

Active quantum flocks

lundi 18 mars 2024 14:30 (30 minutes)

Flocks of animals represent a fascinating archetype of collective behavior in the macroscopic classical world, where the constituents, such as birds, concertedly perform motions and actions as if being one single entity. Here, we address the outstanding question of whether flocks can also form in the microscopic world at the quantum level. For that purpose, we introduce the concept of active quantum matter by formulating a class of models of active quantum particles on a one-dimensional lattice.

We provide both analytical and large-scale numerical evidence that these systems can give rise to quantum flocks. A key finding is that these flocks, unlike classical ones, exhibit distinct quantum properties by developing strong quantum coherence over long distances. We propose that quantum flocks could be experimentally observed in Rydberg atom arrays.

Our work paves the way towards realizing the intriguing collective behaviors of biological active particles in quantum matter systems. We expect that this opens up a path towards a yet totally unexplored class of nonequilibrium quantum many-body systems with unique properties.

Orateur: HEYL, Markus (University of Augsburg)