Title of the project: Chaotic Transport and mixing in Hamiltonian models of Fluids

Brief Summary:
Transport and mixing properties of Fluids and Plasmas are studied using tools from Hamiltonian dynamical systems [del-Castillo-Negrete and Morrison 1993, Physics of Fluids, 4, 948-965, Szezech et al. 2009, Chaos, 19,043108]. For this reason, simple Hamiltonian systems, (discrete and continuous systems) have been proposed to study transport by waves in shear flows and the role of the potential vorticity conservation in chaotic transport. In order to investigate transport barrier that eliminates or reduces the chaotic transport in these systems, we will use the method of Lagrangian descriptors [1,2,3] that has been applied successfully to the study of transport and mixing in Hamiltonian Dynamics, Chemical reaction dynamics and Geophysical fluid dynamics. We will also study the role of the unstable periodic orbits, of stickiness, and of the homoclinic and heteroclinic intersections to the chaotic transport in these models.

Maximum number of students: 3

References
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2. M. Katsanikas, V. J. García-Garrido, M. Agaoglou, S. Wiggins, Phase Space Analysis of the Dynamics on a Potential Energy Surface with an Entrance Channel and Two Potential Wells, Physical Review E, **102**, 012215, (2020)
3. J. Curbelo, V.J. Garcia-Garrido, C. R. Mechoso, A. M. Mancho, S. Wiggins, C. Niang. Insights into the three-dimensional Lagrangian geometry of the Antarctic polar vortex. Nonlin. Processes in Geophys. **24** (3), 379-392, (2017).