On a generalization of the Bardos-Tartar conjecture to nonlinear dissipative PDEs

Edriss S. Titi

University of Cambridge
Texas A&M University
and
The Weizmann Institute of Science

Abstract

In this talk I will show that every solution of a KdV-Burgers-Sivashinsky type equation blows up in the energy space, backward in time, provided the solution does not belong to the global attractor. This is a phenomenon contrast to the backward behavior of the 2D Navier-Stokes equations, subject to periodic boundary condition, studied by Constantin, Foias, Kukavica and Majda, but analogous to the backward behavior of the Kuramoto-Sivashinsky equation discovered by Kukavica and Malcok. I will also discuss the backward behavior of solutions to the damped driven nonlinear Schrödinger equation, the complex Ginzburg-Landau equation, and the hyperviscous Navier-Stokes equations. In addition, I will provide some physical interpretation of various backward behaviors of several perturbations of the KdV equation by studying explicit cnoidal wave solutions. Furthermore, I will discuss the connection between the backward behavior and the energy spectra of the solutions. The study of backward behavior of dissipative evolution equations is motivated by a conjecture of Bardos and Tartar which states that the solution operator of the two-dimensional Navier-Stokes equations maps the phase space into a dense subset in this space.