Lagrangian transport and mixing in fluids from geometric, probabilistic, and topological perspectives

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Abstract Several geometric and probabilistic methods for studying chaotic phase space transport have been developed and fruitfully applied to diverse areas of mechanics, particularly particle motion in fluid mechanics. Increasingly, systems of interest are determined not by analytically defined model systems, but by data from experiments or large-scale simulations. This emphasis on real-world systems sharpens our focus on those features of phase space transport in finite-time systems which are robust. In this talk, we will discuss invariant manifolds and invariant manifold-like objects, and also their connection with almost-invariant sets, almost-cyclic sets, and space-time braids. These perspectives significantly advance our capability to both understand and exploit fluid flows in engineering and natural systems.

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