

MAR12-2011-000539

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Plasma Analogy and non-Abelian Braiding Statistics in Ising-type Quantum Hall States

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Quantum Hall systems are effectively two-dimensional and thus allow for quasiparticle excitations with exotic exchange statistics based on the braid group. These may be “anyons” with fractional statistics that lie somewhere between that of bosons and fermions, or, even more exotically, “non-Abelian anyons” with quasiparticle exchange represented by matrices. The quasiparticle statistics of candidate quantum Hall states (universality classes) is usually conjectured, but in some instances can be deduced from their representative trial wavefunctions. I will explain how this can be done for wavefunctions with a “plasma analogy” similar to Laughlin’s. Then I will construct a plasma analogy for the non-Abelian Ising-type states, e.g. the Moore-Read Pfaffian state. This provides the first complete proof of the non-Abelian braiding statistics of quasiparticles in these states, which are likely candidates to explain the observed Hall conductivity plateaus in the second Landau level, most notably the one at filling fraction $\nu = 5/2$.