A measurement of the evolution of Interatomic Coulombic Decay in the time domain

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Synopsis Interatomic Coulombic Decay in helium dimers has been measured time-resolved for the first time.

An interatomic decay process of excited atoms called “Interatomic Coulombic Decay” (ICD) [1,2] involves the neighbors of the electronically excited atoms: The excitation energy is transferred to another atom and usually ionizes that. ICD is known to be a very common decay path in many different systems. Its time evolution is predicted to be highly complex: The efficiency of the process depends on the distance of the atoms and so it changes during the decay process.

We present the first direct measurement of the time dependence of ICD using a novel experimental streaking approach. The results show the evolution of the vibrational wavepacket of a helium dimer during the decay. So we gain insight into the complex behavior of ICD in the time domain.

Figure 1 shows the experimental results. Top: Electron energies and kinetic energy releases measured in coincidence. Middle and bottom: Measured kinetic energy releases corresponding to an integration over times from zero to (top to bottom): “infinity”, 2000 fs, 600 fs, 210 fs, 120 fs, 100 fs, 70 fs and 50 fs.

Figure 1. Experimental results: Measured electron energies and kinetic energy releases and different projections to the KER-axis (see text).

References
[1] L S Cederbaum et al 1997 Phys. Rev. Lett. 79, 4778
[2] T Jahnke et al 2004 Phys. Rev. Lett. 93, 163401

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