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How free are composite fermions? An inelastic light scattering perpective.

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The presentation is focused on the study of spin excitations in the regime of the Fractional Quantum Hall Effect (FQHE) to probe composite fermion interactions. The spin excitations are observed by inelastic light scattering methods. The composite fermion picture is appealing because the FQHE of strongly interacting electrons in 2D becomes the Integer Quantum Hall Effect of nearly-free composite fermions. Recent inelastic light scattering experiments show that the study of spin excitations of composite fermion quasiparticles offers unique venues to address the question: how free are composite fermions? Our experiments are conducted in the filling factor range 2/7¡ν¡2/5. We measured low energy spin-flip excitations of composite fermions in which orientation of spin and composite fermion Landau level quantum number change simultaneously. The filling factor dependence of the spin-flip excitation intensity displays a striking non-monotonic behavior as the occupation of composite fermion Landau levels are changed. This occurs when the filling factor moves above and below $\nu = 1/3$. We find remarkable behaviors that are attributed to the strong impact of residual composite fermion interactions. The breakdown of the non-interacting composite fermion picture seen in our experiments seems to manifest quasiparticle condensations that in magneto-transport experiments are interpreted as the FQHE of composite fermions. (*) The work was done in collaboration with Jun Yan, T.H. Kirschenmann, C.F. Hirjibehedin, I. Dujovne, A. Pinczuk , B.S. Dennis, L.N. Pfeiffer and K.W. West.