Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

IRTG-Seminar

Dr. Daniela Rupp

Max-Born-Institute Berlin

“Imaging excitation and plasma formation in a single nanoparticle”

Extremely intense pulses from short-wavelength free-electron lasers (FELs) turn condensed matter into highly excited plasma within only a few femtoseconds. While this plasma formation constitutes an unpleasant artifact termed ‘ultrafast radiation damage’ for coherent diffractive imaging (CDI) applications, it promises unparalleled opportunities to prepare and study highly non-equilibrium plasma states in a well-controlled way. A precise understanding of ultrafast interactions of matter under intense extreme ultraviolet (XUV) and X-ray pulses is therefore a major focus of FEL research. Atomic clusters and nanodroplets in the gas phase are fascinating nanoscale laboratories for laser-matter interaction studies due to their simple geometric and electronic structure and the possibility to change their size from the molecular to the bulk limit.

Single-shot diffractive imaging allows to determine the shape of the short-lived and non-depositable specimen such as superfluid helium nanodroplets. More importantly, the light-induced dynamics during and after the illumination with the intense short wavelength pulse become visible in the diffraction patterns. However, ultrafast changes of the electronic structure occur on a sub-femtosecond timescale and cannot be temporally resolved using the currently available femtosecond pulses from free-electron lasers. Our recent demonstration of diffractive imaging of single nanoparticles with intense XUV pulses from a laser-based high-harmonic generation (HHG) source thus opens a door to ultrafast coherent diffractive imaging of electron dynamics with phase-controlled multicolor fields and attosecond pulses.

Tuesday, October 17, 2017, 1:00 p.m., seminary room I, Physics high rise, Hermann-Herder-Str. 3

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