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Experimental Investigation of Homogeneity, Isotropy, and Circulation of the Velocity Field in Buoyancy-Driven Turbulence[1] QUAN ZHOU, Department of Physics, the Chinese University of Hong Kong, CHAO SUN, Department of Applied Physics, University of Twente, KEQING XIA, Department of Physics, the Chinese University of Hong Kong — We present a direct multipoint velocity measurements of the 2D velocity field in the central region of turbulent Rayleigh- Bénard convection. The local homogeneity and isotropy of the velocity field are tested using a number of criteria and are found to hold to an excellent degree. The distribution of Γ_r is found to depend on the scale r, reflecting strong intermittency. Besides, the slight asymmetry of the distribution tails reflects the fact that the velocity circulation structure functions (CSFs) are able to capture anisotropic coherent structures, such as thermal plumes, more effectively than longitudinal structure functions (LSFs) and transversal structure functions (TSFs). It is further found that velocity circulation has the same anomalous scaling exponents as LSFs and TSFs for low-order moments ($p <= 5$). Whereas, for high-order moments ($p > 5$), the anomalous scaling exponents for circulation are found to be systematically smaller than those of LSFs and TSFs.

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