A 34: Correlation Phenomena

Time: Thursday 14:30–15:15 Location: N 25

A 34.1 Thu 14:30 N 25

Robust detection of entanglement transitions in the projective transverse field Ising model — •Felix Roser[1], Etienne M. Springer[2], Hans Peter Büchler[1], and Nicolai Lang[1] — [1]Institute for Theoretical Physics III, University of Stuttgart, Germany — [2]Institute for Theoretical Physics I, University of Stuttgart, Germany

We propose a scalable and noise-resilient protocol for the detection of the entanglement transition in a projective version of the transverse-field Ising model. Entanglement transitions are experimentally difficult to observe due to the inherent randomness of projective measurements which prohibits repeated state preparation, and due to noise in large-scale experimental settings. Our approach combines decoding techniques with classical shadow tomography to overcome both problems. This allows for experimentally accessible upper and lower bounds on the entanglement transition without post-selection or full state tomography. These bounds remain robust under noise and their sharpness is only limited by the noise rate.

A 34.2 Thu 14:45 N 25

Graph neural network models for predicting local electronic properties of disordered correlated electron systems — •Konrad Koenigsmann[1], Ho Jang[1], Peter Schauss[2], and Gia-Wei Chern[1] — [1]Department of Physics, University of Virginia, 382 McCormick Road, Charlottesville, VA 22904, USA — [2]Institut für Quantenphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

The rapid development of machine learning (ML) methods has opened up many new avenues of research in the field of condensed matter physics by bridging the tradeoff between efficiency and accuracy that is inherent to many numerical methods used for multiscale simulations. Here, we present a scalable ML model that can predict local and short-range electronic and spin properties of disordered correlated electron systems. A novel feature of our model is the use of a graph neural network (GNN). While GNNs have achieved considerable success in a number of fields including quantum chemistry and materials science, their applications in condensed matter physics remain largely unexplored. We tested the model by training on small-system-size determinant quantum Monte Carlo (DQMC) simulations of the square-lattice Anderson-Hubbard model, a paradigmatic system for studying the interplay between disorder and correlations. We find that the model is able to reasonably predict the local and short-range electronic and spin properties of the system. Our results demonstrate the potential and effectiveness of using GNNs for multiscale modeling of disordered correlated electron and other condensed matter systems.

A 34.3 Thu 15:00 N 25

Bell's theorem and non-commutation — •Carsten Held — Nonnenrain 2, 99096 Erfurt, Germany

Bell's theorem, in the form of the CHSH inequality (<ab> + <ab'> + <a'b> - <a'b'> * 2), can be derived using the presupposition that the values of hidden variables are scalars, not vectors. Here the relation of this thought with geometric algebra more generally is explored. Non-commutation appears as a key to understanding the significance of Bell's theorem.