Abstract Submitted
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The Wall-Pressure Footprint of the Largest Motions in a Turbulent Boundary Layer[1] BRADLEY GIBEAU, SINA GHAEMI, University of Alberta — Few investigations have resolved the low-frequency region of the wall-pressure spectrum beneath a turbulent boundary layer (TBL). As a result, we currently cannot reliably describe the coupling between wall-pressure and the largest motions in the flow, namely the large- (LSMs) and very-large-scale motions (VLSMs). We probe the relationship between wall-pressure and the largest motions in a TBL at $Re_\tau = 2600$ using simultaneous time-resolved particle image velocimetry and wall-pressure measurements. The latter have been post-processed to remove wind tunnel background noise and Helmholtz resonance to ensure reliability across the relevant frequencies. Filtering and correlation techniques reveal that the lowest frequencies of the wall-pressure spectrum are associated with the modulation of the VLSMs. Positive (negative) VLSMs are found to cause positive (negative) wall-pressure. An adjacent band of higher frequencies is found to be associated with the ejection and sweeping patterns of the LSMs. The demarcation between these two frequency bands coincides with the peak of the wall-pressure spectrum, suggesting that the peak may be a result of the transition between pressure sources that occurs at this point in the frequency domain.

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