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Tunneling Spectroscopy of Graphene Nanodevices Coupled to Type-II Superconductors JOEL I-JAN WANG, LANDRY BRETHEAU, DANIEL RODAN-LEGRAIN, Massachusetts Institute of Technology, USA, KENJI WATANABE , TAKASHI TANIGUCHI , National Institute for Materials Science (NIMS), Japan, PABLO JARILLO-HERRERO, Massachusetts Institute of Technology, USA — By coupling a graphene sheet to type-II superconductors, it was recently shown that the Josephson effect could persist in the quantum Hall regime. Microscopically, the supercurrent arises from the existence in graphene of electron-hole resonance states called Andreev bound states (ABS). However, the way ABS form in graphene subject to high magnetic field remains unclear. For this purpose, we have performed tunneling spectroscopy of graphene proximitized by Nb/NbN electrodes, using graphite probes and hBN tunneling barriers. The geometry of our device allows for spectroscopic and transport measurement in the same graphene flake. In the superconducting regime, Fabry–Pérot oscillation of the critical Josephson current suggests ballistic transport characteristics in the device. In the presence of magnetic field, graphene density of states (DOS) is modulated by the superconducting phase, as expected for ABS in a normal weak link. Finally, tunneling measurement performed through spurious quantum dots, presumably embedded in the heterostructures, manifests coupling between discrete energy levels and proximitized graphene DOS with evident phase dependence.

Joel I-Jan Wang
Massachusetts Institute of Technology

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