NEWSLETTER

NOTABLE
ASTRONOMICAL
AUTHORS

COUNTING
POINTS ON
ELLIPTIC CURVES

NOTES OF
A NUMERICAL
ANALYST

COVER IMAGE

An image of author Margaret Bryan and two children from the frontispiece of the LMS 1799 second edition copy of Bryan's book *A Compendious System of Astronomy*. From the feature article 'Notable Astronomical Authors in the LMS Philippa Fawcett Collection' by Emma Baxter and Deborah Kent (page 27).

Do you have an image of mathematical interest that may be included on the front cover of a future issue? Email images@lms.ac.uk for details.

NEWSLETTER WEBSITE

The Newsletter is freely available electronically at lms.ac.uk/publications/lms-newsletter.

MEMBERSHIP

Joining the LMS is a straightforward process. For membership details see lms.ac.uk/membership.

SUBMISSIONS

The Newsletter welcomes submissions of feature content, including mathematical articles, career related articles, and microtheses from members and non-members. Submission guidelines and LaTeX templates can be found at lms.ac.uk/publications/submit-to-the-lms-newsletter.

Feature content should be submitted to the editor-in-chief at newsletter.editor@lms.ac.uk.

News items should be sent to newsletter@lms.ac.uk.

Notices of events should be prepared using the template at lms.ac.uk/publications/lms-newsletter and sent to calendar@lms.ac.uk.

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LMS NEWS

Former LMS President Professor Caroline Series Awarded a CBE

The LMS is delighted to report that Professor Caroline Mary Series FRS, former LMS President and Emeritus Professor of Mathematics, University of Warwick, was awarded a CBE in the King's Birthday Honours, for services to mathematics.

From the citation: Professor Series was the third female president of the LMS, holding the post from 2017 to 2019. During this time, she drove through essential reforms and was a major contributor to the Society's response to the Bond Review of Mathematics (2018), work which continued with a role on the national Strategy Committee implementing review recommendations. She was also a founding member of European Women in Mathematics and in 2015 became the first vice-chair of the International Mathematical Union's Committee for Women in Mathematics. She continues to serve global mathematics through, for example, her role on the Nominating Committee of the International Mathematical Union (IMU) in 2022. She has served on the Scientific Steering Committee and on the Management Committee of the Isaac Newton Institute, on the Pure Mathematics Subpanel in RAE2008, and on the Mathematical Sciences Subpanel in REF2014, among many others.

In addition to her exemplary service to the community, Professor Series is an outstanding mathematician whose groundbreaking work connects geometry to dynamics and topology. She is known for her work on symbolic coding of geodesics on hyperbolic surfaces and for novel contributions to the study of hyperbolic manifolds via their fractal limit sets, and she proved important results on simple curves on surfaces.

Commenting on her award, Professor Series said: "I am truly honoured to receive this award. My career has been dedicated to mathematics, and it's wonderful to be recognised in this way in our new King's first birthday honours. Over the years I have had the pleasure of working alongside brilliant teachers, colleagues and students who have supported me throughout, and this award is a testament to them, as well as to the research I have been able to carry out. Mathematics is so important nowadays and leads to all sorts of opportunities for a great career."

LMS Staff Team: An Update

LMS staff in the garden at De Morgan House

Over the past year we have had changes to the LMS staff team with some new people joining and some existing staff taking on slightly changed roles. A full staff team is now in place. Below is a short summary of the main staff teams and the areas of the Society's work they support.

Executive Secretary (CEO) Office

The Executive Secretary, Simon Edwards, is responsible for the overall management of the staff team and for supporting Trustees with the strategic development of the Society. Clare Ralphs (PA to Executive Secretary) oversees the day to day running of the office as well as human resource support to staff and other project work across the Society.

Society Business Group

The team runs the wider range of Society activities from communications & events, grants, our main committees, and our membership services. The team is headed by Jennifer Gunn (Head of Society Business) who oversees the society business functions and leads support for the Council for the Mathematical Sciences, strategic projects, and overall policy

development. Elizabeth Fisher (Membership and Grants Manager), Lucy Covington (Grants Administrator) and Valeriya Kolesnykova (Membership and Fellowship Assistant) look after our membership services, our grants programmes and web development. Katherine Wright (Communications and Policy Manager) and Kieran O'Connor (Events Coordinator) look after our communications, events and policy work on education, research, and diversity in mathematics. Lesley Campbell (Governance Officer) supports LMS Council, the election process and other governance requirements.

Publications Group

The team runs our publications portfolio which includes our own LMS-owned journals, partner journals and our books series. The team is headed by Simon Buckmaster (Head of Academic Publications) who leads overall publications strategy, open access development and business relationships. Ola Tornkvist (Publisher) looks after our editorial processes and the editorial development of individual journals. Anna Agathopoulou (Publications Assistant) supports the day-to-day operation of peer-review, handles queries from authors, as well as supporting development projects.

Conferences and Facilities

The team runs our conference venue at De Morgan House as well as the wider facilities for staff and tenants. The team is headed by Andrew Dorward (Head of Buildings and Conferences) who oversees our conference business and its continued development. Andrew works with Tiana Teta (Conference Assistant) as well as temporary catering and security staff that support individual events.

Finance and Accounting

The team runs our day-to-day payments, monthly reporting, setting and managing budgets and providing financial support to decision making. The team is headed by Ephrem Abate (Head of Accounting and Finance) who is responsible for our accounting processes and compliance with our duties as a charity and other financial regulations. He is supported part-time by Valeriya Kolesnykova (Accounts Assistant).

All staff can be contacted by using the email format firstname.surname@lms.ac.uk or further details can be found on the staff pages on the LMS website (lms.ac.uk/about/staff).

Simon Edwards
LMS Executive Secretary

JLMS and BLMS Now Welcome Specialised Papers

Following up on my announcement in the July newsletter, I am delighted to confirm that we have now implemented a new structure for the Editorial Board of the *Journal of the London Mathematical Society* (JLMS) and the *Bulletin of the London Mathematical Society* (BLMS).

The shared Editorial Board for JLMS and BLMS has been reshaped to include seven Section Editors, each of whom oversees and is responsible for accepting papers in a different area of the journals' scope:

- Algebra — Srikanth Iyengar (University of Utah, USA)

- Analysis — Nadia Larsen (University of Oslo, Norway)

- Combinatorics, Discrete and Computational Mathematics and Logic — Alex Fink (Queen Mary University of London, UK)

- Geometry and Topology — Arend Bayer (University of Edinburgh, UK)

- Number Theory — Jack Thorne (University of Cambridge, UK)

- Partial Differential Equations and Geometric and Numerical Analysis — José Carrillo (University of Oxford, UK)

- Probability, Stochastic Analysis and Dynamical Systems — Amanda Turner (University of Leeds, UK)

The full Editorial Board can be viewed at lms.ac.uk/publications/BJ-editorial-board.

With the introduction of our new Section Editors and their specialist expertise, I am pleased to confirm that both JLMS and BLMS now welcome the submission of papers which are more specialised, alongside the general interest papers for which the journals are well known. To be considered for publication, specialised papers must include a well-written introduction which sets the research in a context that a wider community of mathematicians can understand.

With their shared editorial board, both journals employ the same high standard of peer review, publishing leading research across the field of mathematics. BLMS publishes concise research papers with a maximum length of 20 pages, as well as survey articles of any length. JLMS focuses on long-form research articles with a minimum length of 18 pages.

JLMS and BLMS are published alongside the Society's flagship high-impact journal, *Proceedings of the London Mathematical Society* (PLMS); and the fully Open Access journal *Transactions of the London Mathematical Society* (TLMS). As well as being key publications in the field, the Society's journals are also a vital source of funding for the Society activities. An important way that LMS members can support the Society's programme of grants and events is by choosing to publish their research in the Society's journals.

Niall MacKay
LMS Publications Secretary

New *Journal of Topology* Managing Editor

The Society is pleased to welcome John Greenlees, University of Warwick, as the new Managing Editor of the *Journal of Topology*. John replaces Ivan Smith FRS who has been Managing Editor 2021–23 and was prior to that on the Editorial Board of the *Journal of Topology* since 2012. The LMS wishes to express its gratitude to Ivan for his excellent service to the journal and the Society.

Niall MacKay
Publications Secretary

New Managing Editors for the LMS *Journal*

The Society is pleased to welcome Caroline Series FRS, University of Warwick, and Stuart White, University of Oxford, as new Managing Editors of the *Journal of the London Mathematical Society*.

Caroline and Stuart replace Mark Haskins and James Maynard FRS who have led the *Journal* since 2018/2019.

The LMS wishes to express its gratitude to Mark and James for their excellent service to the journal and the Society.

Niall MacKay
Publications Secretary

Forthcoming LMS Events

The following events will take place in forthcoming months:

LMS South West and South Wales Regional Meeting and Workshop: 17-19 January 2024, Bath (bit.ly/lms-sw-sw-regional-meeting-2024)

LMS Northern Regional Meeting and Workshop: 25-28 March 2024, Durham University (bit.ly/lms-northern-regional-meeting-2024)

LMS Midlands Regional Meeting and Workshop: 2-5 April 2024, Loughborough University (bit.ly/lms-midlands-regional-meeting-2024)

A full listing of upcoming LMS events can be found

OTHER NEWS

Professor Miles Reid Awarded the Royal Society's Sylvester Medal

Professor Miles Reid FRS has been awarded the Royal Society's Sylvester Medal. Professor Reid's award is for his exceptionally creative research and fundamental insights into higher-dimensional algebraic geometry, in particular the minimal model program for 3-folds, and for untiring work for the community of algebraic geometers. He was elected an LMS member in 1983 and awarded Senior Berwick Prize in 2004 and Pólya Prize in 2014.

The Sylvester Medal is awarded annually for outstanding contributions in the field of mathematics. The award was created in memory of the mathematician James Joseph Sylvester FRS, who was Savilian Professor of Geometry at the University of Oxford in the 1880s.

PROMYS Europe 2024: Call for Applications

PROMYS Europe, a challenging mathematics summer programme, based at the University of Oxford, UK, is seeking applications from pre-university students from across Europe who show unusual readiness to think deeply about mathematics, as well as undergraduate students who would like to work with them as counsellors.

PROMYS Europe is designed to encourage mathematically ambitious students who are at least 16 to explore the creative world of mathematics. Participants tackle fundamental mathematical questions within a richly stimulating and supportive community.

The programme is dedicated to the principle that no one should be unable to attend for financial reasons. Most of the cost is covered by the PROMYS Europe partnership and by generous donations from supporters. In addition, full and partial financial aid is available, for those who need it. Applications open in January. For more information and details of how to apply, visit the PROMYS Europe website www.promys-europe.org.

AIMS Admission: Solution

In July the LMS *Newsletter* published (p.9) an item from AIMS South Africa giving a mathematical question from their new applications portal. The question was: "40 identical balls are rolling along a straight line. They all have speed equal to v, but some of them might move in opposite directions. When two of them collide they immediately switch their direction and keep the speed v. What is the maximal number of collisions that can happen?"

The solution given in a subsequent AIMS Newsletter was as follows:

Let the 20 leftmost balls move to the right, and 20 rightmost balls move to the left. Every time there is a collision between two balls, the two balls effectively swap their identity. In this process, each of the 20 leftmost balls have to swap places with each of the 20 rightmost balls. Four hundred (400) such collisions or swaps can take place before the balls are moving with no more balls ever obstructing them.

A proof that this is in fact the maximum possible number of collisions is omitted; we leave this detail to LMS readers.

INTERNATIONAL DAY OF MATHEMATICS
MARCH 14

The International Day of Mathematics (IDM) is a worldwide celebration. Each year on March 14 all countries will be invited to participate through activities for both students and the general public in schools, museums, libraries and other spaces.

Invitation to celebrate the International Day of Mathematics 2024

One of the aims of the IDM is to convey the love for mathematics to young people and the message that mathematics is everywhere and that it is useful and beautiful.

Everyone is invited to celebrate, with a special invitation to teachers to celebrate in their classroom. Schools can also organise larger events.

The 2024 theme is:

Playing with Math

Here are some suggestions:

- Think of a stimulating activity to organize, either with the public or in the classroom. You can find inspiration in the Organize section.

- Organize an activity Mathematics in the Street, for instance in the schoolyard.

- Register your event on the IDM website, so that it appears on the IDM event map 2024.

- Use the resources (poster 2024, pins, etc.) or produce your own.

Join us at www.idm314.org!

- The IDM logo already exists **in 40 languages** and more will be added if requested.

- Participate to the **International Challenge** announced beginning of January. Classroom participation is welcome

- **Participate in the live coverage** on March 14 (see the 2023 coverage as a reference) and watch the virtual ceremony.

- Visit the IDM website and **share photos or videos** of your activities on social networks.

- Subscribe to the **IDM newsletter** to receive all the information in the run-up to IDM 2024.

All schools around the world are invited to celebrate!

Pass the word to the school networks around you!

We are here to help.

Contact: Christiane Rousseau
info@idm314.org

Visit **www.idm314.org** for more information

The International Day of Mathematics is a project led by the
International Mathematical Union (www.mathunion.org)

MATHEMATICS POLICY DIGEST

Mathematical Futures programme — A New Approach to Mathematics and Data Education

In September 2023 the Royal Society launched a discussion paper (bit.ly/3QXekdn) for consultation ahead of a major report to be published in spring 2024. The paper makes the case for a new approach to mathematical education from early years through to GCSE level. The aim is to provide a better mathematics and data education for everyone that will equip future citizens with the capabilities, skills, adaptability, and resilience they need to thrive in a world where mathematics and data play increasingly important roles in everyone's lives.

You can read details of the report on the Royal Society website: bit.ly/mathematical-futures-programme.

The LMS has responded to the discussion paper and you can read the reponse at lms.ac.uk/policy/reports-and-policy-submissions. Dr Kevin Houston, who until 17 November 2023 was the LMS Education Secretary, said "As data education becomes an increasingly important part of the school curriculum, the LMS is keen to support the Royal Society ACME vision for the subject as part of mathematics education. We look forward to working with Royal Society ACME to develop this vision."

Labour Announces 'Phonics For Maths' Scheme in Planned Curriculum Review

At the Labour Party Conference in September, Labour's Shadow Education Secretary Bridget Phillipson unveiled a new plan to encourage stronger lifelong numeracy by boosting early intervention and "real world" mathematics teaching at primary school and a new expert-led review as part of its plan to drive "high and rising standards in education".

Labour's mathematics plan will centre on upskilling primary school teachers who are not mathematics teachers with the right skills and knowledge to deliver high-class mathematics teaching through the Teacher Training Entitlement, paid for through Labour's plans to end private schools' tax breaks.

For further details, visit the Labour party website: bit.ly/labour-real-world-maths.

£30m Allocated to Multiply Scheme is Returned to Treasury

Multiply, the UK Prime Minister's flagship numeracy programme, is intended to improve adult mathematics skills across the country. The scheme offers free courses for adults who did not achieve a grade C or above in GCSE mathematics or an equivalent level 2 qualification.

£559 million was committed to the programme across three financial years to the end of 2024-25 from the UK Shared Prosperity Fund. In its first year of delivery, £30.3 million of the £81 million awarded was returned to the Treasury, according to data obtained by local government expert Jack Shaw through a Freedom of Information request and published in the Financial Times.

For further details on this story, read on the FT: on.ft.com/3QKHkot.

For more details on Multiply, see bit.ly/3sxj3ci.

Digest prepared by Kieran O'Connor
Events Co-ordinator

Note: items included in the Mathematics Policy Digest are not necessarily endorsed by the Editorial Board or the LMS.

LMS Prizes 2024: Call for Nominations

Deadline: 8 January 2024, 23:59 (GMT)

Nominations are invited for the following LMS prizes in 2024, which are intended to recognise and celebrate achievements in and contributions to mathematics:

The Pólya Prize, awarded in recognition of outstanding creativity in, imaginative exposition of, or distinguished contribution to, mathematics within the United Kingdom.

The Senior Berwick Prize, awarded to the author(s) of an outstanding piece of mathematical research published by the Society in the past 8 years. We strongly encourage nominations for all prizes for women and other underrepresented groups in the mathematical community. The Prizes Committee interprets the criteria for all prizes broadly, so if in doubt please submit a nomination.

The Fröhlich Prize, awarded for original and extremely innovative work in any branch of mathematics.

The Shephard Prize, awarded to a mathematician or mathematicians for making a contribution to mathematics with a strong intuitive component which can be explained to those with little or no knowledge of university mathematics, though the work itself may involve more advanced ideas,

The Whitehead Prizes, awarded for work in and influence on mathematics to mathematicians with fewer than 15 years' experience at post-doctoral level (up to six may be awarded).

The Anne Bennett Prize, awarded to mathematicians with fewer than 10 years' experience at post-doctoral level for work in, influence on or service to mathematics, particularly in relation to advancing the careers of women in mathematics.

To submit a nomination for the Pólya, Fröhlich, Shephard, Anne Bennett, or Whitehead Prizes, visit: lms.ac.uk/form/lms-prizes-nomination-form.

To submit a nomination for the Senior Berwick Prize, visit: lms.ac.uk/form/berwick-prize-nomination-form.

Full regulations for each prize can be found at lms.ac.uk/prizes/lms-prize-regulations.

Any queries should be sent to Kieran O'Connor at prizes@lms.ac.uk.

Christopher Zeeman Medal 2024: Call for Nominations

Deadline: 28 February 2024

Nominations are invited for the 2024 Christopher Zeeman Medal, which is intended to recognise excellence in the communication of mathematics.

The Medal is awarded jointly by the LMS and the Institute for Matheamatics and its Applications (IMA). The prize winner will have excelled in promoting mathematics and engaging with the general public. They may be academic mathematicians based in universities, mathematics school teachers, industrial mathematicians, those working in the financial sector or from any number of other fields.

Most importantly, nominees will have worked exceptionally to bring mathematics to a non-specialist audience, whether it is through giving public lectures, writing books, appearing on radio or television, organising events or through an entirely separate medium.

The award is named after Professor Sir Christopher Zeeman FRS, whose notable career was pioneering not only in the fields of topology and catastrophe theory but also because of his groundbreaking work in bringing mathematics to the wider public. Sir Christopher was the first mathematician to be asked to deliver the Royal Institution Christmas Lectures in 1978, 160 years since they began.

The most recent winner of the Christopher Zeeman Medal is Simon Singh in 2022. Previous winners of the Medal are Matt Parker (2020), Hannah Fry (2018), Rob Eastaway (2016), Marcus du Sautoy OBE (2014), John Barrow FRS (2011) and Ian Stewart (2008).

Nominations should be sent to Emma-Jane Wheal (emma-jane.wheal@ima.org.uk) by 28 February 2024. See details and download a nomination form at bit.ly/zeeman-2024.

Louis Bachelier Prize 2024: Call for Nominations

Deadline: 31 January 2024, 23:59 (GMT)

The Louis Bachelier Prize is a biennial prize jointly awarded by the LMS, the Natixis Foundation for Quantitative Research and the Société de Mathématiques Appliquées et Industrielles. Nominations are now invited for the 2024 award.

The prize will be awarded to a mathematician who, on 1 January 2024, has fewer than 20 years (full time equivalent) of involvement in mathematics at postdoctoral level, allowing for breaks in continuity, or who in the opinion of the Bachelier Prize panel is at an equivalent stage in their career.

The prize is awarded to the winner for his/her exceptional contribution to mathematical modelling in finance, insurance, risk management and/or scientific computing applied to finance and insurance. The prize winner will receive €20,000 including £5,000 to organise a scientific workshop in Europe on their area of research interests.

Download a nomination form at bit.ly/bachelier-2024. Completed nomination forms should be sent to Katherine Wright, Secretary to the Bachelier Prize panel: prizes@lms.ac.uk.

Travel Grants to Attend 9ECM

Deadline: 8 January 2024

Applications are open for travel grants for established mathematicians to attend the 9th European Congress of Mathematics (9ECM), to be held from 15 to 19 July 2024 in Seville, Spain.

Applicants to this scheme should be established mid- to late-career mathematicians, defined as being beyond five years since completing their PhD (excluding career breaks), and should be based at a UK institution. The grants are not expected to cover all the costs and will not support attendance at satellite meetings.

Please note that there is a separate 9ECM travel grant scheme for UK-based early career researchers.

Please remember to make a copy of your application to send to your Head of Department and ask your Head of Department (or equivalent) to complete the online referee form at https://bit.ly/ecm-grants-referee by 8 January 2024. The application form is available at bit.ly/lms-ecm-grants.

You do not need to be an LMS member to apply. However, information on becoming a member is available at lms.ac.uk/membership/how-join.

Applications will be acknowledged by email. Applicants will be informed of the outcome in February 2024 and queries should be addressed to grants@lms.ac.uk.

Read more about 9ECM at ecm2024sevilla.com.

LMS Invited Lectures 2024

Dan Abramovich of Brown University will be the LMS Invited Lecturer 2024. He will give a course of 10 lectures at Imperial College London, 1–5 July 2024, on *Logs and Stacks in Birational Geometry and Moduli*, supported by classes, discussion periods and 5 lectures by Hülya Argüz (Georgia), Pierrick Bousseau (Georgia), Francesca Carocci (Lausanne), Navid Nabijou (Queen Mary University of London) and Dhruv Ranganathan (Cambridge). Lectures will be delivered in person as well as being recorded and broadcast online live. For more details, and to apply and register, see sites.google.com/view/lms-invited-lectures-2024.

Abramovich is one of the world's leading algebraic geometers who has, for the past thirty years, been at the centre of many of the most interesting advances in the subject, such as alterations and resolutions of singularities, stacks, tropical geometry, log geometry, and Gromov–Witten theory. He is renowned as an excellent and approachable speaker.

Logarithmic Geometry is a subject of intense interest in both geometry and number theory. Despite much exciting recent progress, it remains a famously difficult and ferociously technical field. In many ways it is bewilderingly counterintuitive — something which underlies its great power, but which makes teaching the subject uniquely difficult. Developing the right point of view, and the right way to think about it, has taken decades. Now that we have many overlapping conceptual points of view — such as the Artin stack approach pioneered by Abramovich — progress has accelerated enormously.

While the definitions can be given in a few lines, developing an understanding and intuition can take years. There is a dearth of suitable written texts. A week long course built around basics, examples, different points of view and their interrelations will allow a new generation to truly absorb and own the material for themselves.

Holgate Session Leaders: Call for Applications

Deadline: 31 January 2024

The LMS currently has vacancies for Holgate Session Leaders, and invites applications from those interested in taking part in this scheme.

The Holgate Lectures and Workshops Sessions scheme (named in memory of Philip Holgate, who helped to ensure the success of the LMS Popular Lectures) provides session leaders who are willing to give talks or run workshops on mathematical subjects to groups of students or teachers. The sessions are intended to enrich and enhance mathematical education, looking both within and beyond the curriculum.

Holgate sessions are intended for school- and college-level students, from primary and secondary to A-Level or equivalent (including STEP/AEA). They may also cover adult education. Session leaders are also free to offer sessions to other relevant groups, e.g. teachers of mathematics, to enhance their professional mathematical development.

The local organiser of a session may be a school, 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.

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.

More information on the scheme and details of current Holgate session leaders can be found at bit.ly/3QlLayk.

If you are interested in applying, please send a short (maximum 2-page) CV and a letter outlining: a) what you could offer as a Holgate Session Leader, and b) what you believe the Holgate sessions could offer as an educational experience, to Katherine Wright at education@lms.ac.uk.

Although there is no strict person specification, applicants should have a track record in mathematics education, communicating with people and 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. Applicants do not need to be members of the LMS.

Appointments will be for an initial three-year term, renewable by agreement.

Call to Host the LMS Mathematical Symposia 2026–2030

Deadline: 14 December 2023

The LMS invites proposals from UK-based institutions or consortia to host the LMS Mathematical Symposia in 2026–2030. Proposals should be submitted to grants@lms.ac.uk.

The LMS Mathematical Symposia, currently held at the University of Bath, is a well-established and recognised series of international research meetings, which provides an excellent opportunity to explore an area of research in depth, learn of new developments, and instigate links between different branches of mathematics.

The Symposia offer opportunities to increase and celebrate equality, diversity, inclusivity, accessibility and sustainability within the mathematical sciences community. To ensure that all UK institutions have the opportunity to benefit from hosting the LMS Mathematical Symposia, the Society encourages applications from universities or consortia of universities that have not traditionally hosted the events.

For further details, please visit the Society's website at: bit.ly/math-symp-2026.

LMS–Bath Mathematical Symposia 2025: Call for Proposals

Deadline: 15 December 2023

Proposals are invited for the LMS–Bath Mathematical Symposia, which will be held at the University of Bath in 2025. Funding is available for two symposia at approximately £40,000 per event.

The format is designed to allow substantial time for interaction and research. The meetings are by invitation only and will be held in July/August, with up to 50 participants, roughly half of whom will come from the UK. A novel element of the symposia is that they will be complemented by a summer school to prepare young researchers such as PhD students, or a "research incubator", where problem(s) related to the topic of the conference is studied in groups. These entire events,

summer school/incubator and workshop, will typically last around two weeks.

Prospective organisers should send a formal proposal to the Grants Team (grants@lms.ac.uk) by 15 December 2023. Proposals are approved by the Society's Research Grants Committee after consideration of referees' reports.

Proposals should include:

- A full list of proposed participants, divided into specific categories:

  – Category A — Scientific Organisers
  – Category B — Key Overseas Participants
  – Category C — Key UK-based Participants
  – Category D — Important Overseas Participants
  – Category E — Important UK-based Participants

- Proposers are encouraged to actively seek to include women speakers and speakers from ethnic minorities or explain why this is not possible or appropriate.

- A detailed scientific case for the symposium, which shows the topic is active and gives reasons why UK mathematics would benefit from a symposium on the proposed dates.

- Details of additional support from other funding bodies, or proposed avenues of available funding.

- Indicative plans for the summer school or research incubator.

- Where appropriate, prospective organisers should consider the possibility of an 'industry day'.

For further details, see the Society's website: lms.ac.uk/events/mathematical-symposia or the LMS–Bath symposia's website: bathsymposium.ac.uk.

Before submitting, organisers are welcome to discuss informally their ideas with the Chair of the Research Grants Committee, Professor Andrew Dancer (grants@lms.ac.uk).

Undergraduate Summer School 2025: Call for Expressions of Interest

Deadline: 22 February 2024

The call for expressions of interest to host the LMS Undergraduate Summer School in 2025 is now open.

A grant of up £24,000 plus income from registration fees (£250 per registered student attending in-person and £25 per registered student attending remotely) is available to support the costs of the LMS Undergraduate Summer School that can accommodate at least 50 undergraduate students attending in-person and up to 200 undergraduates attending remotely.

The LMS has held an annual Undergraduate Summer School, aimed at introducing enthusiastic undergraduate students to modern mathematical research, since 2015. The Undergraduate Summer Schools take place for a two-week period in July and have proved very popular.

For more information and to submit an expression of interest, please visit lms.ac.uk/events/lms-summer-schools.

Fellowships Call for Applications

The LMS invites applications for the following fellowships:

LMS Early Career Fellowships 2023-24 with support from the Heilbronn Institute for Mathematical Research (HIMR) and UKRI

The LMS Early Career Fellowship provides financial support for talented UK mathematicians who have recently completed their PhD and have not yet secured their next postdoctoral position. During this transition period the Society, together with its sponsors HIMR and UKRI, offers a stipend of £1,552 per month to support a research visit or research collaboration between three to six months, along with additional £800 for travel or relocation allowance.

The closing date to apply for the LMS Early Career Fellowship is 14 January 2024. For further information about the Fellowships and information on how to apply, see lms.ac.uk/grants/lms-early-career-fellowships.

Atiyah UK–Lebanon Fellowships 2023-24 in partnership with the Centre for Advanced Mathematical Sciences (CAMS) at the American University of Beirut

The Atiyah UK-Lebanon Fellowship will support an academic visit in 2024-25 from the UK to Lebanon for a period of between one week and 6 months, or a visit for study or research to the UK from Lebanon for a period of up to 12 months. The maximum funding of £8,600 will cover travel and related costs up to £2,000 and subsistence expenses up to maximum of £2,200 per month from an allocated maximum of £6,600.

The closing date to apply for the Atiyah UK–Lebanon Fellowships is 31 January 2024. For further information about the Fellowships and information on how to apply, please visit lms.ac.uk/grants/atiyah-uk-lebanon-fellowships.

LMS Research Grant Schemes: January and February Deadlines

The next closing date for research grant applications (Schemes 1,2,3,4,5,6 and AMMSI) is 22 January 2024. Applications are invited for the following grants to be considered by the Research Grants Committee at its February 2024 meeting. Applicants for LMS Grants should be mathematicians based in the UK, the Isle of Man or the Channel Islands. For grants to support conferences/workshops, the event must be held in the UK, the Isle of Man or the Channel Islands:

See details of these schemes, including how to apply, at lms.ac.uk/grants/research-grants.

Conferences (Scheme 1)

Grants of up to £5,500 are available to provide partial support for conferences. This includes travel, accommodation and subsistence expenses for principal speakers, UK-based research students, participants from Scheme 5 countries and caring costs for attendees who have dependents.

Visits to the UK (Scheme 2)

Grants of up to £1,500 are available to provide partial support for a visitor who will give lectures in at least three separate institutions. Awards are made to the host towards the travel, accommodation and subsistence costs of the visitor. Potential applicants should note that it is expected the host institutions will contribute to the costs of the visitor. In addition, the Society allows a further amount (of up to £200) to cover caring costs for those who have dependents.

Research in Pairs (Scheme 4)

For those mathematicians inviting a collaborator, 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. For those mathematicians collaborating with another UK-based mathematician, grants of up to £600 are available to support a visit for collaborative research either by the grant holder to another institution or by a named mathematician to the home base of the grant holder. In addition, the Society allows a further amount (of up to £200) to cover caring costs for those who have dependents.

Research Reboot (Scheme 4)

Grants of up to £500 for accommodation, subsistence and travel plus an additional £500 for caring costs are available to assist UK mathematicians who may have found themselves with very little time for research due to illness, caring responsibilities, increased teaching or administrative loads, or other factors. This scheme offers funding so that they can leave their usual environment to focus entirely on research for a period from two days to a week. For applications submitted by the next deadline (22 January 2024), the Reboot Retreats should take place between 15 March and 30 June 2024.

Collaborations with Developing Countries (Scheme 5)

For those mathematicians inviting a collaborator to the UK, grants of up to £3,000 are available to support a visit for collaborative research, by a named mathematician from a country in which mathematics could be considered to be in a disadvantaged position, to the home base of the grant holder. For those mathematicians going to their collaborator's institution, grants of up to £2,000 are available to support a visit for collaborative research by the grant holder to a country in which mathematics could be considered to be in a disadvantaged position. Applicants will be expected to explain in their application why the proposed country fits the circumstances considered eligible for Scheme 5 funding. In addition, the Society allows a further amount (of up to £200) to cover caring costs for those who have dependents. Contact the Grants team if you are unsure whether the proposed country is eligible or check the IMU's Commission for Developing Countries definition of developing countries (tinyurl.com/y9dw364o).

Research Workshop Grants (Scheme 6)

Grants of up to £10,000 are available to provide support for Research Workshops. Research Workshops should be an opportunity for a small group of active researchers to work together for a concentrated period on a specialised topic. Applications for Research Workshop Grants can be made at any time but should normally be submitted at least six months before the proposed workshop.

African Mathematics Millennium Science Initiative (AMMSI)

Grants of up to £2,000 are available to support the attendance of postgraduate students at conferences in

Africa organised or supported by AMMSI. Please contact grants@lms.ac.uk for more information.

The next closing date for early career research grant applications (Schemes 8,9 and ECR Travel Grants) is 15 October 2023. Applications are invited for the following grants to be considered by the Early Career Research Committee at its November 2023 meeting:

Postgraduate Research Conferences (Scheme 8)

Grants of up to £2,500 are available to provide partial support for conferences, which are organised by and are for postgraduate research students. The grant award will be used to cover the costs of participants. In addition, the Society allows the use of the grant to cover to cover caring costs for those who have dependents.

Celebrating New Appointments (Scheme 9)

Grants of up to £400-£500 are available to provide partial support for meetings to celebrate the new appointment of a lecturer at a university. Potential applicants should note that it is expected that the grant holder will be one of the speakers at the conference. In addition, the Society allows the use of the grant to cover to cover caring costs for those who have dependents.

ECR Travel Grants

Grants of up £500 are available to provide partial travel and/or accommodation support for UK-based Early Career Researchers to attend conferences or undertake research visits either in the UK or overseas.

LMS Undergraduate Research Bursaries in Mathematics 2024

Application deadline: 1 February 2024

The Undergraduate Research Bursary scheme provides an opportunity for students in their intermediate years to explore the potential of becoming a researcher. The award provides support to a student undertaking a 6-8 week research project over Summer 2024, under the direction of a project supervisor.

Students must be registered at a UK institution for the majority of their undergraduate degree and may only take up the award during the summer vacation between the intermediate years of their course. Students in the final year of their degree intending to undertake a taught Masters degree immediately following their undergraduate degree may also apply.

Applications must be made by the project supervisor on behalf of the student.

For further information please contact Lucy Covington (urb@lms.ac.uk).

LMS Research Schools and Research Schools in Knowledge Exchange 2025

Grants of up to £15,000 are available for LMS Research Schools, one of which will be focused on Knowledge Exchange. The LMS Research Schools provide training for research students in contemporary areas of mathematics. The Knowledge Exchange Research Schools will primarily focus on Knowledge Exchange and can be in any are of mathematics.

The LMS Research Schools take place in the UK and support participation of research students from both the UK and abroad. The lecturers are expected to be international leaders in their field. The LMS Research Schools are often partially funded by the Heilbronn Institute for Mathematical Research (Heilbronn.ac.uk) and UK Research and Innovation (ukri.org). Information about the submission of proposals can be found at tinyurl.com/ychr4lwm along with a list of previously supported Research Schools. Applicants are strongly encouraged to discuss their ideas for Research Schools with the Chair of the Early Career Research Committee. Professor Chris Parker (research.schools@lms.ac.uk) before submitting proposals. Proposals should be submitted to Lucy Covington (research.schools@lms.ac.uk) by 22 February 2024.

Clay Mathematics Institute Enhancement and Partnership Program

To extend the international reach of the Research School, prospective organisers may also wish to consider applying to the Clay Mathematics Institute (CMI) for additional funding under the CMI's Enhancement and Partnership Program. Further information about this program can be found at tinyurl.com/y72byonb. Prospective organisers are advised to discuss applications to this program as early as possible by contacting the CMI President, Martin Bridson (president@claymath.org). There is no need to wait for a decision from the LMS on your Research School application before contacting the CMI about funding through this program.

LMS Council Diary —
A Personal View

Council met online on Friday, 20 October 2023. The meeting started with the President, Ulrike Tillman, welcoming Simon Buckmaster as new Head of Publications. She then reported on her activities since the Council meeting on 30 June 2023, which included the LMS Northern Regional meeting in York on 4 September 2023 and the LMS-IMA joint meeting on the mathematical foundations of artificial intelligence at De Morgan House on 13 October 2023. This was a hybrid meeting that was well received.

Council members heard that a new donor had provided funds for communications and outreach activities, for which the LMS is very grateful. Some discussion ensued about the LMS commitment towards the core funding of the newly launched International Centre for Mathematics in Ukraine (ICMU). It was decided to ring fence £100k of the LMS reserve over a period of ten years to establish a Distinguished Visiting Fellowship that would support long term visitors of the ICMU, whose mission is to support top-level research in mathematics, with special emphasis on training younger generations of scientists and the development of mathematics in Ukraine. These funds would be matched by the founding donor and the principal donor of ICMU in 2023, XTX Markets. The President continues to engage with other potential partner institutions in order to identify how best to support other international mathematics communities in need.

Council received a strategic framework update from the Executive Secretary following a very constructive discussion at the strategic retreat. In particular, the framework lists three new LMS strategic goals, built on the Society's charitable objectives, and how they will be attained in the period 2023-2028. The document will appear on the LMS webpages.

A good part of the meeting was dedicated to the proposed Academy of Mathematical Sciences. Vice-President Iain Gordon presented an update on work undertaken by the LMS working group and on recent discussions with the proto-Academy. An animated and constructive conversation ensued on the wording of the proposed statement of support to the proto-Academy on the continued creation of a full Academy. The President thanked Council members for their contribution to the discussion. It was agreed to support the President in her signing the letter of support on behalf of the LMS.

The meeting proceeded with the usual items of Governance, Legislation and Policy. Nothing salient to report, except that the external auditors have given the LMS accounts for 2022-23 a clean bill of health.

The meeting closed well into the afternoon, after the President had thanked Council members again for their engagement in the important discussions of the day and more generally, for the work done across the board since June.

Anne Taormina
Member-at-Large

Maximising your Membership: Free Online Journal Access

Since the LMS was founded in 1865, it has published high-quality peer-reviewed papers in a growing collection of esteemed journals. Beginning with the *Proceedings of the London Mathematical Society* in 1865, the portfolio of journals published by the Society now comprises nine well-regarded titles.

LMS Members can benefit from free online access to the following journals from the Society's collection:

- *Bulletin of the London Mathematical Society:* Publishing leading research in a broad range of mathematical subject areas since 1969, the Bulletin features high-quality and well-written research articles with a maximum length of 20 pages, authoritative survey articles (of any length) and obituaries of distinguished mathematicians.

- *Journal of the London Mathematical Society:* Since 1926, the Journal has welcomed papers on subjects of general interest that represent a significant advance in mathematical knowledge, as well as submissions that are deemed to stimulate new interest and research activity. The Journal welcomes longer papers, of 18 pages or longer.

- *Proceedings of the London Mathematical Society:* The flagship journal of the LMS, the Proceedings publishes articles of the highest quality and significance across a broad range of mathematics, with no page length restrictions for submitted papers.

- *Mathematika:* Published by the LMS on behalf of its owner, UCL, Mathematika features both pure and applied mathematical articles, and has done so continuously since its founding by Harold Davenport in the 1950s. Its traditional emphasis has been towards a purer side of mathematics, but applied mathematics and articles addressing both aspects are equally welcome.

- *Nonlinearity:* Owned and published jointly with the Institute of Physics, Nonlinearity is aimed at mathematicians and physicists interested in research on nonlinear phenomena, with its coverage ranging from proofs of important theorems to papers presenting ideas, conjectures and numerical or physical experiments of significant physical and mathematical interest.

Members can sign up to free online access to any or all of these titles:

- By logging into their LMS user record here: www.lms.ac.uk/user and going to the "My LMS Membership" tab, or

- By returning a completed subscription form for the current year (which is available to download from the LMS website here: lms.ac.uk/membership/paying-your-subscription) either by email (to membership@lms.ac.uk) or by post (to: LMS Membership, De Morgan House, Russell Square, London, WC1B 4HS, UK).

In addition, the Society's fully open access journal, Transactions of the London Mathematical Society, is available to both members and non-members. It welcomes papers of general or specialised nature that represent a significant advance in mathematical knowledge, and the papers can be read online here: londmathsoc.onlinelibrary.wiley.com/journal/20524986.

Please visit our website lms.ac.uk/publications for more information about our publications or contact us at membership@lms.ac.uk if you have any other queries.

Elizabeth Fisher
Membership & Grants Manager

Maximising your Membership: Books Discount

The LMS has published world-class mathematical texts since its founding in 1865. There are 12 peer-reviewed journals, two book series and some individual book titles are produced in the collaboration with different partners. All publications have high quality well-written articles that appeal to a broader audience. The Society's members can receive a 25% discount on books in the following two series, when they are purchased direct from the LMS publishing partners:

- LMS Lecture Notes Series was founded in 1968 and has become an established and valuable source of information for mathematicians and research professionals. Most of the volumes are short monographs written in informal way that present overview of a current knowledge and interests, give a convenient path to understand recent developments in the wide range of mathematical topics. The series also covers conference proceedings and similar collective works that meet its general objectives.

- LMS Student Texts Series was introduced in 1983 to complement the LMS Lecture Notes and is designed for undergraduates or beginning graduate students. The textbooks cover whole range of pure mathematics, as well as topics in applied mathematics and mathematical physics that involve a substantial use of modern mathematical methods. The series allows non-specialists and students with some background and knowledge in specific topics to get to grips with the subject. Materials of a current interest of non-standard nature are also covered in this series.

All publications from these book series are available to individual members at a discounted price when ordered directly from the Cambridge University Press website. Please visit bit.ly/LMSmember for more information.

Independently, if your institution has purchased electronic editions of titles in the series, you can get free online access to it. This will be indicated by the word 'Access' (in green) and a tick mark next to these titles on the Cambridge Core platform.

The discount codes and other exciting news about Society's activities and events are sent to all members in our monthly eUpdates. Please visit our website lms.ac.uk/publications for more information about our publications or contact us on membership@lms.ac.uk if you have any other queries.

Elizabeth Fisher
Membership & Grants Manager

Longstanding LMS Members

The LMS greatly values the contributions made by all its members and would particularly like to acknowledge the following members who will be celebrating membership milestones of more than 50 years in 2024.

Elizabeth Fisher
Membership & Grants Manager

Over 75 years of membership: Bernard Fishel, Eric L. Huppert and Godfrey L. Isaacs.

Over 70 years of membership: John R. Ringrose.

70 years of membership: Daniel E. Cohen and Ioan M. James FRS.

Over 65 years of membership: Bryan Birch FRS, John F. Bowers, Ronald Brown FLSW, Aldric L. Brown, Gearoid De Barra, David E. Edmunds, David A. Edwards, Hanafi K. Farahat, Donald Keedwell, Michael F. Newman, Roger Penrose, Roy L. Perry, Francis Rayner and Dennis C. Russell.

65 years of membership: Roland F. Hoskins, Glenys Ingram, Joseph F. Manogue and Alan West.

Over 60 years of membership: J. Clifford Ault, Benjamin Baumslag, Alan F. Beardon. Thomas S. Blyth, John H.E. Cohn, Hallard T. Croft, Charles W. Curtis, Ian M.S. Dey, Vlastimil Dlab, J. Keith Dugdale, L.C. Eggan, David Epstein, James O.C. Ezeilo, David J.H. Garling, Robin E. Harte, Philip Heywood, John F.C. Kingman FRS, J. David Knowles, Alun Morris, Albert A Mullin, John E. Peters, Frederick C. Piper, John S. Pym, Frank Rhodes, Joseph B. Roberts, Eira J. Scourfield, Dona Strauss, Anthony C. Thompson, Ronald F. Turner-Smith, C. Terence C. Wall FRS, John F. Watters, Alfred Weinmann, David J. White, Joyce E. Whittington and Sheila O. Williams

60 years of membership: William Brown, John Erdos, Edward A. Evans, David G. Larman, Hugh Morton, George A. Reid, James Edward Roseblade, Brian F. Steer and Graham F. Vincent-Smith. Over 55 years of membership: Irene A. Ault, Anthony D. Barnard, John C.R. Batty, M.C. Bramwell, Roger M. Bryant, Allan G.R. Calder, Sheila Carter, Munibur R. Chowdhury, Michael J. Collins, P. Laurie Davies, M.A.H. Dempster. M.M. Dodson, Martin J. Dunwoody, Roger H. Dye, Barry G. Eke, K. David Elworthy, W. Desmond Evans, Roger A. Fenn, Colin R. Fletcher, James W.M. Ford, Peter Giblin, Charles Goldie, Keith E. Hirst, Wilfrid A. Hodges FBA, Terence H. Jackson, Graham J.O. Jameson Michael E. Keating, Otto H. Kegel, Thomas J. Laffey, E. Christopher Lance, Earl E. Lazerson, W.B. Raymond Lickorish, Bernard L. Luffman, Bob Margolis, Malcolm T. McGregor, Peter McMullen, Ian M. Michael, William Moran, Kung-Fu Ng, David R. Page, Oliver Pretzel, John F. Rennison, Derek J.S. Robinson, Colin P. Rourke, Keith Rowlands, Stephan M. Rudolfer, Philip Samuels, Rodney Sharp, David Singerman, Nelson M. Stephens, Bill Stephenson, W. Brian Stewart, Anthony E. Stratton, David Tall, Brian Thorpe, Grant Walker, Martin Antony Walker, Bertram Wehrfritz, Christopher M. Williams, Geoffrey V. Wood and Douglas R. Woodall.

55 years of membership: R.B.J.T. Allenby, Mark A. Armstrong, Nicholas H. Bingham, Richard Delanghe, Peter Dixon, John Duncan, John B. Fountain, Jonathan Hodgson, David L. Johnson, Peter J. Nicholls, Fredos Papangelou, Jon V. Pepper, Hilary A. Priestley, Peter Rowlinson, John Silvester, Gabrielle A. Stoy, R.F. Streater, Jeffrey R.L. Webb

FRSE, Dominic J.A. Welsh, Christopher Wensley and Abraham Zaks.

Over 50 years of membership: David H. Armitage, Roger C. Baker, Earl R. Berkson, Thomas G.K. Berry, W. Meurig Beynon, Béla Bollobás, John Bolton, David A. Brannan, F. Trevor Brawn, Douglas S. Bridges, Geoffrey Burton, Colin Campbell, Roger J. Cook, Alan Cornish, E. Brian Davies, John D. Dixon, Christopher Terence Dodson, Brian Fisher, Leslie R. Fletcher, T. Alastair Gillespie, Paul R. Goodey, John A. Haight, F. Mary Hart, Richard Haydon, Allan Hayes, Michiel Hazewinkel, Anthony J.W. Hilton, William Holcombe, Chris Houghton, Tiao-Tiao Hsu, John Hubbuck, Donal Hurley, Ignacio Iribarren, John E. Jayne, Cherry Kearton, Monsur A. Kenku, Arthur Knoebel, P. Ekkehard Kopp, Aldo J. Lazar, Charles Leedham-Green, Hendrik W.E. Leemans, T.H. Lenagan, John C. Lennox, Frederick Long, John H. Loxton, Zafer Mahmud, Vassilis Mavron, John C. McConnell, Thomas McDonough, Harold V. McIntosh, John R. Merriman, Paul R. Meyer, Paul Milnes, Peter E. Newstead, Adam J. Ostaszewski, Roger J. Plymen, Timothy Porter FLSW, John R. Quine, Andrew Rae, Nigel Ray, Helen D. Robinson, J. Christopher Robson, David M. Rodney, Harvey Rose, David L. Salinger, Jean F.H. Schmets, Klaus Schmidt, Robert Scruton, Dan Segal, Jean-Pierre Serre, John R. Shackell, Allan M. Sinclair, Patrick F. Smith, Fenny Smith, Robert C. Solomon, Linda R. Sons, Elizabeth Taylor, Donald Taylor, R. Kenneth Thomas, R.C. Vaughan FRS, Michael R. Vaughan-Lee, Richard Walton, David B. Webber, Carol A. Whitehead, Anthony Wickstead, Graham D. Williams, Stephen Wilson, Robin Wilson, Christopher F. Woodcock and Christopher K. Wright.

50 years of membership: Peter H. Baxendale, William D. Blair, John D. Bovey, Walter D. Burgess, James S. Byrnes, Ian M. Chiswell, Cho-Ho Chu, Christopher G. Gibson, Geoffrey R. Goodson, Mary W. Gray, Michael Hallett, A.J.C. Lewis Hogarth, George Lusztig, David Masser, Joseph H. Mayne, T. Brian M. McMaster, Adil G. Naoum, J.B. Nation, John W. Neuberger, Brian D. Ripley, Igor R. Safarevic, Graeme Segal FRS, John B. Slater, Stephen D. Smith, Olaf P. Stackelberg, David S.G. Stirling, David Trotman, John Wilson, Michael F. Worboys and E. Watcyn Wynn.

2024 HEILBRONN FOCUSED RESEARCH GRANTS - Call for proposals

The Heilbronn Institute for Mathematical Research is offering a number of grants of up to £8K to fund focused research groups to work on adventurous and challenging mathematical problems, or to discuss important new developments in mathematics. Grants under this scheme will be funded either through the UKRI/EPSRC 'Additional Funding Programme for Mathematical Sciences' (part of the £300M government investment announced in 2020) or by the Heilbronn Institute directly.

Open to all mathematicians and to any department in the UK, these grants will support travel and local expenses for groups to come together to focus intensively on a problem or to discuss a significant new development in mathematics. We expect these groups to be normally 8 or fewer people. Groups are encouraged to include international participants but should also involve a substantial UK-based component.

Proposals from these areas of research, interpreted broadly, will be given priority: Pure Mathematics, Probability and Statistics, and Quantum Information.

One A4 page proposals should be sent by **9am, Thursday, 1st February 2024** to: heilbronn-administrator@bristol.ac.uk For further particulars and additional information, please visit our website: https://heilbronn.ac.uk/frg/

Annual LMS Membership 2023–24: Reminder

Members are reminded that their annual membership fees for the period November 2023 to October 2024 became due on 1 November 2023.

In September, the Society sent a reminder to all members to renew their subscription for 2023-24. If you have not received a reminder, please email membership@lms.ac.uk.

Members can now view and pay their membership fees online via the Society's website: lms.ac.uk/user. Further information about the fee rates for 2023-24 and a subscription form may also be found on the Society's website: lms.ac.uk/membership/paying-your-subscription.

The Society encourages payment by direct debit. If you do not already pay by this method and would like to set up a direct debit (this requires a UK bank account), please set up a direct debit to the Society with GoCardless.com via your online membership record: lms.ac.uk/user.

The Society also accepts payment by credit or debit card and by cheque. Please note card payments are now accepted online only and can be made via your online membership record: lms.ac.uk/user.

Benefits of LMS membership include free online access to selected Society journals, a complimentary Newsletter, discounts on selected Society publications and much more: lms.ac.uk/membership/member-benefits.

Elizabeth Fisher
Membership & Grants Manager

REPORTS OF THE LMS

Report: LMS Society Meeting: Mary Cartwright Lecture 2023

The Mary Cartwright Lecture 2023 was held on Thursday 19 October 2023 at the International Centre for Mathematical Sciences (ICMS) at The Bayes Centre in Edinburgh. It is an annual lecture organised by the Committee for Women and Diversity in Mathematics and forms part of the annual programme of LMS Meetings. The event was established in 2000 and is named after Dame Mary Lucy Cartwright, the first female mathematician FRS, the first woman to receive the Sylvester Medal, the first woman to receive the LMS De Morgan Prize and the first female President of the LMS. The aim is to celebrate the achievements of distinguished women mathematicians; previous speakers include previous and present LMS Presidents Dame Frances Kirwan, Caroline Series and Ulrike Tillmann.

This year's Mary Cartwright lecture, *Ivanov's Metaconjecture: Encoding Symmetries of Surfaces,* was given by Professor Tara Brendle (University of Glasgow) with an accompanying lecture given by Professor Dan Margalit (Vanderbilt University) entitled *Reconstruction Problems in Mathematics: from Euclid to Ivanov.* The afternoon began with Professor Sara Lombardo (Heriot-Watt University and Chair of the LMS Women and Diversity in Mathematics Committee) providing an introduction to the meeting, presenting some background on Mary Cartwright and

leading the handling of Society Business, including an invitation for new members to sign the LMS Members' Book.

Margalit's lecture introduced what reconstruction problems are, drawing on the familiar examples of the side angle side rule and Chinese remainder theorem. The idea is that of recovering or reconstructing an unknown mathematical object or structure from partial or incomplete information. Another example given was determining the order of the Farey sequence from a Farey graph, discussed in detail in 'Office Hours with a Geometric Group Theorist', edited by Matt Clay and Dan Margalit (2017). Then followed a discussion on Darboux's Theorem as stated in Jason Jeffers' 'Lost Theorems of Geometry' (2021), which asserts "Suppose that $f : E^2 \to E^2$ is a bijection that preserves Euclidean geodesics. Then f is an affine transformation." This was to highlight the notion of starting with a bijection and wanting to recover an isometry, and it preceded a presentation on how the proof that the group of automorphisms of the fine curve graph for a surface is isomorphic to the group of homeomorphisms of the surface uses the Farb-Margalit theorem. The proof is based on the idea that a sequence of automorphisms of the extended fine curve graph preserve convergent sequences. The Farb-Margalit theorem is analogous to the seminal result of Ivanov that the group of automorphisms of the (classical) curve graph is isomorphic to the extended mapping class group of the corresponding surface. Margalit's talk raised the question of whether there is a pattern to these Ivanov-like theorems?

In her talk Brendle first introduced mapping class groups (MCGs) as capturing the symmetries of surfaces up to isotopy, as well as an introduction to Ivanov's Metaconjecture. Although this is not explicitly formulated, the metaconjecture proposes a unified framework to understand concepts related to MCGs, which asserts that any 'sufficiently rich' object associated to a surface has automorphism group isomorphic to the extended MCG, for a broad class of such objects. Brendle explained how it is possible to prove that if a normal subgroup of the extended MCG of a closed surface has an element of sufficiently small support, then its automorphism group and abstract commensurator group are both isomorphic to the extended MCG. Then followed a discussion of how the curve complex (introduced by W.J. Harvey in 1978) encodes the MCG, and that every MCG falls into at least one of three types as defined by Nielsen–Thurston classification based on its action on curves. These are periodic

(elliptic), reducible (parabolic), and pseudo-Anosov (hyperbolic). A definition of the genus of a mapping class was also presented; the smallest k such that a surface S contains a subsurface of genus k with one boundary component that contains any Nielsen–Thurston component. Additionally, Brendle put forward an idea of using commutator tricks to prove natural maps are all isomorphisms algebraically. Finally, some of the applications for this type of geometric group theory result were described, for example, in recovering known results for MCGs, the Torelli group, the Johnson kernel, the Johnson filtration, and finite-index subgroups of all of these. Additionally, applications were given in new rigidity results for infinitely many additional normal subgroups of the Torelli group, the Magnus filtration and the normal closure of powers of a Dehn twist.

Kaitlyn Louth
University of Edinburgh & Heriot-Watt University

Report: LMS Northern Regional Meeting

Anne Schilling

It was our pleasure to attend our first LMS meeting, the Northern Regional Meeting at the University of York, on 4

September 2023. President Ulrike Tillmann FRS opened the meeting and then introduced the two speakers, Anne Schilling (University of California, Davis) and Lewis Topley (University of Bath).

Anne Schilling spoke about *The Mystery of Plethysm*. She gave a gentle introduction to the problem of plethysm and provided context within algebraic combinatorics and representation theory as a whole. Her main result described a useful technique to give an algorithm for computing monomial and Schur expansions of symmetric functions. Lewis Topley gave a talk entitled *What the W?*, an introduction to finite W-algebras. He motivated these algebras through non-commutative geometry and highlighted several applications in Lie theory, including generalisations of the orbit method and classification of (completely prime) primitive ideals of enveloping algebras. These talks provided an excellent overview of these fields, and opened the more specialist LMS Workshop on Lie Theory, which took place over the next two days (5-6 September).

Alice Dell'Arciprete, Amit Hazi
University of York

Records of Proceedings at LMS Meetings
Black Heroes of Mathematics: Ordinary meeting, 3–4 October 2023

The meeting was held virtually via Zoom, in partnership with African Institute for Mathematical Sciences (AIMS), British Society for the History of Mathematics (BSHM), ICTP-East African Institute for Fundamental Research (ICTP-EAIFR), Institute of Mathematics and its Applications (IMA), International Centre for Mathematical Sciences (ICMS), Isaac Newton Institute (INI) and Mathematical Association (MA). Over 130 members and guests were present for all or part of the meeting.

The meeting began at 13:00 on Tuesday 3 October with Professor Dr Nira Chamberlain OBE, in the Chair. Professor Chamberlain welcomed guests, thanked the organising parties, and then introduced a recorded welcome message from Professor Iain Gordon, University of Edinburgh and Vice-President of the LMS, followed by a recorded welcome message from Paul Glendinning, University of Manchester and President of the IMA. Professor Chamberlain also welcomed the watch party at Swansea University.

The order of talks for the first day was as follows:

Fatumah Atuhaire, Southampton University on Deciphering Buruli Ulcer Dynamics: The Power of Mathematical Modelling.

Dr Luke Davis, University College London on Towards a Statistical Mechanical Understanding of Living Matter.

Dr Nicole Joseph, Peabody College on Making Black Girls Count in Mathematics Education: A Black Feminist Vision of Transformative Teaching.

Dr Megel Barker, TASIS The American School in England on Diverse Voices, Reshaping Classrooms: Black Diaspora Educators in UK Mathematics Education.

Before the panel discussion, recorded welcome messages from Minhyong Kim, Scientific Director of ICMS and Rachel Bearon, resident of AIMS were played. Professor Chamberlain then chaired a panel discussion with panellists Dr Alain Zemkoho, Lara Lalemi, Ayan Farah, Olivia Brechon-Smith, Dr Grace Olugbodi and Dr Justice Moses K. Aheto.

The first day of the meeting ended at 19:30 and Professor Chamberlain thanked all the speakers and panellists.

The second day of the meeting began at 10:00 on Wednesday 4 October 2023 with Professor Nira Chamberlain in the Chair and then introduced recorded welcome messages from Christie Marr, Deputy Director of Isaac Newton Institute and Sarah Hart, President of BSHM. He also welcomed the watch party at Swansea University.

The order of talks for the second day was as follows:

Dr Gilbert Owusu, President of the Operational Research Society on Leveraging AI Technologies for Delivering Better Service Outcomes.

Manuela Souza, Universidade Federal da Bahia on Ain't a Mathematician? Perspectives of a Brazilian Black Woman Mathematician.

Tobi George-Oyederin, Nottingham University on Navigating your Early Career as a Young Black Mathematician: Insights and Impact.

Dr Prince Osei, AIMS Ghana on Nurturing the Talents of African Youth in Mathematics: A Case Study of AIMS and Beyond.

Before the panel discussion, Professor Chamberlain delivered a welcome message as the President of the MA. Professor Chamberlain then chaired a panel discussion during with panellists Dr Ayodeji Akiwowo, Lloyd Demetrius, Dr Flavia H. Santos, Atieno Songa, Geoffrey Mboya, Yohance Osbourne, Teresa Senyah, Tosin Babasola, Marcia Philbin, Ayan Farah, Taiy Estwick and Glory Ohikhena.

The second day of the meeting ended at 15:30 and Professor Chamberlain thanked all of the speakers, panellists and organisers.

Records of Proceedings at LMS Meetings
LMS/IMA Joint Meeting — *The Mathematical Foundations of Artificial Intelligence:* Ordinary meeting, 13 October 2023

The meeting was held at De Morgan House, London, as part of the Joint Meeting with the Institute of Mathematics and its Applications (IMA). Over 118 members and guests were present for all or part of the meeting, either in person or online.

The meeting began at 11:00 with The President, Professor Ulrike Tillmann FRS, in the Chair.

No members were elected to Membership at this Society Meeting.

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

After Society Business was concluded, Professor Paul Glendinning, President of the IMA gave a short presentation on the work of the IMA.

Professor Ginestra Bianconi (Queen Mary University of London), welcomed the Society's members and guests to the event and thanked the Society for its support of the Department.

Professor Bianconi introduced the first lecture given by Professor David Saad (Aston University) on *The Space of Functions Computed by Deep-learning Networks*.

Professor Bianconi introduced the second lecture given by Michael Bronstein (University of Oxford) on *Physics-Inspired Graph Neural Networks*.

After lunch, Professor James Davenport (University of Bath), taking over hosting duties from Professor Bianconi, introduced the third lecture by Lisa Kreusser (University of Bath) on *Differential Equations for Machine Learning*.

Professor Davenport introduced the fourth lecture by Gitta Kutyniok (LMU München), who was appearing via Zoom, on *Reliable AI: Successes, Challenges, and Limitations*.

After the break, Professor Davenport introduced the final lecture by Petar Velickovic (DeepMind and University of Cambridge) on *Capturing Computation with Algorithmic Alignment*.

Professor Davenport thanked the speakers for their excellent lectures and then expressed the thanks of the Society on behalf of the organising committee, including Professor Bianconi and Professor András Juhász (University of Oxford), for a wonderful meeting.

Afterwards, a wine reception was held at De Morgan House. The Society dinner was held at Trattoria Verdi.

Records of Proceedings at LMS Meetings
Society Meeting and Mary Cartwright Lecture: Ordinary meeting,
19 October 2023

The meeting was held at the International Centre for Mathematical Sciences (ICMS), Edinburgh. Over 50 members and guests were present both in person and online for all or part of the meeting.

The meeting began at 14:00 with Chair of the Committee for Women and Diversity in Mathematics, Professor Sara Lombardo (Heriot-Watt University) in the Chair standing in for Professor Iain Gordon (University of Edinburgh) and Vice President of the LMS.

No members were elected to Membership at this Society Meeting.

Two members signed the Members' Book and were admitted to the Society.

Professor Lombardo introduced the first lecture given by Professor Dan Margalit (Vanderbilt University) on *Reconstruction Problems in Mathematics: from Euclid to Ivanov*.

After tea, Professor Lombardo introduced the second lecture by Professor Tara Brendle (University of Glasgow) on *Encoding Symmetries of Surfaces*.

Professor Lombardo thanked the speakers for their excellent lectures and then expressed the thanks of the Society to the organisers for a wonderful meeting and workshop.

Afterwards, a wine reception was held at the ICMS.

Records of Proceedings at LMS meetings
LMS Northern Regional Meeting: Ordinary Meeting,
4 September 2023

The meeting was held at King's Manor, University of York. Over 30 members and guests were present for all or part of the meeting.

The meeting began at 13:30 with The President, Professor Ulrike Tillmann FRS, in the Chair.

No members were elected to Membership at this Society Meeting.

Four members signed the Members' Book and were admitted to the Society.

Dr Chris Bowman-Scargill, University of York, introduced the first lecture given by Professor Anne Schilling (University of California, Davis) on *The Mystery of Plethysm*. After tea, Dr Bowman-Scargill introduced the second lecture by Dr Lewis Topley (University of Bath) titled *What the W?*

Dr Bowman-Scargill introduced the third lecture by Dr Beth Romano (Kings College London) on *Graded Lie Algebras and Applications to Number Theory*.

Dr Bowman-Scargill thanked the speakers for their excellent lectures.

Afterwards, a wine reception was held at 22 Yards Wine Bar.

Notable Astronomical Authors in the LMS Philippa Fawcett Collection

EMMA BAXTER AND DEBORAH KENT

The LMS Special Collections at DeMorgan House includes the Philippa Fawcett collection, a library of books written by and about women active in mathematical sciences, mostly during the nineteenth and early 20th centuries. The Fawcett collection is rich in 19th-century astronomical texts written by women, notably Agnes Mary Clark, Margaret Bryan, and Agnes Giberne. The complete catalogue of 200+ works is available on the LMS webpage. Members are welcome to peruse the collection by appointment.

In 1898, the popular magazine *Girl's Own Paper* featured an interview with Agnes Giberne (1845-1939), a popular writer of historical fiction and, more famously, books on astronomy, geology and science. The interview explored the origins of her interest in astronomy. Giberne recalled how her father "was explaining about the distance of the earth from the sun, and stated that the earth was some three millions of miles nearer the sun in our winter than in our summer." Though puzzled, she noted how "he sat not far from the fire, and I, a small child, stood close by, he pointed to a fly on his knee, and said, 'Look, Aggie; if that fly were one inch nearer the fire would it feel any hotter?'" Giberne reported how "[t]hat settled the matter. I never again felt any difficulty to the fact of greater cold combined with greater nearness." This anecdotal tale of how Giberne first became interested in astronomy captures the conversational style of her books.

The LMS Fawcett Collection features first editions of Giberne's most famous works on astronomy, including *Sun, Moon and Stars: Astronomy for Beginners* (1879) and *Among the Stars* (1885), Figure 1.

LMS Philippa Fawcett Collection

LMS member A.E.L Davis donated the Collection as an inspiration to future mathematicians and as a useful resource to scholars of the history of women in mathematical sciences. Dr Davis named the Collection in honour of Philippa Fawcett, the first woman to come top (in 1890) in the Mathematical Tripos at the University of Cambridge. The Collection is also intended as a tribute to her mother, notable suffragist Millicent Fawcett.

Following Giberne's death in 1939, *The Times* obituary observed that the success of her science and astronomy books for beginners demonstrated "her power of reducing the complexities of science to simple terms and of presenting them in a very clear and engaging way." [1]
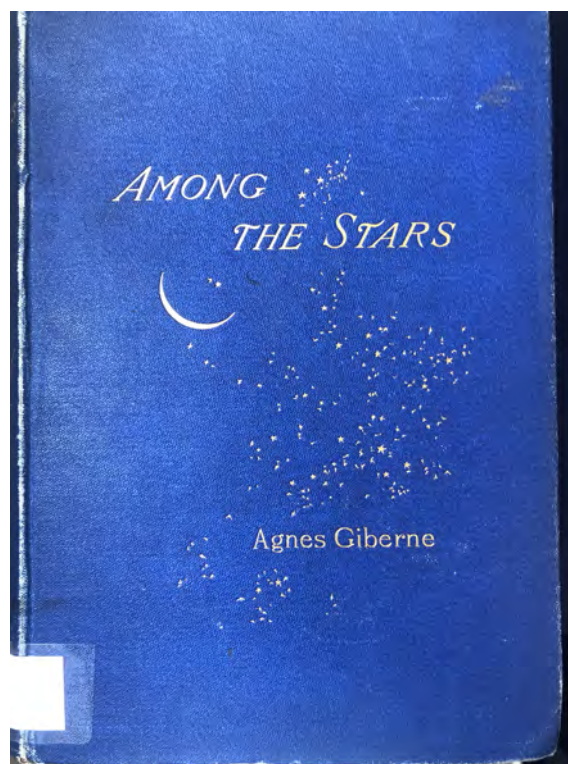

Figure 1: The front cover of the LMS first edition of *Among the Stars*.

While Giberne often aimed her work at a young audience, her writing was equally popular among adults. Giberne's books feature beautiful illustrations, accompanied by narrative text that introduces scientific ideas such as constellations through dialogue, stories, and illustrations. For example, in

Among the Stars (1885), a boy Ikon is introduced to the Great Bear constellation (Ursa Major) by Herr Lehrer, who explains how to find the Pole star (North Star) from the Great Bear. This explanation is beside an illustration of the Great Bear constellation, enhanced by a recoganisable image of a bear as in Figure 2.


THE GREAT BEAR.

Figure 2: An illustration from Agnes Giberne's *Among the Stars* (1885).

Giberne's work often touched upon religious and moral themes in both her science writing and her fictional stories for young adults. The opening page of *Among the Stars* features a short verse from a hymn: "God is love; that anthem olden, Sing the glorious orbs of light, In their language glad and golden, Telling to as, day and night. Their great story, God be Love, and God is Might". The book makes continuous references to biblical passages and quotes, with which Herr Lehrer demonstrates to young Ikon the role of God in the creation of the universe. In *Among the Stars*, Herr Lehrer directs Ikon to the sixth verse of Psalm 33: "By the Word of the LORD were the heavens made; and all the host of them by the Breath of His mouth." Herr Lehrer explains, "The Word of the Lord is Christ and the Breath of God is the Holy Spirit," before he concludes, "God made the host of heaven, Ikon."

Giberne also wrote religious young adult fiction, particularly in her earlier years as an author, including *Sunday Mornings with Mamma* (1865), and *My Father's House, or Thoughts about Heaven* (1881). Giberne also wrote other popular science books for young people, including *The World's Foundations, or Geology for beginners* (1882), *The Ocean of Air, Meteorology for Beginners* (1890), and *The Mighty Deep and what we know of it* (1902).

Maria Cunitz and *Urania Propitia*
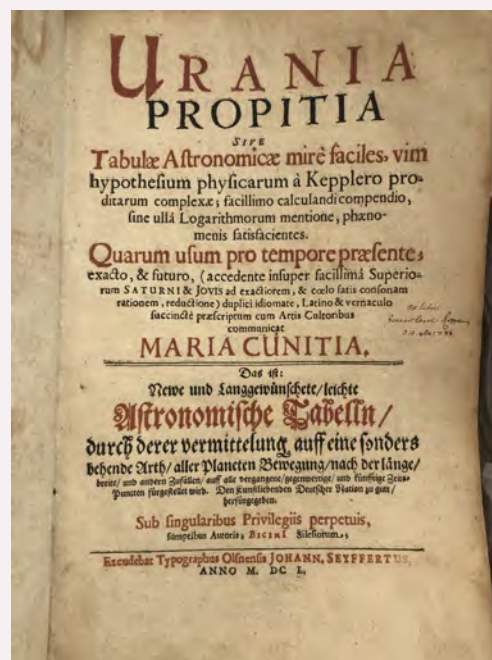
The frontispiece of the spectacular LMS Philippa Fawcett Collection copy of a rare 1650 first edition of *Urania Propitia sive tabulae astronomicae mire faciles, vim hypothesium physicarum á Kepplero proditarum complexae; facillimo calculandi compendio, fine ullá Logarithmorum mentione, phaenomenis satisfacientes.*

Urania Propitia is a remarkable astronomical volume, published in 1650 at personal expense of Maria Cunitz and her husband Elias. The book includes 300 pages of five numerical tables giving planetary positions calculated by Cunitz. She was an early adopter of Johannes Kepler's three laws of planetary motion, particularly the one stating that planets move in elliptical orbits with the Sun as one focus. (Early detractors of this law included Galileo.) In *Urania Propitia*, Cunitz notably eliminated logarithms from the method Kepler had used to produce his 1627 *Rudolphine tables*. She both simplified Kepler's computation and corrected errors in his published tables. This substantive work also includes 250 pages of commentary written in both Latin – the then-standard academic language – and in vernacular German. This both made her work accessible to a wider audience and contributed to the rise of German as a scientific language.

Unfortunately, a career in writing left Agnes Giberne financially struggling in later life. For forty years Giberne helped look after her family, and she was also suffering from heart difficulties and cataracts. Her case made it to 10 Downing Street, where Mr Ramsey of the Treasury wrote that Giberne's work was "not of the highest class" but "eminently sound and wholesome, and has been of service in spreading a knowledge of elementary science among a wide class, not exclusively among children." She received £200 from the Royal Literary Fund and £273 from the Royal Bounty Fund in 1905 (together worth over £70,000 in 2023), and a further £50 from the Royal Literary Fund in 1917 (worth roughly £4,400 in 2023).

A portrait of Agnes Clerke featured in Lady Margaret Huggin's *Agnes Mary Clerke and Ellen Mary Clerke: An Appreciation* (1907)

Agnes Clerke (1842-1907) shared not only a first name with Giberne, but also a love for astronomy and a talent for writing books about this subject, which was so heavily dominated by men. Clerke was born in Skibbereen, Ireland and grew up with a rather unconventional education, through which she developed a deep curiosity for science, and in particular, astronomy.

Several of Clerke's works are held in the Phillippa Fawcett Collection, including a second edition of her most famous work *A Popular History of Astronomy During the 19th Century*, originally published in 1885, and the second edition in 1887.

Margaret Bryan, author of *A compendious system of astronomy*

A well-known image of author Margaret Bryan and two children from the frontispiece of the LMS 1799 second edition copy of Bryan's book *A Compendious System of Astronomy*. The engraving by William Nutter is from a miniature of the same size painted by Samuel Shelley.

The verbose yet informative full title of Bryan's popular book is *A compendious system of astronomy, in a course of familiar lectures, in which the principles of that science are clearly elucidated, so as to be intelligible to those who have not studied the Mathematics: also trigonometrical and celestial problems, with a key to the ephemeris, and a vocabulary of the terms of science used in the lectures, which latter are explained agreeably to ther applications in them.* Editions of the volume appeared in 1797, 1799 and 1805.

Bryan also wrote *Lectures on Natural Philosophy* (1806) and *Astronomical and Geographical Class Book for Schools* (1815), and devised a board game called *Science in Sport, or the Pleasures of Astronomy* (1804).
She spent twenty years as a boarding school headmistress. It is only very recently [1] that research has uncovered more details about the life and work of Margaret Bryan.

In 1907, the *Daily Telegraph* wrote in Clerke's obituary that *A Popular History* "created a considerable sensation, since it was not only a complete compilation of the facts of astronomical observation and research, but was written by the brilliant pen of someone who evidently was able to weigh the merits and discuss the possibilities of those same facts; and that someone was a lady, until then unknown."

Clerke's life and work have been extensively written about, and still are today. Her work differed from that of many other women of the Victorian era, because although she could not do research in astronomy in the traditional sense, as the Daily Telegraph notes, her work synthesised and interpreted information, discussing and hypothesising about potential future developments in the field.

Editions of Clerke's later works are also held in the Philippa Fawcett Collection, including *Problems in Astrophysics* (1903), a second edition of *The System of the Stars* (1905), *Modern Cosmologies*, as well as the 1912 editions of the first and third sections of *The Concise Knowledge Library: Astronomy*, which Clerke co-wrote with Alfred Fowler and John E. Gore in 1898.
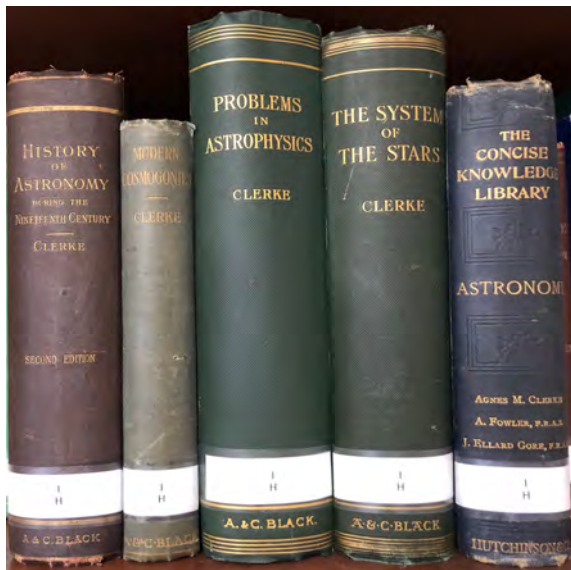
The books authored by Agnes Clerke in the Philippa Fawcett Collection.

Clerke's *Problems in Astrophysics* (1903) illustrates the depth of understanding and knowledge Clerke held, not only in relation to what was known, but also in relation to the next steps astronomy was taking, and where research was currently heading. As she

writes in the Preface, the main motivation behind the text was a "desire for a rectification of the frontier in the interests of science." The book goes on to detail and evaluate past and contemporary research on problems in solar physics,

In 1903 Agnes Clerke was elected to the Royal Astronomical Society, alongside Lady Margaret Huggins, both for their monumental contributions and deep commitment to astronomy and the dissemination of astronomical knowledge.

FURTHER READING

[1] G. S. Girolami, "Margaret Bryan: Newly Discovered Biographical Information about the Author of A Compendious System of Astronomy (1797)", in *Notes and Records of the Royal Society* (2023), https://doi.org/10.1098/rsnr.2022.0052.
[2] M. Brück, *Agnes Mary Clerke and the Rise of Astrophysics*. Cambridge University Press, 2008.
[3] Gillian Daw, 'On the Wings of Imagination: Agnes Giberne and Women as the Storytellers of Victorian Astronomy', in *The Victorian*, 2 (1) (2014). pp. 1-23.

Emma Baxter

Emma is a recent graduate of the University of St Andrews in Mathematics and Russian who will begin an MPhil in Russian Literature at the University of Oxford this autumn.

Deborah Kent

Deborah is a senior lecturer in history of mathematics at the University of St Andrews and the current Librarian of the LMS. Her research focuses on mathematical sciences in the 19th and early 20th centuries, including the global history of eclipse expeditions. She is looking forward to the next opportunity to experience totality on 8 April 2024.

Counting Points on Elliptic Curves

THOMAS OLIVER AND CHRISTIAN WUTHRICH

Using relatively elementary terminology, we will discuss a natural question on the number of rational points on an elliptic curve. This will lead us to questions that are linked to the conjecture of Birch and Swinnerton-Dyer.

Let A and B be two integers such that $\Delta = -16 \cdot (4A^3 + 27B^2)$ is non-zero. Then the equation

$$y^2 = x^3 + Ax + B \qquad (1)$$

is called an elliptic curve. More precisely,

$$E: \qquad Y^2Z = X^3 + AXZ^2 + BZ^3$$

is a smooth projective cubic curve defined over $\mathbb{Q}$ in the projective plane $\mathbb{P}^2$.

Together with its unique point $O = (0 : 1 : 0)$ at infinity, it is an elliptic curve. The arithmetic of elliptic curves has attracted lots of interest, partly due to the famous conjecture by Birch and Swinnerton-Dyer. The aim of this text is to present some conjectures and questions formulated with as little technical terminology as possible. This is comparable to Zagier's article [7], but we develop things in a different direction.
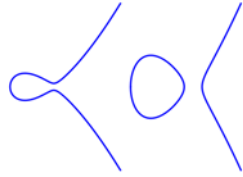
Two elliptic curves

Points of bounded height

The set $E(\mathbb{Q})$ of points on the elliptic curve with rational coordinates $(X : Y : Z)$ consists of the point O and those of the form $(x : y : 1)$ with $(x, y) \in \mathbb{Q}^2$ satisfying the equation (1). Since projective coordinates can be scaled, we can write any $P \in E(\mathbb{Q})$ as $(X : Y : Z)$ with integer X, Y, Z such that no $m > 1$ divides all three. Up to sign this representation is unique. Therefore the quantity

$$H(P) = \max\{|X|, |Y|, |Z|\}$$

is a well-defined integer for each $P \in E(\mathbb{Q})$, called the **height** of P.

Let T be a large integer. We define

$$\mathcal{N}(T) = \#\left\{P \in E(\mathbb{Q}) \,\middle|\, H(P) < T\right\}, \qquad (2)$$

which is a finite number.

Points modulo integers

Let $Q > 1$ be any integer. We will denote by $\mathcal{M}(Q)$ the number of solutions $(X : Y : Z)$ to

$$Y^2Z \equiv X^3 + AXZ^2 + BZ^3 \pmod{Q}. \qquad (3)$$

We count points in the projective plane over $\mathbb{Z}/Q\mathbb{Z}$, which means the triples (X, Y, Z) where there is no divisor $m > 1$ of Q dividing all three and scalar multiplication by an integer coprime to Q does not alter the point. We could instead count the number of solutions $(x, y) \in \mathbb{Z}/Q\mathbb{Z}$ to the equation

$$y^2 \equiv x^3 + Ax + B \pmod{Q} \qquad (4)$$

but we would miss not only one point, but $Q/\prod_{p|Q} p$ points. By the Chinese remainder theorem, $\mathcal{M}$ is a multiplicative function: if Q and Q' are coprime then $\mathcal{M}(Q \cdot Q') = \mathcal{M}(Q) \cdot \mathcal{M}(Q')$.

An initial conjecture

Conjecture 1. For each $T > 1$ set $Q = T!$. The sequence

$$\frac{Q \cdot \mathcal{N}(T)^2}{\mathcal{M}(Q)} \qquad (5)$$

converges to a positive real number as $T \to \infty$.

This seemingly harmless conjecture is actually a very strong statement and, to be honest, maybe even too much to hope for. We can already note that it would not be true if $\Delta = 0$.

Lemma 1. *Let $T > 1$. The fraction*

$$\frac{Q}{\mathcal{M}(Q)}$$

is independent of Q as long as $\Delta^2 \mid Q$ and the prime divisors of Q are exactly all primes below T.

Idea of the proof. Let p be a prime smaller than T. Because $\mathcal{M}$ is multiplicative, it is enough to show that $\mathcal{M}(p^k)/p^k$ is independent of k as long as k is large enough for all $p \mid \Delta$. First if $p \nmid \Delta$, then using the multi-dimensional version of Hensel's lemma, one can show that $\mathcal{M}(p^k) = \mathcal{M}(p) \cdot p^{k-1}$ for all $k \geqslant 1$. For $p \mid \Delta$, one can show that $\mathcal{M}(p^k) = c \cdot p^{k-1}$ for some integer c when k is large enough.

Certainly the convergence of sequence (5) is very slow for some curves E, but it does not look implausible either. Some examples for a few curves are illustrated in Figure 1. The jump in the graph for the curve $y^2 = x^3 + x + 1$ is not an error. This is due to two points $(x,y) = \left(\frac{43992}{82369}, \pm\frac{30699397}{23639903}\right)$ of height 30699397, which increases $\mathcal{N}(T)$ from 9 to 11 at this T.
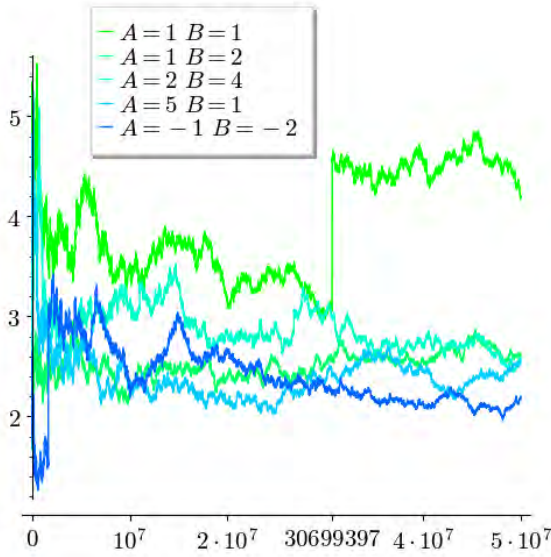

Figure 1: The sequence (5) for a few curves

We learn from this that the function $\mathcal{N}(T)$ grows slowly and its jumps cause the convergence in Conjecture 1 to be too slow.

Counting points of bounded height

In Figure 2, there are the plots of the function $\mathcal{N}(T)$ for some curves. We observe that $\mathcal{N}(T)$ grows like $C \cdot \log^{r/2}(T)$ for some C and some integer r. We will describe a concrete incarnation of this integer r.

At the heart of the reason why elliptic curves stand out among algebraic curves (and why they are so useful in applications like cryptography) is the fact that the set of points $E(\mathbb{Q})$ forms an abelian group with identity element O. The group law is constructed geometrically using what is called the chord and tangent principle. About 100 years ago, Louis J. Mordell proved that for any elliptic curve defined over the rational numbers, a finite set of points suffices to obtain all points in $E(\mathbb{Q})$ using this group operation. The rank $r = \operatorname{rank} E(\mathbb{Q})$ is the minimal number of points needed to create a subgroup of finite index or, equivalently, that $E(\mathbb{Q})$ is a direct product of a finite abelian group, called the torsion subgroup $E(\mathbb{Q})_{\mathrm{tors}}$, and a group isomorphic to $\mathbb{Z}^r$.

Our observation based on the graphs of $\mathcal{N}(T)$ in Figure 2 are confirmed by the following proposition. It is also the first Proposition in [7].

Proposition 1. *There is an explicit constant C such that*

$$\#\{P \in E(\mathbb{Q}) \mid H(P) < T\} \sim C \cdot \log(T)^{r/2}$$

as $T \to \infty$, where $r = \operatorname{rank} E(\mathbb{Q})$.
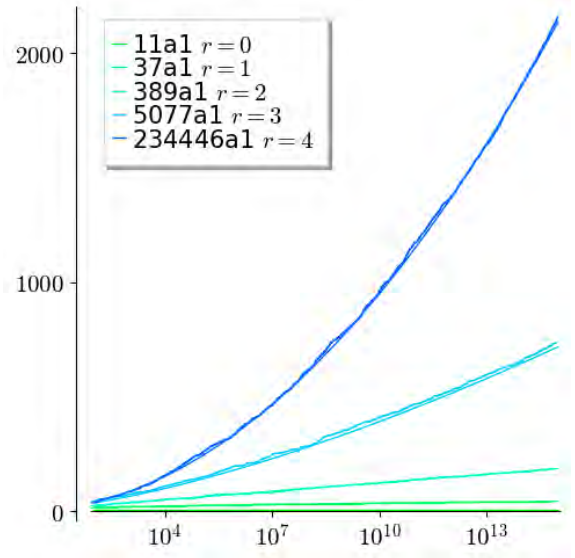

Figure 2: $\mathcal{N}(T)$ for some curves

The symbol $\sim$ here means as usual that the fraction of the two sides tends to 1 as $T \to \infty$. More precisely, the difference of the two sides can be shown to be $\mathbf{O}\big(\log(T)^{(r-1)/2}\big)$. The constant C is also given in [7], though it missed an extra factor $\frac{2}{3}$:

$$C = \frac{\#E(\mathbb{Q})_{\mathrm{tors}}}{\sqrt{R}} \cdot \left(\frac{2\pi}{3}\right)^{r/2} \cdot \frac{1}{(r/2)!}$$

where $R = \operatorname{Reg}(E) \in \mathbb{R}$ is the so-called regulator of E. If r is odd, we should interpret $(r/2)!$ as $\Gamma(r/2 +$

1). In Figure 2, we plotted $\mathcal{N}(T)$ for some curves of rank 0, 1, 2, 3, and 4 against the prediction in this proposition. The names like "11a1" refer to their Cremona labels as in [3].

The proposition also implies that Conjecture 1 is equivalent to

$$\frac{Q \cdot C^2 \cdot \log(T)^r}{\mathcal{M}(Q)} \qquad (6)$$

converging to a positive limit as $T \to \infty$ with Q as before. If we take $Q = T!$ or $Q = \prod_{p<T} p$, then Q is exponential in T, while we compare it to $\mathcal{N}(T)$ which is logarithmic. This double exponential gap between the two illustrates again how fragile the behaviour of this quotient is. We plot in Figure 3 the graphs for the quotient (6) with the same curves as in Figure 1. In this figure, we also plot the conjectured limit that we are getting to in a moment.
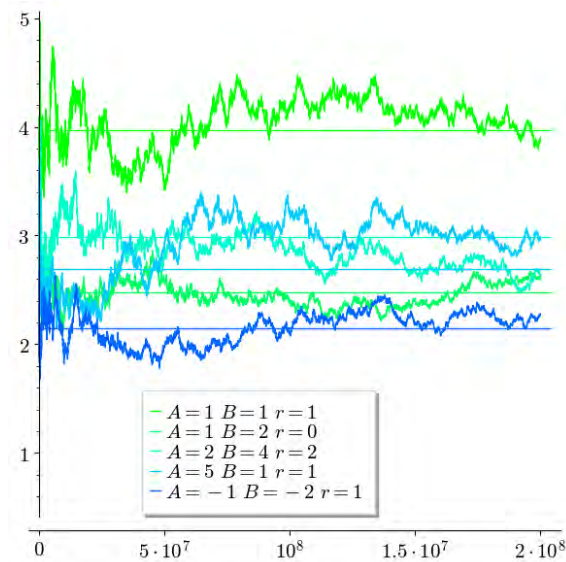

Figure 3: Convergence of the limit of (6) for some curves

The link to the Birch and Swinnerton-Dyer conjecture

Those who are aware of the history of the conjecture made by Bryan Birch and Peter Swinnerton-Dyer will now have recognised the connection between our Conjecture 1 and the rank part of their famous conjecture. As explained in [1], their initial

investigations concerned the behaviour of the product

$$\prod_{p<T} \frac{\mathcal{M}(p)}{p}$$

as T increases. They made an initial guess that it grows like $\log(T)^r$. Up to a factor linked to primes with $p \mid \Delta$, this product is equal to $\mathcal{M}(Q)/Q$. They made a better and, in many respects more interesting, conjecture involving the L-function $L(E,s)$ attached to E, which we will avoid in this exposition. Their conjecture says that $L(E,s)$ has a zero of order $r = \operatorname{rank} E(\mathbb{Q})$ at $s = 1$ and they gave a precise formula for the leading term of its expansion at $s = 1$. See [6].

Goldfeld established the connection between the two versions and, as a consequence, we find the following.

Theorem 1. *If Conjecture 1 holds then the rank part of the Birch and Swinnerton-Dyer conjecture holds.*

However, it also turns out that much more is true. In [2], it is well explained that Conjecture 1 not only implies the Birch and Swinnerton-Dyer conjecture, it would also imply that the function $L(E,s)$ satisfies the analogue of the Riemann hypothesis in a very strong form. Maybe too strong to believe, but there is also no reason to disbelieve it currently.

The period

Number theorists like to split problems into global and local problems. Issues concerned with divisibility by one (or a few) primes, like the term $\mathcal{M}(Q)$, are local, while rational points and their heights, like $\mathcal{N}(T)$, are global. This terminology comes from the construction of the completions of $\mathbb{Q}$. For each prime p, there is a field $\mathbb{Q}_p$, called the field of p-adic numbers. It is the completion of $\mathbb{Q}$ with respect to the topology given by the distance

$$d(x,y) = |x - y|_p = p^{-k} \qquad \text{for } x,y \in \mathbb{Z},$$

where p^k is the largest power of p dividing $x - y$, extended to $\mathbb{Q}$ by $|a/b|_p = |a|_p/|b|_p$. Together with the more commonly known completion $\mathbb{R}$ with respect to the usual absolute value $|\cdot|$, they form all possible completions of $\mathbb{Q}$.

Let $T > 1$ and take Q as before. Let $\varepsilon = p^{-k}$ where $p^k < Q \leqslant p^{k+1}$. To say that (4) holds for (x, y) with integer x, y can now be formulated by asking that

$$\left| -y^2 + x^3 + A x + B \right|_p < \varepsilon$$

for all $p < T$. The quantity $\mathcal{M}(p)$ is then linked to the area in $\mathbb{Q}_p \times \mathbb{Q}_p$ satisfying this inequality.

It is therefore natural to look at the equivalent inequality over the real numbers $\mathbb{R}$. Consider $(x, y) \in \mathbb{R}^2$ such that

$$\left| -y^2 + x^3 + A x + B \right| < \varepsilon$$

for some small $\varepsilon > 0$. Assume that $\Delta < 0$, which means that the graph of $E(\mathbb{R})$ is connected containing only (x, y) with x bigger than the unique solution e_1 of $x^3 + A x + B = 0$ in $\mathbb{R}$. The area of this part of the plane $\mathbb{R}^2$ is given by

$$2 \int_{e_1}^{\infty} \left(\sqrt{x^3 + A x + B + \varepsilon} - \sqrt{x^3 + A x + B - \varepsilon} \right) dx$$

$$= 2 \int_{e_1}^{\infty} \frac{2\varepsilon}{\sqrt{x^3 + A x + B + \varepsilon} + \sqrt{x^3 + A x + B - \varepsilon}} dx$$

$$= 2\varepsilon \cdot \int_{E(\mathbb{R})} \frac{dx}{2|y|} + \mathbf{O}\left(\varepsilon^2 \right)$$

The same result holds when $E(\mathbb{R})$ is formed of two connected components. The quantity $\Omega = \int_{E(\mathbb{R})} dx/(2|y|)$ is known as a period of E. One can consider $\Omega \cdot \mathcal{M}(Q)$ to be linked to the area of the subset of $\mathbb{R}^2 \times \prod_{p < T} \mathbb{Q}_p^2$ cut out by the inequalities above.

The limit

Because Conjecture 1 is linked to the rank part of the Birch and Swinnerton-Dyer conjecture, the limit of the quotient (5) should have something to do with the leading term of the function $L(E, s)$ at $s = 1$.

Theorem 2. *Suppose Conjecture 1 holds. Then the Birch and Swinnerton-Dyer formula holds if and only if*

$$\lim_{T \to \infty} \frac{Q \cdot \mathcal{N}(T)^2}{\mathcal{M}(Q)} = \frac{1}{\sqrt{2} \cdot ((r/2)!)^2} \cdot \left(\frac{3e^{\gamma}}{2\pi} \right)^r \cdot \Omega \cdot S.$$

where S is a square integer, which is conjecturally the order of the mysterious Tate-Shafarevich group $\mathrm{III}(E)$.

Oh, e and γ are both constants due to Euler. In Figure 3 we have plotted the expression (6) against this limit for the curves in question.

It remains to explain what the Tate-Shafarevich group $\mathrm{III}(E)$ is. It is a torsion abelian group, which is conjectured to be finite. The group $\mathrm{III}(E)$ can also be viewed as measuring the discrepancy between a local and a global question. Its elements can be viewed as curves C defined over $\mathbb{Q}$ which become isomorphic to E when considered over any p-adic field as well as over $\mathbb{C}$. This group appears as an obstruction to effectively calculating $E(\mathbb{Q})$ by the method of infinite descent.

Refined counting of points modulo primes

One of the vague arguments given initially for the conjecture is the following: If we have lots of points with integer $(X : Y : Z)$, then they produce lots of points modulo integers, and primes in particular. In other words the larger r, the more often $\mathcal{M}(p)$ should be above average. This is however too simplistic.

But, what is this average? Hasse proved that $p + 1 - 2\sqrt{p} < \mathcal{M}(p) < p + 1 + 2\sqrt{p}$, which suggests $p + 1$ as the average. We define

$$a_p = p + 1 - \mathcal{M}(p),$$

where negative values of a_p indicate an excess of points modulo p.

Originally conjectured by Sato and Tate, the values $a_p/(2\sqrt{p}) \in [-1, 1]$ are known to satisfy a precise distribution, which is independent of r. See [5] for a good overview. In particular positive and negative values should appear with the same frequency. Except for the special elliptic curves with extra endomorphisms (complex multiplication), the distribution of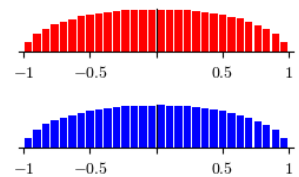 $a_p/(2\sqrt{p})$ looks like this: The red histogram on top is for the curve $A = B = 1$ for which $E(\mathbb{Q})$ is infinite and the bottom in blue is for $A = 1$, $B = 2$ which has a finite $E(\mathbb{Q})$. For both we used all primes $p \leqslant 10^7$
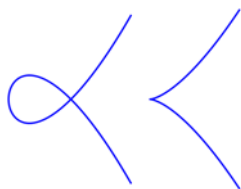
Murmurations

Finally, we present a recently discovered phenomenon related to counting points on elliptic curves.

The reduction of an elliptic curve curve at a prime p can be bad in that the reduced curve has a singularity. There are two possibilities: On the left, we have the case of nodal reduction and, on the right, that of cuspidal reduction

The conductor $N(E)$ of an elliptic curve E defined over $\mathbb{Q}$ is an integer divisible only by the primes of bad reduction. In other words, the conductor may be written as a product

$$N(E) = \prod_{p:\ \text{bad}} p^{e_p}.$$

More precisely, for a bad prime $p \notin \{2,3\}$, we have $e_p = 1$ (resp. $e_p = 2$) if E has a nodal reduction (resp. cuspidal reduction) modulo p. For $p = 2$ and 3, the recipe is known but more complicated.

The so-called **murmuration** phenomenon refers to the oscillating behaviour of the average value of $a_p(E)$, as a function of p, where E varies over a suitable finite set of elliptic curves [4]. More precisely, we set:

$$M_{\mathscr{E},r}(p) = \frac{1}{\#\mathscr{E}(r)} \sum_{E \in \mathscr{E}(r)} a_p(E),$$

where $r \in \mathbb{Z}_{\geqslant 0}$, $\mathscr{E}$ is a finite set of elliptic curves over $\mathbb{Q}$, and $\mathscr{E}(r)$ is the subset of $\mathscr{E}$ containing its curves of rank r. In Figure 4 below we plot $M_{\mathscr{E},r}(p)$ against p for even r (blue) and odd r (red), where we take $\mathscr{E}$ to be the set all elliptic curves defined over $\mathbb{Q}$ with conductor in the interval $2^{17} < N(E) < 2^{18}$. Most of these curves have either rank 0 or 1 and so the blue dots correspond to curves with a finite $E(\mathbb{Q})$ and the red for infinite $E(\mathbb{Q})$.
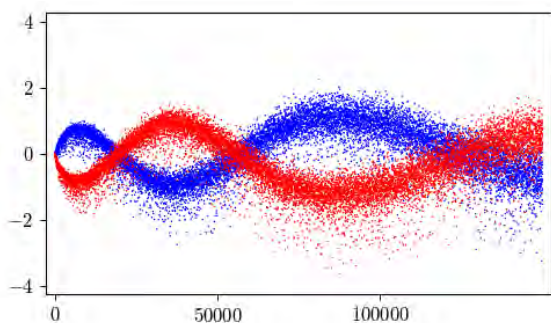

Figure 4: Murmuration with even rank curves in blue and odd rank curves in red

In forthcoming work of He, Lee, Oliver, Pozdnyakov, and Sutherland, this oscillating behaviour is shown to hold for elliptic curves with much larger conductor, and also for related arithmetic objects such as modular forms and genus 2 curves. There is some initial progress towards understanding why this pattern appears due to Zubrilina, but there is no comprehensive explanation for this phenomenon so far. Since most curves in the interval are of rank either 0 or 1, and because the total average should be 0 by the Sato-Tate distribution, we expect the two waves of murmuration to be complementary. The naive heuristic that curves of rank 1 have more points modulo prime, and hence a_p is more frequently negative, may be the reason that the red wave dips initially for small primes p.

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Notes of a Numerical Analyst

From Dice to Adjoints

NICK TREFETHEN FRS

David Acheson has a wonderful puzzle involving a dice rolling along a track [1]. When it gets to the end, what number will be on top?
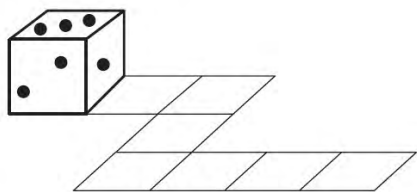
If you try to solve this in your head, it will drive you crazy. It's just too complicated. Eventually you'll give up and look in the kitchen drawer to see if you've got an old dice hanging around to help you out. But then Acheson reveals his elegant trick. Just run the problem backwards!
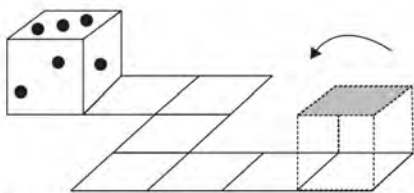
Imagine starting from the end, with the grey face on top, and tracking the position of that face step by step backwards to the start position. This is easy in your head. At the start, the grey face is facing to the left, opposite the single dot. So it must be the face with 6 dots.

The trick of running it backwards turns out to be at the heart of many things. What makes this problem hard in forward mode is that there are 24 states of the dice — 6 possible numbers on top, 4 rotations. What makes it easy in reverse mode is that we don't care about the rotations, just the position of the grey face. Actually, you could solve it forward via easy 6-state simulations: but you'd have to do six of them, not just one. One forward simulation tells you where the 3-face ends up, another where the 2-face ends up, and so on. After six runs (or three, exploiting

symmetry), you'll have solved the problem. But that's nowhere near as slick as one run in reverse.

For an analogy from linear algebra, think of the 6×24 matrix y resulting from a product of a sequence of 24×24 matrices $A_1, \ldots, A_n$ finally times a 6×24 matrix x:

$$y = x \boxed{A_n} \cdots \boxed{A_1}$$

If you work from right to left multiplying the matrices in the usual order of composition, it's a sequence of big square matrix products, but if you start from the vector x and work from left to right, all the products are small rectangular ones.

Rolling dice is not a major problem of computational science, but the computation of derivatives is. The same switch from forward to reverse mode is what made the technique of Automatic Differentiation take off late in the last century [3]. More recently the idea has grown even more conspicuous in the technique of *backpropagation* for training neural networks. These are all ideas related to the distinction between an operator and its adjoint [2].

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Nick Trefethen
Trefethen is Professor of Applied Mathematics in Residence at Harvard University.

Mathematics News Flash

Jonathan Fraser reports on some recent breakthroughs in mathematics.

Pólya's conjecture for Euclidean balls

AUTHORS: Nikolay Filonov, Michael Levitin, Iosif Polterovich, and David A. Sher
ACCESS: https://arxiv.org/abs/2203.07696

Pólya's famous conjecture from 1954 states that the eigenvalue counting functions of the Dirichlet and Neumann Laplacian on a bounded domain in Euclidean space can be controlled by the leading term of Weyl's asymptotics. Pólya himself proved the conjecture for 'tiling domains' in 1961. Here a *tiling domain* is a domain which can tile the ambient Euclidean space up to a set of measure zero. For example, the open unit square is a tiling domain in the plane and the tiling is by translation by the integer lattice. Despite this early success, progress for non-tiling domains has been relatively slow. This paper, published in *Inventiones Mathematicae* in 2023, proves Pólya's conjecture for planar Euclidean balls. Since Euclidean balls are a very natural choice of domain, but do *not* tile the plane (can you see why?), this represents a significant breakthrough in the area.

Furstenberg sets estimate in the plane

AUTHORS: Kevin Ren and Hong Wang
ACCESS: https://arxiv.org/abs/2308.08819

A *Kakeya set* is a subset of Euclidean space which contains a unit line segment in every possible orientation. The famous *Kakeya conjecture* is that Kakeya sets should have Hausdorff dimension as large as possible, that is, the dimension of the ambient Euclidean space. This problem is trivial in dimension 1 and was solved by Roy Davies in 1971 for Kakeya sets in the plane (ambient dimension 2) but the conjecture remains open in higher dimensions.

The *Furstenberg set conjecture* is a generalisation of the planar Kakeya conjecture. Given $s \in [0,1]$ and $t \in [0,2]$, an (s,t)-*Furstenberg set* is a set in the plane for which there exists a collection of lines of Hausdorff dimension at least t such that, for every line in the collection, the set intersects the line in a set of Hausdorff dimension at least s. In particular,

a Kakeya set is a $(1,1)$-Furstenberg set. So, how big do you think an (s,t)-Furstenberg set must be?

This paper, which appeared on arXiv in summer 2023, sensationally solved the Furstenberg set conjecture by proving that the Hausdorff dimension of an (s,t)-Furstenberg set must be at least

$$\min\left\{s+t, s+1, \frac{3s+t}{2}\right\}.$$

Be honest, is that what you guessed?

Limits of Latin squares

AUTHORS: Frederik Garbe, Robert Hancock, Jan Hladký and Maryam Sharifzadeh
ACCESS: https://arxiv.org/abs/2010.07854

A general problem on the interface between combinatorics and analysis is to understand suitable limits of sequences of discrete objects. For example, an increasing sequence of graphs converges (in an appropriate sense) to an infinite object known as a *graphon* and, similarly, an increasing sequence of permutations converges (in an appropriate sense) to an infinite object known as a *permuton*. It is then of interest to, for example, examine which properties of the finite objects pass to the limit (and in what form).

A *Latin square* is an $n \times n$ array of points with labels in the set $\{1, \ldots, n\}$ and the property that each row and column uses each label precisely once. There are many interesting combinatorial questions about such objects. This paper, published in *Discrete Analysis* in 2023, introduced the concept of a *Latinon*. (That's right, the objects which are the appropriate limits of increasing sequences of Latin squares!)

Jonathan Fraser is a pure mathematician working at the University of St Andrews in Scotland. He is especially interested in fractals, analysis, dynamics and—more recently—portraiture.

Reciprocal Societies: Finnish Mathematical Society

Origins

The Finnish Mathematical Society (FMS) is only three years junior to the LMS, making it the oldest of the five Nordic mathematical societies. Founded in November 1868, the society chose as its first president Lorenz Lindelöf—the only mathematics professor in Finland at the time.

Mathematical research was in its nascency in Russian Empire-era Finland. Notwithstanding the brief professorship of Gösta Mittag-Leffler in 1877–1881, the real starting point could be the appointment of Lindelöf's son Ernst in 1903. He created a school of complex analysis together with his numerous students, including Rolf Nevanlinna and Lars Ahlfors. He also steered the FMS for some four decades.

Professor Ernst Lindelöf in late 1930s.

Other notable mathematicians from this era include Jarl Lindeberg (who worked on the central limit theorem), Hjalmar Mellin (known for the integral transform named after him), and Karl Sundman (who gave a solution to the three-body problem).

Activities

Since those days, Finnish mathematical research has expanded from chiefly analysis to a wide range of fields across ten universities. As part of this growth, the FMS has long organized visiting lectures of renowned international researchers. This practice has recently been rejuvenated as an online colloquium, with "watch parties" held across Finnish universities.

The FMS coordinates Finnish Mathematical Days, a meeting organized every other year by a rotating department. Another roughly biennial event is the Nordic Congress of Mathematicians that rotates between the Nordic mathematical societies. These societies also jointly publish the journal *Mathematica Scandinavica*.

Moreover, there have been some special occasions where the FMS has played a role. The latest was the International Mathematical Union general assembly and prize ceremony in July 2022, quickly moved from St. Petersburg to Helsinki due to the Russian invasion of Ukraine. This was the second time Fields medals were awarded in Helsinki: the 1978 International Congress of Mathematicians was held there with support from the FMS.

Perhaps the internationally most significant regular activity is the journal *Annales Fennici Mathematici*. This diamond open-access journal was previously published under the name *Annales Academiæ Scientiarum Fennicæ Mathematica*. While the journal has historically emphasized analysis, it publishes articles in all fields of mathematics. More information and archives up to 1962 (as of this writing) can be found at afm.journal.fi.

Together with the two physical societies in Finland, the FMS also publishes the professional magazine *Arkhimedes*. Young mathematicians are supported with prizes for the best Master's and doctoral theses of each year. Future mathematicians benefit from *Matematiikkalehti Solmu*, a magazine distributed to schools, and the Mathematical Olympiad training organized under the society.

As a scientific society in a small country, the Finnish Mathematical Society has always reached out abroad. It has reciprocal agreements with the London Mathematical Society, European Mathematical Society, and the applied mathematics organizations ICIAM and ECCOMAS. While many official activities of the society are conducted in Finnish, its scientific events are in English and open to all interested.

Acknowledgements

Obituaries of Members

John D.M. Wright: 1942–2023

Professor John D.M. Wright, who was elected a member of the London Mathematical Society on 20 March 1969, died on 7 August 2023, aged 81. Professor Wright was LMS Treasurer from 1986-1994.

Cho-Ho Chu writes: John David Maitland Wright, an eminent functional analyst, was born in Aberdeen on 20 May 1942, elected a Fellow of the Royal Society of Edinburgh in 1978 and a Foreign (Honorary) Academician of Società Nazionale di Scienze, Lettere e Arti in Napoli in 1994.

John was the only child of Phyllis Harris and the distinguished mathematician Sir Edward Maitland Wright, who co-authored with G.H. Hardy the book *An Introduction to the Theory of Numbers* (1938). He attended Aberdeen Grammar School from the age of four and a half and graduated with first class honours from the University of Aberdeen in 1964. He then moved to Oxford and worked under the supervision of David Edwards, obtaining his doctorate in 1967, and was awarded the Oxford Senior Mathematical Prize and Johnson Prize for his thesis on measure theory.

While at Oxford, he was appointed to a junior college lectureship in 1965 at Christ Church and became the Leathersellers' Tutorial Fellow in Mathematics in 1968 at St. Catherine's College. As well as teaching undergraduate mathematicians, he also served as Secretary of the Governing Body. At the young age of 28, he was appointed to a Chair of Pure Mathematics at the University of Reading and subsequently Head of Department in 1980-88 and in 1992-93. In 2004, he returned to Aberdeen as a part-time Research Professor, becoming emeritus in 2015. From 2015 until 2021, he was a Senior Associate Research Fellow at Christ Church, then became an Honorary Member of the Common Room.

During his time in Reading, he held visiting positions in Paris and Lausanne, and supervised three PhD students, S. Ali (1980), L.J. Bunce (1982) and F. Jamjoom (1990). John was an inspiring supervisor: in Jamjoom's words "his patience and continuous encouragement gave me the determination to boost my strength at my weakest moments".

John's contribution to mathematics is enormous, having written over 130 research papers in many areas, by himself as well as with many distinguished co-authors. Mathematics can be a rather solitary science, but as a gregarious person John enjoyed collaboration. I did some joint work with John when I was a University Research Fellow at Reading and we sometimes worked and sipped tea in his garden, which was enjoyable and fruitful. His longest collaboration was with Kazuyuki Saito. Much of their work was on classes of operator algebras which generalise von Neumann algebras, namely, the AW*-algebras and monotone complete C*-algebras. They answered many open questions and posed others. Remarkably, they constructed a classification semi-group for small monotone complete factors, revealing that these factors exist in huge abundance. Their work culminated in the book *Monotone Complete C*-algebras and Generic Dynamics*, published by Springer in 2015.

John had also done important work on quantum measure theory, where maps defined on operator algebras are studied. His collaboration with L.J. Bunce led to the solution of the Mackey-Gleason Problem in 1994, proving that a finitely additive Banach space-valued measure on projections in a von Neumann algebra without type I_2 summand extends to a bounded linear map on the whole algebra.

Another work of John in 1977 on Jordan C*-algebras, a term coined by I. Kaplansky, is among his most cited works in MathSciNet and plays an important role in Jordan algebras and geometry. It is now known (Crelle 2021, pp. 145-169) that Jordan C*-algebras correspond to a class of Finsler symmetric manifolds that are open cones in real Banach spaces.

Besides teaching and research, John's service to the mathematical community was extensive and significant, which was evidence of his administrative talents and managerial skills. He was on the Editorial Board of *Journal of Mathematical Analysis and its Applications* for many years. During the time when he was Treasurer and managing the investments of the London Mathematical Society in 1986-94, the assets of the Society grew from around one million pounds to some five and a half million pounds. He was a Council Member of the Society in 1977-78 and 1985-94, and Director of LMS Publishing Ltd in

1986-94. In addition, he was on the Management Committee of the Isaac Newton Institute, Cambridge, in 1992-96, and served as Deputy Director to Sir Michael Atiyah at the Institute in 1994-96. He also served on the Senate, Court, Council, AUT Joint Committee and Standing Committee of the University of Reading.

John was a very sociable and kind person. His warmth, charm and hospitality won him many friends, making him very popular at conferences and meetings. He was held in high regard by his friends and colleagues. In later life John was afflicted by Parkinson's Disease, but stayed active, completing his book with Kazuyuki Saitô and presenting his research at the International Conference on Jordan Geometric Analysis in 2014, at Queen Mary, London, while being looked after with great skill and kindness by his wife, Harvinder. He remained on friendly terms with his first wife Helen, and was close to his children, Jane, Lucy, Vicky and Edward; proud of their achievements and always delighted to see his grandchildren. They all survive him. John will be missed by all who knew him.

Death Notices

We regret to announce the following deaths:

- Dr John F. Barrett, who was elected a Member of the London Mathematical Society on 16 June 1975, died on 10 February 2023, aged 92.

- Professor Roy O. Davies, who was elected a Member of the London Mathematical Society on 21 December 1961, died on 12 June 2023, aged 96.

- Professor G. Peter Scott, who was elected a Member of the London Mathematical Society on 19 October 1972, died on 19 September 2023, aged 78. Professor Scott was awarded the Senior Berwick Prize in 1986.

- Terry Sheil-Small, who was an LMS member from 1980-2003, died on 22 September 2023, aged 86.

South West and South Wales Regional Meeting & Workshop 2024

Location: University of Bath
Date: 17–19 January 2024
Website: bit.ly/46hdtbV

The meeting will open with Society business, during which LMS members will have the opportunity to sign the Members' Book. The meeting will include a graduate student meeting. A reception will be held afterwards. Funds are available for partial support to attend. See the website for details.

Midlands Regional Meeting & Workshop

Location: Loughborough University
Date: 2–5 April 2024
Website: tinyurl.com/5bbjkaeh

The LMS Regional Meeting speakers will be Jonathan Bennett (University of Birmingham), Oana Ivanovici (Sorbonne Université) and Christopher Sogge (Johns Hopkins University). The Workshop Speakers will include Jeffrey Galkowski (University College London), Daniel Grieser (Universität Oldenburg), Jonathan Hickman (University of Edinburgh), Simon Myerson (University of Warwick), Anke Pohl (Universität Bremen) and more.

British Applied Mathematics Colloquium 2024

Location: Newcastle University
Date: 9–11 April 2024
Website: tinyurl.com/bamc2024

The largest, annual applied mathematics conference in the UK brings together students, academics and industry professionals to discuss work and exchange ideas. Contributed talks and mini-symposium to include mathematical biology; geo- & astro-physical flows; complex flows, flow-structure interactions, industrial maths, cosmology, mathematical education and nonlinear systems. Plenary speakers: Emmanuel Dormy (ENS Paris), Bérengère Dubrulle (CNRS Paris), Julia Gog (Cambridge), Tannie Liverpool (Bristol), Nigel Mottram (Glasgow), Silke Weinfurtner (Nottingham). Support from LMS grant is gratefully acknowledged.

Northern Regional Meeting & Workshop

Location: University of Durham
Date: 25–28 March 2024
Website: bit.ly/3G0khjg

The LMS Regional Meeting Speakers will be Sophie Morier-Genoud (Université Reims), Matthew Pressland (University of Glasgow) and Ian Short (The Open University). The Workshop speakers will be Karin Baur (University of Leeds), Oleg Karpenkov (University of Liverpool), Valentin Ovsienko (Université Reims), Michael Shapiro (Michigan State University) and Alexander Veselov (Loughborough University), with more to be confirmed.

Young Geometric Group Theory XII

Location: University of Bristol
Date: 8–12 April 2024
Website: sites.google.com/view/yggt2024

This conference is aimed at early-career researchers in the area of geometric group theory. There will be mini-courses, plenary talks, and discussion sessions, as well as opportunities for participants to share their own research via lightning talks and a poster session. The mini-courses will be given by Mark Hagen (University of Bristol), Kathryn Mann (Cornell University) and Romain Tessera (CNRS, University Paris-Cité). Registration details can be found on the conference website. This conference is supported by an LMS Conference Grant.

Hirst Lecture and Society Meeting

Location: De Morgan House, London and online
Date: 26 April 2024
Website: lms.ac.uk/events/meeting/hirst

The 2024 Hirst Lecture will be given by the 2023 Hirst Prize winner Professor Erhard Scholz (Bergische Universität Wuppertal). His talk is titled 'From Grassmann Complements to Hodge Duality'. Professor Jeremy Gray (Open University) will give the supporting lecture on 'F.S. Macaulay and Modern Commutative Algebra'. The Hirst Prize is awarded for excellence in the field of history of mathematics. See further details and register on the website.

Society Meetings and Events

January 2024

17 LMS South West and South Wales Regional Meeting and Workshop, Bath

March 2024

25-28 LMS Northern Regional Meeting & Workshop, Durham

April 2024

2-5 LMS Midlands Regional Meeting & Workshop, Loughborough

26 Hirst Lecture and Society Meeting

June 2024

28 LMS General Meeting, London

July 2024

1-5 LMS Invited Lecture Series 2024, Imperial College London

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.

December

12-14 Cryptography and Coding Conference, Royal Holloway, London (507)

March

14 International Day of Mathematics (509)

April

8-12 Young Geometric Group Theory XII, University of Bristol (509)

9-11 British Applied Mathematics Colloquium 2024, Newcastle University (509)

22-26 2024 Conference on Modern Topics in Stochastic Analysis and Applications (in honour of Terry Lyons' 70th birthday)

August

12-16 International Workshop on Operator Theory and its Applications (IWOTA) (509)

GRESHAM COLLEGE PROFESSOR OF GEOMETRY
The Mathematical Sciences

Applications are invited for the position of Professor of Geometry, i.e. the mathematical sciences. Gresham College has been giving free public lectures since 1597; today these lectures are presented in person in London, and live-streamed to a global audience, with recordings made available online. Gresham Professors are outstanding in their fields and superb communicators, able to connect with an audience whose members may not have specialist expertise in the subject, but who will be informed people with a thirst for increased knowledge and understanding.

The Professorship of Geometry is open to any academic discipline within mathematical sciences.

The 3-year appointment (start date 1 Aug 2024) requires the professor to present six lectures each academic year. Gresham Professors also participate in College life, attending the Academic Board, participating in promotion and outreach, attending social events and acting as ambassadors for the College. The post offers excellent opportunities to widen public exposure for the successful candidate. The College pays an annual stipend of £8,000 (plus reasonable expenses) and encourages applications from all backgrounds and communities.

Further information about this position and how to apply is available on the Gresham website at:

https://www.gresham.ac.uk/professor-geometry or contact the Academic Programme Manager,   Dr Sophie Scott-Brown (s.scottbrown@gresham.ac.uk)

The closing date for application is 9:30 am on **8 January 2024**. Interviews will be held in London on **4 March 2024**.

## ASPIRING AND INSPIRING

Tenure and Leadership in Academic Mathematics

Edited by Rebecca Garcia, Colorado College et al

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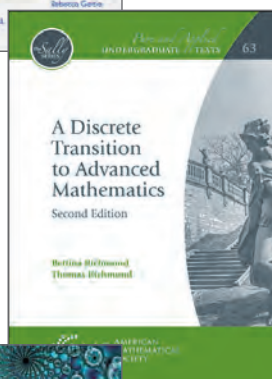
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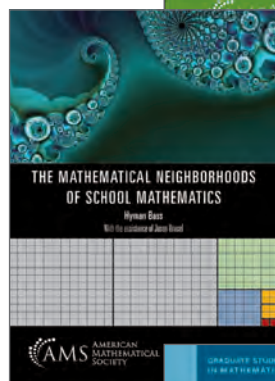
## THE MATHEMATICAL NEIGHBORHOODS OF SCHOOL MATHEMATICS

Hyman Bass, University of Michigan
With the assistance of Jason Brasel

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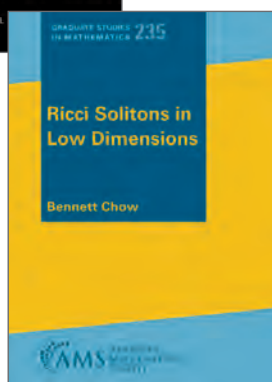
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Bennett Chow, University of California
Graduate Studies in Mathematics, Vol. 235

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