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On the Lagrangian Power Spectrum of Turbulence Energy in Isotropic Turbulence FRANCESCO LUCCI, Aerothermochem. and Combustion Systems Laboratory, ETH, Zurich, Switzerland, VICTOR L'VOV, Dept. of Chem. Phys., The Weizmann Institute of Science, Rehovot 76100, Israel, ANTONINO FERRANTE, Dept. of Aeronautics & Astronautics, Univ. of Washington, Seattle, WA 98195, SAID ELGHOBASHI, Dept. of Mech. & Aerospace Engineering, Univ. of California, Irvine, CA 92697 — We present, for the first time, a derivation of the transport equation of the Lagrangian frequency power spectrum, $E_L(t,\omega)$, of turbulence energy in isotropic turbulence starting from the autocorrelation of the Lagrangian velocity. The new equation is: $\partial E_L(t,\omega)/\partial t = \mathcal{T}_L(t,\omega) - \varepsilon_L(t,\omega) + \Psi_L(t,\omega)$, where $\mathcal{T}_L(t,\omega)$ is the transfer rate of $E_L(t,\omega)$ across the frequency spectrum, $\varepsilon_L(t,\omega)$ is the viscous dissipation rate of $E_L(t,\omega)$, and $\Psi_L(t,\omega)$ is the external forcing rate. Our DNS shows that $\varepsilon_L(\omega)$ is maximum at low frequencies and vanishes at high frequencies. We also performed an analytical study which confirms the DNS result and shows that $\varepsilon_L(\omega) \sim (\omega_\eta - \omega)$, i.e. there is non-locality for $\varepsilon_L(\omega)$ in the ω domain, whereas $E_L(\omega) \sim (1/\omega^2 - 1/\omega_\eta^2)$, i.e. the locality is valid for $E_L(\omega)$, where ω_η is the Kolmogorov scale frequency.

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