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Accurate estimates of universal quantities: Monte Carlo simulations of improved lattice models and finite size scaling

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The accurate determination of universal quantities, such as critical exponents, by using high temperature series expansions or Monte Carlo simulations of lattice models is hampered by corrections to scaling.
In [J. H. Chen, M. E. Fisher and B. G. Nickel, Phys. Rev. Lett. 48, 630 (1982)] the authors suggested to study one parameter families of models.
The amplitudes of corrections to scaling depend on the parameter of the model family. In the case of the Ising universality class in three dimensions a zero of the amplitude of the leading correction can be found. Starting from the nineties of the last century, this idea has been expoited by using Monte Carlo simulations in conjunction with finite size scaling.
I sketch the basic ideas and summarize numerical results for the Ising, the XY and the Heisenberg universality classes in three dimensions.
Recently I have studied the cubic fixed point in three dimensions. I obtain $y_{t,\mathrm{cubic}} - y_{t,O(3)} = 0.00124(12)$ for the difference of the thermal RG-exponents of the cubic and the O(3) invariant fixed points in three dimensions.

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