Collective dynamics of 2D self-propelled semiflexible chains

Gi-Moon Nam and Changbong Hyeon
Korea Institute for Advanced Study, Seoul, Republic of Korea

Collective behavior is an emergent dynamics in active systems such as, on a microscopic length-scale, a suspension of bacteria and microtubules. This behavior often involves a hydrodynamic transition between a coherent and a turbulent flow, which occurs spontaneously even in the absence of an external driving. While the coherent flow state is theoretically well described as a polar and nematic phase, the turbulent state is rather difficult to describe as a single phase due to the existence of many complex local structural patterns such as vortices and spirals. So far, most of the studies have focused on such transition in self-propelled particles system, but the corresponding polymers system is rarely studied. In recent simulation studies on self-propelled chains, it has been implicated that the transition could take place near the boundary between the coherent flow and spiral phases, where each phase is characterized by different values of the stiffness and Péclet number of a single chain. Nevertheless, a physical origin of the spontaneous emergence of filamentous turbulence remains elusive. To reveal the underlying mechanism, we have studied the collective dynamics of 2D active semiflexible chains. By means of coarse-grained modeling and Brownian Dynamics simulation, we modeled self-propelled chains melt and monitored its structural dynamics. In this poster session, we report our recent progress on the collective behaviors of 2D active polymer system.