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Devising scaling parameters for wall bounded turbulent thermal transport[1] CHIRANTH SRINIVASAN, DIMITRIOS PAPAVASSILIOU, University of Oklahoma — Scaling of turbulent heat transfer from a wall with the friction temperature does not work well for all turbulence quantities and for all Prandtl number (Pr) fluids. The lack of a comprehensive database covering heat transfer statistics for a wide range of Pr and Reynolds numbers (Re) has hindered recent investigations to obtain more appropriate scaling parameters. This study uses turbulent transport statistics from our extensive database to propose a new scaling framework for turbulent transport. The database is obtained by using DNS in conjunction with Lagrangian tracking of heat markers to generate heat transfer statistics in a turbulent channel flow. The simulated cases involve applying uniform heat flux on one wall while maintaining the other wall adiabatic, or applying uniform heat flux on both walls. The channel half-height is equal to 150 and 300 in viscous wall units and the Pr varies between 0.1 and 50,000. It is found that the peak value of the turbulent heat flux appears to be a parameter that can be used to asymptotically collapse the mean and the fluctuating scalar profiles to corresponding single profiles for different Re and Pr, thus, establishing the peak normal turbulent heat flux as an important scaling parameter.

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