Long-time dynamics and turbulence of nonlinear waves

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Abstract

Over the past twenty years, the long-time behavior of small amplitude solutions to nonlinear dispersive and wave equations on Euclidean spaces ($\mathbb{R}^n$) became relatively well-understood. In contrast, the situation is much less understood on bounded domains, that feature a markedly different and rich set of behaviors. In particular, the dynamics in this setting is characterized by out-of-equilibrium behavior, in the sense that solutions typically do not exhibit long-time stability near equilibrium configurations.

At the level of the physics underlying these problems, studying this out-of-equilibrium behavior leads to an interesting interplay between dynamics and statistical mechanics, in what is often known as wave turbulence theory. At the level of the mathematics, this study features an interaction between PDE methods, dynamical systems theory, probability theory, as well as a surprising and very elegant input from analytic number theory.

In this talk, we shall discuss all these aspects, and survey some recent advances in this direction of research.