清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

Title: **Thermodynamics and order beyond equilibrium -- the physics of periodically driven quantum systems**

Speaker: **Roderich Moessner (*MPI-PKS Dresden*)**

Time: **3:30pm, Wednesday, 2016-08-31**

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

Abstract

The field of thermodynamics is one of the crown jewels of classical physics. However, only comparatively recently, due to the advent of experiments in cold atomic systems with long coherence times, has our detailed understanding of its connection to quantum statistical mechanics seen remarkable progress.

Extending these ideas and concepts to the non-equilibrium setting is a challenging topic, in itself of perennial interest. Here, we study perhaps the simplest non-equilibrium class of quantum problems, namely Floquet systems, i.e. systems whose Hamiltonians depend on time periodically, $H(t + T) = H(t)$. For these, there is no energy conservation, and hence not even a natural concept of temperature.

We find that it is nonetheless possible to identify several fundamentally distinct thermodynamic ensembles. We also ask if there exists a sharp notion of a phase in such driven, interacting quantum systems. Disorder turns out to play a crucial role, enabling the existence of states which are straightforward analogues of equilibrium states with broken symmetries and topological order, while others--genuinely new to the Floquet problem--are characterized by a combination of order and non-trivial periodic dynamics.

This work was done in collaboration with Arnab Das, Vedika Khemani, Achilleas Lazarides and Shivaji Sondhi.

References: Phys. Rev. Lett. 112, 150401 (2014); Phys. Rev. E 90, 012110 (2014); Phys. Rev. Lett. 115, 030402 (2015); Phys. Rev. Lett. 116, 250401 (2016)

About the speaker:

Prof. Roderich Moessner is a condensed matter physicist with seminal contributions in frustrated magnets, topological phases and glass physics. After working in Princeton, the Ecole Normale Supérieure de Paris and Oxford University, he is now serving as the director of the Max Planck Institute for the Physics of Complex Systems in Dresden, Germany. For the co-discovery of emergent magnetic monopoles in spin ice materials, he has been awarded the Condensed Matter Division Prize of the European Physical Society in 2012. And in 2013 he received the Gottfried Wilhelm Leibniz Prize (Germany's most prestigious research funding prize) jointly with Achim Rosch for their contributions to the physics of strongly interacting quantum systems.