Abstract Submitted
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What is turbulence and which way does it cascade? CARL GIBSON, University of California at San Diego — Turbulence is defined as an eddy-like state of fluid motion, where the inertial vortex forces v x curl v of the eddies are larger than any other forces that tend to damp the eddies out. In the beginning at Planck conditions, it is assumed that the relevant dimensional parameters were the speed of light c, the Planck constant h, the Newton constant G, and the Boltzmann constant k. The first turbulence appeared at 10^{-43} s, 10^{-35} m, 10^{32} K when the Kolmogorov scale first matched the horizon scale ct. Inertial vortex forces of adjacent fluid particles with the same spin cause them to merge, so the turbulence cascade is always from small scales to large, as observed, contrary to the standard Taylor-Lumley model which must be abandoned. Adjacent fluid particles with opposite spin repel each other and are repelled by walls, which explains boundary layer separation and turbulent diffusion. The second turbulence appeared at 10^{12} seconds at density 10^{-17} kg m^{-3} with the fragmentation of protogalaxies along fossil big bang turbulence vortex lines. Life began at 10^{13} seconds in Jeans mass clumps of a trillion planets.

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