Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Anisotropic turbulent temperature probability densities in high-Ra thermal convection[1] XIAOZHOU HE, DENNIS P. M. VAN GILS, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany, GUENTER AHLERS, Department of Physics, University of California, USA — We present systematic measurements of conditional diffusion $r(x) = \langle \ddot{X} | X = x \rangle$ and dissipation $q(x) = \langle (\dot{X})^2 | X = x \rangle$ of the normalized temperature fluctuations $X = (T - \bar{T})/\sigma$ in turbulent Rayleigh-Bénard convection (RBC) at several radial positions where the flow is anisotropic. The data cover the Rayleigh-number range $10^{13} \leq Ra \leq 10^{15}$ for a Prandtl number $Pr \simeq 0.80$. The sample was a right-circular cylinder with aspect ratio $\Gamma \equiv D/L = 0.50$ ($D = 1.12$ m is the diameter and $L = 2.24$ m is the height). We compared experimental forms of $q(x)$ and $r(x)$ with previous investigations based on the "fluctuation-dissipation" relation for isotropic flow.[2] We derived a general form for the temperature probability-density function (PDF). Similar analyses have also been extended to the study of the temperature time derivative, and to the temperature increment in the time domain. Good agreements are found between experimental temperature probability densities and predicted PDF forms.

[1]Supported by the Max Planck Society, the Volkswagenstiftung, the DFG Sonderforschungsbereich SFB963, and NSF Grant DMR11-58514.
[2]Emily S. C. Ching, Phys. Rev. Lett. **70**, 283 (1993)

Xiaozhou He
MPIDS, Goettingen, Germany

Date submitted: 30 Jul 2014 Electronic form version 1.4