-Ho Chu
Queen Mary, London



Attendees

CLAY RESEARCH FELLOWS 2015



The Clay Mathematics Institute is pleased to announce that James Maynard and John Pardon have been appointed Clay Research Fellows.

James Maynard received his PhD in 2013 from the University of Oxford under the supervision of Roger Heath-Brown and is currently a Fellow by Examination at Magdalen College, Oxford. James is primarily interested in classical number theory, in particular the distribution of prime numbers. His research focuses on using tools from analytic number theory, particularly sieve methods, to study primes. James has been appointed

as a Clay Research Fellow for a term of three years beginning 1 July 2015.

John Pardon will receive his PhD in 2015 from Stanford University under the supervision of Yakov Eliashberg. His most recent work concerns the construction of virtual fundamental cycles on moduli spaces of holomorphic curves in symplectic geometry. He is also interested in geometry and low-dimensional topology. John received his AB in Mathematics from Princeton University in 2011. John has been appointed as a Clay Research Fellow for a term of five years beginning 1 July 2015.

For more information visit www.claymath.org.

INSTITUT HENRI POINCARÉ



After World War I, French science had suffered great losses; it lacked resources and international contacts. It is in this context that math-

ematicians Émile Borel in France and David Birkhoff in the United States persuaded American and French sponsors (the Rockefeller Foundation and Edmond de Rothschild respectively) to fund the building of a center for lectures and international exchanges in mathematics and theoretical physics. Born in 1928, the Henri Poincaré Institute fostered intellectual vibrancy thanks to its positioning as a hub of mathematical expertise.

The Institut Henri Poincaré is located on the campus of Pierre and Marie Curie University in the 5th arrondissement of Paris, a place steeped in history that is also associated with the first steps of atomic physics, the discovery of radioactivity and the birth of the National Center for Scientific Research (CNRS). The Institute, ideally located in Paris downtown, enjoys a remarkable environment in terms of culture and gastronomy.

The IHP's supervising bodies are the CNRS and the Université Pierre and Marie Curie (UPMC). It also maintains close links with the University Paris-Sud, the Clay Institute and many other institutions. The original administrative structure of the IHP reflects its exchange hosting missions: the director, Cédric Villani and deputy director, Jean-Philippe Uzan constitute the only permanent scientists.

The Institute serves multiple purposes: first of all, as a place for national and international scientific exchange, it hosts quarterly thematic programmes, high-level doctoral courses and countless conferences and seminars; it makes offices and logistic facilities available to its guests and visitors, including its renowned library. It is a meeting place where all mathematicians are welcome to organise conferences and seminars, or just arrange to meet for a discussion or a work session. Every year, this 'House of Mathematics and Theoretical Physics' welcomes hundreds of visiting scientists from all over the world, and thousands of visitors who come to share their scientific expertise.

It is also the 'embassy' of French mathematics, reaching out to the press and the general public, and works in close partnership with as-

sociations and societies for the promotion of mathematics; no fewer than ten such institutions are hosted at the IHP.

A recent project of popularization of mathematics was the book 'La Maison des Mathématiques', published by Les éditions du Cherche-Midi. Four years in the making, this book reflects, through a combination of texts and photos, the bustle of activity within a modern research institute, interspersed with musings, equations, discussions, emotions, flashes of inspiration, intense thinking and moments of perplexity. Rich with many testimonials and illustrated with photographs by Vincent Moncorgé, the book was an immediate success and it will be available in English soon.

Regarding our news, 2015 will be the opportunity for the Institute to produce and direct a film on general relativity, in the footsteps of the Lagrange documentary. Indeed, 2015 will be the centenary of the discovery of general relativity by Albert Einstein. The list of the 2015 activities is augmented by an exceptional Abel Symposium on the occasion of the Abel Committee meeting at the beginning of this year; it comes on top of the three thematic quarters: disordered systems and

random processes (a mix of physics and probabilities); inverse problems (partial differential equations applied to the exploration of unknown systems); and of course general relativity (mostly from the mathematical angle, which has recently won praise with spectacular proofs this past year). The academic year 2015-16 will also be the occasion to welcome two new laureates of the Poincaré Chair: Jason Miller (MIT) and Daniel Wise (McGill). Like their predecessors Denis Auroux and Ivan Corvin, these young researchers have already distinguished themselves on the international stage.

Launched in January 2013 by the Institut Henri Poincaré and the Clay Mathematics Institute, the Poincaré Chair offers exceptionally talented young mathematicians ideal working conditions to develop their scientific projects by providing them the necessary means to develop profound and audacious research. The Poincaré Chair owes its creation to the prize awarded by the Clay Mathematics Institute (CMI, Providence, Rhode Island) for the solution of the Poincaré Conjecture.

Delphine Demols
Communication Manager
Institut Henri Poincaré





It all adds up:
Celebrating 150 years
of women across the
mathematical sciences

14th-17th April 2015

Mathematical Institute, University of Oxford

The LMS 150th Anniversary Women in Maths event

Tuesday 14th April and Wednesday 15th April: talks and workshops for school students.

Thursday 16th April and Friday 17th April: for mathematicians and mathematical scientists from **undergraduates to professors**, and including lectures, panel discussions, talks, posters, and time to meet others.



Registration: free for students, £5 for others.

Limited funds available for travel costs.

Limited free accommodation and limited free places at the conference dinner on Thursday 16th April (first come, first served).



Prizes for the best posters by students and postdocs.

(Left: Loyal Hakim, winner of the best poster competition in 2014.)



For the programme, for registration, to offer a talk or to express interest in submitting a poster, see

www.maths.ox.ac.uk/events/conferences/women-maths

#italladdsup2015



Photographs by Jonathan Tickner Photography

Oxford
Mathematics



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150 YEARS

LMS 150TH ANNIVERSARY LMS NORTHERN REGIONAL MEETING

Department of Mathematics and Statistics, Lancaster University
7 April 2015

2.00 pm	Opening of the meeting Peter Neumann (Oxford)
3.00 pm	Dennis Sullivan (SUNY, Stony Brook)
4.00 pm	Tea/Coffee
4.30 pm	Ieke Moerdijk (Radboud University Nijmegen/Sheffield)
6.00 pm	Reception and Dinner

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

For further details and to register and to reserve a place at the dinner, visit the website at www.lancaster.ac.uk/math/research/homotopical/.

The cost of the dinner will be approximately £30, including drinks.

The meeting forms part of a workshop on *Homotopical Algebra and Geometry* from 7 - 11 April 2015. The speakers at the workshop include: D.-C. Cisinski, V. Ginzburg, M. Gross, I. Grojnowski, V. Hinich, D. Joyce, A. King and M. Livernet. For further details visit the website above or contact the organiser (j.grabowski@lancaster.ac.uk).

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

| *b s h m* |

LONDON
MATHEMATICAL
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150 YEARS

LMS 150th Anniversary

BSHM-LMS De Morgan Day

9th May
2015

De Morgan House, Russell Square, London
(nearest tube: Russell Square)

Programme

10.00	Arrival and Coffee
10.30	Society Meeting
	Adrian Rice, <i>An Introduction to the Life and Work of Augustus De Morgan</i>
11.30	Coffee
12.00	Sloan Despeaux, <i>Augustus De Morgan's 'Budget of Paradoxes'</i>
1.00	Lunch
2.00	John Heard, <i>Augustus De Morgan and the Early History of the London Mathematical Society</i>
3.00	Ian Stewart, <i>Augustus De Morgan and George Boole</i>
4.00	Tea
4.30	Wilfrid Hodges, <i>The Influence of Augustus De Morgan</i>
5.30	Reception
7.00	Dinner (venue tbc)



Registration: To register contact Elizabeth Fisher (lmsmeetings@lms.ac.uk) by Friday 1st May. Late registrations for places may still be accepted, subject to availability. The reception will be followed by a dinner at venue tbc, at a cost tbc per person, inclusive of wine. If you would like to attend the dinner, please contact Elizabeth Fisher by Friday 1st May. There are limited funds available to contribute in part to the expenses of members of the Society or research students to attend the meeting. Please contact Elizabeth Fisher for further information.



THE LONDON MATHEMATICAL SOCIETY
JOINTLY WITH GRESHAM COLLEGE

Wednesday, 20 May 2015

6:00pm at The Museum of London

*Geometry: A New Weapon in the
Fight Against Viruses*

Professor Reidun Twarock

University of York

Viruses like the common cold look like tiny footballs and mathematics can therefore help to understand how they form and evolve. Our highly interdisciplinary approach in understanding and combating viruses, in which mathematics plays a key role, provides surprising new avenues in our fight against viral disease.

ADMISSION FREE

NO RESERVATIONS REQUIRED – FIRST COME, FIRST SERVED

Museum of London, London Wall, London EC2Y 5HN
Nearest underground stations: Barbican, St Paul's, and Moorgate

020 7831 0575 enquiries@gresham.ac.uk www.gresham.ac.uk



Heilbronn Institute for
Mathematical Research



LONDON
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150 YEARS

REGULARITY AND ANALYTIC METHODS IN COMBINATORICS

LMS-CMI Research School

1-5 July 2015, University of Warwick

Organisers: Peter Keevash, Daniel Král and Oleg Pikhurko

Course outline

The school will cover three interlinked discrete mathematics topics with computer science applications, which all saw exciting developments in the last few years: the Regularity Method, Limits of Combinatorial Structures, and Property Testing.

The three main lecture course topics are:

- *Regularity Method* (David Conlon, Oxford)
- *Limits of Combinatorial Structures* (Christian Borgs and Henry Cohn, Microsoft)
- *Property Testing* (Asaf Shapira, Tel-Aviv).

These lecture courses will be supplemented by tutorial sessions.

The school will also include three more generally focused talks given by:

Noga Alon (Tel Aviv)

Christian Borgs (Microsoft)

Ben Green (Oxford)

The school is collocated with the 25th British Combinatorial Conference.

For further information please visit:

www2.warwick.ac.uk/fac/sci/math/people/staff/daniel_kral/school15

Applications: Applications should be made using the registration form available via the Society's website at: www.surveymonkey.com/s/WXTVKYD Research students, post-docs and those working in industry are invited to apply.

The closing date for applications is **1 April 2015**. Numbers will be limited and those interested are advised to make an early application. All applicants will be contacted within three weeks after the deadline.

Fees

All research students will be charged a registration fee of **£150**. There will be no charge for **subsistence costs**.

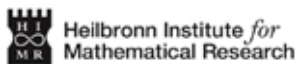
All early career researchers will be charged a registration fee of **£200**. There will be no charge for **subsistence costs**.

All other participants (e.g. those working in industry) will be charged a registration fee of £250 plus the full subsistence costs (£340) **£590** in total.

All UK-based participants must pay their own travel costs. For overseas-based participants, some support will be available to contribute towards travel costs.

Fees are not payable until a place on the course is offered but will be due by 6 May 2015.

*LMS-CMI Research Schools aim to provide training for young researchers in core areas of mathematics. Students and post-docs can meet a number of leading experts in the topic as well as other young researchers working in related areas. The LMS is the UK's learned society for mathematics. Registered charity no. 252660 (www.lms.ac.uk)
The CMI is charitable private operating foundation, incorporated in the USA.*



DIOPHANTINE EQUATIONS

LMS-CMI Research School

Baskerville Hall, Hay-on-Wye

15-19 September 2015

Organisers: Tim Dokchitser (Bristol), Vladimir Dokchitser (Warwick)

The course will give an overview of the existing methods for investigating integer and rational solutions to Diophantine equations. It will include both the algebraic, analytic and model theory aspects of the subject. The course will take the format of three 6-hour mini-courses, supported by exercise classes. The three mini-courses are:

1. Rational Points.

- A. Rational points on curves. **Michael Stoll (Bremen)**
 B. Higher-dimensional varieties. **Alexei Skorobogatov (Imperial)**

2. Integral Points.

- A. Basic methods and solubility. **Jennifer Park (McGill)**
 B. Analytic methods. **Trevor Wooley (Bristol)**

3. Elliptic and Modular Curves.

- A. Elliptic curves. **Tim and Vladimir Dokchitser**
 B. Modularity. **Andrew Granville (Montreal/UCL)**

For further information please visit: www.maths.bris.ac.uk/~matyd/DE/

Applications

Applications should be made using the registration form available via the Society's website at: www.surveymonkey.com/s/RYXPBY5 and applicants should have a letter of support sent to the organisers at DiophantusBaskerville@gmail.com. Research students, post-docs and those working in industry are invited to apply.

The closing date for applications is **15 June 2015**. Numbers will be limited and those interested are advised to make an early application. *All applicants will be contacted within two weeks after the deadline; information about individual applications will not be available before then.*

Fees

All research students and early career researchers will be charged a registration fee of **£150**. There will be no charge for subsistence costs.

All other participants (e.g. those working in industry) will be charged a registration fee of £250 plus the full subsistence costs (£250), **£500** in total.

All UK-based participants must pay their own travel costs. For overseas-based participants, support will be available to contribute towards travel costs.

Fees are not payable until a place on the course is offered but will be due by 15 August 2015.

LMS-CMI Research Schools aim to provide training for young researchers in core areas of mathematics. Students and post-docs can meet a number of leading experts in the topic as well as other young researchers working in related areas.

*The LMS is the UK's learned society for mathematics. Registered charity no. 252660 (www.lms.ac.uk)
 The CMI is charitable private operating foundation, incorporated in the USA.*

VISIT OF DAVID BANKS

Professor David Banks (Duke University, USA) will visit the universities of Durham and Cambridge and Imperial College London from 14 to 30 May 2015. Professor Banks has made significant contributions to Statistics and Adversarial Risk Analysis, with applications in a wide variety of areas including biostatistics, e-commerce and counter-terrorism. During his visit, he will give the following presentations:

- 15 May, Cambridge University
Text Mining of Document Networks
(contact Richard Samworth: r.samworth@statslab.cam.ac.uk)
- 26 May, Durham University
Adversarial Risk Analysis
(contact Frank Coolen: frank.coolen@durham.ac.uk)
- 29 May, Imperial College London
Bayesian Regression Models for Metabolomic Data
(contact David van Dyk: d.van-dyk@imperial.ac.uk)

During his visit to the UK, Professor Banks will participate at several further research meetings, and will also present a training day on Data Mining and Machine Learning, at Durham University on 21 May. This is aimed particularly at postgraduate students. For further details please contact Frank Coolen (frank.coolen@durham.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISIT OF CIPRIAN MANOLESCU

Professor Ciprian Manolescu (University of California, Los Angeles) will be visiting the UK in mid-May. Professor Manolescu has made major contributions to the Heegaard Floer homology for knots and 3- and 4-dimensional manifolds, and has resolved the Triangulation Conjecture for high-dimensional manifolds. During his visit Professor Manolescu will lecture at:

- Imperial College London, Friday 15 May at 1:30 pm, Huxley Building, 180 Queen's Gate

The Triangulation Conjecture

Contact Richard Thomas: rpwt@ic.ac.uk

- University of Oxford, Monday 11 May at 3:45 pm, Room L6, Mathematical Institute, Andrew Wiles Building, Woodstock Road
The Triangulation Conjecture
Contact Andras Juhasz: Andras.Juhasz@maths.ox.ac.uk
 - University of Cambridge, Wednesday 13 May at 4 pm, Meeting Room 13, Centre for Mathematical Sciences, Wilberforce Road
Involutive Heegaard Floer Homology and New Correction Terms
Contact Jacob Rasmussen: jar60@dpmmms.cam.ac.uk
 - University of Edinburgh, Monday 18 May at 4.10 pm, Room 6206, James Clerk Maxwell Building
The Triangulation Conjecture
Contact Andrew Ranicki: a.ranicki@ed.ac.uk
 - University of Glasgow, Wednesday, 20 May at 4.00 pm, Room 516, School of Mathematics and Statistics, University Gardens 15
Involutive Heegaard Floer Homology and New Correction Terms
Contact: Brendan Owens: brendan.owens@maths.gla.ac.uk and Liam Watson: Liam.Watson@glasgow.ac.uk
- For further details contact Andrew Ranicki (a.ranicki@ed.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISIT OF PAOLO SECCHI

Professor Paolo Secchi of University of Brescia, Italy will visit UK from 29 April to 16 May 2015. Professor Secchi's research expertise includes PDEs analysis and mathematical theory of fluid dynamics. He will give lectures at:

- University of Surrey on 1 May at 16:00
- University of Oxford on 7 May
- Imperial College, London on 13 May at 16:00

Professor Secchi's hosts at University of Surrey are Bin Cheng (b.cheng@surrey.ac.uk) and Michele Bartuccelli (m.bartuccelli@surrey.ac.uk). The visit is supported by an LMS Scheme 2 grant.

VISIT OF KARMA DAJANI

Dr Karma Dajani (Utrecht University) will be visiting the UK from 2 to 16 May 2015. Her expertise lies in the fields of ergodic theory, number theory and probability theory. During her visit Dr Dajani will lecture at:

- University of Warwick, 4-6 May (contact Zemer Kosloff:

Z.Kosloff@warwick.ac.uk)

- University of York, 7-8 May (contact Sara Munday: sara.munday@york.ac.uk)
- University of Manchester, 11-15 May (contact Simon Baker: simonbaker412@gmail.com)

For further details contact Simon Baker (simonbaker412@gmail.com). This visit is supported by an LMS Scheme 2 grant.

SYMBOLIC AND ALGEBRAIC COMPUTATION

The *International Symposium on Symbolic and Algebraic Computation* (ISSAC) is the premier conference for research in symbolic computation and computer algebra. This, the 40th in the series, will be held at the University of Bath from 6 to 9 July 2015.

The tutorial day on 6 July will consist of the following three sessions:

- Ankur Moitra (MIT, USA) *Nonnegative Matrix Factorization: Algorithms, Complexity and Applications*
- Clement Pernet (Grenoble, France) *Exact Linear Algebra Algorithmic: Theory and Practice*
- Veronika Pillwein (RISC-Linz, Austria) *An Introduction to Finite Element Methods*

The main conference is held from 7 to 9 July and will consist of invited speakers, contributed talks, posters and software demonstrations. The invited speakers are:

- Erika Ábrahám (RWTH Aachen University, Germany)
- Éric Schost (University of Western Ontario, Canada)
- Lihong Zhi (MMRC, Chinese Academy of Sciences, China)

The contributed talks programme is being decided now, while calls for posters and software demonstrations are being finalised and will appear on the website soon. Conference registration and local information will also appear on the website shortly.

ISSAC 2015 is followed by the affiliated workshop, PASCO 2015 (Parallel Applications of Symbolic Computation) from 10 to 12 July

2015. PASCO information is available at: <http://pasco2015.imag.fr/>

ISSAC 2015 is supported by an LMS Conference grant and the University of Bath.

The organisers have limited support for UK based research students, as well as participants from LMS Scheme 5 and former Soviet Union countries. The deadline for applying for support is **15 May 2015**, with details to appear at www.issac-symposium.org/2015/.

MATHEMATICS AND COMPUTATION IN MUSIC

May not music be described as the mathematics of the sense, mathematics as music of the reason? The musician feels mathematics, the mathematician thinks music.

John Joseph Sylvester

The international conference on *Mathematics and Computation in Music* (MCM) brings together researchers from around the world who combine mathematics or computation with music theory, music analysis, composition and performance. MCM, the flagship conference of the Society for Mathematics and Computation in Music, aims to provide a dedicated platform for the communication and exchange of ideas amongst researchers in mathematics, informatics, music theory, composition, musicology, and related disciplines.

The Fifth Biennial MCM conference will be held from 22 to 25 June 2015 at Queen Mary University of London, and will be jointly hosted by the School of Mathematical Sciences and the School of Electronic Engineering and Computer Science. MCM began in 2007 in Berlin (Staatliches Institut

für Musikforschung), and has taken place subsequently at New Haven (Yale), Paris (Ircam), and Montreal (McGill).

The general chairs are Oscar Bandtlow and Elaine Chew (QMUL), the programme chairs are David Meredith (Aalborg University) and Anja Volk (University of Utrecht), and the publication chair is Tom Collins (De Montfort University).

Participants from a broad spectrum of disciplines are welcome. Registration and programme details will be forthcoming on the conference website (mcm2015.qmul.ac.uk). Further questions should be directed to (mcm2015-enquire@qmul.ac.uk).

The meeting is supported by an LMS Conference grant and by the Institute for Musical Research.

FOURIER-MUKAI, 34 YEARS ON

The workshop *Fourier-Mukai, 34 Years On* will take place at the Mathematics Research Centre, University of Warwick from Monday 15 to Friday 19 June 2015 and forms part of the Warwick Symposium 2014/15 on *Derived Categories and Applications*. Fourier–Mukai transforms were introduced in a celebrated paper of Mukai in 1981. His motivation was to obtain new information about certain moduli spaces. Since then, the theory has been massively developed and applied. The Vector Bundles on Algebraic Curves 2015 Workshop will review these developments and draw attention to potential new applications. The invited speakers are:

- Arend Bayer (Edinburgh)
- Martin Gulbrandsen (Stavanger)
- Herbert Lange (Erlangen)
- Antony Maciocia (Edinburgh)
- Margarida Melo (Coimbra)
- Werner Nahm (Dublin IAS) (tbc)
- M.S. Narasimhan (TIFR, Bangalore)
- Dmitri Orlov (Steklov)
- David Ploog (Hannover)
- S. Ramanan (Chennai)
- Alice Rizzardo (Edinburgh)
- Fernando Sancho de Salas (Salamanca)
- Paolo Stellari (Milan)
- Carlos Tejero Prieto (Salamanca)
- Kota Yoshioka (Kobe)

There is no conference fee but there will be a charge for the social dinner on Thursday 18 June. For further information visit the website tinyurl.com/m25cbs6 which contains a link for the registration page. Limited support is available for young researchers (in particular for UK-based research students). The deadline for applying for support is **14 April 2015**. The same deadline applies for offers of contributed talks, which should be sent to newstead@liv.ac.uk and should include title and abstract. Research students requesting funding should also email newstead@liv.ac.uk and provide a supporting statement from their supervisors. Those not requiring support but requesting help with arranging accommodation should register by **30 April 2015**.

The workshop is supported by EPSRC, an LMS Conference grant, Foundation Compositio and the University of Warwick.

GROUPS, REPRESENTATIONS, AND COHOMOLOGY

There will be a workshop and conference on *Groups, Representations, and Cohomology* in the College Sabhal Mor Ostaig on the Isle of Skye, Scotland from 19 to 26 June 2015.

The workshop takes place from 19 to 22 June 2015 and is organised by Greg Stevenson, Jan Stovicek, and Ivo Dell'Ambrogio. The goal of the workshop will be to understand and prove the following result, due to Benson, Carlson and Rickard: the thick tensor ideal subcategories of the stable module category of a finite group are classified by the specialization closed subsets of the projective variety associated to the cohomology ring of the group. This foundational theorem establishes the theory of support varieties as a powerful and elegant link between group cohomology and group representations, via algebraic geometry.

The workshop will be accessible to graduate students and postdocs. Each participant is expected to contribute a talk, or to help in preparing a talk (depending on the number of participants). Prerequisites are: some proficiency with basic homological familiarity with commutative algebra, algebraic geometry, derived categories.

The workshop is followed by a conference from 23 to 26 June 2015, in honour of Dave Benson's 60th birthday, with invited speakers:

- Ragnar-Olaf Buchweitz (Toronto, Canada)
- Jesse Burke (Los Angeles, USA)
- Jon Carlson (Georgia, USA)
- Joseph Chuang (London, UK)
- John Greenlees (Sheffield, UK)
- Srikanth Iyengar (Salt Lake City, USA)
- Bob Oliver (Paris, France)
- Julia Pevtsova (Seattle, USA)
- Jeremy Rickard (Bristol, UK)
- Britta Spaeth (Kaiserslautern, Germany)
- Antoine Touze (Paris, France)

Further information, including on how to register and on available funding, can be found on the conference website <http://tinyurl.com/lglm7t2>.

This meeting is supported by an LMS Conference grant, the EPSRC Network Grant 'Anglo-Franco-German Representation Theory', and the grants DFG SPP 1388 'Representation Theory', DFG CRC 701 'Spectral Structures and Topological Methods in Mathematics' of the German Science Foundation DFG.

STOCHASTIC PROCESSES AND THEIR APPLICATIONS



The 38th *Stochastic Processes and their Applications Conference* will take place in Oxford from 13 to 17 July 2015. Hosted by the Oxford-Man Institute of Quantitative Finance, the Mathematical Institute and the Department of Statistics, University of Oxford, this major international meeting is organised under the auspices of the Bernoulli Society for Mathematical Statistics and Probability.

This conference brings together, from across the generations, some of the best speakers in the area and in mathematical sciences as a whole. The meeting will have at its core the mathematics of randomness coupled with a range of applications within and outside mathematics, including representation theory, algebra, and partial differential equations, through to data science, control theory and climate prediction.

The speakers for the named lectures are:

- Michael Cranston (UCI) Ito Prize Lecture
- Michel Ledoux (Toulouse) Schramm Lecture
- Gregory Miermont (ENS, Lyons) IMS Medallion Lecture
- Scott Sheffield (MIT) IMS Medallion Lecture
- Terence Tao (UCLA) Doob Lecture
- Boris Tsirelson (Tel Aviv) Levy Lecture

With a further 10 plenary speakers, as well as 27 invited sessions (81 talks) and over 250 contributed speaker slots.

For further information concerning the other speakers, invited session and registration see <http://spa2015.oxford-man.ox.ac.uk/>. The deadline for early bird registration is **30 April**. The meeting is supported by an LMS Conference grant.

BSHM EVENTS

The British Society for the History of Mathematics (BSHM) runs several events each year, and there are three in May and June in which LMS members may be interested. For full details of these and other forthcoming events, visit the BSHM website www.bshm.ac.uk.

De Morgan Day, London - 9 May

A joint celebration with the LMS of the life and work of Augustus de Morgan, first LMS President, on the 150th anniversary of the foundation of the LMS (see page 25).

Symmetry and Groups - 23 May

A one-day BSHM conference at Birkbeck College London. Speakers are Rob Curtis, Siobhan Roberts, Sarah Hart, Mark Ronan, Norman Biggs and Peter Neumann. For full details, and to book, visit www.bbk.ac.uk/ems/faculty/hart/symmetry-and-groups-conference.

The Big Picture: A celebration of 100 Years of General Relativity, Oxford - 20 June

A one day conference covering the mathematics of space from Newton until the present day. The keynote speaker will be Jocelyn Bell Burnell. Speakers include Rob Iliffe, Michael Hoskin, Jeremy Gray, Bob Lambourne and Malcolm McCallum. For full details, and to book, visit www.conted.ox.ac.uk/courses.

INTERNATIONAL MATHEMATICS COMPETITION FOR UNIVERSITY STUDENTS

Preliminary Announcement



The 22nd *International Mathematics Competition for University Students* is being organized by University College London and hosted by the American University in Bulgaria, Blagoevgrad, Bulgaria from 27 July to 2 August 2015.

Every participating university is invited to send several students and one teacher. Individual students are welcome. The competition is planned for students completing their first, second, third or fourth year of university education and will consist of two sessions of five hours each. Problems will be from the fields of Algebra, Analysis (Real and Complex), Geometry and Combinatorics. The working language will be English. Over the previous twenty one competitions there have been participants from over two hundred institutions in over fifty countries.

Groups Although this is an individual event, the Universities traditionally divide their participants into groups of four each. The number of students in the teams is, however, not fixed. The professor who accompanies the students is expected to be a member of the Jury.

Selection of the Problems The problems will be chosen at the Meeting of the Jury on 28 July from those received in advance by the President of the Jury, Professor John Jayne. The problems proposed should be precisely formulated and accompanied by a detailed solution. The problems should be in fields of Algebra, Analysis (Real and Complex), Geometry and Combinatorics. The problems given at the last twenty-one Competitions can give a general idea of the level expected (see the IMC web site www.imc-math.org.uk/). Additional topics may be also included.

Evaluation The students' work will be evaluated by Team Leaders and other Professors and Assistant Professors using criteria provided by the Jury.

Necessary Information Participants are invited to confirm their intention to participate, either by on-line registration or by email, by the **end of May 2015**, providing the following information: University: City, Country: Leader of the team (name, email address): Students (number): Mailing address: email address: fax.

Visas The participants from some countries will need a visa to enter Bulgaria. Please, contact your travel agent or the Bulgarian Consulate in your country for details. If necessary, the organizers will post formal invitations for participation in the Competition. You must begin the visa process early as it requires time.

Local Expenses The competition fee, which will include accommodation and meals from dinner on the 27 July to breakfast on 2 August, have not yet been finalized.

Send all confirmations of participation and arrival details to John Jayne (j.jayne@ucl.ac.uk). If you would like a copy of the competition poster email John Jayne with your postal address. For further information visit the website at www.imc-math.org.uk.

PROFINITE GROUPS

A *Profinite Groups Meeting* will take place at Lancaster University, Management School, Lecture Theatre 5 on Thursday 23 April 2015 from 11.30 to 17.30. It aims to bring together experts and would-be experts on profinite groups, giving all an opportunity to interact and engage with the topic. Young participants and women are especially encouraged to attend. The speakers are:

- John Wilson (Oxford)
- Dan Segal (Oxford)
- Inna Capdeboscq (Warwick)
- Benjamin Klopsch (Düsseldorf)
- Ged Corob Cook (RHUL)
- Eugenio Giannelli (Kaiserslautern)

For further details and to register visit the website at www.lancaster.ac.uk/math/news-and-events/events/ or contact the local organiser: Nadia Mazza (n.mazza@lancaster.ac.uk).

Limited funding is available for students and, subject to availability, early-career researchers. The conference is supported by an LMS Conference grant.



LONDON
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SOCIETY
150 YEARS

LMS 150th Anniversary

Midlands Regional Meeting

University of Warwick

Schedule

- Opening of the meeting
- R. Guralnick (Los Angeles)
Title (tbc)
- C. Roney-Dougal (St Andrews)
Title (tbc)
- Tea/Coffee
- Poster Session
- Wine Reception and Dinner

7th July
2015

These lectures are aimed at a general mathematical audience. All interested, whether LMS members or not, are most welcome to attend this event. For further details and to register and to reserve a place at the dinner, please visit www2.warwick.ac.uk/fac/sci/math/research/events/2014-15/nonsymposium/lmsreg/

The cost of the dinner is to be confirmed, but will include drinks.

The meeting forms part of a workshop on Finite Simple Groups and Related Topics from 8-10 July 2015. For further details visit www2.warwick.ac.uk/fac/sci/math/research/events/2014-15/nonsymposium/lmsreg/ or contact the organiser, Inna Capdeboscq.

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



Isaac Newton Institute
for Mathematical Sciences

DESIGN AND ANALYSIS OF EXPERIMENTS IN HEALTHCARE

6 – 10 July 2015

in association with the Isaac Newton Institute programme
Design and Analysis of Experiments
(18 July – 21 December 2011)

Organisers: Rosemary Bailey (St Andrews), Barbara Bogacka (Queen Mary, London), Holger Dette (Bochum) and Ralf-Dieter Hilgers (Aachen).

Workshop Theme: This workshop aims to bring together researchers in the design and analysis of experiments in healthcare, including academic researchers as well as people from the pharmaceutical industry and regulatory authorities. Topics include (but are not limited to): (1) randomization in trials with small population groups; (2) designs for dose-response studies; (3) designs for dependent observations; (4) optimal designs for pharmacodynamic/pharmacokinetic (PK/PD) models; (5) adaptive design; (6) population-enrichment designs.

Tuesday will be devoted to PODE (Population Optimum Design of Experiments), organised by Barbara Bogacka: see www.maths.qmul.ac.uk/~bb/PODE/PODE2015.html

Thursday will be devoted to an Open for Business Industry Day, organised by Vlad Dragalin.

The focus will be on seamless and more complex adaptive designs in drug development.

The programme is currently being developed and details will shortly be available.

This workshop is partly supported by the IDEAL (Integrated Design and Analysis of small population group trials) consortium: see www.ideal.rwth-aachen.de

Further information and application forms are available from the website www.newton.ac.uk/event/daew07

Closing date of the receipt of applications is **30 April 2015**.

CAMBRIDGE

O-Minimality and Diophantine Geometry

A. J. Wilkie,
University of Manchester
G. O. Jones,
University of Manchester

- Brings researchers up to date with exciting developments in the field
- Includes background material to help graduate students new to the area
- Focuses on Jonathan Pila's proof of the Andre–Oort conjecture, for which he was awarded the Senior Whitehead Prize



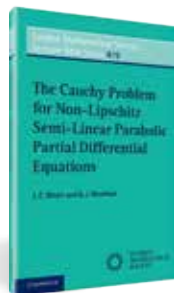
London Mathematical Society Lecture Note Series, No. 421
Paperback | 9781107462496 | May 2015

www.cambridge.org/lms421

The Cauchy Problem for Non-Lipschitz Semi-Linear Parabolic Partial Differential Equations

J. C. Meyer,
University of Birmingham
D. J. Needham,
University of Birmingham

- A novel new approach to the study of semi-linear parabolic PDEs, of interest to those working in reaction-diffusion theory and its applications
- Presents a number of specific applications in combustion, autocatalysis, biochemical reactions, epidemiology and population dynamics
- Requires only a solid appreciation of real analysis, making it suitable for a wide range of researchers in applied mathematics and the theoretical aspects of physical, chemical and biological sciences



London Mathematical Society Lecture Note Series, No. 419
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gre.ac.uk/pg/maths

OBITUARIES

HANS SCHNEIDER



Professor Hans Schneider, who was elected a member of the London Mathematical Society on 19 December 1957, died on 28 October 2014, aged 87.

Bryan Cain writes:
Three months after the March 1938 Anschluss,

'Hans' and his two dentist parents (whom, though unreligious, the Nazis viewed as Jewish) presciently left Vienna and illegally entered Czechoslovakia. When the notorious September 1938 Munich agreement changed the borders, the Schneiders found themselves paperless in Poland. After more difficulties and dramas, the family was together in Edinburgh in August 1939, three weeks before WWII started, 'Hans' having arrived via the Netherlands and his parents by boat from Poland. Hans attended George Watson's Boys' College there even during the few months of 1940 while his father was interned on the Isle of Man and his mother obliged to live in Glasgow, as German speaking aliens – possible spies. Eventually the dental practice got opened and Hans enrolled and got an MA with first class honours from the University of Edinburgh in 1948. That year he married professional violinist Miriam Weick and got an observatory job. Then he returned to the university and obtained a PhD (Doktorvater A.C. Aitken) in 1952. He taught for seven years at Queen's University Belfast before the family moved permanently to Madison in 1959.

At the University of Wisconsin Hans had 17 PhD students, published nearly 175 papers, was elected, aged 39, to a term as department chair, was appointed J.J. Sylvester Professor of Mathematics, and served as Editor-in-Chief of *Linear Algebra and its Applications* (LAA) from 1972 to 2012. He crowned this record by founding the International Linear Algebra Society (ILAS, incorporated 1990). Not all these were single-handed achievements. His

ability to work with and motivate others was one of his key assets. Indeed, his collaborators were legion, perhaps numbering in the hundreds.

Though Raoul Bott would come to say 'Eighty percent of mathematics is linear algebra', when Hans got his PhD linear algebra was not a popular research topic. It still does not attract the prestigious prizes. Hans Schneider's leadership invigorated research in linear algebra. LAA, which in 1972 published a modest number of articles, now processes nearly 1,200 submissions/year. Other journals started up to take a share of the linear algebra action. ILAS (which publishes two itself) was founded and structured with an eye to guaranteeing linear algebra research a lively and lasting future.

While his research has underpinned many applications, e.g. in robotics and stability, Hans had an enduring affection for Perron-Frobenius theory, which he elaborated and extended greatly. Its best known and most impressive application is in Google searches.

He is survived by his wife of 66 years, three children and six grandchildren.

¹Page 1 of P. Renteln's *Manifolds, Tensors, and Forms* CUP 2014

RON LEIGH



Professor Ron Leigh, who was elected a member of the London Mathematical Society on 19 October 1972, died on 23 October 2014, aged 83.

Derek Wilson writes:
Ron, as he was known to his friends and colleagues, made a significant contribution to the theory and practice of control engineering. He was a prolific author who wrote a number of books on control and its applications ranging across topics such as applied digital control, functional analysis and linear control as well as detailed work on practical topics such as temperature measurement and control.

Ron wrote with clarity and simplicity that maintained a combination of intellectual rigour with practical application that mirrored his own experience of practical problem solving in the steel industry, when automation was in its infancy.

Ron's early career was based in Sheffield where he studied Electrical Engineering at the then Sheffield College of Technology. Subsequently he completed postgraduate studies in the Control Engineering Group at Cambridge University, which was founded and led by Professor J.F. Coales. His PhD thesis (1968) *Development of Control Strategies for a Hot Strip Rolling Mill* typified his life-long interest in industrial control. He was Head of Control Systems Development at British Steel Corporate Labs in 1973, when he made the transition to an academic career, initially at the then Polytechnic of Central London.

Ron had many international associations and made several contributions to IFAC, the International Federation of Automatic Control, but he also made many contributions to the Control Institute in Warsaw, through his links with Professor T Kaczorek. It is important to remember that in the Soviet era, travel within Poland was unpredictable and his contribution to the development of productive relations with the Control Institute in Warsaw was significant.

For many years Ron was Head of the Industrial Control Centre, at the Polytechnic of Central London, now the University of Westminster and subsequently he served in a similar capacity at Brunel University. He was always a congenial and stimulating colleague and friend, and he has left a lasting legacy to the control engineering community.

REVIEWS

MAN RAY – HUMAN EQUATIONS: A JOURNEY FROM MATHEMATICS TO SHAKESPEARE

Man Ray – Human Equations: A Journey from Mathematics to Shakespeare explores the intersection of art and science that defined a significant component of modern art at the beginning of the 20th century. The exhibition displays together for the first time Man Ray's photographs and paintings with the mathematical objects that inspired them

The Phillips Collection (Washington, DC) introduces *Man Ray–Human Equations: A Journey from Mathematics to Shakespeare*, an exhibition exploring the intersection of art



and science that defined a significant component of modern art on both sides of the Atlantic at the beginning of the 20th century. Highlighting the multimedia work of the legendary

Surrealist artist, *Man Ray – Human Equations* is on view until 10 May 2015. Working in Hollywood in the late 1940s, Man Ray (American,

1890–1976) created his *Shakespearean Equations*, a series of paintings that he considered to be the apogee of his creative vision. Drawing upon photographs of 19th century mathematical models he made in the 1930s, the series was a culmination of 15 years of multimedia exploration. Featuring more than 125 works, *Man Ray–Human Equations* displays side-by-side for the first time the original plaster, wood, papier-mâché, and string models from the Institut Henri Poincaré (IHP) in Paris, Man Ray's inventive photographs of these unusual forms, and the series of *Shakespearean Equations* paintings they inspired.



The exhibition's diverse works—including 70 photographs, 25 paintings, eight assemblages or modified 'readymades' and 25 original mathematical models—juxtapose Man Ray's Surrealist-inspired photographs of mathematical models and the associated *Shakespearean Equations* paintings within

the larger context of the role of the object in the artist's work.

The exhibition will also be on view at the Ny Carlsberg Glyptotek, Copenhagen from 11 June to 20 September 2015, followed by The Israel Museum, Jerusalem from 20 October to 23 January 2016.

MATH AND THE MONA LISA by Bülent Atalay, Smithsonian Books, Washington, 2014, pp 352, \$15.95, ISBN 978-1-58834-493-9.



The title of the book *Math and the Mona Lisa: The Art and Science of Leonardo da Vinci* isn't too representative of what the book is actually about. The focus and purpose of the book is better represented by the closing lines: *"The model that worked*

magnificently for him [Leonardo - namely curiosity, experimentation and independent thought] *will never make any of us another Leonardo, a man called by many scholars "the greatest genius who ever lived."* But it cannot fail to make us each far more creative and more effective practitioners in the intellectual world that we inhabit.

Atalay's book is a very wide-ranging tour through the cultural and social history of science and art with Leonardo used as a focal point. The discussion of Mona Lisa is fairly superficial and the mathematics covered is limited; not much beyond the Fibonacci numbers, the Golden Mean and a bit on perspective and symmetry.

The book is a mixture of anecdotes, well known clichés and quite a bit about the authors own personal achievements and experiences. We learn, for example, that Leonardo was horrified when he discovered that the person he chose to sit as Judas for the mural *"The Last Supper"* turned out to be the same person that, months before, Leonardo had used for Jesus. We are presented with stock phrases about the conflict between science and religion.

More deep digging thoughts would have been welcomed, since the great heroes presented in the book, such as Galileo, Newton, Einstein and many other great scientists, all were men of reflective faith with sophisticated views on the relation between science and theology. So when Atalay declares that with religion, there appears to be no reasonable way to reconcile science and religion, he treats religion in quite a narrow sense, that doesn't allow one to understand why in fact faith and scientific enquiry for millennia have been inseparable.

We also get quite a few Atalay stories. We get to know that he, besides being a theoretical physicist, is an accomplished artist whose art can be found in Buckingham Palace. These little intermezzos are sometimes entertaining.

So what are the strengths of the book, if any? I very much sympathise with Atalay's concern that our present highly specialised educational system does little to encourage an understanding of the profound interconnection between the arts, the sciences and our worldview. I agree very much with Atalay that Leonardo da Vinci is a sublime example of how genuine understanding of different spheres of knowledge enables deep new insights. The book is not about math, not much about Mona Lisa – it is an attempt to remind us that great science and art is the result of insatiable curiosity. Leonardo was not driven by exam marks (nor was Einstein for that matter); rather, in Leonardo's own *"The natural desire of good men is knowledge"*. I believe the book can be read as an antidote to the present insistence on specialisation and fast shallow achievement.

Henrik Jeldtoft Jensen
Imperial College London

MATHEMATICS AND THE REAL WORLD by Zvi Artstein, Prometheus Books, Amherst, NY, 2014, pp 426, \$26.00, ISBN 978-1-61614-091-5.

This well-written and entertaining book is aimed at the general public. Technical mathematical material is avoided, although there are occasional more technical notes in a smaller font. The subject matter is the nature of mathematics, and the mathematics of nature, including both the physical and social world. The author's central point is that the human brain (identified with the human mind) is the result of an evolutionary process, and this affects the kind of mathematics we developed, the way we use it, and our ability to cope with it. He rejects the idea that there is such a thing as *mathematical thinking*, if that is taken to mean that mathematicians think in a way that is radically different from other people. This is not to minimize the remarkable achievements made by mathematicians and their impact on human development. Indeed, much of the content of the book celebrates these achievements, showing off the *many facets of mathematics*, and invites the reader to learn more about them.

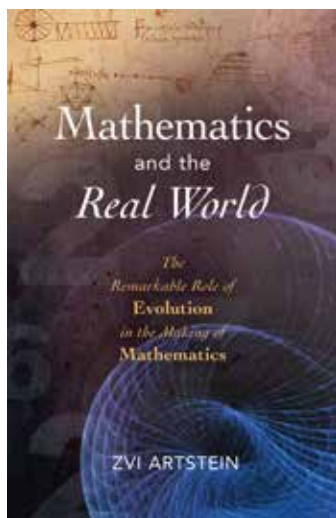
An introductory chapter sets out the basic premise, reviewing the basics of evolution, the mathematical abilities of dumb animals and giving a rapid summary of the historical development of mathematics. The key idea is a division of mathematics into that part (including some arithmetic and geometry) that could have conferred some selective advantage, and the rest. The former comes *naturally* or *intuitively* to us, and the latter is *hard*.

Artstein says that the remaining chapters may be read in any order. Three chapters

trace the whole history of mathematics with particular reference to man's developing view of the natural world and with a focus on the major cognitive leaps involved. The remaining chapters deal with the mathematics of randomness from ancient times to Kolmogoroff, human behaviour and economics, computation and computability, foundations and infinity, the modern mathematical research ecosystem, and mathematical education.

The writing is engaging and witty, and the range is vast. Artstein has spent half a lifetime embedded in the mathematical research community, and over the course of the book he explains for a lay reader practically all the topics that come up in coffee-room conversations and colloquium talks. He has a well-judged way of explaining *everything*, without patronizing his reader. His peers will have already met much of the

historical and philosophical material, and will note only that the account is largely faithful to received opinion. Even so, though he avoids technicalities and rigorous explanations, experts will find much fascinating information. He draws on evidence gleaned from extensive reading in the scientific and technical literature (not to mention Holy Writ), much of it striking, amusing and instructive. For instance, this reviewer was unaware that Maxwell invented Control Theory when thinking about governors for steam engines, and that Gauss anticipated the Fast Fourier Transform when he computed the orbit of Ceres in 1801-2. In making the case that people can't deal easily with complex logical structures he points out



that while we do have idiot savants who can do prodigious arithmetic, we have none who can manage complex logical structures, and that almost everyone misunderstands the sentence: "There is no head injury too minor for you to ignore."

Whether writing about ancient, renaissance or modern astronomy and physics, paradoxes about probability, artificial intelligence, transfinite cardinals, economics, the nature of mathematical research, or elementary education, Artstein keeps coming back to his central idea about the role of evolution in what we do, and can do. This original perspective of his injects a tension into the reading. The reader sees a grand new idea presented as illuminating everything, and is seduced by the thought, but hesitates to yield. Could this really be the answer? We know that many people like mathematics, but we are acutely aware that most do not. We have bitter experience of the difficulty in teaching mathematics to the masses. Some have said that the first step we must take to succeed as mathematics lecturers is to accept that the students are not the problem: we are the problem, because we do not think like ordinary people. Artstein explicitly rejects this. His thesis is that evolution has left us all with two ways of thinking, one of which operates by default, automatically, when we meet a problem, and he identifies specific characteristics of this way, such as the tendency to ignore improbable events (or risks) and fill in (by assuming or inventing) missing data. He presents evidence to show that we do not easily make rational choices when faced with uncertainty. In his final chapter he reflects on elementary education from this perspective, and his observations deserve to be taken seriously.

It is hard to deny that that the human brain is shaped by an evolutionary process that continued for over a hundred thousand generations. By contrast, the distinctly rational features of our species (or perhaps genus) appeared at most a few thousand generations ago. So it is plausible that human rationality is a graft on a prehuman rational

stock. Mathematics as we now think of it, with its emphasis on rigour and precision, is even more recent, less than 150 generations old, and results not from evolution but from something else. Artstein attributes it to the modicum of freedom and leisure enjoyed by some Greeks. He gives an interesting cross-classification of types of thinking, into thinking by comparison (involving searching and matching; cannot be learned in the abstract) and creative thinking (based on intuition, feeling, hunches; cannot be learned at all, just encouraged; needs more time in maths than in other disciplines). He quotes Poincaré: "By logic we prove, but by intuition we discover", and points to the helpful role of face-to-face discussion, subconscious activity and sleep in creative thinking. He speculates that our creative thinking utilises different 'brain areas', and may be what distinguishes man from brutes.

Among other controversial views, Artstein rejects the idea that creative thinking declines with age, and the distinction between pure and applied mathematics. His key contention about mathematical education is that understanding cannot be achieved via formal logic. We should distinguish the logical structure of mathematics from the structure for teaching mathematics. He advocates no formal mathematical work before the fourth grade. He says that we do not think conditionally, so probability is difficult and cannot be imparted intuitively. He says there is no chance that we will develop in the student an "intuition for logical operations, mathematical symbols, or other abstract systems without their being rooted in and backed by arithmetic and geometry."

No one is going to read a book with Mathematics twice in the title unless they have a positive disposition towards the discipline. This book is highly recommended for young people who are that way inclined. Its central idea and its relevance to mathematical education should be considered seriously by all professionals.

Anthony G. O'Farrell
Maynooth University

CALENDAR OF EVENTS

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

APRIL 2015

1 LMS 150th Anniversary Celebration Day at BMC-BAMC Joint Meeting, Cambridge (445)

7 LMS Northern Regional Meeting, Lancaster (446)

7-10 Almost-Periodic and other Ergodic Problems INI Workshop, Cambridge (442)

7-11 Homotopical Algebra and Geometry Workshop, Lancaster (441)

12-15 Water Waves and Floating Bodies International Workshop, Bristol (444)

13-15 Postgraduate Combinatorial Conference, Queen Mary University of London (444)

13-17 Mathematics for Health and Disease ICMS Workshop, Edinburgh (440)

13-17 Statistical Properties of Dynamical Systems LMS-CMI Research School, Loughborough (442)

14-17 LMS Women in Maths Event, Oxford (446)

15-16 Breaking Boundaries between Analysis, Geometry and Topology Meeting, Sussex (445)

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

20-21 Inductive Logic Summer School, Kent (442)

20-22 Computational Complex Analysis for Free Surface Flows Meeting, University College London (444)

20-24 Gradient Flows: From Theory to Application ICMS Workshop, Edinburgh (440)

20-24 Random Planar Structures INI Workshop, Cambridge (441)

22-24 Combining Probability and Logic, University of Kent (442)

23 Profinite Groups Meeting, Lancaster (446)

28-1 May Mathematical and Computational Models in Evolutionary Biology Workshop, Leicester (445)

MAY 2015

6-8 Optimization and Big Data Workshop, Edinburgh (445)

8-9 Integrability and All That, Loughborough (445)

9 LMS-BSHM De Morgan Meeting, De Morgan House, London (446)

12 Variational Methods for Stationary and Evolutionary Problems, Warwick (445)

18-20 Wales Mathematical Colloquium, Gregynog Hall, Powys (445)

20 LMS-Gresham College Joint Lecture, London (446)

22-23 Groups in Galway, National University of Ireland (445)

23 Symmetry and Group BSHM Conference, Birkbeck College London (446)

28-30 Edinburgh Mathematical Society & Societat Catalana de Matematiques Joint Meeting, Barcelona (443)

JUNE 2015

8-12 Relations between Banach Space Theory and Geometric Measure Theory Workshop, Warwick (444)

10-13 AMS-EMS-SPM International Meeting, Porto, Portugal (442)

15-19 Geometry of Random Walks and SLE, INI Workshop, Cambridge (445)

15-19 Fourier-Mukai, 34 Years On Workshop, Warwick (446)

19-26 Groups, Representations, and Cohomology Workshop and Conference, Isle of Skye (446)

20 The Big Picture BSHM Conference, Oxford (466)

22-25 Mathematics and Computation in Music, Queen Mary, University of London (446)

22-26 Random and other Ergodic Problems INI Workshop, Cambridge (444)

23-26 Hopf-Galois Theory and Galois Module Structure Workshop, Exeter (445)

JULY 2015

1-5 Regularity and Analytic Methods in Combinatorics, LMS-CMI Research School, University of Warwick (446)

3 Hardy Lecture, LMS Meeting, London (446)

5-10 Developments in Modern Probability LMS-CMI Research School, University of Oxford (446)

6-9 Symbolic and Algebraic Computation Conference, Bath (446)

6-10 Design and Analysis of Experiments in Healthcare INI Workshop, Cambridge (446)

7 LMS Midlands Regional Meeting, Warwick (446)

13-17 Quantum Groups and Quantum Information Theory Workshop, Herstmonceux

Castle, Sussex (445)
13-17 Stochastic Processes and their Applications Conference, Oxford (446)
20-30 Permutation Groups and Transformation Semigroups LMS-EP SRC Durham Research Symposium, Durham (443)
20-31 LMS Undergraduate Summer School, Loughborough (442)
20-30 Permutation Groups and Transformation Semigroups LMS-EP SRC Durham Research Symposium, Durham (443)
27-31 Metric and Analytic Aspects of Moduli Spaces INI Workshop, Cambridge (446)
27-2 Aug International Mathematics Competition for University Students, Blagoevgrad, Bulgaria (446)

30-1 Sep Modern Mathematical Methods in Science and Technology, Kalamata, Greece (445)

SEPTEMBER 2015

15-19 Diophantine Equations LMS-CMI Research School, Baskerville Hall, Hay-on-Wye (446)
17 LMS Computer Science Colloquium, The Royal Society London
18-20 LMS/EMS Joint Anniversary Mathematical Meeting, Birmingham (446)

NOVEMBER 2015

13 LMS AGM, London
19-11 Joint Meeting with the Edinburgh Mathematical Society, ICMS, Edinburgh

AUGUST 2015

3-12 New Moonshines, Mock Modular Forms and String Theory LMS-EP SRC Durham Research Symposium, Durham (444)
17-20 Young Researchers in Mathematics Conference, Oxford
23-28 Heidelberg Laureate Forum, Heidelberg (444)
24-28 European Set Theory INI Conference, Cambridge (445)

DECEMBER 2015

7-11 Combinatorial Mathematics and Combinatorial Computing Australasian Conference, Brisbane, Australia (445)
10-11 LMS Joint Meeting with the Edinburgh Mathematical Society, Edinburgh (443)
14-17 LMS South West & South Wales Regional Meeting, Southampton
15-16 LMS Prospects in Mathematics, Loughborough



METRIC AND ANALYTIC ASPECTS OF MODULI SPACES

27 – 31 July 2015

in association with the Isaac Newton Institute programme
Metric and Analytic Aspects of Moduli Spaces
 (20 July – 14 August 2015)

Organisers: Sergey Cherkis (Arizona), Nigel Hitchin (Oxford), Rafe Mazzeo (Stanford), Michael Singer (UCL) and Anda Degeratu (Freiburg).

Workshop Theme: The workshop will provide a focus for reporting on recent progress and highlighting new research directions in analysis and geometry of moduli spaces. Contributions will be invited from analysts, geometers, and mathematical physicists, and our themes will include complete hyperkaehler manifolds, moduli of curves and Teichmüller theory, analytic problems related to moduli spaces, and the continuing role of moduli spaces in mathematical physics.

Further information and application forms are available from the website
www.newton.ac.uk/event/mamw01

Closing date of the receipt of applications is **29 May 2015**.

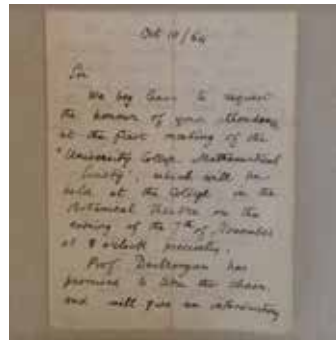
150TH LMS ANNIVERSARY

QUEEN OF THE SCIENCES

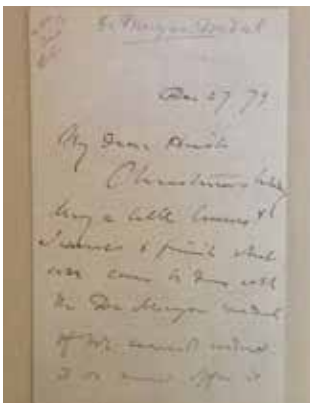
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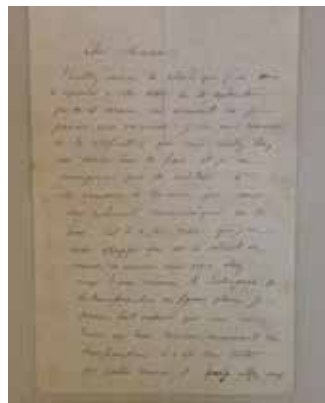
Admission ticket to a Society meeting



Letter from George De Morgan and Arthur Raynard inviting Hirst to the inaugural meeting



Letter from Henry Bompas (Council Secretary) concerning a subscription for the De Morgan Medal



Letter from Jean Gaston Darboux regarding the French Mathematical Society



Student's notebook from August De Morgan's lectures on *Algebraic Geometry and the Calculus*



Admission ticket to Spitalfields Mathematical Society lectures