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Chaotic advection and mixing inside drops subject to transient electric fields XIUMEI XU, G.M. HOMSY, Department of Mechanical and Environmental Engineering, University of California-Santa Barbara — We numerically study the 3D chaotic trajectories inside a neutrally buoyant drop driven by periodically switching the orientation of a uniform electric field. The extent of the chaotic trajectories is related to two parameters: the modulation frequency and the change in the orientation angle α of the electric field. When α equals $\pi/2$, although the axisymmetry of the streamlines is broken, Poincare maps show that for all modulation frequencies, particle trajectories are confined by certain KAM surfaces determined by initial positions. The curvilinear coordinates of the KAM surfaces are formed by the rings of fixed points at the vortex centers which are orthogonal when α equals $\pi/2$. For α is different than $\pi/2$, the Poincare sections depend on the modulation frequency, and there is a range of intermediate frequencies where the volume of the chaotic region is a maximum. Typically a single trajectory can fill most portion of the drop, and there are ordered islands near the crossings of the rings of center fixed points. These results suggest there are optional protocols that maximize mixing.

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