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Measuring Fractional Statistics with Fabry-Perot Quantum Hall Interferometers

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Laughlin quasiparticles are the elementary excitations of a highly-correlated fractional quantum Hall electron fluid. They have fractional charge and obey fractional statistics. The quasiparticles can propagate quantum-coherently in chiral edge channels, and constructively or destructively interfere. Unlike electrons, the interference condition for Laughlin quasiparticles has a non-vanishing statistical contribution that can be observed experimentally. Two kinds of interferometer devices have been realized. In the primary-filling interferometer, the entire device has filling 1/3, and the e/3 edge channel quasiparticles encircle identical e/3 island quasiparticles. Here the flux period is h/e, same as for electrons, but the back-gate charge period is e/3. In the second kind of interferometer, a lower density edge channel at filling 1/3 forms around a higher density island at filling 2/5, so that e/3 edge quasiparticles encircle e/5 island quasiparticles. Here we observe superperiodic oscillations with 5h/e flux and 2e charge periods, both corresponding to excitation of ten island quasiparticles. These periods can be understood as imposed by the anyonic braiding statistics of Laughlin quasiparticles. This work was done in collaboration with Fernando E. Camino, Ping Lin and Wei Zhou.