# Wada basin boundary in leaky hydrodynamical flows

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Chaotic advection, a phenomenon characterized by the unpredictable movement of particles in fluid flows, finds broad applications across diverse fields, including meteorology, oceanography, and chemical engineering. A hallmark of chaotic trajectories is their ability to facilitate large-scale transport and mixing. The advection of passive scalars in time-independent two-dimensional incompressible fluid flows is an integrable Hamiltonian system. It becomes non-integrable if the corresponding stream function depends explicitly on time, allowing the possibility of chaotic advection of particles. This study focuses on a specific model, the double gyre flow, which represents an open system with multiple exit points. We explore the presence of basin boundaries exhibiting the Wada property, a condition where a boundary point separates three or more escape basins. This property signifies an extreme degree of fractality, suggesting complex and intricate patterns in the particle trajectories.

## Type

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