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REFERENCE: Short Term Scientific Mission, COST P9
Beneficiary: MSc Predrag Kolarž
Institute of Physics, Belgrade
Host: Nigel Mason, The Open University
Period: from 11/11/2006 to 30/11/2006 Place: Milton Keynes (GB)
Reference code: COST-STSM-P9-888

SCIENTIFIC REPORT

PURPOSE OF VISIT

This visit was undertaken to foster the collaboration between two groups associated with the RADAM COST Action P9: Laboratory for Atomic Collision Processes, Belgrade (CS) and Centre of Molecular and Optical Studies, The Open University, Milton Keynes (GB). The purpose of the visit was the collaborative work on interactions of high energy photons with plasmid DNA molecules.

DESCRIPTION OF THE WORK CARRIED OUT DURING THE VISIT

During the visit P. Kolarž was acquainted with the undergoing research activities at Centre of Molecular and Optical Studies, The Open University, Milton Keynes (GB) and their programme of research connected to synchrotron radiation measurements. The work carried out during the visit included investigation of the VUV radiation damage to the DNA molecules in a water solution and on cellular membranes.

Ionizing radiation induces a range of structural and chemical modifications of the DNA helix within the cell and it is the major cause of cell death and mutation. Recent measurements of ionizing radiation damage to DNA components have shown that low energy ions can induce structurally complex strand-breaks in DNA. These breaks are less easily repaired than the predominantly breaks produced directly by energetic radiation. Recent research of Sanche and co-workers have shown that strand breaks in DNA may be initiated by secondary electrons at sub-ionization energies and are dependent upon the target DNA base identity, DNA sequence, and incident electron energy. This phenomenon is explained with "dissociative electron attachment".

Aim of our work is to repeat and extend the study of DNA strand breaks undertaken by Sanche and his co-workers in Sherbrooke to other plasmids and under a wider variety of experimental conditions in order to find relationship between the amounts of energy deposited within a given region of the DNA helix and the type and severity of damage that is produced.

Two types of samples used in experiments of studying the effects of radiation on cellular membranes was prepared in the laboratory:

- DNA molecules in water solution;
- layer-by-layer films technique on cellular membranes. In this technique alternating cationic and anionic layers are deposited onto a solid substrate (lipid bilayers are semi-permeable membrane so they keep macromolecules such as proteins and DNA inside the cell).

Prepared samples of biomolecules was irradiated in VUV spectra using beamline 3.1.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

We attained the dose-dependent SSB formation occurring as a relaxed form increase in plasmid pBR322 at 120nm. We have also checked that there wasn't any mechanical damage or heating effects coming from the equipment.

FUTURE COLLABORATION WITH HOST INSTITUTIONS

The future collaboration with host institution is envisaged in the area of radiation damage on bimolecular systems. These include further measurements on different biomolecular systems irradiated in VUV spectra.

PROJECTED PUBLICATION ARTICLES RESULTING OR TO RESULT FROM THE STSM

Joint publications are anticipated in near future partly covering the results obtained within this scientific mission. Prof. N. J. Mason has been already participated in the Symposium on physics of ionized gases organized in Serbia and his next visit is foreseen during the March 2007 plasma meeting in Belgrade.

MSc Predrag Kolarž
Institute of Physics, Belgrade
Research assistant

Belgrade, 19.12.2006

CONFIRMATION BY THE HOST INSTITUTE OF THE SUCCESSFUL EXECUTION OF THE MISSION

The visit of MSc Predrag Kolarž was underdone with success and according the planned activities.

Milton Keynes, 19.12.2006.

Prof. N. J. Mason

Director of Research

Centre for Molecular and Optical Studies