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

Seminar

Turbulent Superstructures in Rayleigh-Benard convection

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Thermal convection in horizontally extended domains exhibits turbulent superstructures with characteristic length scales larger than the thickness of convective layer. The characteristic spatial and temporal scales of these superstructures depend on the governing parameters of the flow, i.e., on the Rayleigh and Prandtl numbers. The skeleton of such superstructures consists of hot and cold temperature ridges along with topological defects at the locations where the ridges merge or end. An important question is to understand the role of these superstructures in turbulent heat transport. Here, we numerically study the role of turbulent superstructures in heat transport for water (Prandtl number Pr = 7) at three Rayleigh numbers Ra = 10^5, 10^6, 10^7. In order to reveal the superstructures, turbulent fluctuations are removed by time-windowed averaging of the velocity and temperature fields for an appropriate time interval. To extract the ridge network, we use machine learning algorithms to train a deep convolutional neural network. We find that the contribution from superstructures to total heat transport decreases as the Rayleigh number increases. This observation indicates that the small scales become significant in transporting heat as the thermal driving force is increased.

Monday, Mar 25th 2019

4:00 PM (Tea/Coffee at 3:30 PM)

Seminar Hall, TIFR-H