trees. Used by Research Associate Nick Gill and collaborators to obtain lower bounds for the support of an element in a multiply transitive group that does not contain the alternating group. From Bamberg, John; Gill, Nick; Hayes, Thomas P.; Helfgott, Harald A.; Seress, Akos and Spiga, Pablo (2013). Bounds on the diameter of Cayley graphs of the symmetric group. Journal of Algebraic Combinatorics. DOI 10.1007/s10801-013-0476-3
Foreword

Welcome to the 2013 Mathematics Research Report which covers the Pure, Applied, History, and Mathematics Education groups in the Department of Mathematics and Statistics, in the Faculty of Mathematics, Computing and Technology, at the Open University. The Department also has a very strong Statistics group which publishes its own annual report – see http://statistics.open.ac.uk/2013_annual_report.

Research is a core part of our mission, and we foster a vibrant collaborative research culture encompassing academic staff, postdoctoral researchers and full- and part- time research students. The Department has key expertise in Combinatorics, Analysis and Geometry, Theoretical and Mathematical Physics, History of Mathematics in the 19th and early 20th Century, and topics in Mathematics Education.

In 2013, the Department joined the London Taught Course Centre (LTCC), and our postgraduate research students now attend lectures at De Morgan House in London. Our staff have also contributed courses to the Centre, with June Barrow-Green and Jeremy Gray teaching topics in the History of Mathematics, and Nick Gill delivering a course on Group Theory in the autumn.

We maintain an active programme of seminars and research days, which attract national and international participation. Particular highlights in 2013 included the annual Winter Combinatorics Meeting and Open Statistical Physics conference, as well as the inaugural Energy Research Day Conference, which is part of a faculty-wide energy research initiative. As well as the one-day meetings held on-campus, Phil Rippon and Gwyneth Stallard co-organised a highly successful workshop in May at the International Centre for Mathematical Sciences in Edinburgh. In November, two of our PhD students, Rosie Cretney and Mairi Walker, organised the 2013 Novembertagung (an annual meeting of postgraduate research students in the History of Mathematics) in De Morgan House, London.

We have continued to make significant contributions to the public awareness and understanding of science, in particular through collaborations with the BBC and by our annual Christmas Lecture for local schools, which this year was delivered by Katie Chicot. Several of our members were also involved in the organisation and policy development of learned societies, such as the London Mathematical Society, the Institute of Physics, and the British Society for the History of Mathematics.

Let me end by mentioning several highlights from OU Mathematics research in 2013. As well as numerous grants to support research visits, conferences and meetings, Gwyneth Stallard and Phil Rippon were awarded a further £225k from EPSRC to continue their work on Baker’s conjecture and Eremenko’s conjecture. 2013 also saw the publication of the first volume of *Aperiodic Order*, co-written by Uwe Grimm, and it is already set to become a standard reference in the study of quasicrystals. Finally, following its publication in 2012, Jeremy Gray’s acclaimed book *Henri Poincaré: a scientific biography* was listed as one of Choice’s “Outstanding Academic Titles for 2013”.

Robert Brignall (Director of Research)
Membership of  Mathematics Groups, 31 December 2013

**Head of Department**
Dr Toby O'Neil

**Professor**
Prof Jeremy Gray
Prof Uwe Grimm
Prof Philip Rippon
Prof Jozef Širáň
Prof Michael Wilkinson

**Emeritus Professor**
Prof David Brannan
Prof Mike Grannell
Prof Terry Griggs
Prof John Mason
Prof Robin Wilson

**Senior Lecturer**
Dr Barbara Allen
Dr June Barrow-Green
Dr Mick Bromilow
Dr Robert Hasson
Dr Ben Mestel
Dr Kathleen Quinn
Dr Andrey Umerski
Dr Bridget Webb

**Lecturer**
Dr Robert Brignall
Mr Matthew Esplen
Mr Michael Hall
Mr Gerard Hayes

**Staff Tutor**
Dr Tim Lowe
Dr Ian Short
Dr Paul Upton

**Visiting Research Associate**
Dr John Osborne

**Office Manager**
Mrs Tracy Johns

**Secretary**
Ms Sara Griffin
Mrs Patricia Telford

**Long-term visitor**
Visiting Professor Michael Baake
Visiting Senior Research Fellow Dr Gerold Baier

**Full-time research student**
Mr David Bevan
Ms Rosanna Cretney
Mr Grahame Erskine
Miss Vasiliki Evdoridou
Mr Matthew Jacques
Mr David Marti Peti
Miss Mairi Walker
Mr Mark Whinnett

**Visitors**

Professor Sergey Kuznetsov (Russian Academy of Science and Saratov State University), 25 May – 7 June

Professor Einar Steingrimsson (University of Strathclyde), 25 – 28 February

Dr Vincent Vatter (University of Florida), 26 May – 7 June

Dr Pierre Guillot (University of Strasbourg) , 18 – 21 March

Professor Alan Beardon (University of Cambridge), 24 – 29 November

Professor Francoise Dal’Bo (University of Rennes 1), 12 – 13 December

Jean-Baptiste Aujouge (Lyon), 26 – 28 June

Professor Birgit Loch (Swinburne University of Technology), 15 – 19 July

Professor Mikhail Klin (Ben Gurion University of the Negev, Israel), 8 – 10 May

Professor Diane Donovan (University of Queensland), May

Dr John Britnell (Imperial College London), 29 January

Dr Amarpreet Rattan (Birkbeck University of London), 7 May

**Research Associate**
Dr Nick Gill
Dr Nicholas Korpelainen
Dr Dave Sixsmith

**Visiting Research Fellow**
Dr David Crowe
Dr Tony Forbes
Dr Fred Holroyd
Dr Penelope Lynch

**Part-time research student**
Mr Walter Burke
Mr John Grant
Mr Rob Lewis
Mr Paul Verschueren
Research degrees awarded

**Harry Kennard** M.Phil. for his thesis *Dynamics in Turbulence*. Supervisors: Uwe Grimm & Andrey Umerski

**Penny Lynch** Ph.D. for her thesis *Mathematical modelling of the effects of health interventions on the evolution of life history in disease-causing organism*. Supervisor: Uwe Grimm

**Dave Sixsmith** Ph.D. for his thesis *Topics in Transcendental Dynamics*. Supervisors: Gwyneth Stallard & Phil Rippon

Publications

Books


Articles and book chapters


Gill, Nick (2013). (2,m,n)-groups with Euler characteristic equal to $-2^a s^b$. Electronic Journal of Combinatorics, 20(3) article 8.


Jones, Gareth A.; Macaj, Martin and Širáň, Jozef (2013). Nonorientable regular maps over linear fractional groups. Ars Mathematica Contemporanea, 6(1) pp. 25–35.


Conferences/meetings organised by members of the Department

The Open University has a fine tradition of organising research meetings that draw national and international audience. Meetings organised by members of the Department held in 2013 were:


ICMS Workshop on The Role of Complex Analysis in Complex Dynamics, ICMS, Edinburgh, May 2013 Organisers: Phil Rippon, Gwyneth Stallard and Jim Langley (Nottingham) http://www.icms.org.uk/workshops/complexdynamics


Mathematics seminars hosted by the Department

In 2013 the Department held 33 Mathematics seminars, of which 5 (15 %) were given by women mathematicians. List of seminars in chronological order.

Thomas Jordan (University of Bristol) Multifractal analysis for the continued fraction map and related dynamical systems

David Chillingworth (University of Southampton) Gravitational lensing and Galois theory

John Britnell (Imperial College) Orbit-coherence in permutation groups

Giles Harrison (University of Reading) Fair weather atmospheric electricity

Jim Langley (University of Nottingham) Non-real zeros of derivatives of meromorphic functions

Mike Grannell (OU) Beauty and the beast, or Projective and rigid Steiner triple systems

Fred Holroyd (OU) Peano arithmetic and the Hercules-Hydra game: a puzzle

Pierre Guillot (University of Strasbourg) Graphs on surfaces

Nikita Sidorov (University of Manchester) On a family of explicit counterexamples to the Finiteness Conjecture
Pablo Shmerkin (University of Surrey) On sets containing circles/squares centered at every point
Tuomas Sahlsten (University of Bristol) The Brownian graph is not round
Michael Wilkinson (OU) Two universalities in semiconductor physics
Amarpreet Rattan (Birkbeck, University of London) New formulae for structure constants in the symmetric group
Mikhail Klin (Ben-Gurion University of the Negev, Israel) Primitive triangle free strongly regular graphs, a survey: from Dale Mesner to recent results
Chris Sangwin (University of Birmingham) Using STACK through Moodle for mathematics assessment
Neil Edwards (OU) A brief descent from the elegance of ocean currents to the wicked world of climate change
Sergey Kuznetsov (Russian Academy of Sciences, and Saratov State University, Russia) Hyperbolic Chaos: A Physicist's View
Eva-Maria Graefe (Imperial College) Mean-field approximation for a many-particle system with complex-valued interaction strength
Jesper Lützen (University of Copenhagen) Impossibility theorems with special emphasis on the classical problems
Tom Archibald (Simon Fraser University) Integral equations 1900-1920: pure and applied dimensions of an explosively growing research specialty
Mairi Walker (OU) Rosen's solution to the word problem for the Hecke groups
Matthew Jacques (OU) Limit sets of semigroups of Möbius transformations
Peter Fenton (University of Otago, New Zealand) Subharmonic functions that are harmonic when they are large
Alex Chroneos (OU) Engineering defects in energy materials
Silvia Barbina (OU) Model theory
Michael Wilkinson (OU) The Puzzle of Planet Formation
Ovidiu Bagdasar (University of Derby) On the geometric patterns of complex Horadam sequences
Lena Zuchowski (University of Cambridge) Gestalt switches in the prize paper: An inspiration for (but not an instance of) chaos
John Osborne (OU) Connectedness properties of the set where the iterates of an entire function are bounded
Andy Woods (BPI, University of Cambridge) Fluid Mechanics for Carbon Sequestration
Dave Sixsmith (OU) The size of the Julia set of functions outside the Eremenko-Lyubich class
Alan Beardon (University of Cambridge) The Carathéodory Kernel Theorem
Francoise Dal'Bo (University of Rennes 1) Unipotent actions on compact quotients of \( \text{SL}(2,\mathbb{R}) \): theme and variations

Visits to other institutions

Robert Brignall and Nicholas Korpelainen University of Florida, USA
Nick Gill University of Bristol, UK
Terry Griggs Two visits to Charles University, Prague, February and November.
Uwe Grimm University of Bielefeld, Germany (several short visits)
Vassar College, Poughkeepsie, USA, June.
Michael Hall Helsinki University Viikki Teacher Training School
Jozef Širáň Ben Gurion University of the Negev, Israel
Conference & workshop papers and posters given

Barbara Allen, Michael Hall and Gerald Hayes
Working enactively on mathematics tasks (2 × 1.5 hours sessions) ATM conference, Sheffield, April.
Anything Goves (1 × 1.5 hours session), ATM conference, Sheffield, April.

David Bevan
Permutation grid classes and the spectra of graphs, 24th British Combinatorial Conference, July.

June Barrow-Green

Robert Brignall
Forbidding paths and cliques at 24th British Combinatorial Conference, Royal Holloway, University of London, July.

Rosanna Cretney
From publications to letters and back again: Euler’s early work on the Riccati equation BSHM Research in Progress, The Queen’s College, Oxford

Mike Grannell
Counting transversal designs, British Combinatorial Conference, Royal Holloway, July.
Embeddings of \( K_n \), with uniform face sizes, Geometrical and topological aspects of graph theory, Bristol, UK, April. (invited plenary talk)

Jeremy Gray
Henri Poincaré: Mathematician, Physicist, Philosopher, Keynote speaker (the Kenneth O. May Lecturer) at the Mathematical Association of America Mathfest, Hartford, Connecticut, August.
The soul of the fact: Poincaré and proof Invited speaker, 20th anniversary conference of the Erwin Schrödinger Institute, Vienna, April/May.
On the cusp of the new physics: Henri Poincaré and mathematical physics 100 years ago Bernoulli Lecturer, the Bernoulli Society, Groningen, the Netherlands, March.
Henri Poincaré and mathematical physics 100 years ago Distinguished Speaker at the European Mathematical Society meeting, Aarhus, Denmark, April.
On the cusp of the new physics: Henri Poincaré and mathematical physics one hundred years ago Invited speaker at the workshop on the history of mathematics, BMC, Sheffield, March.

Terry Griggs
Quandles and Design Theory, KAFKA seminar, Charles University Prague, February.
Biembeding Steiner triple systems using the Bose construction, Geometrical and topological aspects of graph theory, Bristol, UK, April 2013 (invited plenary talk).
Representing graphs in Steiner triple systems, British Combinatorial Conference, Royal Holloway, July.
Steiner triple systems and their close relatives, KAFKA seminar, Charles University Prague, November.

Uwe Grimm
The squiral tiling and its diffraction, SubTile 2013, CIRM, Marseille, France, January (contributed talk).
Recent advances in mathematical diffraction theory German Physical Society (DPG) Spring Meeting, Regensburg, Germany, March (invited topical talk).
Diffraction of the squiral tiling, Mini-Symposium Dynamical Systems, Bielefeld, Germany (25 April) (Invited talk).
Recent advances in mathematical diffraction theory, SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, USA, June (invited talk).
Recent progress in mathematical diffraction, 12th International Conference on Quasicrystals ICQ12, Kraków, Poland, September (invited tutorial).

Michael Hall (see also Barbara Allen’s entry)
Mindfulness in the primary mathematics classroom (1 session of 90 minutes), Mindfulness conference –hosted by Forest School, Redbridge, for Preparatory Schools in England, May.
How far can you go with two digits? (1 session of 90 minutes) Norfolk mathematics Conference 2013: Infinity and Beyond – for Norfolk primary and secondary mathematics teachers, December.

Tim Lowe
Contemporary challenges for the delivery of undergraduate courses, HEA workshop at the British Mathematical Colloquium, Sheffield, April.

Dave Marti-Pete
Annular itineraries, Topological and Combinatorial Problems in One-dimensional Complex Dynamics. Pisa, Italy, October.
Annular itineraries, Workshop on Holomorphic Dynamics, Holbæk, Denmark, October.
Escaping points of transcendental functions Meeting: Graduate Student Meeting of the London Mathematical Society. CIPR, Russell Square, London. December.
Fast escaping points of holomorphic self-map, Complex Dynamics Working Seminar of the UB. Universitat de Barcelona, Barcelona (Spain), December.
A brief introduction to complex dynamics and how to produce nice pictures Meeting: Postgraduate Student Day of the Maths & Stats dept. of the OU Open University, Milton Keynes, December.

John Osborne
Connectedness properties of the set K(f) where the iterates of an entire function f are bounded, The Role of Complex Analysis in Complex Dynamics, ICMS, Edinburgh, May.

Phil Rippon
Applications of harmonic functions in complex dynamics, The Role of Complex Analysis in Complex Dynamics, ICMS, Edinburgh May.
Annular itineraries of entire functions, Topological and Combinatorial Problems in One-dimensional Complex Dynamics, Pisa, October.

Ian Short
On a conjecture of Lorentzen and Ruscheweyh, Complex Analysis and Approximation – A conference in honour of Anthony G. O'Farrell, June.

Jozef Širáň
Large vertex-transitive graphs of diameter two and given degree from finite projective planes, 7th Czech and Slovak Symposium in Graph Theory, July.
How symmetric can maps on surfaces be? British Combinatorial Conference, Royal Holloway, July (invited plenary lecture).
Regular maps on non-orientable surfaces, Geometric and Topological Graph Theory Workshop, Banff, Canada, October.
Regular maps on a given surface, 25th International Workshop in Topological Graph Theory, Yokohama, November (Invited plenary lecture).
Dave Sixsmith
The size of the Julia set of some families of functions outside the Eremenko-Lyubich class, The Role of Complex Analysis in Complex Dynamics, ICMS, Edinburgh May.

Gwyneth Stallard
Escaping to infinity, Two-day Women in Mathematics meeting at the Isaac Newton Institute, Cambridge, April.
Applications of the hyperbolic metric in complex dynamics, The Role of Complex Analysis in Complex Dynamics, ICMS, Edinburgh May.
Quite fast escaping points of transcendental entire functions, Topological and Combinatorial Problems in One-dimensional Complex Dynamics, Pisa, Italy, October.

Mairi Walker
Henry Roy Brahana and his Classification of Regular Maps. BSHM Research in Progress, Queen’s College, Oxford March.
Rosen’s solution to the word problem for Hecke groups. Postgraduate Group Theory conference, Manchester University July.
Poster entitled Geodesic Rosen Continued Fractions at Women in Mathematics event 18–19 April.

Bridget Webb
Bachelors, monogamists and the Delta lemma International Workshop on Finite Fields Constructions of Combinatorial Arrays, Florianópolis, Brazil, April 21-27 (Invited plenary lecture).
Infinite designs - a quick tour, Combinatorics, Algebra, and More, A Conference in Celebration of Peter Cameron, Queen Mary, University of London, 8-10 July (Invited plenary lecture).

Michael Wilkinson
A test-tube model for rainfall, Interacting Particle Models in the Physical, Biological and Social Sciences, Warwick, April (invited speaker).
Non-collisional models for rainfall, SIAM conference on Applications of Dynamical Systems, Snowbird, May (invited speaker).
Spectral dimension of inertial particles in turbulence, European Turbulence Conference 14, ENS-Lyon, September (contributed talk).
A test-tube model for rainfall, Particle Mediated Geophysical Flows, KITP, Santa Barbara, October (invited workshop participant).

Invited seminars and talks given

June Barrow-Green
“A Woman can win the victory, though she may not wear the wreath”: women and mathematics in late 19th century Cambridge. Florence Nightingale Day, Lancaster University.
George Birkhoff and the Development of Dynamical Systems Theory Imperial College, London.

Nick Gill
Quasirandom group actions, Imperial College, London.
The width of a finite simple group, Birkbeck College, University of London
Normal approximate group, University of Southampton.

Uwe Grimm
Singular continuous diffraction of the squiral tiling, Ergodic Theory & Dynamical Systems seminar, University of Warwick, April.
What is aperiodic order? Loughborough, December.
Nicholas Korpelainen
*Boundary classes of graphs*, University of Florida, USA, March.

Dave Sixsmith
*The size of the Julia set of functions outside the Eremenko-Lyubich class*, University of Warwick, November and University of Nottingham, December.

Jozef Širáň
*Regular maps 1: Theory and construction*, Ben Gurion University of the Negev, Israel, October.
*Regular maps 2: Classification*, Ben Gurion University of the Negev, Israel, November.
*Regular maps, a brief survey*, Bar Ilan University, Israel, November.

Michael Wilkinson
*Two universalities in semiconductor physics*, UCL, April.
*Two universalities in semiconductor physics*, University of Birmingham, June.
*A test-tube model for rainfall*, University of Bristol, October.

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Other seminars and talks given

Matthew Jacques and David Bevan
Research talks to undergraduates at Cambridge University, November.

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Editorial roles

June Barrow-Green
AMS History of Mathematics book series (Editorial Board member)
Historia Mathematica (Associate Editor)

Jeremy Gray
Archive for History of Exact Sciences (Joint Editor-in-Chief)
Science Networks (Editorial Board member)
Archimedes, New Studies in the History of Science and Technology (Editorial Board member)

Ian Short
Bulletin of the Irish Mathematical Society (Editorial Board member)

Jozef Širáň
Journal of Combinatorial theory Series B (Editorial Board member)
Acta Mathematica Contemporanea (Editorial Board member)
Australasian Journal of Combinatorics (Editorial Board member)
Mathematica Slovaca (Editorial Board member)
Acta Mathematica Universitatis Comenianae (Editorial Board member)

Gwyneth Stallard
Proceedings of the Edinburgh Mathematical Society (Subject Editor)
Major Grants awarded

Michael Hall
£58,000 from the London Schools Excellence Fund phase two funding, for a 5-term project working with NRICH at Cambridge University and a group of 20 primary schools in London. Focus of the project is development of mathematical subject knowledge and pedagogic knowledge. Potential for research into effective CPD and mathematical knowledge in teaching

Gwyneth Stallard and Phil Rippon
£224,007 awarded by the EPSRC to fund joint research (0.5 FTE each for two years) on the project “Baker's conjecture and Eremenko's conjecture: new directions”

Other Activities

Barbara Allen
Member of the Outer Circle of Advisory Committee for Mathematics Education

June Barrow-Green
Librarian for the London Mathematical Society

Katie Chicot
Member of British Science Association, Mathematics Committee: member of organising committee
Member of UKMT Council and Board of Directors, Chair of nominations committee.
Invited speaker at UKMT Mathematical Circles ‘Cipher challenge’

Rosanna Cretney
Co-organiser of BSHM Research in Progress: one-day meeting at The Queen's College, Oxford

Nick Gill
Webmaster and associate member of the European Mathematical Society Committee for Developing Countries

Uwe Grimm
Co-organiser of Workshop on Combinatorial Physics http://mathsevents.cf.ac.uk/combphys2013/
Cardiff University, 17-19 December.

Michael Hall
Trustee and member of General Council of the ATM
Member of the ATM and MA primary mathematics working group
Member of Royal Society STEM Vision meeting

David Marti Pete
Mentor for the UK Mathematics Trust Senior Mentoring Scheme

Phil Rippon
BMC Scientific Committee

Gwyneth Stallard
Chair of the LMS Women in Mathematics Committee
Member of the LMS Good Practice Scheme Steering Group
LMS representative on the Athena Forum
Elected Fellow of the IMA (by invitation of its Council)
Co-organiser of two day "Women in Mathematics" meeting at the INI in Cambridge in April.

Robin Wilson
President of the British Society for the History of Mathematics.
Honorary Fellow of Gresham College, London.
Appointed Visiting Professor of Mathematics, London School of Economics, from 2013–16.

Michael Wilkinson
Ornstein-Uhlenbeck processes: spherical, triangular and anomalous, Dynamics Days Europe 2013, Madrid, June (minisymposium organiser, speaker)

Bridget Webb
Elected committee member of the British Combinatorial Committee.

Edited by Ben Mestel, February 2014.
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