

Abstract Submitted  
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**Why fibers are better turbulent drag reducing agents than polymers.**<sup>1</sup> ARNOUT BOELENS<sup>2</sup>, University of Chicago, MURUGAPPAN MUTHUKUMAR, University of Massachusetts, Amherst — It is typically found in literature that fibers are not as effective as drag reducing agents as polymers. However, for low concentrations, when adding charged polymers to either distilled or salt water, it is found that polymers showing rod-like behavior are better drag reducing agents than polymers showing coil-like behavior [1]. In this study [2], using hybrid Direct Numerical Simulation with Langevin dynamics, a comparison is performed between polymer and fiber stress tensors in turbulent flow. The stress tensors are found to be similar, suggesting a common drag reducing mechanism in the onset regime. Since fibers do not have an elastic backbone, this must be a viscous effect. Analysis of the viscosity tensor reveals that all terms are negligible, except the off-diagonal shear viscosity associated with rotation. Based on this analysis, we are able to explain why charged polymers showing rod-like behavior are better drag reducing agents than polymers showing coil-like behavior. Additionally, we identify the rotational orientation time as the unifying time scale setting a new time criterion for drag reduction by both flexible polymers and rigid fibers. References: [1] P.S. Virk (1975), *Nature*, 253, 109-110 [2] A.M.P. Boelens, M. Muthukumar (2016), *PRE*, 93, 052503

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