**P. Cvitanović**, N.B. Budanur, M. Gudorf and B. Gutkin
School of Physics, Georgia Tech, Atlanta GA, USA

*A zeta function for transitional turbulence?*

Advances in experimental imaging, computational methods, and dynamical systems theory reveal that the unstable recurrent flows observed in moderate Reynolds number turbulent flows result from close passes to unstable invariant solutions of Navier-Stokes equations. These 3D, fully nonlinear solutions -equilibria, traveling waves, and (relative) periodic orbits- structure the infinite-dimensional state space of turbulent flows and provide a skeleton for analyzing their dynamics.

However, with dynamics in high-dimensional state spaces come new challenges - we will discuss two. (1) Flows of interest (pipe, channel flows) often come equipped with continuous symmetries. Just to get started with charting out their state spaces, one first has to quotient the symmetries, i.e., replace the flow by an equivalent, symmetry reduced flow, in which each family of symmetry-related states is replaced by a single representative. Doing this well remains a challenge. (2) The space-time translationally recurrent flows are doubly-periodic tori (not periodic orbits). Coupled cat map lattices suggest that symbolic dynamics should likewise be 2-dimensional. The zeta function is within reach.