ETH zürich

Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Reaction fronts and swimming microbes in laminar flows: Invariant manifolds and one-way barriers

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We present experiments on the effects of laminar flows on the motion of swimming microbes and on the motion of the excitable Belousov-Zhabotinsky chemical reaction. We test theories that predict invariant manifolds -- "burning invariant manifolds" (BIMs) for front propagation and "swimming invariant manifolds" (SwIMs) for self-propelled tracers -- that act as one-way barriers for both of these systems. We present results from several experiments: (a) BIMs blocking reaction fronts in a range of 2-D and 3-D vortex-dominated flows; (b) SwIMs blocking motion of swimming bacteria and eukaryotic microbes in a microfluidic hyperbolic flow in a cross channel; and (c) on-going experiments about the behavior of swimming microbes in vortex flows.

Tom Solomon is a professor in the Department of Physics & Astronomy at Bucknell University in central Pennsylvania, USA. He and his undergraduate research students study chaotic fluid mixing and the effects of fluid mixing on dynamical processes occurring in the flows. Their experiments at Bucknell have been funded by 8 grants from the National Science Foundation and Research Corporation, and have resulted in 40 publications. The research program was recognized by the American Physical Society in 2005 for outstanding research by an undergraduate and in 2014 for outstanding research by a faculty member at an undergraduate institution.

Date: Wednesday, 20 March 2024
Time: 16:15 - 17:15h
Place: ETH Zurich, ML H 44
Host: Prof. Dr. George Haller

Further information: https://ifd.ethz.ch/events/ktf.html

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