A Fluorescence Imaging Apparatus for the Study of Biomolecular Plume Evolution During Laser Desorption from Surfaces

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This project seeks to determine the optimum parameters for the production of a gas phase target of biomolecules such as short strands of DNA. Initial work concentrates on the production of isolated molecules with future work to produce biomolecules embedded in clusters of water molecules. Such targets can subsequently be used for studies of fragmentation processes induced by interactions with low energy ions, electrons, photons and radicals. Previous in-vacuo studies have used either solid phase material such as plasmid DNA deposited on a substrate [1] or thermally evaporated DNA or RNA bases. These techniques cannot be applied to a wide range of biomolecules because of substrate effects or thermal decomposition.

The techniques of UV and IR laser desorption are well established for the generation of positive or negative ions of biomolecules. This is frequently carried out in a process known as MALDI (Matrix Assisted Laser Desorption and Ionisation) [2] with which this group has several years experience. However, the necessity of a matrix material results in the production of plumes of desorbed material with both biomolecule and analyte components thus making it unsuitable for use as a 'clean' target. The current work intends to study several novel techniques for production of gaseous biomolecules *without* the need for a matrix.

Characterisation of the targets will be carried out by fluorescent dye tagging and laser induced fluorescence imaging of the target spatial density profiles [3]. The production of characterized targets of biomolecular species including DNA strands will enable biological radiation damage studies investigating the underlying molecular mechanisms on a single-radiation-quantum/single-molecule level. There is considerable current interest in this topic because of its potential applications in radiation biology, diagnostic and therapeutic medicine.

References:

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