MAR12-2011-009364

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

Observation of Braiding Statistics in the Fractional Quantum Hall Effect[1]

WOOWON KANG, University of Chicago

It has been postulated that the quasiparticles excitations of fractional quantum Hall (FQH) states are Abelian anyons with fractional statistical angles. More interestingly, non-Abelian anyons have been predicted for certain FQH states such as that found at filling factors $nu = 5/2$ and $12/5$. To date experimental detection of anyons and their braiding statistics in quantum interference experiments has remained controversial. In this talk I will present results from the study of Abelian and non-Abelian braiding statistics of anyons in the fractional quantum Hall (FQH) systems through Fabry-Perot interferometry. In the $\nu = 7/3$ FQHE state we confirm the anyonic braiding statistics by detecting the postulated statistical phase angle of $2\pi/3$. This result is consistent with a change of the anyon number by one. In the interference study of the $\nu = 5/2$ FQH state we observe phase slips $5\pi/4, \pi$, and $\pi/4$. These observed statistical phase slips agree with a theoretical model of braiding of Majorana modes of the $\nu = 5/2$ non-Abelian state that is strongly coupled to each other and to the edge modes of interferometer in presence of Coulomb interaction. Our results provide compelling support for the existence of non-Abelian anyons.

[1]Work performed in collaboration with Sanghun An, P. Jiang, H. Choi, S.H. Simon, L.N. Pfeiffer, K.W. West, and K.W. Baldwin; supported by Microsoft and NSF MRSEC.