G J Sreejith
ISSER Pune

Title: Composite fermions: wavefunctions, numerical strategies, and some results on inverse problems

Abstract:
In this talk, I introduce how lowest Landau level fractional quantum Hall (LLL-FQH) states can be understood as the integer quantum Hall states of weakly interacting composite fermions in an effective magnetic field. Their wave functions closely approximate the Coulomb eigenstates but in general are not exact eigenstates of any known local Hamiltonians. This motivates an interesting inverse problem that can be partly solved using properties of symmetric polynomials, but nevertheless remains intractable. Motivated by the structure of these functions, we construct a model Hamiltonian for strongly interacting fermions at filling fractions in the limit where the interaction is strong compared to the cyclotron energy. The Hamiltonian produces the same low energy quantum numbers as the composite fermions wavefunctions describing LLL-FQH states while allowing exact formal solutions to ground states, quasihole, quasiparticle and neutral excitations at arbitrary filling fractions of the form n/(2pn+1). We present results in the spherical, torus and cylindrical geometries to demonstrate the one-to-one correspondence with the non interacting fermions in an effective magnetic field. We also show numerical results from exact denationalisation, Monte Carlo and iDMRG studies testing the adiabatic connection with Coulomb physics, quasiparticle Berry phase, entanglement spectrum and charge. We then extend the strategy to obtain similar exactly solvable versions for quasiparticles of the Pfaffian.