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Current-phase relation of long Josephson junction between 1D chiral Majorana modes

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Abstract:

We find current-phase relations of long Josephson junctions formed by 1D charge-neutral chiral Majorana modes. These are Fabry-Perot interferometers with spin-polarized ballistic 1D normal regions and gapless superconducting leads implemented as 3D topological insulator/superconductor/magnet hybrid structures. We propose two different setups formed by strongly and poorly transmitting contacts, where Thouless energy, given by the inverse dwell time of the junction, is smaller than the induced superconducting gap. The junctions can act as internal SQUIDs operated by magnetic flux, enclosed by a chiral loop of the normal region. We show that the critical current diffraction of the SQUID regime shows non-Fraunhofer h/e -periodic resonant patterns.