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Mapping Fermi contours of 2D holes and hole-flux composite fermions

M. Shayegan and L. Pfeiffer (IRG-1)
Princeton University

A fundamental question in the physics of interacting two-dimensional (2D) electron systems is the role of anisotropy. The IRG-1 study measured the Fermi contours of 2D holes, and composite fermions (CFs), exotic quasiparticles consisting of one hole (fermion) and two flux quanta. These quasiparticles form near the half-filled Landau level and can elegantly describe the fractional quantum Hall effect. Of particular interest is whether or not the anisotropy of the fermions is transferred to the CFs.

Via applying uniaxial strain to the sample, the team tuned the Fermi contour shape, and determined its anisotropy for both the zero-field 2D holes and the high-field CFs through geometric resonance measurements. The results, summarized in Fig. 1, demonstrate that the anisotropy is indeed transferred to the CFs, but it is reduced by a square-root relation: $\alpha_{CF} = \alpha_F^{1/2}$. This remarkable, yet simple relation has been now confirmed in numerical calculations.

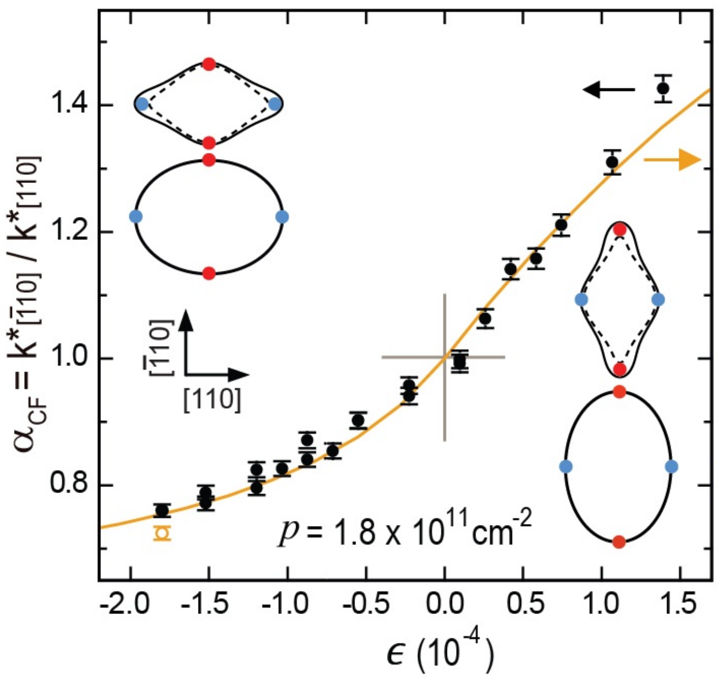

Fig. 1 Measured Fermi contour anisotropy (α), defined as the ratio of the Fermi wave vectors along the two principal crystal direction, for 2D holes (α_F, right scale) and composite fermions (α_{CF}, left scale), demonstrating that $\alpha_{CF} = \alpha_F^{1/2}$. The insets show the deduced Fermi contours.

References:

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