Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Thermal boundary layer profiles in turbulent Rayleigh-Benard convection PENGER TONG, YIN WANG, Department of Physics, Hong Kong University of Science and Technology*, XIAOZHOU HE, Max Planck Institute for Dynamics and Self Organization — We have studied the mean temperature boundary layer profile T(z) and root-mean-square (rms) temperature profile S(z) in turbulent Rayleigh-Benard convection along the central axis z of a convection cell, which has a thin vertical disk shape with an inner diameter D = 18 cm. The temperature measurements were made at fixed Prandtl numbers Pr = 4.3 and Pr = 7.6 and with the Rayleigh number Ra varied in the range between 1×10^9 and 1×10^{10}. The measured T(z) for different values of Pr and Ra can all be well described by the newly proposed boundary layer model [Shishkina et al., Phys. Rev. Lett. **114**, 114302 (2015)] with a parameter c varying from 1 to 2.1. The measured rms temperature profile S(z) is found to be a single-peaked function with the peak position located at $z \simeq 0.8\delta$, where δ is the boundary layer thickness. The measured S(z) has two separate scaling lengths. Within the boundary layer, it scales with δ and can be fitted to a power law, $S(z) \sim (z/\delta)^\alpha$ with $\alpha \simeq 0.6$. Outside the boundary layer, it scales with the cell size D and follows a different power law, $S(z) \sim (z/D)^\beta$, with $\beta = -0.42$. *This work was supported by the Research Grants Council of Hong Kong SAR.

Penger Tong
Hong Kong University of Science and Technology

Date submitted: 27 Jul 2015 Electronic form version 1.4