UNIVERSITY of HOUSTON

TEXAS CENTER FOR SUPERCONDUCTIVITY

TCSUH SPECIAL SEMINAR

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Florida State University

Monday, September 30, 2019

Room 102, Houston Science Center, 1:00 – 2:00 pm

The Mother of All States of the Kagome Quantum Antiferromagnet

ABSTRACT: Strongly correlated systems provide a fertile ground for discovering exotic states of matter, such as those with topologically non-trivial properties. Among these are geometrically frustrated magnets, which harbor spin liquid phases with fractional excitations. On the experimental front, this has motivated the search for new low dimensional quantum materials. On the theoretical front, this area of research has led to analytical and numerical advances in the study of quantum many-body systems. I will present aspects of our theoretical and numerical work in the area of frustrated magnetism, focusing on the kagome geometry, which has seen a flurry of research activity owing to several near-ideal material realizations. On the theoretical front, the kagome problem has a rich history and poses multiple theoretical puzzles which continue to baffle the community. First, I will present a study of the spin-1 antiferromagnet, where our numerical calculations indicate that the ground state is a trimerized valence bond (simplex) solid with a spin gap [1], contrary to previous proposals. I will show evidence from recent experiments that support our findings but also pose new questions [2]. The second part of the talk follows from an unexpected outcome of my general investigations in the area for the well-studied spin-1/2 case [3]. I will highlight our discovery of an exactly solvable point in the XXZ-Heisenberg model for the ratio of Ising to transverse coupling $J_z/J=-1/2$ [4]. This point in the phase diagram has "three-coloring" states as its exact quantum ground states and is macroscopically degenerate. It exists for all magnetizations and is the origin or "mother" of many of the observed phases of the kagome antiferromagnet. I will revisit aspects of the contentious and experimentally relevant Heisenberg case and discuss its relationship to the newly discovered point [4,5].

BIO: Dr. Hitesh Changlani is an Assistant Professor at Florida State University. He received his Ph.D. in Physics, from Cornell University in 2013. He was a Postdoctoral Fellow at the Institute for Condensed Matter Theory, University of Illinois at Urbana Champaign, from 2013 to 2016. He later joined faculty at Florida State University in 2018.

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