Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Effect of rotation on the temperature profile of turbulent convection with a Prandtl number $Pr = 12.3$[1] PING WEI, GUENTER AHLERS, Univ of California - Santa Barbara — We report on the influence of rotation about a vertical axis on the temperature profiles and the large-scale circulations (LSC) of turbulent Rayleigh-Bénard convection (RBC) in a cylindrical sample with aspect ratio $\Gamma = D/L = 1.00$ (D is the diameter and L the height). The working fluid was a fluorocarbon at a mean temperature $T_m = 25°$C with a Prandtl number $Pr = 12.3$. The measurements covered the Rayleigh-number range $2 \times 10^{10} \leq Ra \leq 2 \times 10^{11}$ and the inverse Rossby number range $0 \leq 1/Ro \leq 9$. With weak rotation the temperature in the fluid varied as $A \times ln(z/L) + B$, where z is the distance from the bottom or top plate. For $1/Ro \geq 1.2$ we found that the temperature varied linearly with z. The temperature signature of the LSC along the sidewall was detectable up to $1/Ro \simeq 0.5$. Retrograde rotation of the LSC was observed. The LSC temperature amplitude first decreased and then remained constant up to the critical inverse Rossby number $1/Ro_c$ for the onset of Ekman-vortex formation, and then decreased again.

[1]Supported by NSF Grant DMR11-58514.

Ping Wei
Univ of California - Santa Barbara

Date submitted: 24 Jul 2014 Electronic form version 1.4