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Competing Antiferromagnetic and Spin-Glass phases in a hollandite structure YANIER CRESPO HERNANDEZ, International Center for Theoretical Physics, ALEXEI ANDREANOV, Max Planck Institute for Physics of Complex Systems, NICOLA SERIANI, International Center for Theoretical Physics —
We introduce a simple model to explain recent experimental results on spin freezing in a hollandite-type structure. We argue that geometrical frustration of the lattice with antiferromagnetic (AFM) interactions is responsible for the appearance of a spin-glass phase in presence of disorder. We check our predictions numerically using parallel tempering on a model that considers Ising spins and nearest-neighbor AFM interactions. The proposed model presents a rich phenomenology: in absence of disorder two ground states are possible, depending on the strength of the interactions, namely an AFM or a geometrically frustrated phase. Remarkably for any set of AFM couplings having an AFM ground state in the clean system, there exist a critical value of the disorder for which the ground state is replaced by a spin-glass one while maintaining all couplings AFM. To the best of our knowledge in the literature there is not a model that presents this kind of transition considering just short-range AFM interactions. Therefore we argue that this model would be useful to understand the relation between AFM coupling, disorder and the appearance of spin glasses phase.

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