Abelian oil and water dynamics does not have an absorbing-state phase transition

Alexandre Stauffer

University of Bath

Abstract:
The oil and water model is an interacting particle system with two types of particles and a dynamics that conserves the number of particles. It belongs to the so-called class of Abelian networks. Widely studied processes in this class are sandpiles models and activated random walks, which are known (at least for some choice of the underlying graph) to undergo an absorbing-state phase transition. This phase transition characterizes the existence of two regimes, depending on the particle density: a regime of fixation at low densities, where the dynamics converges towards an absorbing state and each particle jumps only finitely many times, and a regime of activity at large densities, where particles jump infinitely often and activity is sustained indefinitely. We show that the oil and water model is substantially different than sandpiles models and activated random walks, in the sense that it does not undergo an absorbing-state phase transition and is in the regime of fixation at all densities. Our proof works in great generality: for any graph that is vertex transitive and for a large class of initial configurations. Joint work with Elisabetta Candellero and Lorenzo Taggi.