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Electron Impact Ionization and Fragmentation Dynamics of Small Atomic and Molecular Clusters

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New ionization and fragmentation reactions emerge if target atoms or molecules are embedded in an environment as it is the case in small clusters or in the condensed phase. These can be intermolecular energy and charge transfer processes or a completely modified fragmentation behavior of the molecular ions. Here we study low energy electron impact induced ionization with a multi-electron and ion imaging spectrometer (reaction microscope) and a supersonic gas jet target which can produce small clusters of various target species. Interatomic reactions are studied for the model system of weakly bound Ar_2 dimers. Here, the coincident detection of three electrons and two ions gives detailed insight in interatomic Coulombic decay and radiative charge transfer processes. Such processes were also found in bio-relevant systems like water clusters. We studied pure and water-mixed clusters of tetrahydrofuran (C_4H_8O, THF) which is the simplest analog of deoxyribose in the DNA backbone. One observation is that ionization of the outermost valence orbital for the monomer leads to stable THF ions. In contrast if THF is bound to another THF or a water molecule the molecular ring breaks. In addition we identify intermolecular Coulombic decay induced by energy transfer from a water molecule ionized in the inner valence shell to the neighboring THF molecule.