MAGNETISM AND MUON SITE IN CeAs

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Cerium and Ytterbium monopnictides have drawn much attention and inspired a lot of experimental and theoretical work because they show complex magnetic phase diagrams [1] and exhibit unusual transport properties [2]. CeAs orders antiferromagnetically below *ca.* 7.5 K. From neutron diffraction experiments an AF-I single-$\vec{k}$ or triple-$\vec{k}$ structure has been concluded [3]. μSR experiments on a polycrystalline sample revealed a damping increase below 9 K and the onset of a spontaneous precessing signal fraction below 7.4 K with a low temperature saturation frequency corresponding to a local field of $\approx$ 0.18 T [4]. Assuming the most probable tetrahedrally coordinated muon site which has been successfully used in all other μSR work on Cerium and Uranium monopnictides [5], the occurrence of this signal cannot be understood since dipolar field calculations for this site cancel for the single-$\vec{k}$ and triple-$\vec{k}$ structures and the Fermi contact field will vanish from symmetry considerations also. To clarify this problem we started μSR experiments on a CeAs single crystal.

So far we have carried out zero field (ZF) and longitudinal field (LF) μSR between 3.3 and 12 K to confirm the precession signal. To deduce the spatial orientation of the local field we chose different experimental geometries (with the initial muon spin polarisation and the LF field parallel <100> and <110>). In the present experiments we found a rotating signal with $\approx$ 75% of the full sample amplitude in the magnetically ordered state below a transition temperature of 6.8 K. The frequency shows a temperature dependence typical for a second order transition with an estimated saturation value of $\approx$ 25 MHz or 0.18 T magnetic field strength below 2 K. (Fig. 1). The relaxation rate of this signal is $\approx 8\,\mu s^{-1}$. This signal could be decoupled completely with 6 kG longitudinal external field. Taking into account the formation of different magnetic domains the full sample signal corresponds to a site with a well defined static magnetic field at the muon site.

The relative enhancement of the relaxation rate caused by the longitudinal field is much stronger for the <110> orientation than for the <100> orientation. Analysing the vectorial superposition of the internal and external magnetic fields this behaviour suggests a <100> orientation of the magnetic field at the muon site. For a final determination similar experiments in <111> orientation are necessary.

The knowledge of the local field orientation together with measurements of the angular dependence of the paramagnetic Knight shift which are planned for the next round should clarify the muon site and the magnetic spin structure in this system.

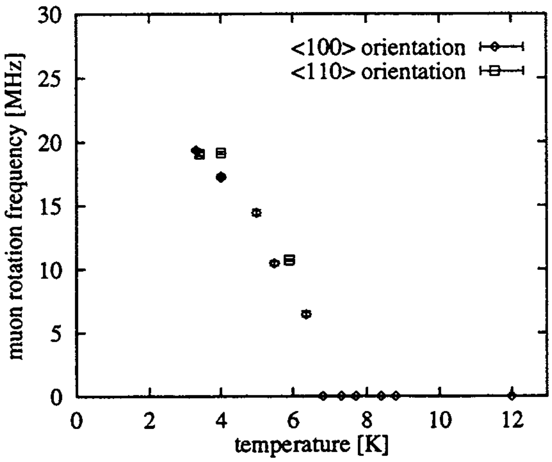

Figure 1: Temperature dependence of the spontaneous rotation frequency in CeAs.

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