Física

Electron transfer in DNA subunits

CEFITEC / Atomic and Molecular Collisions Laboratory

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Objectives

The current research interests include: the electronic state spectroscopy of biomolecules, aeronomic and plasma processing molecules by interaction with photons and electrons; charge transfer processes by atom-molecule collisions and the role of negative ions; surface induced chemistry, especially the reactivity of co-adsorbed molecular species and the formation of ices in the Earth's upper atmosphere and in the interstellar medium, that might be in the origin of some microorganisms. Charge transfer experiments on atom-(bio)molecule collisions with negative ion formation.
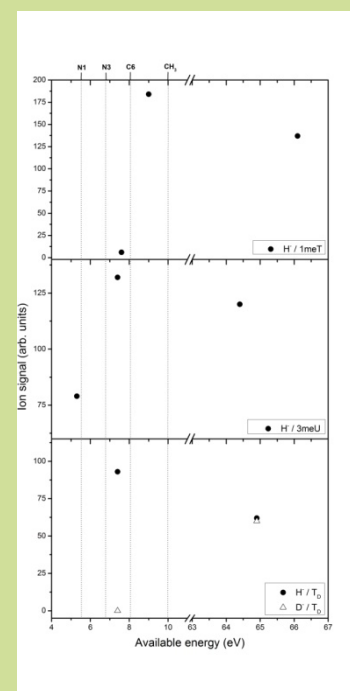
Methodology

Electron transfer in low energy atom-molecule collision is usually mediated by the crossing of the potential energy surfaces, $K + AB$ and $K^+ + AB^-$.

This crossing processes leads to the formation of both K^+ and a molecular anion and allows access to states which are not accessible in free electron attachment experiments. In particular, states with a positive electron affinity can be formed, and the role of vibrational excitation of the parent neutral molecule can be studied. In this particular case the electron donor is a potassium (K) atom and AB the electron acceptor molecule will be the biomolecule.

Expected Results

Using a crossed molecular beam technique, we investigate electron transfer processes in collisions of fast potassium atoms with DNA nucleotide bases (adenine, thymine, cytosine and guanine), uracil the comparable RNA base and other relevant biomolecular targets such as sugars (e.g., glycoaldehyde), and radiosensitizers (chloro- and fluoro-uracil). We investigate the formation of negative ions and hence model the parent anion state. Total partial cross sections are obtained in an energy range from about a few eV up to several hundreds of eV.