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Convection Velocities of Coherent Structures in a Thermally Perturbed Turbulent Boundary Layer REBECCA ROUGHT, California Institute of Technology, STANISLAS GORDEYEV, University of Notre Dame, BEVERLEY MCKEON, California Institute of Technology — Increasing use of airborne laser-based communication systems has led to a need to understand the effects of turbulent boundary layers on the performance of such systems. As a beam of coherent light passes through a variable density flow, it is degraded as a result of changes in the index of refraction associated with the density fluctuations. In order to study this phenomenon, a zero-pressure gradient flat plate is subjected to a thermal perturbation, causing an internal, heated layer to form within the boundary layer. A Malley probe is used downstream of the perturbation to measure the Optical Path Difference of a laser traversing the flow. This probe consists of two parallel laser beams which deflect as heated turbulent structures convect through the beams. Cross-correlating the deflection angle spectrum of the two beams provides convective velocity information. The mean convective velocity is compared to the free stream velocity and estimates of structure convection velocities in the literature obtained using other diagnostics.

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