

SIMIS Seminar series on Quantum computing, Quantum simulation and Strongly-correlated systems

Prof. Jianda Wu

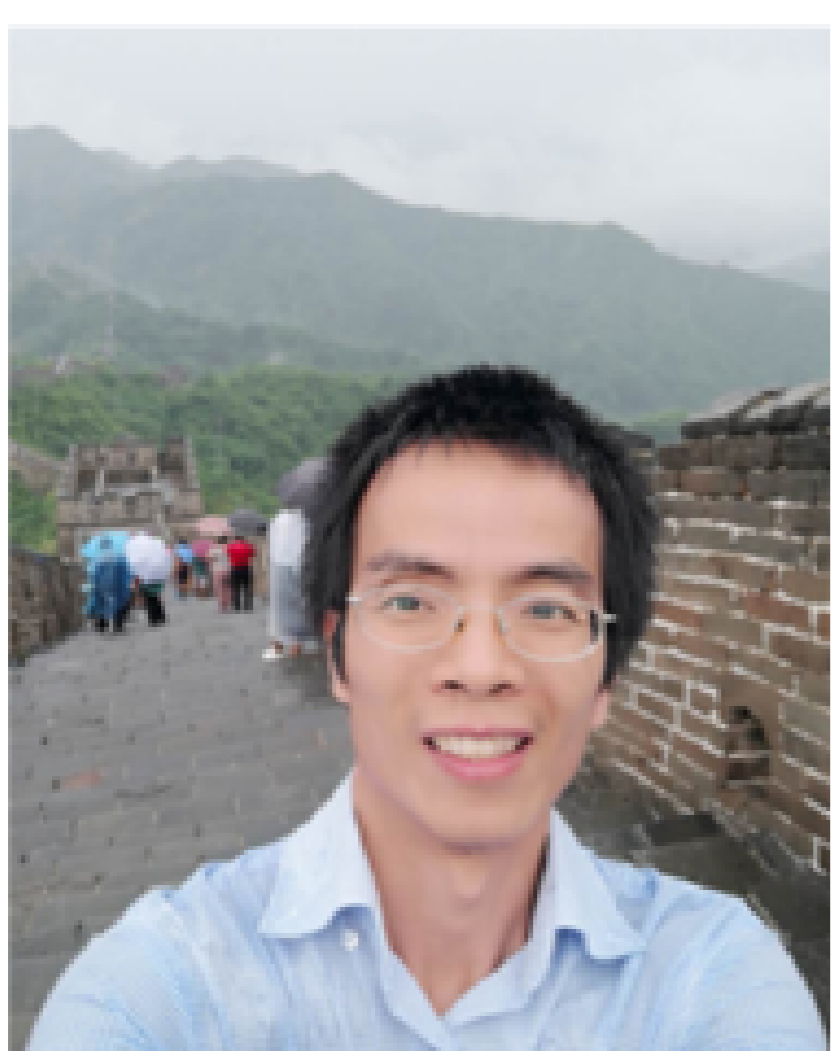
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“A tale about discovery of quantum E_8 particles in quantum material $BaCo_2V_2O_8$ ”

Abstract

Exotic thermodynamics and excitations can emerge in the vicinity of a quantum phase transition. In the talk, I will first detailedly discuss the unique quantum criticality for the Grüneisen ratio in the transverse field Ising chain (TFIC). The unique quantum criticality of the Grüneisen ratio then serves as a smoking gun to identify the underlying TFIC universality observed in quasi-1D antiferromagnetic materials $BaCo_2V_2O_8$ with transverse field applied along [110] direction. From systematic quantum critical analysis for the effective model of the material $SrCo_2V_2O_8$, we confirm the material with field applied along [100] direction can also accommodate the TFIC universality with much weaker magnetic field. Furthermore, when the quantum critical point of the TFIC is perturbed by a longitudinal magnetic field, it was predicted that its massive excitations are precisely described by the exceptional E_8 Lie algebra. Here we first discuss non-trivial low temperature local spin dynamics of the exotic E_8 model. Then we show an unambiguous experimental realization of the E_8 physics in the material $BaCo_2V_2O_8$, via nuclear magnetic resonance and inelastic neutron scattering measurements, and detailed theoretical analysis. The large separation between the masked 1D and 3D quantum critical points of the system allows us to identify, for the first time, the full 8 single-particle E_8 excitations, various multi- E_8 -particle states as well as the dispersion of E_8 particles in the spin excitation spectrum. Our results open new experimental and theoretical routes for exploring the dynamics of quantum integrable systems and physics beyond integrability, and thus bridge key physics in condensed matter and statistical field theory.

Biography of the speaker



Prof. Jianda Wu has long been committed to the research work in quantum phase transitions, quantum critical thermodynamics and dynamics, Bethe ansatz, and dynamics in quantum integrable systems. He obtained BS (2004) and MS (2007) degrees from University of Science and Technology of China, and got PhD (2014) from Rice University. From 2014-2017 he carried out postdoc research at University of California at San Diego, then (2017-2018) became a guest scientist at Max Planck Institute for the Physics of Complex Systems. Since 2018 he became a Tsung-Dao Lee Fellow at Tsung-Dao Lee Institute and a faculty member at School of Physics and Astronomy at Shanghai Jiao Tong University. Jianda has published more than 30 papers including Nature, Nature Physics, Nature Communications, and Phys. Rev. Lett. Etc. So far, he has delivered more than 70 invited talks at international conferences/workshops, universities and institutes around the world.

Date and Place: March 11th, Tuesday, 2025, 11:00h-12:00h. Room: 1610. Send comments or questions to: Miguel Tierz (Seminar organizer) to tierz at simis.cn