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Experimental Observations of Particle-hole Asymmetry for Composite Fermions[1]

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In this talk, I will present our experimental study of the breaking of particle-hole symmetry for composite fermions (CFs), quasi-particles formed by attaching two flux quanta to each electron at large perpendicular magnetic fields. We measure the Fermi contour of the spin-polarized CFs near $\nu = 1/2$ via commensurability oscillations, and find an asymmetry of the Fermi wave vector for $\nu < 1/2$ and $> 1/2$. In particular, we find that the deduced wave vector is smaller for $\nu > 1/2$ compared to $\nu < 1/2$, and on both sides consistent with the density of minority carriers in the lowest Landau level. We also study the spin-polarization transitions of fractional quantum Hall states near $\nu = 3/2$ and $1/2$; these states are particle-hole conjugates of each other and are expected to have the same polarization energies. Our systematic results clearly show the transition energies are about three times larger for states near $\nu = 3/2$ compared to those near $\nu = 1/2$. Work done in collaboration with D. Kamburov, M. A. Mueed, S. Hasdemir, A. Wojs, J.K. Jain, L.N. Pfeiffer, K.W. West, K.W. Baldwin, and M. Shayegan.

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