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Energy spectrum in high Reynolds number turbulence - high resolution DNS results KOJI MORISHITA, Kobe University, TAKASHI ISHIHARA, Nagoya University, YUKIO KANEDA, Aichi Institute of Technology, MITSUO YOKOKAWA, Kobe University, ATSUYA UNO, RIKEN AICS — The energy spectrum and energy flux in high Reynolds number (Re) forced incompressible turbulence are investigated by using high-resolution DNS in a periodic box. We used negative viscosity (at a wavenumber range $kL < 3$) to keep the total energy constant, and used well-developed turbulence fields as the initial conditions (L is the integral length scale). The DNS with up to 6144^3 grid points show that, after a transient period of the order of eddy turnover time, the standard deviation of the energy spectrum and that of the energy flux are largest at $kL \sim 1$ and is an algebraically decreasing function of kL. As in previous studies, the energy spectra are insensitive to the values of $k_{max}\eta$ when $k_{max}\eta \geq 1$ (η is the Kolmogorov length scale). The time-averaged, normalized energy spectra of high Re turbulence at high k overlap well with each other when they are plotted against $k\eta$. The normalized spectra have a slope steeper than -5/3 (the Kolmogorov scaling law) by factor 0.1 at $k\lambda \sim 1$ (λ is Taylor micro-scale). The DNS suggest that there is another wavenumber range ($k\lambda < 1$), in which the spectrum has a slope close to -5/3, and also that the latter range increases with Re and the Kolmogorov constant is 1.8 ± 0.1.

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