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Chaotic Advection with Inertia in a 2D Cavity Flow RICHARD M. LUEPTOW, JULIO M. OTTINO, Northwestern University, JIAJUN WANG, Zhejiang University — The mechanisms underlying chaotic advection and mixing in inertial flow above the Stokes flow regime are incompletely understood. We performed numerical simulations of chaotic advection and mixing for time-periodic inertial flow in a two-dimensional rectangular cavity driven by alternating motion of the upper and lower walls. The effects of inertia were analyzed in terms of the flow topology and tracer dynamics. The Poincaré map evolves as the Reynolds number increases. Periodic points shift in position from their original locations in Stokes flow, and the Poincaré sections transition from those characteristic of Stokes flow to a different characteristic pattern at higher Reynolds numbers. Tracer motion exhibits increasing degrees of disorder with increasing Reynolds number and decreasing forcing frequency resulting in increased chaotic mixing. The forcing frequency has a much greater impact on chaotic advection and mixing than inertial effects.

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