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Large-scale structure of a passive scalar field in homogeneous turbulence KATSUNORI YOSHIMATSU, YUKIO KANEDA, Nagoya University — We study the large-scale structure of a passive scalar field without any scalar source in incompressible homogeneous turbulence. We assume that the initial scalar spectrum at time $t = 0$ takes the form $Ck^2 + o(k^2)$ at the wavenumber $k \to 0$, where C is independent of k. Theoretical analysis [Yoshimatsu and Kaneda, Phys. Rev. Fluids 3, 104601 (2019)] shows that the spectrum keeps the form at $k \to 0$ and C is time independent for $t \geq 0$. On the basis of the independence andan assumption of a certain self-similar evolution of the scalar field at the large scales including the scales comparable to the scalar integral length scales, it is shown that a certain measure of the anisotropy of the scalar field remains time-independent at the large scales in a self-similar state, irrespective of the velocity field. In addition, we performed direct numerical simulation (DNS) of the passive scalar field in a periodic box. It is found that the DNS results are consistent with the theory.

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