Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Log-law and compressibility effects in transcritical turbulent boundary layers at supercritical pressure[1] SOSHI KAWAI, Department of Aerospace Engineering, Tohoku University — In this talk, we discuss the log-law and effects of compressibility in transcritical heated turbulent boundary layers on a zero-pressure-gradient flat plate at supercritical pressure conditions by solving the compressible Navier-Stokes equations using direct numerical simulation. In the supercritical fluids (especially at transcritical conditions), due to the strong real fluid effects thermodynamic properties vary abruptly within a narrow temperature range through the pseudo-critical temperature and significantly deviate from the ideal fluid. Peculiar interactions between the strongly non-linear real fluid effects and wall turbulence, and its resultant log-law and turbulence statistics are discussed, which have never been seen in the ideal-fluid turbulent boundary layers. We also show non-negligible compressibility effects in the flow even in the low-Mach number regime considered in this study.

[1]This work was supported by Japan Society for the Promotion of Science KAKENHI Grant Number 26709066. Computer time was provided by the K computer at the RIKEN Advanced Institute for Computational Science through the HPCI System Research project hp150035.

Soshi Kawai
Department of Aerospace Engineering, Tohoku University

Date submitted: 01 Aug 2015 Electronic form version 1.4