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Observation of THz Magnetodielectric Contrast in Graphite Nanoplatelet Films

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The temperature and magnetic field dependences of the optical properties of graphite nanoplatelet films in the THz frequency range have been investigated. The room-temperature THz spectrum of graphite nanoplateles displays a coherent response of itinerant charge carriers at zero frequency. With decreasing temperature, the Drude plasma frequency (~ 1675 cm-1) decreases slowly, whereas the carrier scattering rate (~ 175 cm-1) is almost temperature independent. Such behavior is typical of conventional semiconductors. The lack of a major change in Drude plasma frequency down to 4.2 K implies any band gaps in graphite nanoplatelets are less than 1 meV. In a magnetic field, the Drude oscillator strength is suppressed and transferred to various finite frequency transitions between the Landau levels. The dramatic increase of the low-frequency transmission is a THz counterpart of the positive magnetoresistance effect. The 300 K magnetodielectric contrast is as large as 60% near 1 THz at 10 Tesla. The results are potentially useful for magnetic memory applications away from the dc limit.

References:

1) H. L. Liu *et al*., New J. Phys.**12**, 113012 (2010).