Recent developments in the random-field Ising model

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In theoretical physics, the behaviour of a strongly disordered system cannot be inferred from its clean, homogeneous counterpart. In fact, disordered systems are prototypical examples of complex entities in many aspects, mainly in the rough free-energy landscape profile. In the current talk I will present an overview of recent results on the random-field Ising model [1, 2, 3, 4, 5,6], one of the simplest and most investigated models for collective behaviour in the presence of quenched disorder, whose applications in hard and soft condensed matter physics are numerous. Notably, the random-field Ising model is unique among other disordered systems due to the fact that the random-field fixed point lies at zero temperature [7], rendering the determination of exact ground states of huge system sizes using efficient optimisation algorithms a numerically feasible task. Our results, obtained via large-scale zero-temperature simulations and benefiting from recent advances in finite-size scaling and reweighting methods for disordered systems [8], settle down some of the most ambiguous questions in the history of the random-field Ising model , and pave the way towards a complete resolution of the model's critical behaviour.

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