Physikalisches Kolloquium

Universität Konstanz

Di 2.5.17
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513

Prof. Dr. Peter Uhd Jepsen
Technical University of Denmark

Electron dynamics in metals and semiconductors in strong THz fields

Electron dynamics in semiconductor materials determine the properties of virtually all electronic devices. With shrinking dimensions and increasing operational frequency of contemporary and future transistors, knowledge of the behavior of electrons in strong electric fields is becoming increasingly important. With current transistor technology, the gate lengths and operational voltages dictate operational electric fields inside components of several hundred kV/cm, and realistic projections show that this internal field strength with reach the MV/cm regime within the next 5-7 years. At such field strengths, highly nonlinear processes such as Zener tunneling, impact ionization and Auger scattering become relevant limiting factors for performance. Additionally, long-term effects such as electromigration has decremental effects on device performance and lifetime.
In this presentation I will discuss recent ultrafast experiments based on intense, single-cycle pulses of electromagnetic radiation in the THz range, which address effects such as impact ionization in silicon, intersubband scattering and Zener tunneling in silicon carbide, and THz-induced field emission of ultrashort electron bunches from metallic sub-wavelength structures. This latter process may enable femtosecond-resolution in studies of chemical reactions relevant in radiation chemistry, such as decomposition of water, and radiation induced damage to DNA.