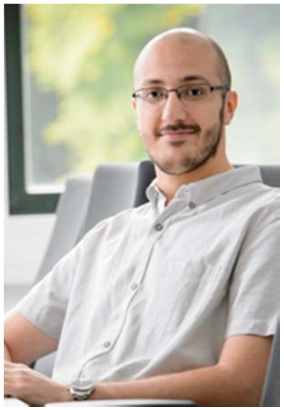
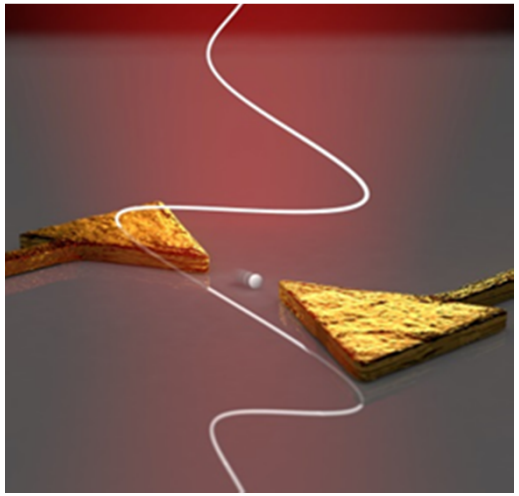
Physikalisches Kolloquium

Universität Konstanz



Dr. Daniele Brida
Universität Konstanz

Di 06.12.16
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513



Ultrafast control of electronic properties at the nanoscale

Many fundamental and ubiquitous physical phenomena have origin at the ultrafast timescale. Their observation and understanding would expand our knowledge of the underlying mechanisms on which nature is established. The possibility to investigate various primary processes on their intrinsic timescales relies on the generation of ultrashort pulses with widely tunable carrier frequency, from ultraviolet to mid-infrared. These optical waveforms allow the investigation of microscopic electronic interactions in exemplary 2D and correlated material systems to unveil deep origin of their optoelectronic properties. In particular, electron-electron and electron-lattice interactions can be observed on a sub-10-fs timescale.
Further applications address the optical response of semiconducting nanostructures: in Ge it is possible to impulsively excite a plasma frequency extending to the mid-infrared range that establishes a plasmonic resonance. This allows the activation of optical field localization at the nanoscale for the enhancement of light-matter coupling in sensing and nonlinear optics experiments. Another novel approach is exploited to access ultrafast electron transport phenomena at the nanoscale via the manipulation of the peak electric field of a single-cycle optical pulse. The field is harnessed for the direct control of electron tunneling in nanostructured gold circuits with a dielectric gap of approximately 8 nm. The geometrical confinement and the nonlinear nature of the tunneling process allows for the complete control of single-electron currents with sub-cycle precision.