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Highly sensitive hBN/graphene hot electron bolometers with a Johnson noise readout DMITRI EFETOV, Massachusetts Institute of Technology, YUANDA GAO, Columbia University, EVAN WALSH, REN-JYE SHIUE, GABRIELE GROSSO, CHENG PENG, Massachusetts Institute of Technology, JAMES HONE, Columbia University, KIN CHUN FONG, BBN Raytheon, DIRK ENGLUND, Massachusetts Institute of Technology — Graphene has remarkable opto-electronic and thermo-electric properties that make it an exciting functional material for various photo-detection applications. In particular, owed to graphenes unique combination of an exceedingly low electronic heat capacity and a strongly suppressed electron-phonon thermal conductivity G_{th}, the electronic and phononic temperatures are highly decoupled allowing an operation principle as a hot electron bolometer (HEB). Here we demonstrate highly sensitive HEBs made of high quality hBN/graphene/hBN stacks and employ a direct electronic temperature read out scheme via Johnson noise thermometry (JNT). We perform combined pump-probe and JNT measurements to demonstrate strongly damped C_e and G_{th} in the ultra-low impurity σ_i =10^9 cm^{-2} hBN/G/hBN stacks, which result in unprecedented photo-detection sensitivity and noise equivalent power for graphene HEBs.

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