**Atomic and Laser Physics Seminar**

**Monday, 26 November**

**11.30**

**Audrey Wood Seminar Room**

**Professor Peter Norreys**

STFC, Rutherford Appleton Laboratory/

Department of Physics

***Exploring New Concepts in Ultra-High Intensity Laser-Plasma Interactions***

Over the past two decades, laser technology has advanced rapidly and the focused intensity on target has increased by many orders of magnitude during that time. Laser powers have increased from the 20 terawatt level in the early 1990’s to petawatt peak powers available today. Also, reductions in costs have allowed the number of petawatt lasers to increase rapidly around the world, both for their own fundamental interest, but also for the many applications that will impact other areas of the natural sciences in the future. For example, present-day petawatt-class lasers produce electric fields close to 100 TV/m when 1-micron light is focused to intensities of 1021 Wcm-2. These fields generate gigantic currents (in the Giga-Ampere range), electrons are accelerated to relativistic energies and matter, when subjected to these currents, is heated to tens of millions degrees Kelvin almost instantaneously. Violent oscillations are induced in the irradiated material, and a wealth of new and interesting highly non-linear phenomena arises as a result. In this lecture, I will review advances in laser wake-field accelerators, X-ray harmonics from relativistic oscillating mirrors, ion beam generation and fusion energy science. I will link these to new research areas where very significant advances can be made using high power lasers, to provide unique insights into the behaviour of matter under truly extraordinary conditions.