Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Constrained Branching Random Walks as a minimal model for adaptive evolution OSKAR HALLATSCHEK, Biological Physics and Evolutionary Dynamics, Max Planck Institute — Models of both sexual and asexual adaptation in well-mixed populations usually lead to solitary waves of adaptation. This means that the fitness distribution of the population assumes the form of a wave and moves to higher fitness at a certain speed of adaptation. This nonequilibrium steady state is easy to obtain in simulations but usually hard to analyze due to lack of detailed balance. Here, we introduce an analytically tractable minimal model that captures the essence of fitness waves of adaptation: i) a branching random walk of genotypes. ii) a global constraint that keeps the populations size finite. We show that for certain constraints an exact solution can be found. This exact solution, which can be summarized as a deterministic PDE with a peculiar cutoff, also turns out to approximate conventional models of adaptation in an unprecedented accuracy.

Oskar Hallatschek
Biological Physics and Evolutionary Dynamics, Max Planck Institute

Date submitted: 20 Nov 2009 Electronic form version 1.4