Institute of Physics In Scotland

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Edinburgh Winter Lecture Programme – 2019 / 20

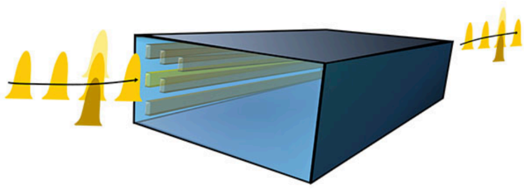
All talks start at 7.30pm in the Royal Society of Edinburgh, 22 - 26 George Street, with refreshments from 7.00 pm

Download the talk abstracts at:
http://home.eps.hw.ac.uk/~phyrrt/IOP_Edinburgh_2019_20

Tuesday 5th November 2019

Dr Margherita Mazzera
(Heriot Watt University)

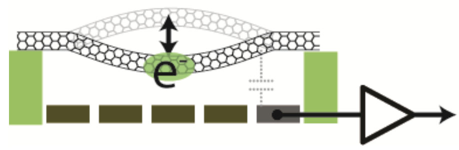
How to use quantum coherence to trap light: The lazy person's guide to USB drives of the future



Tuesday 3rd December 2019

Dr Natalia Ares
(University of Oxford)

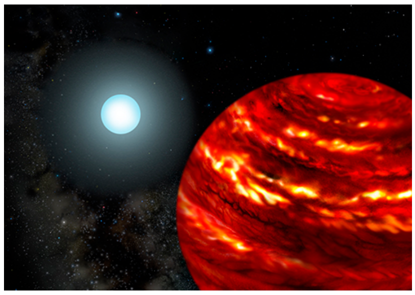
Quantum devices for thermodynamics at the nanoscale



Tuesday 18th February 2020

Dr Beth Biller
(University of Edinburgh)

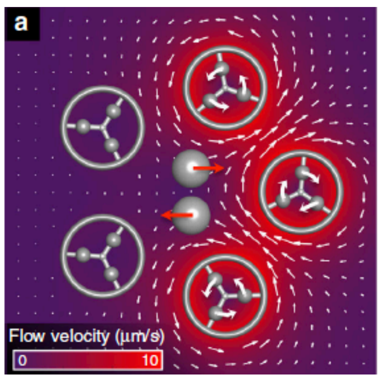
Weird New Worlds



Tuesday 24th March 2020

Dr David Phillips
(University of Exeter)

Digital light shaping: from light driven micro-robotics to seeing through scattering



We sincerely thank Renishaw for sponsorship

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

Edinburgh IOP Winter Lecture Programme – 2019 / 2020

Tuesday 5th November 2019 – Dr Margherita Mazzera (Heriot Watt University)

Lecture Title: How to use quantum coherence to trap light: The lazy person's guide to USB drives of the future

Abstract: In this contribution, I will highlight how quantum physics can give us access to new technological tools and I will present a strategy to develop quantum devices, as e.g. photonic quantum memories, using crystals. These are interfaces between light and atoms that lay the bases of quantum information science, whose purpose is to open new possibilities for the transmission and the processing of information. They are crucial, for example, for the realization of quantum networks. While the first proof of principle demonstrations of quantum memories were carried out in ensembles of atomic gases, recently, some solid-state systems have emerged as a promising alternative. I will explain how protocols for the storage of light work in a solid-state environment and show that it is possible to take advantage of light confinement in extremely small structures to enhance the interaction between the light and the atoms of the crystal.

Tuesday 3rd December 2019 - Dr Natalia Ares (University of Oxford)

Lecture Title: Quantum devices for thermodynamics at the nanoscale

Abstract: Understanding how thermodynamics operates at small scales, where fluctuations are significant and quantum behaviour arises, may reveal possibilities for entirely novel technologies. We can explore thermodynamics in this limit by combining exquisite control over mechanical degrees of freedom and the quantum states of confined electrons.

I will show how to detect the displacement of a carbon nanotube approaching the standard quantum limit near the phonon ground state. This capability, with quantum dots embedded in the carbon nanotube, allowed us to explore the impact of electron tunnelling on the mechanical energy, including the excitation of coherent self-oscillations. I will discuss the potential of these findings to pave the way for experiments on quantum thermodynamics, in particular, for direct measurements of work exchange in the quantum regime.

Tuesday 18th February 2020 – Dr Beth Biller (University of Edinburgh)

Lecture Title: Weird New Worlds

Abstract: With literally thousands of exoplanet candidates discovered to date, we now know of a few relatively Earthlike worlds – and many many more planets very different from those in our own solar system! I will discuss what we know already about these worlds and what we will be learning in the next decades as new and more advanced telescopes come online. I'll discuss as the prospects for getting the first "weather reports" from extrasolar planets and show the first weather maps made for brown dwarfs – objects a bit bigger than planets but smaller than stars.

Tuesday 24th March 2020 - Dr David Phillips (University of Exeter)

Lecture Title: Digital light shaping: from light driven micro-robotics to seeing through scattering

Abstract: What is digital light shaping? In this talk I will explain how we can now precisely and dynamically spatially pattern the intensity and phase of laser beams. This capability has triggered a raft of new technologies, and here I will focus on two of them: **Light driven micro-robotics:** Light carries momentum. This momentum can be used to capture and move around microscopic objects. This technique is called 'Optical tweezers', and its inventor, Arthur Ashkin, shared the Nobel Prize in Physics in 2018 for his discovery. Optical tweezers act like miniature tractor beams inside a microscope - and using them allows us to not only observe the microscopic world, but also interact with it, move things around to build structures, and measure tiny picoNewton scale forces between objects such as living cells. I will discuss how we are applying robotic principles to optical tweezers - to create devices that can explore micro-scale environments autonomously. **Seeing through scattering:** Light can pass through opaque objects such as frosted glass, a sugar cube, or even living tissue. Yet we can't see through these materials. This is because during its passage, the light is scattered multiple times, scrambling the spatial information it carries and corrupting the formation of images. In the last decade, it was realised that many of these extremely complicated scattering systems are deterministic in nature. Therefore, we can use digital light shaping technology to measure and reverse their scattering effects – unscrambling the light back to the state it was in before it entered the medium. I will describe how these developments promise a new generation of cameras, capable of unscrambling light to peer deep inside living tissue.