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Third-order structure functions for isotropic turbulence with bidirectional energy transfer JIN-HAN XIE, College of Engineering, Peking University, OLIVER BUHLER, Courant Institute of Mathematical Sciences, New York University — We derive and test a new heuristic theory for third-order structure functions that resolve the forcing scale in the scenario of simultaneous spectral energy transfer to both small and large scales, which can occur naturally in rotating stratified turbulence or magnetohydrodynamical turbulence, for example. The theory has three parameters, namely the upscale/downscale energy transfer rates and the forcing scale, and it includes the classic inertial range theories as local limits. When applied to measured data, our global-in-scale theory can deduce the energy transfer rates using the full range of data, therefore it has broader applications compared with the local theories, especially in the situations where the data is imperfect. In addition, because of the resolution of forcing scales, the new theory can detect the scales of energy input, which was impossible before. We test our new theory with a two-dimensional simulation of MHD turbulence and use the theory to analysis geophysical fluid data.

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