CFEL SCIENCE

SEMINAR

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Building 49, Seminar Room (108)

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Thomson scattering on inhomogeneous targets at FLASH

The introduction of brilliant free-electron lasers enables new pump-probe experiments to characterize warm dense matter states. For instance, a shortpulse optical laser irradiates a liquid hydrogen jet that is subsequently probed with brilliant soft x-ray radiation. The strongly inhomogeneous plasma prepared by the optical laser is characterized with particle-in-cell simulations. The interaction of the soft x-ray probe radiation for different time delays between pump and probe with the inhomogeneous plasma is also taken into account via radiative hydrodynamic simulations. We calculate the respective scattering spectrum based on the Born-Mermin approximation for the dynamic structure factor considering the full density and temperature-dependent Thomson scattering cross section throughout the target. We can identify plasmon modes that are generated in different target regions and monitor their temporal evolution. Therefore, such pump-probe experiments are promising tools not only to measure 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 and soft x-ray, as well as x-ray sources.

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