Maxwell Lectures at King's College London

Monday 2pm in K2.31 (Nash Lecture Theatre)

Mo 29 Sep Giovanna Tinetti, Professor of Astrophysics, Royal Society URF
University College London, Dept. of Physics and Astronomy

The exoplanet revolution

Our knowledge of planets other than the eight "classical" Solar System bodies is in its infancy. We are discovering thousands of planets orbiting stars other than our own, and yet we know little or nothing about their chemistry, formation and evolution. Planetary science therefore stands at the threshold of a revolution in our knowledge and understanding of our place in the Universe: just how special are the Earth and our Solar System? It is only by undertaking a comprehensive chemical survey of the exoplanet population that we can hope to answer these critical questions.

Little more than 10 years ago, the detection of a signal from an exoplanet atmosphere was still in the realm of science fiction. Pioneering results were then obtained through transit spectroscopy with Hubble, Spitzer and ground-based facilities, making it possible the detection of ionic, atomic and molecular species and of the planet's thermal structure.

With the arrival of improved or dedicated instruments in the coming decade, planetary science will expand beyond the narrow boundaries of our Solar System to encompass our whole Galaxy.

Mo 6 Oct

Mo 13 Oct Marina Kuimova, EPSRC Career Acceleration Fellow, Department of Chemistry, Imperial College London

Illuminating biological cells: from cell viscosity to cancer treatment

Many biological processes are based on chemical reactions. Viscosity determines how fast molecules can diffuse, and react. Therefore in cells viscosity can affect signalling, transport and drug delivery, and abnormal viscosity has been linked to disease and malfunction. In spite of its importance, measuring viscosity on a scale of a single cell is a challenge. I will describe a new approach used in my lab which allows two distinct advantages over the current state of the art: (i) imaging viscosity with high resolution, for example in single live cells and (ii) measuring how viscosity changes in real time, over the course of seconds or hours. I will also explain how our viscosity measurements can be put to diagnostic use in medical treatment called photodynamic therapy of cancer.

Mo 20 Oct Emmanuel Fort, Paris

Reading week 27 Oct

Mo 3 Nov Carolyn Crawford, Cambridge, Dark Energy and the ever-expanding Universe

Mo 10 Nov Todd Huffmann, Oxford

"Why Must One Apply the Brakes to Stop?"

On July 4 2012 a particle was discovered that we now believe is the Higgs boson. This is the quantum field which pervades all of space and gives inertial mass to all of the sub-atomic particles in the Universe, presumably both seen and unseen.

When the discovery was announced millions were watching and I dare say most of them were not Particle Physicists. The presentation given, however, was clearly for a Particle Physics audience. This talk is about how the Higgs boson was found boiled down to its essential bits. One still needs some basic maths, but the essence of how experimental particle physics makes a discovery is not as arcane as one might at first believe. So using this most recent discovery as the primary backdrop, I hope to impart a flavour of the process of search and discovery at a particle physics experiment and along the way help to illuminate the answer to the question as to why brakes are necessary to come to a stop.

Mo 17 Nov Tony Mann, maths Greenwich

Mo 24 Nov Daniel Pooley, STFC, neutron scattering

Neutron Science; an overview of technique and instrumentation with emphasis on the new field of energy-resolved neutron imaging.

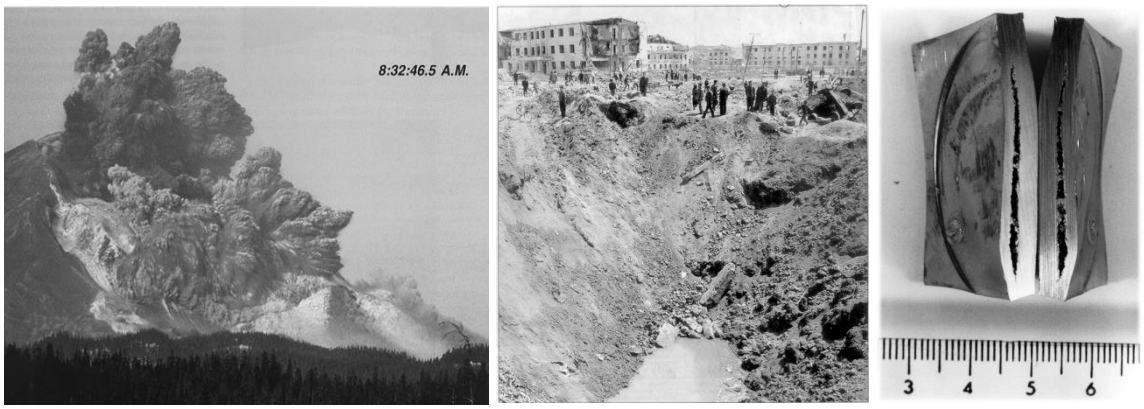
The ISIS pulsed neutron and muon source at the Rutherford Appleton Laboratory in Oxfordshire is a world-leading centre for research in the physical and life sciences. Neutron scattering is a powerful technique giving unique insight into complex structures. I will present an overview of neutron scattering techniques and the state-of-the art instrumentation at the ISIS facility. I will emphasise how the current shortfall in instrumentation for the novel technique of *energy resolved neutron imaging* is being addressed. The demand for energy resolved neutron imaging has generated a huge advance in detector instrumentation and technique development [1], particularly with the use of borated MCP's [2] and fast, gated, CCD technology [3]. I will also present the development of an exciting new detector type, the GP2 detector, currently in the prototype phase of R&D. The GP2 detector utilises a fast PImMs CMOS sensor [4], so named as it was developed for Particle Imaging Mass Spectrometry, to record event-mode data from a pulsed neutron source. The CMOS sensor has been made neutron sensitive by using gadolinium as a conversion material; directly detecting electrons from gadolinium.

[1] M. Strobl NIMA. 604 (2009) 646
[2] A. S. Tremsin, et.al., Nucl. Instr. Meth. Phys. Res. A. 592 (2008) 374
[3] M. Strobl, et.al., J. Phys. D: Appl. Phys. 42 (2009) 243001
[4] I. Sedgwick, et.al., NEWCAS 2012 IEEE 10 (2012) 497

Mo 1 Dec William Proud, Imperial

Shock and Blast Waves: Natural, Accidental and Scientific

The Subject: Shock waves can be thought of as very high-pressure pulses which move through material causing rapid acceleration, temperature rise and velocity changes. They are often thought of as destructive as a result. This talk will provide an overview of this area including natural shock waves, accidents, technical applications and fundamental research which can be conducted using this phenomena e.g. turning graphite into diamond, investigating the process during high-velocity impact and protection of people and vehicles from blast waves. Examples will be illustrated by high-speed photography.



Natural: Mount St. Helens / Accidental: Effects of Explosion in North Korean accident / Scientific: the dynamic strength of iron.

The speaker: WG Proud is the director of the Institute of Shock Physics, Imperial College London and chair of the Institute of Physics Shock Waves and Extreme Conditions Group. He has been investigating shock waves since 1994 and has written numerous articles on the subject.

Mo 8 Dec – only Monday and Tuesday teaching