Joint CQSE & NCTS Seminar

2022
May. 06, Friday

TIME May. 06, 2022, 2:30~3:30pm

TITLE Supervised and unsupervised deep Learning of topological phase transitions from entanglement aspect for one- and two-dimensional chiral p-wave superconductors

SPEAKER Professor, Ming-Chiang Chung (Department of Physics, National Chung-Hsing University)

PLACE NCTS Physics Lecture Hall, 4F, Chee-Chun Leung Cosmology Hall, NTU

Abstract:

The one-dimensional or two-dimensional chiral p-wave superconductor proposed by Kitaev has long become a classic example for understanding topological phase transitions through various methods, such as examining the Berry phase, edge states of open chains, and, in particular, aspects from quantum entanglement of ground states. In order to understand the amount of information carried in the entanglement-related quantities, here we study topological phase transitions of the model with emphasis of using the deep learning approach. Using both supervised or unsupervised ways, we feed different quantities, including Majorana correlation matrices (MCMs), entanglement spectra (ES) or entanglement eigenvectors (EE) originating from Block correlation matrices, into the deep neural networks for training, and investigate which one could be the most useful input format in this approach. We find that ES is information that is too compressed compared to MCM or EE. MCM and EE can provide us abundant information to recognize not only the topological phase transitions in the model but also phases of matter with different U(1) gauges, which is not reachable by using ES only. We also build a procedure for using unsupervised learning to find the phase transition points. We have used this method for other models.

Biography Brief:

Ming-Chiang Chung, graduated in Free University Berlin with postdoral experience in Ames Lab, RWTH Aachen, Max-Planck Institute and AS, is a theoretical physicist working on the field of statistic mechanics, manybody physics, quantum informations in condensed matter, cold atoms, out of equilibrium physics and artificial intelligence applied in condensed matter theory. I am trying to capture the core of the manybody physics, either using quantum field theory or exactly solvable models or numerical methods like DMRG and Tensor Network or deep learning methods.