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Spontaneous Supercurrents in a Chiral p-Wave Superconductor¹

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In a chiral p-wave superconductor, spontaneous equilibrium supercurrents are expected to flow at the sample edges and at domain walls, separating the two chiralities. MuSR experiments on Sr₂RuO₄ have been interpreted as evidence for such supercurrents in the bulk and these, as well as many other experiments, are taken as evidence for chiral p-wave superconductivity in Sr₂RuO₄. However, scanning SQUID and scanning Hall bar measurements failed to see evidence for such currents and put stringent limits on the size of these currents. These currents are not topologically protected, although they are connected to the protected zero energy modes and to the macroscopic angular momentum of the chiral p-wave state. I will discuss Ginzburg-Landau and Bogliubov-de Gennes calculations which explore the conditions under which these currents can be substantially suppressed, while maintaining chiral p-wave order.

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