Abstract Submitted
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On-Chip High-Responsivity Graphene−Boron Nitride Photodetector Integrated with Si Waveguide YUANDA GAO, Columbia University, REN-JYE SHUIE, DIRK ENGLUND, Massachusetts Institute of Technology, JAMES HONE, Columbia University — Graphene and other two-dimensional (2D) materials have emerged as promising materials for broadband and high-speed photodetection [1] and optical modulation [2]. These optoelectronic capabilities can augment complementary metal−oxide− semiconductor (CMOS) devices for high-speed and low-power optical interconnects. Here, we demonstrate an on-chip ultrafast photodetector based on a two-dimensional heterostructure consisting of high-quality graphene encapsulated in hexagonal boron nitride. Coupled to the optical mode of a silicon waveguide, this 2D heterostructure-based photodetector exhibits a maximum responsivity of 0.36 A/W and high-speed operation with a 3 dB cutoff at 42 GHz [3]. From photocurrent measurements as a function of the top-gate and source-drain voltages, we conclude that the photoresponse is consistent with hot electron mediated effects. 1. Gan, X. et al. Chip-integrated ultrafast graphene photodetector with high responsivity. Nat. Photonics 7, 883–887 (2013). 2. Gao, Y. et al. High-Speed Electro-Optic Modulator Integrated with Graphene-Boron Nitride Heterostructure and Photonic Crystal Nanocavity. Nano Lett. 15(3), 2001-2005 (2015) 3. Shiue, R.-J. et al. High-Responsivity Graphene–Boron Nitride Photodetector and Autocorrelator in a Silicon Photonic Integrated Circuit. Nano Lett. Article ASPA

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