

Abstract Submitted  
for the DFD16 Meeting of  
The American Physical Society

**Measured temperature fluctuations and Reynolds number in turbulent Rayleigh-Bénard convection with varying roughness size**<sup>1</sup> YICHAO XIE, KEQING XIA, Department of Physics, The Chinese University of Hong Kong — We present measurements of the temperature fluctuations  $\sigma_T$  and of the Reynolds number  $Re$  in turbulent Rayleigh-Bénard convection in cylindrical cell with pyramid-shaped rough top and bottom plates. To study the effects of roughness size, we varied a roughness parameter  $\lambda$ , defined as a single roughness height  $h$  (kept at a constant of 8 mm) over its base width  $d$ , from 0.5 to 4.0. Fluorinert Liquid FC-770 was used as the working fluid with the Rayleigh number  $Ra$  varying from  $4.49 \times 10^9$  to  $9.94 \times 10^{10}$  and Prandtl number  $Pr$  kept at 23.34. It is found that  $\sigma_T$  in both cell center and sidewall increases dramatically with  $\lambda$ . The scaling exponent of the normalized  $\sigma_T$  with respect to  $Ra$  increases from  $-0.16$  to  $-0.09$  at cell center and  $-0.23$  to  $-0.08$  near sidewall when  $\lambda$  is increased from 0.5 to 4.0. The Reynolds number  $Re$  based on the circulation time of the large-scale circulation (LSC) also increases with  $\lambda$ , suggesting a faster LSC. The scaling exponent of  $Re$  with respect to  $Ra$  increases from 0.47 to 0.55 with  $\lambda$  increased from 0.5 to 4.0. The study reveals that the flow and temperature fluctuations are very sensitive to the perturbation induced by rough plate with vary  $\lambda$ .

<sup>1</sup>This work is supported by the Hong Kong Research Grant Council under grant number *N\_CUHK437/15*.

Yichao Xie  
Department of Physics, The Chinese University of Hong Kong

Date submitted: 28 Jul 2016

Electronic form version 1.4