Abstract Submitted
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Scaling analysis of the mean and variariance of temperature in a developing thermal boundary layer[1] CLAYTON BYERS, MARCUS HULTMARK, Princeton University — A developing thermal boundary layer in a turbulent boundary layer is investigated both theoretically and experimentally. A scaling analysis of the mean temperature field and temperature variance, $\frac{1}{2}\overline{\theta^2}$, is developed by utilizing the Asymptotic Invariance Principle developed by George and Castillo (1997), including the possible effects of the Reynolds and Prandtl number. The derived solution for the inner and outer scaling is then used to develop a heat transfer law for the wall heat flux, q_w. The condition of constant wall temperature is utilized, with an analysis of the temperature field treated as a passive scalar through ensuring the temperature differences remain small. Data collection is performed with a nanoscale temperature sensor, providing an improvement to performance over previous cold wire data acquisition.

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