Applied Mathematics Seminar
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Anomalous Behavior of a Passive Tracer in Wave Turbulence

by

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Abstract

We consider the behavior of a passive tracer when the velocity field represents a superposition of random waves and there is no separation of scales: The energy spectrum of the velocity field extends into the region of long waves and even can be singular there. The turbulence of various ocean or atmospheric waves provides examples. We obtain anomalous diffusion, anomalous drift, and anomalous spreading of a passive tracer cloud. For the latter we find the existence of two regimes: (1) the initial "fast" divergence of the passive tracer particles, which can be sub- or supper-exponential, and (2) the later power-law spreading of the passive tracer cloud. The exponents, as well as the corresponding pre-factors, are found. The theoretical results are confirmed by numerical simulations.