Microscopic description of the second moment of the field distribution in magnets and in the mixed phase of superconductors

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The common wisdom tells us that the observation of an oscillating μSR polarisation function as a compound is cooled down in zero field, is a signature of the occurrence of a long-range magnetic phase transition. However, no quantitative information as to the spatial extension of the magnetic order has ever been provided. In contrast this information is available from diffraction techniques which gauge the extension of the coherence of a structure through the coherence (correlation) length.

We have derived an analytical expression for the ratio $\mathcal{R}_{\rm c}(\kappa) = \Delta_{\rm c}^Z(\kappa)/(\gamma_\mu B_0)$ where $\Delta_{\rm c}^Z(\kappa)$ is the variance of the field distribution arising from the magnetic structure of inverse coherence length κ and B_0 the mean field at the muon site. Using $\mathcal{R}_{\rm c}(\kappa)$ we discuss the consequences of the detection of μSR wiggles in terms of the coherence of the underlying magnetic structure.

In 2004, an expression for the variance of the field distribution arising from the magnetic disorder in the Bragg-glass phase of a superconductor was given (P. Dalmas de Réotier *et al.*, J. Phys.: Condens. Matter **16**, S4687 (2004)). Here, using published data on V_3Si (J.E. Sonier *et al.*, Phys. Rev. Lett. **93**, 017002 (2004)), we test two possibilities for the correlation function: a conventional decay and the algebraic correlation function proposed by Giamarchi and le Doussal (T. Giamarchi and P. le Doussal, Phys. Rev. B **52**, 1242 (1995)). The conventional decay is found to be inappropriate.