Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Moving Walls Accelerate Mixing[1] JEAN-LUC THIFFEAULT, University of Wisconsin - Madison, EMMANUELLE GOUILLART, CNRS / Saint-Gobain Recherche, OLIVIER DAUCHOT, CEA Saclay — Mixing in viscous fluids is challenging, but chaotic advection in principle allows efficient mixing. In the best possible scenario, the decay rate of the concentration profile of a passive scalar should be exponential in time. In practice, several authors have found that the no-slip boundary condition at the walls of a vessel can slow down mixing considerably, turning an exponential decay into a power law. This slowdown affects the whole mixing region, and not just the vicinity of the wall. The reason is that when the ergodic mixing region extends to the wall, a separatrix connects to it. The approach to the wall along that separatrix is polynomial in time and dominates the long-time decay. However, if the walls are moving then closed orbits are created, separated from the bulk by a homoclinic orbit connected to a hyperbolic fixed point. The long-time approach to the fixed point is exponential, so we recover an overall exponential decay, albeit with a thin unmixed region near the wall.

[1]This work was partially supported by the Division of Mathematical Sciences of the US National Science Foundation, under grant DMS-0806821.

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Date submitted: 31 Jul 2009 Electronic form version 1.4