MAR17-2016-020012

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Spin-dependent tunneling and particle-hole symmetry breaking in 2D electron systems in the fractional quantum Hall regime

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At high magnetic field the tunneling rate between two parallel two-dimensional electron systems is profoundly influenced by both inter- and intra-layer electron-electron interactions. In addition to a pronounced pseudo-gap at the Fermi level, the tunneling current-voltage characteristics vividly expose the broadening of the Landau levels due to these interactions. In this talk I will discuss recent tunneling experiments which are sensitive to the spin configuration of the 2D electron systems. In particular, a new technique, based on density-imbalanced bilayer 2D systems, has been developed which allows for a spin-selective study of the underlying electronic spectral functions in the two layers. This technique provides an estimate of the net spin polarization of the 2D systems at filling factors 5/2 and 7/2 in the first excited Landau level, and sheds new light on the breakdown of particle-hole symmetry between filling factors 1/2 and 3/2 in the ground Landau level. This work represents a collaboration with L.N. Pfeiffer and K.W. West and was supported, in part, by the Institute for Quantum Information and Matter, an NSF Physics Frontiers Center with support of the Gordon and Betty Moore Foundation through Grant No. GBMF1250.