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Turbulent spectra formation over energy and helicity transfer

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Large-scale turbulence universality was revealed recently in wind and magneto-hydrodynamic flows (Branover et al, 2004) with characteristic scales exceeding a scale of forcing. Here we study an effect of the large-scale and dissipative ranges of homogeneous isotropic turbulence on the inertial range in order to define its asymptotic scaling. A structure function of a velocity obtained in the inertial range reads $D(r) \propto \left(\frac{\varepsilon^2}{\eta}\right)^{2/3} \left(\frac{\eta}{\varepsilon}\right)^{\delta_L} r^{\delta_L}$, where ε and η are energy and helicity transfer rates, δ_L is a parameter defined by ε and η properties at a large scale range. A similar expression was obtained by Golbraikh, Moiseev (2002), where a parameter δ (instead of δ_L) is defined by ε and η properties in a dissipative range. Therefore, structure functions and spectra in the inertial range depend on relations between δ_L and δ. Wind spectra measured in experiments for different atmospheric boundary layer conditions revealed spectral slopes corresponding to the model.