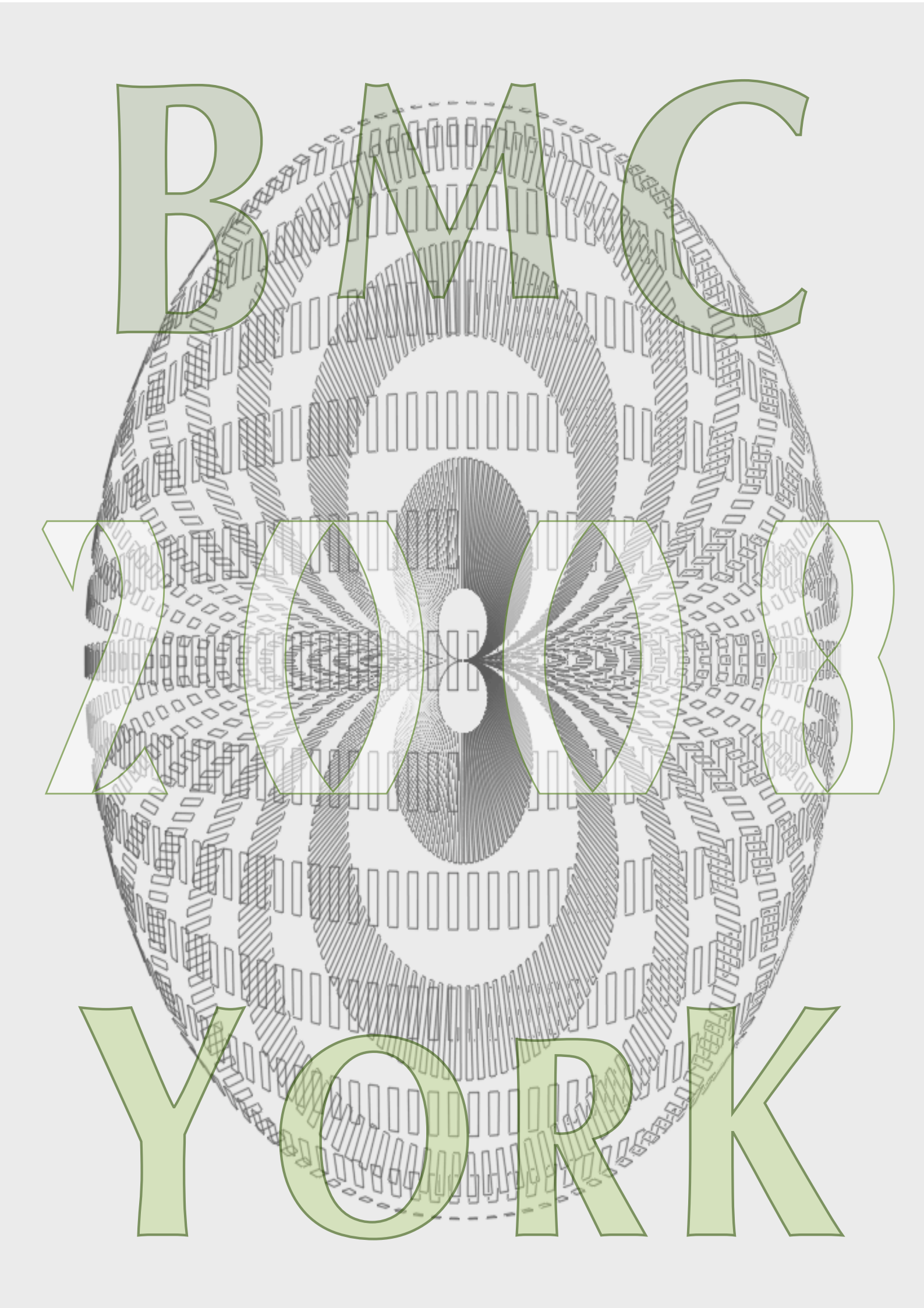
BMC
2008
YORK

BMC 2008

60th British Mathematical Colloquium

25-28 March 2008

Organised by the **DEPARTMENT OF MATHEMATICS**

Hosted by the ***National Science Learning Centre***

THE UNIVERSITY *of York*

Supported by:

London Mathematical Society

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Edinburgh Mathematical Society

Department of Mathematics, University of York

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BMC 1970 Programme (extract) .....

Welcome

The York Department of Mathematics extends a warm welcome to participants in the 60^{th} British Mathematical Colloquium. The programme follows the pattern established by recent Colloquia. Within it, we have been able to provide an exciting range of mathematical talks. But the BMC offers more than lectures on mathematics: there are opportunities to discuss its place in today's complex world, the problems it faces and the answers it provides. In this regard, the interest in the BMC has been encouraging, and accommodating all the requests for slots challenging. The programme is thus a full one and includes:

Two Special Lectures. Chris Budd is giving a highly relevant Public Lecture, and in his History of Mathematics Lecture, Edmund Roberston will speak on the history of the Edinburgh Mathematical Society, one of our sponsors.

Three Special Sessions. Differential Geometry and Geometric Analysis, Number Theory, Stochastic PDEs and Stochastic Analysis.

Four Special Events. A video interview with Walter Ledermann, a discussion forum on the future of the IMA and the LMS, a presentation on the Isaac Newton Institute, and an MSOR Session.

This year's BMC is flanked by a Postgraduate Conference and a Satellite Meeting of the North British Functional Analysis Seminar on Tuesday, and by a Semigroup Satellite Seminar on the Friday afternoon. The Postgraduate Conference gives mathematics PhD students the chance to hear each other speak, display posters and to make useful contacts.

The 2008 BMC is being held at York's new National Science Learning Centre, a thoroughly up-to-date building with very modern facilities which have been something of a revelation to the Organising Committee. We are pleased to have such a modern and attractive venue, and hope that Mathematics will have a permanent place in the Centre's future activities.

The BMC was last held in York in 1970, and the overall structure this year is surprisingly similar. In 1970 there were three overseas plenary speakers, but the number of UK-based Morning Speakers and Splinter Groups remains much the same. However the range of additional activities, listed above, has increased. The registration fee has gone up 50 fold — in 1970 it was just £1 — dinner then was 12/6d (62.5p), and day visitors were charged 25/- (£1.25); and campus parking was free! For interest, part of the 1970 colloquium programme has been included in this booklet; the absence of computers is evident!

The Department at York has always included Pure Mathematics, Mathematical Physics, and Statistics. In 1970, it numbered 13 faculty, with about 100 students; now it numbers 42, with over 650 students! Research has flourished and grown in scope, extending recently to Stochastic Analysis, Continuum Mechanics, Mathematical Biology, and Financial Mathematics.

We are very grateful to the London Mathematical Society, the Edinburgh Mathematical Society, EPSRC, ConfOnline and our Department for financial support. Christine Cockett and Mark Preston have provided invaluable assistance, ably supported by Sue Adams and Cathy Moore, and our colleagues. The university's portering, audio-visual and catering staff deserve special thanks. We would also like to thank our Vice-Chancellor Brian Cantor for his support for the BMC and the Reception (in the VC's absence, we are particularly grateful to Deputy Vice Chancellor Trevor Sheldon), and the Conference Office, which excelled itself.

We very much hope that you will enjoy BMC 2008 in York: meet old friends, make new ones, have the chance to talk mathematics and find out what's going on here and abroad, and pick up some interesting books in congenial and comfortable surroundings.

And finally we wish the BMC Many Happy Returns on its 60^{th} anniversary.

The BMC 2008 Organising Committee:

Maurice Dodson, Steve Donkin, Tony Sudbery, Chris Wood.

BMC 2008 PROGRAMME

Tuesday, March 25

09:00–13:00 **Postgraduate Conference** ..... NSLC Lecture Theatre 2

10:00–19:00 **Registration** ..... NSLC Main Entrance

11:00–11:30 **Coffee/Tea** ..... NSLC

12:15–14:45 **North British Functional Analysis Seminar** ..... CA101, Chemistry

13:00 **Lunch (for postgraduates & NBFAS delegates)** ..... NSLC

15:00–16:00 **Plenary Lecture 1** ..... NSLC Lecture Theatre
Forty years ago in Cambridge.
Hugh Montgomery (Ann Arbor)
Chair: Maurice Dodson (York)

16:00–16:30 **Tea/Coffee** ..... NSLC

16:30–17:30 **History of Mathematics Lecture** ..... NSLC Lecture Theatre
The Edinburgh Mathematical Society: the first fifty years (1883-1933).
Edmund Robertson (St Andrews)
Chair: Tony Mann (Greenwich)

17:40–18:40 **Public Lecture** ..... NSLC Lecture Theatre
Confessions of an Industrial Mathematician.
Chris Budd (Bath)
Chair: Chris Wood (York)

18:45–20:00 **Anniversary Reception** ..... NSLC Lower Atrium

20:00 **Dinner** ..... Vanbrugh College Dining Room

20:00–23:00 **Colloquium Bar** ..... Vanbrugh College Bar

Wednesday, March 26

09:00–10:00 **Morning Talk 1** ..... NSLC Lecture Theatre 1
Diagram algebras and Lie theory.
Anton Cox (City)

09:00–10:00 **Morning Talk 2** ..... NSLC Lecture Theatre 2
Periodic travelling waves in field vole populations.
Jonathan Sherratt (Heriot-Watt)

10:00–11:00 **Morning Talk 3** ..... NSLC Lecture Theatre 1
Highest weight theory for finite W-algebras.
Simon Goodwin (Birmingham)

10:00–11:00 **Morning Talk 4** ..... NSLC Lecture Theatre 2
Spectral problems and the Bethe Ansatz.
Patrick Dorey (Durham)

11:00–11:30 **Coffee/Tea** ..... NSLC

11:30–12:00 **Special Event 1** ..... NSLC Lecture Theatre
An Interview with Walter Ledermann
Recorded to mark the occasion of Walter's 97th birthday.
Chair: Charles Goldie (Sussex)

12:00–13:00 **Plenary Lecture 2** ..... NSLC Lecture Theatre
Quantum groups: introducing q into Lie theory.
Tony Joseph (Weizmann Institute)
Chair: Steve Donkin (York)

13:00–14:00 **Lunch** ..... NSLC

14:00–17:30 **Special Session 1** ..... NSLC Lecture Theatre 1
Number Theory

14:00 *42.*
Brian Conrey (AIM)

15:00 *On the decimal expansion of an algebraic number.*
Yann Bugeaud (Strasbourg)

16:30 *Waring's problem in function fields.*
Trevor Wooley (Bristol)

14:00–17:30 **Special Session 2** ..... NSLC Lecture Theatre 2
Differential Geometry & Geometric Analysis

14:00 *Covariant Hamiltonian description of relativistic fields and the construction of observable quantities.*
Frédéric Hélein (Paris 7)

15:00 *G_2 manifolds with isolated conical singularities.*
Spiro Karigiannis (Oxford)

16:30 *Harmonic maps between complete, noncompact negatively curved manifolds.*
Mario Micallef (Warwick)

14:00–17:30 **Splinter Groups** ..... Alcuin East Wing, Langwith College

Semigroups 1 L002	Mathematical Biology L036	Topology* AEW105
Stochastic Analysis L037	Groups* L047	History of Mathematics* L049
Logic* AEW106	Functional Analysis* AEW104	

16:00–16:30 **Tea/Coffee** ..... NSLC, Derwent College

16:30–17:30 **Special Sessions 1 & 2, Splinter Groups (Cont.)**

18:00–19:00 **BMC Annual General Meeting** ..... NSLC Lecture Theatre

19:00 **Dinner** ..... Vanbrugh College Dining Room

20:15–22:00 **Special Event 2** ..... NSLC Lecture Theatre
Discussion Forum
The future of the IMA and the LMS.
Chair: Brian Davies (LMS President)

18:00–23:00 **Colloquium Bar** ..... NSLC Charm Bar

Thursday, March 27

09:00–10:00 **Morning Talk 5** ..... NSLC Lecture Theatre 1
Discrete analogues in harmonic analysis.
Jim Wright (Edinburgh)

09:00–10:00 **Morning Talk 6** ..... NSLC Lecture Theatre 2
Reduction of binary forms over imaginary quadratic fields.
John Cremona (Warwick)

10:00–11:00 **Morning Talk 7** ..... NSLC Lecture Theatre 1
The dynamics of piecewise isometries.
Franco Vivaldi (Queen Mary)

10:00–11:00 **Morning Talk 8** ..... NSLC Lecture Theatre 2
Recent applications of random matrix theory to number theory.
Nina Snaith (Bristol)

11:00–11:30 **Coffee/Tea** ..... NSLC

11:30–12:00 **Special Event 3** ..... NSLC Lecture Theatre
Isaac Newton Institute Presentation
Sir David Wallace (INI Director)

12:00–13:00 **Plenary Lecture 3** ..... NSLC Lecture Theatre
Conformal invariance of lattice models.
Stanislav Smirnov (Geneva)
Chair: Tony Sudbery (York)

13:00–14:00 **Lunch** ..... NSLC

14:00–17:30 **Special Session 3** ..... NSLC Lecture Theatre 1
Stochastic PDEs & Stochastic Analysis

14:00 *Some recent results concerning the 3D Navier-Stokes equations driven by a random force.*
Marco Romito (Firenze)

15:00 *Brownian motion of Jordan curves and stochastic calculus on the diffeomorphism group of the circle.*
Anton Thalmeier (Luxembourg)

16:30 *On the Divine Clockwork and stochastic mechanics.*
Aubrey Truman (Swansea)

14:00–17:30 **Splinter Groups** ..... Alcuin East Wing, Langwith College

Semigroups 2 L002	Algebras* AEW104	Geometry AEW105
Number Theory L036	Mathematical Physics* L047	Random Matrices L037
Dynamical Systems AEW106		

16:00–16:30 **Tea/Coffee** ..... NSLC, Derwent College

16:30–17:30 **Special Session 3, Splinter Groups (Cont.)**

17:40–19:00 **Special Event 4** ..... NSLC Lecture Theatre 2
MSOR Network, Presentation and Interactive Session
Teaching & learning mathematics in higher education: what are the challenges we face?
Chair: Michael Grove & Joe Kyle (Birmingham)

19:00–23:00 **Colloquium Bar** ..... Galleria Bar, Roger Kirk Centre, Goodricke College

19:30 **Colloquium Dinner** ..... Roger Kirk Centre, Goodricke College

Friday, March 28

09:00–10:00 **Morning Talk 9** ..... NSLC Lecture Theatre 1
Algebras and communications.
Ted Hurley (Galway)

09:00–10:00 **Morning Talk 10** ..... NSLC Lecture Theatre 2
Hunting Lagrangian submanifolds.
Ivan Smith (Cambridge)

10:00–11:00 **Morning Talk 11** ..... NSLC Lecture Theatre 1
Some stochastic reaction diffusion models.
Roger Tribe (Warwick)

10:00–11:00 **Morning Talk 12** ..... NSLC Lecture Theatre 2
Mumford conjecture, Pontryagin-Thom construction and sheaf theoretic methods.
Michael Weiss (Aberdeen)

11:00–11:30 **Coffee/Tea** ..... NSLC

11:30–12:30 **Plenary Lecture 4** ..... NSLC Lecture Theatre
Dynamics and the geometry of numbers.
Akshay Venkatesh (Courant Institute)
Chair: Sanju Velani (York)

12:40 **Lunch** ..... NSLC

13:15 **BMC Scientific Committee Meeting** ..... NSLC Teaching Room 3

14:00–16:00 **Semigroup Satellite Seminar** ..... L002, Langwith College

16:00–16:30 **Tea/Coffee** ..... Langwith College

Special Events

Special Event 1 ..... Wednesday, 11:30 –12:00, NSLC Lecture Theatre

An Interview with Walter Ledermann
Recorded to mark the occasion of Walter's 97th birthday.

Outline. This, the 60th British Mathematical Colloquium, follows in unbroken succession from the first, in Manchester in 1949. For that first BMC the local organiser was Walter Ledermann. Now aged 97 and an Emeritus Professor of the University of Sussex, Walter had by that time achieved early distinction in algebra and number theory, and as an expositor and teacher of mathematics. In this interview, recorded last November, Walter talks about the early BMCs and their antecedents in the St Andrews Colloquia of 1934 and 1938, both of which he attended. He goes on to describe his early life as a refugee student at St Andrews, and the beginning of his career.

Special Event 2 ..... Wednesday, 20:15 –22:00, NSLC Lecture Theatre

Discussion Forum
The future of the IMA and the LMS.
Brian Davies (Kings College London, LMS President)

Outline. The LMS and IMA are in the process of exploring a model for a single society that, if implemented, would replace the London Mathematical Society and the Institute of Mathematics and its Applications. The two Councils will be giving preliminary consideration to the report of the group examining the model in March. Brian Davies will be talking about the model and the process by which the two societies are planning to involve the memberships in the consideration of the next steps. This will be followed by an open discussion, where members will have the opportunity to air their views and provide feedback.

Special Event 3 ..... Thursday, 11:30 –12:00, NSLC Lecture Theatre

Isaac Newton Institute Presentation
Sir David Wallace (INI Director)

Outline. The Isaac Newton Institute runs themed research programmes of one, four and six months' duration on behalf of the mathematical sciences community. In this talk David Wallace, who was appointed as Director in 2006, will give an overview of planned activities at the Institute, and outline how it operates in terms of selecting programmes, supporting participants and interacting with the community.

Special Event 4 ..... Thursday, 17:40 –19:00, NSLC Lecture Theatre 2

MSOR Network, Presentation and Interactive Session
Teaching & learning mathematics in higher education: what are the challenges we face?
Michael Grove & Joe Kyle (University of Birmingham)

Outline. Teaching and learning within higher education is undergoing a period of change. There is a requirement that all new teaching members of staff must undertake formal training, and the National Student Survey now provides students with an opportunity to make their opinions on their higher education student experience known at a national level. However, issues still exist with the mathematical preparedness of students as they commence undergraduate programmes, and the UK skills agenda is now a priority at the highest level which may have future implications for higher education.

The purpose of this session will be to explore some of the current issues facing those who are involved in the teaching of mathematics at HE level, be they postgraduate students, new academic members of staff, research assistants, or more experienced members of staff. The session will consist of presentations and demonstrations of the types of support available to address some of the current issues, but it is also intended to be interactive and participants are encouraged to contribute freely to the discussions that will take place.

Exhibitions

The NSLC Lower Atrium will be used as an exhibition area.

Throughout the Colloquium, there will be displays of the latest and most popular titles (and opportunities to purchase them at special BMC prices) from leading mathematical publishers, including:

Birkhäuser;
Cambridge University Press;
London Mathematical Society;
Oxford University Press;
Springer.

Liverpool Mathematical Society Funmaths Roadshow ..... Tuesday, March 25

An exhibition of interactive materials, for young mathematicians.

Ian Porteous (University of Liverpool), assisted by Jon Tims (University of Cambridge)

The Roadshow was originally created to celebrate the centenary of the Liverpool Mathematical Society in 1999, and now comprises 300 interactive problems, each set out on an A3 baseboard, with material appropriate for use with all school years from Y3 to Y13, with Y2 material in draft. Typically one has from 50 to 60 of the activities set out on 30 tables, randomly in a hall, no chairs, and for 75 minutes anything from 30 to 75 youngsters tackle the problems, working in pairs. Our philosophy is that you don't walk away from difficulties, but rather face up to challenges, and in this game help is always at hand, and success guaranteed. There are no prizes for doing the most. Our aim is to empower all the youngsters, whatever their ability, and make them hungry for more, and in this we have some success. Ideally one has older children assisting the work with the younger children, and they receive special certificates. Everything is on a CD, priced at £20, and there are translations of much of the material into Welsh, Scots Gaelic, French and Spanish. Currently there are trials in Portuguese and Mandarin Chinese. We will have a few samples on show on the Tuesday only in the exhibitors' area. For more information about the scheme visit: `www.liv.ac.uk/maths/lms/funmaths/`

Plenary Lectures: Titles & Abstracts

Plenary Lecture 1 ..... Tuesday, 15:00 –16:00, NSLC Lecture Theatre

Forty years ago in Cambridge
Hugh Montgomery (University of Michigan, Ann Arbor)

Abstract. When I arrived in Cambridge in 1966, Baker, Cassels, Conway, Davenport, Ingham, and Swinnerton-Dyer were all in peak form, and analytic number theory was moving very quickly, thanks to new ideas that had been introduced by Roth, with further work by Bombieri. It was THE place to be, if you wanted to become a number theorist. It was great, and I was lucky to be there at that precise moment. I'll describe some of the great theorems of that era, such as the large sieve, and Baker's theorem on linear forms in logarithms, and give some complete proofs of elementary results, but my talk will be heavily laced with anecdotes of Conway, Besicovitch, Littlewood, Ingham *et al.*

Plenary Lecture 2 ..... Wednesday, 12:00 –13:00, NSLC Lecture Theatre

Quantum groups: introducing q into Lie theory
Anthony Joseph (Weizmann Institute of Science, Rehovot, Israel)

Abstract. At first, the Drinfeld-Jimbo theory of quantum groups, introduced a little over twenty years ago, seemed to do little more than sprinkle formulæ in the theory of Lie algebras with powers of an indeterminate, popularly designated as q to denote quantum. Yet a host of deep results were subsequently developed, many of which gave new results in the representation theory of the (mainly semisimple) Lie algebras themselves. Some of these will be reviewed.

First, q-differentiation is defined and placed in the context of a skew-derivation. This leads to a hybrid having both the qualities of a Lie group and of a Lie algebra exhibiting Sweedler's example of a Hopf algebra being neither commutative nor cocommutative. Then the Drinfeld double construction yields quantum $\mathfrak{sl}(2)$. Bringing the Cartan matrix into the picture recovers the original Drinfeld-Jimbo quantum groups. Further generalizations and attempted classifications are briefly mentioned.

It is noted that the quantization procedure yields new structure theorems. This casts new light on invariants, even in the classical theory.

Crystallization (or the $q = 0$ limit) is described. It is explained that the resulting combinatorics, particularly the path model, can yield information on tensor product decomposition. Globalization, or defrosting, yields bases (of Lusztig and Kashiwara) with remarkably useful properties. Alternatively, the Littelmann standard monomial bases can be obtained.

Specialization at roots of unity leads to a powerful connection with results in positive characteristic. New developments on this subject are mentioned.

Plenary Lecture 3 ..... Thursday, 12:00 –13:00, NSLC Lecture Theatre

Conformal invariance of lattice models.
Stanislav Smirnov (University of Geneva)

Abstract. It is conjectured that many 2D lattice models of physical phenomena (percolation, Ising model, self avoiding polymers) become invariant under rotations and even conformal maps in the scaling limit (ie. when "viewed from far away"). A well-known example is the Random Walk (invariant only under rotations preserving the lattice), which in the scaling limit converges to the conformally invariant Brownian Motion.

Assuming the conformal invariance conjecture, physicists were able to make a number of striking but unrigorous predictions: eg. dimension of a critical percolation cluster is almost surely 91/48; the

number of simple length N trajectories of a Random Walk is about $N^{11/32} \cdot \mu^N$, with μ depending on a lattice, and so on.

We will discuss the recent progress in mathematical understanding of this area, in particular for the Ising model. Much of the progress is based on combining ideas from probability theory, complex analysis, and combinatorics.

Plenary Lecture 4 ..... Friday, 11:30–12:30, NSLC Lecture Theatre

Dynamics and the geometry of numbers.
Akshay Venkatesh (Courant Institute of Mathematical Sciences, New York University)

Abstract. It was understood by Minkowski that one could prove interesting results in number theory by considering the geometry of lattices in $\mathbb{R}^n$. (A lattice is simply a grid of points.) This technique is called the "geometry of numbers". We now understand much more about analysis and dynamics on the space of all lattices, and this has led to a deeper understanding of classical questions. I will review some of these ideas, with emphasis on the dynamical aspects.

Special Lectures: Titles & Abstracts

History of Mathematics Lecture ..... Tuesday, 16:30–17:30, NSLC Lecture Theatre

The Edinburgh Mathematical Society: the first fifty years (1883-1933).
Edmund Robertson (University of St Andrews)

Abstract. The Edinburgh Mathematical Society was founded in 1883, and for the first 50 years of its existence the majority of its members were schoolteachers. In this talk we will investigate how a Society primarily interested in mathematical research came to be run mainly by schoolteachers. The Society introduced important innovations, such as running the first mathematical colloquia to be held in Britain. However, we will also see how the changing educational scene in Scotland produced tensions within the Society. Strong personalities in the Society argued over the role of the schoolteachers as mathematical research became more specialised.

Public Lecture ..... Tuesday, 17:40–18:40, NSLC Lecture Theatre

Confessions of an Industrial Mathematician.
Chris Budd (University of Bath)

Abstract. The speaker has unusually close and fruitful connections with a wide range of industry (from chocolates to aeroplanes) and has been applying and developing mathematics in industry for many years. The lecture will cover his experiences of working in the industrial world. Amongst amusing incidents and provocative digs at both pure and applied mathematics, he will make some serious points about the relevance and future of mathematics in the 21st century. While there will be some technical mathematics, the lecture will be accessible to the general public.

Morning Lectures: Titles & Abstracts

Morning Lecture 1 ..... Wednesday, 09:00–10:00, NSLC Lecture Theatre 1

Diagram algebras and Lie theory.
Anton Cox (City University)

Abstract. Diagram algebras arise in a number of contexts, including Invariant Theory and Algebraic Statistical Mechanics. Their representation theory has a number of pleasing features, not least the interplay between elementary combinatorial arguments and more sophisticated algebraic techniques. We will introduce various examples of diagram algebras and discuss their (sometimes surprising) relationship with different aspects of Algebraic Lie Theory.

Morning Lecture 2 ..... Wednesday, 09:00–10:00, NSLC Lecture Theatre 2

Periodic travelling waves in field vole populations.
Jonathan Sherratt (Heriot-Watt University)

Abstract. This talk concerns the use of mathematics to understand spatiotemporal patterning in ecology; it is intended for a general mathematical audience. Field voles are a classic example of a cyclic population, meaning that there are large amplitude oscillations in population density, with a period of several years. Recent spatiotemporal data from Kielder Forest (UK) indicate that these oscillations are spatially organised into a specific pattern known as a periodic travelling wave. The pattern is selected from a one-parameter family of waves, and I will discuss established results and some open problems associated with this wave selection mechanism. In some cases the selected wave is actually unstable as a solution of the governing partial differential equations, in which case the long term behaviour is highly disordered spatiotemporal oscillations. I will describe a new method of numerical continuation that enables wave stability to be determined, via computation of the essential spectrum. This enables prediction of whether a given set of parameter values result in regular or disordered behaviour in the long term. I will end by discussing the ecological implications of the work, and the key challenges for future mathematical research.

Morning Lecture 3 ..... Wednesday, 10:00–11:00, NSLC Lecture Theatre 1

Highest weight theory for finite W-algebras.
Simon Goodwin (University of Birmingham)

Abstract. There has been much recent interest in finite W-algebras due to their connections with geometry and representation theory of complex semisimple Lie algebras, and their applications in mathematical physics. In this talk we will discuss these connections and then present an approach due to Brundan and Kleshchev to highest weight representation theory of finite W-algebras.

Morning Lecture 4 ..... Wednesday, 10:00–11:00, NSLC Lecture Theatre 2

Spectral problems and the Bethe Ansatz.
Patrick Dorey (University of Durham)

Abstract. This talk will explain a connection that has emerged in the last few years between spectral problems associated with certain ordinary differential equations, and aspects of quantum integrability related to a technique known as the Bethe ansatz.

Morning Lecture 5 ..... Thursday, 09:00–10:00, NSLC Lecture Theatre 1

Discrete analogues in harmonic analysis.

Jim Wright (University of Edinburgh)

Abstract. Recently, two interesting perspectives are being developed where discrete analogues of problems in harmonic analysis are considered. Roughly, one point of view seeks to model fundamental open problems in euclidean harmonic analysis in the setting of a finite field, successfully highlighting certain combinatorial and algebraic-geometric issues. The other point of view, inspired in part from problems in ergodic theory, seeks to reproduce recent successes from the euclidean setting in the setting of the integers, making the problem more difficult while taking on a distinct number theoretic flavour. In this lecture we argue that a third point of view, a middle road which effectively replaces the underlying real field in the euclidean setting with the ring of integers modulo N has interesting ramifications.

Morning Lecture 6 ..... Thursday, 09:00–10:00, NSLC Lecture Theatre 2

Reduction of binary forms over imaginary quadratic fields.

John Cremona (University of Warwick)

Abstract. We show how the classical theory of reduction of real binary forms with respect to the action of $SL(2,\mathbb{Z})$ may be extended to a reduction theory for binary forms with complex coefficients under the action of certain discrete groups. In particular, we give some explicit results concerning the reduction of binary cubics and quartics with coefficients in the ring of integers of an imaginary quadratic field of class number one (such as $\mathbb{Z}[i]$), and mention applications to the enumeration of cubic fields and two-descent on elliptic curves.

Morning Lecture 7 ..... Thursday, 10:00–11:00, NSLC Lecture Theatre 1

The dynamics of piecewise isometries.

Franco Vivaldi (Queen Mary, University of London)

Abstract. After a long gestation, intermittent progress, and repeated discoveries of the same basic phenomena, the study of piecewise isometries has now blossomed into an active area of research, fuelled by its geometrical appeal and important applications. In this class of dynamical systems the geometry of the phase space is shaped by discontinuity rather than nonlinearity, resulting in strikingly complex behaviour from minimal ingredients. The mathematical theory that begins to emerge combines elements of dynamical systems and ergodic theory, algebraic number theory, fractal geometry, and diophantine approximations. I will survey recent results and open problems.

Morning Lecture 8 ..... Thursday, 10:00–11:00, NSLC Lecture Theatre 2

Recent applications of random matrix theory to number theory.

Nina Snaith (University of Bristol)

Abstract. It has been ten years since it was realised that calculations in random matrix theory could be used to make surprisingly precise predictions for answers to important questions in number theory. This talk will review some of these applications.

Morning Lecture 9 ..... Friday, 09:00–10:00, NSLC Lecture Theatre 1

Algebras and communications.
Ted Hurley (National University of Ireland, Galway)

Abstract. Algebras are fundamental building blocks for many structures in the communications area such as Coding Theory, Cryptography and Signal Processing. Engineers and Computer Scientists have been tinkering at the edge of some basic algebraic structures, without realising it, when indeed they should be learning more abstract algebra. The talk will discuss some of the algebras behind the communications areas and how progress can be made by generalisation.

Morning Lecture 10 ..... Friday, 09:00–10:00, NSLC Lecture Theatre 2

Hunting Lagrangian submanifolds.
Ivan Smith (University of Cambridge)

Abstract. Symplectic topology, originally part of dynamical systems and more recently influenced by mirror symmetry and string theory, is built out of Lagrangian submanifolds, but they're quite hard to find (or to exclude). There has been recent progress on understanding the topology of Lagrangian submanifolds using diverse tools from algebraic topology, real algebraic geometry, homological algebra and elsewhere. We'll try and describe what the problems are and where progress has been coming from.

Morning Lecture 11 ..... Friday, 10:00–11:00, NSLC Lecture Theatre 1

Some stochastic reaction diffusion models.
Roger Tribe (University of Warwick)

Abstract. The talk will describe some recent examples showing the effect of noise on some simple reaction diffusion models. The common theme is the use of 'individual' based noise. Typically there is an underlying particle system, and the particles contribute independently to the noise. This noise, in the context of a spatial model without interactions, arises in the Dawson-Watanabe branching diffusion, and is one of the best understood non-Gaussian spatial evolution, with many detailed properties understood. Its use in more realistic models is showing success, and this talk will describe some work (by Cox, Durrett, Mytnik, Mueller, Perkins and others) on models (including stochastic Lokka-Volterra models, and stochastic KPP) where the noise affects the behaviour; for example, persistence or wavespeeds.

Morning Lecture 12 ..... Friday, 10:00–11:00, NSLC Lecture Theatre 2

Mumford conjecture, Pontryagin-Thom construction and sheaf theoretic methods.
Michael Weiss (University of Aberdeen)

Abstract. The Mumford conjecture (1983) predicts the structure of the ring of rational characteristic classes for surface bundles with connected oriented fibers of "large" genus. A highly surprising connection between such surface bundles and generalised cohomology theories was found by Tillmann in 1997. Within the next few years this led to an integral reformulation of the Mumford conjecture by Madsen and Tillmann, involving a specific generalised cohomology theory of type "bordism". Eventually that reformulation was proved by Madsen and myself with a battery of difficult theorems from differential topology, and presented in the language of sheaf theory. Surprisingly, that was not the end of it. Galatius joined the team, and under his influence and/or leadership most of those difficult theorems were eliminated from the proof. Only a scaffold of sheaf theory and category theory remained—and a debt to certain cohomological stability theorems relating characteristic classes for surface bundles with fibers of smaller genus to characteristic classes for surface bundles with fibers of larger genus.

Special Sessions: Titles & Abstracts

Special Session 1: Number Theory

Wednesday 26 March, 14:00–17:30, NSLC Lecture Theatre 1

Talk 1. *42.*
Brian Conrey (American Institute of Mathematics, Palo Alto, California)

Abstract. The number 42 played a crucial role in the development of the Keating-Snaith model for moments of L-functions. It originally arose in a conjecture for the sixth moment of the Riemann zeta-function on the critical line. In joint work with Iwaniec and Soundararajan we can now prove an asymptotic formula for a suitably averaged sixth moment of Dirichlet L-functions which contains this famous number.

Talk 2. *On the decimal expansion of an algebraic number.*
Yann Bugeaud (University of Strasbourg)

Abstract. It is commonly expected that the decimal expansion of an irrational algebraic number behaves, in many respects, like the one of almost all real numbers. For instance, it should include every finite block of digits from $\{0, \dots, 9\}$. We are very far away from establishing such a strong assertion. However, there has been some recent progress. For instance, in a joint work with Adamczewski, we proved that, for C arbitrary and n large, at least Cn such blocks of length n do appear in the decimal expansion of every irrational algebraic number. We discuss this and related results.

Talk 3. *Waring's problem in function fields.*
Trevor Wooley (University of Bristol)

Abstract. Let k be a finite field of characteristic p. We discuss what is known concerning Diophantine problems involving dth powers in $k[t]$, and in particular analogues of Waring's problem. Much, but not all, of this work rests on a version of the Hardy-Littlewood (circle) method applicable to $k[t]$. Recent progress makes use of work joint with Yu-Ru Liu that delivers mean value estimates for exponential sums over smooth polynomials, and an analogue of Vinogradov's mean value theorem, in this function fields setting.

Special Session 2: Differential Geometry and Geometric Analysis

Wednesday 26 March, 14:00–17:30, NSLC Lecture Theatre 2

Talk 1. *Covariant Hamiltonian description of relativistic fields and the construction of observable quantities.*
Frédéric Hélein (Université Denis Diderot, Paris 7)

Abstract. We present a covariant description of the dynamics of relativistic fields equations on a space-time by using the so-called multisymplectic formalism, which goes back to Carathéodory, De Donder, Weyl, Lepage and Dedecker. We discuss the question of building observable functionals on the set of solutions to the dynamical equations by using perturbation series and some motivations which concern mainly the quantization of fields.

Talk 2. *G_2 manifolds with isolated conical singularities.*
Spiro Karigiannis (University of Oxford)

Abstract. Compact G_2 manifolds with isolated conical singularities have recently started to receive some attention in physics. I will discuss such manifolds, and explain a method to "desingularize" them by glueing in pieces of asymptotically conical G_2 manifolds. There are topological obstructions

to such desingularizations that depend on the rate of convergence to the cone at the singularities, and on the geometry of the links of the cones. If time permits, I will also briefly discuss a new related project with Dominic Joyce which could provide the first examples of such manifolds, as well as a possible new construction of smooth compact G_2 manifolds.

Talk 3. *Harmonic maps between complete, noncompact negatively curved manifolds.*
Mario Micallef (University of Warwick)

Abstract. The construction of a harmonic extension of a map between the ideal boundaries of two complete noncompact manifolds of strictly negative curvature involves two parts:
(i) the construction of an extension of the boundary map to the whole space with bounds on the energy density and the tension fields;
(ii) deformation of the extension in (i) to a harmonic map.
I will survey the work of Li and Tam and others in this area. I will then describe recent progress due to Fotiadis, Markovic and myself concerning step (ii) which enables one to allow the boundary map to be considerably more singular than previously considered.

Special Session 3: Stochastic PDEs and Stochastic Analysis

Thursday 27 March, 14:00 –17:30, NSLC Lecture Theatre 1

Talk 1. *Some recent results concerning the 3D Navier-Stokes equations driven by a random force.*
Marco Romito (Universitá di Firenze)

Abstract. Well-posedness of the Navier-Stokes equations is a well-known open problem. Similar problem are shared by the equations driven by noise. We shall present a few recent results, together with a review of open problems.

Talk 2. *Brownian motion of Jordan curves and stochastic calculus on the diffeomorphism group of the circle.*
Anton Thalmeier (University of Luxembourg)

Abstract. We start with differential geometry of the diffeomorphism group of the circle and explain how Brownian motion on the space of Jordan curves is constructed by solving a "welding" problem of "sewing" together conformally the interior and exterior of the unit circle, glued on the unit circle by diffeomorphisms. Using Kirillov's point of view, our approach leads to stochastic analysis on the space of univalent functions on the complex disk. This is joint work with H. Airault and P. Malliavin and part of a project to construct unitarizing measures for representations of the Virasoro algebra.

Talk 3. *On the Divine Clockwork and stochastic mechanics.*
Aubrey Truman (University of Swansea)

Abstract. Based on joint work with Richard Durran, Andrew Neate and Feng Yu Wang, I consider the Bohr correspondence limit of the Schrodinger wave function for an atomic elliptic state using Nelson's stochastic mechanics. This exposes an underlying deterministic dynamical system in which trajectories converge to Keplerian motion on an ellipse, solving the longstanding problem of deriving Kepler's laws in a quantum mechanical setting. Local mild instabilities occur in the Keplerian orbit for eccentricities greater than $2^{-1/2}$ which could give an experimental test of Nelson's stochastic mechanics. The convergence of the Nelson diffusion process to the Keplerian motion is discussed in 2 and 3 dimensions whose partial results are established using methods of large deviations and Cheeger's and Poincaré's inequalies.

Splinter Groups: Titles & Abstracts

The following were submitted before the conference booklet went to press on 18 March.

Algebras

Strongly irreducible ideals.
Abdulrasool Azizi (Shiraz)
Abstract. A proper ideal I of a ring R is said to be strongly irreducible, if for each pair of ideals A and B of R, $A \cap B \subseteq I$ implies that either $A \subseteq I$ or $B \subseteq I$. In this paper we will study strongly irreducible ideals in different rings. Also the relations between strongly irreducible ideals of a ring and strongly irreducible ideals of localizations of the ring are studied. Furthermore, a topology similar to the Zariski topology, related to strongly irreducible ideals is introduced. This topology has the Zariski topology defined by prime ideals as one of its subspace topology.

The uniform Artin-Rees property and the prime spectrum.
Liam O'Carroll (Edinburgh)
Abstract. We give a negative answer to the problem, open for twenty years, as to whether the full Uniform Artin-Rees Property holds on the prime spectrum of an excellent ring (it was known to hold locally on the prime spectrum of such a ring). This is joint work with F Planas-Vilanova (UPC, Barcelona).

Bounds for membership in the Frobenius closure and tight closure.
Helena Fischbacher-Weitz (Sheffield)
Abstract. Let R be a standard-graded algebra of dimension $d+1$ over a field of positive characteristic, and let I be an ideal in R. We seek to describe the Frobenius closure I^F and the tight closure I^* of the ideal I. In particular, we are interested to find the smallest m such that R_m is contained in I^F or in I^*, respectively. This "degree bound" depends on the minimal number of generators of I and on their degrees. Using geometric methods, one can reduce the original problem to finding the smallest zero of the Hilbert function associated to an ideal in a polynomial ring. The Froberg conjecture states that the Hilbert function coincides with a certain combinatorial function, whose zeroes can be computed explicitly. In the cases where the conjecture is known to hold true, in particular for $d = 2$, this leads us to an explicit formula for the degree bound. This talk is based on joint work with Holger Brenner, with further contributions from Thomas Fischbacher.

On torsion in free central extensions of groups.
Marianne Johnson (Manchester)
Abstract. Let G be a group given by free presentation $G = F/R$ and consider the quotient $F/[\gamma_c R, F]$, where $\gamma_c R$ denotes the cth term of the lower central series of R and $c \geq 2$. This quotient is a free central extension of $F/\gamma_c R$, which is in turn an extension of G with free nilpotent kernel $R/\gamma_c R$. While $F/\gamma_c R$ is always torsion-free, elements of finite order may occur in the centre of $F/[\gamma_c R, F]$. In the case where $c = 2$ and $R = F'$, that is for the free centre-by-metabelian group $F/[F'', F]$, this phenomenon was discovered by C. K. Guppy in 1973, who proved that the free centre-by-metabelian group of rank d contains an elementary abelian 2-group of rank $\binom{d}{4}$ in its centre. This was a major surprise at the time as it was the first example of a relatively free group that is given by a single multilinear commutator identity and is not torsion-free. In his pioneering 1977 paper Yu. V. Kuz'min introduced homological methods into studying Guppy's torsion elements, and was able to identify the torsion subgroup with the fourth homology group of the free abelian group F/F' reduced modulo 2. Nowadays, primarily due to the work of R. Stöhr, we have precise identification of the torsion subgroup of $F/[\gamma_c R, F]$, in the case where c is prime or equal to 4, subject to certain conditions on G. In this talk I will explain joint work with R. Stöhr on the case $c = 6$.

RIT algebras: images of finite dimensional representations and combinatorics.
Natalia Iyudu (Queen's University Belfast)
Abstract. We study finite dimensional representations of simplest RIT algebra via properties of image algebras for these representations. We prove that all image algebras enjoy most structural properties of commutative Artin algebras. While the initial algebra itself is obviously wild, we examine the question when image algebras are tame or wild. The images of indecomposable representations are local algebras and we use Ringel's list of maximal tame and minimal wild local complete algebras to prove that image algebras are tame for n (the dimension of representation) not exceeding 4 and wild for n starting from 5. We prove an analogue of the Gerstenhaber theorem on the dimension of algebras of commuting matrices, which gives a result different from the commutative case. For arbitrary RIT algebras we analyse a connection of combinatorics of colored graphs defined by relations to such properties of algebras as PBW property, Koszulity, Auslander regularity, and property of being Cohen-Macaulay.

Dynamical Systems

Functional Analysis

An intuitive proof of Heath's theorem on Swiss cheese sets.
Jonathan Mason (Nottingham)
Abstract. A Swiss cheese set is a compact plane sets produced by deleting from the complex plane the elements of a collection containing open discs and one open complement of a closed disc. When used as a domain, these sets provide a good source of examples in the theory of uniform algebras and rational approximation. For us a Swiss cheese will be a map from a subset of the non-negative integers onto a collection that defines a Swiss cheese set such that 0 is mapped to the complement of a closed disc. A Swiss cheese is then described as classical if the closures of the elements in the image of the map are pairwise disjoint. Further, a Swiss cheese set defined by such a collection is also called classical. In this talk we consider a new proof of an existing theorem by Matthew J. Heath. The theorem states that any Swiss cheese set which satisfies a particular radius condition contains a classical Swiss cheese set as a subset that also observes the radius condition. Whilst the existing Zorns lemma proof is elegant the new method provides a more intuitive approach as well as a nice example of the application of transfinite induction and the use of cardinality in proof.

The Hermite property of a causal Wiener algebra used in control theory.
Amol Sasane (LSE)
Abstract. We consider a Banach algebra arising in control theory comprising the Laplace transforms of measures with support in $[0, +\infty)$ without singular continuous part, and show that its maximal ideal space, equipped with the Gelfand topology, is contractible. It follows that the algebra is Hermite. We also apply this result to the problem of completing a left invertible matrix (with entries in the algebra) to an isomorphism, which has useful consequences in control theory.

Centres of group algebras of compact groups.
Nico Spronk (Waterloo)
Abstract. We investigate the cohomological properties of the centres of the group algebras of compact groups. We show for many compact groups that the centre is non-amenable, though it is generally approximately amenable, in a sense defined by Ghahrmani and Loy. This is joint work with Ebrahim Samei and Reza Azimifard.

Existence of non-variational eigenvalues of the p-Laplacian operator.
Bryan P Rynne (Heriot-Watt)

Abstract. A standard technique for showing the existence of eigenvalues for nonlinear operators is the well known Ljusternik-Schnirelmann method, which constructs 'variational' eigenvalues as inf-sups of a suitable functional over sets of given genus. The question then arises as to whether the variational construction produces all the eigenvalues of the operator. For the p-Laplacian operator (with p not equal to 2) this has been a long-standing open question (for both ordinary and partial differential operators).

In the case of the ordinary differential p-Laplacian operator, with separated boundary conditions (e.g., Dirichlet or Neumann), it is known that the Ljusternik-Schnirelmann method does indeed yield all the eigenvalues. However, it is not known if this is true more generally, although, until now, no examples of non-variational eigenvalues have been constructed.

In this talk, non-variational eigenvalues will be constructed for the ordinary differential p-Laplacian operator with periodic boundary conditions. This construction is then extended to partial differential operators on annuli, with Neumann boundary conditions. Thus, in general, the Ljusternik-Schnirelmann method need not yield all the eigenvalues of the p-Laplacian operator.

Moment problems for real measures on the unit circle.
Mihaly Bakonyi (Georgia State)
Abstract. In this talk we are considering the following problem: when are the given complex numbers $(c_j)_{j=-n}^n$, $c_{-j} = \bar{c}_j$, the first moments of a real Borel measure $\mu = \mu^+ - \mu^-$ on $\mathbb{T}$, such that μ^- is supported on a set of at most k points? A necessary and sufficient condition is that the Toeplitz matrix $T = (c_{i,-j})_{i,j=0}^n$ is a certain real linear combination of rank 1 Toeplitz matrices. For $k > 0$, this is more general than the condition that T admits self-adjoint Toeplitz extensions with k negative squares. For a singular T, an equivalent condition is that a certain polynomial has all its roots on $\mathbb{T}$. We also discuss the situation when T is invertible. This research is based on joint work with E. Lopushanskaya.

Can pseudospectra jump?
Eugene Shargorodsky (King's College London)
Abstract. The talk will address the following questions:
1) Can the norm of the resolvent of a linear operator take a finite constant value on an open set?
2) Is the pseudospectrum of a bounded linear operator defined with the help of a non-strict inequality equal to the union of the spectra of perturbed operators?

A compact null set with a differentiability point of every Lipschitz function.
Michael Doré (Warwick)
Abstract. A classical result of Rademacher shows that every Lipschitz function defined on a finite dimensional Euclidean space is differentiable almost everywhere. It is well known that the converse is true in the case dim = 1: given a measure-zero subset S of $\mathbb{R}$ it is possible to construct a Lipschitz function $f\colon \mathbb{R} \to \mathbb{R}$ that is nowhere differentiable on S. On the other hand, a theorem of Preiss shows this converse is false for functions defined on a higher dimensional space $\mathbb{R}^n$. However the set Preiss constructs for the counterexample is dense in $\mathbb{R}^n$. We improve Preiss' result by giving a different construction, which leads to a *compact* subset S of $\mathbb{R}^n$ with zero measure such that every Lipschitz function $f\colon \mathbb{R}^n \to \mathbb{R}$ contains a point of differentiability in S. This is a joint work with Olga Maleva.

The topological stable rank of non-selfadjoint operator algebras.
Rupert Levene (Queen's University Belfast)
Abstract. In a 1983 paper, Rieffel introduced two dimension-like invariants of unital Banach algebras: the left and right topological stable rank. He showed that these are equal for a unital C^*-algebra, and asked if the left and right topological stable rank always agree. We answer this question in the negative; our counterexample is a nest algebra. This talk represents joint work with Ken Davidson, Laurent Marcoux and Heydar Radjavi.

Enhanced negative type for finite metric trees.
Ian Doust (New South Wales)
Abstract. The p-negative type and generalized roundness inequalities arose classically in studies of isometric embeddings: when does a metric space embed isometrically in a Hilbert space or in an L^p space? These ideas remain of great interest in areas ranging from functional analysis to theoretical computer science. Hjorth et al. have shown that finite metric trees have strict 1-negative type. In this talk I shall describe joint work with Tony Weston in which we show that a new and substantially stronger family of geometric inequalities holds for finite metric trees.

On the spectrum of frequently hypercyclic operators.
Stanislav Shkarin (Queen's University Belfast)
Abstract. A bounded linear operator T on a Banach space X is called *frequently hypercyclic* if there exists $x \in X$ such that the lower density of the set $\{n \in \mathbb{N} : T^n x \in U\}$ is positive for any non-empty open subset U of X. Bayart and Grivaux, who have introduced this concept, have raised a question whether there is a frequently hypercyclic operator on any infinite dimensional Banach space. It is shown that the spectrum of a frequently hypercyclic operator has no isolated points. It follows that there are no frequently hypercyclic operators on hereditarily indecomposable Banach spaces, which provides a negative answer to the their question.

Universal estimates in harmonic analysis; a geometric inequality
Spyros Dendrinos (Bristol)
Abstract. We look at how universal estimates can be obtained for a number of problems in harmonic analysis where an underlying curve is involved. Central to the proofs is a certain decomposition of the real axis in intervals such that a "geometric" inequality holds on each interval.

Geometry

Generic one-parameter transitions of the affine parabolic curve.
Declan Davis (Liverpool)
Abstract. We give a brief review of affine differential geometry from the structural point of view. This follows the work of Nomizu. We establish the generic one-parameter transitions which occur on the affine parabolic curve and the affine Gauss map. These results are established using standard ideas from singularity theory and bifurcation theory.

Affine equidistants and their generating families.
Paul Warder (Liverpool)
Abstract. In this talk we introduce the notion of an equidistant of a generic surface M in $\mathbb{R}^3$. The equidistants are a type of affinely invariant symmetry construction. They are particularly interesting in a neighbourhood of the parabolic curve of M where the equidistant can be studied locally. They have some important structure revealing characteristics, e.g. they can distinguish certain points on the parabolic curve, besides cusps of Gauss, which do not appear to have been studied before. We will go on to show that the equidistants can be formed as the envelope of a certain family of planes and use some standard concepts in singularity theory to obtain normal forms for equidistants local to various types of special point on the host surface M. Several examples will be given.

Elliptic, parabolic and hyperbolic geometry of the upper half-plane.
Vladimir V Kisil (Leeds)
Abstract. The hyperbolic geometry in the upper half-plane can be characterised by its group of isometries: Moebius transformations in complex numbers. The same group $SL(2, R)$ acts by Moebius transformations in two-dimensional algebras of dual and double numbers. We consider all three corresponding geometries.

Groups and Representations

Property A and affine buildings.
Sarah Campbell (Southampton)
Abstract. Yu's Property A is a non equivariant generalisation of amenability introduced in his study of the coarse Baum Connes Conjecture. Unlike amenability, it is a property which can be applied to metric spaces as well as the groups acting on them. In this talk we look at the case of affine buildings and outline how they, and thus any group acting properly on them have Property A.

History of Mathematics

Using the past to inspire the future.
Noel-Ann Bradshaw (Greenwich)
Abstract. This talk will explore various ways that history of maths can be used to help engage and enthuse first year undergraduates in their mathematical studies. Illustrations, taken from the lives of Galois, de Moivre, Taylor, Lagrange and others, will be used to demonstrate how insights into these mathematicians lives have helped to enrich the study of calculus at the University of Greenwich.

Student's Student's t.
Peter M Lee (York)
Abstract. An account of the way in which Gosset himself derived (somehing equivalent to) the t statistic by a mixture of heuristic and inspiration.

Christopher Wren and mathematics in London.
Tony Mann (Greenwich)
Abstract. This year sees the tercentenary of the completion of St Paul's Cathedral. This talk looks at one of Christopher Wren's lesser-known outputs. His 1657 inaugural lecture as Gresham Professor of Astronomy presents a view of London as "A City particularly favour'd by the Celestial Influences" for the development of mathematics. I examine the context of Wren's speech and discuss how far his vision was realised over the following decades.

Geometry and sin.
Nicole Bloye (Plymouth)
Abstract. "Among geometers it is in a way considered to be a considerable sin when somebody finds a plane problem by conics or line-like curves and when, to put it briefly, the solution of the problem is of an inappropriate kind." Latin tr. by Commandino of a passage from Pappus' 'Collection'; English tr. "Redefining Geometrical Exactness", H. Bos, Springer (2001).

In 1588 a Latin translation of Pappus' Collection became widely available. The Collection provided mathematicians with strict rules for geometrical problem solving. Pappus classified these problems according to the methods required for their construction. The talk will consider what was meant by this striking statement. We will be asking not only what this meant for geometry in practical terms, but also what led Pappus to make such a moralistic comment, and why this was of such great influence among mathematicians of the early modern period such as Viète.

This leads us to ask why construction was the favoured method of classical geometers for solving problems and proving geometric theorems. We explore the relationship between anthyphairetic analysis and quadratic constructions and how this may have influenced Euclids decision to restrict the content of the Elements to ruler and compass constructions. We will question the relationship between construction and existence and how this was later refuted by mathematicians such as Kepler who, whilst firmly believing that the only truly geometric methods were those employing straight lines and circles, did not require constructibility as proof of existence.

The hunt for the lost cities of Ptolemy.

Daniel Mintz (St Andrews)

Abstract. Almost two thousand years ago, Claudius Ptolemaeus created a world map, identifying the names and coordinates of over 8,000 settlements and geographical features. In the British Isles, the location of many of Ptolemy's cities, such as London and Bath, are known to us today. Yet many locations still elude us. Most efforts to find and identify these hidden cities, rivers, headlands, etc. have concentrated on the etymology of modern place names, trying to work backwards in time until a match could be found with a name given by Ptolemy. Rather than looking at the names, I am focusing on the other half of the Ptolemy's data: the coordinates. Using the data of those cities and landmarks that have already been identified, I am applying a series of best-fit transformations to Ptolemy's map of the British Isles. It is my hope that by "correcting" Ptolemy's map, the validity of previous identifications can be tested and new conjectures can be made about those locations that are still lost.

How to get capped in a year: the Edinburgh Association for the University Education of Women.
Marit Hartveit (St Andrews)

Abstract. In 1886, Flora Philip joined the Edinburgh Mathematical Society. She had no university degree at that point, as Scottish universities weren't to open their MA's to women for another six years. Yet she had enough mathematical knowledge to want to join a society dealing mainly in advanced mathematics. In fact, she had enough knowledge in general, when she finally matriculated in 1892, to be able to graduate in only a year. How did she, and the seven other women who got capped with her, achieve this seemingly remarkable feat? The answer is to be found with the Edinburgh Association for the University Education of Women. This was an association that had been providing women with university level training since 1868. This talk will explain who they were, how they worked, who supported them, and why it all worked so well.

Logic

Mathematical Biology

Mathematical models of bacteria-phage coevolution.
Ivana Gudelj (Bath)

Abstract. Both theoretical and empirical work suggests that much genetic and phenotypic diversity is generated and maintained by coevolutionary interactions. Similarly, there is an increasing body of evidence that abiotic differences among environments in the form of resource availability (productivity) influence patterns of diversity in coevolving interactions. Here we develop a series of mathematical models to investigate the relationship between nutrient availability and bacterial diversity underpinned by bacteria-phage coevolution. Bacteria and phage are assumed to reproduce clonally but if a mutation occurs during cell division it will result in an offspring with phenotype different from that of its parent. The fitness of the mutant bacteria or phage depends both on the nutrient availability and on the types of phage and bacteria present in the environment. We consider three separate assumptions for the nature of the bacteria-phage interaction: (1) matching alleles, (2) gene-for-gene, and (3) a modified gene-for-gene mechanism. The three models make divergent predictions that are subsequently tested using laboratory experiments of E.coli and T7 phage.

DNA rarrangements through virtual knot diagrams.
Natasha Jonoska (South Florida)

Abstract. We propose models for homologous DNA recombination events that are guided by either double-stranded RNA or single-stranded RNA templates. This recombination can be seen as topological braiding of the DNA, with the template-guided alignment proceeding through DNA branch migration. We show that a virtual knot diagram can provide a physical representation of the DNA

at the time of recombination. Schematically, the braiding process can be represented as a crossing in the virtual knot diagram. The homologous recombination corresponds to removal of the crossings in the knot diagram (called smoothing). We associate operations on hese diagrams corresponding to rearrangements and investigate those properties which lead to "proper order" of the DNA sequence. Joint work with Angela Angeleska and Masahico Saito.

Group theory and virus capsid dynamics.
Kasper Peeters (Utrecht)
Abstract. The protein capsids of viruses exhibit a surprisingly rich symmetry structure. I will present a top-down approach to the analysis of capsid dynamics, which employs group theory together with a judicious coarse-graining to provide an analytic understanding of low-frequency vibrations. Our results highlight several generic features of the spectra which have been overlooked so far in large all-atom simulations.

Exact asymptotic methods for spatially extended stochastic populations.
Stephen Cornell (Leeds)
Abstract. Spatial birth-death processes are widely used to model biological population dynamics, but they are notoriously intractable and the only commonly used analytical approaches are uncontrolled approximations such as moment closure. I shall describe a perturbation method using the inverse of an interaction length as a small parameter, which permits the calculation of properties of the system in an asymptotically exact way. I shall illustrate this method by discussing the importance of landscape spatial and temporal structure on the occupancy of metapopulations, and how spatial kernels influence the stability of interacting species.

Mathematical Physics

Representations of nilpotent groups and dynamics.
Vladimir V Kisil (Leeds)
Abstract. It is well known that quantum dynamics of a particle is described by through an infinite-dimensional representation of the Heisenberg group. It is less known that the classical dynamics equally well described through the set of one-dimensional representations of the Heisenberg group. Considering representations of direct product of two Heisenberg groups we obtain dynamics of quantum-classic composite system. Clifford algebra valued representations of Galilean group provide a quantisation of De Donder-Weyl field theory.

Number Theory

Hopf-Galois module structure of tame extensions of prime power degree.
Paul Truman (Exeter)
Abstract. A major result in local Galois module theory is Noether's Theorem, that given a finite Galois extension of local fields L/K, the ring of integers $\mathcal{O}L$ is free over the integral group ring $\mathcal{O}K[G]$ if and only L/K is at most tamely ramified. In Hopf-Galois module theory, the Galois group is replaced by a (possibly non-unique) Hopf algebra, giving a so-called Hopf-Galois structure on the extension, and the behaviour of $\mathcal{O}L$ in this Hopf-Galois structure is studied. We present a generalisation of Noether's Thereom to this setting for Galois extensions of prime power degree.

On the fields generated by the coefficients of modular eigenforms.
L J P Kilford (Bristol)
Abstract. In this talk, we will use techniques of Conrey, Farmer and Wallace to find spaces of modular forms $S_k(\Gamma_0(N))$ where all of the eigenspaces have Hecke eigenvalues defined over $\mathbf{F}_p$, and give a heuristic indicating that these are all such spaces. We will also discuss recent work with Gabor

Wiese using the theory of class groups to show that only finitely many of these spaces have all of the mod 2 Hecke eigenvalues defined over $\mathbf{F}_2$.

Multi-Frey and Diophantine equations.
Samir Siksek (Warwick)
Abstract. At the heart of Wiles' proof of Fermat's Last Theorem is a device called the 'Frey curve'. The Frey curve is now typically used to derive information about solutions to Diophantine equations. In this talk, which is based on joint work with Bugeaud and Mignotte, we explain a powerful refinement which uses several Frey curves simultaneously. For example, we solve the equation $2^r 3^s x^n - 5^t y^n = 1$.

Integers n dividing $2^n + 1$.
Chris Smyth (Edinburgh)
Abstract. We show how this sequence can be generated from a much sparser subsequence of itself. We also show how to use congruence properties of the solutions to $n|2^n + 1$ to generate many terms of the sequence very rapidly.

Irrational rotations and inhomogeneous Diophantine approximation.
Simon Kristensen (Aarhus)
Abstract. It is a classical result due to Weyl that an irrational rotation of the circle is ergodic. Recently, associated questions on the so-called shrinking target problem have attracted attention. This problem is strongly connected with inhomogeneous Diophantine approximation. In this talk, we describe this connection and present new results on the shrinking target problem and associated problems in this setting. This is joint work in progress with Yann Bugeaud.

The group ring of $\mathbb{Q}/\mathbb{Z}$ and an application of a divisor problem.
Alan Haynes (Brandeis)
Abstract. First we will demonstrate some elementary but useful identities in the group ring of $\mathbb{Q}/\mathbb{Z}$. Then we will show how our identities, together with some analytic number theory and results about divisors in short intervals, can be used to estimate the cardinality of a class of sets of fundamental interest. This is joint work with Kosuke Homma (University of Texas at Austin).

Random Matrices

Random Covariance Matrices: a deformed Wishart-Laguerre ensemble.
Pierpaolo Vivo (Brunel)
Abstract We propose a one-parameter deformation of Wishart-Laguerre ensemble of random covariance matrices. The new ensemble is still rotationally invariant and exactly solvable, but displays power-law tails and delocalization. The macroscopic spectral density is in good agreement with eigenvalue distributions from financial data, after a simple one-parameter fit.

A theorem mapping chRMT to low energy QCD through superbosonisation.
Basile Francesco (Brunel/Pisa)
Abstract. Both chRMT and chPT provides a description of the epsilon-regime of QCD. We show a theorem mapping the resolvents in chRMT to the super-integrals generating the resolvents in chPT. This maps is performed using the superbosonisation theorem.

Zeros of the derivative of characteristic polynomials.
Christopher Hughes (York)
Abstract. The zeros of the characteristic polynomial of a random unitary matrix are a good model for the zeros of the Riemann zeta function. In this talk we will argue that the zeros of the derivative of the characteristic polynomial are also of interest, and study their radial distribution.

RMT and zero statistics of elliptic curve L-functions.

Duc-Khiem Huynh (Bristol)

Semigroups

Primitive partial permutation representations of the polycyclic monoids.
Mark V Lawson (Heriot-Watt)
Abstract. We generalise the group theoretic notion of a primitive permutation representation to inverse monoids. Such representations are shown to be determined by the proper maximal closed inverse submonoids. We characterise all such submonoids of the polycyclic monoids and relate our results to the work of Kawamura on certain kinds of representations of the Cuntz C^*-algebras, and to the branching function systems of Bratteli and Jorgensen.

Subgroups of free idempotent generated semigroups need not be free.
Stuart W Margolis (Bar-Ilan)
Abstract. As part of his deep theory of biordered sets and inductive groupoids, Nambooripad described the structure of the free regular idempotent generated semigroup $RIG(E)$ on a biordered set E. In this talk we describe topological methods for computing the maximal subgroups of $RIG(E)$ by associating a 2-complex with E whose fundamental groups are indeed the maximal subgroups. The one-skeleton of our 2-complex is a graph associated to completely 0-semigroups that was discovered independently by Graham and Houghton. It turns out that the 2-complexes are all squared complexes, that is all 2-cells have boundaries of length 4. Such complexes have been extensively studied in recent years in topology.

We give the first examples of biordered sets E such that $RIG(E)$ has non-free subgroups. One example arises from a certain geometric configuration over a finite dimensional vector space over the field of order two corresponding (somewhat mysteriously) to the embedding of a square complex on the surface of a torus and in which we find a maximal subgroup isomorphic to the fundamental group of the torus, namely, the free Abelian group of rank 2. Another example looks at the biordered set of the multiplicative monoid of 3×3 matrices over a field F in which we find a maximal subgroup isomorphic to the multiplicative group of the field.

This is joint work with Mark Brittenham and John Meakin of the University of Nebraska, Lincoln.

Partial actions of inverse monoids on K-rings
Christopher Hollings (Lisbon)
Abstract. The partial actions of groups on K-rings (a.k.a. associative K-algebras) have been studied by Dokuchaev and Exel (2005), as a purely algebraic version of earlier work on the partial actions of groups on C^*-algebras. In particular, Dokuchaev and Exel address the perennial problem of constructing an action from a partial action, which in this case is termed the 'enveloping action' of the given partial action. In this talk, I will set up appropriate definitions for the partial actions of inverse monoids on K-rings and describe the construction of enveloping actions for such partial actions.

Representing inverse semigroups by block permutations.
Des FitzGerald (Tasmania)
Abstract. The symmetric inverse monoid has a counterpart in the category dual to the category of sets, the monoid of block permutations. Although the two share some common features as extensions of the symmetric group and vehicles for representations of inverse semigroups, the monoid of block permutations presently lacks a theory of representation comparable with Schein's theory for partial permutations. I shall explain the problems, and examine what can be done.

Diagonal acts and applications.
Nik Ruskuc (St Andrews)

Abstract. The diagonal act of a semigroup S is the set $S \times S$ with an action of S defined by $(x, y)s = (xs, ys)$. Diagonal acts were introduced by S. Bulman-Fleming in an Amer. Math. Monthly problem. I encountered them first in connection with finite generation of wreath products of semigroups. Since then, they proved to play a role in combinatorial questions concerning power semigroups, Schutzenberger products, and, most recently, ranks of direct powers of monoids.

Reflection monoids.
John Fountain (York)
Abstract. The inverse monoid of all partial isomorphisms of a vector space V is denoted by $ML(V)$. A partial reflection is defined to be the restriction of a reflection of V to a subspace of V, and a reflection monoid is a factorisable inverse submonoid of $ML(V)$ generated by partial reflections. A reflection monoid can be characterised by two pieces of data: a reflection group W acting on V and a collection of subspaces of V that forms a W-invariant semilattice and contains V itself. In the talk we will outline the basic properties of reflection monoids and give some examples. We also mention connections with Renner monoids.

The Bergman property for semigroups.
James Mitchell (St Andrews)
Abstract. In this talk, we will discuss the Bergman property for semigroups and the associated notions of cofinality and strong confinality. An uncountably infinite semigroup S is said to have the Bergman property if for all generating sets U there exists a number n so that every element of S is a product of at most n elements of U. We will see that the semigroup of all mappings on an infinite set has the Bergman property but that its finitary power semigroup does not; the symmetric inverse semigroup on an infinite set and its finitary power semigroup have the Bergman property; the Baer-Levi semigroup does not have the Bergman property.

Analogues of the decimal expansion for all groups and monoids.
Chrystopher L Nehaniv (Hertfordshire)
Abstract. We explain how Krohn-Rhodes Theory for finite semigroups and automata and Frobenius-Lagrange embeddings for finite groups can viewed as providing "coordinate systems" for understanding and manipulating these structures. These, and analogues of these theorems proved for all, possibly infinite, semigroups and groups, can be considered analogues of the decimal expansion in which coordinates correspond to a sequence of divisors of the original structure. These are related to level-transitive spherically homogeneous actions on order-theoretic rooted trees. In the case of countably generated monoids and groups the existence of such an action on a finitely branching rooted tree of depth with order type of the natural numbers is equivalent to residual finiteness. Moreover, every group arises in such coordinates where the coordinates lie in simple groups.

The word problem is not so hard after all.
Mark Kambites (Manchester)
Abstract. It is well-known that one can construct finitely presented monoids for which the word problem is arbitrarily hard. But how hard is the word problem for a *typical* finitely presented monoid? It transpires that a randomly chosen finite presentation will with high probability satisfy certain small overlap conditions of the kind introduced by J H Remmers. We introduce a new, combinatorial approach to the study of small overlap presentations, which allows us to show amongst other things that the corresponding word problems are solvable in linear time.

Automatic presentations for semigroups.
Alan J Cain (St Andrews)
Abstract. An automatic presentation is a description of a relational structures using regular languages. Informally, an automatic presentation consists of a regular language of abstract representa-

tives for the elements of the structure, such that each relation (of arity n, say) can be recognized by a synchronous n-tape automaton. The concept, which arose from computer scientists' need to extend finite model theory to infinite structures, has only recently been applied to algebraic stuctures. This talk will introduce and survey automatic presentations for semigroups. In particular, it will discuss:
(1) classifications of those semigroups of certain species that admit automatic presentations;
(2) the interaction of automatic presentations and various semigroup constructions;
(3) decision problems.

Syntactic monoids of context-free languages and groups.
Claas Roever (Galway)
Abstract. During the study of word and co-word problems of groups syntactic monoids emerged as the unifying object which led me to study the question of which groups can occur as syntactic monoids of a given class of languages. I will give some classifications in the case of deterministic context-free languages and report on interesting examples that occur in the case of context-free languages.

A problem in a free group related to the Andrews-Curtis conjecture.
Alexei Vernitski (Essex)
Abstract. Let us consider an n-tuple of elements of a free group, say, $(u_1, \dots, u_n)$. A left Nielsen transformation consists of replacing the i-th element u_i of the n-tuple by either $u_j u_i$ or $u_j^{-1} u_i$ for some $j \neq i$. I have found an algorithm solving the following problem. Problem: given two n-tuples of elements of a free group, find out whether one of them can be tranformed into the other using left Nielsen transformations.

Morita equivalence of partially ordered monoids.
Valdis Laan (Tartu)
Abstract. We say that partially ordered monoids (pomonoids) S and T are Morita equivalent if the categories of right S-posets and right T-posets are equivalent as categories enriched over the category of partially ordered sets. The classical theory of Morita equivalence deals with rings and modules. In the beginning of 1970's, Knauer initiated the study of Morita equivalent monoids. It turns out that several classical results have their analogues also in the case of pomonoids.

Polycyclic and bicyclic monoid automata.
Elaine Render (Mons-Hainaut)
Abstract. We study the classes of languages defined by valence automata with rational target sets (or equivalently, regular valence grammars with rational target sets), where the valence monoid is drawn from the important class of polycyclic monoids. We show that for polycyclic monoids of rank 2 or more, such automata accept exactly the context-free languages. For the polycyclic monoid of rank 1 (that is, the bicyclic monoid), they accept a class of languages strictly including the partially blind one-counter languages. Key to the proof is a description of the rational subsets of polycyclic and bicyclic monoids, other consequences of which include the decidability of the rational subset membership problem for these monoids, and the closure of the class of rational subsets under intersection and complement. This is joint work with Mark Kambites.

Approaching cosets using Green's relations and Schutzenberger groups.
Robert Gray (St Andrews)
Abstract. One of the most fundamental concepts in combinatorial group theory is the notion of index. The index of a subgroup is found by counting its right (or left) cosets. It may be thought of as providing a way of measuring the difference between a group and a subgroup. In this sense, we can think of finite index subgroups as only differing from their parent group by a finite amount. Many finiteness conditions are known to be preserved under taking finite index subgroups and extensions, including: finite generation / presentability, periodicity, local finiteness, residual finiteness, and having

a soluble word problem. Over the past decade or so, several attempts have been made to develop an analogous theory of index for semigroups. In my talk I shall discuss two such approaches (and some recent results relating to them) which arise from two different ways of thinking about what coset should mean for semigroups. The first approach is to think of cosets as being right translates of the substructure under the action of the semigroup on subsets. This approach is restricted in the sense that it only applies usefully to subgroups of semigroups (and not arbitrary subsemigroups). The second approach is a notion of index (which is called the Green index) that arises from a generalised form of Green's relations, where Green's relations are taken relative to a given subsemigroup. This approach has the advantage that it applies to arbitrary subsemigroups. In both cases, theorems exist relating the properties of the semigroup, its subsemigroups, and certain Schutzenberger groups.

Existentially closed semigroups with Bergman's property.
Victor Maltcev (St Andrews)
Abstract. In this talk we will discuss existentially closed semigroups. A semigroup S is existentially closed if every countable collection of equations and inequations that is soluble in a semigroup containing S is soluble in S. Analogous notions are used widely in many different branches of mathematics, for example, the random graph is an existentially closed structure. The existence of such semigroups will be considered. For example, answering a question of Cornulier, we will show that assuming the continuum hypothesis there is only one existentially closed group with order the least uncountable cardinal. We will also see that in the varieties of semigroups, groups, and inverse semigroups every existentially closed semigroup has Bergman's property.

Stochastic Analysis

Elliptic operators on abstract Wiener spaces.
Jan Maas (Delft)
Abstract. A classical result in Malliavin calculus, due to P A Meyer, says that the Riesz transform associated with the Ornstein-Uhlenbeck operator is bounded on L^p with Gaussian measure for $1 < p < \infty$. We generalise this result to non-symmetric elliptic operators on abstract Wiener spaces. Our main tools are the functional calculus for bisectorial operators and randomised versions of gradients estimates. The result is applied to generators of transition semigroups associated with linear SDEs in Banach spaces. This is joint work with Jan van Neerven.

Topology

Finding an element in $H_3(GL(F))$.
Zacky Choo (Sheffield)
Abstract. Let F be a number field. We will constuct an explicit element in $H_3(GL(F))$ using free Fox differentiation. The element is one of the few known explicit elements in the known universe and was found to compute Borel's Regulator, an invariant with exciting possiblities.

Doubly-periodic textile patterns.
Hugh Morton (Liverpool)
Abstract. Grishanov, Meshkov and Omelchenko have introduced the idea of representing a fabric with a repeating (doubly periodic) pattern by a knot diagram on a torus, having made a choice of a unit cell for the repeat of the pattern. Algebraic invariants of this diagram based on the Jones polynomial were used to associate a polynomial to the fabric which was independent of the choice of unit cell, so long as a minimal choice of repeating cell was made.

Grishanov and I are currently working on a very promising application of the multivariable Alexander polynomial to strengthen the information available about topological properties of the fabric.

We use the term *fabric* to mean a doubly periodic oriented plane knot diagram, consisting of coloured strands with at worst simple double point crossings, up to the classic Reidemeister moves. A fabric gives rise to a link diagram on the torus $S^1 \times S^1$ by choosing a repeating cell in the pattern and splicing together the strands where they cross corresponding edges to form the diagram on the torus. A link in S^3 with two further auxiliary components X and Y is constructed by placing the torus in S^3 as a standard torus and including the core curves on each side of the torus in addition to the curves forming the diagram on the torus. The multivariable Alexander polynomial of this link has many nice features which are independent of the choice of unit cell, and relate more closely to the original fabric.

Postgraduate Conference: Titles, Abstracts and Posters

Homogeneous spaces for the group $SL(2,\mathbb{R})$.
Mohamed Bugatma (Leeds)
Abstract. We consider for, the elliptic, parabolic and hyperoblic homogeneous spaces, the decomposition $g = dt$ for any g in $SL(2,\mathbb{R})$, where t represents an element of subgroup H and d is a matrix representing the homogeneous space $SL(2,\mathbb{R})/H$. Here H denotes the compact group K of elliptic case, the nilpotent subgroup N of the parabolic case, or the diagonal subgroup A of the hyperoblic case. In all three cases we will discuss the action of matrices d and t on the unit disk (circle); then we explain that the Lebesgue measures under the rotation t are invariants. Finally we calculate the invariant measures in the EPH cases.

Aleksandrov-Clark measures.
Sam Elliott (Leeds)
Abstract. The subject of Aleksandrov-Clark measures was originally discovered when trying to understand the properties of certain operators on Hilbert spaces. Since their birth, a wide variety of new and interesting properties of the measures have been found, with applications to a number of different areas of mathematics, as well as practical uses in the field of information compression and storage. We will present a basic introduction to the area, and touch on some of the more interesting properties, as well as many recent developments as time permits.

Differentiability of Lipschitz functions.
Michael Doré (Warwick)
Abstract. Recall that a function f is Lipschitz iff for any points x,y the distance between their images $f(x)$ and $f(y)$ does not exceed $L\|x-y\|$ where L is a fixed constant. We study differentiability properties of Lipschitz functions. In this talk we outline some recent progress in the area and discuss open problems and the techniques used to attack them.
Poster. Differentiability of Lipschitz functions.

Magic chain generator.
Zacky Choo (Sheffield)
Abstract. Having problems creating elements in Homology? Can't find that elusive chain or cycle? Now and for an un-limited time, for free, we show a method to generate chains from free group identities. A step by step guide to free Fox differentiation. While stocks last!
Poster. Computing Borel's Regulator II.

Modular degrees of elliptic curves.

Srilakshmi Krishnamoorthy (Sheffield)

Abstract. In this talk we discuss the power of 2 dividing the modular degree. This will be motivated by it's connection with the congruence number, Selmer group, conjectures and research results associated with them.

Reasoning about cryptographic security with spygraphs.

Clive Blackwell (Royal Holloway)

Abstract. Bigraphs [1] are a process algebra based on category theory. A bigraph is composed of a link and place graph with the same nodes, but different edges. The link graph represents logical communication (as in the pi calculus) and the place graph models physical locality (as in the ambient calculus). Concrete bigraphs can be represented by s-categories, whereas abstract bigraphs can be represented by strict symmetric monoidal (ssm) categories. An abstract bigraph is an equivalence class of concrete bigraphs when we identify concrete bigraphs that have the same shape and differ only in the names given to edges and nodes. Spygraphs are a novel extension of bigraphs with additional graph rewriting rules to model cryptographic and other security mechanisms, which is analogous to the extension of the pi-calculus to the spi-calculus. This allows systems and their users including attackers to be modelled as spygraphs, where the defenders objectives can be defined by invariants of the spygraph that represent secure system states that the attacker attempts to defeat. In this talk, we propose operational semantics for the basic cryptographic operations and give the equality relations used to show if spygraphs are equivalent. We demonstrate these axioms are sound and complete for the new operations by appeal to the underlying category theory.

[1] R Milner, "Pure Bigraphs: a Tutorial (Draft 7)" (2007), `www.cl.cam.ac.uk/~rm135`

BMC Annual General Meeting

Wednesday, 26 March ..... 18:00–19:00, NSLC Lecture Theatre

AGENDA

(1) Apologies for absence.
(2) Minutes of AGM in Faraday Lecture Theatre, University of Swansea, 17.45, Tuesday 17 April, 2007.
(3) Matters arising.
(4) Summary of accounts for BMC in Swansea 2007 (for information only).
(5) The BMC Scientific Committee.*
Election of chairman of the BMC Scientific Committee to serve 2008–2011.
(6) Election of one member from the AGM to the BMC Scientific Committee to serve for one year 2008–09.
(7) Report on progress of BMC 2009, Galway.
(8) Invitations to hold BMC 2011.
(9) Any other business.

* **BMC Scientific Committee 2007–08**

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