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Composite fermion valley polarization energies: Evidence for particle-hole asymmetry MEDINI PADMANABHAN, TAYFUN GOKMEN, MANSOUR SHAYEGAN, Princeton University — In an ideal two-component two-dimensional electron system, particle-hole symmetry dictates that the fractional quantum Hall (FQH) states around nu = 1/2 are equivalent to those around nu = 3/2. We demonstrate that composite fermions (CFs) around nu = 1/2 in AlAs possess a valley degree of freedom like their counterparts around nu = 3/2. We valley polarize these CFs by applying an in-plane uniaxial strain. Normalized to the Coulomb energy, the energies required to completely valley-polarize the CFs around nu = 1/2 and 3/2 should be identical. Surprisingly, we find that it takes much less energy to completely valley polarize the CFs around nu = 1/2 compared to the CFs around 3/2. We investigate the FQH states at nu = 2/3 and 4/3 for a wide range of 2D electron density and conclude that particle-hole symmetry is violated in our system.

Medini Padmanabhan
Princeton University

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