School of Physical Sciences Seminar

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The School of Physics and Astronomy
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Nursing Building, HG19, 16:00

Title: *Probing the interactions between lasers, electrons and atoms - how we combine different techniques to reveal new information about excitation and ionisation*.

Abstract

In this talk I will introduce and describe a number of techniques that we use to probe the interactions that occur between atoms, electrons and laser beams. In these experiments we combine very high resolution laser beams with low energy electron beams to reveal new information about excitation and ionization of the targets. We use lasers to initially excite, cool and trap atoms, and then we may fire a controlled beam of electrons at the atoms to either ionise them, further excite them or de-excite them. We also use additional lasers to excite the atoms to very highly excited Rydberg states so that they have diameters larger than a human cell, or we may use the lasers to directly photo-ionize the targets to then study the laser-ionization process. In our Rydberg experiments we are probing the interactions that occur when these macroscopic atoms overlap in space, which leads to quantum correlations between the excited targets. Our photo-ionization experiments are also being used to produce electron beams of extremely high resolution for injection into new accelerators, and for use in time-resolved electron diffraction experiments of different materials. I will briefly outline the different experiments that we carry out, and will show some of the new results we have obtained from these studies.