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Experimental studies of reaction front barriers in a three-dimensional nested vortex flow[1] MINH DOAN, KATIE LILIENTHAL, TOM SOLOMON, Bucknell University — We present experiments that study the behavior of reaction fronts propagating in three-dimensional, laminar fluid flows. The primary flow is a chain of nested horizontal and vertical vortices, a flow that has been shown to produce chaotic mixing even if time-independent[2] The fronts are produced by the excitable, Ruthenium-catalyzed Belousov-Zhabotinsky chemical reaction. When illuminated with a near-UV laser beam, the Ru indicator fluoresces everywhere except where there is a reaction front. By scanning the laser beam and imaging from above, we are able to do a full 3D-visualization of the reaction front propagating through the flow. The fronts are observed to encounter tube- and sheet-like barriers, whose properties we measure experimentally. We interpret the results by generalizing a recent theory of "burning invariant manifolds" [3] which have been shown previously to act as one-way barriers for reaction fronts propagating in two-dimensional fluid flows.

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