Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Entropy cascade and Bolgiano-Obukhov scaling in turbulent thermal convection[1] EMILY S.C. CHING, W.C. CHENG, Department of Physics, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong. — It is interesting to understand the scaling behavior of velocity and temperature fields in turbulent thermal convection. Theoretical ideas suggest Bolgiano-Obukhov scaling when the turbulent dynamics are governed by a cascade of entropy. On the other hand, there were experimental and numerical studies of confined convection which showed results that are inconsistent of Bolgiano-Obukhov scaling. To help shedding light on this issue, we have studied a shell model of turbulent convection whose stationary dynamics are, by construction, governed by a cascade of entropy when buoyancy is significant. We have indeed observed Bolgiano-Obukhov scaling plus corrections. We have further found that the corrections are due to intermittent variations of the entropy transfer rate. By assuming that the moments of the entropy transfer rate have a hierarchical structure, we are able to understand the observed scaling behavior and predict the velocity and temperature scaling exponents.

[1]This work is supported by the Hong Kong Research Grants Council (CUHK 400304)

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Date submitted: 12 Aug 2005 Electronic form version 1.4