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Statistical Properties of 2 Dimensional Turbulence in a Finite Box COLM CONNAUGHTON, Center for Nonlinear Studies, Los Alamos National Laboratory, MISHA CHERTKOV, Theoretical Division, Los Alamos National Laboratory, VLADIMIR LEBEDEV, Landau Institute for Theoretical Physics, IGOR KOLOKOLOV, Landau Institute for Theoretical Physics — In the standard statistical theory of two dimensional hydrodynamics forced at some intermiediate scale, two cascades are produced. Energy flows to large scales, producing Kolmogorov's $k^{-5/3}$ spectrum at small k and enstrophy flows to small scales to produce Kraichnan's k^{-3} spectrum at large k. If we consider turbulence in a finite box in the absence of large scale dissipation, the inverse cascade eventually reaches the size of the box and the cascade is blocked. This leads to accumulation of energy in the largest modes, a process which can be qualitatively thought of as a nonequilibrium condensation process. The "condensate" in this case is a coherent, large scale vortex dipole. We investigate how the system passes through a series of distinct regimes, leading to the emergence of this large scale structure. We show how it affects the scaling properties of two-dimensional turbulence and explain how the presence of very strong vortices leads to an apparent modification of the small scale statistical properties of the inverse cascade.

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