Abstract Submitted
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Turbulent inertia and the onset of log region in pipe flows[1] JIMMY PHILIP, CHENG CHIN , Univ of Melbourne, JOSEPH KLEWICKI, Univ of New Hampshire and Univ of Melbourne, ANDREW OOI , IVAN MARUSIC, Univ of Melbourne — The wallnormal (y)-location where the log-region begins in wall-turbulence is the same location where the turbulent inertia or TI ($\mathrm{d}\left\langle -uv\right\rangle /\mathrm{d}y$) and the pressure gradient terms from the mean-momentum equation start balancing each other. This location is closely followed by the location, y_m^+ where TI vanishes (before becoming negative in the log-region). Dynamics of TI is elucidated using DNS data of pipe flow at $\delta^+ \approx 500$, 1000 and 2000. We decompose TI as (i) velocity-vorticity correlations ($\langle v\omega_z\rangle + \langle -w\omega_y\rangle$) and their co-spectra, and (ii) wall-normal gradient of the Reynolds shear stress co-spectra ($\partial\Phi_{-uv}/\partial y$). One interesting result is that the onset of the log-region moves outward with increasing Reynolds number as $\sim \sqrt{\delta^+}$ because the eddies located close to y_m^+ are influenced by large scale accelerating motions of the type $\langle -w\omega_y\rangle$ related to vorticity stretching.

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