On the asymptotic behaviour of nonlocal phase separation processes

Jens A. Griepentrog, WIAS Berlin

In our talk we present a model of nonlocal phase separation processes in multicomponent systems of particles. These processes are driven by the minimization of the free energy under the constraint of mass conservation. The free energy functional contains both a convex logarithmic part describing the FERMI-type behaviour of the particles and a nonconvex quadratic part taking into account nonlocal particle interaction. This leads to an evolution system of second order parabolic equations for the mass densities including nonlinear drift terms.

The assumptions on the interaction operator, which ensure the unique solvability and the regularity of the problem in suitable function spaces, are quite general. The key quantity to study the asymptotic behaviour is the free energy, which turns out to be a LYAPUNOV functional for the system. Using the regularity of the solution, we prove a ŁOJASIEWICZ–SIMON gradient inequality for this functional. This leads to strong convergence results for the whole trajectory to a stationary point. At the end of the talk we show some numerical simulations to illustrate our analytic results.