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Charting the scaling region of the Ising universality class in finite temperature QCD

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We discuss the behaviour of a universal combination of susceptibility and correlation length in the Ising model in two and three dimensions, in presence of both magnetic and thermal perturbations, in the neighbourhood of the critical point. In three dimensions we address the problem using a parametric representation of the equation of state. In two dimensions we make use of the exact integrability of the model along the thermal and the magnetic axes. Our results can be used as a sort of "reference frame" to chart the critical region of the model.
While our results can be applied in principle to any possible realization of the Ising universality class, we address in particular, as specific examples, instances of Ising behaviour in finite temperature QCD related in various ways to the deconfinement transition. Most notably, we study the critical ending point in the finite density, finite temperature phase diagram of QCD. In this finite density framework, due to well know sign problem, Montecarlo simulations are not possible and thus a direct comparison of experimental results with QFT/Statmech predictions like the one we discuss may be important. Moreover in this example it is particularly difficult to disentangle "magnetic-like" from "thermal-like" observables and thus an explicit charting of the neighbourhood of the critical point can be particularly useful.

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