CFEL SCIENCE

SEMINAR

3rd April 2013 - 11:00 a.m.

CFEL-bldg. 99, seminar room IV

Philipp Sperling

University of Rostock, Germany

Thomson scattering on inhomogeneous targets

The introduction of free electron lasers enables new pump-probe experiments to characterize warm dense matter, i.e. systems at solid-like densities and temperatures of several eV. For instance, such extreme conditions are relevant for the interior of giant planets and along the compression path of inertial confinement fusion capsules. Due to strong correlations and quantum effects a theoretical treatment of warm dense matter is rather complicated so that consistent methods of many-body physics have to be applied. Theoretical results for the pair distribution functions and the equation of state can now be checked using new experimental techniques. For instance, within ongoing experimental campaigns, a short-pulse optical laser irradiates a target, e.g. liquid jets (at FLASH) or thin foils (at LCLS), that is subsequently probed with brilliant x-ray radiation. The inhomogeneous plasma prepared by the optical laser is characterized with particle-in-cell simulations.

For pump-probe scenarios on hydrogen, helium, and carbon targets, we calculate the respective Thomson scattering spectrum based on the Born-Mermin approximation considering the full density and temperature dependent dynamic structure factor. We can identify plasmon modes that are generated in different target regions and monitor their temporal evolution. Therefore, pump-probe experiments are promising tools to measure not only the important plasma parameters density and temperature but also to gain valuable information about their time-dependent profile through the target. The method described here can be applied to various pump-probe scenarios by combining optical lasers, soft and hard x-ray sources.

Host: Robin Santra - CFEL Theory Division