Tracing and Controlling Energy Transfer in Few- to Many-Particle Quantum Systems

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Energy-transfer mechanisms in molecules drive crucial phenomena in nature, such as DNA repair and photosynthesis. Understanding and controlling these processes is an important research field shared by physics, chemistry, and biology. Within this project, the relaxation dynamics of innershell-ionized molecules is investigated using UV pump X-ray probe experiments. In particular, the interatomic/intermolecular Coulomb decay (ICD) in model systems and its competition with other electronic relaxation processes, like electron transfer and Auger decay, is measured. ICD is a decay mechanism on the femtosecond time-scale that is ubiquitous in weakly bound systems. An excited atom or molecule relaxes by transferring its excitation energy to a neighbor, which is consequently ionized. The emitted low-energetic ICD electrons are known to damage chemical bonds efficiently by dissociative electron attachment, which may lead to DNA damage in radiation therapy. Alternatively, these genotoxic electrons may be employed as a tool to destroy malignant tissue by implanting certain absorber molecules where ICD is locally triggered.

Projektbeteiligte

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