

Abstract Submitted  
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**A new state of turbulence: Elasto-inertial turbulence**<sup>1</sup> YVES DUBIEF, University of Vermont, DEVRANJAN SAMANTA, MARKUS HOLZNER, Max Planck Institute for Dynamics and Self-Organization, Gottingen, Germany, CRISTOF SCHAFER, Saarland University, Saarbrucken, Germany, ALEXANDER MOROZOV, School of Physics & Astronomy, University of Edinburgh, UK, CHRISTIAN WAGNER, Saarland University, Saarbrucken, Germany, BJORN HOF, Max Planck Institute for Dynamics and Self-Organization, Gottingen, Germany, VINCENT TERRAPON, Aerospace & Mechanical Dept, University of Liege, Belgium, JULIO SORIA, Mechanical Engineering Dept, Monash University, Australia — The elasticity of polymer solutions is found to generate a new state of turbulence, elasto-inertial turbulence (EIT), characterized by an interplay between elastic and flow instabilities. Experiments and direct numerical simulations (DNS) in pipe and channel flows demonstrate the emergence of EIT at Reynolds numbers much lower than the critical Reynolds number for transition to turbulence in Newtonian flows. EIT causes the friction factor to deviate from the laminar solution and subsequently transition to the maximum drag reduction asymptote around  $Re=1800$ . EIT is a self-sustained mechanism that arises from the interactions between fluctuations of extensional viscosity, velocity and pressure. The polymer solution elasticity controls the growth of flow instability, resulting in transitional-like flows at high Reynolds numbers. The existence of EIT is not limited to pipe, channel or boundary layer flows, and evidence of EIT will be discussed in other flows, including natural convection using DNS.

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