

Low-frequency excitations and charge transport in semiconductors studied by nonlinear terahertz spectroscopy

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The recent optical generation of ultrashort high-field transients at terahertz frequencies and the implementation of novel spectroscopic methods allow for studying nonlinear low-frequency excitations of and charge transport in solids in the quantum coherent limit [1-3]. This talk combines an introduction into experimental techniques covering the far- to mid-infrared spectral range with a discussion of new results on intersubband Rabi flopping in GaAs/AlGaAs quantum wells [3] as well as nonlinear polaron transport and coherent ballistic electron motions in bulk GaAs [4].

- [1] T. Bartel, P. Gaal, K. Reimann, M. Woerner, T. Elsaesser: Generation of single-cycle THz transients with high electric-field amplitudes, *Opt. Lett.* **30**, 2805 (2005)
- [2] P. Gaal, K. Reimann, M. Woerner, T. Elsaesser, R. Hey, K. H. Ploog: Nonlinear terahertz response of n-type GaAs, *Phys. Rev. Lett.* **96**, 187402/1-4 (2006)
- [3] W. Kuehn, K. Reimann, M. Woerner, T. Elsaesser: Phase-resolved two-dimensional spectroscopy based on collinear n-wave mixing in the ultrafast time domain, *J. Chem. Phys.* **130**, 164503 (2009)
- [4] P. Gaal, W. Kuehn, K. Reimann, M. Woerner, T. Elsaesser, R. Hey: Internal motions of a quasiparticle governing its ultrafast nonlinear response, *Nature* **450**, 1210 (2007)