Collective effects in quantum many-body open systems:

Transitions, synchronisation and time crystals

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Thanks to the recent impressing experimental progresses, the investigation of non-equilibrium properties of driven-dissipative systems in quantum systems has received an impressive boost. This activity revived the study of dissipative phase transition in synthetic matter. The predicted steady-state phase diagram of these driven dissipative systems becomes incredibly rich, manifesting a variety of phenomena. Moreover phase transitions in these system display properties that are not shared by their equilibrium counterparts.

I will discuss several aspects of dissipative systems. I will discuss in particular the possible existence of exotic phases in the steady state making connections to quantum synchronisation and time crystals.