DFD16-2016-001602

Abstract for an Invited Paper
for the DFD16 Meeting of
the American Physical Society

High Reynolds Number Wall Turbulence

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A key consideration in the characterization of the mechanics of turbulent flows is to understand the generation, evolution and interactions of the large-scale structures and the range of eddying motions that make up the turbulent flow. The non-linearity of these processes makes the problem challenging, both computationally and experimentally. This is particularly true in wall-bounded flows where an increasing hierarchy of energy-containing eddy scales exists with increasing Reynolds number. In this talk we will review recent studies in high Reynolds number flow facilities and from the atmospheric surface layer documenting unique high Reynolds number phenomena in wall turbulence. The focus will be the logarithmic region, looking at issues regarding its universality, coherent structures and how they interact across the boundary layer. These findings lead to a new consideration of so-called "inner-outer" interactions and form the basis of a new predictive model for the near-wall inner region and the wall-shear stress. The implications of this model will be discussed.