P-A-50

Quantum Transport Study of Canted Antiferromagnet Phase in ν = 2 Bilayer Quantum Hall State

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The ν = 2 bilayer quantum Hall (QH) state is clean two dimensional electron systems (2DESs) to study effects of not only layer degree of freedom called 'pseudospin' but also 'real' spin degree of freedom. In the one-body picture, due to the competition between the Zeeman energy and the interlayer tunneling energy Δ_{SAS}, two phases are realized: one is the spin-singlet and pseudospin-ferromagnet phase called 'singlet phase' (S phase) and the other is the spin-ferromagnet and pseudospin-singlet phase called 'ferromagnet phase' (F phase). However, the novel canted antiferromagnetic phase (CAF phase) has been predicted, as results in from subtle many-body electron interactions between the S and F phases. Though the inelastic light scattering experiments and the capacitive measurements indicates an onset of the CAF phase, no systematic transport study has been demonstrated yet. We have carried out a magnetotransport measurement of the ν = 2 bilayer QH state using the sample with Δ_{SAS}=11 K. Activation energy was elaborately measured as a function of the total density n_T of 2DES and the density difference between the two layers. The activation energy increases, then decreases and finally steeply increases as n_T increases at the density balanced point. We interpret this as the appearance of the CAF phase between the S and F phases. The stability of the CAF phase against the density imbalance was also investigated. We make a comparison between experiments (including this and our previous resullts) and theoretical works.