Graduate School Seminar

www.physik.uni-rostock.de/grk/
grk.sfb652@uni-rostock.de

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Bastian Witte
Statistische Physik

Calculation of plasmon-damping within X-ray Thomson scattering on isochorically heated warm dense aluminum

X-Ray Thomson scattering (XRTS) is an effective tool to determine plasma parameters like temperature or electron and ion density in the warm dense matter (WDM) regime [1]. However, also transport properties in WDM are of great interest, e.g., for fusion experiments or the modelling of planets and stars. A recent experiment at the Linac Coherent Light Source (LCLS) on isochorically heated warm dense aluminum [2] showed that the electrical conductivity could also be extracted from the XRTS spectra.
In this talk we present density-functional-theory molecular dynamics (DFT-MD) simulations in order to calculate the dynamic electrical conductivity in warm dense aluminum via the Kubo-Greenwood formula. The choice of the exchangecorrelation functional in the DFT calculations has an impact on the density of states and thus the dc conductivity. A good agreement with experimental results is achieved by using a hybrid functional. In addition the calculation of the XRTS spectrum based on the dynamic electrical conductivity yields a very good agreement with the LCLS data [2].

[1] S. H. Glenzer and R. Redmer, Rev. Mod. Phys. 81, 1625 (2009).
[2] P. Sperling, E. J. Gamboa, H. K. Chung, Y. Omarbakiyeva, H. Reinholz, G. Röpke, U. Zastrau, J. Hastings, L. B. Fletcher, S. H. Glenzer, and H.-J. Lee, Phys. Rev. Lett. 115, 115001 (2015).

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