Wahlobligatorische Vorlesung (2 SWS) im WP-Schwerpunkt Theoretische Physik

Plasma Theory II: Quantum plasmas

Prof. Dr. Michael Bonitz and PD Dr. Hanno Kählert[1]

This research-oriented lecture is for students with interest in Theoretical Physics and PhD students working in the field of plasma physics. The focus is on dense quantum plasmas that occur in astrophysical environments and upon compression of matter in the laboratory with high intensity lasers, for example in inertial confinement fusion (ICF).

Part I. **Quantum plasmas in equilibrium. Warm dense matter**

(a) Overview on warm dense matter, ICF [1, 1a]

(b) The uniform electron gas at finite temperature [2]

(c) Thermodynamics of correlated electrons: analytical models and simulations

(d) Two-component quantum plasmas: screening, bound states, phase diagram [1a]

Part II. **Nonequilibrium many-particle theory for quantum plasmas**

(a) Introduction. Boltzmann equation: properties and problems [1]

(b) Quantum Vlasov equation. Dielectric theory. RPA and beyond

(c) Quantum kinetic equations for dense plasmas.

(d) Generalized Balescu-Lenard equation. Screening dynamics [1]

(e) Hydrodynamic approach to classical and quantum plasmas [3]

(f) Quantum kinetic theory of ion stopping

[1] M. Bonitz, *Quantum Kinetic Theory*, 2nd ed. Springer 2016
[1*a*] M. Bonitz et al., Phys. Plasmas **31**, 110501 (2024)
[2] T. Dornheim, S. Groth, and M. Bonitz, Phys. Reports **744**, 1-86 (2018)
[3] Z. Moldabekov, M. Bonitz, and T. Ramazanov, Phys. Plasmas **25**, 031903 (2018); ibid. **26**, No. 9, 090601 (2019)

Vorbesprechung: Mi, 8.10. 10:30, LS 15-230
Termin: donnerstags (vorläufig)

[1]with contributions from Dr. J.-P. Joost, E. Schroedter, C. Makait, and D. Krimans