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The boundary layer structure in Rayleigh-Bénard convection in a cylindrical cell[1] NAN SHI, JOERG SCHUMACHER, TU Ilmenau, Germany — We report first results of our studies of the boundary layer structure in turbulent Rayleigh-Bénard convection in a cylindrical cell of aspect ratio one. They are based on three-dimensional direct numerical simulations (DNS) of the Boussinesq equations at $Ra = 3 \times 10^9$ and $Pr = 0.7$. The study is motivated by two recent experiments: LDA measurements of the velocity boundary layer structure in the cylindrical Barrel of Ilmenau by du Puits et al. and PIV measurements in a slender rectangular convection cell by Xia et al. Both experiments detected deviations from the classical Blasius solution for time-averaged flow profiles. A rescaling by the instantaneous boundary layer thickness resulted however in a much better agreement with the Blasius profile in case of the rectangular cell. The DNS allow us to combine the analysis methods of both experiments. We confirm the significant deviation for the time-averaged profiles. Closer agreement with the Blasius solution is also reproduced for the fit with the instantaneous thickness. Our analysis is extended to the Pohlhausen solution in case of the thermal boundary layer. The flow profiles are also taken at different positions in the boundary layers. Further statistical properties in both boundary layers are reported.

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Nan Shi
TU Ilmenau, Germany

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