# Anomalous electric transport induced by dynamic nuclear polarization in the vicinity of ν=2/3 quantum Hall state

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Quantum Hall effects at filling factor ν = 2/3 is known to show a huge magnetoresistance $R_{xx}$ [1] accompanying with hysteresis due to the degeneracy between different spin states, spin polarized (SP) state and spin unpolarized (SU) state. The Hyperfine coupling of electron spins and nuclear spins in the host material dynamically changes the nuclear spin polarization, and the $R_{xx}$ proportionally changes the value with regard to the dynamical nuclear spin polarization (DNP) [2]. We report that the increased resistance state, which is induced by a large current (~60 nA), shows the temperature dependence that is indicative of the Anderson insulator as the underlying cause [3]. Here we present the experimental results of the electric transport measurement before and after DNP that is induced at the points different from the exact ν = 2/3 point.

The sample that we use in this study is GaAs/AlGaAs heterojunctions grown by molecular beam epitaxy in NTT basic research laboratories. The sample has two conducting layers, however we use only one layer (monolayer experiment). The low temperature mobility is approximately 2 x $10^6$ $cm^2$/Vs. Figure 1 shows the $R_{xx}$ and $R_{xy}$ before and after DNP as a function of the inverse of ν (1/ν). The values before DNP are obtained by the fast sweep of the density with regard to the constant magnetic field $B$ = 7.1 T and the measuring current $I_m$ of 5 nA. The values after DNP are obtained after 3000 s DNP at 1/ν=1.55 (indicated by a dash-and-dot line) with the nuclear spin pumping current $I_p$ of 60 nA and $I_m$ of 5 nA by sweeping 1/ν toward the increasing direction. This sweep is done before the DNP is relaxed to equilibrium, and is confirmed that there is only a small hysteresis between the directions of the sweeps. $R_{xx}$ before DNP has three minima corresponding to ν=2/3 SU state, ν=2/3 SP state, and ν=3/5 state, respectively. We find that $R_{xx}$ after DNP changes its $I_m$ dependence for 1/ν < 1.5 and for 1/ν > 1.5. We also notice that $R_{xy}$ after DNP deviates upward for 1/ν > 1.5 from the quantized value of $3h/(2e^2)$, where $h$ denotes Planck's constant and $e$ denotes the elementary charge, and makes another plateau. Interestingly, this deviation in $R_{xy}$ becomes opposite and $I_m$ dependence of $R_{xx}$ changes its behavior when the position of DNP is 1/ν < 1.5 (not shown here). We further show the DNP time dependence of $R_{xx}$ and $R_{xy}$ and discuss the relation with regard to the amount of $B_N$ and the SU-SP transition point in the conference.

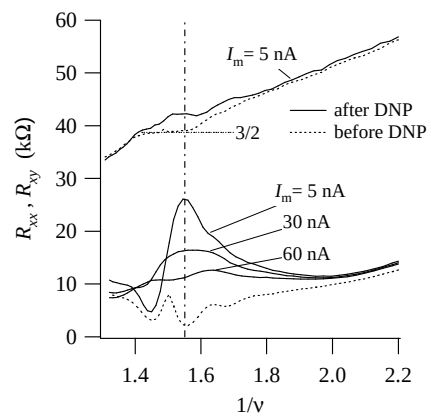


Figure 1 $R_{xx}$ and $R_{xy}$ before DNP and after DNP as a function of 1/ν. Note that the measurement method is different between before and after DNP (see text).

[1] S. Kronmüller, *et al*., Phys. Rev. Lett., **81** 2526 (1998)
[2] K. Hashimoto, *et al*., Phys. Rev. Lett., **88**, 176601 (2002).
[3] S. Tsuda, *et al*., to be presented in EP2DS-20.