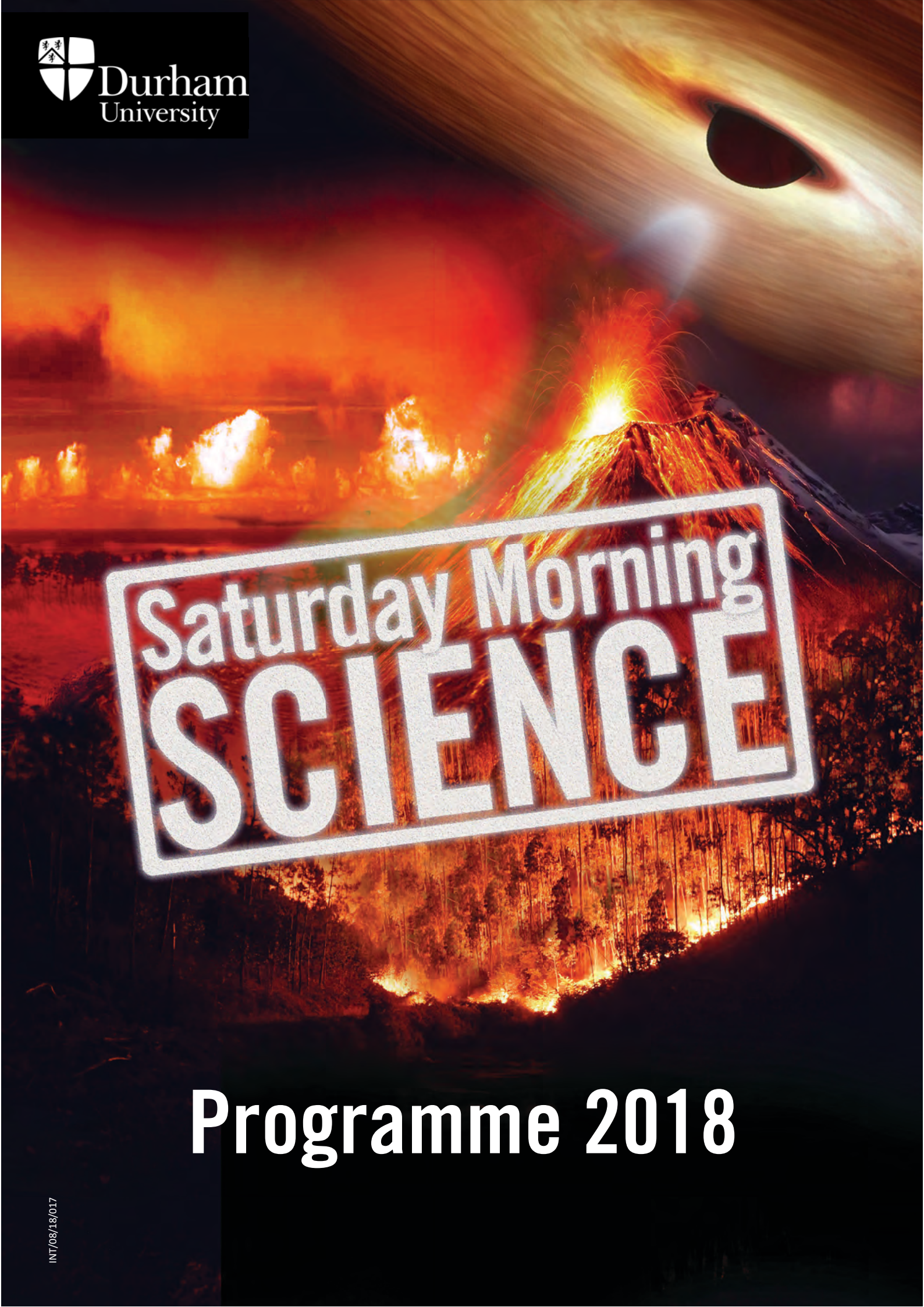


Programme 2018

INT/08/18/017

LIST OF PARTICIPATING SPEAKERS

Date	Speaker	Name of talk
29th Sept	Prof. Richard Bower	The Big Bang Show
6th Oct	Prof. Ben Alderson-Day	Do you hear what I hear? The science of auditory hallucinations
13th Oct	Dr. Robert Pal	Lights, colours, camera, action!
20th Oct	Prof. Simon Hogg	UK Electricity System: The future ain't what it used to be
27th Oct	Prof. Toby Breckon	Sensing for Driverless Cars – the technology being driven to a street near you
3rd Nov	Dr. Camila Caiado	Two of a kind: are identical twins possible?
10th Nov	Prof. John Parker	Geometry, Tessellations and Surfaces
17th Nov	Dr. James Baldini	Using cave deposits to reconstruct past and to predict future climate change
24th Nov	Dr. John Bothwell	The rough guide to seaweed, or, should we eat it, burn it, or wear it?
1st Dec	Prof. Silvia Pascoli	The mysterious neutrinos
2nd Feb	Dr. Christopher Donaghy-Spargo	Oliver Heaviside: Electromagnetician
9th Feb	Wilson, Bromley, Rakonjac	Clocks, quantum control, and cold atoms
16th Feb	Dr. Paul Chazot	10,000,000,000,000,000 reasons to love the brain
23rd Feb	Dr. Phil Heron	A (geophysical) journey to the centre of the Earth
2nd Mar	Emine Gurbuz	Social and Academic Experiences of Higher-Education Students with and without an ASD in the UK
9th Mar	Prof. Tom Lancaster	You'd better shape up: magnetism, vortices and skyrmions
16th Mar	Dr. Sunil Chhita	Geometry, Tessellations and Surfaces
23rd Mar	Voitchovsky, Kusumaatmaja and Staykova	Soft can be the toughest!
30th Mar	Prof. Marc Knight	How do plants feel?
27th Apr	Dr. Anthony Yeates	Rogue Sunspots
4th May	Dr. Ed Llewellin	Bubble, burp, bang! The physics of volcanic eruptions
11th May	Jacob Kegerreis	When Worlds (Literally) Collide

29th SEPT

Physics

The Big Bang Show

Prof. Richard Bower, Institute for Computational Cosmology & Centre for Extragalactic Astronomy, Department of Physics

How does the Universe begin? This question has pre-occupied human thought for more than 3000 years. But contemporary cosmologists think they know the answer. We'll explore our place in the Universe, what the Universe is made from and the evidence for the expansion of the Universe. We'll discuss how astronomical and cosmological observations have lead to the big bang model in which the Universe is created in a cosmic "big bang", a hot explosion of matter.

6th OCT

Psychology

Do you hear what I hear? The science of auditory hallucinations

Prof. Ben Alderson-Day, Assistant Professor (Research), Department of Psychology

Why do some people hear voices or see things, when other people do not? What makes someone more hallucination-prone?

In this session we will explore what science can tell us (so far) about how and why hallucinations occur. We will talk about using sine-waves to mask hidden speech, how our brains test hypotheses about the world around us, and what this might tell us about mental health conditions such as schizophrenia.

There will also be a chance to try out experiments designed by Durham University's "Hearing the Voice" project, an 8-year investigation of auditory hallucinations.

Biosciences

13th OCT

Lights, colours, camera, action!

Dr. Robert Pal, Royal Society University Research Fellow, Director of Research and Development, Biophysical Sciences Institute & Department of Chemistry

What do sweet wrappers, Pink Floyd and Darth Vader have in common? It's light! Join Robert Pal from Durham University in a quest to understand light in all its glory.

This demonstration will guide the audience thorough the wonderful phenomena that is light. From its humble origins from the stars through all the colours of the rainbow we aim to shed light on diffraction, refraction and reflection. We will chart the invisible by understanding the full spectrum of light from ultra violet to infra red touching on subject such as suncream, glowworms and fiberoptic broadband.

Engineering

20th OCT

UK Electricity System: The future ain't what it used to be

Professor Simon Hogg,
Ørsted Professor in Renewable Energy,
Head of the Department of Engineering

Electric power generation is changing globally, driven by carbon reduction targets to safe-guard the environment and the need for security of supply at affordable prices. For the UK this has led to the retirement of most of our coal-fired power plants and the exponential growth in wind power seen in recent years.

This lecture will provide an overview of the conventional and renewable generating technologies that are currently contributing to supplying the UK National Grid, how this mix is expected to change over the next decade and the challenges that need to be overcome in order to deliver this.

27th OCT

Computer Sciences

Sensing for Driverless Cars - the technology being driven to a street near you

Prof. Toby Breckon, Professor in the Innovative Computing Group at the Department of Engineering and Department of Computer Science

It appears autonomous vehicles (driverless cars) may become one of the most significant changes to the way we travel in over 100 years. Central to this fast moving technological development is the use of computer vision – how can computers see? - and machine learning – how can computer learn to perform complex tasks?

Advances in these area of computer science and information engineering present many opportunities and implications for our daily lives.

This talk will explore research work at Durham on automotive visual sensing, outline the underlying scientific advances that underpin driverless car technology and also some research challenges that remain to be addressed.

More broadly, I will discuss wider technological developments in the field and the potential impacts of future driverless vehicles appearing on our roads and beyond.

3rd NOV

Mathematical Sciences

Two of a kind: are identical digital twins possible?

Dr. Camila Caiado, Assistant Professor (Statistics) in the Department for Mathematical Sciences

Digital twins are representations of processes and systems used to understand the real world. They are commonly used to optimize machines such as wind turbines, F1 cars and even robots like the NASA Mars rover. They can also be used to understand how people use buildings, how the heart works, and how a bank operates. The two basic components to creating your own digital twin are good data, and mathematical and statistical models to represent the object or process in question – all bundled in a system that can be easily used by the person making decisions. Let's explore how a digital twin is designed and created, and how mathematics and statistics can help us make better decisions.

Mathematical Sciences

10th NOV

Geometry, Tessellations and Surfaces

Prof. John Parker, Director of Postgraduate Studies & Professor of Geometry in the Department of Mathematical Sciences

We can understand the geometry of surfaces by cutting them into flat pieces which fit together nicely. Taking lots of copies of these pieces we can reassemble them as a tessellation, or tiling. This makes geometry problems easier. On the other hand, we can sometimes reconstruct our surface by gluing some of the tiles of the tessellation together. But sometimes we can't do this... How do we decide?

Earth Sciences

17th NOV

Using cave deposits to reconstruct past and to predict future climate change

Dr James Baldini, Associate Professor (Reader) Department of Earth Sciences

Caves have fascinated mankind since prehistoric times, serving as shelters as well as being assigned numerous supernatural attributes. Over the last hundred years or so, they have also attracted scientific enquiry, but never more so than over the last two decades. Cave deposits are now one of the leading sources of information regarding past climate change, and in turn are hugely important for understanding what the climate might be like in the future. In this talk we will explore how cave deposits, and caves in general, are used to answer fundamental scientific questions, ranging from working out the cause of civilisation collapse to locating vast quantities of hidden carbon dioxide gas.

After the talk, there will be an opportunity to examine cave deposits (stalagmite samples) from all over the world, and to measure the carbon dioxide concentrations inside the Calman Learning Centre. There will be the opportunity to discuss how cave deposits form, and how climate information is extracted from them.

24th NOV

Biosciences

The rough guide to seaweed, or, should we eat it, burn it, or wear it?

Dr. John Bothwell, Co-Director, Durham Energy Institute and Associate Professor in the Department of Biosciences & Biophysical Sciences Institute

"Vilior alga est" - "more worthless than seaweed" - wrote the Roman poet, Horace. But times have changed and we now know that our seaweeds form the foundations of life on our coastlines. But can they do any more than that?

This talk will describe how humans have used seaweeds in the past, and how we're planning to get even more from them in the future.

1st DEC

Physics

The mysterious neutrinos

Prof. Silvia Pascoli, Deputy Director of the Institute for Particle Physics Phenomenology and Professor in the Department of Physics & Centre for Particle Theory

Neutrinos are the most elusive of known particles. Despite being the most abundant fermions in the Universe, we still do not know many of their properties, even their mass. The discovery of neutrino oscillations, rewarded by the Nobel Prize in Physics in 2015, implies that, contrary to expectations, neutrinos have an, albeit tiny, mass which is much smaller than those of all other fermions. Why this happens remains a mystery. I will discuss the knowns and unknowns regarding neutrinos and what they can tell us on how nature works and how the Universe evolved. I will also show how to visualise neutrinos with the Neutrinoscope App and play with them in the NuOdyssey videogame.

Engineering

2nd FEB

Oliver Heaviside: Electromagnetician

Dr. Christopher Donaghy-Spargo, Deputy Director of the Future Energy Systems Research Challenge and Assistant Professor of Electrical Engineering

Electromagnetism is a fascinating and somewhat mysterious subject – electricity and magnetism have long captivated the minds of many.

This talk will explore what electromagnetism is, how it is applied in an engineering context in order to improve our lives and also highlight the very many important contributions to the subject by eminent Victorian scientist, Oliver Heaviside.

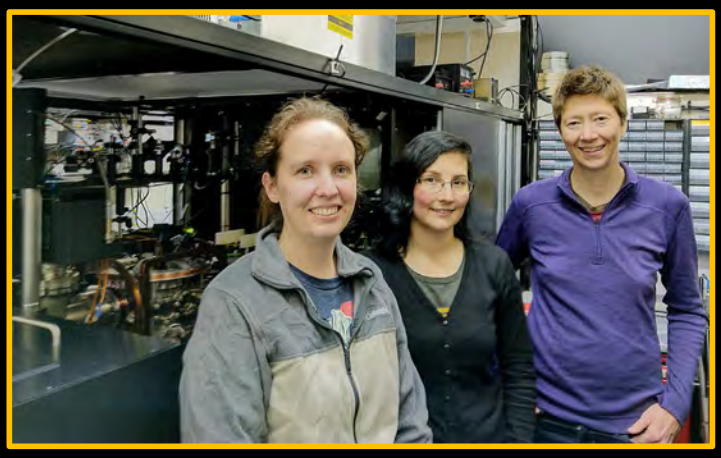
It will also describe the subjects links to the North East of England and more specifically to Newcastle upon Tyne and its Engineering heritage.
The talk will conclude by highlighting how the theory as laid out by James Clerk Maxwell and others in the 19th Century, is equally applicable now with respect to modern engineering applications.

Physics

9th FEB

Clocks, quantum control, and cold atoms.

Dr. Kali Wilson, Dr. Sarah Bromley, Dr. Ana Rakonjac - Post Docs, Atomic and Molecular Physics, Department of Physics



The best atomic clocks today are accurate to within 0.0000000000000001 seconds. This means if two atomic clocks were made at the beginning of time, they would still be in sync to within a second of each other. To make the best clocks we need to work with atoms a tiny fraction of a degree above absolute zero; much colder than outer space. How does laser cooling atoms lead to better clocks? How do we cool and control atoms in the lab? What else can we do with cold and slow atoms?

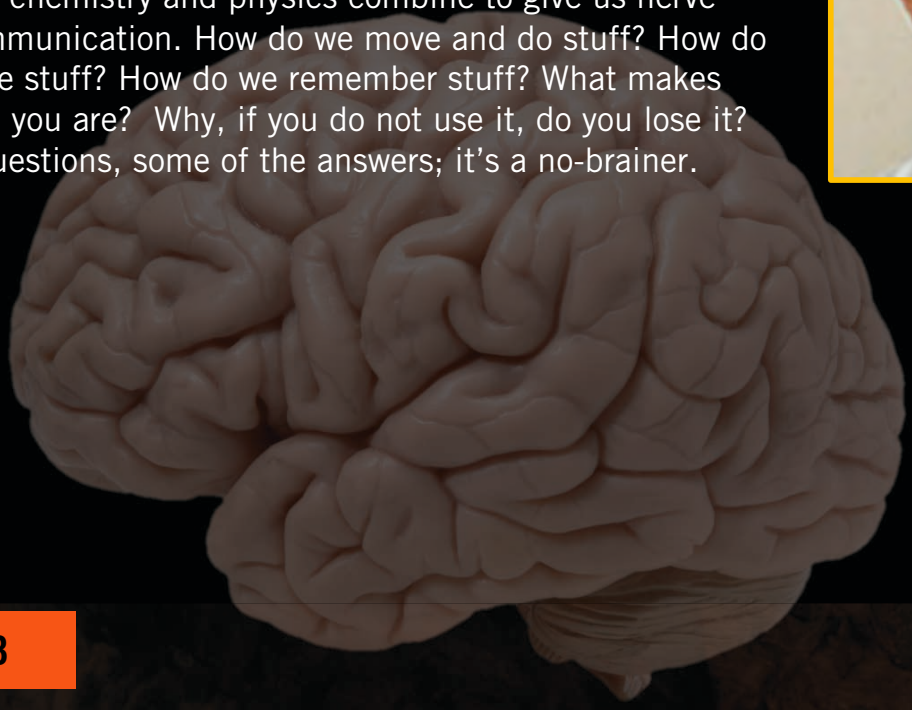
16th FEB

Biosciences

10,000,000,000,000,000 reasons to love the brain

Dr. Paul Chazot, Associate Professor in the Department of Biosciences, Member of the Centre for Developmental Disorders, Learning and Memory Processes Centre, Fellow of the Wolfson Research Institute for Health & Wellbeing

Biology, chemistry and physics combine to give us nerve cell communication. How do we move and do stuff? How do we sense stuff? How do we remember stuff? What makes you who you are? Why, if you do not use it, do you lose it? Many questions, some of the answers; it's a no-brainer.



23rd FEB

Earth Sciences

A (geophysical) journey to the centre of the Earth

Dr Phil Heron, Marie Skłodowska-Curie Research Fellow, Department of Earth Sciences

We stand on a surface that is moving about as quickly as your fingernails grow. The theory of plate tectonics describes this motion and explains activities like earthquakes and mountain ranges.

Over the years, we have been able to illuminate deep below the surface to discover mega structures and complex layering where the impact of plate tectonics is far reaching!
We will take a geophysical journey to the centre of our dynamic Earth to explore how the planet's slowly moving surface dramatically influences (and can be influenced by) the evolving landscape deep beneath our feet. After the talk, we'll have a super poster session on super-volcanoes and the supercontinent cycle!

Biosciences

30th MAR

How do plants feel?

Prof. Marc Knight, Department of Biosciences and Behaviour, Ecology & Evolution Research Centre

Plants in your garden, as well as those in the wild, simply can't move and have to take everything that the weather throws at them. As well as this, they also have to deal with being attacked by insects and microbes pretty much constantly. Not being able to run away or take medicines means that plants have to defend themselves in a particular way. This involves changes in the plants which will make them resistant to each type of attack. To do this plants need to be able to properly sense their environment, in the same way as you or I. Plants do indeed have "senses" which in some ways are similar to ours, and in other ways very different. This presentation will discuss what we know about how plants are able to see, sense touch, and taste, sense temperature, as well as to discuss the thorny topic of whether or not they can hear!

Mathematical Sciences

27th APR

Rogue sunspots

Dr. Anthony Yeates, Associate Professor, Magnetohydrodynamics in the Department of Mathematical Sciences

It has long been known that the Sun's 11-year activity cycle fluctuates both in strength and duration, caused by random variations in the thousands of individual sunspots which emerge over each 11-year period. However, recent research has suggested that just a handful of "rogue" sunspots could have a profound effect on this activity cycle, even shutting it down altogether. I will show you the mathematical modelling that has led scientists to this conclusion, and discuss whether we should be worried. After the talk, there will be the opportunity to find out more about our work on modelling the Sun in the Department of Mathematical Sciences.

Psychology

2nd MAR

Social and Academic Experiences of Higher-Education Students with and without an ASD in the UK

Emine Gurbuz, Research Postgraduate in the Department of Psychology and Member of the Centre for Developmental Disorders

The number of university students with autism is increasing, and it is crucial that these students can access adequate support. An online questionnaire was completed by 26 autistic students and 158 non-autistic students enrolled at UK universities to investigate social and academic experiences. Autistic students self-reported significant challenges and more mental health difficulties than non-autistic students. Significant challenges focused on the social components of university life, including social skills, social support opportunities, and levels of ASD awareness from others. Many strengths were also reported regarding academic skills of autistic university students. Importantly, there were more thoughts of withdrawal by the students with autism highlighting the need for support. This data can inform university student support services.

Physics

9th MAR

You'd better shape up: magnetism, vortices and skyrmions

Prof. Tom Lancaster, Department of Physics, Centre for Materials Physics and Durham X-Ray Centre

Despite its effects being known for millennia, we are only just beginning to understand the magnetism of materials. For many scientists, magnets are a testing ground for a range of theories of nature, including ideas of how a one- or two-dimensional Universe might behave. Very recently, a new sort of particle was discovered in magnets: the skyrmion, a sort of magnetic vortex that owes its existence to simple ideas about how shapes behave. I will explain what skyrmions are and why being able to manipulate them might just solve the energy crisis. There will be an opportunity to meet with scientists researching skyrmions after the talk.

16th MAR

Mathematical Sciences

Geometry, Tessellations and Surfaces

Dr. Sunil Chhita, 1H Course Director & Assistant Professor, Probability in the Department of Mathematical Sciences

Most people are familiar with the idea of randomness in their daily lives. Examples include coin flipping, dice, fluctuations of the stock market, the weather, etc. This talk aims to present some of the mathematical thinking behind probability theory, a theory which has been developed to study randomness.

23rd MAR

Physics

Soft can be the toughest!

Dr. Kislon Voitchovsky, Dr. Halim Kusumaatmaja & Dr. Margarita Staykova Department of Physics and Centre for Materials Physics

A large part of the materials surrounding us are soft in the sense that they can be easily deformed or re-shaped: the air we breathe, the liquid we drink, our bodies, food, clothing and some of our modern technology. So what makes a material soft and what are the implications? Understanding the structure and properties of soft matter is key to many applications, ranging from medicine and biology to paints, car lubricants, electronic displays and the development of novel materials.

From L: Kislon Voitchovsky
Halim Kusumaatmaja
Margarita Staykova

4th MAY

Earth Sciences

Bubble, burp, bang! The physics of volcanic eruptions

Dr Ed Llewellin, Associate Professor (Reader), Department of Earth Sciences

Volcanic eruptions are spectacular, fascinating and diverse. Some produce explosions that blast many cubic kilometres of rock into the stratosphere and cause regional devastation.

Others produce fountains and rivers of lava that create a dramatic natural tourist attraction. Many do no more than quietly release gas into the atmosphere. Despite this diversity of behaviour, all volcanic eruptions are driven by the same fundamental mechanism – the formation and growth of bubbles of gas. So why do some volcanoes explode violently, whilst others bubble quietly?

We will explore this question through observation and experiment. We will examine volcanic eruptions and their products to see what clues they can give us about the physical processes that govern volcanic eruptions, then conduct a series of experiments to test our hypotheses.

After the lecture, you will have the chance to conduct your own hands-on experiments, and visit Durham's Volcanological Fluid Dynamics laboratory.

Warning: includes live volcanic eruption!

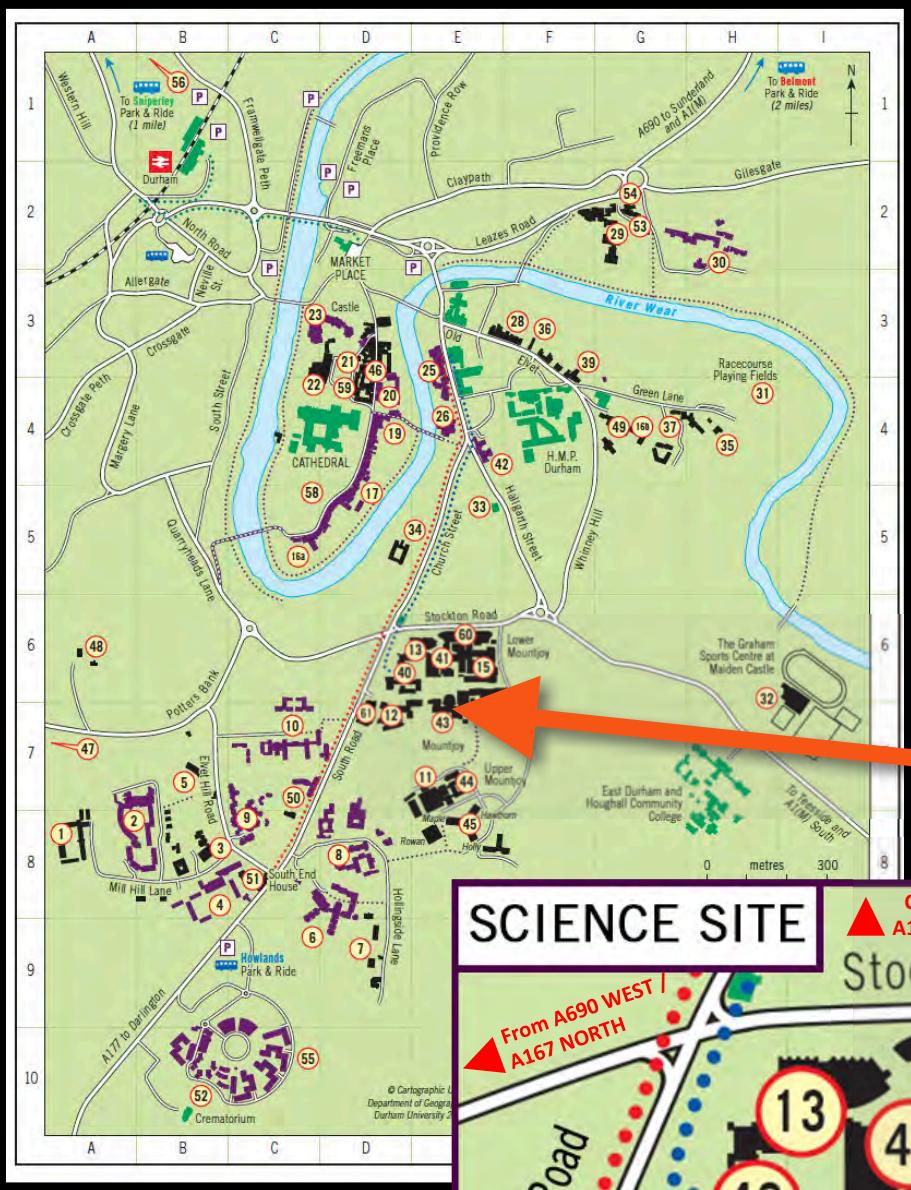
11th MAY

Physics

When Worlds (Literally) Collide

Jacob A. Kegerreis, Department of Physics and Institute for Computational Cosmology

Planets smashing into each other is an important part of our solar system's violent history. We study these giant impacts with supercomputer simulations to help us understand mysteries ranging from the formation of Saturn's surprisingly young rings, to how Uranus fell over.



Parking at the University Science Site is severely limited. All other guests/delegates wishing to park are recommended to use the Park and Ride scheme or a public car park within Durham City.

By road

Durham city is only 2 miles from the A1(M). Leave the motorway at Junction 62 on the A690 (Durham/Sunderland) and follow signs to Durham city centre, then to the A177. From the city bus station - a short walk from the railway station – a bus service runs every 15 minutes past the University Science Site on South Road.

By rail

Regular rail services on the East Coast Mainline with connections across the region via Newcastle and Darlington. Check www.nationalrail.co.uk for timetables.

The taxi journey from the railway station to the Physics Department takes only 5 minutes (depending on the time of day) and the fare is normally about £3. Alternatively, you can walk to the Department (25 minutes) or take bus number 5 or 6 direct from the railway station (every 30 minutes during the day; journey time 6 minutes).

By air

Durham is 30 minutes' drive from Newcastle International Airport and from Durham Tees Valley Airport. Durham is linked to Newcastle International Airport by rail and metro.

Saturday Morning SCIENCE

- No pre-booking needed
- 60 minute talks (45 mins plus questions)
- Coffee break at 11:30am
- Other activities after (e.g. lab tours)

www.durham.ac.uk/physics