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Partition Function Zeros and Finite-Size Effects in the Blume–Capel Model on a Complete Graph

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The Blume–Capel model, an extension of the Ising model with single-ion anisotropy, features a rich phase diagram with the first- and second-order phase transition lines intersecting at the tricritical point. While the exact solution is known in the
thermodynamic limit for a complete graph, finite-size effects remain less understood. This talk presents an overview of recent results obtained by analyzing partition function zeros in complex temperature, magnetic field, and crystal field planes. These zeros offer complementary insights into the system's critical behavior and its finite- size scaling. The results show that effective criticality persists even in large systems, with partition function zeros revealing the gradual crossover to the asymptotic mean-field behavior. Distinctions between critical and tricritical behavior are particularly evident when comparing Fisher, Lee–Yang, and crystal-field zeros, making this approach a powerful tool for characterizing phase transitions in finite systems.
[1] Yulian Honchar, Mariana Krasnytska, Bertrand Berche, Yurij Holovatch, Ralph
Kenna. Partition function zeros for the Blume-Capel model on a complete graph.
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