

Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Initiation vs. Sustenance of Active Polymer-Turbulence Interactions.¹ JAMES BRASSEUR, ASHISH ROBERT, Pennsylvania State University, LANCE COLLINS, T. VAITHIANATHAN, Cornell University — Lumley (1973) theorized that polymer molecules are passively stretched only by strain-dominated turbulent eddies with time scales below polymer relaxation time. Tabor & DeGenne (1986) added the argument that *active* turbulence-polymer energy exchange occurs only at strain-dominated eddies where polymer elastic and turbulent kinetic energies are comparable. The Lumley-Tabor-DeGenne (LTG) arguments suggest an interruption to the energy cascade with an effective increase in small-scale cutoff scale. With these concepts in mind, we analyzed the evolution of polymer-laden homogeneous shear turbulence—from an initial period of passive stretch, through initiation of active polymer-turbulence interaction, to quasi equilibrium—using DNS with accurate numerical implementation of the FENE-P model. We find at equilibrium, contrary to the LTG arguments, that polymer-turbulence energy exchange is concentrated at the largest eddies. Evolution backwards in time, however, leads to a state more consistent with LTG phenomenology, suggesting relevance to the model at the point of transition from passive to active polymer in quasi Newtonian turbulence. LTG phenomenology rapidly loses its relevance, however, as turbulence evolves towards an equilibrium state of active polymer-turbulence interactions.

¹Supported by DARPA

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Date submitted: 08 Aug 2005

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