Anisotropic Magnetotransport Near The Bilayer $\nu = 2/3$ Quantum Hall State

Masayuki Morino[a], Kazuki Iwata[a], Michiro Suzuki[a], Akira Fukuda[b], Anju Sawada[b], Zyun F. Ezawa[a], Norio Kumada[c], and Yoshiro Hirayama[c]

[a]Department of Physics, Graduate School of Science, Tohoku University, Sendai 980-8578, Japan
[b]Research Center for Low Temperature and Materials Science, Kyoto University, Kyoto 606-8502, Japan
[c]NTT Basic Research Laboratories, NTT Corporation, Atsugi 243-0198, Japan

We report experimental results on an anisotropic magnetotransport of a bilayer system with a tunneling gap $\Delta_{\mathrm{SAS}} = 11\,\mathrm{K}$ under tilted magnetic field near $\nu = 2/3$. We have found that the magnetoresistance of the system exhibits a huge variation when the direction of applied in-plane field is changed. For lower tilting angle, the resistance with a current parallel to the in-plane field exceeds the one with a current perpendicular to the field. As the tilting angle is increased, however, the difference between the two resistances vanishes. To investigate the phenomenon more in details, we have also studied the relation between the anisotropy and the quantum phase transition induced by an in-plane field. It is known that there are two ground states at the $\nu = 2/3$ bilayer quantum Hall state. For weaker in-plane field, the state is "pseudospin polarized state", where the electron tunneling between the layers is allowed. On the contrary, for stronger field, the state is "pseudospin unpolarized state", where the tunneling is forbidden. We have revealed the existence of the anisotropy in the former state. On the other hand, this anisotropy is absent in the latter state. These results imply that the anisotropy is essentially related to the electron tunneling between two layers. We shall also explain a conceivable mechanism of the anisotropy.

Sorting category: Db Conducting electrons in condensed matter

Keywords: quantum Hall state, tilted magnetic fields, magnetoresistance, bilayer systems

LT1059