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turbulent intermittency as consequence of stationary constraints[1]

SBASTIEN AUMAITRE, CEA-Saclay, STEPHAN FAUVE, ENS-Paris — In its seminal work on turbulence, Kolmogorov made use of the stationary hypothesis to determine the Power Density Spectra of velocity field in turbulent flow. However to our knowledge, the constraints that stationary processes impose on the fluctuations of power have never been used in the context of turbulence. Here we first recall how the Power Density Spectra of the fluctuations of the injected power, the dissipated power and the energy flux have to converge at vanishing frequency. Then we show that these constraints cannot be satisfied by using naive scaling argument in the no-intermittent framework of the 1941 Kolmogorov theory (the K41 theory). Yet the intermittent GOY–shell model, fulfills these constraints on the power fluctuations. Hence, they might induce some intermittency. Indeed, we show that the constraints on the power fluctuations implies a relation between scaling exponents which is consistent with our GOY–shell model and agrees the She-Leveque formula. It also fixes the intermittent parameter of the log-normal model to a realistic value. The relevance of these results for real turbulence is drawn in the concluding remarks.

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