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

Seminar

Universality of turbulence in fluids and plasmas

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Turbulence is believed to be the last unsolved problem of classical physics. The phenomenon of turbulence is ubiquitous in nature starting from the mixing of milk in a coffee cup to the non-linear instabilities of super massive black holes. Despite its highly complex nature, turbulent flows exhibit universal properties. In spectral space, this universality is perceived through Kolmogorov's -5/3 law where the energy spectral density obeys a power law as $k^{-5/3}$, where k is the wavenumber. In physical space, this is expressed in terms of the so-called exact relations where the third order statistical moment of velocity fluctuations scales linearly with the corresponding length scale (Kolmogorov, 1941). Unlike the phenomenological spectral power laws, the exact relations are mathematically rigorous and hence can give a correct estimate for ε .In the case of incompressible magnetohydrodynamic[1] (MHD) turbulence, the energy cascades due to the weak interaction of two counter propagating linear wave modes (Alfvén mode) and we find a power law in $k^{-3/2}$ (Iroshnikov 1964, Kraichnan 1965). For compressible turbulence, exact relations are derived only recently (Galtier & Banerjee, 2011, Banerjee & Galtier, 2013, 2014). These relations help in understanding crucial problems in solar wind turbulence e.g. the anomalous heating of the fast solar wind and also in numerical simulations of astrophysical fluid turbulence.

Friday, Sep 8th 2017

04:00 PM (Tea/Coffee at 03:45 PM)

Auditorium, TIFR (FReT-B)