Intermittency in two dimensional turbulence

YONGGUN JUN, JIE ZHANG, XIAO-LUN WU — Intermittency of the velocity difference $\delta v_l$ and the energy dissipation rate $\varepsilon_l$ on scale of $l$ is investigated on the inverse energy cascade range in the forced 2D turbulent flow. Measurements are performed on the freely-suspended horizontal soap film using particle tracking velocimetry. We use the multifractal method to analyze the energy dissipation rate $\varepsilon_l$ and calculate the scaling exponent $\tau_q$ and the intermittency parameter $\mu_{\varepsilon}$. From high order structure function $\langle (\delta v)^{p} \rangle \sim l^{\zeta_{p}}$, We obtain the scaling exponent $\zeta_{p}$ with integer $p$ and estimate the intermittency parameter $\mu_{v}$. The Komogorov refined hypothesis suggests the relation $\zeta_{p} = \frac{\tau_{p/3}}{3} + \frac{p}{3}$. This relation agrees with the experimental data up to $p = 5$. The deviation for larger $p$ may be due to linear damping in the system that also contributes to the energy flux on large scales.

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