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Spectral scaling of the two-dimensional Navier-Stokes-α and Leray-α models EVELYN LUNASIN, University of California, San Diego, CA, SUSAN KURIEN, Los Alamos National Laboratory, NM, MARK TAYLOR, Sandia National Laboratories, NM, EDRISS TITI, University of California, Irvine CA and Weismann Institute of Science, Rehovot, Israel — The NS-α model of turbulence is a mollification of the Navier-Stokes equations, such that the vorticity is advected by a velocity field that is smoothed over spatial scales of size smaller than α. The spectral properties of the smoothed velocity field match those of Navier-Stokes turbulence for wavenumbers k such that $k\alpha \ll 1$. For $k\alpha \gg 1$ it is not possible to predict the scaling of the energy spectrum *a priori* since the smoothed and unsmoothed velocities provide several possible characteristic timescales for the problem. The same holds true for the other α-models of turbulence. We measure the $k\alpha \gg 1$ scaling of the energy spectra from high-resolution simulations in two-dimensions, in the limit as $\alpha \to \infty$, for two models: the Navier-Stokes-α model and the Leray-α model. The spectrum of the smoothed velocity field scales as k^{-7} in the former and as k^{-5} in the latter. These scalings correspond to the direct cascade of the conserved enstrophy in each case, the governing time scales given by $(k|v_k|)^{-1}$ and $(k\sqrt{(u_k, v_k)}\ )^{-1}$ respectively, where u_k and v_k are the fourier components of the filtered (smoothed) velocity field u and unfiltered velocity field v.

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