

Spontaneous Edge Current in Higher Chirality Superconductors

Xin Wang,¹ Zhiqiang Wang,¹ and Catherine Kallin^{1,2}

¹*Department of Physics and Astronomy, McMaster University, Hamilton, Ontario, L8S 4M1, Canada*

²*Canadian Institute for Advanced Research, Toronto, Ontario M5G 1Z8, Canada*

The effects of finite temperature, Meissner screening and surface roughness on the spontaneous edge current for higher chirality superconductors are studied in the continuum limit using the quasiclassical Eilenberger equations. We find that the total spontaneous current is non-zero at finite temperature T and maximized near $T = T_c/2$, where T_c is the transition temperature, although it vanishes at $T = 0$. In the presence of surface roughness, we observe a surface current inversion in the chiral d -wave case that can be understood in terms of a disorder induced s -wave pairing component in the rough surface regime. This conclusion is supported by a Ginzburg-Landau analysis. However, this current inversion is non-universal beyond the continuum limit as demonstrated by self-consistent lattice Bogoliubov-de Gennes calculations.