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Heat transport by turbulent Rayleigh-Bénard convection for $Pr \simeq 0.8$ and $4 \times 10^{11} < Ra < 2 \times 10^{14}$: ultimate-state transition for aspect ratio $\Gamma = 1.00$ [1] DENNIS P.M. VAN GILS, XIAOZHOU HE, MPI Dynamics and Self-Organization, Goettingen, Germany, DENIS FUNFSCHILLING, LRGP CNRS, Nancy, France, GUENTER AHLERS, UCSB, Santa Barbara, USA, EBERHARD BODENSCHATZ, MPI Dynamics and Self-Organization, Goettingen, Germany — We report experimental results for heat transport by Rayleigh-Bénard convection (RBC) in a cylindrical sample with aspect ratio $\Gamma \equiv D/L = 1.00$ ($D = 1.12$ m is the diameter and $L = 1.12$ m is the height) over the range $4 \times 10^{11} < Ra < 2 \times 10^{14}$ at $Pr \simeq 0.8$. For $Ra < Ra_1^* \simeq 2 \times 10^{13}$ we find $Nu = N_0 Ra^{\gamma_{\rm eff}}$ with $\gamma_{\rm eff} = 0.321 \pm 0.002$ and $N_0 = 0.0776$, consistent with classical turbulent RBC in a system with laminar boundary layers (BLs) below the top and above the bottom plate and with the prediction of Grossmann and Lohse$^{(1)}$. For $Ra > Ra_1^*$ the data rise above the classical-state power-law and show greater scatter. In analogy to similar behavior observed for $\Gamma = 0.50^{(2)}$, we interpret this phenomenon as the onset of the transition to the ultimate state. Within our resolution this onset occurs at nearly the same value of Ra_1^* as it does for $\Gamma = 0.50$.

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