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Attached flow structure and streamwise energy spectra in a turbulent boundary layer JOHN CHRISTOS VASSILICOS, imperial college london, SRICHARAN SRINATH, Ecole Centrale Lille, JEAN-PHILIPPE LAVAL, CNRS and Univ. Lille, CHRISTOPHE CUVIER, MICHEL STANISLAS, JEAN-MARC FOUCAUT, Ecole Centrale Lille — On the basis of (i) Particle Image Velocimetry data of a Turbulent Boundary Layer with large field of view and good spatial resolution and (ii) a mathematical relation between the energy spectrum and specifically modeled flow structures, we show that the scalings of the streamwise energy spectrum in a wavenumber range directly affected by the wall are determined by wall-attached eddies but are not given by the Townsend-Perry attached eddy model. Instead, this spectrum's wavenumber exponent is -1-p where p varies smoothly with distance to the wall from negative values in the buffer layer to positive values in the inertial layer. The exponent p characterises the turbulence levels inside wall-attached streaky structures conditional on the length of these structures.

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