Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Covariant Lyapunov Vectors of Chaotic Rayleigh-Bénard Convection MU XU, MARK PAUL, Virginia Tech — The complex dynamics of large spatially extended systems that are driven far-from-equilibrium are central to many important challenges. Much of the difficulty is rooted in the fact that the dynamics are extremely high dimensional. Progress has been made using Lyapunov exponents and vectors that have been computed using frequent Gram-Schmidt reorthonormalizations. However, a significant disadvantage of this approach is that the directions of all of the Lyapunov vectors, except the leading order vector, is lost due to the reorthonormalizations. However, it is well known that there exists a set of vectors intrinsic to the dynamics which satisfy the so-called Oseledec splitting and are called the covariant Lyapunov vectors. Recently, algorithms have become available to compute the spectrum of covariant Lyapunov vectors for large spatially extended systems. In this talk, we use the covariant Lyapunov vectors to explore the chaotic dynamics of Rayleigh-Bénard convection in a large rectangular domain. Knowledge of the covariant Lyapunov vectors allows us to probe fundamental features of the dynamics such as the degree of hyperbolicity, the spatiotemporal features of the spectrum of Lyapunov vectors, and the possible splitting of the dynamics into physical and isolated modes.

Mu Xu
Virginia Tech

Date submitted: 01 Aug 2014 Electronic form version 1.4