CFEL SCIENCE

SEMINAR

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CFEL – Building 99, seminar room II+III (ground floor)

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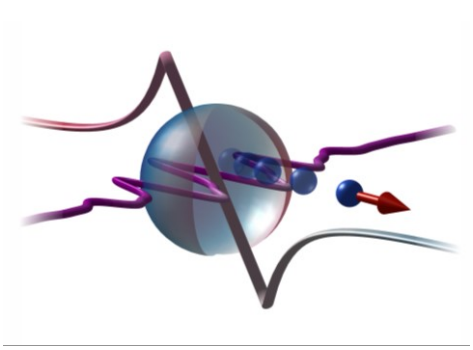
Imaging and controlling electron dynamics at the nanoscale

Ultrashort laser pulses have opened intriguing routes to access ultrafast electron dynamics in various forms of matter. Irrespective of the target, the ability to control the laser electric field waveform on a sub-cycle basis or the delay between individual spectral field components with attosecond resolution is key to observing and steering electronic motion in real time. The dominant processes, however, can vary fundamentally for different types of nanosystems as will be discussed for two characteristic metallic targets: clusters and nanotips.



Waveform-controlled electron acceleration in silver clusters is considered to explore the realization and impact of a transient plasmon resonance, which was debated extensively in the literature on enhanced electron emission in laser-cluster interactions [1]. Our simulations and measurements show extreme enhancement of the energies of electrons from clusters when compared to atoms and a pronounced phase dependence that witnesses phase-controlled forward rescattering [2] – in contrast to the dominant elastic backscattering known from atoms and surfaces.

The second part focusses on the two-color strong field photoemission from sharp metallic nanotips. Semiclassical and TDSE simulations are employed to explore and understand the phase dependent response observed in recent measurements [3]. The comparison of the theory models is shown to enable discrimination of the individual impacts of the ionization rate and the electron trajectory on the two color effect found in the electron spectra [4].

References:

[1] T. Fennel et al., Rev. Mod. Phys. **82**, 1793 (2010).
[2] J. Passig et al., Nat. Commun. **8**, 1181 (2017).
[3] M. Förster et al., Phys. Rev. Lett. **117**, 217601 (2016).
[4] L. Seiffert et al., J. Phys. B **51**, 134001 (2018).

Host: Francesca Calegari