Plenary Talk PV IV Tue 8:30 HSZ 01

Quantum Hall Phases "seen" as Quantum Liquids — •Aron Pinczuk, T.D. Rhone, J. Yan, Y. Gallais, J. Groshaus, I. Dujovne, C. Hirjibehedin, L.N. Pfeiffer, and K.W. West — Dept. of Appl. Physics & Appl. Mathematics and Dept. of Physics, Columbia University, New York, NY

Electron fluids in semiconductor quantum structures support remarkable quantum phases that emerge from fundamental interactions in two-dimensions. The benchmark semiconductor system is that of the well-known ultra-high mobility 2D electron gas in GaAs-AlGaAs heterostructures. Atomic layers of graphene with linear dispersion of the electron bands and density tunable by electric field doping are of enormous current interest.

Inelastic light scattering methods at very low temperatures (reaching below 50 milliKelvin degrees) are experimental venues to study excitations of electron fluids in the low dimensional systems. The light scattering experiments access directly low-lying "quasiparticle" excitation modes that take the fluids above its ground states and that express key properties of emergent quantum phases.

This talk presents a brief introduction to inelastic light scattering methods for studies of exotic quantum phases in quantum Hall regimes. These results are examples that demonstrate the power of light scattering experiments to study the low-lying excitations. These are the excitations that express quantum phases of the electron liquids. The measurements of these modes uncover key insights on the physics of interactions that drive the emergence of novel quantum phases.

Recent inelastic light scattering studies explore excitations of the quantum Hall fluids that reside in the second Landau level at filling factors such as ν=5/2 and ν=7/3. The quantum Hall fluids in higher Landau levels are of great current interest for applications in topologically protected quantum computations. The recent light scattering results will be evaluated to show how these experiments directly reveal properties not currently accessible by other methods, and seek to elucidate the interplay among competing non-quantum-Hall phases that occur in higher Landau levels. [1]

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[1] T.D. Rhone, J. Yan, Y. Gallais, A. Pinczuk, L.N. Pfeiffer, K.W. West, work in progress.