Applied Dynamical Systems Seminar

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Effects of Diffusion and Advection on the Principal Eigenvalue of a Periodic-parabolic Problem with Applications

Abstract:

The principal eigenvalue is a basic concept in the field of reaction-diffusion partial differential equations. In recent decades, there has been a large amount of research work devoted to the investigation of the qualitative properties of the principal eigenvalue and its eigenfunction for second-order linear elliptic operators. As far as the periodic-parabolic operator is concerned, however, to our best knowledge, much less has been known for the associated principal eigenvalue, especially when the advection term appears. The principal eigenvalue for linear periodic-parabolic operators is important because it not only contains the autonomous elliptic case but is interesting in its own right when a time periodic environment is involved.

In my talk, we are concerned with the one-dimensional periodic-parabolic eigenvalue problem. The dependence of the principal eigenvalue on the diffusion and advection coefficients is investigated. In particular, the asymptotic behaviours of the principal eigenvalue as the diffusion and advection coefficients go to zero or infinity are derived. These qualitative results are then applied to a nonlocal reaction-diffusion- advection equation modelling the spatiotemporal evolution of a single phytoplankton species with periodic incident light intensity.

This is joint work with Dr. Xiaoqiang Zhao.