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Infrared magneto-spectroscopy of graphene-based systems

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The results of infrared magneto-spectroscopy of different graphene-based materials will be presented. These systems involve multi- and mono-layers of epitaxial graphene, decoupled graphene flakes on the surface of graphite as well as bulk graphite. The magneto-optical methods serve us mostly as a tool of Landau level spectroscopy. It is used to study the characteristic response due to massless or massive Dirac-type particles and, e.g., to distinguish materials with graphene layers exhibiting rotational or Bernal stacking. Broadening of inter-Landau level transitions has been traced as a function of magnetic field and energy to evaluate the quality of multi-layer epitaxial graphene in terms of scattering time and carrier mobility. From broadening of overlapping Landau levels we find that the scattering rate increases linearly with energy. Complementary to these experiments, inelastic relaxation processes have been studied in pump-and-probe measurements in THz range. The obtained data indicate that the inelastic processes are significantly slower than the elastic ones, and also that the inelastic relaxation is slowed down when the photon energy is tuned to values below the optical phonon frequency. References: M. Orlita et al., PRL, to be published (2011); S. Winnerl et al., PRL, to be published (2011).