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Interaction of magneto-excitons with phonons in graphene and graphite JUN YAN, TREVOR DAVID RHONE, Department of Physics, Columbia University, SARAH GOLER, NEST and Scuola Normale Superiore, Pisa, Italy, MELINDA HAN, Department of Physics and Applied Physics, Columbia University, VITTORIO PELLEGRINI, NEST and Scuola Normale Superiore, Pisa, Italy, PHILIP KIM, Department of Physics, Columbia University, ARON PINCZUK, Department of Physics and Applied Physics, Columbia University — We study the Landau levels of graphite and single layer graphene by measurements of the magneto-phonon resonance effect in which there is coupling between the inter-Landau level magneto-exciton with the long wavelength optical phonon (G band). In graphite the G band displays a rich line shape evolution as the magnetic field is finely tuned between 5 and 7 Tesla. These observations indicate that the G band is resonantly coupled to the magneto-excitions at these fields. In the interpretation we postulate that the anticrossing of the phonon band with the inter-Landau level transitions results in a mode-splitting at around 6.2 T. The evolution of the energy and spectral weight of the two coupled modes indicates that the phonon is a probe of the unique structure of Landau levels in graphene-related materials. In an as-prepared single-layer graphene, much smaller changes are observed for fields reaching as high as 12 Tesla.

Jun Yan
Department of Physics, Columbia University

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