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Photoresponse in Graphene Boron Nitride Vertical Heterostructures TROND ANDERSEN, QIONG MA, CHUN-HUNG LUI, Massachusetts Inst of Tech-MIT, NITYAN NAIR, University of California, Berkeley, NATHANIEL GABOR, University of California, Riverside, ANDREA YOUNG, WENJING FANG, Massachusetts Inst of Tech-MIT, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute of Materials Science, Japan, JING KONG, NUH GEDIK, PABLO JARILLO-HERRERO, Massachusetts Inst of Tech-MIT — Combining two-dimensional materials into vertical heterostructures reveals diverse, intriguing phenomena and provides a novel way of engineering materials with desired electronic properties. Placing graphene on hexagonal boron nitride (hBN) has given particularly interesting results, including enhanced mobility, opening of a band gap, and highly controllable photo-induced doping. We explore the photoresponse of vertical graphene-hBN-graphene heterostructures in a high electronic temperature regime where thermionic emission dominates. Near the charge neutral point, we observe a pronounced conductance peak, which we attribute to a cooling bottleneck that appears at low carrier density, thus suggesting hot carrier enhanced thermionic emission. To further investigate the mechanism by which current is generated, we conduct two-pulse correlation measurements and study the temporal dynamics of the system. We observe a positive correlation, implying that the hot carriers thermalize before crossing the hBN barrier. Finally, we propose an advanced, modified two-temperature model, which allows for numerical simulations that are consistent with our measurements.

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