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Critical Behavior of Structurally Disordered Systems Magnets with Long-Range Interaction

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Our research aims to examine critical behavior of a magnetic system under the influence of two competing factors: long-range interaction and weak structural disorder (e.g., weak quenched dilution). We analyze ferromagnetic ordering in a structurally-disordered magnet within an n-vector model in d-dimensional space, where the long-range interaction decays with distance x as $J(x) \sim x^{-d-\sigma}$, where with σ as is the control parameter. Field-theoretical renormalization group methods (RG) are used to identify the system's universality classes, and the universal characteristics of critical behavior depending on the global parameters d, n, σ. We demonstrate that there exists a parameter region (d, n, σ), where the interplay of long-range interaction and structural disorder leads to emergence of a new structural-disorder-induced long-range universality class. Using fixed spatial dimension approach we extract values of correlation length critical exponent ν characterizing this class from perturbative RG functions at $d = 3$ applying asymptotic series resummation methods.

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