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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.

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800x600 Two dimensional allotropes of carbon: Magnetic field studies

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