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A MUON SPIN ROTATION INVESTIGATION OF THE MAGNETIC STRUCTURE OF $CeRh_2Si_2$

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The muon spin rotation (μSR) technique makes use of a short-lived subatomic particle called muon, a spin-1/2 particle. Spin polarized muon beams can be prepared and subsequently implanted in various types of matter. The muons precess around the local magnetic field and then disintegrate preferentially in the direction pointed by their spins. Therefore muons can be used to investigate a variety of static and dynamic magnetic effects and hence to deduce properties concerning magnetism, superconductivity and molecular dynamics. The use of muons in condensed matter physics has shed new light on subjects as diverse as passivation in semiconductors, frustrated spin systems, vortex lattice melting, phase separation and phase coexistence in magnetic materials.

In general, μSR gives information that is complementary to that provided by other well-recognized techniques such as neutron scattering, ESR and NMR. The μSR technique has a unique time window for the study of magnetic fluctuations in materials that is complementary to other experimental techniques like those mentioned above.

We have used the muon spin rotation (μSR) method to investigate the magnetic properties of $CeRh_2Si_2$. $CeRh_2Si_2$ crystallizes in a body-centred tetragonal structure of $ThCr_2Si_2$ type (space group *I4/mmm*). It is an antiferromagnet with two magnetic transitions, at 36 K (T_{N1}) and 25 K (T_{N2}). The magnetic structure of $CeRh_2Si_2$ below T_{N2} is still ambiguous. From neutron diffraction experiments done by GRIER et al. (1984) and KAWARAZAKI et al. (1995), the magnetic structure is a modulated structure described by two ***k*** vectors, ***k1*** and ***k2***, which reflect either a multidomain structure or a multi-q structure. KAWARAZAKI et al. (2000), from another neutron diffraction experiment reported a 4-***k*** structure. We have performed μSR experiments to confirm/deny the proposed magnetic structures. Below T_{N2} we observed a slowly depolarized oscillating component superposed over two Kubo Lorentz depolarisation functions. This indicates that there are several magnetically inequivalent muon-stopping sites. The 4-***k*** structure predicts two magnetic inequivalent sites, one with zero field and one with finite magnetic field which should be detected in a μSR experiment as a flat component and an oscillating one respectively. By performing computer simulations we have tried to associate the depolarisation functions with imperfections of the magnetic (4-***k***) structure: tilted magnetic moments, missing magnetic ions, but this explains only partially the depolarisation rates observed in the μSR experiments.

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