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Application of magnetic fields, a relevant experimental tool in solid state physics, has been largely used to studying the electronic properties of various graphitic materials. Very early investigations, lately revisited, were focused on bulk graphite. More recent experiments have been devoted to exploring the electronic properties of two-dimensional allotropes of sp₂ carbon, such as graphene and its bilayer, multi-layer epitaxial graphene and few-layer Bernal-stacked graphenes. Experiments include electric transport measurements as well as optical spectroscopy studies, the results of which are the main focus of the present talk.

As a contactless and noninvasive tool, optical magneto-spectroscopy (e.g., magneto-transmission, Raman scattering) can be applied to structures which are difficult to probe by other means (e.g., electric transport or STM techniques). The spectral resolution offers an obvious advantage, to select the response of the particular electronic system in sometimes multicomponent graphitic materials.

Primarily, the magneto-optics is used to explore the electronic band structures and has provided relevant information on Dirac-like states in multilayer graphene (on SiC), on the energy bands of graphene domains present on graphite surface, and revealed the details of the band structure of bulk graphite including the peculiar characteristics of electrons in the vicinity of the Lifshitz transition. Further applications of magneto-optics are in the studies of carrier scattering and the experiments reveal the unprecedented electronic quality of graphene flakes on graphite substrates, setting a possible limit for carrier mobility in graphene above 107 cm²/Vs. Finally, magneto-optical studies provide valuable information on the effects of interactions. The most visible in experiments are those of electron-phonon interactions which results in a pronounced magneto-resonant hybridization of electronic and optical phonon excitations. Consequences of electron-electron interactions can be traced in experiments on high quality graphene structures.

References

Cloning of Dirac fermions in graphene superlattices, L. A. Ponomarenko et al., Nature **497**, 594, (2013)

Circular dichroism of magneto-phonon resonance in doped graphene, P. Kossacki et al., Phys. Rev. B **86**, 205431, (2012)

Two dimensional allotropes of carbon: Magnetic field studies

Wpisany przez Jacek Szczytko

piątek, 11 października 2013 12:31 - Poprawiony wtorek, 22 października 2013 12:09

Classical to quantum crossover of the cyclotron resonance in graphene : A study of the strength of intraband absorption, M. Orlita et al., New J. Phys. **14**, 095008, (2012)

Probing the band structure of quadri-layer graphene with magneto-phonon resonance, C. Faugeras et al., New J. Phys.

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Polarization resolved magneto-Raman scattering of graphene-like domains on natural graphite, M. Kühne et al., Phys. Rev. B

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Cyclotron motion in the vicinity of a Lifshitz transition in graphite, M. Orlita et al., Phys. Rev. Lett. **108**, 017602, (2012)

Electronic excitations and electron-phonon coupling in bulk graphite through Raman scattering in high magnetic fields, P. Kossacki et al., Phys. Rev. B **84**, 235138, (2011)

Carrier scattering from dynamical magneto-conductivity in quasi-neutral epitaxial graphene, M. Orlita et al., Phys. Rev. Lett.

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Magneto-Raman scattering of graphene on graphite : Electronic and phonon excitations, C. Faugeras, et al., Phys. Rev. Lett.

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Dirac electronic states in graphene systems : optical spectroscopy studies, M. Orlita and M. Potemski, Semiconductor Science and Technology

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