Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Lagrangian transport near perturbed periodic lines in three-dimensional unsteady flows MICHEL SPEETJENS, Eindhoven Univ of Tech — Periodic lines formed by continuous strings of periodic points are key organizing entities in the Lagrangian flow topology of certain three-dimensional (3D) time-periodic flows. Such lines generically consist of elliptic and/or hyperbolic points and thus give rise to 3D flow topologies made up of families of concentric closed trajectories embedded in chaotic regions. Weak perturbation destroys the periodic lines and causes said trajectories to coalesce into families of concentric tubes. However, emergence of isolated periodic points near the disintegrating periodic lines and/or partitioning of the original lines into elliptic and hyperbolic segments interrupt the tube formation. This yields incomplete tubes that interact with the (chaotic) environment through their open ends, resulting in intricate and essentially 3D flow topologies These phenomena have been observed in various realistic flows yet the underlying mechanisms are to date only partially understood. This study deepens insight into the (perturbed) Lagrangian dynamics of these flows by way of a linearized representation of the equations of motion near the periodic lines. Predictions on the basis of this investigation are in full (qualitative) agreement with observed behavior in the actual flows

Michel Speetjens
Eindhoven Univ of Tech

Date submitted: 31 Jul 2015 Electronic form version 1.4