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Thomson scattering in warm dense matter R. THIELE, T. BORNATH, University of Rostock, R.R. FÄUSTLIN, DESY Hamburg, C. FORTMANN, University of Rostock, S. GLENZER, LLNL, G. GREGORI, University of Oxford, B. HOLST, University of Rostock, T. TSCHENTSCHER, XFEL Hamburg, V. SCHWARZ, R. REDMER, University of Rostock — Free electron lasers employing scattering of high-brilliant, coherent photons in the extreme ultraviolet (VUV), e.g. at FLASH (DESY Hamburg) or LCLS (Stanford), allow for a systematic study of basic plasma properties in the region of warm dense matter (WDM). WDM is characterized by condensed matter-like densities and temperatures of several eV. Collective Thomson scattering with VUV or x-ray has demonstrated its capacity for robust measurements of the free electron density and temperature in WDM. Collective excitations like plasmons ("electron feature") appear as maxima in the scattering signal. The respective frequencies can be related to the free electron density. Furthermore, the asymmetry of the red- and blue shifted plasmon intensity gives the electron temperature due to detailed balance. We treat collective Thomson scattering in the Born-Mermin-approximation which includes collisions and present a generalized Gross-Bohm dispersion for plasmas. The influence of plasma inhomogeneities on the scattering spectrum is studied by comparing density and temperature averaged scattering signals with calculations assuming homogeneous targets. For the "ion feature," results of semi-classical hypernetted chain (HNC) calculations and of quantum molecular dynamics simulations are shown for dense beryllium.

Robert Thiele
University of Rostock

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