Sharp time asymptotics of the quasi-geostrophic equation and near plane waves of reaction-diffusion models

Fazel Hadadifard

In this talk we aim to introduce and improve the scaled variables method of Galley–Wayne. As the first application, we compute the sharp time decay rates of the solutions to the quasi–geostrophic equation, subject to fractional dissipation, in L^p based spaces, $1 \leq p \leq 2$. In another application, we present the stability of the plane waves of reaction–diffusion models, in which, we rigorously calculate the sharp relaxation rates in $L^\infty(\mathbf{R}^n)$ based spaces, both for the asymptotic phase and the radiation terms.

The scaled variable method allows us to compute the decay rate and explicitly identifies the asymptotic profiles. Our works, joint with Prof. A. Stefanov, generalizes the classical works on the Navier-Stokes system. Since the Green's functions in the fractional dissipation context are not sufficiently decaying at infinity, the center-stable manifold construction of Gallay-Wayne appears to be out of reach. Instead, we rely on appropriate a priori estimates for the solutions (both in weighted and unweighted settings) to derive the asymptotic profiles.