Doron Levy

Group Dynamics of Phototaxis

Abstract: In this talk, we will present a hierarchy of new models for describing the motion of phototaxis, that were constructed based on the experimental observations. The first model is a stochastic model that describes the locations of bacteria, the group dynamics, and the interaction between the bacteria and the medium in which it resides. The second model is a new multi-particle system that is obtained from a discretization of the first model. Our third model is obtained as the continuum limit of the second model, and as such it is a system of nonlinear PDEs. Our main theorems clarify the sense in which the system of PDEs can be considered as the limit dynamics of the multi-particle system. We conclude with several numerical simulations that demonstrate the properties of our models.

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