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Resonant Modes in Circular Graphene *pn* Junctions Created by STM Probes JONATHAN WYRICK, Center for Nanoscale Science and Technology NIST, YUE ZHAO, Center for Nanoscale Science and Technology NIST; Maryland NanoCenter UMD, FABIAN NATTERER, Center for Nanoscale Science and Technology NIST, JOAQUIN RODRIGUEZ NIEVA, Department of Physics, Massachusetts Institute of Technology, CYPRIAN LEWANDOWSKI, Department of Physics, Imperial College London, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, LEONID LEVITOV, Department of Physics, Massachusetts Institute of Technology, NIKOLAI ZHITENEV, JOSEPH STROSCIO, Center for Nanoscale Science and Technology NIST — Electronic states in graphene (and similar 2D materials) are susceptible to interactions with local probes; characterization of these interactions is necessary for predicting the behavior of all graphene devices incorporating local probes and interpreting the results of related experiments. Here we report the creation of resonant modes in circular *pn* junctions on graphene. Such junctions, induced by a tip, are ubiquitous in STM experiments, create states akin to whispering-gallery modes, and are quasi-localized within the *pn* junction ring. These modes yield 2 types of resonances in the tunneling spectrum: first as oscillations in the otherwise linear graphene dispersion, and second when they are pulled across the Fermi-level due to tip gating. Tunable with tip height/radius, and tip work-function, the oscillations act as fingerprints of an induced *pn* junction. We compare experimental results to theory for confined states in circular geometries, characterizing energy and spatial characteristics of these modes.

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