Abstract Submitted
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Scale-locality of the energy cascade in turbulence using Fourier Analysis[1] HUSSEIN ALUIE, GREGORY L. EYINK, Johns Hopkins University — We investigate the scale-locality of non-linear interactions which drive the energy cascade in a turbulent flow. The main picture that emerges from our work is that the primary participants in the cascade process are triplets of "eddies" comprised of adjacent *logarithmic bands* of Fourier modes. We disprove in particular an alternate picture of "local transfer by nonlocal triads" by showing that such triads, due to their restricted number, make a vanishingly small contribution to the energy flux in the inertial range. We rigorously prove that it is only the aggregate effect of a geometrically increasing number of local wavenumber triads which can sustain the energy cascade to small scales. Our analysis shows that the SGS definition of the flux is the proper measure of the cascading energy and that the sharp spectral filter has a firm theoretical basis for use in LES modeling. It also demonstrates the danger in the widespread notion that the elementary interactions in turbulence are those involving triads of single Fourier modes. We support our results with numerical data from a 512^3 pseudo-spectral simulation of isotropic turbulence with phase-shift dealiasing.

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