

Father Lafont Memorial Lecture

Speaker : Professor Roderich Moessner, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

Date & Time : 17th December, 2019 at 3.00PM

Venue : C.V. Raman Hall

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

Abstract : 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.

Reference: for an introductory overview, see Nature Physics 13, 424-428 (2017); for a brief history of time crystals, see [arXiv:1910.10745](https://arxiv.org/abs/1910.10745).