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Circulation in turbulent flows[1] KATEPALLI SREENIVASAN, KARTIK IYER, New York University, P.K YEUNG, XIAOMENG ZHAI, Georgia Institute of Technology — Circulation around Eulerian contours has been a valuable conceptual tool in classical fluid dynamics and aerodynamics, but its properties have not been explored and exploited much in the turbulence literature, especially in comparison with multi-point objects such as velocity increments. The initial theoretical work of Migdal (Int. J. Mod. Phys. A **9** 1197-1238 (1994)) has been followed up only in a small number of empirical papers (e. g. Umeki, JPSJ **69**, 3788-3791 (1993), Cao et al. PRL **76** 616-619 (1996) and Benzi et al. PRE **55** 3739-3742 (1997)) and these latter papers use direct numerical simulations data on relatively small grids and low Reynolds numbers. Using our recent data base of simulations (Yeung et al. PNAS **112** 12633-12638 (2015)) of isotropic and homogeneous turbulence on 8192^3 grids (and others on smaller boxes down to 256^3), we explore here the statistical properties of circulation, such as the probability density functions of circulation around contours of various sizes within the inertial range and its scaling properties. Among the results obtained, the one that stands out is that circulation statistics can be described very closely by a lognormal process, and, to within experimental accuracy by a uni-fractal of dimension 2.8.

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