# Using Field-dependent $\mu$SR to Study a Metamagnet

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Studies of magnetically ordered materials using implanted muons usually focus on the behaviour of the muon polarisation in zero applied magnetic field, where precession signals reflect the internal field due to the onset of magnetic order. In systems such as metamagnets where the magnetic structure is modified under applied fields, the behaviour of the $\mu$SR signal as a function of field also has the potential to provide a local probe of the changes taking place in the magnetic structure. In order to aid such investigations, quantitative analytical expressions for the polycrystalline averaged muon polarisation components in an unperturbed spin structure have been set out [1], which may be used as a reference baseline to detect departures resulting from changes in the magnetic structure in response to the applied field.

This approach has been applied to the analysis of a metamagnetic transition in a molecular magnet consisting of bilayers of $[W(CN)_8]^{3-}$ and $Cu^{2+}$ [2]. In the magnetically ordered state a spontaneous precession signal was found containing two main components and the temperature dependence of the characteristic internal fields was followed up to the critical temperature. Experiments performed in longitudinal magnetic field demonstrate clearly a spin-flip phenomenon associated with the weak inter-bilayer coupling, that takes place in the magnetic field region below 100 G. The muon precession signals measured in the vicinity of this transition provide detailed local information about the corresponding rearrangements of the spin structure.

[1] F.L. Pratt, J. Phys.:Condens. Matter 19 (2007) 456207.
[2] F.L. Pratt *et al*, J. Phys.:Condens. Matter 19 (2007) 456208.