## **JITCP Seminar**

THE UNIVERSITY OF HONG KONG HKU-UCAS JOINT INSTITUTE OF THEORETICAL AND COMPUTATIONAL PHYSICS HK INSTITUTE OF QUANTUM SCIENCE & TECHONOLOGY [Thursday Morning, 10:30 am, Zoom]

## Quantum phase transitions of extended Kitaev Model Prof. Cristian D. BATISTA

Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37996-1200, USA; Neutron Scattering Division and Shull Wollan Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA

We will introduce a new variational method to compute the low-energy excitation spectrum of an extended Kitaev model on the Honeycomb lattice, which includes Heisenberg, Gamma and Zeeman terms. The method reveals the physical origin of the asymmetry in the stability range of Kitaev spin liquid phases around the ferromagnetic and antiferromagnetic Kitaev points. It also reveals the emergence of bound states of fractionalized excitations in the proximity of the quantum phase transition between the Kitaev spin liquid and different magnetically ordered states induced by the Heisenberg and terms that have been reported in multiple numerical works. These bound states, which appear below the continuum of matter Majorana fermion excitations, can be used as fingerprints of the quantum spin liquid phase.

Finally, we will see that the same method can be used to derive a low-energy theory of the continuous transition between different spin liquids induced by a magnetic field applied along the (111) direction. According to this theory, the field-induced spin liquid is gapped and belongs to Kitaev's 16-fold way. Specifically, the low-field non-Abelian liquid with Chern number transitions into an Abelian liquid. The critical field and the field-dependent behaviors of key physical quantities are in good quantitative agreement with published numerical results. Furthermore, we derive an effective field theory for the field-induced critical point which readily explains the ostensibly gapless nature of the intermediate-field spin liquid.

## **Online Zoom Seminar** Thursday, May 4, 2023, 10:30 am

## https://hku.zoom.us/j/94049355999?pwd=MzU0bjZrNnYyWStjc3Q1NnQ3SXhtQT09 Meeting ID: 940 4935 5999, Password: 25600

Host: Professor Gang CHEN, The University of Hong Kong

Sponsored by HKU-UCAS Joint Institute of Theoretical and Computational Physics, The University of Hong Kong and HK Institute of Quantum Science & Technology

Phone: 28592360, Fax: 25599152. Anyone interested is welcome to attend.