Local and nonlocal models of aggregation and their applications.

Theodore Kolokolnikov, Dalhousie

We discuss two very different approaches to modelling bacterial aggregations. The first approach is a simple stochastic model which leads to a novel fourth-order local nonlinear PDE in its continuum limit. This PDE admits soliton-type solutions corresponding to bacterial aggregation patterns, which we explicitly construct. The second model is a well-studied all-to-all coupling aggregation equation. We apply it in the context of predator-swarm interactions. One of the questions we address is whether swarming behaviour helpful in avoiding a predator. In the last part of the talk, we will use techniques developed in the study of swarms to describe shape and density of vortex crystals in Bose Einstein Condensates, and we derive both upper and lower bounds on the number of vortices within a condensate.