

# Institute of Physics

LONDON AND SOUTH EASTERN BRANCH REMS SECTION

## Visit to Centre of Molecular and Optical Science and Interdisciplinary Centre of Astrobiology The Open University. Thursday 20<sup>th</sup> November 2003

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This visit has been organised by David Pick & Nigel Mason

This visit will comprise two overview talks explaining research in the new fields of Astrobiology and atomic and molecular engineering (manipulating matter at the atomic level). There will then be a series of laboratory tours to see some of the research being undertaken in the new centres these include;

**Astrobiology:** One of the greatest scientific challenges for the 21st century is to answer the question, where did life begin and how widespread may it be in the Universe? However, it is only within the last decade that this area of science has been the subject of rigorous scientific study. The development of the genome project, and with it a more practical understanding of the 'code of life', the discovery of the molecular building blocks of life in space, the detection of extrasolar planets, and the study of fossils and meteorites have all suggested that life may be prevalent across the universe and that the origins of life may be understood at a more basic scientific (physico-chemical-biological) level. These new developments have spawned a thriving new subject, "Astrobiology" (sometimes called "Exobiology"), and throughout the USA, and now in Europe, groups of scientists, spanning diverse disciplines, are working together seeking to assemble pieces of the puzzle of the origin and nature of primitive life on Earth. The Open University has recently opened a centre in this new area of research building on its research strengths. It was here that Beagle2 the UK mission to Mars was designed and built !

**Global Warming and Ozone depletion:** In the last few decades the possible detrimental impact mankind is having upon the planet Earth has caused increasing concern. The appearance of the ozone 'hole' over Antarctica, the first evidence of industrial induced global warming, the widespread phenomenon of acid rain and the growing evidence of health problems caused by urban pollution has attracted world-wide attention from both social and political commentators. These concerns have been reflected in the first global treaties attempting to regulate the use of the Earth's resources and limit the production of chemicals believed to be detrimental to its environment. In order to understand and assess the possible dangers to the Earth caused by our exploitation of its resources and the development of industry it is necessary to ring together 'traditional' physics and chemistry particularly through the adoption of tools developed in these well established fields but adopting them for the study of specific environmental issues. Research includes atmospheric chemistry, the role of volcanoes in climate change and paleoclimate studies.

**Radiation damage of biomolecules and cellular structures:** Many of the mutagenic or lethal effects of ionizing radiation can be traced to structural and chemical modification of cellular DNA through double-strand breaks (DSB) and clustered lesions. Although the development of mechanistic models of radiation damage in DNA has reached a high level of sophistication, further refinements are needed to understand fully the underlying mechanisms in particular on a molecular level. Current studies are designed to provide, in a comprehensive manner, missing information about the molecular pathways that lead from initial deposition of radiative energy to the formation of double strand breaks and lesions in DNA.

**Cold atom research and Quantum optics:** The ability to cool, trap and manipulate atoms, culminating in the successful formation of Bose-Einstein condensates, is one of the most exciting advances in the field of atomic and molecular physics in the late 20th century. Such experimental advances are pioneering new instrumentation on the atomic and nanoscale (e.g. development of atomic interferometers) and has led to orders of magnitude improvement in our ability to measure time while opening the possibility of new technologies of atom lasers, quantum computing, quantum cryptography and even teleportation. Research includes manipulation of cold atoms and the formation of the coldest plasmas in the world !

We meet at Walton Hall at 10.30 for a 11.00 start. The cost for lunch and refreshments will be payable on the day. **For travel instructions see [www.open.ac.uk](http://www.open.ac.uk) or request a map from [n.j.mason@open.ac.uk](mailto:n.j.mason@open.ac.uk) or David Pick on the reply form.**