Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Evolutionary dynamics of range expansions with curved fronts and inflationary directed percolation MAXIM LAVRENTOVICH, Harvard University, KIRILL KOROLEV, Massachusetts Institute of Technology, DAVID NELSON, Harvard University — We compare the evolutionary dynamics of populations expanding into a new territory with flat and curved fronts. When actively reproducing individuals confined to a thin, uniform population front experience deleterious mutations, the evolutionary dynamics fall into the directed percolation (DP) universality class. At the DP phase transition, the selective advantage of the fit individuals balances the deleterious mutation rate. Curvature in the front changes the dynamics: Sectors of the population become causally disconnected after a time $t_* = R_0/v$, where R_0 is the initial radius of the population and v is the radial front propagation speed. The reproducing population size increases, creating an inflationary effect that prevents the loss of fit individuals due to sector boundary diffusion and sector interactions. We develop a generalization of the Domany-Kinzel model on amorphous, isotropic lattices to simulate radial expansions. We find scaling functions characterizing the effects of inflation at criticality. We also discuss analytic results for two-point correlation functions and survival probabilities in the two limiting cases of no mutations (compact DP)and no selection.

Maxim Lavrentovich
Harvard University

Date submitted: 14 Nov 2011 Electronic form version 1.4