SFB1242

SFB 1242 Nichtgleichgewichtsdynamik kondensierter Materie in der Zeitdomäne

UNIVERSITÄT DUISBURG ESSEN

Open-Minded

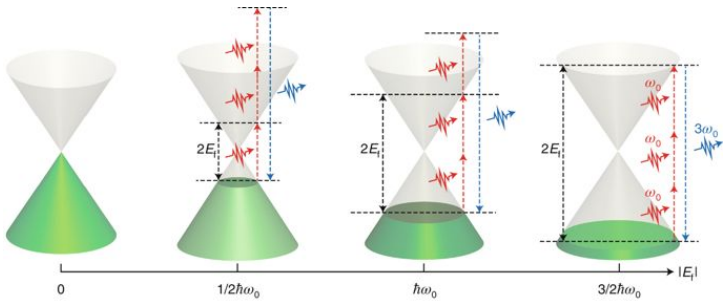
26.01.2021 / 10 Uhr c.t.

Unconventional nonlinear optical responses from doped graphene

Prof. Dr. Wei-Tao Liu

Fudan University

The control of optical properties by electric means is the key to optoelectronic applications. For atomically thin two-dimensional (2D) materials, the natural advantage lies in that the carrier doping could be readily controlled through the electric gating effect, possibly affecting the optical properties. By exploiting this advantage, we studied nonlinear optical responses from doped graphene, including both coherent nonlinear processes such as the second harmonic generation (SHG) and third harmonic generation (THG), and the incoherent ultrafast photoluminescence (PL). For SHG and THG, the quantum interference between various multi-photon transition pathways plays crucial roles. We found that THG and sum-frequency four-wave-mixing (FWM) are strongly enhanced in heavily doped graphene, while the difference-frequency FWM appears just the opposite. Difference-frequency FWM exhibited a novel divergence towards the degenerate case in undoped graphene, leading to a giant enhancement of the nonlinearity [1]. Moreover, the unusual electric quadruple SHG manifests itself as a sensitive probe of the electron-hole symmetry in graphene and graphene-like materials around Dirac or Weyl nodes [2]. For the ultrafast luminescence, it can be completely switched off by the Pauli-blocking of one-photon interband transition in graphene with an on/off ratio exceeding 100, which is remarkable compared to other 2D semiconductors and 3D bulk counterparts [3]. The demonstration of these broadband, electrically tunable nonlinear optical responses in graphene is promising for a host of nonlinear optical applications.



References

[1] T. Jiang et al., Nat. Photon. **1**2, 430 (2018).
[2] Y. Zhang et al., Phys. Rev. Lett. **1**12, 047401 (2019).
[3] D. Huang et al., Nano Lett. **1**6, 7985 (2018).

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

Contact: Prof. Dr. Björn Sothmann, Faculty of Physics
Phone: +49 (203) 37-91578 / Mail: bjoerns@thp.uni-due.de