Craig's XY-distribution and the statistics of Lagrangian power in two-dimensional turbulence.[1] COLM CONNAUGHTON, University of Warwick, MAHESH BANDI, Los Alamos National Laboratory — We study the probabililily distribution function (PDF) of injected power in numerical simulations of stationary 2D turbulence in the Lagrangian frame. The simulation mimics an electromagnetically driven fluid layer, a well-documented system for generating 2D turbulence in the laboratory. The forcing and velocity fields in the numerics are close to Gaussian, but the injected power PDF is sharply peaked at zero (suggesting a singularity) with asymmetric exponential tails. Large positive fluctuations are more probable than large negative ones leading to a net positive mean energy input. The main features of the power distribution are well described by Craig's XY distribution for the PDF of the product of two correlated normal variables. We show that the power distribution should exhibit a logarithmic singularity at zero and decay exponentially for large absolute values of the power. We calculate the asymptotic behaviour and express the asymmetry of the tails in terms of the correlation coefficient of the force and velocity and compare the measured PDFs with theoretical calculations.

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