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Impurity Effects in Highly Frustrated Diamond-Lattice Antiferromagnets

LUCILE SAVARY, University of California, Santa Barbara

We consider the effects of local impurities in highly frustrated diamond lattice antiferromagnets, which exhibit large but non-extensive ground state degeneracies. Such models are appropriate to many A-site magnetic spinels. We argue very generally that sufficiently dilute impurities induce an *ordered* magnetic ground state, and provide a mechanism of degeneracy breaking. The states which are selected can be determined by a "swiss cheese model" analysis, which we demonstrate numerically for a particular impurity model in this case. Moreover, we present criteria for estimating the stability of the resulting ordered phase to a competing frozen (spin glass) one. The results may explain the contrasting finding of frozen and ordered ground states in $CoAl_2O_4$ and $MnSc_2S_4$, respectively.