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A Way from GHz to THz Graphene Nanosensor YUICHI OCHIAI, AKRAM MAHJOUB, NOBUYUKI AOKI, Chiba University, JUNG WOO SONG, SUNY Buffalo, GREGORY AIZIN, CUNY Kingsborough, JONATHAN BIRD, SUNY Buffalo, DAVID FERRY, Arizona State University, YUKIO KAWANO, KOJI ISHIBASHI, ADLab, RIKEN, G-COE COLLABORATION — The unique bandstructure, and associated carrier properties, of graphene make this material of ideal interest for application as a broadly tuneable sensor, for specific application to the microwave and terahertz (THz) regime. The gapless spectrum characteristic of single-layer graphene, as well as the small forbidden gap that appears in bi-layer graphene, is ideally matched to the low (meV) energy of photons near the THz regime, in marked contrast to conventional semiconductors whose relevant bandgaps are typically several orders of magnitude larger. In this presentation, we describe the results of ongoing research that is being undertaken with the objective of developing upto THz nanosensors based on graphene. We describe the preparation of graphene devices by mechanical exfoliation, after which we discuss the characterization of their electrical properties using low-temperature magneto-transport investigations [1]. These studies demonstrate the formation of open quantum-dot structures in small graphene flakes, contacted by sub-micron scale metal electrodes. The observation of quantum fluctuations in the magneto-resistance of these structures indicates the presence of quantized dot states, whose characteristics may be of use in THz sensing. [1] Y. Ujiie et al., J. Phys.: Condens. Matt. 21 (2009) 382202.

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