Conductance oscillations and magnetic orbital effects with chiral Majorana modes

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Topological transport in Condensed Matter systems is attracting strong interest. In particular, chiral Majorana edge modes in quantum anomalous Hall strips are presently much discussed, theoretically and experimentally. We predict fundamental conductance oscillations in a quantum-anomalous Hall 2d strip having a superconducting region of length Lx with a chiral Majorana mode. These oscillations require a finite transverse extension of the strip Ly of a few microns or less. Measuring the conductance periodicity with Lx and a fixed bias, or with bias and a fixed Lx, yields the speed of the chiral Majorana mode. The physical mechanism behind the oscillations is the interference between backscattered chiral modes from second to first interface of the NSN double junction. The interferometer effect is enhanced by the presence of side barriers. In presence of a vertical magnetic field, the magnetic orbital effect favours the existence of charged Fermionic modes of chiral edge character. These modes are compatible with the present experiments observing a 0.5 plateau in NSN junctions, although a bias dependence of such plateau is predicted.

[1] J. Osca, L. Serra, Conductance oscillations and speed of chiral Majorana mode in a quantum anomalous-Hall 2d strip, Phys. Rev. B 98, 121407(R) (2018); arXiv:1807.07713.

[2] J. Osca, L. Serra, Magnetic orbital motion and 0.5e2/h conductance of quantum-anomalous-Hall hybrid strips, Appl. Phys. Lett. 114, 133105 (2019); arXiv:1811.11622.