Name: Ajit C. Balram

Title: Towards a unified description of the quantum Hall effects

Abstract: The fractional quantum Hall effect (FQHE) forms a paradigm in our understanding of strongly correlated systems. A majority of the FQHE phenomena in the lowest Landau level (LLL) are understood in a unified manner in terms of weakly-interacting composite fermions, which are bound states of electrons and vortices. The most prominent states in the LLL are understood as integer quantum Hall states of composite fermions and the compressible state at 1/2 as a Fermi liquid of composite fermions. For the FQHE in the second LL, such a unified description has been lacking: experimentally observed states are described by different physical mechanisms. In this talk, I will demonstrate that a unified understanding of states in the second LL can be obtained using the ``parton" theory which generalizes the idea of composite fermion. I will elucidate our recent work on the parton construction of wave functions to describe all of the FQH states observed in the second LL. Our work suggests that the parton theory provides a unified description of the quantum Hall effects.