

## Barriers to Active Transport in Turbulence

We discuss results to identify material barriers to the transport of active vector fields, such as vorticity and momentum, in three-dimensional unsteady flows. Challenges include the vectorial nature of these active quantities, as well as their dependence on the frame of reference. With these challenges addressed, we obtain a general algorithm for locating objective material barriers to active transport, which form a dynamical skeleton around possible pathways in the flow. We illustrate the results on closed-form solutions of the Navier-Stokes equations, and well as on two- and three-dimensional numerical simulations.

*Fig. 1: Visualisation of instantaneous vorticity transport barriers in a channel flow ( $Re = 150$ )*

