Article
Flow, Turbulence and Combustion
June 2004, Volume 72, Issue 2, pp 161-179

First online:

The First Turbulence and First Fossil Turbulence

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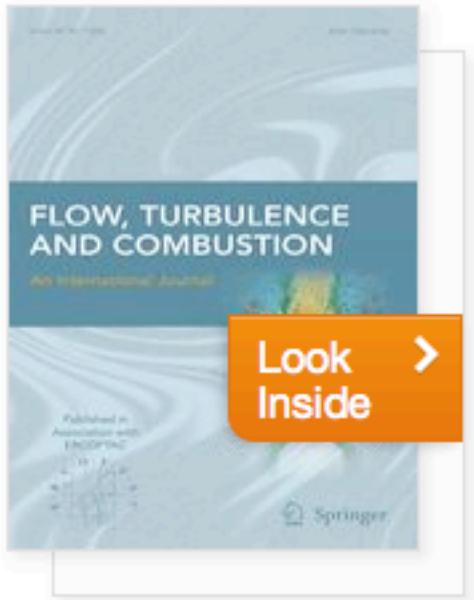

Co-published with
European Research Community on Flow, Turbulence and Combustion

Abstract

A model is proposed connecting turbulence, fossil turbulence and the big-bang origin of the universe. While details are incomplete, the model is consistent with our knowledge of these processes and is supported by observations. Turbulence arises in a hot big-bang quantum gravitational dynamics scenario at Planck scales. Chaotic, eddy-like motions produce an exothermic Planck particle cascade from 10^{-35} m at 10^{32} K to 10^{8} larger, 10^{4} cooler, quark-gluon scales. A Planck-Kerr instability gives high Reynolds number (Re ~ 10^{6}) turbulent combustion, space-time-energy-entropy and turbulent mixing. Batchelor-Obukhov-Corrsin turbulent-temperature fluctuations are preserved as the first fossil turbulence by inflation stretching the patterns beyond the horizon *ct* of causal connection faster than light speed *c* in time *t*~ 10^{-33} sec. Fossil big-bang temperature turbulence reenters the horizon and imprints nucleosynthesis of H-He densities that seed fragmentation by gravity at 10^{12} s in the low Reynolds number plasma before its transition to gas at *t*~ 10^{13} s and *T*~ 3000 K. Multiscaling coefficients of the cosmic microwave background (CMB) temperature anisotropies closely match those for high Reynolds number turbulence, Bershadskii, A. and Sreenivasan, K.R., *Phys. Lett. A* **299** (2002) 149-152; Bershadskii, A. and Sreenivasan, K.R., *Phys. Lett. A* **319** (2003) 21-23. CMB spectra support the interpretation that big-

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