Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Dynamics of the large-scale circulation of turbulent Rayleigh-Bénard convection at low Rayleigh numbers.[1] MATTHEW SCHREINER, ERIC BROWN, GUENTER AHLERS, UCSB — Measurements of the large-scale circulation (LSC) of turbulent Rayleigh-Bénard convection (RBC) in cylindrical samples of aspect ratio $\Gamma = 1$ (= diameter/height) are reported. They covered the Rayleigh-number range $9 \times 10^5 < R < 2 \times 10^9$ and the Prandtl-number range $4.4 < \sigma < 29$. Using observations of the mid-plane temperature-profile around the side wall of the sample and successive shadowgraph images taken from above, we determined that the amplitude δ of the thermal imprint by the LSC at the side wall, divided by the applied vertical temperature difference ΔT, increased with decreasing R, approximately as $\delta/\Delta T \simeq R^{-0.33}$ when $R > 10^8$. For smaller R the R-dependence became more complicated, but $\delta/\Delta T$ remained finite. This suggests that the LSC persisted for small R. For $R < 10^6$ the azimuthal temperature profile could no longer be described by a simple cosine function. This profile is as yet unexplained. We continued to observe diffusive meandering of the LSC orientation as well as spontaneous cessations and reorientations of the flow at $R \simeq 10^6$.

[1]Supported by NSF Grant DMR07-02111

Guenter Ahlers
UCSB

Date submitted: 03 Aug 2007 Electronic form version 1.4