Dirac Composite Fermions in the Half-filled Landau Level

Roger Mong

Department of Physics and Astronomy, University of Pittsburgh, United States

***Email of Presenting Author: rmong@pitt.edu**

One of the most spectacular experimental findings in the fractional quantum Hall effect is evidence for an emergent Fermi surface when the electron density is nearly half the density of magnetic flux quanta ($\nu = 1/2$). The seminal work of Halperin, Lee, and Read (HLR) attributed this to the formation of composite fermions, bound states of an electron and a pair of vortices. We use infinite cylinder DMRG to provide compelling numerical evidence for the existence of a Fermi sea of composite fermions for realistic interactions between electrons at $\nu = 1/2$. Moreover, we show that the phase is particle-hole symmetric, in contrast to the theory of HLR. Instead, our findings are consistent if the composite fermions are massless Dirac particles, at finite density, similar to the surface state of a 3D topological insulator.