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Stability of Soliton Lattice phase in the ν = 1 Bilayer Quantum Hall State under Tilted Magnetic Fields

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The bilayer quantum Hall (QH) state at the total Landau level filling factor ν = 1 shows various fascinating quantum phenomena due to the layer degree of freedom called "pseudospin". We report an experimental evidence of the soliton lattice (SL) phase, which is a domain structure of pseudospin, by the appearance of a local maximum of magnetoresistance near the ν = 1 QH state. This phase is related to the commensurate (C) - incommensurate (IC) transition at ν = 1, which occurs in association with the change in the pseudospin symmetry induced by the in-plane magnetic field $B_{//}$. We investigate the stability of the SL phase by changing $B_{//}$ and the total electron density n_T. Detailed magnetotoransport measurements under tilted magnetic fields were carried out to obtain a $B_{//}$ - n_T plane phase diagram containing the C, IC and SL phases. The sample having the tunneling energy Δ_{SAS}=11K was used in this experiment. We found SL phase is only stable at low n_T region. Namely, the C-SL-IC phase transition occurs only at low n_T region as $B_{//}$ increases. On the contrary, the C-IC phase transition directly occurs without passing through the SL phase at high n_T region. A comparison between this experiment and the theoretical prediction is made.