Spin textures induced by quenched disorder in a reentrant spin glass: vortices versus frustrated skyrmions

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Disorder plays a central role in the advent of the most spectacular quantum phenomena observed in condensed matter. Reentrant spin glasses (RSG's) are nice playground to study the influence of disorder on frustrated ferromagnets, and see how it affects topological defects. RSG's develop vortex-like textures under magnetic field [1,2], which we investigate in comparison with the frustrated skyrmions predicted by theory [3,4].

Our recent study of a $Ni_{1-x}Mn_x$ single crystal by small angle neutron clarifies their internal structure and shows that these textures are randomly distributed. Using two magnetic field geometries, we found that transverse spin components rotate over length scales of 3-15 nm, decreasing as field increases from 0 up to 8 T according to a scaling law [5].

Monte-Carlo simulations reveal that the internal structure of the vortices is strongly distorted and differs from that assumed for frustrated skyrmions. The pattern of topological charge density depends on the bond distribution. The vortices keep an anisotropic shape on a 3 dimensional lattice, recalling "croutons" in a "ferromagnetic soup". Their size and number can be tuned *independently* by the magnetic field and concentration x (or heat treatment), respectively. This opens an original route to understand and control the influence of quenched disorder in systems hosting non trivial spin textures.

[1] M. Hennion *et al.*, Europhys. Lett. **2**, 393, (1986); [2] S. Lequien *et al.*, Phys. Rev. B **35**, 7279, (1987); [3] T. Okubo *et al.*, Phys. Rev. Lett. **108**, 017206 (2006); [4] A. O. Leonov and M. Mostovoy, Nature Comm. **6,** 8725 (2015); [5] I. Mirebeau, N. Martin *et al.,* submitted (2018).

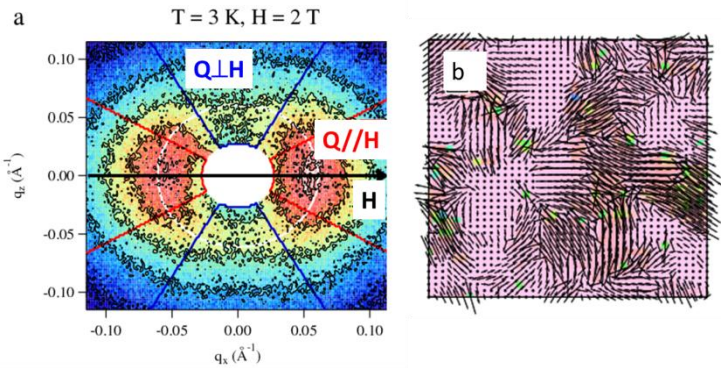

Figure 1 :
a) Scattering pattern of the vortex–like texture when the field H is perpendicular to the neutron beam.
b) Monte Carlo simulation of the quenched spin distribution.