Field-Induced Magnetism in Cuprate Superconductor $Ca_{2-x}Na_xCuO_2Cl_2$

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Field-induced magnetism (FIM) in the mixed state of high-T_c cuprates has been drawing much interest, as it may serve for screening proper theoretical scenario of high-T_c. While the t-J model predicts precipitation of antiferromagnetic phase in vortex cores, appearance of uniform magnetism may be anticipated in the models based on quantum criticality. In this regard, FIM in $La_{2-x}Sr_xCuO_4$ (LSCO) has been regarded as a rather exceptional case because of the strong stripe correlation and its potential pinning by buckling of CuO_2 planes.

$Ca_{2-x}Na_xCuO_2Cl_2$ (Na-CCOC) has a crystal structure common to LSCO, where the buckling of CuO_2 is removed by replacement of apical oxygen to chlorine. We have performed transverse field μSR measurements in optimal doped Na-CCOC ($T_c \sim 28$ K) to elucidate microscopic property of FIM in this compound.

As shown in Fig. 1, muon spin relaxation rate Λ decreases with increasing field below 0.5 T, and it increases with decreasing temperature below T_c at 50 mT. These observations are consistent with the formation of normal vortices and associated inhomogeneous field distribution reflected in Λ. Meanwhile, Λ exhibits turnover at 0.5 T and increases in a fashion $\propto H^{1/2}$, clearly indicating the occurrence of FIM. Moreover, it turns out that this FIM develops already at $\sim$40 K that is higher than T_c. We will report the magnetic field and temperature dependence of Λ in more detail.

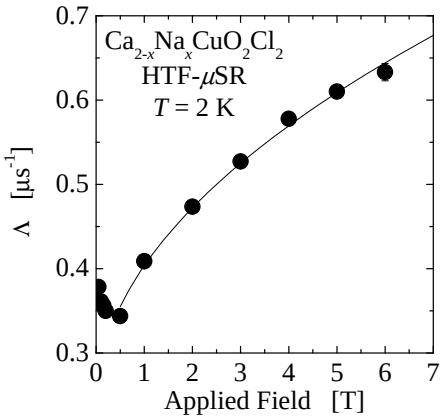

Fig. 1: Muon spin relaxation rate versus external magnetic field at 2 K.

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