

## INI on show at New Scientist Live

In September 2017 the teams from the Isaac Newton Institute (INI) and the Turing Gateway to Mathematics (TGM) exhibited at the much-celebrated New Scientist Live event at ExCel London. Billed as “the world’s most exciting festival of ideas and discovery”, the annual New Scientist Live event has enjoyed great success since its launch in 2016. Typically hosting around 140 speakers and over 100 exhibitors across multiple halls within the ExCel, the 2017 show attracted 30,549 visitors across all age ranges. It therefore proved an excellent forum for INI and TGM to spread awareness of our work, share the opportunities that mathematics can provide for young people, and explain the



joys and challenges inherent within the subject in general. Attending alongside four other mathematical groups and institutes – the Operational Research Society, the Knowledge Transfer Network, the International Centre

for Mathematical Sciences and the Institute of Mathematics and its Applications – the shared stand was presented under the single banner of “Mathematics in the Real World”. The combined factors of a front row location, a wealth of mathematical literature, quiz materials, interactive displays, prize giveaways, sizeable reserves of brightly coloured puzzle cubes and eager teams of INI programme participants and INI/TGM staff made for a stand that was rarely short of activity or interested crowds. Perhaps the strongest indicator of the stand’s success was the measurable levels of interaction generated. In total 382 quiz entries were received and 3,000 “self-assembly” puzzle cubes, 320 INI-branded pens and 180 similarly decorated rulers were distributed across the four days. INI is extremely thankful for

the involvement of many of the event’s major speakers – including statistician David Spiegelhalter, biologist Charles Godfray, and writer/broadcaster Alex Bellos - who joined us at the stand, helping us further engage interested parents, teachers, students, children and other lovers of mathematics. Special mention should also go to INI Director David Abrahams, whose attempt to singlehandedly mark the maths homework of every attending schoolchild was as warmly received by the audience as it was thoroughly enjoyed by David himself.

### See inside for:

- **Current programmes**
- **Three Rothschild talks**
- **"Form in Art: Art of Form" exhibition**
- **New video series**
- **Upcoming events**

(below) A selection of images from the 2017 New Scientist Live event.



## Correspondents network refreshed

In January 2018 INI hosted its annual Correspondents Day meeting in which over 50 attendees from mathematical institutes and higher education centres across the UK gathered in Cambridge. Their ongoing task is to spread awareness of and engagement with INI programmes.



Although this network of volunteers has been active since its establishment in 2002, 2018 marked a comprehensive refresh and update to the group – with the most significant change being that the Correspondents network will now be maintained as a joint project between INI and the International Centre for Mathematical Sciences (ICMS, Edinburgh).

Representatives were present from Universities as geographically disparate as Aberdeen and Exeter. Members were also added to the network from prestigious industry bodies and mathematical organisations such as Microsoft and the Royal Statistical Society. The day’s main talks focused on “The mathematical landscape in the UK” (Andrew Bourne, Associate Director, EPSRC) and redressing the gender imbalance within the mathematical sciences (Professor Liz Mansfield, University of Kent) – the latter topic being discussed with much energy during the ensuing break-out discussions.

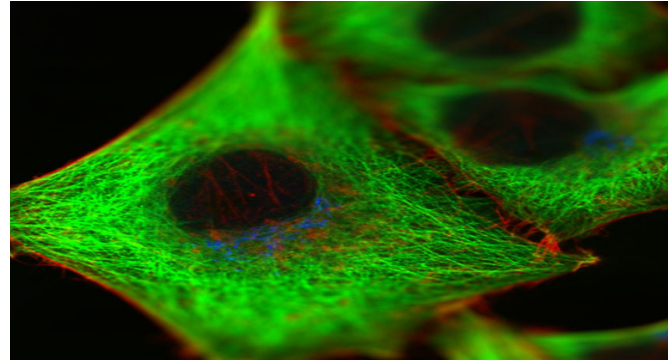
(left) The 2018 INI-ICMS Correspondents gather in the Institute's common area.



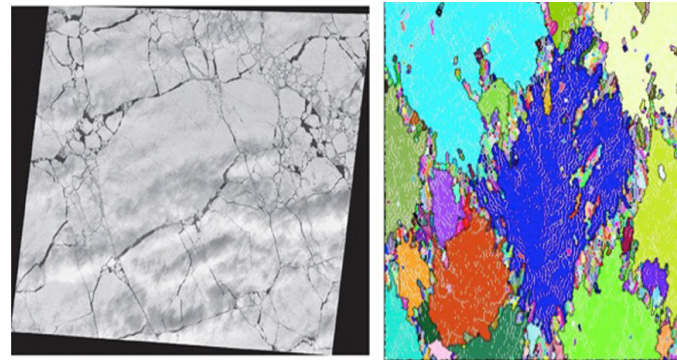
# Recent Programmes Update



The “**Nonlinear water waves**” (NWW) programme ran throughout August 2017. Attracting participants from over 17 nations, the aim was to bring mathematical analysts and applied mathematicians together, with others such as engineers, in a single venue to focus on active areas in the study of surface water waves of large amplitude. The team of organisers report that the programme’s outcomes “will lead to long-term fruitful collaborations resulting in major publications and further scientific activities and advances”.



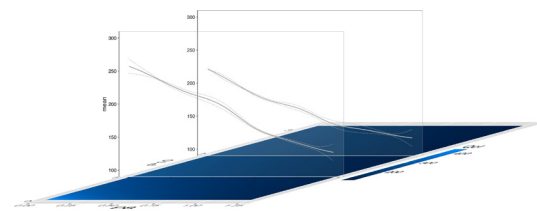
The “**Variational methods and effective algorithms for imaging and vision**” (VMV) programme ran from August to December 2017. The programme brought together different groups of researchers and practitioners involved in mathematical imaging science, in order to stimulate discussions on new horizons in theory, numerical methods and applications of mathematical imaging and vision.



The “**Mathematics of sea ice phenomena**” (SIP) programme ran from August to December 2017. With a focus on sea-ice mechanics and thermodynamics, and sea-ice interactions with fluids and solids, the programme addressed problems that span fields of physics and mathematics as well as the natural sciences and engineering. Beyond its four workshops SIP involved three separate TGM-related events as well as robust interaction with outside groups such as British Antarctic Survey.



The “**Statistical Scalability**” (STS) programme began in January 2018 and will run until June of this year. Throughout its six-month research period the organisers aim to undertake simultaneous consideration of the methodological, theoretical and computational challenges involved within the field of statistical scaling methods, in order to provide robust, scalable methods that are crucial to unlocking the potential of Big Data.



The “**Uncertainty quantification for complex systems: theory and methodologies**” (UNQ) programme began in January 2018 and will run until June of this year. The aim of the programme is to bring together leading applied mathematicians and statisticians to develop theories and methodologies for reducing the cost of model inversion, increasing the level of tractable complexity in modelling, and enabling efficient risk assessment and decision making.



Held in the 100th anniversary year of the publication of d’Arcy Thompson’s “On Growth and Form”, the “**Growth form and self-organisation**” (GFS) programme ran from August to December 2017. With a focus on the mathematics of shape selection, deformations, and self-organisation the topics were broad and stretched from scaling laws in biology to propulsion mechanisms and artificial networks. An international art exhibition was also held as part of the programme (see p.4).



Participants in INI’s Seminar Room 1 during the UNQ workshop: “Key UQ methodologies and motivating applications”, January 2018.

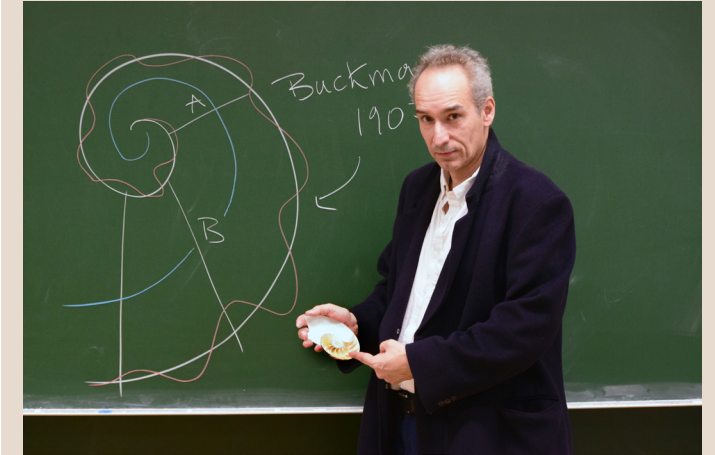


VMV programme organisers Professor Carola-Bibiane Schönlieb (second from left), Professor Michael Hintermüller (centre) and Dr Andrew Fitzgibbon (right).



Participants in the UNQ programme’s second workshop: “Surrogate models for UQ in complex systems”, February 2018.

## Rothschild Lectures update

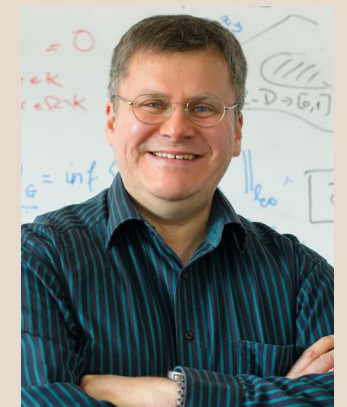


Professor Alain Goriely (Oxford)

Rothschild Visiting Distinguished Fellow **Professor Elizabeth Hunke** (Los Alamos National Laboratory) addressed “Multi-scale modelling of ice characteristics and behaviour” as part of the SIP programme on 11 September 2017. She provided a broad overview of the current CICE sea ice model’s capabilities and uses, highlighted new analysis techniques for statistically assessing model skill against diverse observations, and discussed community engagement effort, all toward addressing society’s needs in the face of the Earth’s changing polar regions.

Rothschild Visiting Distinguished Fellow **Professor Joachim Weickert** (Saarlandes) addressed “Image compression with differential equations” as part of the VMV programme on 28 September 2017.

Professors Elizabeth Hunke (left) and Joachim Weickert (right)



Highlighting that partial differential equations are used to model phenomena in nature, and thus have high potential to compress digital images, he questioned which data should be kept, which are the most useful equations for this purpose and how the selected data could be encoded most efficiently.

Rothschild Visiting Distinguished Fellow **Professor Alain Goriely** addressed “On growth and form and mathematics: reading d’Arcy Thompson 100 years on” as part of the GFS programme on 10 October 2017. In the talk he questioned the real influence and impact of the book, examined in what ways it has measurably shaped questions and methodologies in modern science, and showed how d’Arcy Thompson’s ideas still hold relevance in research to unravel the physical bias of morphogenesis.



## International art exhibition at INI

The public exhibition “Form in Art: Art of Form”, comprising 14 separate artworks from a selection of 10 highly regarded international artists, was hosted at the Institute from 22 November to 15 December 2017. During its three-week run it aimed to “explore the relationship between form, as understood mathematically, and art”. Conceived and launched as part of the “Growth form and self-organisation” (GFS) programme the event aspired towards collaboration and interdisciplinary interaction. The artists in attendance - Peter Randall-Page RA, Paul Friedlander, Mark Francis, Ulyana Gumeniuk, Henry Jabbour, Nedyalka Panova, Emma Rogers, Mella Shaw, Manoel Veiga and Nigel Hall RA - were invited to exhibit according to strict criteria including that their work “employed physics phenomena in their processes” and “engaged themes related to science”. The results were hugely impressive. The core event within the exhibition calendar was an afternoon of talks and interactions which took place on Wednesday 29 November, and this extremely well-attended occasion saw INI’s main seminar room filled to near capacity.

Contributing artist Manoel Veiga (right) told INI: “It was great to see the different approaches to art and form: a cosmologist will see galaxies in my paintings and a geologist will see an aerial photograph. This was very enriching to me. I was overwhelmed by meeting the many artists, mathematicians, physicists and engineers at the event. My mind is spinning with new possibilities which I hope will give birth to new bodies of work, new collaborations!”



## Grant funding finalised

INI is thrilled to announce that the confirmation of our renewed grant has been received from the Engineering and Physical Sciences Research Council (EPSRC). The award from the Research Councils combined is for **£11,570,267** over 6 years, an increase of **28.6 per cent** per annum.

# EPSRC

Engineering and Physical Sciences  
Research Council

## Upcoming events

**9-13 April 2018**

**Workshop UQ for inverse problems in complex systems.** This workshop will be devoted to exploring the challenges associated with stochastic inverse problems for complex systems.

**2 May 2018**

**TGM Conference Development in healthcare imaging - connecting with academia.**

This conference will bring together academics working on advances in imaging technology with researchers who investigate new image analysis methods.

**25-29 June 2018**

**Workshop Future challenges in statistical scalability.** This workshop will conclude the STS programme with a vision of the future of Big Data.

*A full listing of all scientific events at INI is available via [www.newton.ac.uk/events](http://www.newton.ac.uk/events)*

## New video series launched

Since August 2017, INI has filmed video interviews with the Organisers of each programme held at the Institute. The aim of these short films is to provide an introduction to the subject of each programme, the challenges inherent within it, and the likely outcomes from the research undertaken. At the time of press there were eight such videos on [newton.ac.uk](http://newton.ac.uk), which can be accessed via the homepage carousel or the following link: [bit.ly/INIVideos](http://bit.ly/INIVideos)

(below) Professors Peter Challenor and Henry Wynn of the UNQ programme.



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Isaac Newton Institute for Mathematical Sciences  
20 Clarkson Road, Cambridge, CB3 0EH, UK  
**tel:** 01223 335999 **email:** [communications@newton.ac.uk](mailto:communications@newton.ac.uk)  
**web:** [www.newton.ac.uk](http://www.newton.ac.uk)

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