

## Simulating finite-temperature phase diagrams using cluster expansions

*Tuesday 7 October 2025 17:15 (2 hours)*

Cluster expansions were recently proposed as an accurate method to compute the exponential of the Hamiltonian. Since the exponential can be represented as a Projected Entangled Pair Operator (PEPO), a temperature range can be scanned by evolving through imaginary time by multiplying PEPOs and truncating them. Various truncation schemes exist, balancing accuracy and computational efficiency. We show that the cluster expansion method can yield a more accurate prediction of the critical temperature than using the Trotter decomposition. This framework was applied to a model of spinless fermions hopping on a square lattice with an attractive potential. The proposed methods were combined to obtain an accurate prediction of the finite-temperature phase diagram of this model.

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**Session Classification:** Poster Session