PHYSICAL MATHEMATICS SEMINAR

Hydrodynamics of Active Lévy Matter

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ABSTRACT:

Collective ordered motion emerges spontaneously in several biological systems such as bird flocks, insect swarms and tissue under dynamic reorganization. This phenomenon is often modeled within the framework of active fluids, where hydrodynamic descriptions typically rely on microscopic models of active self-propelled particles subjected to alignment interactions and reorientational dynamics. However, single-particle superdiffusion characterized by the super-linear scaling of the position mean-square displacement and fat-tailed displacement statistics is also widespread in biology as it can represent an optimal search strategy for living organisms. Nevertheless, the collective properties of interacting systems exhibiting such anomalous diffusive dynamics - denoted here as *active Lévy matter* - cannot be captured by current active fluid theories. Here, we formulate the hydrodynamic description of active Lévy matter by coarse-graining a microscopic model of alignment interacting active particles performing superdiffusion manifest as Lévy flights. Similarly to ordinary active fluids, this theory predicts characteristic disordered and ordered phases, but, in contrast, reveals upon linear stability analysis that the phase transition can be critical. This analysis not only highlights the need for more realistic models of active matter integrating both anomalous diffusive motility and inter-particle interactions but also suggests that these models can shed new light on the universal properties of active systems.

TUESDAY, MARCH 19, 2019
2:30 PM – 3:30 PM
Building 2, Room 139

Reception following in Building 2, Room 290
(Math Dept. Common Room)

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