Abstract Submitted
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**Statistical Equilibria of Turbulence on Surfaces of Different Symmetry** WANMING QI, JOHN MARSTON, Brown University — We test the validity of statistical descriptions of freely decaying two-dimensional turbulence by performing direct numerical simulations (DNS) of the Euler equation with hyperviscosity on two surfaces of different symmetry, namely, the square torus and the sphere. DNS shows, at long times, a dipolar coherent structure in the vorticity field on the torus but a quadrapole on the sphere [1]. We look for a theoretical explanation in the truncated Miller-Robert-Sommeria theory that conserves the fine-grained enstrophy, while also respecting conservation laws that reflect the symmetry of the domain. This theory is shown to be equivalent to the phenomenological minimum-enstrophy principle [2]. Finally, the theoretical results agree with DNS, and the calculation reveals how the conservation of zero angular momentum forces the sphere to have one more dipole pair than on the torus.

[1] J. Y-K. Cho and L. Polvani, "The emergence of jets and vortices in freely evolving, shallow water turbulence on a sphere," Phys. Fluids 8, 1531 (1996).
[2] A. Naso, P. H. Chavanis, and B. Dubrulle, "Statistical mechanics of two-dimensional Euler flows and minimum enstrophy states," Eur. Phys. J. B (2010).

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