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Using Single Adatoms to Sense Screening by Graphene Charge Carriers JONATHAN WYRICK, FABIAN NATTERER, Center for Nanoscale Science and Technology, NIST, YUE ZHAO, Center for Nanoscale Science and Technology, NIST; University of Maryland, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, NIKOLAI ZHITENEV, JOSEPH STROSCIO, Center for Nanoscale Science and Technology, NIST — As electronic devices approach the nanometer scale it becomes increasingly necessary to understand how small numbers of defects interact with one another and ultimately determine the behavior of a device. In the case of devices with graphene exposed at the surface, defects can be modelled and varied by depositing adatoms. We investigate how Co atoms adsorbed on graphene create and modify the electric potential experienced by graphene carriers using scanning tunneling microscopy and spectroscopy at low temperature. When an STM tip is brought into proximity to a biased graphene sample the electric field between tip and sample is screened by graphene's 2D electron gas, resulting in a local top-gating potential under the tip. This potential can be manipulated by varying a backgate voltage and the sample bias, and can be spatially characterized by imaging charging rings that form around defects when the potential changes their charge state. We find that defect charging rings lying near or even crossing adsorbed Co atoms become distorted and can form secondary charging rings around those atoms. To explain these effects we employ a charging model that incorporates a defect resonance, the screened tip potential, and modified screening in regions localized around Co atoms.

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