Asymptopia

CENTRE FOR MATHEMATICAL SCIENCES NEWSLETTER

UNIVERSITY OF CAMBRIDGE

September 2005

News from the CMS

The Queen officially opened the CMS on 8 June, giving the Mathematics Faculty an opportunity to welcome many of those whose generosity made our beautiful buildings possible. The Duke of Edinburgh accompanied the Queen, and they were re-acquainted with Vice-Chancellor Professor Alison Richard and Professor Stephen Hawking, as well as meeting our good friends Hans and Märit Rausing; Dennis Avery and Sally Wong-Avery, members of the Guild of Cambridge Benefactors; and Michael Gwinnell of The Atlantic Philanthropies Ltd.

The Queen and the Duke both met representatives from the staff, from the student body and from the architects, as well as other benefactors; and were independently given presentations, reports on which are below.

We look forward to Sir David Wallace taking up the Directorship of the Isaac Newton Institute and becoming Rothschild Professor of Mathematics in October 2006, succeeding Sir John Kingman. Sir David will also become Master of Churchill College at that time. More news from the INI; Peter Grindrod, a member of the National Advisory Board, was awarded a CBE in the Queen's Birthday Honours for services to mathematical research and development. Congratulations to Peter.

There have been many other personal achievements since the last edition of Asymptopia, Professor Keith Moffatt scooping two major prizes; the Hughes Medal of the Royal Society and the Senior Whitehead Prize of the London Mathematical Society. Sir Martin Rees, Professor of Cosmology and Astrophysics, is not only one of five non-party-political peers recently appointed to the House of Lords, but he will also become President of the Royal Society in December 2005. Lucasian Professor of Mathematics, Stephen Hawking, received the James Smithson Bicentennial Medal, struck in 1965 for the Smithsonian Institute and awarded to persons who have made distinguished contributions in areas of interest to the Smithsonian. Herbert Huppert, Director of the Institute of Theoretical Geophysics, was awarded the Arthur L Day Prize and Lectureship by the US Academy of Science in May; while Vice-Chancellor Alison Richard presented one of seven Pilkington Prizes awarded within the University for teaching excellence to Natalia Berloff on 7 July. Natalia has recently been promoted to a Senior Lectureship.

Congratulations on promotion to personal professorships in DPMMS to Stephen Brooks, Alessio Corti and Imre Leader; in DAMTP, Malcolm Perry was also promoted to a personal professorship and Nicholas Dorey to a readership.

Janet Booth and Sue Lambert, subject librarians at the Betty and Gordon Moore Library, welcomed a group of thirteen Friends of Cambridge University Library on 8 August and gave them a guided tour.

The Queen opens the Centre for Mathematical Sciences.

Hands On Maths

Julia Hawkins

"Oh, that looks interesting!", said the Queen, making a beeline for the giant dominoes in the corner of the room. Her Majesty was in Cambridge on 8th June to open the new Centre for Mathematical Sciences, and as part of her visit was viewing a demonstration of some of the activities developed as part of a Hands-On Maths Roadshow by the Millennium Mathematics Project (MMP), which aims to support maths education from age 5 to 19 through enrichment activities beyond the school curriculum. A group of 11-year-old pupils from Gamlingay Village College, together with their teacher, Miss Frances Allsop, had come to the CMS for a special Royal Roadshow.

The Hands-On Maths Roadshow was created in 1999 shortly after the MMP began. It is aimed at children from 4 to 13, and is taken to primary and secondary schools all over the country by the MMP's Schools Liaison Officer, Susan Hickman Pinder. The Roadshow consists of a collection of mathematical games, puzzles and challenges – taking the form of everything from a giant foam-filled deconstructed cube to a collection of coloured plastic teacups – which aims to develop mathematical reasoning skills, strategic thinking and problem solving while also challenging pupils' preconceptions about what 'maths' is and stimulating mathematical curiosity.

Her Majesty the Queen with Vice-Chancellor, Professor Alison Richard, and Head of the Department of Applied Mathematics and Theoretical Physics, Professor Timothy Pedley.

Examples of Roadshow activities include the fiendish "Auntie's Teacups" – with four cups and four saucers of each of four colours (blue, red, yellow and green), arrange the cups and saucers on a 4x4 grid so that in any row no two cups and no two saucers are the same colour; the very popular Soma cube - a giant, foam filled cube constructed out of seven pieces, all different, which need to be reassembled; and giant dominoes, which lend themselves to a number of mathematical challenges. The Queen's interest was caught by a challenge to use 10 dominoes from 'double-three' downwards to form a square each of whose sides has 8 dots – an online version of this problem can be found on the MMP's NRICH website (www.nrich.maths.org) if you search for the title 'Domino Square'.

Susan explains: "The Roadshow allows pupils to explore mathematical activities in a more playful and free environment than you can usually allow in class. The activities are designed to get children to develop their strategic thinking and reasoning skills, and they can be taken to different levels depending on the ages of the children and how able they are. Also, the fact that the pupils enjoy it so much helps to build and reinforce positive attitudes to maths." .

As the Queen left the Centre for Mathematical Sciences on 8th June, she paused for a moment beside the Roadshow pupil group. "Do you think you'll end up working here when you grow up then?", she asked with a smile. They answered that they would like to – we hope that perhaps the Hands-On Maths Roadshow and the other activities of the Millennium Mathematics Project might help them, and thousands of other school children, to come a little closer to achieving that aim.

For more information about the Millennium Mathematics Project, including the Hands-On Maths Roadshow, please see www.mmp.maths.org

The Duke of Edinburgh with Professor Richard Weber and Head of the Department of Pure Mathematics and Mathematical Statistics, Professor Geoffrey Grimmett.

The Duke of Edinburgh learns about dolphins

Stephen Brooks

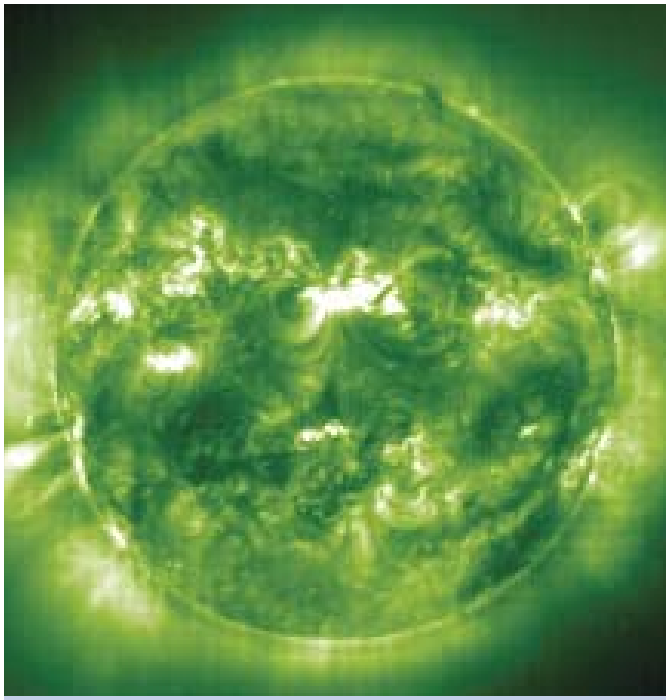
As the Duke of Edinburgh toured the Statistical Laboratory lab members treated him to two presentations highlighting recent work. Richard Weber discussed the problem of traffic modelling and demonstrated that, somewhat counter-intuitively, adding an extra road to an existing network can sometimes increase rather than decrease the level of congestion. Richard provided a practical demonstration of this phenomenon using a contraption made up of rubber bands, string, papers clips and a weighted envelope. The Duke was most entertained and, keen to demonstrate his own expertise in this area, suggested that lorry drivers were perhaps an important contributory factor to congestion on many of our roads.

Steve Brooks gave a short presentation describing recent work on modelling the shape of dolphin fins to help create a database of dolphins living off the Northeast coast of Scotland. The database is used to estimate population sizes and to monitor the effects of various human activities on the dolphins' use of this protected habitat. The project involves photographing dolphin fins to create a digital image that can then be compared with pictures already in the database. A statistical process has been developed which provides a probability of a match and which speeds up the matching process, which now takes mere minutes rather than hours for a full day's worth of images.

The Sun, Our Star

Dr Helen E. Mason

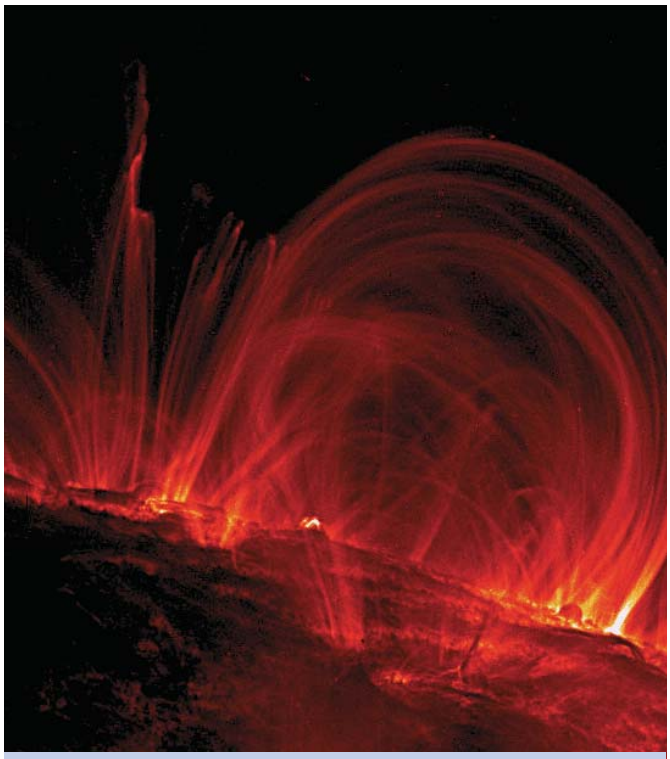
Activities connected with the Sun have recently been flourishing at DAMTP, CMS. Dr Helen Mason is a co-investigator on Solar and Heliospheric Observatory (SOHO), a joint ESA/NASA satellite launched in December 1995, and now approaching ten years of very successful operations (soho.nascom.nasa.gov). SOHO has not simply provided some amazing images and movies, it has also enabled scientists to develop an unprecedented insight into the physics of the Sun. Helen's own particular field of research is that of UV spectroscopy of the solar atmosphere.



UV image of the Sun from SOHO-EIT.

The corona (Sun's outer atmosphere) is very hot, over one million degrees. At such temperatures, the plasma emits strongly in the UV and X-ray wavelength ranges. One of the major questions addressed by scientists working with SOHO observations, is why and how the corona is heated to such extreme temperatures (the photosphere, visible surface of the Sun, is only around 6000 degrees). By analysing UV images and spectra it is possible to probe the prevalent energy transfer mechanisms.

The structures seen in this UV image are dominated by the Sun's magnetic field, which the hot ionised plasma traces out. Studies with SOHO data have shown that changes in the magnetic field enable energy to be channelled from beneath the solar surface and released in the corona. The precise mechanisms are still under debate. Sudden changes in the magnetic field (reconnection) result in huge explosions of energy, solar flares. Why is this work being carried out in a theory department? It is important to build theoretical models of the plasma processes in the solar atmosphere. It is only by linking the theory closely with the observations that we can make progress. Helen is part of the UK consortium for a joint NASA/UK/Japanese spacecraft called SOLARB, to be launched next year, August 2006. This will observe the Sun's magnetic field, X-ray and UV emission in even finer detail.



UV observation of coronal loops from TRACE.

Helen also really enjoys working with school students. She has been developing a web-site/CD-ROM for schools called SunItrek (www.suntrek.org), which will be launched in the autumn. It has been funded by PPARC. SunItrek is about the Sun and its effect on the Earth's environment. It will contain some spectacular images and movies from SOHO, YOHKOH and TRACE together with classroom projects.

Helen has been working closely with the Millennium Maths Project (based at DAMTP), in particular the MOTIVATE video conferences (www.motivate.maths.org). Last year, she and Dr Carolin Crawford, at the Institute of Astronomy, linked up schools in the UK and South Africa for a conference on the Transit of Venus (June 2004). Helen was over in Cape Town for the Transit, at a sleepover with some African students at the MTN science centre! She also went on a motivational tour around schools organised by the University of the Western Cape. Her trip was co-ordinated through the African Institute for Mathematical Sciences Schools Enrichment Centre (AIMSSEC) (www.aims.ac.za/aimssec).

Helen has fostered close links with local schools and teachers, in particular (through a Royal Society partnership) with Mike Cripps, Head of Science at Neatherd High (www.neatherd.org/astronomy). Their project, called 'Our Star', provided solar telescopes for pupils, with which they have been able to capture some spectacular images of the Sun. Neatherd High was invited to exhibit 'Our Star' at the Royal Society's Science Exhibition in summer 2004. It was great fun, but hard work.

The classroom resources being developed by Helen and Mike are designed to help in the delivery of both the UK science and maths curricula.

Sun\|trek - a CD-ROM for schools.

Visiting the Western Cape in July 2005.

In July/August 2005, Helen, Mike and another teacher, Graham Coleman, took a group of 10 students from Dereham Sixth Form College to visit the South African Astronomical Observatory in Cape Town and the new south African Large Telescope (SALT) in Sutherland. The team worked with teachers and students from the 'historically disadvantaged regions' (former townships) of the Western Cape. It was a fantastic experience for everyone, both from the UK and South Africa. This built on the tremendous work being carried out by Toni Beardon and her team through the AIMSSEC. What better way to 'make poverty history' than to provide the educational resources and skills so urgently needed in Africa?

The Queen enters CMS from the Gatehouse, flanked by Professor Timothy Pedley, Head of the Department of Applied Mathematics and Theoretical Physics, and Vice-Chancellor Professor Alison Richard.

The Queen meets Hans and Märit Rausing.

Her Majesty with Professor Geoffrey Grimmett, Head of the Department of Pure Mathematics and Mathematical Statistics.

The Duke of Edinburgh was interested to learn about the work of the CMS.

Hans Rausing and Professor Herbert Huppert.

The Queen enjoyed every minute of her visit to CMS.

The Queen with Professor Geoffrey Grimmett, talking to Mrs Hazel Trapnell and Dr Henry Fajemirokun.

The Duke of Edinburgh sharing a joke with Professor Timothy Pedley.

The Queen with Professor Stephen Hawking. Also pictured from left to right: Professor Timothy Pedley, Hans Rausing, Märit Rausing, Angela Jackson, David Pond, Dennis Avery, Sally Wong-Avery and Michael Gwinnell.

To discuss any aspect of making a donation in support of mathematics at Cambridge, please contact Professor Anne Davis (A.C.Davis@damtp.cam.ac.uk) or Mr Christopher Hesketh (ch10002@cam.ac.uk).