Mathematical Biology Seminar

Monday, March 20, 2017
3 pm – 457 CAB

Rouslan Krechetnikov
University of Alberta

Stability theory and pattern formation on time-dependent spatial domains

We explore near-critical behavior of spatially extended systems on time-dependent spatial domains with convective and dilution effects due to domain flow. A universal amplitude equation governing weakly nonlinear evolution of patterns on time-dependent domains is derived and proves to be a generalization of the standard Ginzburg–Landau equation. Its key solutions demonstrate a substantial variety – spatially periodic states with a time-dependent wavenumber, steady spatially non-periodic states, and pulse-train solutions – in contrast to extended systems on time-fixed spatial domains. The effects of domain flow, such as bifurcation delay due to domain growth and destabilization due to oscillatory domain flow, on the Eckhaus instability responsible for phase slips in spatially periodic states are analyzed with the help of both local and global stability analyses. A nonlinear phase equation describing the approach to a phase-slip event is derived using multiple time scale methods with the detailed analysis of a phase slip demonstrating different mechanisms governing the wavelength changing process at different stages. The talk is concluded with the discussion of our recent experimental study of Faraday waves on a time-dependent domain.