Free-electron x-ray laser measurements of collisional-damped plasmons in isochorically heated warm dense matter

P. Sperling,[1] E. J. Gamboa,[1] H. J. Lee,[1] H.-K. Chung,[2] E. Galtier,[1] Y. Omarbakiyeva,[3] H. Reinholz,[3] G. Röpke,[3] U. Zastrau,[4] L. B. Fletcher,[1] and S. H. Glenzer[1]

[1] *SLAC National Acceleration Laboratory, USA*
[2] *International Atomic Energy Agency, Austria*
[3] *Universität Rostock, Germany*
[4] *XFEL GmbH, Germany*

Collisional-damped plasmons were obtained in highly-spectrally resolved measurments of isochorically heated solid aluminum providing the determination of electrical conductivities. X-ray pulses from the seeded Linac Coherent Light Source delivering an average of 0.3 mJ of 8 keV x-ray photons in a 0.005% bandwidth pulse, have been focused to micrometer diameter focal spots isochorically heating solid materials to temperatures up to several eV. The inelastic forward scattering spectra resolve electronic plasma oscillations that directly allow an accurate determination of the electron temperature and density indicating a warm dense matter state. This accuracy enable us to extract plasma properties, e.g. the electrical conductivity, and enables the validation of existing theories.