

## Edinburgh Programme – 2014 / 15

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

Download this poster and talk abstracts at:

<http://home.eps.hw.ac.uk/~phyrrt/IOPinEdinburgh2014to15.htm>

Tuesday 4<sup>th</sup> November 2014

Prof. Richard Myers (University of Durham)

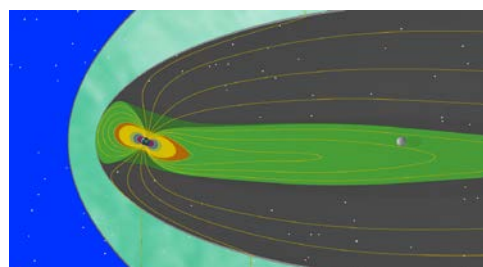
### Adaptive Optics for Future Extremely Large Telescopes



Tuesday 2<sup>nd</sup> December 2014

Dr Jonathan Eastwood (Imperial College London)

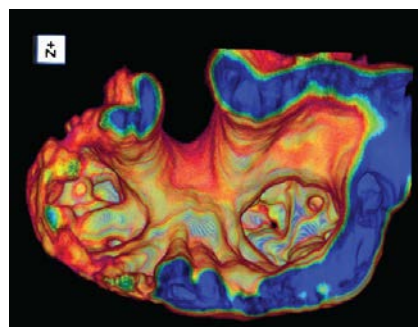
### Space weather



Tuesday 27<sup>th</sup> January 2015

Dr Jonathan Taylor (University of Glasgow)

### Heart-stopping moments in biomedical imaging - how physics is helping advance cardiac medicine



Tuesday 24<sup>th</sup> February 2015

Prof. John Dudley (Université de Franche-Comté)

(President of the European Physical Society)

### A Brief History of Light



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

# Institute of Physics in Scotland, Edinburgh Programme – 2014 / 15

## Lecture Abstracts

Tuesday 4<sup>th</sup> November 2014

### Adaptive Optics for Future Extremely Large Telescopes

Prof. Richard Myers (University of Durham)

**Abstract:** Adaptive Optics can be used to compensate for the effects of atmospheric turbulence on the imaging performance of ground-based telescopes. This technology is optional for existing 4-8m telescopes, but will become mandatory for the future 25-39m telescopes. We will look at the astronomical drivers for these new facilities and how the consequent need for adaptive optics impacts on their designs. Substantially new forms of adaptive optics will be required to perform the main scientific missions and we will examine the current state of development, which has included on-sky technology prototyping. We will look in particular at the results from the France-UK CANARY adaptive optics demonstrator, which provides a scaled model of two of the new adaptive optics modes of the 39m European Extremely Large Telescope on the 4.2m William Herschel Telescope. CANARY has been developed by a collaboration including Durham University, Observatoire de Paris and the UK Astronomy Technology Centre in Edinburgh.

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Tuesday 2<sup>nd</sup> December 2014

### Space Weather

Dr. Jonathan Eastwood (Imperial College London)

**Abstract:** Outer space is not quite empty: it is filled with a very dilute gas of charged particles – plasma – and this provides an invisible link between the Earth and the Sun which has the potential to disrupt every aspect of our life on Earth as we know it. In this lecture I will guide you through this invisible world existing just above our heads, and explain how the Earth's magnetic field extends into space, forming a shield which protects us from the solar wind and solar activity. Although the Sun looks like a relatively unchanging object, constantly shining in the sky, if we look more carefully, we see that it is a complex and dynamic place, prone to eruptions which can travel through space towards the Earth and which can break down the protective shield that surrounds the Earth, leading to what are known as geomagnetic storms. The principal manifestation of such storms in the night sky are extraordinary and vivid auroral displays, but they also pose a significant risk to many aspects of modern life.

Consequently, space weather is defined as the conditions on the Sun and in the solar wind, Earth's magnetosphere, ionosphere, and thermosphere that can influence the performance and reliability of space-borne and ground-based technological systems and endanger human life or health. I will discuss some different types of space weather, which range in risk from relatively minor to extremely major, albeit with decreasing likelihood. Space weather is now in fact widely recognised as a significant risk, for example appearing on the cabinet office national risk register of civil emergencies; there is a concerted world-wide effort to understand the physics of space weather, and develop appropriate forecasts, mitigation strategies and technological solutions. I will conclude with discussing both international and UK activities in this area, including the new Met Office Space Weather Operations Centre, as well as plans for the next generation of monitoring satellites.

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Tuesday 27<sup>th</sup> January 2015

### Heart-stopping moments in biomedical imaging - how physics is helping advance cardiac medicine

Dr Jonathan Taylor (University of Glasgow)

**Abstract:** Much can be learned about the development of the heart by studying small animals such as the zebrafish. Imaging the normally-beating heart requires us to look deep inside living tissue, at a structure that is constantly moving. I will show how techniques such as fluorescence imaging and adaptive optics can give us unprecedented views inside a living animal as we watch the heart grow. Realtime image analysis makes it possible to synchronize this imaging to the beat of the heart, allowing us to "freeze" the motion of the heart and obtain a snapshot of the heart in on the level of individual cells. Advances such as these in imaging and optics are making it possible for biomedical researchers to study the heart in its natural environment in greater detail than ever before.

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Tuesday 24<sup>th</sup> February 2015

### A Brief History of Light

Prof. John Dudley (Université de Franche-Comté)

**Abstract:** The United Nations (UN) has declared the year 2015 the International Year of Light and Light-based Technologies. In declaring this International Year, the UN has recognized the centrality of how the fundamental study and applications of light impact on virtually all areas of science, and how light-based technologies can promote sustainable development and provide solutions to global challenges in energy, education, agriculture, health and well-being. The year 2015 has been selected for this celebration as it commemorates a remarkable series of important milestones in the history of the physics of light: the early work on optics by the Islamic scholar Ibn Al-Haytham in 1015; the mathematical theory of the wave nature of light proposed by Fresnel in 1815; the electromagnetic theory of light propagation proposed by Maxwell in 1865; Einstein's embedding of light in cosmology through general relativity in 1915; the discovery of the cosmic microwave background by Penzias and Wilson in 1965; and Charles Kao's achievements in 1965 concerning the transmission of light in fibers for optical communication. In this talk, we will briefly review the general aims and objectives of the International Year of Light, but we will mainly focus on providing a survey of the recent developments in physics that relate closely to the anniversaries which will be celebrated in 2015. Topics will be presented at a level suitable for non-specialists but with enough breadth in coverage to surprise even the experts!

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