

Einladung zum Physikalischen Kolloquium Montag, 25.04.2016 16:15 Uhr in N24/H13



Professor Dr. Claus Ropers

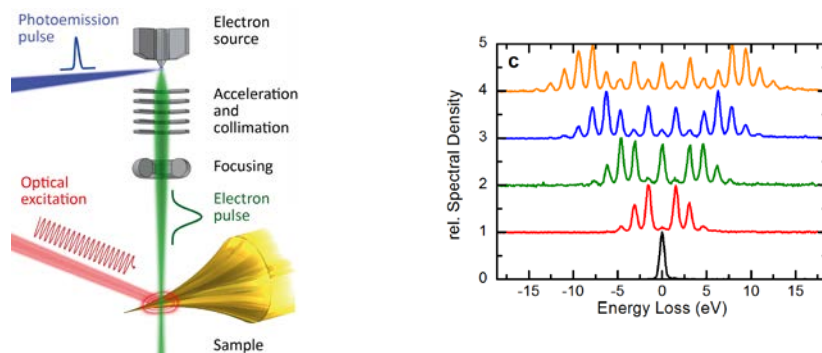
IV. Physikalisches Institut

Georg-August-Universität Göttingen

Quantum coherent interactions of light with free electrons studied by ultrafast transmission electron microscopy

The spatial confinement of light using metallic nanostructures enables the enhancement of a multitude of different nonlinear optical phenomena, including harmonic generation, atomic ionization, and nonlinear photoemission. This talk will discuss field-driven interaction of electrons with optical near-fields at nanostructures over a broad range of physical parameters, with an emphasis on several examples of our recent and ongoing work.

In one set of measurements, we study ultrafast photoelectron emission from nanoscopic cathodes, including means to actively control this emission by intense mid-infrared [1] or Terahertz fields [2]. The enhanced brightness of nanotip photoemitters, on the other hand, leads to novel applications in Ultrafast Low-Energy Electron Diffraction (ULEED) [3] and Ultrafast Transmission Electron Microscopy (UTEM) [4]. Specifically, UTEM allows for the study of quantum features in the interaction of free electrons with optical near-fields. This includes the observation of multilevel Rabi-oscillations [4], Ramsey-type dual interactions in spatially separated near-fields and multi-color coherent control. Overall, we demonstrate various new possibilities in the coherent manipulation of the longitudinal and transverse degrees of freedom of free electron wavefunctions, which will eventually allow for the generation of attosecond electron pulses.



References

- [1] G. Herink, D. R. Solli, M. Gulde, and C. Ropers, "Field-driven photoemission from nanostructures quenches the quiver motion", *Nature* **483**, 190 (2012).
- [2] L. Wimmer, G. Herink, D. R. Solli, S. V. Yalunin, K. E. Echternkamp, and C. Ropers, "Terahertz control of nanotip photoemission", *Nature Physics* **10**, 432 (2014).
- [3] M. Gulde, S. Schweda, G. Storeck, M. Maiti, H. K. Yu, A. M. Wodtke, S. Schäfer, and C. Ropers, "Ultrafast low-energy electron diffraction in transmission resolves polymer/graphene superstructure dynamics", *Science* **345**, 200 (2014).
- [4] A. Feist, K. E. Echternkamp, J. Schauss, S. V. Yalunin, S. Schäfer, and C. Ropers, "Quantum coherent optical phase modulation in an ultrafast transmission electron microscope", *Nature* **521**, 200-203 (2015).

Ab 16.00 Uhr Kaffee, Tee und Kekse vor dem Hörsaal H13

Organisation: Prof. Dr. F. Jelezko, Tel. 23750, Host: Prof. Dr. U. Kaiser, Tel. 22950, off.: 22951