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Toward Graphene-Based Microwave Photon Counter

KIN CHUNG FONG, California Institute of Technology

Graphene is a material with remarkable electronic properties. However, the thermal properties of this two-dimensional Dirac Fermions, that determine the characteristics of photo detectors, plasmonic devices, and bolometers, are less explored. Here, we present our measurement of specific heat capacity, Wiedemann-Franz (WF), and electron-phonon (e-ph) thermal conductance from 0.3 to 100 K using the novel single layer graphene bolometer [1]. These measurements suggest that graphene-based devices can generate substantial advances in the areas of ultra-sensitive bolometry, calorimetry, microwave, and terahertz single photon detection for applications in areas such as observational astronomy, quantum information and measurement. The physics of the e-ph coupling and the possible violation of Wiedemann-Franz Law near the charge neutrality point in single layer graphene will be discussed.

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[1] K.C. Fong and K.C. Schwab, Phys. Rev. X 2, 031006 (2012)