CMP Seminar
Michigan State University

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Non-equilibrium Relaxation and Aging Scaling in Driven Systems

If systems characterized by slow (algebraic) dynamics are prepared in an out-of-equilibrium initial configuration that is quite distinct from its asymptotic equilibrium or non-equilibrim stationary state, one may observe a "physical aging regime" in the ensuing relaxation kinetics that is governed by broken time translation invariance and non-trivial, often universal scaling laws. Dynamical systems near a critical point constitute proto-typical and now well-understood examples. Indeed, measuring critical
exponents in the intermediate aging rather than the asymptotic stationary temporal regime has become a standard numerical tool. In this talk, I will demonstrate that these concepts can also be employed to gain a better understanding of both generic scale invariance and critical dynamical scaling in driven system far from thermal equilibrium.

I shall first address the critical dynamics [1] and aging scaling [2] for driven-dissipative Bose-Einstein condensation, which in the continuum limitis captured by a noisy complex Ginzburg-Landau or Gross-Pitaevskii equation that also describes the synchronization of coupled non-linear oscillators, as well as various non-equilibrium pattern formation scenarios. Next I willdiscuss driven lattice gases that relax towards non-equilibrium stationary systems displaying generic scale invariance [3], and the continuous non-equilibrium phase transition in two-dimensional driven Ising lattice gases [4]. Finally, I shall show how critical aging scaling might be employed as a early warning signal for the extinction transition in spatially extended stochastic predator-prey competition models, and tocharacterize the ensuing directed percolation universality class [5].

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References:

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[5] S. Chen and U.C.T., Phys. Biol. 13, 025005 (2016) [arXiv:1511.05114].

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Prof. Mark Dykman - Host