Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Colloquium

Manipulating the Fermi Surface of Composite Fermions

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The rich phase diagram of electrons in two-dimensions subject to a strong perpendicular magnetic field changed the very lexicon of condensed matter physics. It revealed the existence of exotic phenomena such as charge fractionalisation, Abelian and non-Abelian quantum states and topological spin excitations. Phases in this quantum Hall regime are most easily understood in terms of "composite" fermions – electrons tied to an even number of magnetic flux quanta.

Most quantum Hall phases are characterised by the presence of a gap in their excitation spectrum, like insulators or superconductors. However, for specific combinations of electron density and magnetic field, a gapless "Fermi-liquid-like" state is observed, akin to metals.

After briefly reviewing the quantum Hall phase diagram, we concentrate on this gapless phase obtained for a half-filled Landau level and explore the nature of its Fermi surface. We show how the Fermi surface of this phase is very different than that of conventional metals with weak electron-electron interactions. We explore the relationship between the Fermi surface of the electron gas at zero field and that of composite fermions. The answers we obtain, using a combination of analytic and numerical methods, are both surprising and amenable to a parameter free experimental test.

Monday, Jan 15th 2024

16:00 Hrs (Tea / Coffee 15:45 Hrs)

Auditorium, TIFR-H