Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Seminar

Exact Coherent Structures: A novel approach to understand turbulence

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Turbulence in fluid flows in nearly ubiquitous. It is present in rivers, oceans, flow past the wings of an aeroplane, blood flow in human heart etc. Scientists have been trying to understand it for centuries, yet it is not fully understood. In the past decade, numerical and experimental investigations in a variety of fluid flows have demonstrated that chaos/turbulence can be understood using the unstable, invariant solutions of the Navier-Stokes equation, called Exact Coherent Structures (ECS). These ECS are patterns that appear fleetingly in a turbulent fluid flow, and possess less spatiotemporal complexity. The ECS along with the dynamical connections between them form the skeleton of fluid turbulence, and are conjectured to guide the dynamics. However, the computation of ECS and their dynamical connections is numerically very challenging. The existing algorithms work efficiently for low dimensional theoretical systems, but are computationally intensive for high dimensional realistic systems. Due to this reason, evidence of ECS, especially the dynamical connections, in realistic fluid flows is very scarce. To circumvent this difficulty, we have developed a robust, efficient algorithm for computing ECS and dynamical connections.

To study the ECS based description of turbulence, we considered an experimentally accessible flow in a shallow layer of fluid. In this presentation, I will talk about our recent success in identifying some of the key ECS in this flow, and their relevance to the turbulence. The talk also illustrates the performance of the newly introduced algorithm by computing ECS and their dynamical connections in this flow.

Friday, Mar 2nd 2018

11:30 AM (Tea/Coffee at 11:00 AM)

Auditorium, TIFR-H