Vicsek-Kuramoto third order system in collective dynamics and their macroscopic equations

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In this talk we consider an Individual-Based Model for self-propelled particles interacting through local alignment and investigate its macroscopic limit. This model has been first introduced by C. Chen *et al.* to describe the behaviour of dense colony of flagellated bacteria (e.g. Escherichia coli) which self organize into robust collective oscillatory motion. In view of this, a 'Vicsek- Kuramoto style' model has been used. The agent based model combines both Kuramoto and Vicsek dynamics - it takes from Kuramoto model the way in which agents try to syncronize the phase of their rotational movement and from the Vicsek model the fact that the syncronization is spacially local. We study the mean-field kinetic and hydrodynamic limits of this system. Due to the lack of energy and momentum preservation in the system, we use the notion of generalized collisional invariant to obtain a closed set of macroscopic equation for the model. The final macroscopic model involves a continuity equation for the total density of particles, a non conservative equation for angular momentum density and a non conservative equation for the direction of the mean velocity.