Institute of Physics In Scotland

Edinburgh Winter Lecture Programme – 2016 / 17

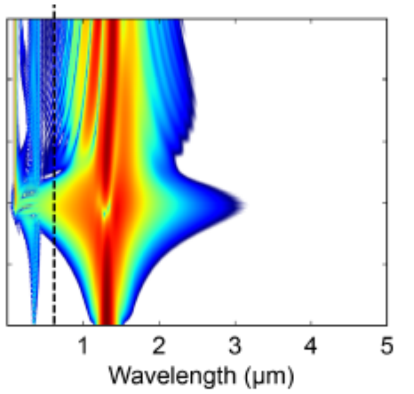
All talks start at 7.30pm in the Royal Society of Edinburgh, 22 - 26 George Street, with refreshments from 7.00 pm

Download the talk abstracts at:
http://home.eps.hw.ac.uk/~phyrrt/IOP_Edinburgh_2016_17

Tuesday 6th December 2016

Dr John Travers
(Heriot-Watt University)

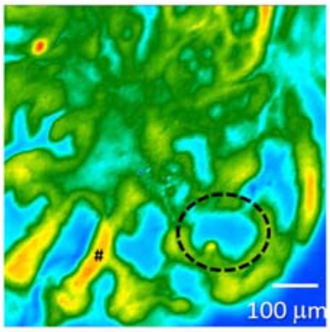
Extreme optical solitons: from water waves in a canal to a table-top synchrotron light source



Tuesday 24th January 2017

Prof. Nick Stone (University of Exeter)

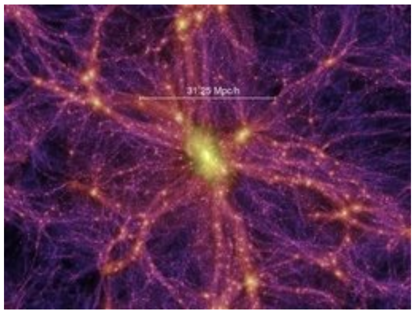
Harnessing the power of light for rapid molecular diagnosis of cancer



Tuesday 28th February 2017

Prof. Carlos Frenk
(University of Durham)

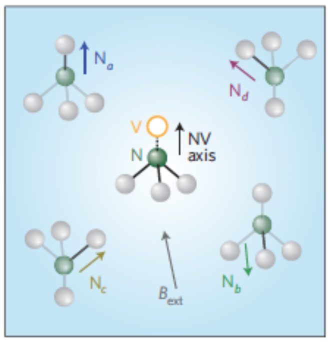
Everything from nothing: how our universe was made



Tuesday 28th March 2017

Prof. Mete Atature
(University of Cambridge)

Quantum Games with Spins Alight



Free and open to non-members
For more information contact Robert Thomson (R.R.Thomson@hw.ac.uk)

Edinburgh IOP Winter Lecture Programme – 2016 / 17

Tuesday 6th December 2016 – Dr John Travers (Heriot-Watt University)

Lecture Title: Extreme optical solitons: from water waves in a canal to a table-top synchrotron light source

Abstract: Solitons are particle-like nonlinear wave-packets or pulses that, in ideal systems, maintain their shape upon propagation and interaction. They are an important concept in nonlinear physics and arise in the dynamics of water-waves, the atmosphere, matter-waves and in nonlinear optics. When intense laser pulses are guided through optical fibres, soliton interactions can be used to modify the shape of the electric field in time. I will explain how we can use these interactions to compress the laser pulse to durations consisting of a single cycle of the electromagnetic carrier wave—just a few femtoseconds (1 fs is 1 million trillionth of a second). I will also explain how we can convert the relatively monochromatic input laser pulse to an extremely broad spectrum pulse, spanning more than 3 octaves of the electromagnetic spectrum, known as a supercontinuum, but sometimes referred to as a sunlight-laser. Finally, I will describe how we can use soliton physics to build a table-top source of vacuum-ultraviolet light (100 nm to 200 nm), a region usually only accessible with building-scale infrastructure, such as synchrotrons and free-electron lasers.

Tuesday 24th January 2017 – Prof. Nick Stone (University of Exeter)
Lecture Title: Harnessing the power of light for rapid molecular diagnosis of cancer.

Abstract: Raman spectroscopy has been demonstrated across many clinical applications to be a powerful tool for the biochemical discrimination of disease. Translation of this technique to the clinic and enabling its use within the body is a difficult but achievable prospect. Rapid, minimally invasive, in vivo molecular diagnosis would provide clinicians for a powerful tool. There are myriad clinical needs where such an approach would add significant value. These range from early diagnosis of malignancies on the linings of organs, to staging more advanced malignancies, to providing treatment monitoring, tumour margin, lymph node metastasis status and of course the prospect for prognostic signature identification. Work over many years has taken the concept of in vivo Raman diagnostics to real clinical studies. A number of groups are now using the technique in vivo for the study of tissue composition and its association with diseased conditions. I will give an overview of some of our current work in the area.

This presentation will focus on a range of approaches:
1) Surface based analysis of disease specific tissue composition utilising endoscopic confocal Raman probes; [1]
2) Subcutaneous analysis using needle Raman probes; [2]
3) Deep Raman analysis of tissue composition with transmission and spatially offset approaches. [3]
4) The potential of plasmonic nanostructures to enhance medical diagnostics/therapeutics.

References
1 J C C Day et al, Phys. Med. Biol., 2009, 54 7077-7087.
2 J Day, N Stone, Applied Spectroscopy, 2013, 67 (3), 349-354.
3 P Matousek, N Stone, J. Biophotonics, 2013, 6 (1), 7-19,

Tuesday 28th February 2017 - Prof. Carlos Frenk (University of Durham)
Lecture Title: Everything from nothing: how our universe was made

Abstract: Cosmology confronts some of the most fundamental questions in science. How and when did our universe begin? What is it made of? How did galaxies and other structures form? There has been enormous progress in the past few decades towards answering these questions. For example, recent observations have established that our universe contains an unexpected mix of components: ordinary atoms, exotic dark matter and a new form of energy called dark energy. Gigantic surveys of galaxies reveal how the universe is structured. Large supercomputer simulations can recreate the evolution of the universe in astonishing detail and provide the means to relate processes occuring near the beginning with observations of the universe today. A coherent picture of cosmic evolution, going back to a tiny fraction of a second after the Big Bang, is beginning to emerge. However, fundamental issues, like the identity of the dark matter and the nature of the dark energy, remain unresolved.

Tuesday 28th March 2017 - Prof. Mete Atature (University of Cambridge)
Lecture Title: Quantum Games with Spins Alight

Abstract: Quantum physical phenomena are usually shielded from our daily interactions with nature and require intricate designs and experiments to reveal them. It is no wonder that most counterintuitive aspects of quantum physics remained a curiosity-driven exercise in most part of the 20th century. However, there is a significant paradigm shift in our perception of the technological opportunities arising from quantum physics. Among many interesting physical systems, diamond offers truly fascinating properties that allow for quantum physics to be displayed in ambient conditions of everyday life. In this talk, I will highlight how diamond can give us potentially disruptive technologies ranging from quantum computers to single molecule MRI machines.
