Phase transitions in three-dimensional random anisotropy Heisenberg magnets

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We are interested in ordering of random anisotropy magnets (RAM) described by the model introduced in the early 1970s [1]. Despite extensive studies, the problem of the nature of a low-temperature phase of RAM remains a very intriguing issue. While, for large values of local anisotropy strength, the majority of studies predict a spin glass, there is much discussion about ordering for small and moderate values of such strength. It appears that the answer to this question depends also on the local anisotropy axis distribution. Field-theoretical renormalization group studies predict an absence of ferromagnetic order for uniform continuous distribution while preserving long-range order for discrete anisotropic distribution. We apply extensive Monte Carlo simulations to study phase transitions in the three-dimensional RAM with three-component (Heisenberg) order parameter and consider two different random anisotropy axis distributions for two different values of local anisotropy strength. For the case of the anisotropic distribution, we have show evidence of universality by finding critical exponents and universal dimensionless ratios independent of the strength of the disorder. In the case of isotropic distribution the situation is very involved: we have found two phase transitions in the magnetization channel which are merging for larger lattices remaining a spin glass phase transition [2].

References

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