

Lorenz Cederbaum:

Exploring Interatomic Coulombic Decay by Free Electron Lasers

To exploit the high intensity of laser radiation, we propose to select frequencies at which single-photon absorption is of too low energy and two or more photons are needed to produce states of an atom that can undergo interatomic Coulombic decay (ICD) with its neighbors. For Ne_2 it is explicitly demonstrated that the proposed multiphoton absorption scheme is much more efficient than schemes used until now, which rely on single-photon absorption. Extensive calculations on Ne_2 show how the low-energy ICD electrons and Ne^+ pairs are produced for different laser intensities and pulse durations. At higher intensities the production of Ne^+ pairs by successive ionization of the two atoms becomes competitive and the respective emitted electrons interfere with the ICD electrons. It is also shown that a measurement after a time delay can be used to determine the contribution of ICD even at high laser intensity.