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Extreme accelerations in turbulent flows JOHN LAWSON, CRISTIAN LALESCU, MICHAEL WILCZEK, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organisation — Even in weakly turbulent flows, fluid tracers routinely undergo strong accelerations tens of standard deviations in excess of the mean. These extreme events are thought to influence everyday phenomena such as rain formation in wet clouds or the turbulent combustion of fuel in engines. We report results on high resolution particle tracking experiments in a vigorously stirred turbulent flow between $R_\lambda = 130$ and 450. These are matched with high resolution direct numerical simulations of isotropic turbulence. By acquiring very large datasets we quantify the distribution of rare, strong acceleration events (as infrequent as one in 10^8 and in excess of 30 standard deviations) and their scaling with Reynolds number. We present back-to-back comparisons between the two to quantify the statistics of accelerations at unprecedented accuracy and discuss their consequences for turbulent flows.

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