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Infrared spectroscopy of 2D electron gas in high magnetic field: a case study of graphite ZHIQIANG LI, WILLIE PADILLA, UCSD, SASA DORDEVIC, Brookhaven National Lab, PABLO ESQUINAZI, University of Leipzig, C.C. HOMES, DIMITRI BASOV, UCSD, UCSD COLLABORATION, BROOKHAVEN NATIONAL LAB COLLABORATION, UNIVERSITY OF LEIPZIG COLLABORATION — We present the first systematic investigation of the optical constants of HPOG graphite in magnetic fields up to 17T. The ab plane magneto-reflectance in the frequency range 15-3000 cm^{-1} was measured with the field in c-axis. The optical conductivity was obtained from Kramers-Kronig analysis augmented with ellipsometry data. These experiments have allowed us to monitor the field-induced transfer of the electronic spectral weight from the Drude mode to cyclotron resonance (CR) modes. In applied fields, the conductivity in the limit of $\omega \rightarrow 0$ is depleted by several orders of magnitude in accord with notoriously large positive magneto-resistance of graphite. A close examination of the lineshape of CR modes is indicative of the coexistence of carriers with 3D and 2D character. The latter mode reveals a $\sqrt{H}$ dependence of the cyclotron frequency long anticipated for Dirac quasiparticles with linear dispersion. In this fashion, our magneto-optics experiments have allowed us to explore novel aspects of charge dynamics in this prototypal quasi-2D material.

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