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Influence of scale interaction on the transport of a passive scalar in a turbulent boundary layer[1] THERESA SAXTON-FOX, SCOTT DAWSON, BEVERLEY MCKEON, California Institute of Technology — A mildly heated turbulent boundary layer is experimentally studied using particle image velocimetry to measure the velocity field and a Malley probe (Malley et al., 1992; Gordeyev et al., 2014) to measure the passive scalar field. Strong gradients in the passive scalar field are observed to be correlated to the interaction of specific velocity scales, illuminating an effect of scale interaction on the passive scalar field. A resolvent analysis performed on the fluctuating velocity and passive scalar equations of motion is used to identify the most amplified velocity and scalar mode shapes at particular wavenumbers. The superposition of a small number of these modes is shown to reproduce the velocity scale interaction phenomenon observed experimentally, as well as the corresponding strong gradient in the scalar field.

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