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Experimental Measurements of Pressure Structure Functions and Acceleration Correlations in High Reynolds number Turbulence[1] DARIO VINCENZI[2], HAITAO XU, NICHOLAS T. OUELLETTE[3], EBERHARD BODENSCHATZ, MPI for Dynamics and Self-Organization, INTERNATIONAL COLLABORATION FOR TURBULENCE RESEARCH COLLABORATION — We present measurements of fluid particle accelerations in turbulent water flows between counter-rotating disks using three-dimensional Lagrangian particle tracking. By simultaneously following multiple particles with sub-Kolmogorov-time-scale temporal resolution, we measured the spatial correlation of fluid particle acceleration at Taylor microscale Reynolds numbers between 200 and 690. We also obtained indirect, non-intrusive measurements of the Eulerian pressure structure functions by integrating the acceleration correlations. Our experimental data provide strong support to the theoretical predictions of the acceleration correlations and the pressure structure function in isotropic high Reynolds number turbulence by Obukhov and Yaglom in 1951. The measured pressure structure functions display K41 scaling in the inertial range.

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