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Determination of counter-propagating edge modes in the $\nu = 5/2$ fractional quantum Hall state JENNIFER CANO, University of California, Santa Barbara, CHETAN NAYAK, University of California, Santa Barbara and Microsoft Station Q — Determining the wavefunction that describes the fractional quantum Hall state at $\nu = 5/2$ remains an unresolved question. Two main candidates are the Pfaffian and anti-Pfaffian states. A major difference between the two is the chirality of their neutral Majorana fermion modes, which in the former run parallel to the charged modes and in the latter, anti-parallel. We consider the recent experiment [Bid, A., et al. Nature, 466, 585-590 (2010)], in which counter-propagating, neutral edge modes in the $\nu = 5/2$ state were detected as a change in shot noise at an inter-edge quantum point contact (QPC) when current was injected at a point downstream of the QPC. We present a theoretical description of this experiment. We model the injection by coupling one edge to an external field and determine that the change in noise is incompatible with a parallel-propagating neutral mode. We also consider the injection as heat transfer to the neutral mode and reach the same conclusion. In agreement with experiment, these results are strong evidence in favor of any state with counter-propagating edge modes, such as the anti-Pfaffian, as a model for the ν =5/2 state.

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