De Morgan Association Newsletter

from the Department of Mathematics UCL

Issue - 20 - 2012 **Editor - Michael O'Neill**

DE MORGAN ASSOCIATION DINNER

Wednesday 6 June 2012

The annual dinner of the De Morgan Association was held on Wednesday 6 June 2012 in the Jeremy Bentham Room at UCL, preceded by sherry in the Haldane Room.

Professor Jeremy Gray speaking at the De Morgan Association Dinner

This year the Guest of Honour was Professor Jeremy Gray, Professor of the History of Mathematics, Open University and Teaching Fellow at UCL. Professor Gray's address highlighted the role played by UCL, or the University of London as it was when it was founded in 1826, in opening up university education to gifted students, whatever their background. It is hard to believe that the creation of the University of London, with its universal religious tolerance, was opposed by the universities of Oxford and Cambridge as well as the Church of England and even Parliament.

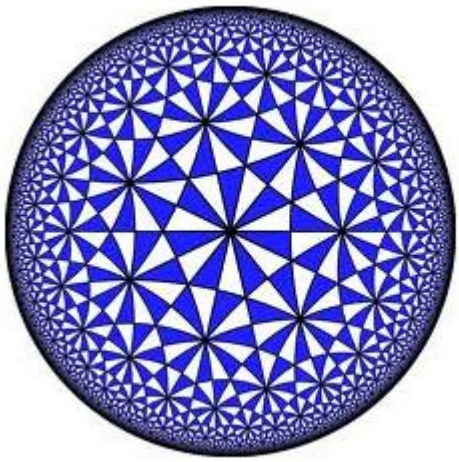
This edition of the Newsletter is issue number 20 and it marks 10 years since I took over as Editor from Patricia Rothman, who had edited the Newsletter since its introduction 10 years earlier when David Larman was Head of Department. I therefore thought that it was now an opportune time for me to pass the torch to a new generation, and I am delighted that my successor as Editor will be Professor Ted Johnson.

The past 10 years have been eventful years for the Department of Mathematics, in common with all university departments in the country, and it has been interesting to observe how the changing face of the Department has been reflected in the articles contributed to the Newsletter.

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

MAKING SPACE

I'd like to thank you for the invitation. It's an honour to be asked, and a pleasure to be among mathematicians.



As I'm sure you all know, UCL – or rather, the University of London – was founded on 11 February 1826, and because of the radical nature of the aims of the founders trouble attended its early years. The ideal of religious tolerance, extended to Roman Catholics, Jews, and members of other faiths was opposed by Oxford, Cambridge, the Church of England, and indeed Parliament.

The foundation stone was laid in 30 April 1827. It was laid by the Duke of Sussex, and this is oddly interesting, because he was the sixth son of George III, and laid the stone in full Masonic regalia as Grand Master of the United Grand Lodge of England. He had become Grand Master in 1811 and remained so until his death in 1843. What he had united was the original Grand Lodge of England, which had been founded in 1717, and a split-off in 1751 called the Grand Lodge of Ancients. The original Grand Lodge then called itself the Grand Lodge of Moderns – so the ancients were modern and the moderns more ancient. Sussex brought them back together in 1813, in the spirit of accepting all religious denominations within Freemasonry – the same ideals that later animated the founders of UCL.

But this story says something more. What were Masons doing with the founding of a University anyway? Masons, as their name reminds us, were originally an ancient guild, whose members possessed the knowledge of a skill – building and architecture – that kept them in work. Only by joining them could anyone learn to put up large buildings, and only after the great fire of London in 1666 did they relax the rules about whether masons could travel from one region of the country to another. So there was a paradox in play, as secret instruction was being replaced by public education and the creation of an architectural profession. The school of architecture was established at UCL in 1841.

This is the first space of the evening: the space created by architects: public spaces, private spaces, institutional spaces, civic spaces. The space where education takes place. In the vision of the creators of UCL, this was to be a much more open space than that contemplated in Oxford and Cambridge, open to men of all religions, although not, initially, to women. It is the space of society, your place in it, and that of others.

The second space I have in mind is associated with the great mathematician, physicist, and philosopher Henri Poincaré, who died a hundred years ago this year and whom I've spent a lot of my time writing about. One of his earliest successes was to find a substantial mathematical use for a discovery that had been gradually accepted by no more than a generation of mathematicians before him. This was the realisation that there might be a geometry of physical space that was not the same as Euclid's. The new, non-Euclidean, geometry had been discovered by Bolyai and Lobachevskii around 1830, but had met with rejection and neglect that took a generation to shift – in this country William Clifford, the Mathematics Professor at UCL, was its first enthusiastic proponent in the 1870s.

Well, in the 1880s Poincaré found a way of defining lots of new functions of a complex variable on the space you see depicted in the disc (see above). There you see lots of triangles with angles of $\pi/2$, $\pi/3$, and $\pi/7$, and if you quickly add them up you see that the triangles have an angle sum of $41\pi/42$, which is less than π. This tells us that in this disc we have non-Euclidean geometry – and all the triangles are congruent. They don't look it, but that's a consequence of the way they are represented in the disc.




Guests at the De Morgan Association Dinner

Today, with our expanding universes and ten-dimensional spaces, and space-time foam at the Planck scale, it may seem rather tame to contemplate just one new geometry. But in the 1880s when the news that space might not be Euclidean – or rather, that mathematicians were beginning to accept that space might not be Euclidean – leaked out, it caused quite a fuss. No-one seriously contemplated the idea that we should adopt non-Euclidean geometry – Euclidean geometry is obviously a very good account of the geometry of space – but the educated public perhaps realised that their school mathematics teachers had been unduly dogmatic. Perhaps all those theorems about isosceles triangles, right-angled triangles, and the like weren't matters of logic – perhaps they weren't actually true.

It looks like an empirical question, albeit a delicate one: is space Euclidean or non-Euclidean? Who better than Poincaré to answer it? But his answer was surely a surprise: he said that we can never tell. Imagine an experiment with light rays and triangles, and suppose it says that the angle sums of the triangles are less than π. Well, you can say either that light rays are straight and space is non-Euclidean, or that space is Euclidean and light rays are curved. There is no logical way of deciding between the two, and we simply adopt the most convenient one, which for us will be Euclidean geometry, but could be, for other creatures in the universe, non-Euclidean geometry.

And why is Euclidean geometry more convenient? Because, through our evolution as a species, everyone of us as an infant, before we are capable of formal instruction, creates the space around us. From the sensations of sight and touch, from our ability to move around, above all for our ability to make compensating motions so that some moving objects seem at rest we each create a geometry. From the motion of solid objects, which form a group that we have evolved to find congenial and useful, we create a geometry – and it is, as I said, Euclidean. So this is the second created space: the idea that space is

whatever it is, and we create a geometry about it that suits ourselves. Using our innate idea of the group, we create our sense of space.

Poincaré was not saying that we can say anything we like about space. He thought it was a mental construct and like all such constructs it had to be useful. To be useful it had to allow all the accepted experimental results to be built into a mathematically consistent theory. But we had also to be clear that there might well be several such theories, and our choice between them was not constrained by logic to a single one.

In his working life, the subject that occupied him greatly and displayed these issues in an extreme form was electro-magnetic theory: there were two inconsistent theories, those of Lorentz and Hertz, and both seemed to have many excellent features and one fundamental flaw.

Now, as you know, these issues are back, and they do concern if not space then space-time – all those 10—dimensional spaces and all that space-time foam. This is one aspect, the creative side of mathematics: we are free to hypothesise all sorts of structures out there and to see if they work. If they do, if they explain, organise, lead to new ideas that also check out, then good – and that's all we can hope for. Mathematicians are not passively describing the world, they are actively describing it.

Non-mathematicians labour under the misapprehension that all mathematicians do is draw out logical consequences of statements already made. But even in what we might call pure mathematics, it is false that mathematicians do not create. The disc was one Riemann would have recognised in the 1850s, although he never drew it. It was visible to Schwarz in a related context in 1871, but he didn't see it that way and missed its significance. It was imagined by Poincaré, although he never drew one as detailed as this, and what it does is make intelligible and usable the discoveries of Bolyai and Lobachevskii, which had been ignored throughout the lives of the true discoverers of non-Euclidean geometry. The disc above is therefore a portal into another world, and it has to be seen as such and used as such.

The final space I want to bring you is yours already. It is personal space. Rather more obviously than the geometry of the universe, it is a space you create, but like architectural space it is also one that is created around you by others. Benjamin Jowett, the great 19th century classical scholar, said of his Oxford contemporary Henry Smith, one of the few really distinguished British mathematicians of the 19th century, that

"The mathematician is more cut off by his pursuits from his fellow-men than the student of any other branch of knowledge. He has interests which are locked up in his own breast, pleasures and also pains which he cannot communicate to others".

I need hardly remind an audience of mathematicians that we all belong to a marginal group in society: we are acceptable figures of fun. We have all spent years studying the only academic subject it is socially acceptable to say you are bad at. Apparently, it is not just elitist to do mathematics, it is also widely believed to be a character failing. Now I realise that some of you have decided to deal with this public perception of your personal space by embracing the 'F' word – I refer, of course, to finance. For that matter, I'm quite sure that you will receive regular requests to contribute to this or that initiative of the College in future years. But whatever you do, I hope that those of us on this side of the fence have succeeded in one thing: to make you a friend of mathematics. Whether you startle us with your discoveries, or do nothing more than write to your MP in support of your local school, you have chosen to create a life for yourself with mathematics in it. Your personal space has its own sense of space, a space for remarkable reflections upon the world around us and the worlds our minds can create. And in it, and I'm sure I speak for all my colleagues in the Mathematics Department at UCL, I hope mathematics will be a friend to you.

■ **Jeremy Gray**
Professor of the History of Mathematics, Open University; Teaching Fellow at UCL

Guests at the De Morgan Association Dinner

FIRST YEAR IN THE JOB

It has been a dynamic year in the Department with many significant happenings some of which are reported on elsewhere in this Newsletter. It is my privilege to highlight some of these in this article. Without doubt the most exciting has been the appointment of many excellent new staff. These include five permanent members of academic staff, two teaching fellows and five members of the administration team. These are all detailed elsewhere in the newsletter. Additionally, we look forward to welcoming in early 2013 Professor Michael Singer to a Chair in Pure Mathematics, Professor Erik Burman to a Chair in Computational Mathematics and Dr Felix Schulze as Reader in Pure Mathematics. The new appointments reflect, for example, new initiatives in financial mathematics and the building of an outstanding group in geometry. Further appointments are planned and we look forward to continued strengthening of research and teaching in the Department.

It has been an excellent year in obtaining major research grants from funding bodies such as EPSRC, Medical Research Council and the Leverhulme Trust, indicating that the Department is a significant contributor to mathematics research in the UK. A particular highlight was Dr Andrei Yafaev's award of European Research Council Starting Grant for his project "Some Problems in Geometry of Shimura Varieties". This is a significant achievement in a very competitive field.

The Department was sorry to see Professor William Shaw leave during the summer to take up a position in industry. His legacy, the MSc programme in Financial Mathematics and Financial Risk Management, has just had its first intake of students and, by all reports, is running smoothly. The Department is grateful to Professor Shaw for his considerable effort in establishing the programme and looks forward to maintaining close links with him in his new position of Visiting Professor.

The British Applied Mathematics Colloquium was another highlight (see photos elsewhere in this Newsletter). This annual national gathering of applied mathematicians, held in exceptionally warm spring sunshine in late March, returned to UCL after an absence of 40 years. It was a great success and attracted 240 delegates from across the UK and abroad. Thanks go to all those involved in its organization, particularly Professor Jean-Marc Vanden-Broeck, Dr Helen Wilson and members of the Department administration team.

Finally, the Department has recently reinvigorated its website. This was a major task ably carried out by Dr James Burnett, a recent PhD graduate and now a part-time Teaching Fellow. Some of the items featured in the newsletter are also available on this website, as will notices of future events and items of interest.

■ **Robb McDonald**
Head of Department

GEOMETRY AND HEART TRANSPLANTATION

The first author was David Larman’s first PhD student, investigating multi-dimensional geometry. His research has since become rather more applied, working in close collaboration with doctors on a broad range of topics including the design of screening programmes, modelling hospital capacity requirements and development of methods for monitoring adverse events such as hospital acquired infections or post-operative deaths.

A recent project concerns paediatric heart transplantation and waiting lists for donor hearts. At first sight, this seemed well suited to analysis using standard techniques from probability theory, although this turned out rather more complicated than expected. Unexpectedly, multi-dimensional geometry proved to be the key.

Our modelling is based on the assumption that, in the absence of transplantation, death while on the waiting list occurs as a chance event at a known average rate. We also assume that arrivals of potential donors occur at random at known average rates, with blood types distributed according to the national average and with a known distribution of body mass. The reason for making these latter assumptions is that donors and recipients have to be matched according to blood type and also have to be of a comparable body mass. Given such matching rules, we assume that when a donor heart becomes available, it is given to the matched transplant patient who has been waiting longest, if there is one.

A problem of interest concerns a new patient just joining the waiting list for heart transplantation. Given the hospital doctors know the blood types and body mass of all those waiting, can one estimate the probability of the new patient surviving long enough to receive a transplant and the expected time waiting? This would be very useful information for patients, parents and the clinicians managing the transplant service.

Although our assumed waiting list rules give priority to those waiting longest, it is not a 'first in, first out' queue. Consider a hypothetical example. Suppose that Derek joins a waiting list of two patients, Alf and Bob, of whom Alf has waited longer. Although Alf has priority, a donor heart may become available that is matched to Bob and not to Alf, and thus Bob might receive a transplant first. Sadly, Bob might also die while waiting, again leaving Alf and Derek still waiting. Up to the time that Derek leaves the waiting list, there are four possibilities for the subset of patients ahead of him in the waiting list: *{Alf,Bob}, {Alf}, {Bob}* and ϕ, the empty set. Using these sets, abbreviating names, the possible courses of Derek's wait in terms of who precedes him in the waiting list can be represented by the directed graph shown in Figure 1.

A similar directed graph is shown in the right hand diagram in Figure 1 in the case where there are initially three people ahead of Derek on the waiting list, (not all the arrows have been included). Given the uncertainty of events, all possible paths might be followed through these directed graphs, the different nodes representing distinct states that the system might be in at any given time.

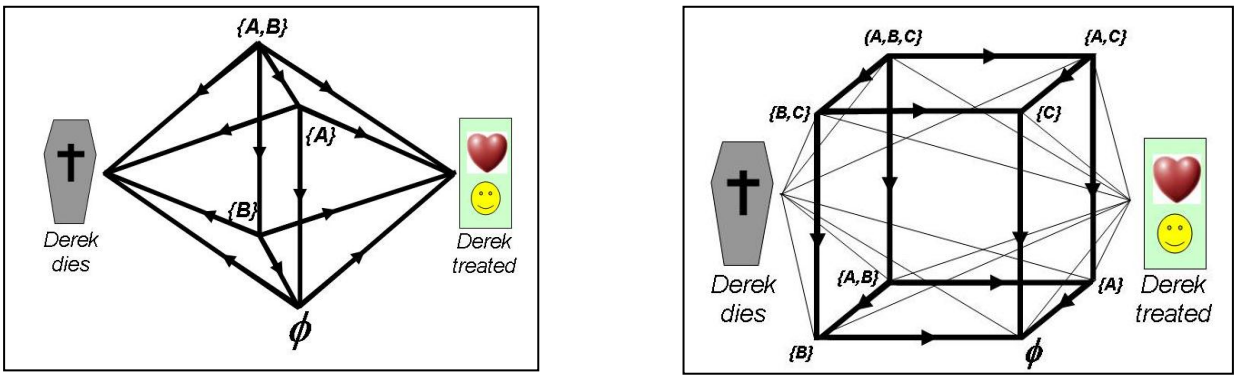


Figure 1. Directed graphs showing the potential courses of Derek's wait in terms of subsets of those ahead of him on the waiting list. The left hand graph is for the case where there are initially two people who precede Derek, the right hand graph where there are three.

Since there is no certainty about exactly which course would be followed through these directed graphs, it is of interest to consider the time-varying probability that the system would be in a given state at a particular time. Representing a waiting process in terms of a directed graph with time varying state probabilities associated with each node is an example of what is called a Markov process, named after the Russian mathematician Andrei Markov (1856-1922) who developed the technique.

Knowing the weight and blood type of everyone waiting and the average arrival rate of donors and how their weights and blood types are distributed, one can estimate the chance of Alf leaving the waiting list within a small time interval of length δt. Equally, one can calculate the probabilities of Bob leaving the

list, depending whether or not Alf is still waiting. In a similar fashion, the probabilities of making any particular transition from one node to the next in the directed graphs of Figure 1 in time δt can be calculated and, from this, one can derive systems of differential equations for all the state probabilities.

In the case where there are initially two or three people preceding Derek on the waiting list, these are easy to solve and their solution can be used to derive the probability that Derek eventually receives a transplant and his expected time on the waiting list. However, this becomes rather difficult in the general case where a new patient on the waiting list is *n*-th in the queue, which is why multi-dimensional geometry became useful.

Figure 1 came about as a result of experimentation motivated purely by the wish to draw attractive diagrams. However, the moment the left hand diagram was drawn, it was recognised that its edges corresponded to those of the octahedron constructed by gluing together two pyramids whose bases are squares. The directed graph depicted in the right hand part of Figure 1 is a four dimensional generalisation of this, this time gluing together two pyramids whose bases are cubes (whatever four-dimensional glue is).

For $n \geq 4$, if a new patient is *n*-th on the waiting list, the directed graph, generalising those in Figure 1, is more difficult to visualise. It corresponds to the edges of an *n*-dimensional polytope (a generalisation of the polygon or polyhedron), this time gluing together two pyramids whose bases are *(n-1)*-dimensional hypercubes, as depicted in Figure 2.

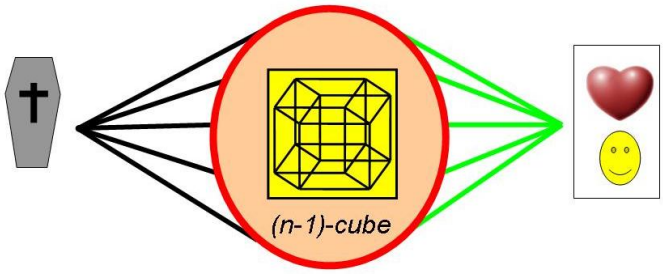


Figure 2. Generalisation of the directed graphs in Figure 1 based on subsets of patients having preceded a patient initially n-th on the waiting list.

Given the geometric nature of the directed graph in Figure 2, it is natural to re-label the vertices of the *(n-1)*-dimensional cube using the 2^{n-1} *(n-1)*-dimensional vectors whose components are all 0 or 1. Directed edges correspond to ordered pairs of such vectors whose components differ in only one place. Given this graph theoretic structure, one can derive an explicit formula for the probability of eventual transplantation for a patient initially *n*-th on the waiting list.

Estimating expected time on the waiting list is a little more difficult, but here one can use a trick from probability theory, using so called probability generating functions. With these, it can be shown that the distribution of waiting times of a patient initially *n*-th on the waiting list is a generalisation of a probability distribution called the hyper-exponential. From this, explicit formulae can be derived for the expected waiting time, its standard deviation and other summary statistics of interest. This generalised distribution could arguably be called a hypo-hyper-exponential distribution, although we doubt that this name will catch on, particularly in paediatric circles.

- **Steve Gallivan**
  Emeritus Professor of Mathematics
  Sonya Crowe
  Lecturer
  Clinical Operational Research Unit

BAMC 2012

From March 27 to March 29 2012, we hosted the British Applied Mathematics Colloquium (BAMC). It was a very exciting event because it was the first time since 1972 that UCL was hosting it. There were more than 250 participants consisting of senior and junior faculty members, postdocs and graduate students. The programme involved 4 plenary lectures, 11 minisymposia, contributed talks (organised in 7 parallel sessions) and posters. The range of the topics of the talks was very broad. It reflected the research interests in the department and included fluid mechanics, general relativity, inverses problems, mathematical ecology, medical applications, numerical analysis, social modelling, free surface flows, industrial mathematics and geophysical fluid dynamics. There were also talks on quantum dynamics and quantum information. A special session was organised to honour Frank Smith with talks presented by his students, postdocs and co-workers.

David Hughes, Russell Davies, Jean-Marc Vanden-Broeck and Robb McDonald

Jennifer Siggers, Frank Smith and Kim Parker

We are pleased that all participants seem to have survived all these scientific activities, maybe because of our extended social programme: 2 wine receptions and a very nice banquet at the Russell Hotel where Nick Trefethen was our after dinner speaker.

As in previous years the event "Meet the Mathematicians" was run in tandem with the BAMC. It welcomed 180 year 12-13 school students, along with their parents and teachers, with an interest in studying mathematics at University. It was also a great success and the crowds from BAMC and 'Meet the Mathematicians' joined to hear a public lecture by David Spiegelhalter.

This meeting could not have been organised without all the work and efforts of many members of the Mathematics Department. Special thanks are due to Helen Wilson, Robb McDonald, Christian Böhmer, to our administrative support staff, Soheni Francis, Bonita Carboo, Helen Higgins, Raheelun Nabi, and to the student helpers. We are also grateful for the generous support of our sponsors.

- **Jean-Marc Vanden-Broeck**
  Professor of Mathematics, Chair of BAMC 2012

David Tranah (CUP) and Alexander Korobkin

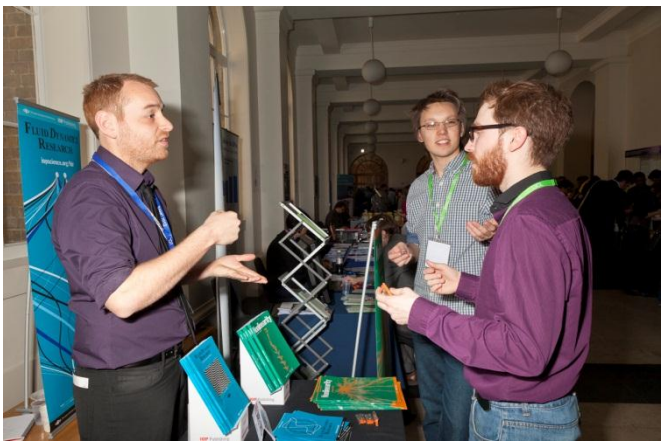
Keith Ball, David Youdan and Caterina Mora

Efim Pelinovsky and Eugene Benilov

Toby Davies (l) Peter Baudains (c) and Steve Bishop (r) at the BAMC

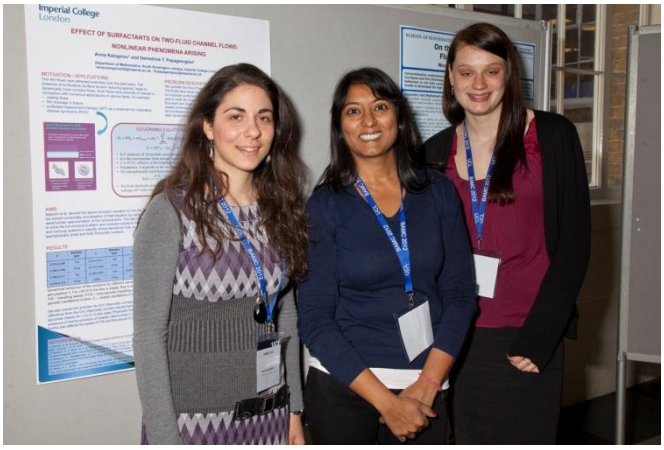
Paul Milewski (r) at the BAMC

Xuesong Wu and Yibin Fu



IOP Publishing representative (l), Adam Townsend (c) and Giancarlo Grasso (r)

Ted Johnson, Eugene Benilov, Roger Grimshaw and Efim Pelinovsky



Anna Kalogirou (l) at the BAMC

Linda Cummings (c) and Joel Phillips (r) at the BAMC

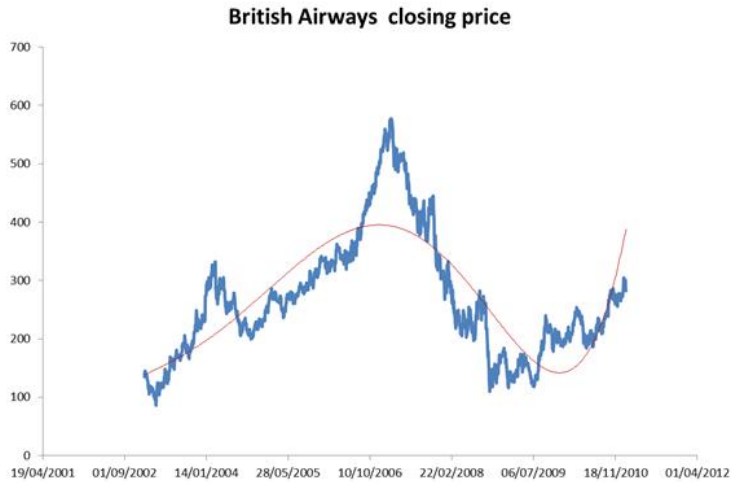
Giancarlo Grasso (l) at the BAMC

Alastair Rucklidge (r) at the BAMC

MATHEMATICS IN FINANCE – THE UNFAIR ADVANTAGE

These days it is hard to escape financial news; whether we watch the news reports on TV, breeze through the financial pages in the press, or look at our hand held devices. Terms such as Derivatives, LIBOR, short selling or FTSE100 are constantly reminding us that finance is the most global of industries. The financial crisis has been the chief headline across worldwide news bulletins and remains a fierce topic of discussion. There has never been a more crucial time for understanding the underlying mechanics of the complex products traded in the markets, together with a responsible approach to managing the associated risk.

Undeniably, the way finance has developed in recent years can be attributed to the part of mathematics which has played a central role, and remains the chief driving force allowing the financial markets to become increasingly sophisticated. There is little doubt that maths has 'hijacked' most disciplines and its appeal and influence is noticeable in most branches of knowledge. In addition to the traditional areas of scholarship that depend on maths for its framework, less obvious academic themes are also enjoying the tangible advances being made due to the reliance on maths, such as Political Science, Medical Research and Sociology.



`Quantitative Finance' as a branch of modern finance continues to be one of the fastest growing areas within the corporate world. The sophistication and complexity of modern financial products, has acted as the motivating factor for new mathematical models and the subsequent development of associated computational schemes. Alternative names for this subject area are Mathematical Finance, Financial Mathematics, or Financial Engineering. Pricing, trading, management and risk control of complex financial products such as derivatives all depend on mathematics for a responsible approach.

As investment decisions for predicting risk and return are being increasingly based on principles taken from the Quantitative Finance arena, the field provides a challenge for both academics and practitioners. Although relatively young, financial mathematics has developed rapidly into a substantial body of knowledge and established part of mathematical science.

The field of mathematical finance has become particularly prominent due to the much-celebrated Black-Scholes equation written in 1973 by Fischer Black, Myron Scholes and Robert Merton, for which the latter two were awarded the Nobel Prize for economics, in 1997. Fischer Black sadly passed away in 1995; the Nobel Prize is not awarded posthumously. The origins of quantitative finance can however be traced back to the start of the twentieth century. Louis Jean-Baptiste Alphonse Bachelier (March 11, 1870 - April 28, 1946) is credited with being the first person to derive the price of an option where the share price movement was modelled by Brownian motion, as part of his PhD, entitled Théorie de la Spéculation (published 1900). Thus, Bachelier may be considered a pioneer in the study of financial mathematics and one of the earliest exponents of Brownian Motion.

Whilst many argue that collaboration between mathematicians and industry is far from optimal, Quant Finance gives an example of the perfect partnership. Financial Engineering has the attraction of being one of only a few areas of mathematics that plays a central role in current developments in its domain of application. It has a direct relationship with the `real world' while it both draws from and has direct implications upon every-day financial practice in the commercial arena.

Quantitative Finance embraces the complete range of pure and applied mathematical subjects, which include probability and statistics, partial differential equations, numerical analysis, computation and operational research. The result has been an extraordinary number of quantitative based scientists from a wide variety of backgrounds moving into this area of research. In addition, the interdisciplinary nature of this subject matter has meant successful collaborative work being conducted by mathematicians, economists, finance professionals, theoretical physicists, and computer scientists. Even the psychologists are now playing a role through behavioural finance!

Washington overlooks Wall Street

In recent years, there has been an explosion in the availability (and popularity) of advanced degrees in mathematical finance at some of the top tier universities internationally. These are aimed at leading numerate graduates towards highly lucrative careers as quantitative analysts (quants), quant developers, and quant traders, in investment banks, hedge funds and other financial institutions. The general view is that “you can teach a mathematician, finance, but you can’t teach a finance person maths.” Imperial College, King’s College and Oxford University were among a handful of elite UK based academic institutes offering world class MSc programmes in this area.

To address this deficit at UCL, and its vision to become a major global player in financial technology, the college took the initiative of creating its first Chair in Mathematical and Computational Finance. Professor William Shaw took up this exciting position in January 2011, hosted jointly by the departments of maths and computer science. In addition to setting up an active Mathematical Finance research group, William created two new MSc degrees based on the application of maths and computation to finance. The MSc in Financial Mathematics is based in the Mathematics Department, whilst the MSc in Financial Risk Management is based in the Computer Science Department. Both these courses will have their first intake in autumn 2012, with some modules common to both programmes.

Advanced instruction that is both demanding in mathematics and related to practice, concurrently, has become a joint concern and a success factor for both educational bodies and the capital markets. The emphasis in the new UCL Financial Mathematics programme is to develop mathematical skills, programming proficiency and confidence in exploring financial data.

An MSc in Mathematical Finance is the basic prerequisite for a serious approach to quantitative analysis work in investment banking. The combination of mathematics and programming provides a very attractive mix of technical expertise for any prospective employer, or forming the basis of future research work. An aptitude for programming in C++ for a quant is of equal importance as mathematical knowledge. At the interview stages, many capable mathematicians fail to demonstrate the necessary degree of competence in programming. The UCL MSc programme has addressed this concern from the outset, and a major component of this degree is the inclusion of C++ instruction throughout the course. Faculty from the departments of Computer Science, Mathematics and Statistics are contributing to the delivery of the course modules.

I finish with a wonderful definition of a derivative that appeared in The Financial Times; and leave you to form your own view!

A derivative is like a razor.
You can use it to shave yourself and make yourself attractive for your girlfriend.
You can slit her throat with it.
Or you can use it to commit suicide.

■ **Riaz Ahmad**
Teaching Fellow, Department of Mathematics

FACULTY TEACHING AWARDS 2012

The winner of the MAPS Faculty Teaching Award for 2012 is **Dr Isidoros Strouthos** (Department of Mathematics).

Many congratulations to Dr Strouthos for displaying an extremely high standard of excellent teaching.

Professor Robb McDonald, Head of the Department of Mathematics, noted that:

"Isidoros teaches mathematics in the traditional way: using a board to carefully build a rigorous and logical argument in real time. He does this with patient and clear explanation, at a pace in which the audience are able to follow and understand. While mathematicians appreciate the importance of modern computer-based learning methods, they know that this traditional method works superbly and is also appreciated by students. What puts Isidoros into the truly exceptional class is his ability to explain not just the mathematics, but, importantly, the context and the strategy in deriving particular mathematical results. This enables students to understand and comprehend fully."

Chris Daw

An additional Faculty award was awarded to:

Mr Christopher Daw in recognition of his inspirational and excellent teaching as a Postgraduate Teaching Assistant.

Many congratulations Isidoros and Chris!

INAUGURAL LECTURE

2011-2012

Valery Smyshlyaev

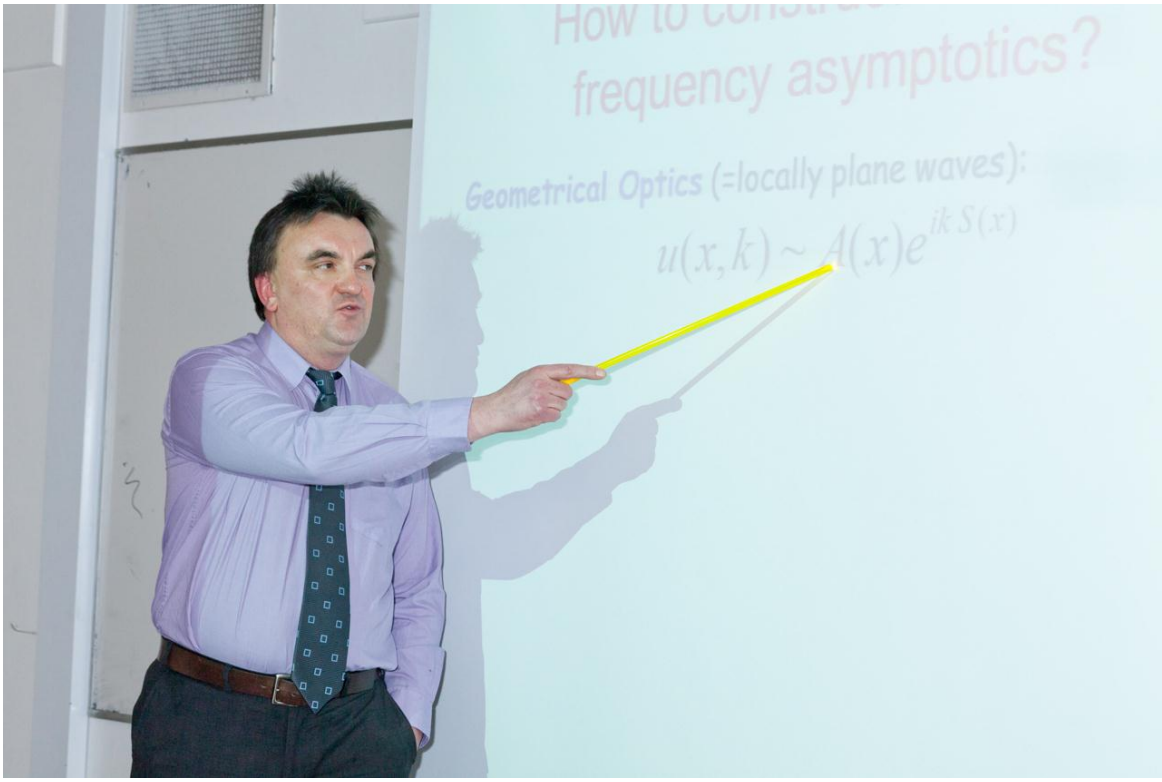
Valery Smyshlyaev gave his Inaugural Lecture **'Living in a multi-scale world (and making a mathematical sense of it)'** on Wednesday 7 March 2012.

Abstract:

Nearly everything around us displays `multiple scale' effects, where interactions between the `smaller' and the `larger' often lead to unusual effects. These can sometimes be explained, predicted, and quantified using tools of mathematical analysis of multi-scale partial differential equations. I will describe some examples from high-frequency scattering and from physics of `metamaterials' (i.e. composite materials with macroscopic properties radically different from those of conventional materials). I will argue that mathematics not only subjects ideas based on physical intuition to scrutiny of rigorous mathematical analysis and hence assists in assessing the accuracy of the physical models (and of their possible limitations), but also leads to rigorously deriving novel mathematical models displaying new physical effects as well as designing new efficient numerical schemes. This prompts in turn development of a new analysis requiring revisiting in this multi-scale context of such fundamental mathematical concepts as convergence and compactness (e.g. in the spectral, operator, and variational theories).

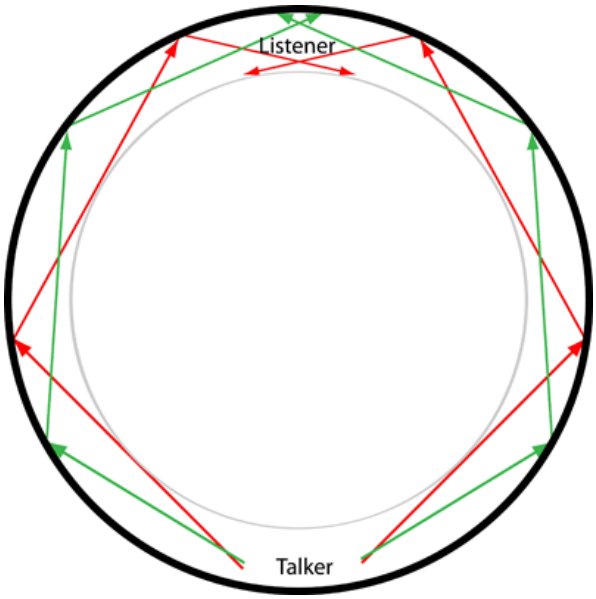
Valery Smyshlyaev, Robb McDonald, Head of the Department of Mathematics and Professor Richard Catlow, Executive Dean, Faculty of Mathematical and Physical Sciences (MAPS), UCL, Chair of Valery Smyshlyaev's Inaugural Lecture

Valery Smyshlyaev received his MSc (1983) from St-Petersburg (Leningrad) University and his PhD (1987) from St. Petersburg Division of Steklov Mathematics Institute. In 1987-1995 he held Research Associate positions in St. Petersburg Division of Steklov Mathematics Institute, Universities of Bath and Cambridge. In 1995, V. Smyshlyaev moved to the University of Bath where he first was a Lecturer and EPSRC Advanced Research Fellow, then a Reader and from 2002 a Professor. In 2010, luckily for all of us, Professor V. Smyshlyaev moved to UCL.

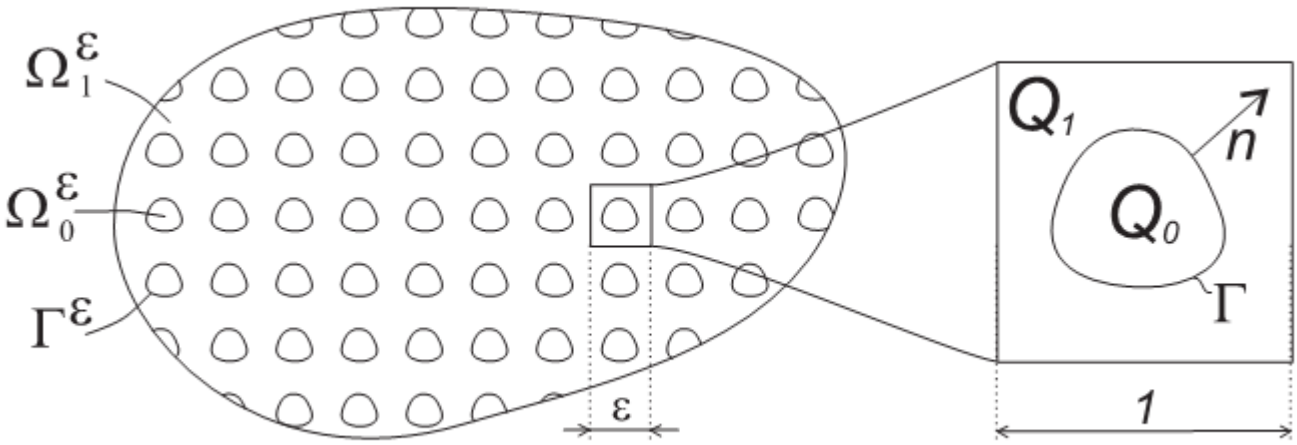


Valery Smyshlyaev presenting his Inaugural Lecture

During 25 years of scientific life, V. Smyshlyaev has been a citizen of a multi-scale world. Back in St. Petersburg he started a study of a macroscopic world inhibited, however, with some short-length, high-frequency waves of a very different nature: acoustic, elastic, electromagnetic. They give rise to various intriguing phenomena studied by Valery such as whispering galleries and boundary inflections, conical diffractions and so on and so forth. Even this short description lets us appreciate how difficult and even sometimes dangerous the studies of Smyshlyaev were. Indeed, even the most prosaic diffraction by a simple convex obstacle could result in a creeping effect!



Whispering Gallery, St Paul`s Cathedral



High-contrast homogenization and 'non-classical' two-scale limits (Zhikov 2000, 2004)

Probably by realising those risks, in 1992 V. Smyshlyaev decided to move from Russia to the UK and from the study of the high-frequency waves interacting with the macroscopic objects to the study of the macroscopic waves interacting with a microscopic environment. And, indeed, this latter study known as mathematical theory of homogenization has brought Professor Smyshlyaev an international acclaim making him a recipient of LMS Whitehead Prize and one of the Editors of SIAM Journal of Mathematical Analysis. (Let me add, in parenthesis, that the ability to predict the macroscopic behaviour from understanding the invisible microscopic environment may be one of reasons behind Valery becoming our successful Head of Applied Mathematics section).

Guests at the Inaugural Lecture of Professor Valery Smyshlyaev

Moreover, the above transformation was not the end of Valery Smyshlyaev's scientific metamorphosis. Now he has moved to an even more complicated and dangerous world which stretches from short-wave to micro-resonances, from negative refraction to the non-classical multi-scaling effects. Luckily, from time to time, Valery reappears in our traditional macroscopic world and we can enjoy scientific and social contacts with him.

- **Yaroslav Kurylev**
  Professor of Mathematics

Sergey Mikhailov, Julius Kaplunov, Valery Smyshlyaev and Richard Craster

Ali Khalid (l) and Tom Ashbee (c)

Hilary Ockendon and Alastair Spence

Guests at the Reception after the Inaugural Lecture

For Your Diary

Rodney Halburd
Rodney Halburd will present his Inaugural Lecture 'Detecting integrability: singularities, solvability and solitons' on Wednesday, 13 March 2013, 4.30pm in Room 505, followed by refreshments in Room 502.

Abstract:
Roughly speaking, an equation (e.g., a differential or discrete equation or a cellular automaton) is said to be integrable if it is in some sense solvable or at least if its solutions can be characterized in a particularly nice way. The integrability of an equation is not always obvious. In this talk I will describe various properties that can be used as integrability detectors. In particular, I will describe the behaviour of solutions of some differential and difference equations in the complex plane and some number-theoretic properties of solutions of discrete equations. There will also be a quick look at "tropical" mathematics.

BRIGHT CLUB

Jason Lotay performing at the Bright Club

Earlier this year two UCL mathematicians, Jason Lotay and Hannah Fry, performed stand up comedy about their research at Bright Club – a comedy-club style evening which showcases comedy sets from university academics alongside professional comedians. The monthly events have previously been described by the Guardian as "a thinking person's comedy night" and by the Londonist as "where funny meets brains".

Bright club was started four years ago by Steve Cross, the Head of Public Engagement at UCL with the aim of engaging young adults in the 20-40 age range who have no connection to university research. Since then, the concept has been enormously successful and been taken up by several other universities across the country, with regular events now being hosted at Edinburgh, Bristol and Cambridge. More young adults are now participating in science entertainment activities than ever, partly thanks to events like Bright Club.

Participants are given thorough training in how to highlight the lighter side of their research and support in writing and performing their eight-minute sets. A great deal of work on the part of the organisers goes into making the audience as welcoming as possible – from the choice of supporting comedians, to the price of tickets on the door – everything is designed to support the researchers in their acts.

Jason was the headline act for the evening, performing a superb piece on differential geometry and artfully explaining high dimensionality with the aid of a light sabre. Hannah's set, which was also performed at a 500 seater super-brightclub event at the Bloomsbury Theatre, explained immunization strategies on scale free networks.

After their experiences, both Jason and Hannah can confirm that writing and performing stand-up is absolutely as terrifying as it looks. And that absolutely everyone should try it at least once.

- **Hannah Fry**
  Lecturer, The Bartlett Centre for Advanced Spatial Analysis, UCL,
  previously Research Associate, Mathematics

SOME THOUGHTS ON BEING A PART OF DARA Ó BRIAIN: SCHOOL OF HARD SUMS

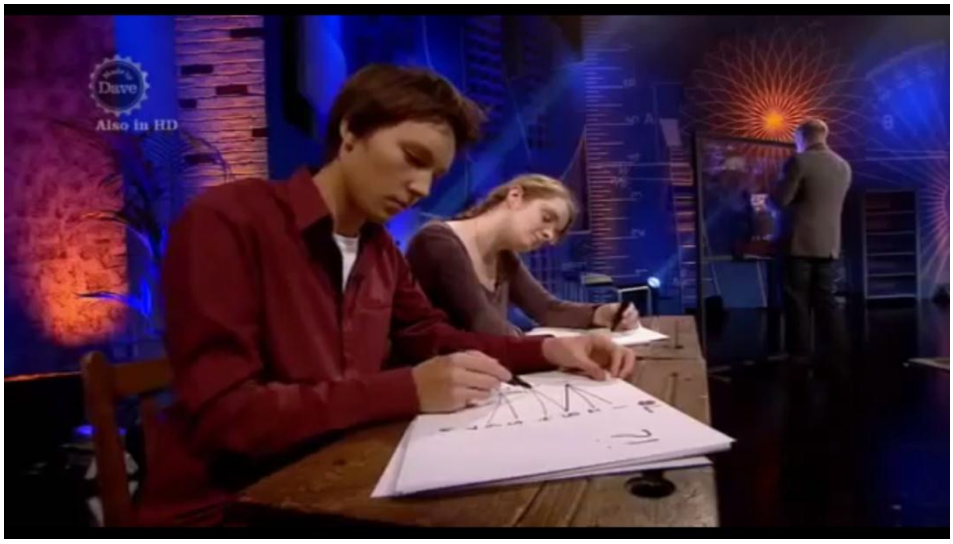
"Jeopardy!" enthused the producer in his loud Belfast brogue. It's getting to about 6pm now. "We need more jeopardy. Who will win? Brain… or brawn?"

Even Dara Ó Briain didn't seem to be buying it, on this, his third attempt at an introduction after the commercial break. I mean, it's a maths quiz: I'd say brain has a pretty good advantage over brawn. What exactly is this show all about?

Comaneci University Mathematics, it turns out. A Japanese Emmy-nominated panel show which started broadcasting in 2006. The host, super-famous Japanese polymath Takeshi Kitano (yes, he of *Takeshi's Castle*), presents a team of comedians and a team of students with a maths problem. The students attack the problem using their expensive education and the comedians attack it using common sense and some generally 'playing around with it'. Brain versus brawn, as our producer so succinctly put.

The problem is, the format had somehow lost its way in translation. What we had here instead was *Dara Ó Briain: School of Hard Sums*, an exclusive to Dave that the channel was rightly pleased to scoop. They even had adverts all over the Tube. Dara is host-cum-physicist, Marcus du Sautoy reprises his role as TV Face of Mathematics and a comedian appears from the Live at the Apollo circuit. Oh, and then me and a fellow student are at some rather charming old school desks with little holes for ink wells. Dara gets one of these *A Beautiful Mind* see-through whiteboards; Marcus and the comedian get a giant iPad to squiggle on, and we get some A3 card and a fat felt tip.

Here's a typical segment: Dara introduces Marcus. Marcus asks a question to Dara and the comedian. Light-hearted chat ensues. Cut to where a VT of Dara explaining the question again. Dara has a go at writing something on that beautiful glass board (which you can't rub out without window cleaner) while big cameras come up behind the students' shoulders to see what they're drawing. Marcus and the comedian have a chat about the problem, have a bit of a play and the comedian makes an educated guess. For the 'big question' of the episode, it cuts to a VT of the comedian doing some thinking aloud with various props. Dara reveals his answer, the comedian reveals his, and the students reveal theirs. Marcus reveals the answer and points are awarded (with *Whose Line?* apathy) to the team that did the best job.



Adam Townsend (l) participating in Dara Ó Briain: School of Hard Sums

Now here's where it gets all lost: Dara's a good mathematician, actually very good. Particularly at the sort of questions that come up. They're the usual lot: combinations, guards that lie or tell the truth, and the sort of thing you play at the pub to win drinks from your friends. (*The Real Hustle* also does pub proposition tricks like this, except Jessica Clement is really far more glamorous than Dara and Marcus.) But Dara's too good – his maths training is pretty much the same as ours, and so what's the point in our input? As my aging uncle pointed out, I "managed to get half a sentence out in half an hour". I'm sure my fellow student, who kindly warned me I was being "a bit full of myself", would be well chuffed with her full sentence which stayed in the edit.

There was really just no need for a student body in the show. I had expected it would go one of two ways: either they use us like Dictionary Corner in *Countdown*, or they'd go *Blockbusters* style and actually get to know us a bit. But there was neither, which was strange since they'd put us through an audition process to find people who had some form of personality.

That's not to say that a format where the host isn't asking the questions doesn't work: BBC One's *Pointless* (think bizarro *Family Fortunes*), with Alexander Armstrong and Richard Osman, works rather well. It's just that it wasn't clear, at least to me, what everyone's roles were.

Without a studio audience the comedians were left to awkwardly make that *Dave* classic, 'banter', to the amusement of each other. Without the cue from the audience everything just seemed less funny. The laughter was added in post-production, but this messes up the timing of the conversation and ended up (I think) looking scruffy.

I was surprised by quite how rough the show was in the filming stage. The set looked great, I was very impressed by how well they'd managed to put it together. But I didn't really see much direction. There was no briefing as to which cameras to look in, when we'd be expected to say something, how they wanted us to present it, or even how we were supposed to *see* the problem when we're perpendicular to the front of the stage!

Who were they trying to pitch the show at? Probably not mathematicians: surely each of them has heard these problems before a couple of times. The general public? No-one really seemed to know. Dara got told off at one point for saying "I can't believe we're making a programme like this" a few too many times. The idea of the comedian attacking it using 'brawl' is not a bad one, and was only really a problem in my second show when it became apparent that the comedian knew far too much about maths to pretend that he didn't. But saying to people "hey, it's OK to just have a play with a problem," is a good message. Of course, mathematicians do this all the time – it's good to get a feel for how the game works before you start figuring out what its rules are.

Don't get me wrong, it's fun to be in the process of making a television show. I had a lovely tour of the BBC Television Studio, and had Cher Lloyd as a dressing room neighbour. I think the makeup woman putting mascara on my eyebrows, so that they could actually be seen, will stay with me forever (it's OK; apparently Michael McIntyre has the same problem). The request for what to wear: "no black, no blue, no white. No stripes, no checks and no logos." Well that pretty much excluded everything in my wardrobe so a desperate dash to Marks & Spencer ensued. And I now have an IMDb entry (Adam Townsend the Third) which puts me well on the track to an Erdős-Bacon number if I get through the PhD programme alive. But perhaps a more definite idea of what the target was for everyone participating would have made for a stronger, more engaging, and more entertaining programme.

■ **Adam Townsend**

Teaching Assistant and Postgraduate Research student

AUGUSTUS DE MORGAN (ADM) MATHEMATICS SOCIETY

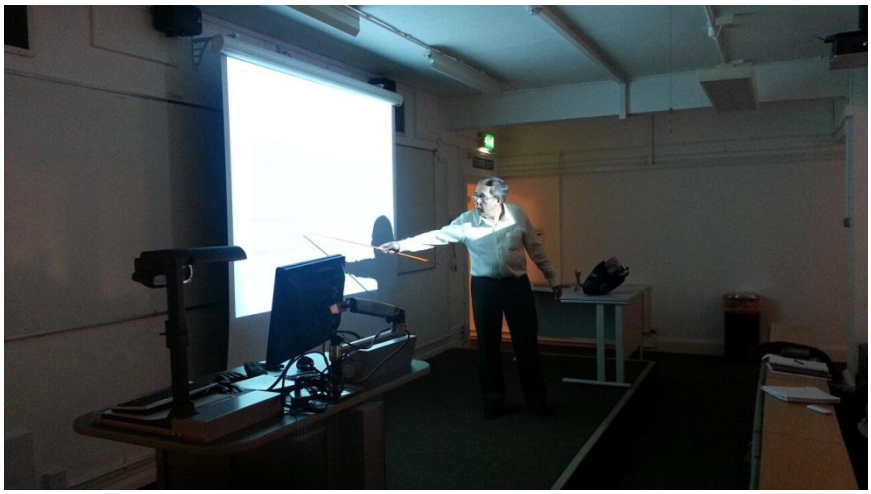
The UCL ADM Mathematics society is one of the oldest running societies at the university, and named after the first Mathematics Professor at UCL, Augustus De Morgan. It is a privilege to have everyone enrolled in the Mathematics Department to be part of our society.

Whilst the society's activity was rather quiet last year, the new committee endeavours to organise a range of beneficial events – academic, career-related, and social. This term, we've been getting in contact with lecturers of the Mathematics Department, encouraging them to give talks on behalf of the society about their research, or areas of mathematics students might not encounter during their degree. We would also be delighted if any of the Alumni wishes to give a talk to the society on research, or perhaps what they did after their degree and their experiences with careers.

Talk by Dima Vassiliev 'Is God a geometer or an analyst?'

The first part of the talk gave a popular overview of the spectral theory of partial differential operators, charting its development from the non-rigorous work of physicists to the eventual rigorous proof of the Weyl Conjecture.

The second part of the talk focussed on recent progress in the spectral theory of first order systems. These new results motivate us to revisit the fundamental question: why do all the main equations of theoretical physics contain the same physical constant - the speed of light?



Dima Vassiliev

Students at the talk

Since the end of summer, we have been in contact with finance and technology firms who plan to give presentations on behalf of the society. It is important for us that our members see the opportunities available to them after graduating. They may also host, for us, networking events and other career related workshops.

In this academic year, we have already organised a Mathematics Department BBQ and a pub crawl which have both been a success. We hope to bring members of the society closer together and to make sure students enjoy their time studying at UCL. This year, we introduced a 'parenting system' into the Mathematics Department for first and second years. Each first year is assigned a second year as a 'parent', we hope that this makes the transition into university less stressful and provides something different from tutorials and mentoring.

We aim to take part in hosting inter-society and inter-collegiate events this year and hope we can provide our members with all the support they need. If you wish to contact us, feel free to do so via our email: adm.maths@gmail.com

- **Atheeta Ching**
  Secretary, ADM Mathematics Society

Christmas Quiz

Freshers' BBQ

For Your Diary

Recent Advances in Algorithmic and High Frequency Trading
April 3rd-5th 2013

The Mathematics Department will host the Recent Advances in Algorithmic and High Frequency Trading conference from 3-5 April 2013.

Algorithmic Trading (AT) and High Frequency Trading (HFT) dominate the way in which market participants trade financial assets. The aim of this conference is to bring together Academics and Practitioners to present and discuss their latest work in the theory and practice of stochastic control, stochastic modelling and computation in AT and HFT. Topics include but are not limited to: market microstructure, statistical properties of AT and HFT, statistical arbitrage, optimal liquidation, limit order book modelling, market-making, and pairs trading.

Invited Speakers:
Robert Almgren; René Carmona; Álvaro Cartea; Rama Cont; Sebastian Jaimungal; Michael Ludkovski; Huyên Pham; Alexander Schied; and Philip Treleaven.

Organizing and Scientific Committee:
Álvaro Cartea; Sebastian Jaimungal; Andrea Macrina; Carlo Marinelli.

See: www.advances-in-hft.com

DEPARTMENT NEWS

Appointments

The following have recently joined the Department of Mathematics:
Dr Álvaro Cartea, Reader in Financial Mathematics
Dr Jonathan Evans, Lecturer in Pure Mathematics
Fiona Gilloway, Administration Team
Dr Christian Lübbe, Teaching Fellow
Dr Andrea Macrina, Senior Lecturer in Mathematics
Dr Carlo Marinelli, Reader in Financial Mathematics
Julija Melesko, Administration Team
Sally Moore, Administration Team, MSc Financial Mathematics
Mr Seamus O'Shea, Teaching Fellow
Dr Marcello Seri, Research Associate
Dr Zhan Wang, Research Associate
Dr Sarah Zerbes, Lecturer in Pure Mathematics

Following Professor Keith Ball's move to the University of Warwick
Imre Bárány – Astor Professor of Mathematics
Leonid Parnovski – Head of Pure Mathematics

Promotions

We are delighted to announce the following promotions effective from October 2012:
Nick Ovenden – promoted to Senior Lecturer
Nadia Sidorova – promoted to Senior Lecturer

PhD Awards

Students who have recently obtained PhDs from the Department include:

Jamie Rodney – *The effects of stratification and coastline geometry on the geographical localisation of shelf wave energy*
James Jackson – *Balanced initialisation techniques for coupled ocean-atmosphere models*
Thomas Brickell – *General two-dimensional linear flows of particle suspensions*
Rahul Nilawar – *Effects of finite Rossby radius on vortex-boundary interactions*
Nyein Chan – *Dynamical systems in cosmology*
Irina Pchelintseva – *Spectral properties of periodic pseudo-differential operators*
Navin Dasigi – *Basepoint dependence of the unipotent fundamental Group of IP'\ {0,1, ∞}*
Benjamin Willcocks – *Instability and nonlinear equilibration of baroclinic flows*
James Burnett – *Coframes, spinors and torsion*
Alexander Smith – *Transition and flow-induced scattering of acoustic modes in ducts*
Stephen Glavin – *Mathematical modelling of urethral and similar flows*
Jack Grahl – *Exceptional Lebesgue densities and random Riemann sums*

Prizes awarded to Undergraduate students – July 2012

The following students were awarded prizes:
Congrong Fu – Bosanquet Prize
Zhi Zhou – Kestelman First Year Prize
Lara Yue Du – Kestelman Second Year Prize
Michael Duong – Andrew Rosen Second Year Prize
Adam Townsend – Andrew Rosen Final Year Prize
Binbin Xue; Atiqa Sheikh – Nazir Ahmad Third Year Prize – shared
Jianzhi Cheng – Stevenson Prize
Giancarlo Grasso – The Ellen Watson Memorial Scholarship in Applied Mathematics
Deborah Ritzmann – Castillejo Prize
Andrei Simionescu – Donald Davies Prize
Aleksander Twarowski – Mathematika Prize
Lue Xiong– Bartlett Prize
Clara Dolfen – Filon Prize
Hui Hui Chong – Hill Prize
Jonathan Jun Jie Lee – Jeffrey Prize
Michal Porvaznik – Sessional Prize
Ignatius Pinto – Sessional Prize
Nik Ahmad Rusydan Nik Hafizi – Sessional Prize
Haoqi Wang – Sessional Prize
Nicholas Beale – Sessional Prize

Na Woo Kim – Sessional Prize
Saif Janab – Sessional Prize

The Institute of Mathematics and its Applications (IMA) Prizes – 1 year membership of the IMA
Cong Chen – Third Year
Adam Townsend – Fourth Year

The following students were awarded Dean's List Commendations:
Cong Chen, BSc Mathematics; Shawn Cohen, BSc Mathematics; Giancarlo Grasso, MSci Mathematics; Maria Protopa, BSc Mathematics; Deborah Ritzmann, BSc Mathematics and Physics; Alexander Twarowski, MSci Mathematics

Jackson Lewis Scholarship 2011-2012:
Lara Du, MSci Mathematics, Year 2 to Year 3

Prizes awarded to MSc and PhD Students – November 2012

Anuj Shrestha – Frank T Smith Prize
Awarded in the MSc Mathematical Modelling programme for the best overall performance.

Edgardo Roldán Pensado – John Hawkes Scholarship; Mayer de Rothschild Scholarship
My supervisors are Professor David Larman and Professor Imre Bárány. The title of my thesis is: **'Problems in Convex Geometry'.**

At the beginning my research was focused on the integer lattice and its relationship with convexity. Two problems were tackled. In the first one the goal was to determine the asymptotic behaviour of the probability that a random copy of a convex body intersects the integer lattice in a certain way. We almost completely solved this in the plane when the random copy is required not to intersect the integer lattice. We also found bounds for other variants of the problem. The second one was about the longest lattice convex chains a given triangle can contain. For a triangle with two specified vertices $v_{1,}v_2$ in Z^2 and large area, we show that the size of the largest lattice convex chain from v_1 to v_2 is at most $8^{*3}\sqrt{\text{Area}}$.

After these problems, we started with three other in the area of convex geometry. A conjecture by Erdos: We study the conjecture by Erdos "On every convex curve there exists a point P such that every circle with centre P intersects the curve in at most 2 points". A Yao-Yao type theorem: Given a nice measure in R^d, we show that there is a partition P of R^d into convex pieces such that every hyperplane avoids at least 2 elements of P. Line transversals: Given a family F of balls in R^d such that every three have a transversal line, we bound the blow-up factor λ needed so that $\lambda^* F$ has a line transversal.

The techniques used for these problems are very diverse and include results from analysis, combinatorics, number theory and topology, as well as the use of computers.

Pablo Soberon Bravo – John Hawkes Scholarship
My supervisor is Professor Imre Bárány. I still don't have a title for my thesis but here is a summary of the work I've been focusing on.

I am working on the relation of topology and convex geometry, mainly in problems involving partitions of measures in Euclidean spaces. This is very similar to the relation of topology and Tverberg-type theorems, which is also interesting by itself.

Ashley Whitfield – Wren Fund; Lighthill Fund

Supervisor: Professor E. R. Johnson Title of thesis: **'Numerical and analytical studies of non-linear wave problems in geophysical fluid dynamics'.**

Abstract: Although the overall direction of the project is not yet clear, we are currently trying to develop an asymptotic theory for wavepacket solutions of the Rotation-Modified KdV equation.

Adam Sanitt – Monica Hulse Scholarship

My supervisor is Dr John Talbot and my thesis is on Extremal Problems in Graphs and Hypergraphs.

Studying the global properties of certain mathematical structures that have given local properties, such as the maximum density of hypergraphs that do not contain particular subhypergraphs.

Lorenzo Toricelli – Edwin Power Fund; Corte Studentship

Supervisor: Professor William Shaw

Bjorn Berntson – Archibald Richardson

Supervisor: Professor Rod Halburd (below is a provisional title and abstract).

Title of thesis: **'Novel singularity structure and integrability'.**

Abstract: A system of differential equations is said to be integrable if it is solvable in a certain sense. Determining whether a given system is integrable can often be difficult. One method that has proven to be very useful is to look at the kind of singularities that solutions can develop in the complex plane. Simple singularity structure is a strong indicator of integrability. However, there is a class of integrable equations that has a complicated singularity structure for which the standard tests, based on the so-called Painlevé property, fail. This project aims at generalising the notion of the Painlevé property to include these equations. Recent work on novel reductions of such equations suggests that there is a way of choosing appropriate auxiliary functions that should have good simple singularities. This work should help us to find new integrable examples of equations that appear in certain natural geometrical problems.

Sergei Siyanko – Sir George Jessel Studentship

My supervisor is Professor William Shaw.

My research interest is as follows: Pricing in incomplete markets with jumps and, in particular, when jumps are directed towards fundamental value of the stock; asymptotic methods for pricing Asian Derivatives.

Christopher Daw – David Warren Fund

My supervisor is Dr Andrei Yafaev and the title of my thesis is **'Around the André-Oort' conjecture'**.

The André-Oort conjecture is a geometrical statement about Shimura varieties. Shimura varieties are complex manifolds that turn out to have an algebraic structure. They often arise as parameter spaces for important objects in arithmetic known as Abelian varieties. An Abelian variety comes with an associated ring of endomorphisms or 'internal symmetries'. Those Abelian varieties with a large commutative subring of endomorphisms are referred to as being of CM-type and correspond to so-called 'special' points on a given Shimura variety. The André-Oort conjecture attempts to describe the Zariski closure of any infinite set of special points."

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* and sent to the Department Administrator, Helen Higgins. 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 do not hesitate to contact Hamish Stewart at makeyourmark@ucl.ac.uk or on +44 (0)20 3108 3834.

Giving Online: http://www.ucl.ac.uk/makeyourmark/giving

Giving By Post: 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 our UK/overseas gift form

https://www.ucl.ac.uk/makeyourmark/documents/gift-form.pdf

and return it to UCL Development & Alumni Relations Office, University College London, Gower Street, London, WC1E 6BT, UK.

Giving over the phone: To make a gift over the phone, using a credit or debit card, please contact the Regular Giving team on +44 (0)20 3108 3834.

Giving for US and Canadian alumni and friends:

US: http://www.ucl.ac.uk/makeyourmark/how-to-give/giving-us

Canada: http://www.ucl.ac.uk/makeyourmark/how-to-give/giving-canada

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

Robert Downes – J J Sylvester Scholarship 2012-2013

My supervisor is Professor 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

The Fellows of the American Mathematical Society program recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics.

Imre Bárány and Peter McMullen have been named in the initial class of Fellows of the American Mathematical Society. This is a great honour: many congratulations to Imre and Peter.

See: http://www.ams.org/profession/ams-fellows

OBITUARIES

In Memoriam

It is with sadness that we record the passing of two retired members of staff, Dr David Belinfante and Professor Rob Seymour.

Dr David Belinfante 1933 – 2012

David Belinfante was an undergraduate student at UCL from 1951 to 1954. He worked with Professor W R Dean as a PhD student, obtaining his PhD in 1957. After working at Fort Halstead and in the Department of Mathematics at Liverpool University, David joined the staff at UCL in 1961 until he was forced to take early retirement through ill health in 1988. He worked at Memorial University, Newfoundland, Canada from 1967-68. David has been survived by 3 living children and 3 grandchildren.

Colleagues from the Mathematics Department write:

Frank Smith: David was extremely helpful in the running of the department. For instance, he organised the applied mathematics seminars for some years and they went very well; and he and Susan Brown were crucial in helping set up and run the IUTAM Symposium held by us at UCL in 1986, which proved very successful. He also did a wide range of teaching. On research his scholarly contributions included research papers in highly ranked journals such as a paper on viscous flow in a pipe with constrictions which appeared in the Mathematical Proceedings of the Cambridge Philosophical Society in 1962. On a personal note, I found David a most welcoming member of staff from the moment I arrived here in 1984.

Ted Johnson: I took over a final year engineering fluid dynamics course from David. He generously gave (this was less common then, but David was a kind man) me his notes (which I unfortunately no longer have). I was impressed at how clear, detailed and broad they were and at such a high intellectual level. He taught those students a lot of good, hard stuff.

David Larman: I was taught methods by David Belinfante. He was extremely kind and helpful.

Michael O'Neill: David Larman was also taught 2nd Year Fluid Mechanics by David Belinfante in 1961/62. I was the demonstrator for that course and had to mark the weekly assignments set to students. In those days, demonstrators were not provided with model solutions to the problems so the first task of the demonstrator each week was to solve the problems set to the students. Model solutions were provided to the students in the Problem Class for the course.

Jon Belinfante: My father continued to be involved in College and Departmental affairs after his retirement, attending UCL for one thing or another right up to the last. He did enjoy the social side of life at UCL and was also an active member of the UCL Alumni.

Professor Rob Seymour 1944 – 2012

Rob Seymour joined the staff at UCL in 1971 as a Lecturer in Pure Mathematics but was one of that rare breed of mathematicians whose interests and contributions successfully straddled both pure and applied mathematics. Part of his obituary, which appeared in The Times, is reproduced below.

Pioneering mathematician who applied his skills in analysis and modelling to the outbreaks of crown-ofthorns starfish on coral reefs.

Robert ("Rob") Seymour, Emeritus Professor of Mathematics at University College London, made significant contributions to modelling in evolutionary biology, ecology, physiology and economic theory. He was a cofounder of CoMPLEX, UCL the pioneering Centre for Mathematics and Physics in the Life Sciences and Experimental Biology at UCL and director of its influential educational programmes.

Rob Seymour graduated from Gonville and Caius College in 1966 and was subsequently awarded his PhD in 1970 from Warwick University with a thesis in algebraic topology, an area of pure mathematics. His thesis contained the first solution of the famous Atiyah-Hirzebruch conjecture.

Between 1969 and 1970 he was a visitor at the Institute for Advanced Study in Princeton before moving on to spend a further year as an assistant professor at the University of Alberta.

In 1971 Seymour took up a post as lecturer in pure mathematics in the Department of Mathematics at UCL. In the early 1980s he developed a growing interest in applied mathematics and used a sabbatical year in 1984-85 at the University of Western Ontario and then the University of Alberta to develop his interests in the subject. He returned to UCL and was appointed Reader in Applied Mathematics in 1995 and Professor of Applied Mathematics in 2002.

In 1994 Seymour became a member of a multidisciplinary team at UCL led by Professor Ken Binmore, of the Economics Department, the noted pioneer of experimental economics. With support from, among others, the “Beliefs and Behaviour” programme of the Economic and Social Research Council, the team established the Centre for the Study of Economic Learning and Social Evolution (ELSE). Seymour was an active member of this team and published articles on many topics within economics. His papers on “The Role of Gifts in Courtship” published with his friend and collaborator, Dr Peter Sozou, received much publicity.

Seymour’s interest in biological phenomena started when he became fascinated by coral reefs. He was deeply concerned about their fate and that of the millions of poor people in the tropical world whose welfare depends on the health of their reefs. He worked on reefs for more than a quarter of a century, establishing a reputation as a mathematician who understood, as few others do, how reefs really work.

He applied his skills in analysis and modelling first to the hard problem of the causes and consequences of the outbreaks of crown-of-thorns starfish, which have so damaged reefs of the Indo-Pacific. He was able to predict with great accuracy the frequency and intensity of future outbreaks. In more recent years, Seymour was a critical part of a team sponsored by the World Bank to develop better ways of managing coral reefs in tropical countries. With his guidance, the team successfully built sophisticated models that allow countries to make much more informed decisions about the management of their reefs. Unfortunately, the conclusions that the team reached were politically unpopular. Their conviction that the reefs are at great risk was again highlighted in the Coral Reef Symposium held a few months ago in Australia.

In 1998 Seymour was one of a small group of founder members of the innovative interdisciplinary research and training centre CoMPLEX. He helped to develop the training structure that has produced a generation of talented young interdisciplinary scientists. Throughout his career, Seymour helped to supervise numerous doctoral students on the CoMPLEX programme in areas as diverse as modelling coral reefs, animal sexual behaviour, the spread of multi-drug resistant bacteria and a systems biology approach for the liver. This last work he undertook long before systems level work became fashionable. It is testament to his abilities that in each of these areas he made significant contributions. In February CoMPLEX held a full-day conference in celebration of his work.

Seymour was a great friend to many in the interdisciplinary science community and he will be remembered not only for his research but for being a skilled, patient and kind teacher. His skills were exceptionally versatile and he was able to grasp the technicalities of complex problems and find just the right simplification.

He is survived by his wife, Charlotte, and his son and daughter.

ALUMNI NEWS

MATHEMATICS DEPARTMENT – CLASS OF 1962 REUNION

2012 was just 50 years since the keen entrants in 1959 to the then newly renovated Mathematics Department obtained their first degrees. It was fitting that Brian Dolton, who organised the Class of 1961 Reunion should invite the Class of 1962 to share in the regular celebration.

As it was, there were five of the 1962 group: Alan Camina, Mike Gerard, Peter Greatrex, Ron McLone with his wife Cecilia, and Roger Woollett, with apologies from Jan Lawrence and Rodney Hornstein. Each of the group had different stories to tell about their careers. Alan has been successful in the Academic field, now an Emeritus Professor at the University of East Anglia. Mike Gerard has had a long career in the IT Department at CERN in Geneva, where he was much worried by a certain Tim Berners-Lee who was stealing all the network bandwidth developing the World-Wide Web! Peter Greatrex has also spent 40 years in computing, the last 10 of which, to 2004, were as Systems Manager at Haberdashers' Aske's Boys' School at Elstree. Ron McLone has had a distinguished career with various Examination Boards, and is now a consultant to the SMART Centre at Durham University.

Ron McLone, Roger Woollett, Mike Gerard, Peter Greatrex and Alan Camina
Class of 1962 Reunion Lunch

The lunch was held at Hardy's Brasserie in Dorset Street. There were some 25 people who took part and it was a very successful reunion. What was particularly interesting was that after such a length of time we were all able to reminisce as if it were yesterday. Looking back on our times at UCL we all remembered the staff at that time, none of whom, not surprisingly, are still there. Lectures started at 09.45, and commuting from North London was the norm. I can recall the mad rush up from Euston Square to make it on time. In those days a register was taken! The refurbished Union was three floors below, and non-alcoholic drinks mid-morning were de rigeur! We made excursions to Kings College for Intercollegiate Lectures. The Heads of Department were Professors Rogers and Dean, and we were honoured to have tutorials with Professor Rogers. Professor David Larman was in fact a student in the year after our group, and Mike Gerard notes that when a postgraduate, he used to mark the work of David's year, and always used to look at David's answers first!

The 1962 group had a poignant toast to Absent Friends, remembering in particular Arthur Sambles, who had died in 2008.

- **Peter Greatrex**
  Mathematics 1962

MATHEMATICS DEPARTMENT – CLASS OF 1972 REUNION

40th anniversary reunion of the 1969-72 UCL maths cohort (16 participated: Peter and Carole Dickenson, Bob and Mal O'Mahoney, Yvette and Tony Parfitt, Steve and Dianne Briancourt, Stephen and Judy Raine, Dave and Sue LeMoir, Janet and Peter Gibbs, Christine James) (there were only about 40 in the whole year group!)

Itinerary:

Friday September 21st: Check in at Premier Inn at County Hall on the South Bank adjacent to the London Eye. Stroll around the embankment. Evening meal at the hotel

Saturday 22nd: 11.00 Flight on the London Eye. 12 noon lunch at nearby Italian cafe. 2.25 Thames river cruise to Greenwich. Explore Greenwich before returning to the hotel circa 6pm. Evening meal at the hotel.

Sunday 23rd: 10.30 2 taxis took us to UCL where we were met by Robb McDonald, Helen Higgins and John Haight. We had tea, biscuits and a good chat about UCL Maths Department now and then, followed by a guided tour the highlight of which was seeing the lecture room. 12.30 The taxis took us back to the hotel where we had a final drink together before returning to our respective homes.

Attendees highlights:

- Everyone said the visit to UCL was a fitting climax to the weekend.

- “Many thanks to Peter for a really grand reunion. Highlights - seeing you lot again! After all, we've been living in London for most of the last 40 years! Even so - London Eye (last did that about 15 years ago, and the skyline has changed since then) - just managed to see the dome of UCL from the top; boat trip - a regular favourite when the kids were young, so always happy to go back down memory lane - and the commentary was a definite plus! Visiting UCL Maths Dept. - not entirely amazed at how little I remembered of it, the nearest I had to an image in my mind was the lecture theatre which is (effectively) no more! But it was great to chat with current staff and reminisce and compare notes. I too loved seeing the mathematical models in the staff room - I made the 5 regular polyhedra as an Upper 5th project, and I also still have Cundy & Rollett on my bookshelf. Seriously impressed with the models on display, much better than the ones I made!”

- Mal’s highlight of the weekend was going into the Maths Staff Common Room and seeing models of the regular figures from ‘Cundy & Rollett’ hanging from the ceiling. Cundy & Rollett’s ‘Mathematical Models’ is one of the half-dozen maths books we still possess – Mal won it as a school prize in 1969. For me the reunion had many highlights; meeting up with old friends and

having time to chat, spending an enjoyable weekend in London (not done that for 14 years) and, of course, visiting the place where it all began. Visiting UCL brought back a lot of memories; the reassuring grandeur of the main buildings was still there but somehow the Maths Department rooms and corridors seemed much smaller than I remember UCL was pivotal for me; it's where I met my future wife and made many good friends. It helped to consolidate my love of maths but at the same time made me more realistic about my abilities & limitations. The satisfaction of completing a difficult proof is hard to beat! Looking back, UCL gave me a good grounding for future employment at Strathclyde University and UKAEA Winfrith. For some reason our visit reminded me of the period when, for me, it almost went wrong. In the spring term of our 2nd year I contracted glandular fever and had to return home for almost a month. Luckily a fellow student carbon-copied notes of all the lectures I missed and, on my return, helped me get organised for the end of year exams. But it was a close thing. Without that help my career at UCL could have ended differently (or at least been delayed). In case you haven't guessed – the carbon-copying student agreed to marry me 2 years later."

Tea in the Mathematics Department staff library

- "We did indeed have a lovely weekend and thank you to Peter and Carole for organising it all. It was a double round of reminiscences for me because I used to occasionally travel up to London on business and walk from Waterloo past County Hall and across the river to wherever I was going. This was before the London Eye ever existed, of course!! The visit to UCL was a highlight of the weekend for two reasons: the effort that the department staff had made to welcome us and provide coffee and cakes and show us around and additionally the fact that we did all have memories which came flooding back despite the improvements to the lecture theatres and the general air of the department having been smartened up. So little had fundamentally changed! I was a little surprised that there was still a blackboard and chalk in use in the lecture theatre and that there were no obvious signs of modern technology - electronic whiteboards, projectors and screens and the like, but of course they may all have been locked away somewhere as it was a weekend. As it was, it gave the impression of intellectual thought reduced to its simplest level - a lecturer writing a formula with a piece of chalk... If only we could have understood what he was writing the universe would have been ours!"

- "I too enjoyed the visit to UCL (and the rest, of course, which was brilliant) but my emotions were somewhat different from yours - it brought back all the fear of Maths that I felt as soon as I realised that it was not the subject that I so loved at school (i.e. after a couple of weeks in 1969)! Still, it was nice to see the lecture room where I used to sit next to Jo....."

- “Peter has already mentioned any things about the weekend that I whole heartedly agree with - the perfect weather for the London Eye (which Steve and I had not been on before) the River Cruise and walking round Greenwich, the perfect location of the hotel and the superb reception we received at UCL from the Maths Department. Steve and I also enjoyed walking along the embankment and the street entertainment. I was very surprised by the visit to UCL, both the bits I remembered and the difficulty in remembering other parts. Maybe it has changed in 40 years and maybe I am getting old. The biggest surprise was just being in the department made me feel I wanted to be back there and a bit of the same excitement I used to feel about maths. A big thanks to Robb, Helen and John for their hospitality and helping us to visit old haunts and Bonita for helping to organise this for us. I also enjoyed being back in London. Having lived out of London for the last 34 years, and visiting it mainly to see family and friends, I was amazed by the number of people and the lack of traffic near the hotel. Maybe the congestion charge works - or maybe it was the weekend?

■ **Peter Dickenson**
Mathematics 1972

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STOP PRESS
For Your Diary

The Mathematics Department
De Morgan Association Dinner will be held on
Friday 7 June 2013
Old Refectory
Guest of Honour and After Dinner Speaker: Dr Hannah Fry

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 welcome news and contributions for the next newsletter which should be sent to:
Professor Ted Johnson, The De Morgan Association, Department of Mathematics,
University College London, Gower Street, London WC1E 6BT.
E-mail: e.johnson@ucl.ac.uk
Please note:
the De Morgan Association Newsletter 2013 will be mailed out in March 2014 with the dinner invitations.




Guests at the De Morgan Association Dinner