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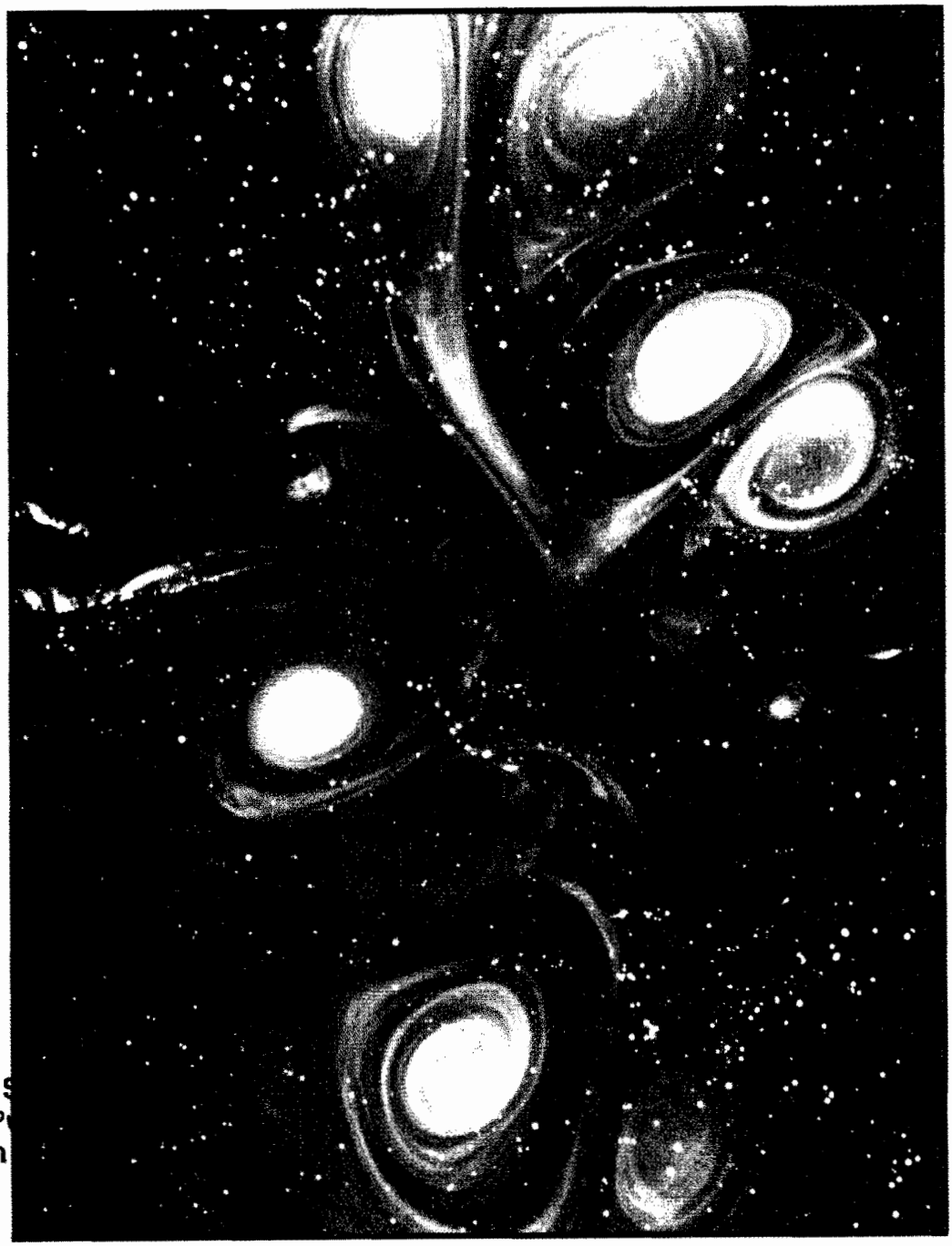

Book of Abstracts

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Intermittency in turbulent boundary layers

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Abstract - Much efforts have been devoted in the recent past towards a better understanding of the phenomenology of homogeneous and isotropic turbulence (in particular from the point of view of intermittency). Here we address the problem of the influences on intermittency of non homogeneities of the flows. We define the following Integral Structure Functions (ISF):

$$\tilde{S}_p(r) = \left\langle (\delta v(r)^3 + r \cdot \mathcal{S} \cdot \delta v(r)^2)^{p/3} \right\rangle \tag{1}$$

The rationale behind these structure functions being that the energy, in presence of shear, is not only transferred to small scale but also is advected spatially by means of the average velocity. In general we expect that there will be a length scale ($L_{\mathcal{S}}$, shear length scale) at which the two contributions will be of the same order of magnitude. In general:

$$\tilde{S}_p(r) \simeq S_p(r) \qquad \text{for} \quad r \ll L_s \tag{2}$$

$$\tilde{S}_p(r) \simeq (r\mathcal{S})^{p/3} S_{2p/3}(r) \quad \text{for} \quad r \gg L_s \tag{3}$$

The shear length scale being defined by the condition $\frac{\delta v(L_{\mathcal{S}})}{L_{\mathcal{S}}} = \mathcal{S}$ can be estimated (neglecting intermittency) as $L_{\mathcal{S}} = (\epsilon/S^3)^{1/3}$ (ϵ being the energy dissipation rate). We report here one test

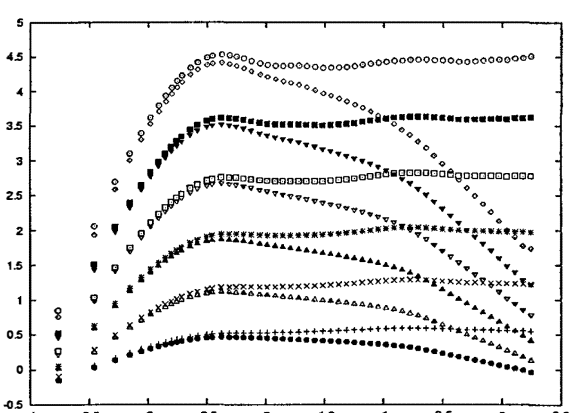

Figure 1: From experimental data at $y^+ = 102$. From bottom to top, in log-log scale, $\tilde{S}_p(r)/r^{\zeta_p}$ as compared to $S_p(r)/r^{\zeta_p}$, for p=1...6.

on experimental data coming from the recirculating wind tunnel of ENS-Lyon. At a distance $y^+ = 102$ from the wall, we have computed the ordinary structure functions, $S_p(r)$, and the ISF, $\tilde{S}_p(r)$. The value of the shear S at our distance from the wall is estimate from the well-established log-law for the average velocity in a turbulent boundary layer.
In Figure 1 we show the normal structure functions compensated by the expected homogeneous/isotropic power law behavior, $S_p(r)/r^{\zeta_p}$ and the ISF compensated by the same intermittency exponents of homogeneous/isotropic turbulence, $S_p(r)/r^{\zeta_p}$ for several values of p. While $S_p(r)/r^{\zeta_p}$ show a definite tendency to decrease at inertial range separations, the $S_p(r)/r^{\zeta_p}$ show a clear *plateau*.