Abstract Submitted
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Nonlinear growth and resonance of second-mode waves[1] JOSEPH KUEHL, University of Delaware, CARLO SCALO, Purdue University — A fundamental mechanism for second-mode wave growth in a Mach 6 hypersonic boundary layers is proposed. It is shown that second-mode behavior is consistent with a standing-wave quarter-wavelength thermoacoustically driven instability. The unstable modes are shown to resonant in an acoustic impedance well between the wall (infinite impedance) and near the sonic line (secondary peak in impedance). A Lagrangian approach is adopted to show that such resonant standing-waves behavior is sustained from the base flow through thermoacoustic Reynolds stress, that result from the divergence of acoustic power inside the impedance well, and thermodynamic work. While this treatment does not represent a complete energy closure, it does provide insight towards the fundamental energy source and physical mechanisms driving Mack's acoustic second-mode.

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Joseph Kuehl
University of Delaware

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