Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

The Reynolds shear stress in zero pressure gradient turbulent boundary layers derived from log-law asymptotics PETER A. MONKEWITZ, Federal Institute of Technology Lausanne, HASSAN M. NAGIB, IIT Chicago — The Reynolds shear stress (RS) in zero pressure gradient turbulent boundary layers is established using recently developed composite mean velocity profiles based on the "log-law" in the overlap region between inner and outer profiles. The contribution of the normal stress difference is discussed and considered to be of secondary importance. From this analysis, an asymptotic expansion for the maximum RS and its location is developed. The hypotheses underlying this analysis are discussed and the results are compared with experiments and DNS. Using the friction velocity as scale, the analytic approximation of the RS agrees reasonably well with low-Re experimental results. However, when comparing with high-Re experiments, the agreement is generally limited as the experimental accuracy and resolution becomes problematic near the wall. Comparison with DNS, on the other hand, is shown to be affected by the delicate numerical treatment of the free stream boundary condition. Finally, the present asymptotics will be compared to the results of Sreenivasan, Panton and others for channels and pipes.

Peter A. Monkewitz
Federal Institute of Technology Lausanne

Date submitted: 31 Jul 2008 Electronic form version 1.4