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Turbulent Rayleigh-Bénard convection in a strong vertical magnetic field[1] RUSLAN AKHMEDAGAEV, OLEG ZIKANOV, University of Michigan - Dearborn, 4901 Evergreen Road, Dearborn, MI 48128-1491, USA, DMITRY KRASNOV, JOERG SCHUMACHER, Technische Universitt Ilmenau, Postfach 100565, 98694 Ilmenau, Germany — Turbulent Rayleigh-Bénard convection in a vertical cylinder of aspect ratio 1 with imposed vertical magnetic field is analyzed in direct numerical simulations. The flow structure and transport properties with the Prandtl number 0.025 and the Rayleigh and Hartmann numbers up to 10^9 and 1400, respectively, are considered. Increase in the strength of the magnetic field has the anticipated effects of suppression of the heat transfer rate and flow's kinetic energy. At the same time, growth of these characteristics with the Rayleigh number is found to be faster in flows at high Hartmann numbers. This behavior is consistent with earlier experimental data. The simulations allow us to attribute it to the newly discovered flow regime characterized by prominent quasi-two-dimensional structures reminiscent of vortex sheets extending into the core. Rotating tongue-like wall modes qualitatively similar to those in the Rayleigh-Bénard convection with rotation are found in flows near the Chandrasekhar linear stability limit. A detailed analysis of the spatial structure of the flows and its effect on global transport properties is reported.

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