UNIVERSITY of HOUSTON

TEXAS CENTER FOR SUPERCONDUCTIVITY

TcSUH SPECIAL SEMINAR

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Monday, April 13, 2020

Room 102, Houston Science Center, 11:00 a.m. – 12:00 p.m.

The Interaction Driven Topological States in Frustrated Kagome Systems

ABSTRACT: Understanding the interplay of geometry frustration and electron correlation is one of the central topics of the modern condensed matter physics. While there are concrete examples of topological phases in such systems, the key challenge remains regarding what quantum phases can be realized in experimental relevant systems. I will present a few examples of numerical discovered topological phases for frustrated electron and spin systems, based on the state of art density matrix renormalization group studies. The first example is the simple case where spinless electrons occupy kagome lattice flatband with hopping and different neighboring interactions. We will establish that the ground state realizes the spontaneous time-reversal symmetry breaking with exactly quantized quantum anomalous Hall effect (QAHE) driven by interaction. Furthermore, we will demonstrate that this QAHE can also emerge in spinful systems with electron at half filling of the flatband model of kagome systems. I will then present results of different quantum spin liquids for kagome spin systems, which are exotic magnetic states without magnetic ordering. In particular, I will show numerical evidences uncovering a chiral spin liquid in kagome Heisenberg model, which was the long-sought state with "anyon" quasi-particles, theoretically proposed more than 30 years ago. We will conclude with discussions of related experiments, open questions and future directions in this field.

BIO: Donna Sheng received her PhD from Nanjing Univ. in 1989 and spent one year as a postdoc at Institute of Theoretical Physics, Chinese Academy of Sciences. She joined TcSUH's theoretical group in 1990, working with Prof. Ting initially as a postdoc and later as a research scientist. She joined California State University – Northridge in 2000 as a faculty member. Dr. Sheng's research focuses on strongly correlated systems. She has extensively developed computational methods which have led to many discoveries in the field of interacting topological materials, including chiral spin liquids, fractional Chern insulators, and spin Bose metals. Currently she is a team member of the Princeton Center for Complex Materials; Senior participant of Princeton NSF MRSEC.

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