Effect of Pressure on Conductive Anion-Radical Salt, (DMe-DCNQI)$_2$Cu

Y. Ishii$^1$, I. Watanabe$^1$, T. Suzuki$^1$, T. Kawamata$^1$, T. Matsuzaki$^1$ and R. Kato$^2$

$^1$Advanced Meson Science Laboratory, RIKEN Nishina Center, 2-1 Hirosawa, Wako, Saitama 351-0198 Japan.

$^2$Condensed Molecular Materials Laboratory, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198 Japan.

A series of anion radical salts, (DCNQI)$_2$Cu, where DCNQI is $N,N$-dicyanoquinonediimine, have been extensively investigated because of their peculiar physical phenomena such as heavy-fermion-like behavior and the Metal-Insulator transition [1]. The hybridization between the wide 1D $2p_z$ bands and the narrow $3d$ bands is a key factor in understanding electronic properties of these systems.

One of these salts, (DMe-DCNQI)$_2$Cu, has an unusual pressure-temperature ($P-T$) phase diagram (Fig. 1). At ambient pressure, this material shows metallic behavior down to 450 mK. Peculiar to (DMe-DCNQI)$_2$Cu, an insulating phase is induced by the application of pressure higher than 100 bar [2]. This unusual $P-T$ phase diagram can be reproduced by the chemical pressure effect using selectively deuterated compounds [3]. The fully deuterated sample of (DMe-DCNQI)$_2$Cu, in which the chemical pressure corresponds to 512 bar, exhibits the antiferromagnetic ordering below 8 K [4].

Recently, we have developed a high-pressure $\mu$SR setup for the RIKEN-RAL Muon Facility and successfully observed a sign of magnetic ordering of (DMe-DCNQI)$_2$Cu under 500 bar by means of the high-pressure setup. In this presentation, we will show the experimental results of high-pressure $\mu$SR measurements for (DMe-DCNQI)$_2$Cu.

Fig.1: P-T phase diagram for (DMe-DCNQI)$_2$Cu.