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Temperature, Magnetic field, and Gate Bias Dependence of the Infrared Hall Effect in Graphene C.T. ELLIS, A.V. STIER, A. STABILE, M.-H. KIM, G. SAMBANDAMURTHY, J. CERNE, Dept. of Physics, University at Buffalo, SUNY, S. BANERJEE, Dept. of Chemistry, University at Buffalo, SUNY
— In our study we probe the infrared Hall conductivity (σ_{xy}) for single and bilayer graphene in the 120-1000 meV range as a function of gate bias at temperatures down to 7K and magnetic fields up to 7T using Faraday measurements. Unlike the longitudinal conductivity (σ_{xx}), which measures the sum of the optical responses for left and right circularly polarized light, σ_{xy} measures the difference and therefore is sensitive to small changes in symmetry. While σ_{xx} and the DC Hall effect have revealed extraordinary properties of graphene (Zhang, Nature 2005; Novoselov, Nature 2005; Jiang, PRL 2007; etc...) recent calculations (Morimoto, PRL 2009) predict remarkable step-like features in the infrared σ_{xy}. We also probe the chiral response of graphene due to spatial inversion symmetry breaking. Our graphene samples are prepared using several methods, including anodically bonding graphite to pyrex, which can produce a high yield of large single layer graphene flakes (>100 μm) (Shukla et al., Solid State Comm. 2009), normal mechanical exfoliation of kish graphite, and grown chemical vapor deposition techniques.

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