



## New Director

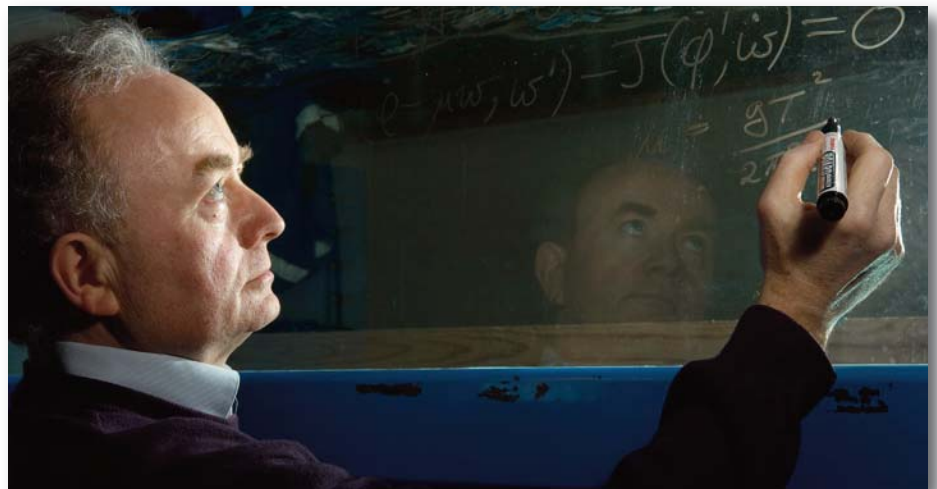
Professor John Toland FRS FRSE will be the next Director of the Newton Institute and the NM Rothschild & Sons Professor of Mathematical Sciences. In October 2011 he will succeed Professor Sir David Wallace who has served as Director since October 2006.

John has been Professor of Mathematics at the University of Bath since 1982 and between 2002 until 2010 he was also Scientific Director of the International Centre for Mathematical Sciences (ICMS) in Edinburgh. He held an EPSRC Senior Research Fellowship from 1997-2002.

He is a mathematical analyst whose research interests include dynamical systems theory, the calculus of variations, degree theory and nonlinear partial differential equations. By deploying all of these methods he has made substantial contributions to the rigorous theory of steady water waves, considering them mathematically as one of a large class of free-boundary problems that are ubiquitous in science and engineering. Moving on, John has begun to extend the theory to engineering applications: ocean waves under ice or large floating platforms are examples.

***"I am really delighted that John has been appointed as my successor"***

"I am really delighted that John has been appointed as my successor," said David Wallace. "He brings with him a wealth of experience in the mathematical sciences both through his personal research and his support for the work of others. I am sure that he will do an excellent job in taking the Institute forward." ●



## John Toland looks forward to meeting the challenges ahead

// The Newton institute is well placed to play a prominent role in what is undoubtedly a golden age for mathematics and it's applications and it is the only Institute of its kind serving colleagues across the UK with long-stay programmes of such breadth and depth. It has an increasingly successful fund-raising Development Committee. The opportunity to support and extend its work must be grabbed with both hands.

Over the next twenty years the Institute will have to confront a broad range of difficult issues. On the one hand, the Institute is small, but at the same time expected to deliver high quality, visible, mathematical achievements across a huge range of mathematical activity. On the other it has to continue its support for the individual researcher, working alone or in collaboration, on many fundamental problems, to achieve research outputs of the highest international quality.

The Institute has to be alert to new developments and prepared to pump-prime emerging ideas.

The role of the director is to maintain an atmosphere and promote a culture of creativity across the mathematical sciences, in whatever content they may be relevant. The Institute needs to make its activities accessible through a broad range of measures.

The challenges will be to maintain the high quality and level of the Institute's activities in the information age, when there are many more institutes world-wide than twenty years ago, and when travel costs, visas issues, availability of long-term participants and the green agenda impinge on its everyday activities. This is to say nothing of the financial threat following cutbacks in public funding in real terms. I'm sure the Institute will rise to the challenge. //

# Climate Change Question Time

Can we ever model climate accurately? Can we detect early warning signs of dramatic climate change? Can climate science help create a greener economy?

These were some of the questions that were discussed at a half-day open forum on 24 November 2010 at the Willis Building in London. The event was organised in collaboration with the Knowledge Transfer Network in Industrial Mathematics and the Centre for Science and Policy. The event opened with an excellent talk by Tim Palmer (University of Oxford, and the European Centre for Medium-Range Weather Forecasts) *Estimating and reducing uncertainty in climate prediction* which reported on key findings from the concurrent Newton Institute programme on Climate Change (see page 3).



Tim Lenton (Earth System Modelling, University of East Anglia) speaking during the first panel discussion

This was followed by two panel discussions: *The scientific uncertainties and their implications*, chaired by Jonathan Leake (Science & Environment Editor, The Sunday Times), and *Policy in the face of the uncertainties*, chaired by Oliver Morton (Energy and Environment Editor, The Economist). Vigorous

discussion took place during both sessions and many questions were asked by the audience. A closing talk was given by Rowan Douglas, Chair, Willis Research Network. Full recordings of the event including both panel discussions can be downloaded or viewed at [www.newton.ac.uk/programmes/CLP/clpw03p.html](http://www.newton.ac.uk/programmes/CLP/clpw03p.html)

## What's happening in our current programmes?

### Discrete Analysis

The programme began in January with a workshop on geometric embeddings. In addition to the research lectures there were excellent survey lectures by Subhash Khot on the unique games conjecture and by Laurent Saloff-Coste on random walks on groups.

In the following weeks there have been several highly rated seminars. Fields Medallist Terence Tao gave a lecture on *Gromov's Theorem on Groups of Polynomial Growth* and Johan Hastad gave a brilliantly clear introduction to the complexity of satisfiability problems.

At the end of March the programme held its second workshop, on discrete harmonic analysis which was attended by over 100 people and featured the Rothschild lecture by Avi Wigderson.

The month of April will be particularly busy with many workshop participants staying on for most of the month.

At the end of June the last workshop (a Satellite Meeting at Gregynog Hall) will focus on additive combinatorics.

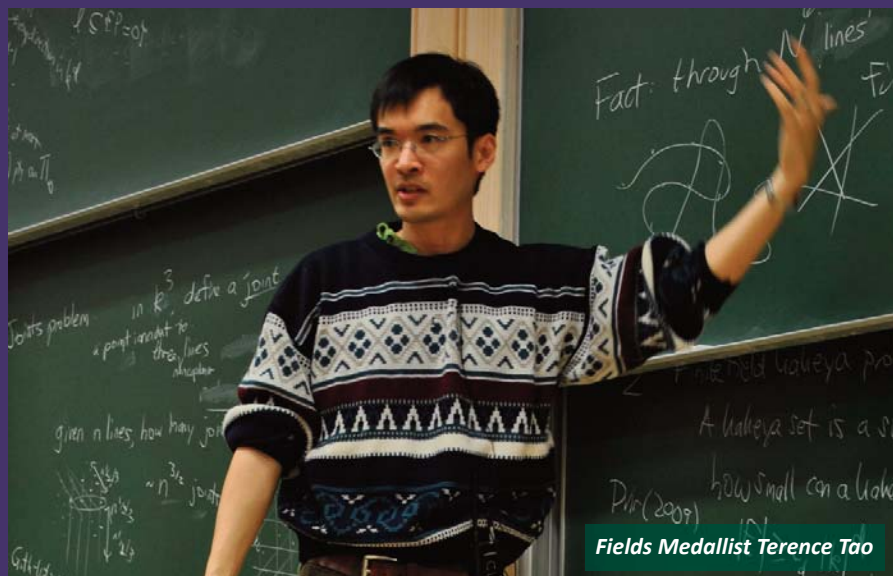
### Moduli Spaces

The programme began with a very successful school. There were more than 100 participants from many countries and excellent lectures and tutorials. A volume of proceedings is being produced. Since then, there has been an active programme of seminars with many stimulating talks, including one by Terence Tao.

One notable development of the programme has been Goettsche's

formulation of a conjecture on refined curve counting and BPS states; his original conjecture was finally given a totally satisfactory proof last year, so this new conjecture is very timely.

Several workshop are planned for the rest of the programme. One area in which advances can be predicted is higher rank Brill-Noether theory and the geometry of moduli spaces of curves, and progress is expected in other areas of moduli theory as well.



Fields Medallist Terence Tao

## Expanding links

Research at the interface between mathematical sciences and other disciplines has always been central to the Institute's work. In a new initiative we aim to deepen this activity by supporting the engagement of mathematicians with scientists, and especially experimenters, working in the natural, environmental, biomedical and social sciences. To achieve this goal, we are expanding our links with UK research communities to inform them of the opportunities provided by the Institute. In this way we expect to be able to respond to their research priorities and themes, and also to strengthen the impact of our research Programmes. For more information please contact Ben Mestel [b.mestel@newton.ac.uk](mailto:b.mestel@newton.ac.uk)

## LMS Lectures

The annual LMS Invited Lecture Series for 2011, took place at the Institute from 21–25 March. Professor Emmanuel Candès (Stanford) gave a well attended eight-lecture minicourse on *Compressed Sensing* which was suitable for graduate students. The talks are available at [www.newton.ac.uk/webseminars/](http://www.newton.ac.uk/webseminars/)

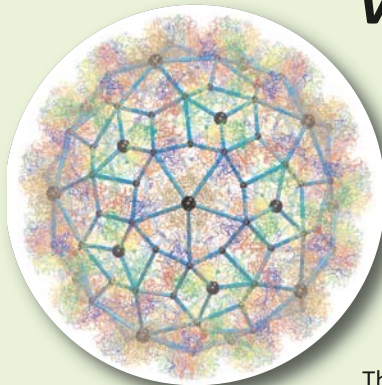
## Mathematical and Statistical Approaches to Climate Modelling and Prediction

**John Huthnance and Jonathan Rougier update us on the successes of their climate modelling programme that ended in December 2010**

The programme brought together more than 150 scientists with a very diverse range of interests. These included researchers in the major aspects of climate modelling and observation and statisticians working in the general area of uncertainty assessment for complex systems. It is clear that there is a huge potential for the incorporation of formal statistical methods into climate science, but there are challenges in tailoring these methods and their outputs to the needs and capabilities of stakeholders. A less expected emergent theme concerned the role and treatment of

simple idealised models, which are amenable both to a detailed mathematical analysis, and a statistical treatment that takes account of their limitations. The programme has stimulated specific advances in (i) paleoclimate and tipping point studies, (ii) the formulation of dynamical equations and their numerical implementation in GCMs, (iii) the representation of sub-grid-scale processes with stochasticity (particularly in respect of clouds, convection and spectra of energy and vorticity), and (iv) the statistical treatment of climate model output, both perturbed parameter ensembles and multi-model ensembles. There are new prospects in data assimilation and in formulating accurately conserving numerical schemes for long model-run.

## Viruses under the microscope



On Saturday 26 March, Reidun Twarock, a member of the Institute's Scientific Steering Committee and Professor of Mathematical Biology at York University, gave a talk on the mathematics of viruses as part of the Cambridge Science Festival.

The talk was delivered to a full seminar room and showed that symmetry plays a key role for virus structure, and that mathematical tools similar to those used in the study of Penrose tilings provide novel insights into viral evolution and how viruses infect their hosts. Many visitors had hands-on experience after the talk with computer simulations and children enjoyed making their own icosahedra to take home.



Prof. Reidun Twarock



S. Wilkinson

## Villani Lecture

On 15 November the Institute was delighted to welcome Professor Cedric Villani, Fields Medallist and Director of Institute Henri Poincaré, to give a public talk entitled *Entropy and H-theorem: The mathematical legacy of Ludwig Boltzmann*. Programme organiser José Carrillo said "it was a wonderful and entertaining talk about the concept of entropy, the H-theorem and Boltzmann's legacy in relation to deep modern theories of kinetic partial differential equations". The talk can be downloaded in full from the Institute Webseminars page at [www.newton.ac.uk/webseminars/](http://www.newton.ac.uk/webseminars/)



Cedric Villani (left) with José Carrillo

S. Greenham



## Staff in the Spotlight



**Steve Greenham**

### What is your job and how long have you worked at the Institute?

I am the Senior AV technician and I have worked at the Institute for almost six years! I started on the anniversary of D-Day, 06/06/05 and the Institute was visited by the Queen in my first week. What a way to start!

### What does your job involve?

My work has evolved a great deal. I began by recording seminars on VHS tape and capturing just the audio. Now the Institute is equipped with high-definition cameras and video mixer, which I control during seminars to produce high quality videos that are enjoyed worldwide. I am also involved with IT support, video conferencing and web site maintenance.

### What have been the highlights of your job so far?

The Institute has one of the best video-recording system for capturing mathematical seminars in the world, and I feel privileged to be at the cutting edge. I also get to meet famous mathematicians, such as Stephen Hawking, Roger Penrose and Andrew Wiles; and I love being involved with events like the Darwin Festival and Cambridge Science Festival.

### What do you enjoy most about your job?

The staff are all friendly and the Institute and environment is inspirational. I love using my technical and creative skills together to produce work which is appreciated by others - it's very rewarding!

### Do you have any hobbies?

I can often be found at home designing websites and researching technologies. But if the weather is nice I enjoy getting out and about - exploring the countryside and visiting National Trust places.

### What is your favourite book?

1984 by George Orwell.

I control the cameras. I am big brother and I am watching you...

### What is your greatest luxury in life?

Having the time to simply relax and travel the globe. I still have many wonders of the world to visit, including Milford Sound, New Zealand and Machu Picchu, Peru.

### Who would be your ideal dinner party guests?

I would have to invite film producer Steven Spielberg, television inventor John Logie Baird, of course Isaac Newton and Jamie Oliver (someone needs to cook!) 🍷

## Events of wider public interest

**05 May 2011 Spitalfields Day: Moduli Spaces**  
This event will include talks by leading international experts and is suitable for a general mathematical audience.

**26 May 2011 Vector Bundles and Coherent Systems**  
This one-day meeting is part of the *Moduli Spaces* programme and anyone is welcome to attend.

**A number of Open for Business events are taking place at the Institute including ;**  
Pharmaceutical day - during 15–19 Aug 2011  
Medical Imaging day - during 22–26 Aug 2011  
Industry Day - during Oct/Nov 2011  
Medical Imaging day - during 22–26 Aug 2011

For further information on these and other events please see [www.newton.ac.uk](http://www.newton.ac.uk)

## Funding and Donors update

The Institute is grateful for generous donations of £250,000 from the Garfield Weston Foundation and a first gift of £50,000 from Henderson Global Investors in support of our activities. These donations are vitally important to ensure that the Newton Institute continues to be able to run research programmes at the cutting-edge of mathematics.

To contribute to the Institute you can contact David Wallace at [David.Wallace@newton.ac.uk](mailto:David.Wallace@newton.ac.uk) or visit [www.newton.ac.uk](http://www.newton.ac.uk) 🍷

## New Programmes for 2013

Four new programmes have been announced for 2013.

**Grothendieck-Teichmüller Groups, Deformation and Operads**  
(3 January - 26 April)



Jean-Louis Loday

An image from the programme on Grothendieck-Teichmüller Groups, Deformation and Operads

**The Mathematics of Liquid Crystals**  
(7 January - 5 July)

**Mathematical Modelling and Analysis of Complex Fluids and Active Media in Evolving Domains**  
(1 May - 23 August)

**Polynomial Optimisation**  
(15 July - 9 August)

Further information on all of our programmes can be found at [www.newton.ac.uk/programmes/](http://www.newton.ac.uk/programmes/) 🍷