

Abstract Submitted  
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**Energy spectra in polymer-doped turbulent soap films**<sup>1</sup>  
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CHIA LIU, OIST — We investigate the energy spectra of turbulent soap films doped  
with a dilute amount of a very large molecular weight polymer ( $> 1M$ ). We perform  
experiments in a soap-film channel that in the absence of polymers manifests decay-  
ing turbulence and a direct enstrophy cascade: the energy spectrum  $E(k) \propto k^{-3}$ .  
For polymer-doped flow, where the polymer is added gently to the soapy solution,  
we observe that the energy spectrum switches to  $E(k) \propto k^{-5/3}$ , which is consistent  
with the inverse energy cascade of forced 2D turbulence. This switching of the spec-  
tral exponent from 3 to 5/3 occurs for polymer concentrations as low as 2 wppm.  
For lower concentrations, the spectral exponent is unaffected. We also find that our  
results are sensitive to the method of polymer doping. If we stir our polymer-doped  
solution repeatedly, the effect of the polymer diminishes: the exponent of the energy  
spectrum switches back from 5/3 to 3.

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