OR 77 SPIN POLARIZATION OF FRACTIONAL QUANTUM HALL STATES

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V. Kukushkin, K. von Klitzing and K. Eberl have measured the electron spin polarization versus magnetic field for the fractional quantum Hall states. The results show very interesting properties. The curve of the polarization versus magnetic field strength has wide plateaus and small shoulders. The fractional quantum Hall effect is caused by the Coulomb interaction because the 2D electron system without the Coulomb interaction does not yield the fractional quantum Hall effect. Therefore the wide plateaus and small shoulders in the polarization curve are also caused by the Coulomb interaction. When the magnetic field is weak, some electrons have up-spins and the others down-spins. Then there are many spin-arrangements in the Landau orbitals. The Coulomb interaction between spin up and down electrons yields the quantum transition constructed by the spin exchange between Landau states. The charge distribution before the transition is the same as one after the transition. Therefore the partial Hamiltonian composed of the spin exchange interaction should be treated exactly. We have succeeded in diagonalizing the spin exchange Hamiltonian for the first and second nearest electron pairs. Furthermore the calculation results of the total energy show the Peierls instability. The exact diagonalization of the partial Hamiltonian reproduces the wide plateaus and small shoulders which are in good agreement with the experimental data.