

De Morgan Association Newsletter

from the Department of Mathematics UCL

Issue - 18 - 2010

Editor - Michael O'Neill

DE MORGAN ASSOCIATION DINNER

Wednesday 9 June 2010

The venue for the Annual Dinner of the De Morgan Association was again the *Jeremy Bentham Room* at UCL and our Guest of Honour was Sir John Ball FRS, Sedleian Professor of Natural Philosophy at the University of Oxford and Director of the Oxford Centre for Nonlinear PDE's, who spoke about the Fields Medal and highlighted the amazing case of Grigori Perelman who refused to accept the coveted prize. Like all those attending the Dinner, Sir John had to contend with a tube strike and this meant that after dinner speeches had to be somewhat shorter. A précis of his speech given in this Newsletter has a number of useful references which expand on many of the points made by Sir John in his interesting speech.

The year marked the retirement of two distinguished members of the Department – Professor Robert (Rob) Seymour and Dr John Haight – and the Department welcomed the arrival of four new members of the academic staff, Professor Valery Smyshlyaev, Dr Javier López Peña, James Burnett and Dr Isidoros Strouthos.

- **Michael O'Neill**
Emeritus Professor of Mathematics



Guests at the De Morgan Association Dinner

PERELMAN, PRIZES AND THE MEDIA

Sir John Ball described the fascinating story of Grigori Perelman, who proved the longstanding Poincaré Conjecture, that every simply connected, closed 3-manifold is homeomorphic to the 3-sphere, and subsequently turned down a Fields Medal. At the time of the dinner, the award of the \$1 million Clay Prize to him was being celebrated in Paris, but Perelman was an absent guest, and subsequently turned down this as well.

The lecture described the events leading up to the award of the Fields Medal, the visit of John Ball (in his capacity of President of the International Mathematical Union) to St Petersburg to try to persuade Perelman to accept, and the tremendous media interest in the story.

Readers interested in learning more can consult the Wikipedia article http://en.wikipedia.org/wiki/Grigori_Perelman and various books such as "The Poincaré Conjecture: In Search of the Shape of the Universe" by Donal O'Shea (Penguin, 2008), "Poincaré's Prize: The Hundred-Year Quest to Solve One of Math's Greatest Puzzles" by George G. Szpiro (Penguin, 2008), and "Perfect Rigor: A Genius and the Mathematical Breakthrough of the Century" by Masha Gessen (Houghton Mifflin Harcourt, 2009).

- **Dima Vassiliev**
Head of Department



Professor Sir John Ball speaking at the De Morgan Association Dinner





Guests at the De Morgan Association Dinner

JOHN HAIGHT



Soheni Datta, Christine and John Haight, Andrei Yafaev, Sevrine Nogre, Richard Hoyle and Dr Edward Cooper at the Charlotte Street Blues Bar

This year saw the retirement of Dr John Haight who gave 40 years of service to the department.

John's background is pretty unusual in that his father was a Hollywood producer working for MGM and that John himself is an American citizen. In fact, the Haight Ashbury district of San Francisco, so favoured by the hippies of the 1960's, is named after John's family. John grew up in England following his parents' divorce and, after studying for his BSc at Sir John Cass College (now subsumed into London Metropolitan University), did a PhD under James Taylor (himself a student of A.S. Besicovitch) at Westfield College, University of London. John's thesis was on Diophantine approximations with applications in measure theory. John's first publication, "A linear set of infinite measure with no two points having integral ratio" appeared in 1970, in the UCL journal *Mathematika*. In this paper John Haight solved a problem set by John Kingman by providing a counterexample to Kingman's conjecture. The same year John Haight was appointed to a lectureship at UCL.

The following is a phrase from a letter of reference in support of John's appointment: "Although Haight has no lecturing experience, I would expect him to become a really good lecturer, because he has the right kind of personality to make an effective teacher". Nowadays such a phrase in a letter of reference would cause serious problems but in those happy, less bureaucratic, days this was deemed to be acceptable.

At the time of his appointment John was awarded the princely salary of £1,355 per annum and £100 per annum London Allowance. Younger readers may assume that in 1970 this was a lot of money, but I myself, having lived in London at the time can testify that such a salary was pretty miserable. As John likes to say, "in those days universities pretended to pay us and we pretended to work". Here "pretending to work" is understood as having the freedom to pursue research as one found it fit, without concern about matters such as the Research Assessment Exercise, research impact, grant income, overheads, etc.

It is also interesting that on his appointment, John Haight was immediately sent to a Residential Discussion Course on Teaching and Learning in Higher Education. This may, again, surprise our younger readers who might be thinking that things like lecturer training were introduced only in the new millennium.

John Haight's appointment was initially temporary. From 1974 his job became permanent, and in 1988 he was promoted to Senior Lecturer.

Overall, John's work can be described as Combinatorial Measure Theory. In particular, John solved several problems of Paul Erdős which led, on one occasion, to his receiving a cheque for 100 US dollars from Erdős (Erdős had this habit of giving money to people who solved his problems). John foolishly cashed the cheque instead of waiting till 2010 and selling it on Ebay. A remarkable feature of John Haight's research is that all his papers are single authored, which shows a highly unusual degree of originality.

About 10 years ago John branched out into a totally new activity: he won a supplementary teaching grant for buying MAC computers for the department and started teaching the computer language Mathematica. In fact, together with Rob Seymour, he marketed an on-line course in Mathematica through their company Haight and Seymour. This package was used extensively by the Australian government's Bureau of Resource Sciences. This activity is becoming increasingly important for the department, one reason being that Mathematica is now widely used in mathematical finance. In 2003, John, together with Ken Binmore and Rob Seymour, constructed the auction for the famous 3G spectrum, netting billions of pounds for the government.

Finally, John is our Union Rep, and in this capacity he has, throughout the years, helped many people, myself included. I discovered John's Union side in May 2006, just before I started my appointment at UCL. John came to discuss Union issues and mentioned, in passing, that if I wanted to "retire" someone early he was prepared to consider it. A year later, in 2007, I took John up on his kind offer and used his early retirement to hire an extra lecturer. Having taken early retirement, John continued to work full-time as a Teaching Fellow from 2007 till 2010. And even now, in 2010, having "finally retired", John continues teaching in the department part-time.

On behalf of the department, I wish John a happy retirement, hoping, at the same time, that we will be able to continue exploiting him as a part-time lecturer as well as an experienced Union Rep.



Dima Vassiliev, Christine and John Haight, and Dr Edward Cooper at the Charlotte Street Blues Bar

- **Dima Vassiliev (with assistance from David Larman and Rob Seymour)**
Head of Department

ROB SEYMOUR

Rob has been, from the outset, a key member of CoMPLEX. He initiated the Advanced Biological Modelling and BioStatistics: ABMB, developing an important, mandatory element of the MRes year. Rob has acted as the Mathematics Tutor, providing essential advice, guidance and support to several generations of CoMPLEX Masters and PhD students. Rob was a member of the team that persuaded EPSRC to place one of their Doctoral Training Centres at UCL, an important step that allowed the CoMPLEX programme to grow and develop into its present status as an internationally renowned programme, drawing applicants from all over the world. Even after formal retirement, students continue to flock to Rob's door for advice and guidance. Rob's quiet, self-effacing personality has meant that many people have not fully appreciated the significance and importance of his contributions to UCL. He will be much missed.

■ Anne Warner

Professor of Developmental Biology, CoMPLEX



Rob Seymour

I have only known Rob in his time as a Mathematical Biologist. I think he made the conversion from Algebraic Topology in the early nineties. Since then Rob has worked in many areas of Mathematical Biology – ecology, evolutionary game theory, immunology, and liver disease, to mention a few. He introduced several of the department's Mathematical Biology courses. In these courses Rob paid particular attention to the Biology, so that as modelling courses these courses were addressing real biological problems, described to students with as much biological detail as necessary, and tackled with a very broad range of mathematical methods – indeed whatever the problem demanded.

In the first half of the nineties Rob was one of the founding members of CoMPLEX, UCL's centre for interdisciplinary research in the life sciences. From humble beginnings as a seminar series and discussion forum, CoMPLEX has grown rapidly. It now runs a 4 year Doctoral training programme "Modelling Biological Complexity". Rob has always been a very active member of CoMPLEX and in particular as an organiser of the MRes and PhD programme. Rob has also supervised numerous PhD students on the programme in areas as diverse as modelling coral reefs (which has

taken him diving in dreary places such as Florida and the Great Barrier Reef), animal sexual behaviour, modelling complex cytokine networks, gene networks and the Systems Biology of the liver.

Predating CoMPLEX, Rob has also been a key member of ESRC Centre for Economic Learning and Social Evolution (ELSE), where he has collaborated with many others in game theory and related fields. His work uses both finite and infinite dimensional dynamical systems in Euclidean and Banach spaces. What is very apparent in reading his work, and collaborating with him, is that Rob likes to build up general frameworks for solving problems, built with serious mathematics, the correct spaces and all – the pure mathematician shining through?

■ Steve Baigent

Senior Lecturer, Department of Mathematics

ENFOLD

The Mathematics Department at UCL – along with six other UCL departments – has recently been awarded a substantial EPSRC grant for an important new project researching global dynamics and complexity theory.



Visualisation of modern city population which forms the basis of the migration flow algorithms the project aims to produce.

The multidisciplinary project - Explaining, modelling, and Forecasting global Dynamics (ENFOLD) – is based within the Centre of Advanced Spatial Analysis (CASA) at UCL and has the explicit aim of developing new forms of complexity science and building a “Global Intelligence System”.

Traditionally, the science used to inform policy makers about future social and economic events has been based on models which treat systems such as trade and migration in isolation. By ignoring the coupling and interaction between such global systems, unexpected dynamics can occur which in turn limits the extent to which such models can be applied when influencing policy.

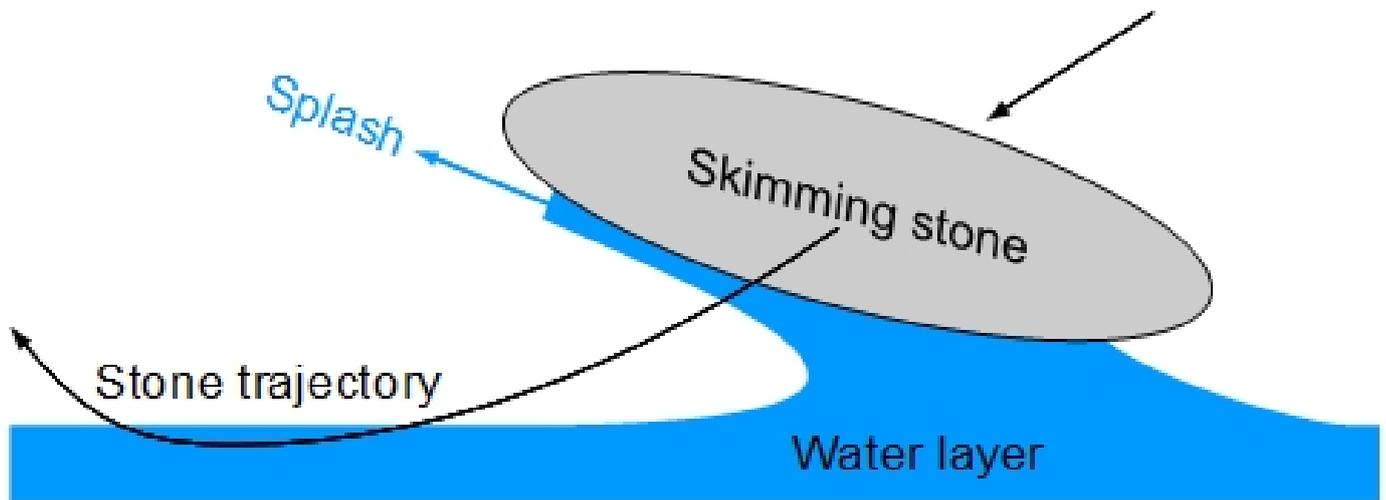
The ENFOLD project aims to focus on four key work streams – trade, migration, security (including crime, terrorism and conflict) and development aid – studying and modelling the dynamics and interactions. A Global Intelligence System will incorporate these ideas, span many spatial and temporal scales and contain interacting reaction diffusion and network models, described in the conventional languages of complexity theory: chaos, bifurcations, turbulence, catastrophes, and phase transition. These dynamic and nonlinear models will be applied to and assessed against existing data, eventually informing global policy makers about future events and helping to develop appropriate policy responses.

Professor Frank Smith FRS and Professor Steven Bishop of the Mathematics Department will work alongside eight other academics including Professor Sir Alan Wilson FRS and Professor Mike Batty FRS of CASA to lead a multidisciplinary team, calling on expertise from Geography, Transport Studies, Political Science, the Jill Dando Institute of Crime Science and the Bartlett School. Several government departments and international businesses are partners in this project.

- **Hannah Fry**
Research Associate

SKIMMING IMPACTS

Earlier this year Dr Peter Hicks and Professor Frank Smith published a paper in the Proceedings of the Royal Society A, which sought to explain the rebounding of a solid object from a liquid surface, as seen in stone skimming or (as it is perhaps better known) "Ducks and drakes". Coupling the motion of the solid body to the hydrodynamics in a thin liquid layer during an oblique impact, the paper showed that the force generated by the pressure under the wetted surface of the body is sufficient to retard the downwards motion of the body and then accelerate it back upwards, clear out of the water. Thus a mathematical explanation of the characteristic bouncing motion of a skimming stone is provided.



Stone and water give each other a glancing blow

While entertaining everyone from small children to mathematics professors who are out looking for inspiration on a riverbank, stone skimming and the question of whether or not an object rebounds from an oblique impact with a liquid surface has an enormous impact on many physical problems, particularly from within the aviation industry. In January 2009, the crew and passengers of an Airbus A320 aircraft were probably desperately relieved their plane didn't bounce when pilot Chesley "Sully" Sullenberger III skillfully "ditched" in the Hudson River, New York. Yet every day while flying through clouds, similar aircraft encounter tiny ice crystals which often interact with thin layers of water coating the outside of the aircraft. If sufficient numbers of these ice crystals do not rebound upon impact and instead attach themselves to the aircraft, then the subsequent loss of lift and increase in drag can have catastrophic consequences for aircraft performance (as in a disastrous crash in Washington DC in 1982). Other applications of this departmental research speciality are in food manufacture, including most notably chocolate drops, and in meteor impacts and bounces on planet surfaces, a joint interest with Professor Jan-Peter Muller in UCL Physics.

The motivation for working on skimming impacts also came from a wider collaboration between Peter and Frank in the Department of Mathematics at UCL and AeroTex UK LLP, an aircraft icing consultancy. The latter's work involves predicting where ice may form on an aircraft, assessing what effect the ice may have and where necessary finding ways of removing it. This ongoing collaboration has also investigated droplet impacts and other phenomena associated with splashing, while seeking to better understand the interactions between an aircraft and a cloud of raindrops.

The publication led to articles in the Daily Telegraph, the Daily Mail and ScienceNOW and to three radio interviews.

- **Peter Hicks; and Frank Smith**
Research Associate; Goldsmid Professor of Mathematics

THE INTERNATIONAL CENTRE FOR MATHEMATICAL SCIENCES (ICMS)

Professor Keith Ball, Astor Professor of Mathematics has been appointed Scientific Director of the International Centre for Mathematical Sciences (ICMS) in Edinburgh <http://www.icms.org.uk/> The appointment is half time and started in September 2010. (And before you ask, the ICMS will be paying UCL for Keith's services.) Being appointed Director of the ICMS is a great honour and responsibility.

Congratulations, Keith!



Keith Ball

FACULTY TEACHING AWARD 2010

The winner of the MAPS Faculty Teaching Award for 2010 is **Professor Raman Prinja** (Department of Physics and Astronomy and Natural Sciences Programme Director).

Many congratulations to Professor Prinja for displaying an extremely high standard of excellent teaching.

Prof. Mark Lancaster, Chair of the Physics and Astronomy Teaching Committee, noted that: "Raman is a teacher who goes out of his way to engage with students both in and outside of lectures and is always readily available to provide feedback. His friendliness, approachability and sheer enthusiasm for the subjects he teaches are well known in the faculty and to the students who have been fortunate enough to have been taught by him".



Hannah Fry

The Faculty received several nominations for this award, which was introduced as a means of recognising the outstanding provision of teaching within the faculty.

The other nominees, all worthy of special mention, were:

- Dr Joe Cain (Science and Technology Studies)
- Prof. Ian Ford (Physics and Astronomy)
- Dr John Haight (Mathematics)
- Dr Chris Kilburn (Earth Sciences)
- Dr Mark Roberts (Mathematics)

An additional Faculty Award has been awarded to **Hannah Fry** (Department of Mathematics) in recognition of her excellence as a Postgraduate Teaching Assistant.

Dr Mark Roberts, Mathematics Departmental Tutor noted that:

"Hannah Fry has been a Teaching Assistant in the

Department of Mathematics since 2006. She has very successfully taught a large Mathematics ancillary module for several years, as well as taking tutorials for Mathematics honours students. She communicates mathematics in a lively, clear and effective way, and is very committed to providing individual help to students at all levels of ability. Many expressions of appreciation for her excellent teaching and help have been received from students."

HONORARY DEGREE FOR PETER HIGGS



Professor Peter Higgs at UCL's Honorary Degree Ceremony on Monday 6 September 2010.

On 6 September 2010 UCL conferred an honorary degree of DSc upon Professor **Peter Higgs** (DSc): Emeritus Professor of Theoretical Physics at the University of Edinburgh. Peter is a former lecturer in the UCL Department of Mathematics and progenitor of Higgs' Boson (see the [CERN website](#) for an explanation).

The ceremonies were held in June (in conjunction with the induction of new Fellows) and September 2010.

THE INTERNATIONAL CONGRESS OF MATHEMATICIANS 2010

I was very pleasantly surprised when I found out that I was an invited speaker at the International Congress of Mathematicians in Hyderabad, India. It is by far the most prestigious mathematical event. I decided to present a survey of my ongoing joint work with Giovanni Alberti (Pisa), Peter Jones (Yale) and David Preiss (Warwick) about the structure of null sets and differentiability problems of Lipschitz functions. I was trying to prepare a lecture accessible to non-specialists, but I didn't really expect to succeed...

Nevertheless, it turned out that too many participants were interested in these results, the lecture room was so packed, more than half of the audience ended up standing. My talk was very well received, and it was followed by many interesting subsequent discussions as a number of the participants found the results to be hard to believe and wanted to learn more about them.

As is expected in a conference like this, it was a great opportunity to meet with mathematicians working in diverse areas of mathematics and to learn about the recent developments in their fields. Many speakers really managed to overcome the specialisation barrier, I was very pleasantly surprised by the number of talks I could enjoy though they were about results that are quite far from my expertise.

If anything was wrong with this conference, it was that far too many talks were excellent, and it was impossible to follow all of them without becoming utterly exhausted. It was a wonderful experience.



The Convention Centre (HICC) at Hyderabad

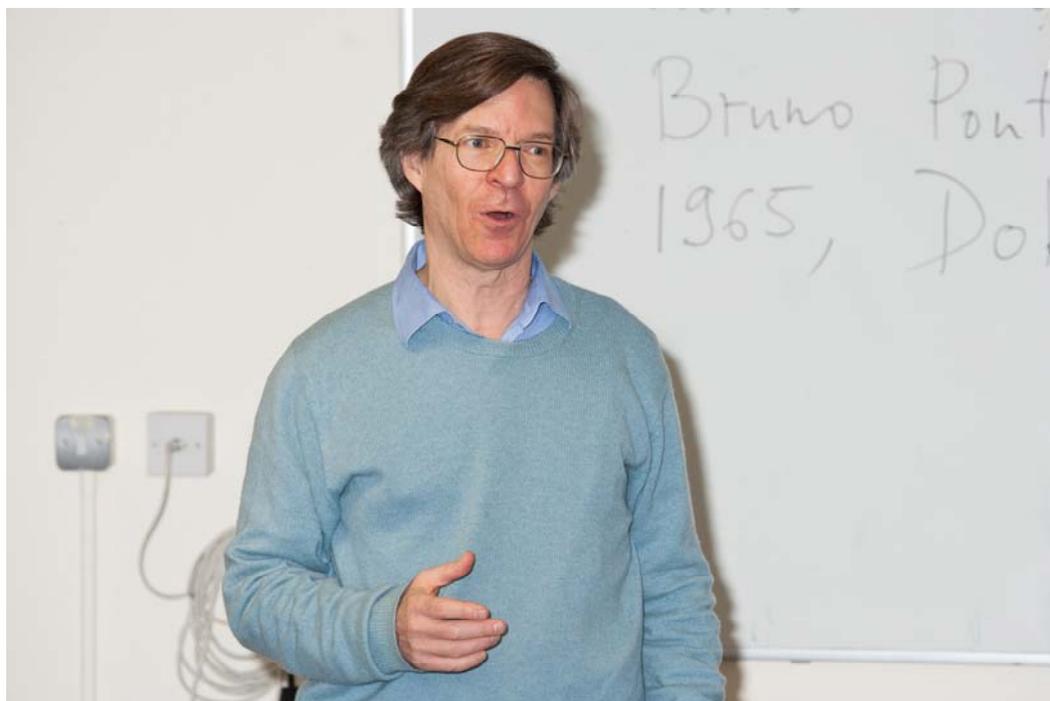
- **Marianna Csörnyei**
Professor of Mathematics

INAUGURAL LECTURES

2009-2010

Alan Sokal

Alan Sokal gave his Inaugural Lecture '**Between combinatorics and analysis (with a little help from statistical physics)**' on Wednesday, 10 March 2010.



Alan Sokal presenting his Inaugural Lecture

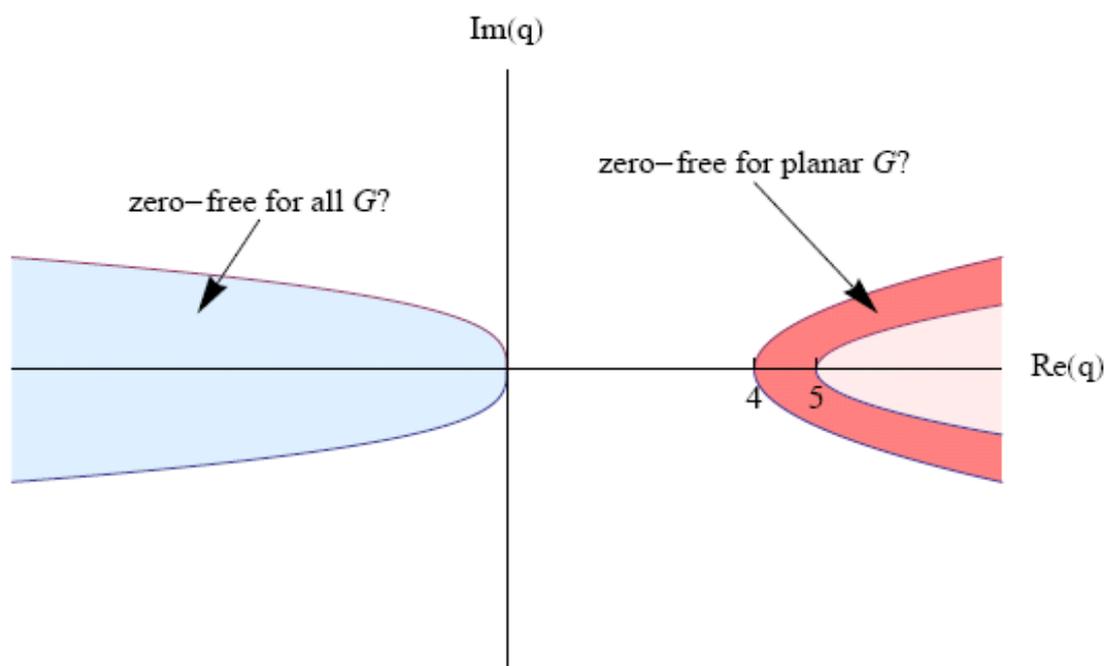
Abstract: I shall discuss a variety of problems (some solved, most of them open) lying at the boundary between combinatorics, real and complex analysis, and probability. These problems concern polynomials canonically associated to graphs (or to more general combinatorial structures such as matroids), such as the chromatic and Tutte polynomials, the independent-set polynomial and the matching polynomial. Many of these polynomials are in fact the partition functions of well-known models in statistical physics, and it turns out that ideas from statistical physics provide not only much of the inspiration for the theorems to be proven, but sometimes even the methods of proof.

This lecture is intended to be understandable to a general audience of mathematicians; no prior knowledge of combinatorics or statistical physics is necessary.

On the 10th March 2010, Alan gave his inaugural lecture as a Professor at UCL (having been appointed in 2002). The audience was expectant, most having knowledge of the famous (infamous) hoax that Alan had perpetrated, in 1996, on the journal “Social Text” when it published his article “Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity” suitably liberally laced with nonsense. A salutary warning for all journals that do not have a refereeing procedure.

Alan’s academic credentials are impeccable. Bachelor’s and Masters degrees from Harvard and a PhD from Princeton. Since 1991 he has been a full Professor (of Physics!) at NYU.

Those of us, who have had the pleasure of hearing Alan lecture before, were looking forward to a talk peppered with jokes and animation. We were not disappointed.



Complex roots of the chromatic polynomial [2nd try]

He spoke first on graphs, graph colouring and the chromatic polynomial of a graph. He mentioned the 4 colour problem (first proposed at UCL in the 19th century) and wistfully noted that the famous number crunching proof of Appel and Haken in 1976 made no mention of chromatic polynomials. I remind you that a graph G consists of a finite number of vertices and edges joining some of the vertices. Colours $1, \dots, x$ assigned to the vertices of G are said to colour G if no two vertices of the same colour are joined by an edge. The number of colourings of a graph G by the colours $1, \dots, x$ is a polynomial in x , called the chromatic polynomial of G . A graph is planar if its vertices and edges can be represented,

without crossings, in the plane. The four colour conjecture (now theorem) was that every planar graph can be coloured with just 4 colours. Thus the four colour conjecture can be phrased as 'The chromatic polynomial of any planar graph does not have 4 as a root'.

He then moved on to the Ising model of Ferromagnetism and the Potts model, where each colouring is assigned a weight (Potts introduced this as a model for statistical physics, in 1952, for the atom in a crystal lattice). Of course, the chromatic polynomial may have complex roots and this was exploited by Yang and Lee in their study of the physics of phase transitions.

Finally he teased us with the possibility that there are unbounded regions of the complex plane which are free of roots of the chromatic polynomials of graphs, but then dashed our hopes with a recent result of Alex Scott which shows that, except possibly for the unit disc, centred at 1, there exists a family of planar graphs whose chromatic roots are dense in the whole complex plane.

■ **David Larman**

Emeritus Professor of Mathematics



2010-2011

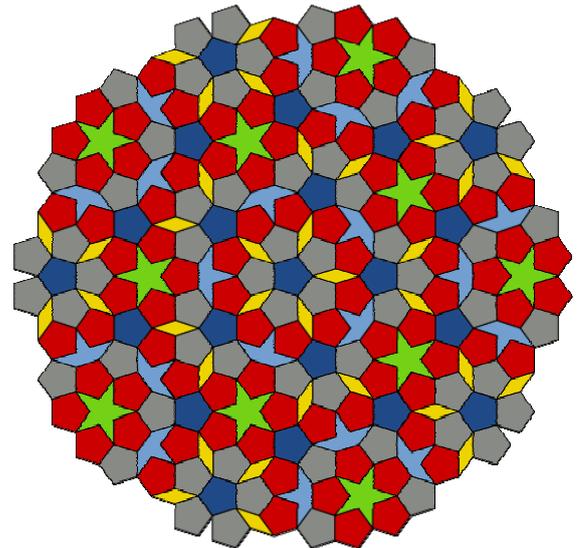
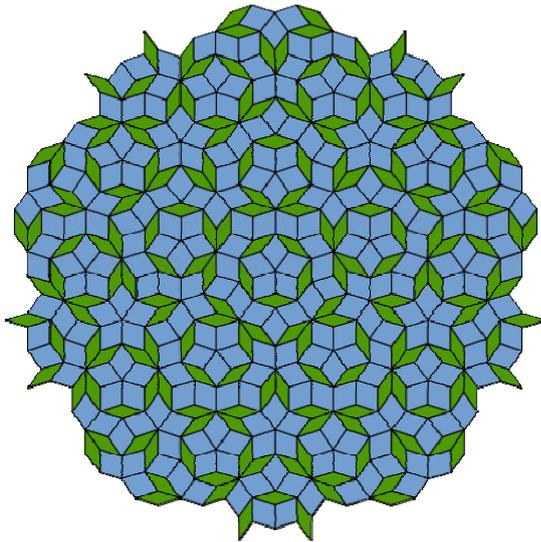
Leonid Parnovski

Leonid Parnovski gave his Inaugural Lecture '**Periodic, almost periodic, and not periodic at all problems**' on Wednesday, 24 November 2010.

Abstract: Most of my talk will be devoted to the spectral problems for periodic operators. I will describe the origins of these operators, their applications and the most interesting mathematical questions arising in the study of them. In particular, I will discuss the Bethe-Sommerfeld conjecture which was formulated in the 1930's and has been proved by me only recently. I will also discuss other classes of problems, like almost-periodic or random operators, where the application of the ideas coming from the study of periodic operators turns out to be quite fruitful.

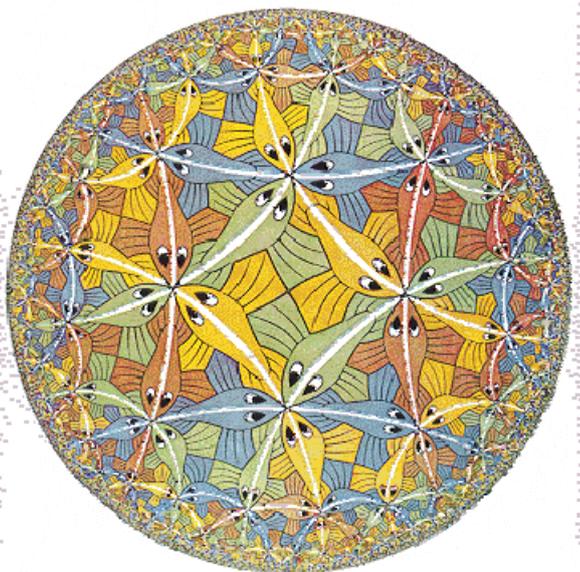


Leonid Parnovski presenting his Inaugural Lecture



Almost-periodic problems

Leonid Parnovski received his MSc (1988) and PhD (1992) from the Moscow University. He held a von Humboldt Fellowship at Düsseldorf (1993-1995), and was a Research Associate at King's College London (1995-1996). His first permanent appointment was with University of Sussex as Lecturer (1996-2000). Leonid joined the UCL Department of Mathematics in 2000 first as Lecturer, and then promoted to Reader and in 2008 to Professor. Leonid Parnovski is an internationally renowned expert on Spectral Theory of Partial Differential Operators. In 2008 he published a proof of the long-standing Bethe-Sommerfeld conjecture about spectra of periodic Schrödinger operators. This paper, published in *Annales Henri Poincaré*, won the Best Paper of 2008 award. In his inaugural lecture "Periodic, almost periodic, and not periodic at all problems", Leonid focused on the new analytic and number-theoretic methods in the theory of periodic operators, and presented other classes of problems where similar methods are likely to be useful. These include spectral problems for almost periodic and random operators.



*Periodic problems on manifolds
The group of periods is no longer abelian*



*Random problems
The potential V is random*

- **Alexander Sobolev**
Professor of Mathematics



Dima Vassiliev, Head of Department of Mathematics, Introducing the Inaugural Lectures



Professor Richard Catlow, Executive Dean, Faculty of Mathematical and Physical Sciences (MAPS), UCL. Chair of Inaugural Lectures



Guests at the Inaugural Lecture of Professor Alan Sokal



Dima Vassiliev and Alan Sokal



For Your Diary

Alexey Zaikin

Alexey Zaikin has a joint appointment with UCL's Institute for Women's Health (50%- 50%).

Alexey Zaikin will present his Inaugural Lecture '**Systems Medicine: dealing with complexity**' on Wednesday, 9 March 2011, 4.30pm in Roberts G08 Sir David Davies LT, followed by refreshments in Room 502.

Abstract:

Systems medicine is a truly multidisciplinary field and allows a systems approach to diseases. I will discuss different examples from Brownian motion to noise-induced effects and show how an interaction between different sciences drives research towards new findings and discoveries. I will illustrate also that everything is more complex than we have expected and can be solved only by systematic approach.



Guests at the Reception after the Inaugural Lecture



Eugene Shargorodsky, Alexander Veselov, Ilya Goldsheid and Nadia Sidorova





Ilya Goldsheid and Yuri Safarov



*Eugene Shargorodsky, Irina Pchelintseva and
Sergey Morozov*



AUGUSTUS DE MORGAN (ADM) MATHEMATICS SOCIETY

The UCL Augustus De Morgan (ADM) Mathematics Society was revived last year by two passionate seniors Pavan Daswani and Nirav Bansal. Despite being disaffiliated from the UCL Students' Union (UCLU), it currently stands as one of the oldest societies in the university and we are proud to be affiliated directly to the UCL Mathematics Department.

The ADM Maths Society committee 2009/10 went through periods of ups and downs with many organisational issues as a budding society. With the range of events organised last year, the society is certain to have given its students a fulfilling and enriching time at UCL.

The Financial Markets Conference (FMC) 2009 was the Society's most successful event with an outstanding attendance by over 200 people from all walks of disciplines. The conference discussed the structure of the financial industry and debated the current financial crisis. It was attended by distinguished senior members of major financial institutions, such as Managing Directors from Morgan Stanley, Deutsche Bank and Credit Suisse. Moreover, the networking sessions provided participants with a plethora of opportunities to learn about the companies involved and to gain insight into the various

application processes for prestigious internships. Indeed, the FMC 2009 was a highlight of the year and showed the commitment and zest of the ADM Maths Society.

In addition, the Finance Insight Event for Supporting Roles in an Investment Bank involved presentations from the Finance, Risk Management, Operations and Technology divisions as well as a networking session with employees of RBS. Through these comprehensive presentations, understanding of the various positions was deepened and new interests were ignited.

The society encourages its members to develop interests outside the curriculum and it also organises talks to inspire curiosity within and beyond the realms of mathematics and its applications. For instance, the society hosted a talk on libel laws by the accomplished journalist Dr. Simon Singh and was able to secure Professor Frank Johnson for an introduction to Cantor's proof of the uncountability of the real numbers.

Besides preparing young men and women for their future, the Society has held a range of social and charity events throughout the year to forge stronger bonds. This includes the Freshers' Barbecue at the start of the year, occasional pub-crawls to let our hair down, and the exhilarating Christmas Quiz held at the end of the autumn term. In February 2010, the Society collaborated with other maths societies across the UK and organised a Charity Fortnight to raise money for 'Children in Need'. It was another success with £400 raised by collective efforts from both the staff and students of the department. The Society hopes to continue this tradition in the year to come and get even more students socially committed.

The new committee 2010/11, initially led by Javkhaa Chuluunbaatar and since November 2010 by David Minarsch and Jin Zhi Teng, strives to improve the existing work and in a continuous effort to make stronger and deeper bonds with the department. In addition to the events already organised last year we have a few new dreams – an end-of-year ball for the graduating seniors and a society hoodie. With such a huge potential, may we scale higher and further in this coming year.

- **David Minarsch**
President ADM Maths Society



Members of the 09/10 committee (Mariam Kaan, Nirav Bansal, Sandra Hoac)



Freshers' BBQ



Freshers' BBQ



Christmas Quiz



Christmas Quiz



Dima Vassiliev at the Christmas Quiz

DEPARTMENT NEWS

Appointments

The following have recently joined the Department:

Mr Peter Baudains, Research Associate

James Burnett, Teaching Fellow

Dr Gaby Caldera-Cabral, Research Associate

Hannah Fry, Research Associate

Dr Javier López Peña, Teaching Fellow

Natalie Milich, Administration Team

Professor Valery Smyshlyaev, Chair of Applied Mathematics and Head of Applied Group

Dr Isidoros Strouthos, Teaching Fellow

Dr Alex White, Research Associate

Promotions

We are delighted to announce the following promotions:

Steve Baigent – promoted to Senior Lecturer

Rod Halburd – promoted to Professor of Mathematics

Karen Page – promoted to Reader in Mathematics

Retirements

John Haight – retired on 30 September 2010

Rob Seymour – retired on 30 September 2010

Provost's News

May 2010 – Imre Barany has been elected as a Fellow of the Hungarian Academy of Sciences

June 2010 – Bill Stephenson has been elected Leader of Harrow Council

PhD Awards

Students who have recently obtained PhD's from the Department include:

Martin Hahn – *Shapley polygons*

Rhodri Nelson – *Modelling vortex-vortex and vortex-boundary interaction*

Susanne Gollek – *Computations in the derived module category*

Pouya Kamali – *Stably free modules over infinite group algebras*

Joseph Pearce – *Dispersive phenomena in extended shallow water models of geophysical flows*

Chris Prior – *The theory and application of writhing*

George Kaoullas – *Localised continental shelf waves-trapped modes*

Selvinaz Sezgin – *The unrestricted blocking number in convex geometry*

Brian Tyler – *A computational method for the construction of siegel sets in complex hyperbolic space*

Prizes awarded July 2010

The following students were awarded prizes:

Artiom Fiodorov – Bosanquet Prize

Tian Xiao – Kestelman First Year Prize
Andrei Simionescu – Kestelman Second Year Prize
Giancarlo Grasso – Andrew Rosen Second Year Prize
Pietro Servini – Andrew Rosen Final Year Prize
Deborah Ritzmann – Stevenson Prize
Shi Hui Woon – Ellen Watson Memorial Scholarship in Applied Mathematics
Anders Schuller – Castillejo Prize
Michael Warschawski – Castillejo Prize
Lewis Kirkham – Mathematika Prize
Marta Gosk – Bartlett Prize
Cong Chen – Filon Prize
Maria Protopapa – Hill Prize
Atiqa Sheikh – Jeffrey Prize
Jin Zhi Teng – Sessional Prize
Amiee Wang – Sessional Prize

IMA Prizes – 1 year membership

Sandra Hoac – Third Year

Anders Schuller – Fourth Year

The following were awarded Dean's List Commendations:

Lewis Kirkham, Anders Schuller and Chuyan Tan.

Prizes awarded to MSc and PhD Students – November 2010

Edgardo Roldán Pensado – Abbott (Corte) Studentship; Archibald Richardson Scholarship

My supervisors are Professor David Larman and Professor Imre Bárány. Here is a summary of what I have been working on. I recently submitted a paper on this.

Take a d -dimensional convex body K with volume V and place it randomly in \mathbb{R}^d . Bárány proved that K missed the integer lattice with probability less than C/V for some constant c depending only on the dimension. I have been working on related problems and obtained results such as:

In an asymptotic sense the smallest possible value for C and the body that maximizes the probability above are $1/4$ and a thin ellipse, respectively.

The probability that K intersects the lattice in a set of dimension $k < d$ is less than C'/V but can sometimes be substantially smaller. I am still working on figuring out exactly how these probabilities behave.

Jonathan Remez – Mayer de Rothschild Scholarship

My supervisor is Professor Frank Johnson. My research is in low dimensional homological algebra. Specifically, I am looking at stably free modules, and obtaining an explicit free resolution for the non-abelian group of order 21: $G(21)$; with the intention of looking into more general metacyclic groups of order pq , where p, q prime and $(p-1)$ divides q . The objective is to see if a positive result can be obtained for the $D(2)$ problem for such groups.

Thomas Ashbee – Edwin Power Scholarship

My supervisors are Professor Robb McDonald and Dr Gavin Esler, and the title is shortened to '**Statistical Mechanics of Point Vortices**'.

Here is a brief summary of one chapter: A neutral vortex gas, consisting of a large number of point vortices with zero net circulation, in a bounded domain is studied. At very high energies (or 'negative temperatures') vortices of the same sign will tend to cluster. In a 'dumbbell' shaped geometry (which is reminiscent of ocean basins), a cluster of one sign can get trapped in one lobe of the dumbbell while the other signed cluster can get trapped in the other lobe. Assuming ergodicity (that every vortex will

eventually visit every point in position space) these clusters will occasionally switch lobes. This switching can be regarded as a 'phase transition' and regular transitions could be a model for seasonal climate changes. Integrations of the many-particle system is performed and compared to a stochastic differential equation (derived from large deviation theory) with a force field based on the uniform distribution of point vortices in the dumbbell (the microcanonical ensemble).

Ahmad Jamil Nadim – Sir George Jessel Studentship; Mayer de Rothschild Scholarship; Monica Hulse Scholarship

Under the supervision of Professor F.E.A. Johnson, I am working on classifying two-dimensional CW complexes up to homotopy, via solving Johnson's ' $R(2) - D(2)$ problem' for various classes of infinite groups. In particular, constructing "exotic" algebraic 2-complexes over $\mathbb{Z}[Q_{4n} \times F_m]$; the group ring of the generalised quaternion group of order $4n$ cross a free group of order m , with $n \geq 2, m \geq 1$, computing the related syzygies and stably free modules. This paves the way to a possible counter-example to Wall's $D(2) -$ problem.

Louise Jottrand – Wren Bequest

My supervisor is Professor David Larman and my thesis is on '**Shadow Boundaries of Convex Bodies**'.

Abstract: It is known that for almost all subspaces of \mathbb{R}^n , the shadow boundaries of any convex body C will be sharp. This result was shown by Ewald, Larman and Rogers in 1970. My main result so far has been to show that these sharp shadow boundaries have finite length. I am now working on using similar methods in the case of increasing paths on the 1-skeleton of convex bodies to show that these also have finite length.

Maung Nyein Chan – Archibald Richardson Scholarship

My supervisor is Dr Christian G Böhmer. The title of my thesis has not yet been decided but it can be generalised as '**Dynamical Systems In Cosmology**'.

The abstract is as follows: This research programme is concerned with the role of dynamical systems in various contexts within cosmology, motivated by the concept of the hypothetical dark energy that is believed to be responsible for the recently discovered accelerated expansion of the universe. Many systems and processes of cosmological interest can be modelled as dynamical systems. Dynamical models of dark energy coupled to dark matter in various forms are being investigated. Primarily, we apply linear stability theory to study such critical systems in cosmology. For cases where linear stability theory fails, for example, when tackling more complicated problems concerned with a three-form field in cosmology, various alternative approaches, including, but not limited to, centre manifold theory, Lyapunov direct method etc were explored. Aforementioned techniques have direct applications not only in applied mathematics, theoretical physics and control engineering, but also in finance, economics, theoretical immunology, neuroscience and many more.

Wenting Wang – Lighthill Scholarship

My supervisors are Dr Robert Bowles and Professor Steve Bishop. I am currently working on Opinion Dynamics and the following is a summary of my research:

The research area is aimed at establishing social communication models and improving their complexity. Complex system theories, asymptotic methods with other analytical methods and computation are used based on mathematical modelling. The main application is persuasion modelling in advertising, politics issues and business negotiations. The initial step is to understand the existing persuasion models and add influencing factors to them. The further plan is to find universal methodology of social communication models.

J J Sylvester Scholarship Fund

The J J Sylvester Scholarship Fund was set up in 1997, on the centenary of the death of J J Sylvester, one of the most gifted scholars of his generation. The Fund aims to award a scholarship to help support a gifted graduate mathematician.

Donations may be made by cheque, charity voucher or GiftAid. Cheques should be made out to the *UCL Development Fund (J J Sylvester Scholarship)* and sent to the Department Administrator, Helen Higgins, or to make a gift by credit or debit card, or set up a direct debit (if you have a UK bank account) by post, please download a [gift form](http://www.ucl.ac.uk/makeyourmark/donating) (<http://www.ucl.ac.uk/makeyourmark/donating>) and return it to UCL Development & Alumni Relations Office, FREEPOST LON 5559, UCL, Gower Street, London, WC1E 6BR, UK. Please remember to add the bracketed words to avoid the monies being put into the general College fund. Any donation, large or small will be gratefully acknowledged by the College. If you are interested in knowing more about the Fund or other tax-efficient ways of supporting the Fund please contact the Gifts Manager at the Development & Alumni Relations Office (020 7679 9736 email: makeyourmark@ucl.ac.uk).

Sylvester was one of the greatest mathematicians to be associated with UCL and it is hoped that, through contributions to the scholarship, we will be able to assist in progressing the education of other mathematicians to realise their full potential for the benefit of us all.

Robert Downes – J J Sylvester Scholarship 2010-2011; John Hawkes Scholarship

My supervisor is Dima Vassiliev and the title of my thesis is (currently) '**Modelling fermions by means of Cosserat elasticity**'.

The research project 'Modelling fermions by means of Cosserat elasticity' aims at developing a new mathematical description of fermions, i.e. elementary particles such as the neutrino and electron. The accepted way of describing fermions mathematically is by means of a spinor field. I do it differently. The central idea is that I allow every material point of the (spacetime) continuum to rotate and assume that rotations of different material points are totally independent. These rotations are described mathematically by attaching to each geometric point a coframe (= orthonormal basis) which plays the role of a dynamical variable.

The idea of rotating material points may seem exotic, however it has long been accepted in continuum mechanics within the Cosserat theory of elasticity. Moreover, this idea lies at the heart of the theory of teleparallelism (= absolute parallelism), a subject promoted by A. Einstein and E. Cartan in the 1920s.

People

Maria Bocharova (2009)

I am currently doing the MRes year of the 4-year CoMPLEX course at UCL.

Tan Li (Tieqiang) (2005)

Passed my VIVA on Differential Topology in November 2009. I am now located at Durham.

**STOP PRESS
For Your Diary**

**The Mathematics Department
De Morgan Association Dinner will be held on**

**Thursday 16 June 2011
Venue to be confirmed**

All those on the UCL Alumni database will be sent an invitation to the next De Morgan Association Dinner. Make sure you send us addresses of anyone else who may want to receive an invitation and remember to keep the Department and Alumni Relations Office of UCL informed of any changes of your address.

We would welcome news and contributions for the next newsletter which should be sent to:

Professor Michael O'Neill, The De Morgan Association, Department of Mathematics, University College London, Gower Street, London WC1E 6BT.

E-mail: meo@math.ucl.ac.uk.



Guests at the De Morgan Association Dinner