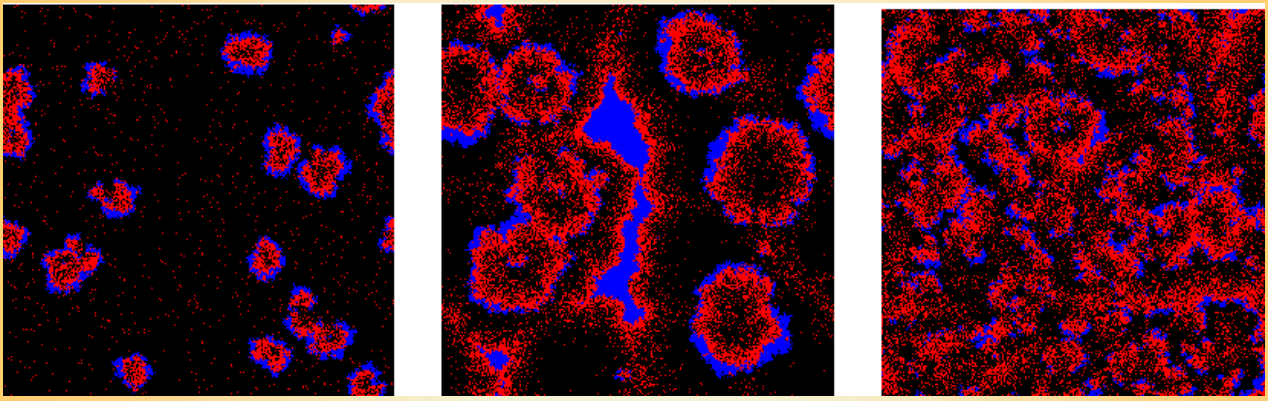
Colóquios de Física

Centro de Física da Universidade do Minho

Quarta-Feira, 5 de Junho às 14:30h
Anfiteatro de Física, Escola de Ciências, edifício 6
do Campus de Gualtar

Stochastic spatial predator-prey models

Uwe C. Täuber - Department of Physics, Virginia Tech



The activity fronts in the stochastic spatial Lotka-Volterra predator-prey model. Time evolution from left to right.

Resumo: Dynamical models of interacting populations have recently become of fundamental interest for the spontaneous formation of patterns and other intriguing features in non-equilibrium statistical physics. In turn, theoretical physics provides a toolbox for quantitative analysis for many paradigmatic models employed in biology and ecology.

Stochastic, spatially extended models for predator-prey interaction display striking spatio-temporal structures. These spreading activity fronts induce persistent correlations between predators and prey that can be studied through field-theoretic methods. Introducing local restrictions on the prey population induces predator extinction. The critical dynamics at this continuous absorbing state transition are governed by the scaling exponents of directed percolation. I will also address the influence of spatially varying reaction rates: Fluctuations in rare favorable regions cause a remarkable increase in both predator and prey populations. Intriguing novel features are found when variable interaction rates are affixed to individual particles rather than lattice sites. The ensuing stochastic dynamics combined with inheritance rules causes rapid time evolution for the rate distributions, with however overall neutral effect on stationary population densities.

I will finally discuss noise-induced spontaneous pattern formation in systems with three cyclically competing species akin to spatial rock-paper-scissors games.