Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Visualization of phase-coherent electron interference in a ballistic graphene Josephson junction MONICA ALLEN, Harvard University, OLES SHTANKO, MIT, ION COSMA FULGA, Weizmann Institute, JOEL WANG, MIT, DANIYAR NURGALIEV, Harvard University, KENJI WATANABE , TAKASHI TANIGUCHI, National Institute for Materials Science, ANTON AKHMEROV, TU Delft, PABLO JARILLO-HERRERO, LEONID LEVITOV, MIT, AMIR YACOBY, Harvard University — Graphene provides an appealing platform to explore electronic analogs of optics-like effects due to the nonclassical nature of ballistic charge transport. By coupling superconductors to a ballistic graphene sheet, we explore a new regime of superconducting transport in which phase-coherent interference of electron waves is a dominant feature. We employ Fraunhofer interferometry to achieve spatial imaging of cavity modes in a graphene Fabry-Perot resonator, embedded between two superconductors to form a Josephson junction. By visualizing current flow using Fourier methods, our measurements provide evidence of separate interference conditions for bulk and edge currents and elucidate the microscopic nature of interference at the crystal boundaries. We also observe modulation of the multiple Andreev reflection amplitude on and off resonance, a direct measure of cavity transparency. These results constitute a strong departure from conventional Josephson behavior and motivate further exploration of new effects at the intersection of superconductivity and electron-optics.

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Date submitted: 05 Nov 2015 Electronic form version 1.4