Title : Solving the turbulent jet puzzle in the scale-relativity framework

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Abstract :
We apply the scale-relativity theory of turbulence to the turbulent round jet problem. In this theory, the time derivative of the Navier-Stokes equations can be integrated under the form of a macroscopic Schrödinger equation acting in v-space, in which the potential is that of harmonic oscillators. This equation is solved in terms of a wave function whose square yields the velocity PDF, from which the Reynolds stresses can be derived, thus solving the closure problem in this case. This allows us to obtain a theoretical prediction for the turbulent intensity radial profiles which agrees with the experimental data, and for the various purely numerical invariants characterizing the turbulent jet, such as its opening angle ≈1/5, the ratio of turbulent intensities over the centerline axial velocity ≈1/4 and the velocity correlation coefficient ≈0.4 (which is common to all free shear flows).