Carl von Ossietzky
Universität
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Institut für Physik

Physical Colloquium

„Non-equilibrium dynamics of laser-excited electrons in a solid“

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Room No. W02 1-148

Femtosecond laser pulses irradiating a solid material induce a cascade of processes starting with the excitation of so-called hot electrons and passing through various relaxation processes. Several scattering mechanisms act on different timescales. At sufficiently high energy densities, phase transitions and ultrafast structural dynamics can be induced.

We simulate the dynamics of a large ensemble of excited electrons using complete Boltzmann collision integrals. We consider the excitation of conduction electrons in a metal with visible light. On a femtosecond timescale, the electrons‘ energy distribution deviates strongly from a Fermi distribution. Electron-electron and electron-phonon scattering mutually influence each other during thermalization. For materials with several electronic systems, e.g. itinerant ferromagnets or dielectrics, temperatures and densities equilibrate independently.

In this talk I will take you on a time travel to explore the different dynamical aspects induced in a solid after ultrafast excitation. I present results showing that athermal electron distributions as well as highly excited electrons can exist much longer than the single-electron lifetime predicts. I will also show, how different out-of-equilibrium stages can affect measurable quantities like the electron-phonon coupling strength and the optical response of the material.

Host: Prof. Dr. Christoph Lienau