Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Optimal aspect-ratio for heat transport in turbulent Rayleigh-Bénard convection in Cartesian geometry[1] KAI-LEONG CHONG, MATTHIAS KACZOROWSKI, KE-QING XIA, The Chinese University of Hong Kong — We present a three-dimensional direct numerical simulation study of the heat transfer efficiency, the Nusselt number Nu, as a function of the aspect ratio in turbulent Rayleigh-Bénard convection with Cartesian geometry. The study spans a range of the Rayleigh number Ra from 10^7 to 3×10^9 but at a fixed Prandtl number $Pr = 4.38$. A recent experimental and numerical study [1] has shown that the heat transfer efficiency increases significantly when the width of the convection cell is narrowed. In the present study, we carry out the simulations with even smaller aspect-ratio to further investigate the effect of cell confinement which is hard to achieve experimentally. It is found that there exists an optimal aspect ratio for heat transport at a given Ra. Furthermore we find an increase in the coherence of flow structures as the degree of confinement increases.

[1] S.-D. Huang, M. Kaczorowski, R. Ni, K.-Q. Xia. Confinement induced heat transport enhancement in turbulent thermal convection, submitted to Phys. Rev. Lett.

[1]This work was supported by the RGC of Hong Kong SAR (CUHK403811).

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Date submitted: 02 Aug 2013 Electronic form version 1.4