INSTITUT FÜR PHYSIK

Physikalisches Kolloquium
Sommersemester 2018

Donnerstag | 19. April | 16:15 Uhr | Hörsaal 1

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Subcycle Quantum Physics

Recent developments exploring a new regime of quantum physics will be presented, where subcycle and sub-wavelength confinement in both time and space opens up access to new phenomena owing to the absence of local conservation of energy and momentum.

The first part features subcycle quantum physics of the electromagnetic field. Reading out the nonlinear displacement of valence electrons in a semiconductor with few-femtosecond laser pulses allows direct sampling of vacuum fluctuations [1,2]. Synchronal noise patterns of squeezed mid-infrared transients are generated and characterized as a first application of this new type of quantum technology [3]. Local deviations from the vacuum noise level arise due to acceleration of the reference frame combined with Heisenberg's uncertainty principle.

Latest progress in attosecond control of nanotransport in the few-electron range [4] will be presented in the second part. Here, we use single cycles of near-infrared radiation from a passively phase-locked Er:fiber system to direct the current between two nanometer-sized contacts made up by a plasmonic antenna. This combination addresses extremely nonlinear optics with pulses of minute energy content in the pJ range. At the moment, we are working towards truly atomic spatio-temporal dimensions where novel quantum transport processes like dynamical Coulomb blockade might prevail.

[1] C. Riek et al., Science 350, 420 (2015)
[2] A. S. Moskalenko et al., Phys. Rev. Lett. 115, 263601 (2015)
[3] C. Riek et al., Nature 541, 376 (2017)
[4] T. Rybka et al., Nature Photon. 10, 667 (2016)

Einlader: Prof. Fennel