UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

Mittwoch, 13.11.2024
13:00 Uhr
MC 122 und Zoom

https://uni-due.zoom-x.de/j/64228670246?pwd=RjVQeFNIUkRKRkpiNVpKYXhJaFNLdz09 (gilt für alle Vorträge)

Watching electrons move inside atoms and molecules

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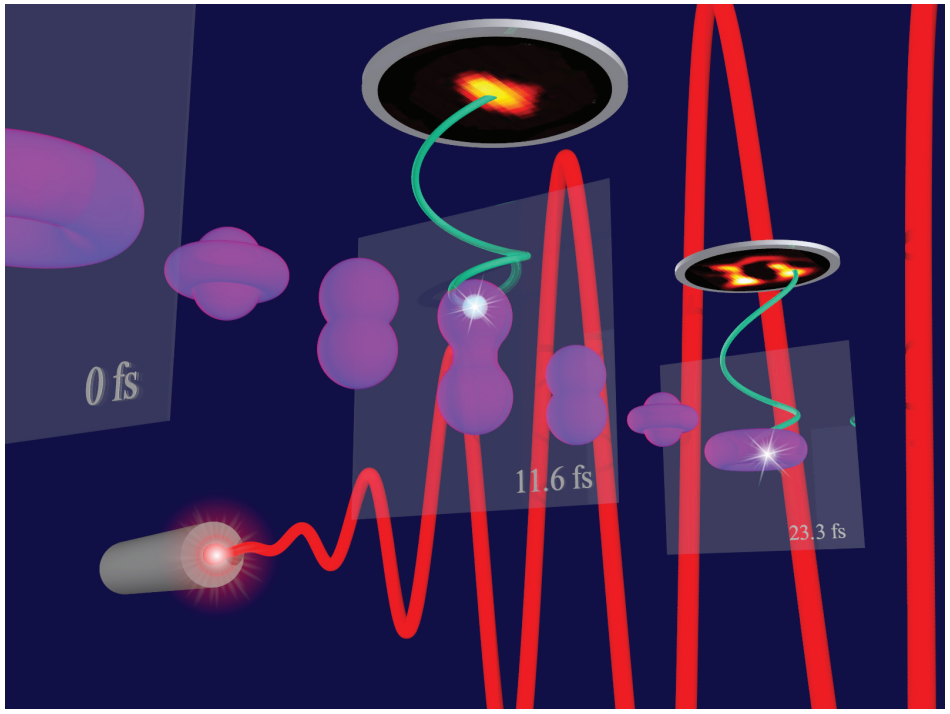

It has been a long-standing dream to watch the constituents of molecules move on their natural length and time scales. Femtosecond (10-15 s) and attosecond (10-18 s) laser pulses have proven to be invaluable tools for achieving this dream. Since their pioneering work in the 1980s and 1990s, much progress has been made in terms of tracking chemical reactions on the femtosecond time scale. In particular, nuclear motion during dissociation and isomerization reactions has been tracked by means of coulomb explosion imaging. However, the fastest response of a molecule to light absorption is given by the electrons. In that sense, electronic motion represents the first step in chemical reactions. Despite its importance, the bound motion of electrons has often remained unobserved in ultrafast experiments.

Here, we show how strong-field photoelectron momentum imaging allows for the direct probing of variations in the transient valence electron density. In our experiment, we image a spin-orbit wave packet in an argon cation with few-femtosecond time resolution. Our method is fully compatible with coulomb explosion imaging, opening the door to creating complete molecular movies, where electronic and nuclear dynamics are imaged simultaneously.