Spin-glass Transition in Bond-disordered Heisenberg Antiferromagnets Coupled with Local Lattice Distortions on a Pyrochlore Lattice

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Motivated by puzzling characteristics of spin-glass transitions widely observed in pyrochlore-based frustrated materials, we investigate effects of coupling to local lattice distortions in a bond-disordered antiferromagnet on the pyrochlore lattice[1] by using a recently developed classical Monte Carlo algorithm.[2,3] We show that the spin-glass transition temperature $T_{\rm f}$ is largely enhanced by the spin-lattice coupling b. As a consequence, $T_{\rm f}$ becomes almost independent of Δ and is set by b in a wide range of the disorder strength Δ. The critical property of the spin glass transition is indistinguishable from that of the canonical Heisenberg spin glass in the entire range of Δ. These peculiar behaviors are ascribed to a modification of the degenerate manifold from continuous to semidiscrete one by the spin-lattice coupling. The results reproduce qualitatively many aspects of the spin-glass transition observed in the pyrochlore-based geometrically frustrated magnets such as $(La_xY_{1-x})_2Mo_2O_7$ and $(Zn_{1-x}Cd_x)Cr_2O_4$.

[1]H. Shinaoka, Y. Tomita, and Y. Motome, arXiv:1010.5625.
[2]H. Shinaoka and Y. Motome, Phys. Rev. B **82**, 134420 (2010).
[3]H. Shinaoka, Y. Tomita, and Y. Motome, arXiv:1102.1222.