Chaotic Manifolds behind a Flapping Foil

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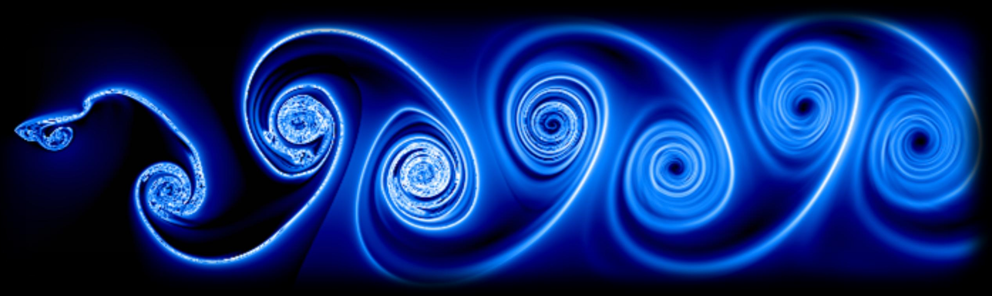
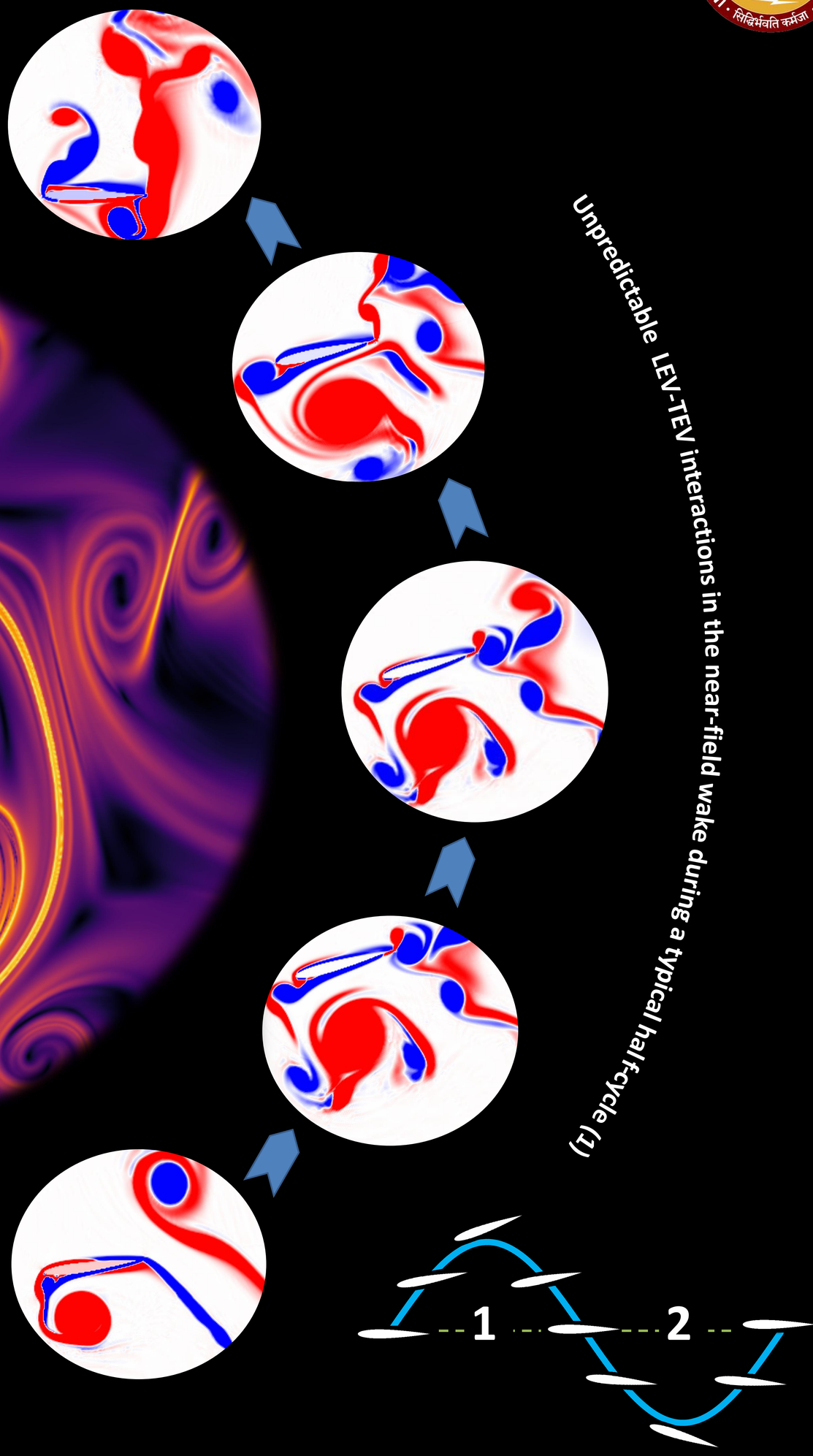
Chaos

High Strouhal number

Order

Low Strouhal number





Natural flyers flap their wings periodically to generate desired aerodynamic loads to fly by leaving a variety of wake patterns in the trail. The nature of these vortex shedding patterns holds the key to the aerodynamic load generation. The manifestation of chaos in the flow-field behind periodically flapping foils is an interesting phenomenon which, in turn, results in chaotic force generation. The leading-edge vortex is found to be the primary trigger behind the transition from order to chaos in the flow topology. Even a small erratic behavior in the leading-edge vortex could spell a complete eventual breakdown of a regular wake, which is sustained by the frequent and spontaneous formation of the vortex couples and the subsequent vortex interactions.