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The onset of elasto-inertial turbulence BJORN HOF, DEVRANJAN SAMANTA, Max Planck Institute for Dynamics and Self-Organization, YVES DUBIEF, School of Engineering, University of Vermont, MARKUS HOLZNER, Max Planck Institute for Dynamics and Self-Organization, CHRISTOF SCHAEFER, Saarland University, ALEXANDER MOROZOV, School of Physics & Astronomy, University of Edinburgh, CHRISTIAN WAGNER, Saarland University, JOSE MANUEL GALLARDO RUIZ, Max Planck Institute for Dynamics and Self-Organization — A new type of turbulence is discovered for elastic fluids such as dilute solutions of long chain polymers and surfactants. Experiments are carried out in channel and pipe flows with diameters ranging from a few centimeters to a few hundred microns. At large enough shear rates an instability is found giving rise to disordered motion. For sufficiently large concentrations this instability already occurs at very low Reynolds numbers, where for Newtonian fluids flows are always laminar. The data for different pipe diameters reveal that the onset of the instability is governed by the shear rate and not by the Reynolds number. The ensuing disordered flow has a larger drag than the laminar one. The friction scaling coincides with the well known maximum drag reduction asymptote inferring that this asymptote is the characteristic friction scaling of elasto-inertial turbulence.

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