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Local fluctuations and fluxes in turbulent Rayleigh-Bénard convection RAJARAM LAKKARAJU, RICHARD J.A.M. STEVENS, Physics of Fluids Group, Faculty of Science and Technology, University of Twente, The Netherlands, ROBERTO VERZICCO, Department of Mechanical Engineering, University of Rome "Tor Vergata," Italy, SIEGFRIED GROSSMANN, Department of Physics, University of Marburg, Germany, CHAO SUN, DETLEF LOHSE, Physics of Fluids Group, Faculty of Science and Technology, University of Twente, The Netherlands — We numerically investigate the local velocity and temperature fluctuations and the local heat flux in a cylindrical Rayleigh-Benard cell for Rayleigh numbers from Ra = 2 $\times 10^6$ to 2×10^9 at a fixed Prandtl number Pr = 5.2. The numerical measurements at different points in the cell reveal that the heat flux at the plume dominated edge is larger and that it always has a power law relationship with Ra, i.e. $j \sim A\ Ra^{\gamma}$. The scaling exponent linearly depends on the radial distance from the center, with = 0.44 at the center to = 0.27 at the edge, similarly has found by Shang, Tong and Xia, PRL 2008 and predicted by Grossmann and Lohse, Phys. Fluids 2004. These values imply a transition to bulk dominated heat flux beyond Ra = 10^{15}. The velocity and temperature fluctuations also have a power law dependence on Ra and the corresponding scaling exponents again dependent on the radial position.

Rajaram Lakkaraju

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