Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Study of global heat transport and plume morphology in severely-confined Rayleigh-Bénard convection[1] KE-QING XIA, KAI LEONG CHONG, The Chinese University of Hong Kong — We study systematically how severe geometrical confinement influences the global heat transport (expressed as Nusselt number Nu) and the plume morphology in Rayleigh-Bénard convection (RBC) by means of direct numerical simulations. Broad ranges of width-to-height aspect-ratio ($1/128 \leq \Gamma \leq 1$) and Rayleigh number ($3 \times 10^4 \leq Ra \leq 10^{11}$) at fixed Prandtl number $Pr = 4.38$ are considered in present study. It is found that Nu exhibits the scaling $Nu - 1 \sim Ra^{0.61}$ over three decades of Ra at $\Gamma = 1/128$ and the flow is dominated by finger-like, long-lived plume columns for such severely-confined situation. The Nu scaling and the flow structures contrast sharply to that found at $\Gamma = 1$ for which Nu exhibits the scaling $Nu - 1 \sim Ra^{0.31}$ and the flow is dominated by mushroom-like, fragmented thermal plumes. Analogy is made between the severely-confined RBC and strongly rotating RBC. 1. This work was supported by RGC of HKSAR (No. CUHK404513), CUHK Direct Grant (No. 3132740) and through a HKPhD Fellowship.

Ke-Qing Xia
The Chinese University of Hong Kong

Date submitted: 28 Jul 2016 Electronic form version 1.4