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Measurements of Composite Fermion Geometric Resonance[1]

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There has been a surge of recent interest in the physics of interacting, two-dimensional (2D) electrons in a large perpendicular magnetic field when they occupy a half-filled Landau level. The long ago proposed composite fermion (CF) picture, in which two magnetic flux quanta are bound to each electron to form a CF, explains many properties of the system. These include the compressible (metallic) behavior of the 2D system at filling factor $\nu = 1/2$, the existence of a Fermi contour with a well-defined Fermi wave vector, and the presence of fractional quantum Hall states as the filling deviates from $\nu = 1/2$ In this talk, I will highlight the results of several recent experiments that probe the presence and properties of CFs via measuring the geometric resonance of CFs' cyclotron orbit diameter with the period of an imposed, unidirectional density modulation. The data reveal several important aspects: (1) An unexpected *asymmetry* of the CFs' Fermi wave vector for filling factors smaller and larger than $\nu = 1/2$, suggesting a subtle breaking of particle-hole symmetry. (2) *Anisotropic* Fermi contours for CFs that can be tuned by applying in-plane magnetic field or in-plane strain. (3) The intriguing presence and behavior of CFs on the *flanks of bilayer quantum Hall states* at filling factors $\nu = 1$ and $1/2$, presumably the Ψ_{111} and Ψ_{333} states. Surprisingly, near $\nu = 1$, the geometric resonance features are consistent with half the total electron density in the bilayer system, implying that CFs prefer to stay in separate layers and exhibit a two-component behavior. In contrast, close to $\nu = 1/2$, CFs appear single-layer-like (single-component) as their resonance features correspond to the total density. (Work done in collaboration with M.A. Mueed, D. Kamburov, I. Jo, Yang Liu, H. Deng, Md. Shafayat Hossain, L.N. Pfeiffer, K.W. West, and K.W. Baldwin.

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