

Kinetic Model for Myxobacteria with Directional Diffusion

The topic of this talk will be a kinetic model inspired by dynamics of myxobacteria colonies moving on flat surfaces. The model is based on the assumption of hard binary collisions of two different types: alignment and reversal, which results in a Boltzmann-type collision operator in the equation of interest. Further, we assume Brownian forcing in the free flight phase of single bacteria that gives rise to a directional diffusion term at the level of the kinetic equation, which opposes the concentrating effect of the alignment operator.

A global existence and uniqueness result as well as exponential decay to uniform equilibrium is proved in the case where the diffusion is large enough compared to the total bacteria mass. Further, the question whether in a small diffusion regime nonuniform stable equilibria exist is positively answered by performing a formal bifurcation analysis, which revealed the occurrence of a pitchfork bifurcation. These results are illustrated by numerical simulations.