Recent progress on the modeling of flocking and synchronization phenomena

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In this talk, I will report recent progress on the particle and kinetic modeling of collective behaviors appearing in biological and social complex systems, in particular flocking and synchronization. Flocking and synchronization of self-propelled particles are common in many biological and social systems, for example, flocking of birds, swarming of fish, consensus dynamics of human society and synchronization of neurons, etc. I will discuss how these macroscopic collective behaviors can be emerged from the simple interaction rules at the microscopic level, and present recent mathematical development on the aforementioned collective behaviors via several particle and kinetic mathematical models.