CFEL SCIENCE

SEMINAR

26th November 2014 - 2:00 p.m.

CFEL-bldg. 99, seminar room IV

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Nonequilibrium electron dynamics in metals after ultrashort laser excitation

In this talk, the electron kinetics within a metal after an ultrashort laser irradiation is investigated [1-3].
First, the electrons are excited and driven out of thermal equilibrium. In this state, no temperatures are defined and the electron distribution is no Fermi distribution (see figure below, taken from [2]).
Second, the electrons thermalize due to electron-electron collisions and reach a new thermal equilibrium state. The time scale of this process varies strongly between some picoseconds down to less than 10fs [2]. This time depends on the excitation (laser wavelength and fluence) and on the material properties.
A further process, the energy transfer to the lattice, also depends on the electron distribution and is analyzed in this talk [3]. To investigate the nonequilibrium effects of the electrons after laser excitation, we apply Boltzmann collision integrals. Our model allows to treat the density of states for a given material [2] and demonstrates the importance of this quantity on the scattering rates.

[1] B. Rethfeld, A. Kaiser, M. Vicanek and G. Simon, Phys.Rev.B 65, 214303, (2002)
[2] B. Y. Mueller and B. Rethfeld, Phys. Rev. B 87, 035139 (2013)
[3] B. Y. Mueller and B. Rethfeld, Appl. Surf. Sci. 320, 24 (2014)

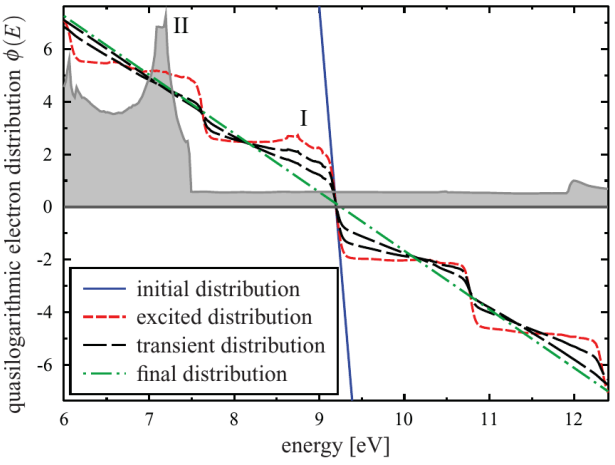

FIG. 3. (Color online) Quasilogarithmic transient distribution function (21) of gold after a laser irradiation of 0.12 mJ/cm^2. The transient distributions are shown for 40 and 100 fs. Background: The density of states in arbitrary units.

Host: Robin Santra – Theory Division