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Scaling of mixed structure functions in turbulent boundary layers P. HENRIK ALFREDSSON, Royal Institute of Technology, Stockholm, BORIS JACOB, INSEAN, Italian Ship Model Basin, CARLO MASSIMO CASCIOLA, La Sapienza, University of Rome, ALESSANDRO TALAMELLI, University of Bologna — The scaling of the anisotropic components of the hierarchy of correlation tensors in the logarithmic region of a flat plate turbulent boundary layer is addressed. We isolate the anisotropic observables by means of a recent theory based on the SO(3)symmetry group of rotations. Employing a dataset made of velocity signals obtained by a multi-probe setup, we demonstrate that the behavior of the anisotropic fluctuations throughout the boundary layer may be understood in terms of the superposition of two distinct regimes, with the transition being controlled by the magnitude of the mean shear and identified with the shear scale. Below the shear scale an isotropy-recovering behavior occurs, characterized by a set of universal exponents which roughly match dimensional predictions based on a first-order expansion in terms of the shear magnitude. Above the shear scale, the competition between energy production and dissipation mechanisms gives rise to a completely different scenario with significant differences in the observed scaling laws. This aspect has profound implications for the correct parameterization of anisotropic behavior in the near-wall region, since approaching the wall, an increasingly larger fraction of the scaling interval tends to conform to the shear-dominated power-laws.

> P. Henrik Alfredsson Linne Flow Centre, KTH Mechanics, Royal Institute of Technology, Stockholm

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