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A new scaling law for temperature variance profile in the mixing zone of turbulent Rayleigh-Bénard convection[1] YIN WANG, WEI XU, Department of Physics, Hong Kong University of Science and Technology, XIAO-ZHOU HE, Shenzhen Graduate School, Harbin Institute of Technology, HIU-FAI YIK, Department of Physics, Hong Kong University of Science and Technology, XIAO-PING WANG, Department of Mathematics, Hong Kong University of Science and Technology, JORG SCHUMACHER, Institut fr Thermo- und Fluiddynamik, Technische Universitt Ilmenau, PENGER TONG, Department of Physics, Hong Kong University of Science and Technology — We report a combined experimental and numerical study of the scaling properties of the temperature variance profile $\eta(z)$ along the central z axis of turbulent Rayleigh-Bénard convection in a thin disk cell and an upright cylinder of aspect ratio unity. In the mixing zone outside the thermal boundary layer region, the measured $\eta(z)$ is found to scale with the cell height H in both cells and obey a power law, $\eta(z)\tilde{}(z/H)^{\varepsilon}$, with the obtained values of ε being very close to -1. Based on the experimental and numerical findings, we derive a new equation for $\eta(z)$ in the mixing zone, which has a power-law solution in good agreement with the experimental and numerical results. Our work thus provides a common framework for understanding the effect of boundary layer fluctuations on the scaling properties of the temperature variance profile in turbulent Rayleigh- Bénard convection.

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