PAUL SCHERRER INSTITUT

CONDENSED MATTER THEORY SEMINAR

Phase diagram of dipolar-coupled XY moments on disordered square lattices

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Abstract:

Frustration denotes that not all interactions can simultaneously be satisfied. This often appears in real world magnetic systems and can lead to interesting phenomena like the inhibition of long range order, incommensurate ordering and spin glasses. In those systems the dipolar interaction is often an important perturbation. However the dipolar interaction itself is often intrinsically frustrated due to the interplay of ferromagnetic and antiferromagnetic contributions. This leads for moments, which only interact via dipolar coupling, on the square lattice to a so called order-by-disorder transition, where the ground state has actually a higher symmetry than the Hamiltonian. This accidental symmetry is however readily destroyed by temperature or disorder and one is left with states following the same symmetry as the Hamiltonian. We derived meaningful order parameters for the relevant phases and employed parallel tempering Monte Carlo simulations to access the full phase diagram for two cases of disorder, namely introduction of vacancies in the otherwise regular grid of dipoles, or the perturbation of the lattice positions by a random displacement. We then compare the two phase diagrams and see many similarities, even though the notion of the disorder in the two systems is quite different. Finally, we will give a possible interpretation of those similarities by means of a flux closure argument.

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