Session 1 Program

Homogeneous Turbulence and Flow Structure

9:00 -10:00 Moffatt (50 min talk + 10 min for question)

10:00-10:08 Tatsumi
10:08-10:16 Domaradzki and Carati
10:16-10:24 Cambon
10:24-10:32 Meneveau
10:32-10:40 Sreenivasan

(6 min talk + 2 min for question)

10:40-10:50 1 min talk for posters

10:50-11:30 Poster and coffee

11:30-12:00 Discussion

Session 1 Discussion

Progresses and new concepts

Computer simulation

Visualization of turbulent flow (Exp. and Sim.)

Phenomenological models of intermittency
(Log normal, fractal, multi-fractal, Log Poisson, Tsallis Stat.)

Dynamical system and shell model

Two-dimensional turbulence
(Inverse and forward cascade ranges)

Analytical theory
(Spectral theory, PDF)

Huge data set and a lot of knowledge about homogeneous turbulence

Unified theory to explain and predict statistical properties
from the first principle ?

Theory

Experiment

Computation

Session 1 Homogeneous Turbulence and Flow Structure

Summary

1. Coherent structures are essential for understanding transport of heat and mass, and generation of drag and aerodynamic noise.
2. Interaction of coherent st. with incoherent turbulence is non-local (both in x and k space) and nonlinear is the critical aspect of turbulence dynamics.
3. Reconnection constitutes a new, alternative scenario of turbulence cascade. Although extensively explored by flow visualization and quantitatively documented through exp. and DNS, accumulated knowledge of coherent structures have not been fully utilized via mathematical representation and incorporation into a system of dynamical equations.
4. Lagrangian studies are necessary for better understanding of turbulence transport phenomena and statistics at small scales.

Questions

1. What is flow structure and coherent structure?
   Any recognizable large scale vorticity patch is a structure. A phase aligned ensemble averaged large scale vorticity patch is a coherent structure in turbulent shear flow. If all patches or structures belong to a single family, then the entire flow has one coherent structure.
   Space time distribution of structures is also important.
2. What are the dynamical equations of coherent structures for prediction of their evolution?
3. What is the physical scenario of cascade in turbulence?
   How does the statistics of turbulence change during cascade?