Critical Phenomena Through the Lens of the Ising Model

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The Ising model is one of the most classical lattice models of statistical physics undergoing a phase transition. Initially imagined as a model for ferromagnetism, it revealed itself as a very rich mathematical object and a powerful theoretical tool to understand cooperative phenomena. Over one hundred years of its history, a profound understanding of its critical phase has been obtained. While integrability and mean-field behavior led to extraordinary breakthroughs in the two-dimensional and high-dimensional cases respectively, the model in three and four dimensions remained mysterious for years. In this talk, we will present recent progress in these dimensions based on a probabilistic interpretation of the Ising model relating it to percolation models.