De Morgan Association Newsletter

from the Department of Mathematics UCL

Issue - 17 - 2009 **Editor - Michael O'Neill**

DE MORGAN ASSOCIATION DINNER

Wednesday 10 June 2009

Professor Sir David Wallace speaking at the De Morgan Association Dinner

The guest speaker at the annual dinner of the De Morgan Association was Professor Sir David Wallace, Director of the Isaac Newton Institute at Cambridge. Sir David took over the directorship of the Institute in 2006 following the retirement of Sir John Kingman, a former guest speaker at the De Morgan Association Dinner. Sir David is a theoretical physicist and he spoke eloquently about the work of Peter Higgs, one time member of staff in the Mathematics Department at UCL, who is renowned for his work on theoretical physics carried out in the 1960s which led to the prediction of the existence of the elementary particle called the Higgs Boson.

This past year witnessed the retirement as a full-time staff member of Professor David Larman. David has been such a significant presence in the Department of Mathematics over many years – first as a student, then as lecturer, reader and professor - culminating with his distinguished 15 year period as Head of Department. We mark this occasion with contributions from two of David's research students, who pay tribute to his many talents. David has always been a UCL man and has been involved with many aspects of UCL life outside the Department.

Those readers of the Newsletter who missed Patricia Rothman's interesting UCL Lunch Time Lecture on William Jones will enjoy her article on this fascinating man who was the first mathematician to introduce the symbol π.

The year was also marked by the promotion of Martin Utley to Professor of Operational Research and Yiannis Petridis, Helen Wilson and Andrei Yafaev to Reader in Mathematics.

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

Professor Sir David Wallace and Dima Vassiliev at the De Morgan Association Dinner

Guests at the De Morgan Association Dinner

A CELEBRATION OF DAVID LARMAN

In 2008, Professor David Larman retired as a full-time staff member of the Department of Mathematics at UCL, and we mark this occasion with contributions from two of his research students, Professor Steve Gallivan and Professor Geoffrey Burton, who pay tribute to David's long and distinguished career as a research worker, teacher and administrator.

David became Head of Department in 1991, succeeding Edwin Power, and served in that role for 15 years, a length of service exceeded only by his teacher and mentor Professor Ambrose Rogers. On becoming Head, David invited me to become his Deputy, a position I was pleased to hold until my retirement in 2003. It proved to be a very eventful period. With money and the raising of it becoming increasingly important for all departments in universities, it soon became abundantly clear that our department, like most other university departments of mathematics in the UK, was particularly vulnerable with regard to income derived from the provision of ancillary mathematics courses for other departments of UCL. We overcame this dependence to a large extent by expanding our own student base through the introduction of a wide range of joint BSc and MSci degree courses to augment our existing specialist mathematics degree courses. The joint degree courses proved to be very popular and contributed to enabling the department to "buck the trend" in the UK of decreasing numbers of students applying to follow degree courses in mathematics. The number of students applying to UCL and the number of students accepted grew year after year with ever increasing entry standards.

David's period as Head of Department also saw the expansion of the staff base, which had changed little since the 1960's, with the incorporation of the CORU and Non-linear Mechanics Groups within the department as well as the establishment of the Lighthill Institute of Mathematical Sciences at De Morgan House, the home of the London Mathematical Society.

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

1968: my arrival in UCL as a fresh faced undergraduate. The Beatles are in the charts, America is losing a war and David Larman is a popular young member of UCL Maths Department. Little changes. Perhaps David is not quite so young any more, but getting older is better than the alternative.

1968: flower power, psychedelia, flair trousers and miniskirts; quite an adventure for someone coming from a sleepy Midlands town where it was still 1950.

If London was a culture shock, the Maths department was more so. It seemed a place of magic with some distinctly odd Pure Mathematical staff. The head wizard, as he seemed, with long white hair who very formally taught us analysis and only used surnames (even with his wife, it was rumoured). A wizened analysist, who refused to use diagrams, instead taught us incantations involving epsilons and deltas uttered in a clipped Austrian accent. A geometer with long white beard gave lectures so unspeakably dull that few attended. This all seemed slightly unreal and somewhat unsettling.

However, in the midst of this confusion came a beacon of hope. I had the great good fortune to be assigned to David Larman's tutorial group along with my good friend Richard Gardner, also now a professor. It is not a bad batting average for David being tutor to two future professors in his first year at UCL and is a testament to David's teaching ability, since neither of us were the most hard working students.

Young, humorous and enthusiatic, David was a blessed relief from the more eccentric members of staff. Damned clever as well. Not just mathematically, because that is what one expects at UCL, but wise in many other ways. Where other tutors seemed to ask questions to which I knew the answer, David's questions were always elusive and thought provoking. At the same time he could be down to earth and commonsensical. I treasure the memory of him drawing a picture of a washing line on the board adding, "that's what a convex function is, don't make life complicated".

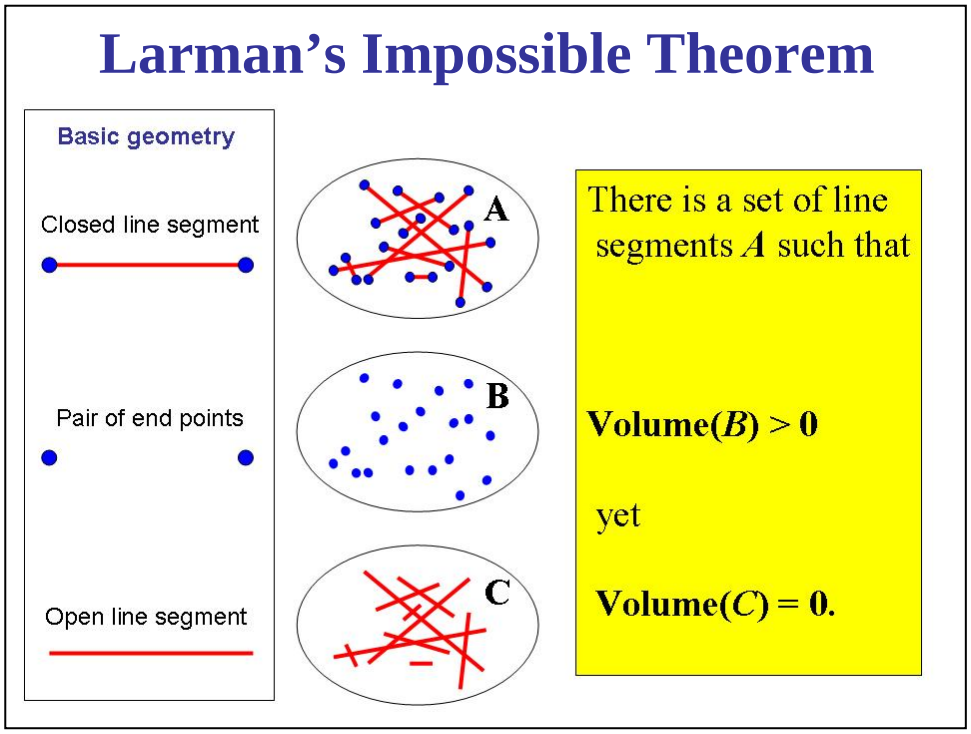
His answer to the problem of our indolence was to introduce Richard and me to research questions. I recall one in particular concerning polytopes (multi-dimensional versions of polyhedra). He asked us to show that one can join any two vertices of a 6-dimensional cube by a path composed of 6 edges or fewer. It was fun to find out what a 6-dimensional cube was and fun to try to find a proof and slightly frustrating that Richard solved the problem first. But both of us remained flummoxed when David asked us to solve the same problem for *any* 6-dimensional polytope with twelve 5-dimensional faces. We learned much later that this is a special case of a famously difficult problem called the "d-step conjecture" that remains unsolved to this day. While it might seem unfair to set undergraduates difficult unsolved problems, it certainly kindled our interest in research.

On graduating, I became David's first PhD student and, with typical kindness, he arranged for me to join him for one of my three years at the University of British Columbia where he was due to spend a sabbatical visit. There I had a wonderful time and learned a lot, even some mathematics. I also got to know David and his family more, often being invited to visit his home to be beaten hollow at bridge, table tennis and a mechanical ice hockey game at which his young sons were demons.

Such mathematics is long behind me and my work in Operational Research is now decidedly impure. I have grown to prefer working on practical problems and, if the truth be known, it's easier than Pure Mathematics. Even so, I still retain some of the good habits that David taught me. In particular I have developed an allergy to the word "clearly".

I once made the mistake of giving David a draft of a proof that contained a sentence that started, "*Clearly, such and such is the case . . .*". He asked me to prove my assertion on the blackboard. I failed to do so. A few weeks later, I had still not managed to find a proof, which was hardly surprising since *such and such* wasn't the case. I had learned a very important lesson - just because something appears intuitively obvious doesn't mean that it is true.

A wonderful example of this concerns line segments that join two distinct points in three-dimensional space. "Clearly" there are infinitely many points of such a line-segment lying between its two end-points. Further, if one has a set formed as the union of such line segments, then "clearly" the set of end-points is smaller than the set of non-end-points. Ambitious students might like to prove this. But don't waste too much time since, unfortunately, it is not the case as David proved. This is an extraordinary result. Of course it depends what one means by "Volume" and one set being bigger than another and these are deep Pure Mathematical questions. Me, I'm sticking to Operational Research.



David has had an illustrious career in mathematics and made great contributions to UCL. He has been UCL's Dean of Students, the Warden of a hall of residence and, for many years, Head of Department.

I have known him as my tutor, my PhD supervisor, line manager and, of course, friend. I wish him a long and happy retirement.

- **Steve Gallivan**
  Emeritus Professor of Mathematics

I first met David Larman in my first undergraduate year, at an introductory weekend for new students in October 1970 organised by the De Morgan Society, just after he had been promoted to Reader, and eighteen months later I attended his second year Analysis lectures.

Another eighteen months on, I started my PhD under his supervision. David had just been awarded the Junior Berwick Prize by the London Mathematical Society. He was a rising star, and a couple of years later he was promoted to a Personal Chair, at such a young age that Peter McMullen, now an Emeritus Professor at UCL, was moved to quip "he's risen to the top of his profession in 16 years from leaving school; there's time to rise to the tops of two more professions before he retires".

David had been a research student of the late C.A. Rogers, then Astor Professor, writing a thesis on measure theory in metric spaces, but he has always been willing to try his hand at hard concrete problems on any topic in Analysis, Geometric Convexity or Combinatorics, a good example being his solution of a problem on the residual set of a packing of unequal discs into a square; he showed that, although the set may have area zero, it must have dimension greater than 1. This problem was one of a pair proposed by A.S. Besicovitch; the other, on the corresponding question for packing equilateral triangles into an oppositely oriented equilateral triangle, had been solved ten years earlier by H.G. Eggleston, who commented in his paper that the problem for circles seemed much more difficult. Rogers was evidently of the same opinion, and though at first very sceptical when David claimed to have solved it, he became convinced both of the correctness of the solution and of the quality of his young research student.

After his PhD he became an Assistant Lecturer at the University of Sussex but soon left for the USA to take up a Harkness Fellowship, which he held at the University of Washington, Seattle, where he worked with Victor Klee. Not long afterwards he returned to UCL and commenced his collaboration with Rogers. They achieved many striking results, including the existence in high dimensions of a symmetric convex body whose central sections have smaller measure than the parallel sections of a ball, but whose volume is greater than that of the ball, a result later refined by Keith Ball, now Astor Professor, who showed that a cube in 10 dimensions had this property.

Another striking result of David's from this period was his proof of the existence of a compact set of disjoint line-segments in 3 dimensions whose interiors had zero measure but whose ends had positive measure. This result has attracted attention more recently, in the theory of Optimal Transportation, where similar constructions provide an obstruction to Sudakov's solution of the Transportation Problem.

Working with David as my supervisor was a marvellous experience, after his initial expectations had given way to realism! His positive attitude and flexibility were an inspiration, as was his flair for applying unexpected ideas. His determination to make his students free-standing as soon as possible stood them in good stead. This was a period of high activity in convex geometry at UCL, and David collaborated with Rogers in organising a Durham Symposium on the relation between finite-dimensional and infinite-dimensional convexity which brought a large number of international leaders in the field to the country.

Later in his career, he served an astonishing fifteen years as Head of Department, during which time many excellent appointments were made and the research strengths of the Department flourished. David's own research activity continued throughout this busy period, and his joint work with Imre Bárány on the approximation in volume of a convex body by random polyhedra was cited in the award of the

1989 Renyi Prize by the Hungarian Academy of Sciences. In 2003 he was a made a Fellow of UCL, an honour afforded to the College's most distinguished former students, among them Alan Baker and Klaus Roth, both Fields Medallists, and Sir Roger Penrose. In 2006 he was awarded the Austrian Cross of Arts and Sciences, presented by the Ambassador at the Embassy in London with a laudation delivered by Professor Peter Gruber of the Technical University of Vienna, a fitting crown to a distinguished career.

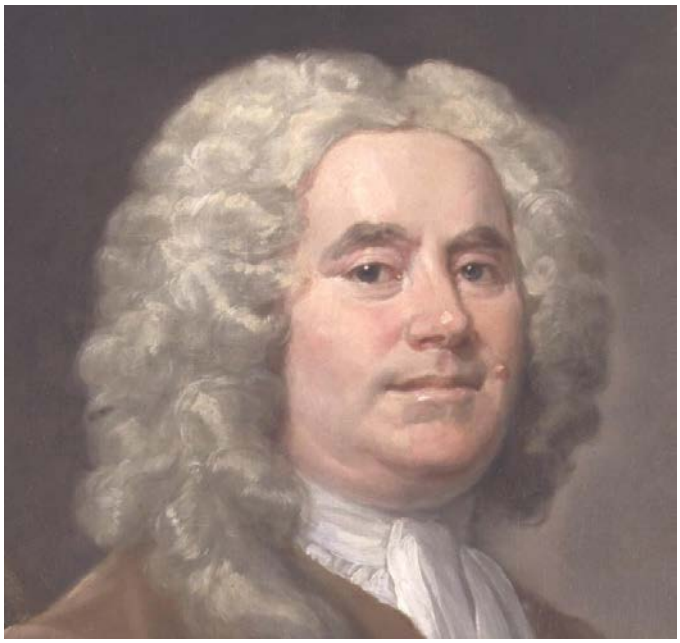
- **Geoffrey Burton**
  Professor of Mathematics
  University of Bath

SUMMER OF 1995 STAFF v STUDENTS FOOTBALL MATCH IN REGENTS PARK

Can you spot David Larman in the picture? Also in the picture are Bharat Dodia, Frank Smith, Paul Caporn, Robbie Burton, Simon Clarke, Robb McDonald, Robert Bowles, Sean Oughton, Paul Workman , Henry Tabe, Riaz Ahmad, Mark Roberts, Mitch Berger.

WILLIAM JONES: THE MAN WHO INVENTED THE CONCEPT OF π

The history of the constant ratio of the circumference to the diameter of any circle is as old as man's desire to measure; whereas the history of the symbol π, to represent this ratio dates from the early eighteenth century.



William Jones, by Hogarth
courtesy National Portrait Gallery ©

Before the appearance of the symbol π, it had been awkwardly referred to in mediaeval Latin as:- *quantitas in quam cum multiplicetur diameter, proveniet circumferencia* (the quantity which, when the diameter is multiplied by it, yields the circumference). Also rational approximations such as 22/7 and 355/113 were used, which may have given the impression that it was a rational number. In its modern sense, π was first used in print by a self-taught mathematics teacher, William Jones (1675-1749), in his book *Synopsis palmariorum matheseos*, or *A new introduction to the mathematics* published in 1706. It is widely believed that Euler (1707-1783), first introduced the symbol π, but he was born one year after the publication of *Synopsis.*

Though he did not prove it, Jones realized that π was an irrational number; in *Synopsis* he wrote, *"……the exact proportion between the diameter and the circumference can never be expressed in numbers…".* Consequently a symbol was required to represent an ideal that can be approached but never reached, a platonic concept.

Eventually the irrationality of π was proved in 1761 by Johann Lambert (1728-1777). It was only later, in 1882, that Ferdinand Lindemann (1852-1939) proved that π was a non-algebraic irrational number, a transcendental number. The discovery that there are two types of irrational numbers however does not detract from Jones's recognition that the ratio of the circumference to the diameter cannot be expressed as a rational number.

In fact the symbol π had been used in quite a different way in the previous century by the Rector and influential mathematician, William Oughtred (c1575-1660), in his book *Clavis mathematicae.* He had used it to represent the circumference of a *given* circle, so that Oughtred's π varied with the diameter of a circle, rather than being the constant we know today. The circumference of a circle was known in those days as the 'periphery', hence the Greek equivalent 'π' of our letter 'p'. Jones's use of π was an important philosophical step which Oughtred had failed to make even though he had introduced other mathematical symbols, for example: **::** for proportion and **x**, the multiplication sign. On Oughtred's death some books from his fine mathematical library were dispersed while others together with some of his papers eventually came into the hands of the mathematician, John Collins (1625-1683).

Born half a century apart Collins and Jones never met, yet history will forever link them together because of the library and mathematical archive that Collins started and Jones continued to develop. Collins was the son of an impoverished minister and was apprenticed to a book seller. Essentially self-taught, like Jones, he had gone to sea and had learnt navigation. On his return to London he earned his living as a teacher and an accountant. He held several increasingly remunerative posts, and was adept at disentangling intricate accounts, a skill greatly sought after, then and now.

Collins's ambition had been to set up a book shop, but was unable to accumulate enough capital. In 1667 he was elected a Fellow of the Royal Society and became an indispensable member serving as its unofficial secretary helping the official, Henry Oldenburg (c1619-1677), who relied on Collins's

mathematical assistance. Collins maintained extensive correspondence with many of the leading English and foreign mathematicians as well as drafting mathematical details for the Society. Collins's archive of letters as well as his library came into the hands of William Jones in 1708.

Beyond his first use of the symbol π, Jones is of interest because of the position he occupied in eighteenth century scientific and political circles. He was also responsible for developing one of the greatest scientific libraries and mathematical archives which remained in the hands of the Macclesfield family, Jones's patrons, for nearly 300 years.

Though Jones ended his life as part of the establishment, his origins were modest. He was born on a small farm on Anglesey. His only formal education was at the local charity school where he showed mathematical ability and it was arranged for him to work in a merchant's counting house in London. Later he sailed to the West Indies and became interested in navigation; he then went on to be a mathematics master on a man-of-war. He was present at the battle of Vigo in 1702, when the British intercepted the Spanish treasure fleet on its return to port, the victorious seamen went ashore in search of the spoils of war, but for Jones:- "…..*literary treasures……were the sole plunder that he coveted*".

When he came back to England he left the Navy and began to teach mathematics in London, probably initially in Coffee Houses where for a small fee customers could listen to a lecture while they drank coffee. Later that year he published his first book, *A New Compendium of the whole Art of Practical Navigation.*

Jones soon became the tutor to Philip Yorke (1690-1764), who later became Lord Chancellor Hardwicke. In 1706 he published his second book *Synopsis palmariorum matheseos* which was based on his teaching notes. It was in this work that he introduced the symbol π in its modern representation as the ratio of the circumference to the diameter of any circle.

Jones had an extensive correspondence with the astronomer and mathematician, John Machin (c1686-1751). Machin served as secretary to the Royal Society for nearly thirty years. He was on the Society's committee set up to decide on the priority of the invention of calculus and was professor of astronomy at Gresham College.

The calculation of π, "….*true to above a 100 places; as computed by the accurate and ready pen of the truly ingenious Mr John Machin…*", appeared in Jones historic 1706 book. Machin performed this calculation by using an infinite series whose sum converged to π. Machin used a variation of James Gregory's (1638-1675) expansion for arctan $x = x - x^3/3 + x^5/5 - x^7/7 + x^9/9 - \ldots$ etc.

When $x = 1$, this becomes $\pi/4 = 1 - 1/3 + 1/5 - 1/7 + 1/9 - \ldots$etc. This series converges very slowly. Machin used a formula, $\pi/4 = 4\arctan(1/5) - \arctan(1/239)$ which made the series rapidly convergent.

In Synopsis Jones explained Newton's (1642-1727) calculus. This is probably when he first came to Newton's attention. Both Newton and Halley (1656-1742) gave him testimonials when he applied for the mastership of Christ's Hospital Mathematical School, but even with these connections he was turned down. Fortunately for Jones, his former pupil, Phillip Hardwicke, had by then embarked on his legal career and knew Sir Thomas Parker (1667-1732), already a successful lawyer. Jones joined his household and became tutor to his only son, George Parker (c1697-1764). This was the start of a life-long connection with the Parker family.

Around this time Newton and Leibniz (1646-1716) were in dispute over priority in the invention of calculus. In Collins's mathematical papers, Jones found a transcript of one of Newton's earliest treatments of calculus, *De Analysi* (1669), which he arranged to have published in 1711. It had previously only been circulated privately and demonstrated Newton's early work on calculus. Newton jealously guarded his intellectual property though he was reluctant to have his work published.

Newton was president of the Royal Society and recognised that he had an ally in Jones who was admitted to fellowship of the Royal Society. In 1712 Jones was included in the committee set up by the Royal Society to determine priority for the invention of calculus. The main documents that the committee

referred to in the resulting publication in 1712, *Commercium epistolicum*, came largely from Jones's collection of the Collins's archive. This report, though anonymous, was known to have been edited by Newton himself and could hardly be looked upon as impartial. Unsurprisingly it came down on the side of Newton's priority.

Today it is considered that both Newton and Leibniz discovered calculus independently though Leibniz's notation is superior to Newton's and is the one in common use.

Jones was now firmly among the mathematical establishment and was corresponding with many of its members. He became a node in a network of influential mathematicians, astronomers and natural philosophers and added to his voluminous archive.

Besides the law, Jones's patron, Thomas Parker, was interested in science and mathematics; he was also a generous patron of the arts as well as the sciences. In 1718 Parker became Lord Chancellor and was created the first earl of Macclesfield. By this time he had purchased Shirburn estate and castle for the then vast sum of £18,350. Shirburn castle became a home for Jones who was almost a family member.

But there was an obverse side to the first earl's character. It seems that together with his great abilities and ambition he had a lust for wealth. In 1825, he was accused of selling chancery masterships to the highest bidder and suitors' funds, held in trust, were misused. Parker had to resign as Lord Chancellor but he was nevertheless impeached. His punishment was a fine of £30,000, an enormous sum in those times, and he had to spend six weeks in the Tower before the necessary money was raised to pay the fine. Some of his assets were sold, but he did not have to forfeit Shirburn which remains in the Macclesfield family to this day. As a final disgrace his name was struck from the roll of privy councillors.

However some dignity was restored when in 1727 he was one of the pallbearers at Newton's funeral.

His son, George Parker, was well educated in mathematics and developed a taste for astronomy. He became an MP for Wallingford and spent much of his time at Shirburn where, with Jones's guidance, he added to the library and archive which Jones had acquired. His interest in astronomy was practical and with the help of a friend the astronomer, James Bradley (c1692-1762), later astronomer royal, he built an astronomical observatory at Shirburn.

In 1750 George Parker wrote a paper which was read to the Royal Society entitled *Remarks upon the Solar and Lunar years*. In 1752 he was a principal proponent for the adoption of the Gregorian calendar and the change of the new year from March 25 to January 1. That year George Parker was elected president of the Royal Society and served until his death. One might consider the revision of the calendar as part of William Jones's scientific legacy.

In later life, Jones served as a council member of the Royal Society and became vice-president. It seems that his bankers failed, an even more frequent occurrence in those days, and he lost his money. His income was boosted by sinecures organised by his former pupils: he was made 'secretary of the peace' through the influence of Hardwicke and 'deputy teller to the Exchequer' with the help of George Parker.

Although Jones looked impressive in this portrait he is reported to have been "*….a little short faced Welshman, and used to treat his mathematical friends with a great deal of roughness and freedom…*".

He died in 1749 aged seventy-four and it was said that he "*died in better circumstances than usually falls to the lot of mathematicians…*". His one surviving son was only three years old at the time; he was also called William and is known to history as 'Oriental' Jones. He excelled as a linguist, philologist and expert in Hindu Law and was duly knighted.

In his will, Jones left his "*study of books*" to George Parker "*as a testimony of my acknowledgement of the many marks of his favour which I have received*". This spectacular collection of books formed the basis of the Macclesfield Scientific Library. Eventually after nearly three hundred years at Shirburn, the

scientific library was sold at Sotheby's in six massive sales that have replenished libraries throughout the world. The collection of papers and manuscripts, the Macclesfield Archive was bought by Cambridge University library for £6,370,000 with the aid of a generous grant from the Heritage Lottery Fund.

In his lifetime, Jones's ability to retain his patrons was important and he served them well. From an historical perspective, Jones gave much more to the Macclesfields than he received and he left a great intellectual legacy to the world.

- **Patricia Rothman**
  Honorary Research Fellow in Mathematics

Bill Stephenson and Patricia Rothman

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UCL INSTITUTE OF ORIGINS

In the previous year the Faculty of Mathematical and Physical Sciences has encouraged the foundation of an interdisciplinary centre where different departments of the faculty are involved, the UCL Institute of Origins (www.ucl.ac.uk/origins/). UCL Institute of Origins recently announced the beginning of its operations. To celebrate this it held a Launch Event in the afternoon of 27 February 2009 at UCL. We were happy to welcome Sir Paul Nurse, Nobel Prize in Medicine 2001, and Prof. John Ellis as keynote speaker.

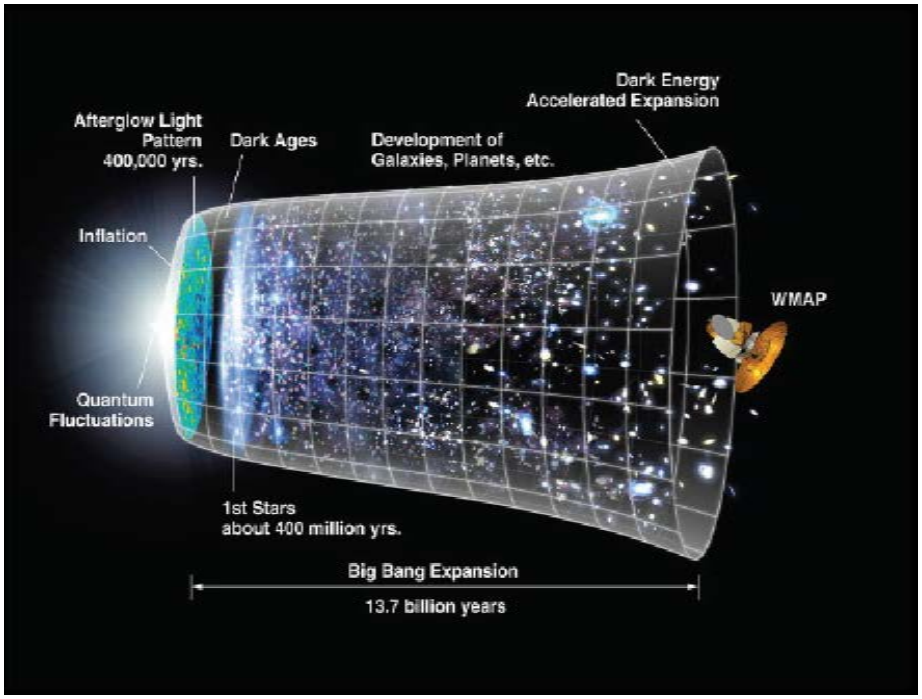
Professor Louise Harra and Sir Paul Nurse at the Launch event

Professor John Ellis (r) at the reception

The Launch event started with a talk by Louise Harra who spoke about the ideas and discussions which led to the foundation of the Institute of Origins. She presented current research areas in various departments throughout the MAPS Faculty and showed how collaborations between them could further strengthen our research output.

Sir Paul Nurse gave an interesting talk about "Curiosity and Science" where he explained one origin of the word lunatic, stemming from the members of the Lunar Society which was very influential in Britain. Curiosity driven research is one of the most important aspects of every fundamental science while its direct impact cannot and in fact should not be foreseen. Foreseeable research, by its very definition, is not and cannot be ground breaking. "We need explorer scientists driven by passion and curiosity, not committee driven or government driven top down directed when we talk about exploratory science."

John Ellis talked about "Particles and Cosmology" where he emphasised the interrelatedness between particle physics and cosmology. One of the most striking observational facts of contemporary cosmology is that the universe seems to consist of mainly dark energy (74%) and dark matter (22%) with the remainder being normal matter like our planet Earth or ourselves. Nobody knows what this mysterious dark energy is while the dark matter worries theoretical physicists a little less. This means, however, that we do not understand 96% of the universe which makes cosmology such an interesting field of research.



History of the Universe

The Origins Institute allowed us to hire a post-doctoral research associate for two years to work on the research theme mathematical foundations. We were lucky to appoint Yuri N. Obukhov for this post. He has over 100 publications and together with Fridrich W. Hehl wrote the monograph “Foundations of classical electrodynamics”, Birkhäuser (2003). Yuri started working in our Department in July 2009.

Origins funding also allowed us to have a graduate student working in mathematical foundations. The successful applicant was Olga Chervova (working with Dmitri Vassiliev) who subsequently won full UCL funding for her graduate studies. This allowed us to have a second graduate student in mathematical foundations who will work with Christian Böhmer on dynamical dark energy models in cosmology.

There is also funding to invite high profile researchers and we invited Fridrich W. Hehl to be a visiting professor for one month in the spring of 2010. Thus, the Mathematical Foundations section of Origins will host two of the leading experts of alternative theories of gravitation.

Sir Paul Nurse and Olga Chervova at the reception

Christian Böhmer and Frank Smith at the reception

- **Christian G Böhmer**
  Mathematical Foundations Group Coordinator
  UCL Institute of Origins
  Lecturer, Department of Mathematics

FACULTY TEACHING AWARD

The winner of the Faculty Teaching Award for 2009 is Professor Steven Bishop, Department of Mathematics.

Many congratulations to Professor Bishop for displaying an extremely high standard of excellent and innovative teaching.

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

The other nominees, all worthy of special mention, were:
- Dr Chris Kilburn (Earth Sciences)
- Dr Ian Mason (MSSL)
- Professor Raman Prinja (Physics)
- Dr Christian Boehmer (Mathematics)

Steven Bishop

2009 HAROLD LARNDER PRIZE WINNER

Steve Gallivan, Clinical Operational Research Unit (CORU)

Steve Gallivan (l) accepting the Larnder Award with René Séguin, Liping Fang, and Saeed Zolfaghari

Steve obtained a first class degree in mathematics from University College London (UCL) in 1971. As an undergraduate, he was fascinated by mathematics and was fortunate to secure a job in a work study department of a chain making company to support his studies. This was his first contact with OR. His PhD concerned generalizations of the mathematics underlying linear programming. This work was mostly carried out in UCL with a year as a visiting graduate student at the University of British Columbia. Following this, Steve joined the UK's Transport and Road Research Laboratory, later moving to the Transport Studies Group at UCL. He worked on a variety of problems associated with traffic signal system design and control. This practical work contributed to the development of methods that are used world wide. In 1985, Steve was invited by the famous RRP (Ray) Jackson to join his newly formed Clinical Operational Research Unit (CORU) at UCL. After the initial "culture shock" of learning how to work in close collaboration with clinicians, he grew to enjoy thoroughly this productive and rewarding area of OR. He has worked on projects in a wide range of clinical areas. These include: cardiac surgery, cardiology, cancer, genetic screening, primary health care, mental health, rheumatology, pharmacy, gynaecology, obstetrics, public health, hospital safety, infection control and health service operation.

Steve has co-authored over 200 publications. These have included papers published in pure mathematics, transport science and OR journals. He has a substantial number of publications in the medical press, the domain where his work has the most impact. There have been many tangible results from his research. Work on cervical cancer screening has been used for evaluating numerous screening options and, more recently, vaccination policies. The modelling of antenatal genetic screening has been used in an empirical study related to screening for haemoglobinopathies. CORU's hospital capacity modelling has been used in several contexts and is being extended by another research group.

The research for which he is most well known concerns the development of analytical methods for monitoring adverse clinical events, particularly post-operative deaths. CORU developed a monitoring tool known as VLAD that can be used to give a graphical summary of clinical outcomes for a single surgeon or unit. This is adjusted to take due account of the risk profile of cases to avoid penalizing surgeons

whose case load is intrinsically complex. Originally developed in the context of adult cardiac surgery at a single centre, the method has been adopted by clinicians within the UK and worldwide. It is in routine use in many cardiac surgery centres, and has been extended for use in the context of myocardial infarction, congenital heart surgery and many other clinical areas. Indeed, a practitioner from Australia has written a book to accompany the method called “VLADs for dummies”.

Canadian Operational Research Society

2008 ANNALES HENRI POINCARÉ PRIZE

Each year the ANNALES HENRI POINCARÉ PRIZE founded by the publisher Birkhäuser is awarded for the most remarkable paper published in the journal Annales Henri Poincaré.

Professor Leonid Parnovski, UCL received the following announcement from Vincent Rivasseau, Chief Editor:

Congratulations!

Leonid Parnovski

In the name of our full editorial board I am pleased to announce you that your paper "Bethe-Sommerfeld Conjecture" has been awarded the 2008 Annales Henri Poincare Prize.

The prize this year is attributed jointly to you and to Peter Balint and Imre Peter Toth for their paper Exponential Decay of Correlations in Multi-Dimensional Dispersing Billiards AHP Vol 9, 1309-1369 (2008). This situation with two excellent papers in sharp competition also happened once before, in 2000, where the prize was also split.

I am very proud that our journal published your proof of the Bethe-Sommerfeld conjecture and I am expecting with great pleasure to meet you for the award of the Prize.

THE INTERNATIONAL CONGRESS OF MATHEMATICIANS 2010

The venue of the ICM-2010 will be the Hyderabad International Convention Centre (HICC), a state of the art facility for holding large meetings such as ICM 2010.

Hyderabad, India, 19-27 August 2010

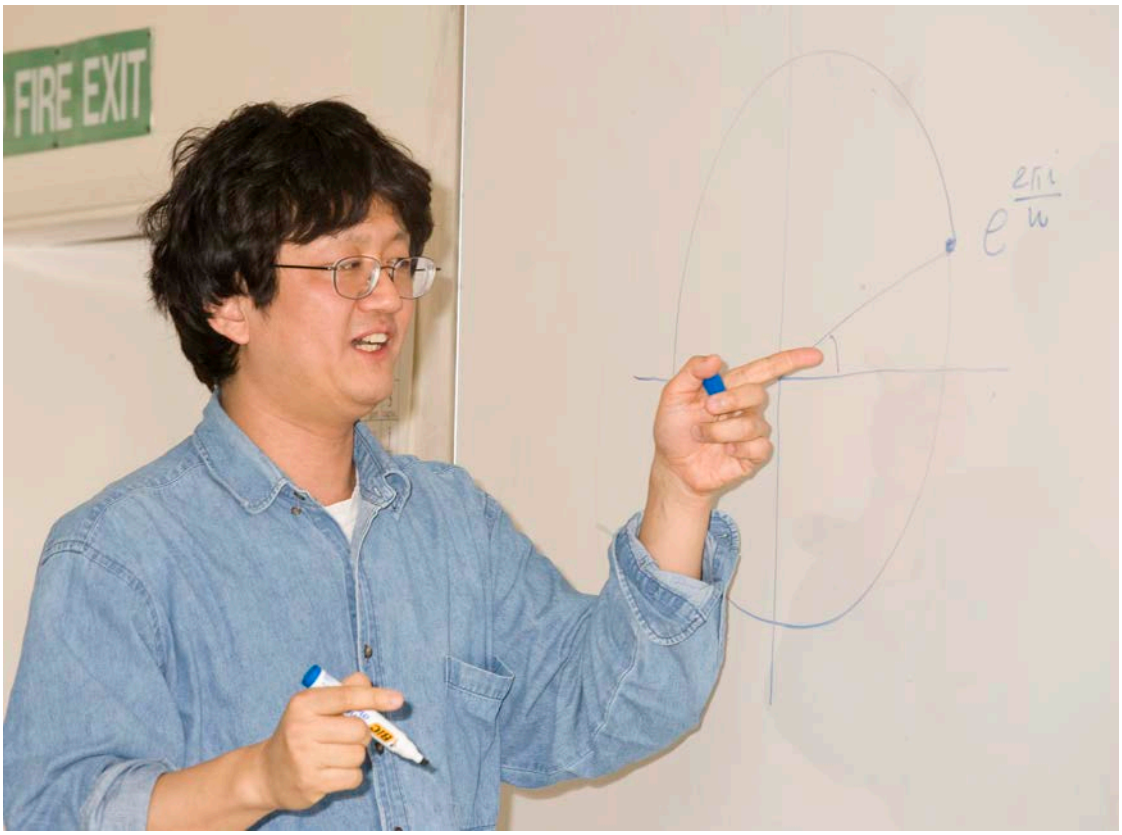
Sectional Speakers include:
SECTION 8: ANALYSIS
Marianna Csörnyei, UCL.

INAUGURAL LECTURES

2008-2009

Minhyong Kim
Minhyong Kim gave his Inaugural Lecture **'On numbers and figures'** on Wednesday 21 January 2009.

Abstract: The study of the mysterious duality that intertwines the algebraic and geometric structures occurring in nature has been a major preoccupation of mathematicians through the ages. The last half-century has seen a robust convergence of numerous strands of this connection into the subject of arithmetic geometry. Persistent recasting of a single object in a complementary fashion using both numbers and figures has led to a unified perspective on a wide-range of mathematical inquiries as well as to the resolution of long-standing conjectures. We give a brief outline of this history and indicate some possible developments of the near future.



Minhyong Kim presenting his Inaugural Lecture

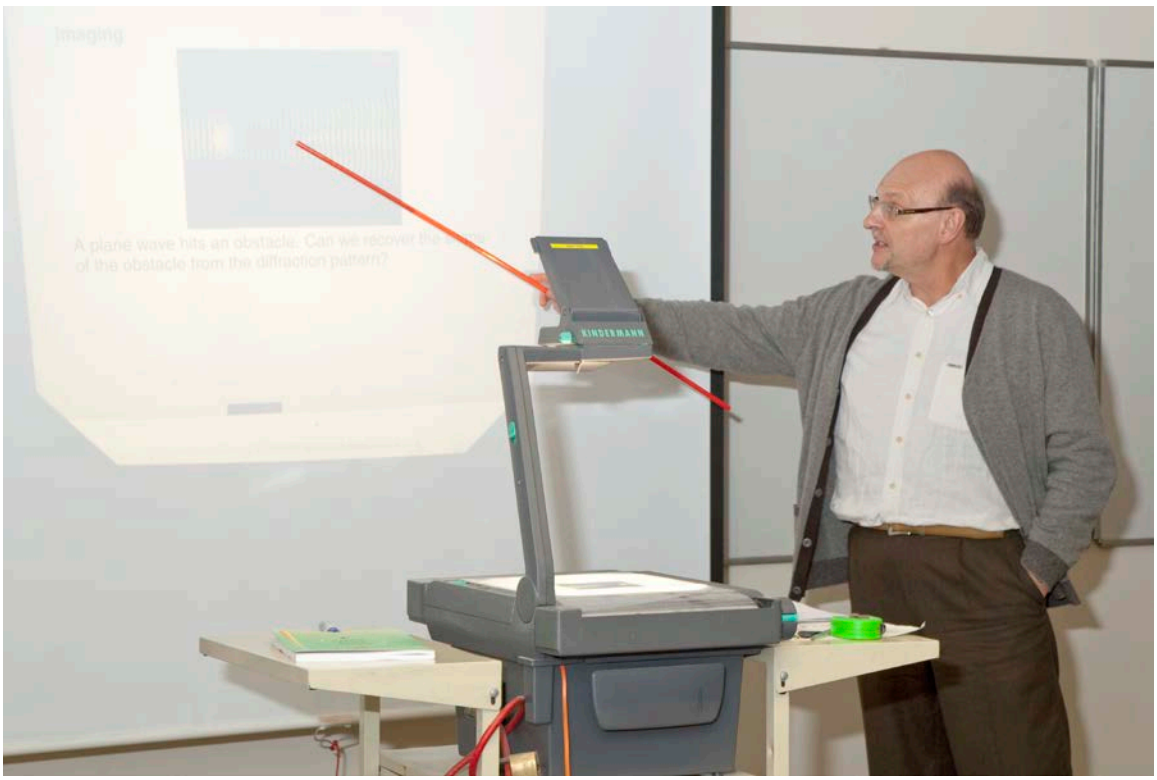
Professor Minhyong Kim was appointed Professor of Pure Mathematics at UCL in 2007. Previously he held professorships at Purdue University, University of Arizona and the Korea Institute of Advanced Study. He obtained his BS in Mathematics at Seoul National University in 1985 and his PhD at Yale University in 1990. Minhyong is a world-leading researcher in number theory and arithmetic geometry with a special interest in the connections between algebraic and geometric structures. This was the theme of Minhyong's inaugural lecture ('On numbers and figures') in which he presented a number of examples, of increasing complexity, which clearly demonstrated the power of considering mathematical problems from this unified perspective. This research area was also the subject of the program, organized by Minhyong, on 'Non-Abelian fundamental groups in arithmetic geometry' at the Newton Institute of Mathematical Sciences, Cambridge, which attracted leading number theorists and geometers from around the world.

- **Robb McDonald**
  Professor of Mathematics

2009-2010

Yaroslav Kurylev
Yaroslav Kurylev gave his Inaugural Lecture **'Inverse Problems and Beyond'** on Wednesday 7 October 2009.

Abstract: Inverse problems deal with the recovery of the cause from the consequences. Certainly, this formulation embraces a lot of real-day issues; from medical diagnostics to police investigation. As a mathematician, I deal with inverse problems for various mathematical models of physical, engineering and other inverse problems. Probably, the first well-known mathematical problem is the one formulated by Heisenberg in the early days of quantum mechanics: Assume that we know the scattering matrix of a quantum system. Is it then possible to identify the properties of this system?
This formulation gets us into the essence of inverse problems: They appear when it is either impossible (say, in medicine or astrophysics) or too expensive (say, in seismology) to directly observe/measure the properties of the material but we have access to some related information.
Typically, this information relies on the measurements of various waves outside the body of interest which, due to these waves' penetration into the body, carry some information of the properties/processes inside this body. In recent years, another problem has started to attract much interest of physicists, engineers and, therefore, mathematicians. We can call this problem an inverse inverse problem and formulate it as follows: Is it possible to design a media which, for an external observer, would be identical to some simple underlying one and, therefore, hide from this observer what is going on inside this modified media?



Yaroslav Kurylev presenting his Inaugural Lecture

Professor Yaroslav Kurylev gave his inaugural lecture on October 7. Professor Kurylev is a distinguished applied analyst who studies inverse problems for the differential equations of physics: so his work has both pure and applied components. He gave an entertaining but challenging lecture on cloaking devices: wave-guides that bend light around an object in such a way that an observer sees exactly the same image as if the wave-guide, and the object inside, were simply not there. At present these cloaking

devices only apply to waves with limited frequency ranges so we are still somewhat behind the Romulan technology described in the series Star Trek. Unlike stealth aircraft which use special materials and smooth geometry to minimise their radar signatures, cloaking devices depend on sophisticated mathematical analysis for the design of intricate geometries that cause the observer to see what is behind them, as if the device were not in the way. Such designs fall under the heading of "inverse problems" because one is trying to give a negative answer to the question: "Is it possible to reconstruct an object from its effects on incident light?"

- **Keith Ball**
  Astor Professor of Mathematics

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

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

Guests at the Inaugural Lecture of Professor Yaroslav Kurylev

Professor Michiel van den Berg and Mette Iversen at the Inaugural Lecture of Professor Alexander Sobolev

Alexander Sobolev
Alexander Sobolev gave his Inaugural Lecture **'Periodicity at work'** on Wednesday 18 November 2009.

Abstract:
Partial differential equations with periodic coefficients have been of overwhelming importance in Mathematics for over a century. This is partly due to their mathematical beauty, and partly due to their relevance to important real life processes: for example the electrical conductivity of metals, properties of crystals, wave propagation and many others. A large number of new results in this field, including the resolution of some long-standing conjectures, were obtained in the last two or three decades. I describe some fundamental mathematical ideas behind periodic problems, and give a short survey of recent results.

Alexander Sobolev presenting his Inaugural Lecture

Professor Alexander Sobolev gave his inaugural lecture "Periodicity at work" on November 18. Professor Sobolev has made many important contributions to the spectral theory of partial differential operators. This area has applications to modern physics, particularly quantum mechanics. Much of his recent work has concentrated on differential equations with periodic coefficients. This is a very natural class of problems, which includes mathematical models of electrons moving in metals. In this case, the periodic coefficient (the potential) in the (Schrödinger) equation models the electric field generated by positive ions in a lattice. Professor Sobolev gave an interesting account of the history of proofs of several versions of the famous Bethe-Sommerfeld conjecture, which states that the number of gaps in the spectrum of the periodic Schrödinger operator is finite in any dimension greater than one. Physically, these gaps represent intervals of forbidden energies for the electrons. It is very interesting that number theoretical considerations regarding the lattice play an important part in these results.

- **Rod Halburd**
  Lecturer, Department of Mathematics

For Your Diary

Alan Sokal

Alan Sokal will present his Inaugural Lecture **'Between combinatorics and analysis (with a little help from statistical physics)'** on Wednesday, 10 March 2010, 4.30pm in Room 505, followed by refreshments in Room 502.

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.

Professor Ilia Goldshied, Leonid Parnovski and Professor E. Brian Davies at the Reception after the Inaugural Lecture

Olga Chervova, Dima Vassiliev and Professor Richard Catlow at the Reception after the Inaugural Lecture

Guests at the Reception after the Inaugural Lecture

DEPARTMENT NEWS

Appointments

The following have recently joined the Department:

Dr Roberta Bosi, Research Associate

Dr Fenwick Cooper, Research Associate

Dr Matias Dahl, Teaching Fellow

Elizabeth Hancock, Administration Team, working on Global System Dynamics & Policies Project with Professor Steven Bishop

Dr Peter Hicks, Research Associate

Dr Nisha Jones, Administration Team, LTCC, with Professor Frank Smith

Dr Mahesh Kakde, Research Associate

Dr Yuri Obukhov, Research Associate

Dr Andrew Wynn, Teaching Fellow

Promotions

We are delighted to announce the following promotions:

Yiannis Petridis – promoted to Reader in Mathematics

Martin Utley – promoted to Professor of Operational Research

Helen Wilson – promoted to Reader in Mathematics

Andrei Yafaev – promoted to Reader in Mathematics

Provost's News

May 2009

Professor **Ming-Yen Cheng**, UCL Statistical Science, has been elected a Fellow of the American Statistical Association. This prestigious honorary title recognises members "of established reputation who have made outstanding contributions to an aspect of statistical work".
(See also link to Ming-Yen Cheng's webpage) http://www.homepages.ucl.ac.uk/~ucakmc0/

May 2009
Lady Nancy Lighthill

We regret to report the death on Sunday 10 May 2009 of Nancy Lighthill, at the age of 88. She was the widow of Sir James Lighthill, who was Provost of UCL from 1979 to 1989. In partnership with Sir James, she made a major contribution to the life of UCL throughout that period. They met when both were students at Cambridge. He had won a scholarship from Winchester to Trinity College at the remarkably young age of 15, though he did not go up until two years later in 1941. She was a mathematics student at Newnham College, and they married in 1945. She is also remembered for giving one of our ancillary mathematics courses, which proved very popular. Occasionally Sir James deputised for her! She returned to UCL for the official launch of the Lighthill Institute of Mathematical Sciences.
(See also the account of his life on the LIMS website): <http://www.ucl.ac.uk/lims/jameslighthill.htm>.
Our sympathies are with the Lighthill family.

PhD Awards

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

Pasquale Iannelli – *Inertial Manifolds in Biological Systems*

Alex White – *Mathematical Modelling of the Embolisation Process in the Treatment of Arteriovenous Malformations*

Gergely Ambrus – *Analytic and probabilistic problems in discrete geometry*

Joss Matthewman – *A vortex dynamics perspective on stratospheric sudden warmings*
Mahboubeh Asgari-Targhi – *Applications of topology in magnetic fields*

Prizes awarded July 2009

The following students were awarded prizes:
Lewis Kirkham – Bosanquet Prize
Chuyan Tan – Kestelman Prize
Henri Roesch – Andrew Rosen Second Year Prize
Athavan Thirunavukarasu – Andrew Rosen Final Year Prize
Giancarlo Grasso – Stevenson Prize
Lucy Keer – Ellen Watson Memorial Scholarship in Applied Mathematics
Zhi Xiang Tan – Castillejo Prize
Seamus O'Shea – Mathematika Prize
Hasit Patel – Bartlett Prize
Joel Kahan – Filon Prize
Artiom Fiodorov – Hill Prize
Panos Marinopoulos – Jeffrey Prize
Alexandre Peyrot – Sessional Prize
Andrei Simionescu – Sessional Prize

The following were awarded Dean's List Commendations:
Martin Leslie Cullum and Zhi Xiang Tan.

Prizes awarded to current MSc and PhD Students – November 2009

Warren O'Neill and Waqas Zahid – Monica Hulse Scholarship

Edgardo Roldn Pensado – Abbott (Corte) Studentship

Jonathan Remez – Mayer de Rothschild Scholarship
My supervisor is Professor F.E.A. Johnson. The thesis will be in the field of 'Algebraic Topology'.

Thomas Ashbee – Edwin Power Scholarship; Lighthill Scholarship
My supervisors are Professor McDonald and Dr Esler and the title of my PhD thesis is 'The statistical mechanics of point vortices and their transport properties near gaps'.

Seamus O'Shea – Sir George Jessel Studentship
My supervisor is Professor FEA Johnson. My research is in low dimensional topology/homological algebra. Specifically, I will be looking at stably free modules over group rings. In the case of certain finite groups, these are closely related to the realization problem of 2-dimensional topology: is every algebraic 2-complex realizable as cellular chain complex of some finite 2-dimensional CW complex?

Francois Crucifix – Wren Bequest
My supervisor is Dr. Yiannis Petridis. I will study automorphic forms from an analytic point of view by applying spectral methods to the Laplace operator on Riemann hyperbolic surfaces.

Louise Jottrand – John Hawkes Scholarship

Pouya Kamali – Archibald Richardson Scholarship

My supervisor is Professor Frank E A Johnson. The title is 'Stably free modules over infinite group algebras'. For each natural number n with at least one odd prime divisor we consider products [Q_{8n} × G] of quaternion groups of order 8n and various infinite groups G. For such groups we show the existence of infinitely many distinct stably free modules of rank 1 over the integral group algebras Z[Q_{8n} × G].

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 and return it to UCL Development & Corporate Communications 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 & Corporate Communications Office (020 7679 7676 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.

Seamus O'Shea – J J Sylvester Scholarship 2009-2010

People

Sheila Frances Barrow (née Longman) (1947)
Retired in 1987 as Principal Lecturer in Mathematics, Southend College of Technology but went on examining until 1990. At nearly 82 years of age still dancing Folk, Sequence and Line and playing bridge. Would love to contact any of my year still alive. Still in contact with 6 UCL alumni who were also in College Hall but none of them did maths.

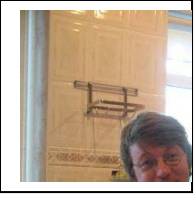
Heini Halberstam (1946)
You may think it of interest to note that, entries this year, Cambridge U. P. have published "Analytic Number Theory", Essays in Honour of K.F. Roth (PhD '50) FRS, 1st British Fields Medallist 1958.
Best wishes for a successful De Morgan Dinner!

Peter Lindon (1975)
Many years after playing bridge for UC in the London Universities league have now reached the rank of premier grandmaster.






Guests at the De Morgan Association Dinner



STOP PRESS
For Your Diary

The Mathematics Department
De Morgan Association Dinner will be held on

Wednesday 9 June 2010
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.