Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Rayleigh- and Prandtl-number dependence of the large-scale flow-structure in weakly-rotating turbulent thermal convection[1]
STEPHAN WEISS, Max Planck Institute f. Dynamics and Self-Organization, PING WEI, GUENTER AHLERS, University of California Santa Barbara — Turbulent thermal convection under rotation shows a remarkable variety of different flow states. The Nusselt number (Nu) at slow rotation rates (expressed as the dimensionless inverse Rossby number 1/Ro), for example, is not a monotonic function of 1/Ro. Different 1/Ro-ranges can be observed with different slopes $\partial Nu/\partial(1/Ro)$. Some of these ranges are connected by sharp transitions where $\partial Nu/\partial(1/Ro)$ changes discontinuously. We investigate different regimes in cylindrical samples of aspect ratio $\Gamma = 1$ by measuring temperatures at the sidewall of the sample for various Prandtl numbers in the range $3 < Pr < 35$ and Rayleigh numbers in the range of $10^8 < Ra < 4 \times 10^{11}$. From these measurements we deduce changes of the flow structure. We learn about the stability and dynamics of the large-scale circulation (LSC), as well as about its breakdown and the onset of vortex formation close to the top and bottom plate. We shall examine correlations between these measurements and changes in the heat transport.

[1]This work was supported by NSF grant DRM11-58514. SW acknowledges support by the Deutsche Forschungsgemeinschaft.

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Date submitted: 30 Jul 2015 Electronic form version 1.4