Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Properties of the Measured Instantaneous Viscous Boundary Layer Thickness in Turbulent Rayleigh-Benard Convection.[1] KE-QING XIA, QUAN ZHOU, Department of Physics, The Chinese University of Hong Kong, Shatin, Hong Kong, China — We report measurements of the instantaneous viscous boundary layer (BL) thickness δ_v(t) in turbulent Rayleigh-Benard convection. The instantaneous δ_v(t) obtained from PIV-measured two-dimensional velocity field is found to exhibit intermittent fluctuations. It is also found that there is a clean separation of statistical behavior of δ_v(t) below and above its most probable value δ_v^{mp}: for δ_v(t)< δ_v^{mp}, it obeys a lognormal distribution and for δ_v(t)> δ_v^{mp}, the distribution of δ_v(t) has an exponential tail. Our results reveal that the variation of δ_v(t) responds negatively to the fluctuations of the large-scale mean flow velocity with a nonzero time delay; while close to the plate the horizontal velocity reflects the variation of δ_v(t) with zero time delay. In the reference frame of the time-dependent thickness δ_v(t), the conditional-averaged velocity profile agrees excellently with the theoretical Prandtl-Blasius laminar BL profile and the shape factor is found to be much closer to the theoretical value of the Blasius shear layer as compared to that obtained in the laboratory frame. It is further found that δ_v^{mp} scales as $Re^{0.5}$.

[1]Work supported by the Research Grants Council of Hong Kong SAR (Project Nos. CUHK 403806 and 403807).

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Date submitted: 31 Jul 2009 Electronic form version 1.4