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Current-phase relation of encapsulated graphene Josephson junctions GAURAV NANDA, JUAN LUIS AGUILERA, Kavli Institute of Nanoscience, Delft, The Netherlands, PETER RAKYTA, Eötvös University, Budapest, Hungary, ANDOR KORMÁNYOS, University of Konstanz, Konstanz, Germany, REINHOLD KLEINER, DIETER KOELLE, Eberhard Karls Universität Tübingen, Tübingen, Germany, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Tsukuba, Japan, LIEVEN VANDERSYPEN, SRIJIT GOSWAMI, QuTech and Kavli Institute of Nanoscience, Delft, The Netherlands —
In the past few years there has been remarkable progress in the study of graphene-superconductor hybrids. This surge in interest has primarily been driven by the ability to combine high-quality graphene with superconductors via clean interfaces. We use such ballistic graphene Josephson junctions to create a superconducting quantum interference device (SQUID) which can be tuned continuously from a symmetric to asymmetric configuration. The symmetric SQUID produces typical flux-periodic oscillations in the critical current with a large modulation amplitude. More interestingly, we show that the highly asymmetric configuration allows one to directly obtain the current-phase relation (CPR) of these ballistic graphene JJs. The CPR is found to be skewed, deviating significantly from a sinusoidal form. The skewness can be tuned with the gate voltage and shows correlations with Fabry-Perot oscillations in the ballistic cavity. We compare our experiments with tight-binding calculations which include realistic graphene-superconductor interfaces and find a good qualitative agreement.

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