MULTIFRACTAL NATURE OF 3D NAVIER-STOKES TURBULENCE AND ITS SCALE LOCALITY IN TERMS OF VORTEX AXIS

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In this talk, we apply a scale decomposition (Littlewood-Paley decomposition) to the 3D Navier-Stokes turbulence in a periodic box and show that the vortex axes in its inertial range surprisingly reproduce a multifractal model, i.e. the lognormal model. To demonstrate this, we use a turbulence snapshot with a resolution of 8192^3 provided by the Ishihara research group. Next, we show (using spatial statistics) that the vortex stretching/compressing transfer energy between adjacent scales, and mathematically prove that fast vortex breakdown never occurs within the vortex stretching process (i.e. scale locality). Note that the proof does not use any singular integral theory, but instead uses a simple Lie bracket structure in Lagrangian coordinates.