PSF14-2014-020012

Abstract for an Invited Paper
for the PSF14 Meeting of
the American Physical Society

Fractional Quantum Hall Effect in the Second Landau Level

ASHWANI KUMAR, Monmouth College

A magnetic field applied perpendicular to the plan of a two-dimensional electron gas (2DEG) resolves the energy spectrum into discrete Landau levels. At low temperatures strong electron-electron interactions lead to the condensation of the 2DEG into the quantum fluid ground state responsible for the fractional quantum Hall effect (FQHE) and other exotic states. The nature of the FQHE states in lowest Landau level can be understood using conventional Laughlin-Jain theory. However the nature of FQHE states forming in second landau level (SLL) remains unknown. Our recent measurements of energy gap in SLL further raise the possibility of the non-conventional origin of these states. In this presentation I will talk about the transport studies of the newly established FQHE state at the Landau level filling factor $\nu = 3 + 1/3$. This and other odd-denominator states in SLL unexpectedly break particle-hole symmetry. Specifically, we find that the relative magnitudes of the energy gaps of the $\nu = 3 + 1/3$ and $3 + 1/5$ states from the upper spin branch are reversed when compared to the $\nu = 2 + 1/3$ and $2 + 1/5$ counterpart states in the lower spin branch. Our findings raise the possibility that the former states have a non-conventional origin.

In collaboration with Ethan Kleinbaum, Purdue University; L.N. Pfeiffer, Princeton University; K.W. West, Princeton University; and Gabor Csathy, Purdue University.