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Second-order structure function in high-resolution DNSs of turbulence – Where is the inertial subrange?[1] TAKASHI ISHIHARA, Okayama Univ., YUKIO KANEDA, Aichi Institute of Technology, KOJI MORISHITA, MITSUO YOKOKAWA, Kobe Univ., ATSUYA UNO, RIKEN AICS — We report some results of a series of high resolution direct numerical simulations (DNSs) of forced incompressible isotropic turbulence with up to 12288^3 grid points and Taylor microscale Reynolds number $R_\lambda \sim 2300$. The DNSs show that there exists a scale range, approximately at $100 < r/\eta < 600$ (η is the Kolmogorov length scale), where the second-order longitudinal velocity structure function fits well to a simple power-law scaling with respect to the distance r between the two points. However, the magnitude of the structure function depends on R_λ, i.e., the structure function normalized by the mean rate of energy dissipation and r is not independent of R_λ nor the viscosity. This implies that the range at $100 < r/\eta < 600$ and R_λ up to 2300 is not the 'inertial subrange', whose statistics are assumed to be independent from viscosity or R_λ in many turbulence theories. The measured exponents are to be not confused with those in the 'inertial subrange': the constancy of the scaling exponent of a structure function in a certain range does not necessarily mean that the measured exponent is the scaling exponent in the 'inertial subrange'. This yields a question, "Where is the 'inertial subrange' in experiments and DNSs?"

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