Cross-over to Mean Field Behavior in Small-World Nanomaterials

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Mississippi State University — Recently the suggestion was made to include small-world network effects into nanoscale materials [1,2]. Small-world connections lead to (slightly modified) mean-field behavior of model systems [3]. Consequently there is the possibility for a new class of nanomaterials governed by the mean-field fixed point. Here we describe finite-scale scaling investigations of ferromagnetic Ising models adding small-world connections to either \( d = 1 \) or \( d = 2 \) lattices with \( V \) sites. In particular, we demonstrate how finite-size scaling works by scaling with a 'length' given by the logarithm of \( V \) rather than a linear dimension of the system. Results are compared to studies of a related model with dilute long-range interactions [4].