Pulsed-NMR studies of Two-dimensional ^{3}He near Localization

D. Sato, K. Mukai, S. Murakawa, D. Tsuji, H. Kambara, and Hiroshi Fukuyama

Dept. of Physics, The Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

^{3}He monolayer adsorbed on graphite substrate preplated with a monolayer of ^{4}He is the ideal realization of strongly correlated two-dimensional (2D) Fermions. Our recent cw-NMR [1] and heat capacity [2] measurements revealed that this simple 2D Fermion system has at least four distinct quantum regions (or states) with remarkably interesting properties depending on density (ρ). The pulsed-NMR method can provide useful information on spin dynamics such as the spin-spin (T_2) and spin-lattice relaxation (T_1) times and the diffusion constant without being affected by magnetic field inhomogeneities. Here we report preliminary results of pulsed NMR measurements of 2D ^{3}He at densities near the Mott localization to the registered 4/7 phase. T_2 measured by the spin-echo method at 100 mK increases as we increase ρ towards that for the 4/7 phase ($\rho_{4/7}$), and decreases rapidly at ρ just above $\rho_{4/7}$. This indicates decreasing motional narrowing near localization and its sudden increase due to the third layer promotion at $\rho > \rho_{4/7}$. The temperature dependence of T_2 has also been determined more reliably than the previous cw-NMR measurements [1]. It is almost T-independent in a wide rage of $100 \leq T \leq 800$ mK, and shortens at lower T down to 1 mK. We also report an unusual T_1 process observed in the 4/7 phase whose magnetic ground state is considered to be the gapless spin liquid [3].

[1] S. Murakawa *et al*., Proceedings of the 24th International Conference on Low Temperature Physics (LT24), AIP Conference Proceedings **850** (2006), *in press*.
[2] Y. Matsumoto *et al*., J. Low Temp. Phys. **138**, 271 (2005).
[3] K. Ishida *et al*., Phys. Rev. Lett. **79**, 3451 (1997).