Signatures of non-Abelian braiding in interference measurements at =5/2 and 7/2

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Abstract

The quantum Hall states at filling factors =5/2 and 7/2 are expected to have Abelian charge e/2 quasiparticles and non-Abelian charge e/4 quasiparticles. The non-Abelian statistics of the latter has been predicted to display a striking interferometric signature, the even-odd effect. In this talk I will focus on the recent experiments measuring resistance oscillations as a function of magnetic field in Fabry-Pérot interferometers using new high purity heterostructures. I will discuss possible theoretical interpretations of the observed oscillations and will argue that these experimental findings strongly support the non-Abelian nature of charge e/4 quasiparticles in both states. Remarkably, this would be the first experimental evidence for the non-Abelian nature of excitations at =7/2. These experiments, both at =5/2 and 7/2, also provide an insight into the fermion parity, a topological quantum number of an even number of non-Abelian quasiparticles. The phase of observed e/4 oscillations is reproducible and stable over long times (hours) near both filling factors, indicating stability of the fermion parity. At both fractions, when phase fluctuations are observed, they are predominantly π phase shifts, consistent with either fermion parity change or change in the number of the enclosed e/4 quasiparticles. Taken together, these results constitute new evidence for the non-Abelian nature of e/4 quasiparticles; the observed life-time of their combined fermion parity further strengthens the case for their utility for topological quantum computation.

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