Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Host-pathogen interactions and bacterial survival under phage fluctuations ANTUN SKANATA, EDO KUSSELL, New York University NYU — Environmental changes can have profound effects on ecosystems, leading to drastic outcomes such as extinction and desertification. Quantifying, predicting, and ultimately preventing those transitions is a key problem in the field. Our previous work in microbial systems has shown that fluctuations in environments drive transitions to alternate evolutionary optima, which can be either smooth or abrupt. The long term growth rate, an analog of free energy for population dynamics, has been used to distinguish under what conditions those transitions will occur. Our framework, which uses the mean field approximation to compute the long term growth rate in fluctuating environments, is uniquely positioned to treat more complex dependencies that allow coexistence among species sharing resources or infected by common pathogens. Here we present a simple model of a bacterial community subjected to fluctuating phage infections that outlines the regimes where species diversity results in long-term stability. We identify prevalent, but often counter-intuitive, strategies that bacteria use to protect against infection, and find a new general principle in the evolution of phage resistance. Our results, which predict the transition regimes, have implications for a broad range of ecological models.

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Date submitted: 02 Nov 2016 Electronic form version 1.4