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Quasiparticle Tunneling in the Fractional Quantum Hall effect at filling fraction ν=5/2

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In a two-dimensional electron gas (2DEG), in the fractional quantum Hall regime, the quasiparticles are predicted to have fractional charge and statistics, as well as modified Coulomb interactions. The state at filling fraction ν=5/2 is predicted by some theories to have non-abelian statistics, a property that might be exploited for topological quantum computing. However, alternative models with abelian properties have been proposed as well. Weak quasiparticle tunneling between counter-propagating edges is one of the methods that can be used to learn about the properties of the state and potentially distinguish between models describing it. We employ an electrostatically defined quantum point contact (QPC) fabricated on a high mobility GaAs/AlGaAs 2DEG to create a constriction where quasiparticles can tunnel between counter-propagating edges. We study the temperature and dc bias dependence of the tunneling conductance, while preserving the same filling fraction in the constriction and the bulk of the sample. The data show scaling of the bias-dependent tunneling over a range of temperatures, in agreement with the theory of weak quasiparticle tunneling, and we extract values for the effective charge and interaction parameter of the quasiparticles. The ranges of values obtained are consistent with those predicted by certain models describing the 5/2 state, indicating as more probable a non-abelian state. This work was done in collaboration with J. B. Miller, C. M. Marcus, M. A. Kastner, L. N. Pfeiffer and K. W. West. This work was supported in part by the Army Research Office (W911NF-05-1-0062), the Nanoscale Science and Engineering Center program of NSF (PHY-0117795), NSF (DMR-0701386), the Center for Materials Science and Engineering program of NSF (DMR-0213282) at MIT, the Microsoft Corporation Project Q, and the Center for Nanoscale Systems at Harvard University.