Abstract Submitted
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**Spectral scaling in boundary layers and pipes at very high Reynolds numbers**[1] MARGIT VALLIKIVI, Princeton University, BHARATH GANAPATHISUBRAMANI, University of Southampton, ALEXANDER SMITS, Princeton University, Monash University — One-dimensional energy spectra in flat plate zero pressure gradient boundary layers and pipe flows are examined over a wide range of Reynolds numbers ($2,600 \leq Re_\tau \leq 72,500$). The peaks associated with the large-scale motions and superstructures in boundary layers behave as they do in pipe flows, with some minor differences. The location of the outer spectral peak (OSP) displays only a weak dependence on Reynolds number, and it occurs at the same wall-normal distance where the variances establish a logarithmic behavior. The outer-scaled wavelength of the OSP appears to decrease with increasing Reynolds number implying that the superstructures represent the inertial range of motions rather than the large scales per se. The location of the OSP appears to mark the start of a plateau that is consistent with a $k_x^{-1}$ slope in the spectrum and the logarithmic variation in the variances. It does not require full similarity between outer and wall-normal scaling on the wavenumber. The extent of $k_x^{-1}$ region depends on the wavelength of the OSP, which appears to emerge as a true inertial scale only at Reynolds numbers typical of atmospheric surface layers.

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