清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

Title: **Quantum Dynamics – Space-time Crystal and Bethe String States**

Speaker: **Congjun Wu (*University of California, San Diego*)**

Time: **3:00pm, Thursday, August 9, 2018**

Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

We present recent works on two different aspects of quantum dynamics – symmetry and strong correlations. For the symmetry aspect, we propose a new concept of "space-time" crystal as a general framework for studying intertwined space-time periodic structures, which include both the static crystal and the Floquet lattice as special cases. A new mathematic structure of "space-time" group is constructed to describe the symmetries of a space-time crystal, which augments the space group with non-symmorphic operations involving fractional translations along the time domain: "time-screw rotation" and "time-glide reflection". Classifications for the 1+1 D and 2+1D space-time crystals (groups) are completed, and their consequences on dynamic band structures will be discussed. For the strong correlation aspect, we have studied the real frequency response at high energy which is a hard problem of condensed matter physics. We studied the role of Bethe-string states in the quantum spin dynamics in antiferromagnetic spin chains in high magnetic fields based on algebraic Bethe ansatz via the form-factor formulae. Close to quantum criticality, the string excitations govern the quantum spin dynamics, whereas the fractional excitations, which are dominant at low energies, reflect the antiferromagnetic quantum fluctuations. These states have been recently observed in the electron-spin-resonance spectroscopy measurement on SrCo2V2O8. This work is helpful for experimental studies on spin dynamics in both condensed matter and cold atom systems beyond the low energy effective Luttinger liquid theory.

References

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Biography

Congjun Wu received his Ph.D. in physics from Stanford University in 2005, and did his postdoctoral research at the Kavli Institute for Theoretical Physics, University of California, Santa Barbara, from 2005 to 2007. He became an assistant professor in the Department of Physics at the University of California, San Diego (UCSD) in 2007, an associate professor at UCSD in 2011, and a full professor in 2017. His research interests include quantum magnetism, superconductivity, orbital physics, and topological states in condensed-matter and cold-atom systems.