CFEL SCIENCE

SEMINAR

6th December 2011 – 14:30

ZOQ (Bldg. 90) - Seminar Room

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Collective electron dynamics in nanoparticles in strong laser fields

Collective electron motion in nanoparticles can unfold on attosecond time scales in plasmonic systems [1]. Similarly, in dielectrics or semiconductors, the collective motion of electrons driven by a strong external field can occur on this characteristic time scale [2]. We have recently investigated the electron emission and directional control of highly energetic electrons from isolated nanoparticles in strong few-cycle laser fields [3]. Quasi-classical simulations reveal that the electron acceleration is based on rescattering in the enhanced near-field of the nanoparticles. The collective motion depends strongly on the size of the nanoparticle with respect to the laser wavelength and on the field strength that is applied in the experiments. We theoretically predicted that strong laser fields can lead to the transient metallization of dielectrics, drastically changing the conductivity on sub-cycle timescales [2]. Experiments, where plasmonic field enhancement was utilized to generate high-order harmonics will also be highlighted [3]. We have developed concepts how the transient collective electron motion in nanostructures in the presence of strong laser fields can be measured in real-time [5].

References:

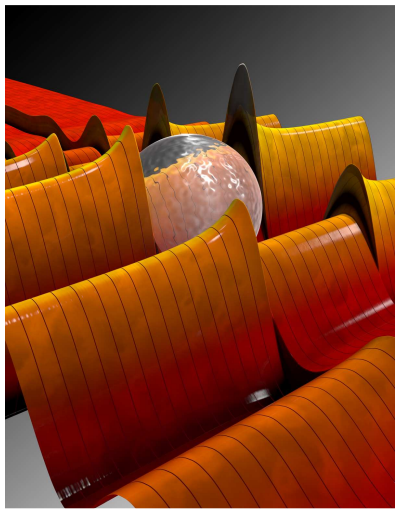
[1] M.I. Stockman et al., Nature Photonics 1, 539 (2007).

[2] M. Durach et al., Phys. Rev. Lett. 107, 086602 (2011).

[3] S. Zherebtsov et al., Nature Physics 7, 656 (2011).

[4] I.-Y. Park et al., Nature Photonics, DOI:10.1038/nphoton.2011.258 (2011).

[5] F. Süßmann, M.F. Kling, Phys. Rev. B 84, 121406 (2011).



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