

CONDENSED MATTER THEORY SEMINAR

Subject: **Thermodynamics and order beyond equilibrium -- from eigentstate thermalisation to time crystals**

Speaker: **Roderich Moessner (MPIPKS Dresden)**

Date & time: **Friday, January 21st, 2022 at 3:15 p.m.**

Venue: **Online Seminar**

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

Extending these ideas and concepts to the non-equilibrium setting is a challenging topic, in itself of perennial interest. Here, we present 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 certain structures from equilibrium thermodynamics are lost, while entirely new non-equilibrium phenomena can arise, including a spectacular spatiotemporal 'time-crystalline' form of order, recently observed experimentally on google AI's sycamore NISQ platform.

Reference: for an introductory overview, see Nature Physics 13, 424–428 (2017). For an in-depth review, see arxiv:1910.10745.