



# School of Mathematics Newsletter

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## Farewell Kay

by SIMON GOODWIN AND CHRIS PARKER

Kay Magaard was part of our School for about ten years. He is world-renowned for major advances in finite group theory and group representations, most famously, the solution of the Guralnick-Thompson conjecture about composition factors of monodromy groups, and his contributions to the research in the algebra group will be missed. A testament to Kay's enthusiasm and breadth in mathematics is that during his years with us, he has worked on joint research projects with most members of the algebra group. In collaboration with Chris and Ben Fairbairn significant progress was made on the theory of Beauville groups with a resolution of the Bauer, Catanese and Grunewald conjecture. His work with Sergey and Adam James, "The lift invariant distinguishes components of Hurwitz spaces for  $A_5$ ", won the paper of the month award and appeared in the Proceedings of the AMS in 2015. His work with Simon, Tung Le and Alessandro Paolini focused on the representation theory of Sylow subgroups of Chevalley groups. In a joint project with Hoff, Bob Guralnick and Dan Frohardt, he is working towards a full classification of small genus covers of the projective line.

*The School of Mathematics wishes to thank Kay for all his contributions to the University over the last 10 years and wishes him the very best of luck with his future endeavours!*

## New staff

Dr John Meyer was appointed as a lecturer in the School of Mathematics in June. John's research interests are in applied analysis of nonlinear PDEs. In particular, he is interested in maximum principles for solutions to differential inequalities, dynamical systems, optimal regularity theory for solutions to boundary value problems for PDEs, and well-posedness of boundary value problems for nonlinear PDEs.

Dr Yuzhao Wang joined the School of Mathematics in September as a Lecturer. Yuzhao's primary research area is mathematical analysis of nonlinear dispersive partial differential equations (PDEs), with tools from harmonic analysis, probability theory, and dynamical systems. In particular, he is interested in Strichartz estimates and its applications to dispersive nonlinear PDEs, probabilistic aspects of nonlinear dispersive PDEs, and the normal form method applied to nonlinear dispersive PDEs.



*The Jinan team*

Dr Robert Leek joined Birmingham in August as part of the Jinan flying faculty. His background is in general topology, specifically on convergence properties (such as radiality and

Fréchet-Urysohn) and structures that characterise these. Recently, Robert has begun transitioning to topological dynamics and will be working with Professor Chris Good on induced dynamical systems and non-metrisable systems. He also has interests in logic, infinite combinatorics, and surreal numbers.

Dr Sam Johnson was born in Seville and studied physics at the University of Granada, where he completed his PhD in 2011. He has since worked as a postdoc at Oxford, a Marie Curie research fellow at Imperial College, and a lecturer at Warwick, before moving to Birmingham as a lecturer in August. Sam's research is in complex systems, with a focus on the relationship between structure and dynamics, and draws from quite disparate fields – such as statistical physics, graph theory, and agent-based modelling. While studying food webs – networks of who eats whom in an ecosystem – Sam discovered a topological property of directed networks called 'trophic coherence' (see Wikipedia: Trophic Coherence). Together with various colleagues he has since shown that this property is important for many aspects of complex, dynamical systems. Sam is currently studying how network science can be applied to car electronics, why the neural network of the brain develops as it does, and how war and peace depend on geography.



*Dr Fabian Spill*

Dr Fabian Spill is a new lecturer in the mathematical biology group. He is interested in both the development of novel mathematical and computational methods to investigate multiscale problems in biology, and in the application of such methods to solve relevant biological problems. Some of his recent work has focused on the influence of mechanics and geom-

etry on the molecular state of cells, which thus ultimately changes the behaviour of the cells. Moreover, he has been developing stochastic multiscale methods to investigate how noise on a small scale can change macroscopic.

Dr Feng Xu joined the Numerical Analysis group in June as a Research Fellow, working with Alex Bespalov. In his current project he is developing adaptive stochastic finite element algorithms for partial differential equations with random inputs. Prior to this project, he also carried out research in hydrodynamics and biofluid dynamics. His research aim is to analyse mathematical models from the real world by using a combination of analytical analysis and numerical simulation.

Dr Michelle Delcourt joined the Combinatorics group in September as a Research Fellow. Delcourt's main area of expertise is using probabilistic techniques to solve problems from extremal and structural graph theory. Working with Will Perkins, she currently is using approaches motivated from statistical physics to study graph coloring questions. She earned her PhD in May 2017 from the University of Illinois, under the direction of József Balogh.



*Dr Ethan Liu*

Dr Zhengliang Liu (a.k.a Ethan) joined the maths department in June as a Research Fellow working with Sergey Sergeev. He received his PhD from Lancaster University in 2016 specialising in multi-objective optimisation. Namely, he looked into the problem of optimising over the Pareto set of a multi-objective optimisation problem. This problem is closely related to bilevel programming and game theory. Ethan's research interests includes theoretical and algorithmic aspects of multi-objective optimisation and bilevel programming problems.



*Dr Sam Johnson, Dr Michelle Delcourt and Dr Feng Xu*

## Outreach in Mathematics

by ELEANOR MESTEL

Staff from the School have been involved in a wide variety of Outreach and Public Engagement events over the spring and summer. These events contribute to the perception of Birmingham as a centre of excellence for interesting mathematical research and, by extension, an outstanding place to study. They are part of the ongoing outreach that has had such a positive effect on our recruitment and admissions, as well as being worthwhile public engagement. Thank you to all who have contributed in the last few years.

The Birmingham Popular Mathematics Lectures are once a month throughout the autumn and spring terms. Over the last few years, these have grown so that we now regularly attract over 100 attendees from local schools, families, and the general public, as well as the university. On the 20th September, this year's LMS popular lectures began the 2017/18 series, with 220 people attending. The Popular Maths Lecture series will continue once a month on Wednesday evenings in the Watson Building (Lecture Theatre A), starting at 7pm (note earlier timing). On 18th October, Dr Peter Neumann will be asking, "Did Galois deserve to be shot?". On 29th November, Professor Paul Flavell will be doing a repeat of his Inaugural lecture, "Numbers". The details of the upcoming lectures are online: [www.birmingham.ac.uk/bpml](http://www.birmingham.ac.uk/bpml).

Staff from the department have been involved in a wide variety of outreach events, trips to schools, and campus visits aimed at under-18s. In March, our largest maths event, the Maths Big Quiz, ran with 324 14-15 year olds attending from 30 local

schools, and some staff ran centrally organised masterclasses. Thank you to Dr Sara Jabbari and Dr Rosemary Dyson for their help. In June, the busiest time of year for these events, Dr Chris Good gave a workshop "Harry Potter and the Mathematicians" for the EPS Discovery Day, and we ran the Mathematics Taster Day for 77 students thinking about studying mathematics at university. Of those students, 22 spent the whole week at the University in Work Experience Week, run jointly by Professor Dave Smith here in maths, and others in computer science.

A full list of our mathematics-specific Outreach events can be found on the outreach webpage. I keep a list of any outreach or public engagement done in the School, so please keep me updated about any outreach you do which is not organised by me. This year's events should run again next year, and if you are interested in getting involved, giving a popular lecture or a workshop, or know someone who might be, please do let me know. I am always looking for more help with outreach events, and am very happy to talk about your outreach and public engagement ideas, just send me an email ([liaison@maths.bham.ac.uk](mailto:liaison@maths.bham.ac.uk)) or see me in Room 218 in the Watson Building.

## News in Brief

- From August 5th to 13th the School of Mathematics hosted the international conference 'Groups St Andrews'. Organised by Chris Parker, the conference was a huge success with more than 200 participants. The principal speakers were: Michael Aschbacher (Caltech); Pierre-Emmanuel Caprace (Univer-

sité Catholique de Louvain); Radha Kessar (City, University of London); and Gunter Malle (TU Kaiserslautern). Further one-hour invited talks were given by: Tim Burness (University of Bristol); Vincent Guirardel (Université de Rennes 1); Harald Helfgott (University of Göttingen); Andrei Jaikin-Zapirain (Universidad Autónoma de Madrid); and Donna Testerman (École Polytechnique Fédérale de Lausanne).

In addition to the plenary lectures there were contributed talks by over 100 of the attendees. Hoff and Sergey led a trip to Stratford-upon-Avon for the excursion while Chris took about 70 people to Warwick Castle. There was also a trip to the Two Towers brewery.

- A 2-day workshop entitled ‘Interactions with Combinatorics’ was held on 29-30 June 2017 at University of Birmingham. The aim of the workshop was to explore the interactions between Combinatorics and other mathematical fields; focusing both on how recent techniques in Combinatorics have been applied to other areas of Mathematics and conversely, how tools from other areas can be applied in Combinatorics. The event was attended by more than 50 mathematicians. Most attendees were from UK universities but we attracted a number of international researchers (e.g. from the USA, Spain, China, Ireland, South Korea, Australia and Mexico!).

More details of the event can be found on the workshop’s webpage.

- The Sixth IMA Conference on Numerical Linear Algebra and Optimization will be held here in the School of Mathematics, 27-29 June 2018. The event is co-chaired by Michal Kočvara and Daniel Loghin. The invited speakers are: Amir Beck (Technion Haifa); Julian Hall (University of Edinburgh); Misha Kilmer (Tufts University); Dominique Orban (Polytechnique Montréal); Alison Ramage (University of Strathclyde); Françoise Tisseur (University of Manchester); Luis Nunes Vicente (University of Coimbra); and Steve Wright (University of Wisconsin). More details about the event can be found here.
- From 29 July to 2 August 2019, the School of Mathematics will host the 27th British Com-

binatorial Conference. This conference series has been running since 1969 and is the main international combinatorics conference held in the UK. The organisers are Allan Lo, Richard Mycroft, Guillem Perarnau and Andrew Treglown. The invited speakers are: Penny Haxell (Waterloo); Michael Krivelevich (Tel Aviv); Dan Král’ (Warwick); Kristin Lauter (Microsoft Research and University of Washington); Hendrik van Maldeghem (Ghent); Iain Moffatt (Royal Holloway); Igor Pak (UCLA); Daniel Paulusma (Durham); and Gábor Tardos (Simon Fraser and Rényi Institute).

- Sara Jabbari recently received an MRC Proximity to Discovery award so that she and research fellow Paul Roberts can travel to the USA to meet a company called Ironclad Biosciences who are interested in using mathematical modelling to inform the development of novel antibacterials.
- The inaugural lecture series will continue on the afternoon of November 8th. Recently appointed staff will give seminars on their research, followed by dinner at the White Swan in Edgbaston. Chris Parker will send out more details in due course.
- A reminder that the College of Engineering and Physical Sciences welcomes entries for the ‘paper of the month’ award. Anyone interested in submitting a paper for this award should contact Chris Parker. Prize winners will receive 1000 pounds towards research expenditure. Recent winners of this award include Peter Butkovic, Rosemary Dyson, Daniela Kühn, Allan Lo, John Meyer, Deryk Osthus, David Needham and Andrew Treglown.
- The next Mathematics Colloquium will be given by Professor Marta Mazzocco (Loughborough) on Wednesday 25th October (4pm in Lecture Room A of the Watson Building). Her research interests lie in the area of Integrable Systems, specialising in monodromy preserving deformations of linear systems, Poisson algebras and their quantisation.
- The School of Mathematics has money available to partially support staff in organising research conferences and workshops. Please

contact your head of group if you are interested in this.

- The College Research Travel fund is continuing this year, on the same basis as before. That is, there is up to 1000 pounds per academic in the financial year. Money can be spent on travel related to research (and could also pay for visitors to come here). Requests should be directed to the School Operations Manager,

Anna Jenkin.

- Congratulations to the following students who have passed their PhD vivas recently: David Beltran; Valentina Grazian; Craig Holloway; Daniel Jones; Wei En Tan; Brain Taylor; Cristina Villanueva Segovia; and Guohan Zhang. The School wishes them well for their future careers!



*Groups St Andrews in Birmingham 2017*