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**Passive scalar separation using chaotic advection** ANDREW DUGGLEBY, PRADEEP RAO, Texas A&M University, PANKAJ KUMAR, MARK STREMLER, Virginia Tech — Separation of two substances with slightly different diffusivities using chaotic advection is explored for finite Reynolds numbers (up to Re$\sim$ 10) and high average Schmidt numbers ( $\overline{\mathrm{Sc}} = (\mathrm{Sc}_1 + \mathrm{Sc}_2)/2 = 10^6$)) for a modified lid-driven cavity. In this approach, exponential stretching of material interfaces enhances diffusion and accelerates separation of concentrated molecules having slightly different diffusivities. At low Re the flow can be reversed and the separated molecules extracted. Using the exponential convergence afforded by the use of a 2D Fourier-Chebyshev spectral algorithm for streamfunction-vorticity formulation with passive scalar transport enables accurate tracking of exponential stretching of material lines in the flow and capturing of the sharp concentration gradients associated with large $\overline{\mathrm{Sc}}$. The two substances separate significantly faster than for simple diffusion. Performance based on topological entropy and almost-invariant sets, as well as application to real separation systems, will be discussed.

Mark Stremler
Virginia Tech

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