RAZVAN FETECAU, Dept. of Mathematics, Simon Fraser University
Nonlocal PDE models for self-organization of biological groups

We introduce and study two new PDE models for the formation and movement of animal aggregations. The models extend the one-dimensional hyperbolic model from Eftimie *et al.*, Bull. Math. Biol. 69 (5) [2007]. Their main novel approach concerns the turning rates of individuals, which are assumed to depend in a nonlocal fashion on the population density.

Our first model assumes in addition that the nonlocal interactions between individuals can also influence the speed of the group members. We investigate the local/ global existence and uniqueness of solutions and we illustrate numerically the various patterns displayed by the model: dispersive aggregations, finite-size groups and blow-up patterns.

The second model extends the approach from Eftimie *et al.* [2007] to two dimensions. We show that the resulting integro-differential kinetic equation with nonlocal terms has a unique classical solution, globally in time. We also present numerical results to illustrate various types of group formations that we obtained with the two-dimensional model, starting from random initial conditions: (i) swarms (aggregation into a group, with no preferred direction of motion), and (ii) parallel/ translational motion in a certain preferred direction with (a) uniform spatial density and (b) aggregation into groups.