P 25 Dichte Plasmen 2

Zeit: Mittwoch 11:00–12:15 Raum: HU 3059

Fachvortrag

P 25.1 Mi 11:00 HU 3059

Dielectric and Optical Properties in Dense Plasmas — •Heidi Reinholz — Institut für Physik, Universität Rostock, 18051 Rostock

For diagnostics of plasmas, reflection, absorption and emmission as well as inverse bremsstrahlung and stopping power are used to get information about plasma parameters and scattering processes. In dense plasma, many-particle effects which are manifested as correlations and in-medium effects are relevant. A systematic approach for the theoretical description of dielectric and optical properties of dense plasmas is given within linear response theory [H. Reinholz et al., Phys. Rev. E 62 (2000) 5648]. The optical properties can be calculated via a generalized Drude formula with a dynamical collision frequency, which contains many-particle effects. Molecular dynamics simulations are used to check the validity of our results. Good agreement is found [H. Reinholz et al., Phys. Rev. E 69 (2004) 066412; A. Selchow et al., Phys.Rev. E 64 (2001) 056410] up to plasma parameters of about 2. The reflectivity on shock-compressed plasma is calculated and compared with experimental results [H. Reinholz et al., Phys. Rev. E 68 (2003) 036403]. Results for the structure factor are relevant for the diagnostics of dense plasmas as done with Thomson scattering [A. Hoell et al., Eur. J. Phys. D 29 (2004) 159]. As a further application, results for the inverse bremsstrahlung are shown. Beside the treatment of a fully ionized plasma, the formation of bound states is influencing the properties. In order to take them into account, contributions in the dielectric function are relevant. Broadening of bound states [G. Roepke et al., J. Phys. A 36 (2003) 5931] and additional scattering mechanisms are taken into account.

P 25.2 Mi 11:30 HU 3059

Equation of state for dense noble gases and hydrogen — •Volker Schwarz, Hauke Juranek, Nadine Nettelmann, and Ronald Redmer — Institut für Physik, Universität Rostock, 18051 Rostock

The knowledge of the equation of state of hydrogen and hydrogen-helium mixtures is important for modeling, e.g., planetary interiors. For this, accurate equation of state data is required for high pressures up to several megabars and temperatures of several thousand Kelvin known as warm dense matter. We calculate the equation of state for hydrogen and noble gases (He, Ar, Xe) within Fluid Variational Theory considering dissociation processes self-consistently and ionization in addition. Effective pair potentials are used to describe the interactions between the species. We present results for the equation of state for the materials mentioned above and compare with available simulations and shock-wave experiments. Especially, the Hugoniot curves are discussed. The results for hydrogen-helium mixtures are used to model interiors of giant planets such as Jupiter.

P 25.3 Mi 11:45 HU 3059

Microfields distribution in a dense high temperature plasma — •Saltanat Sadykova[1], Gerd Fussmann[2], and Werner Ebeling[2] — [1]Department of Physics, Kazakh National University, Tole bi 96, Almaty 480012, Kazakhstan — [2]Institut für Physik der Humboldt-Universität zu Berlin, Newtonstraße 15, 12489 Berlin

For calculations of microfield distribution function P(E) in a nonideal hydrogen one and two-component plasma the method proposed by C.A. Iglesias was used basing on a pair correlation radial distribution function. Numerical calculations of P(E) were made for different plasma parameters. P(E) were determined in a frame of two pspeudopotential models which take into an account both, the quantum-mechanical effect and screening field effects. One is basing on the Deuscht potential the other one on the Kelbg potential. The results obtained by applying the two models for a one and two-component plasmas are compared with those given by Holtsmark, Hooper, Iglesias and other authors.

P 25.4 Mi 12:00 HU 3059

Thomson scattering using the VUV-FEL at DESY Hamburg — •Robert Thiele[1], Eckhart Förster[2], Ronald Redmer[1], Heidi Reinholz[1], Gerd Röpke[1], and Thomas Tschentscher[3] — [1]Universität Rostock — [2]Friedrich-Schiller-Universität Jena — [3]DESY Hamburg

The scattering of photons in plasmas is an important diagnostic tool. The region of solid-density plasmas can be probed by x-ray Thomson scattering. The scattering cross section is related to the dynamic structure factor $S(k,\omega)$. We improve the standard treatment of the scattering on free electrons within the random phase approximation (RPA) by including collisions [1]. $S(k,\omega)$ is calculated via the dielectric function at finite wavenumbers which can be obtained by using a generalized Mermin ansatz [2]. The dynamic collision frequency is treated in Born and Lenard-Balescu approximation [3]. We show that theoretical description beyond the RPA is crucial to obtain reliable results for the plasma parameters. Experimental investigation at experimental parameters where a treatment beyond RPA is required are under preparation for the VUV-FEL at DESY, Hamburg.

[1] A. Höll, R. Redmer, G. Röpke and H. Reinholz, Eur. Phys. J. D **29**, 159-162 (2004)
[2] A. Selchow *at al.*, Phys. Rev. E **64**, 056410 (2001)
[3] H. Reinholz, R. Redmer, G. Röpke, A. Wierling, Phys. Rev. E **62**, 5648 (2000)