The maximum drag reduction asymptote[1] GEORGE H. CHOUEIRI, BJORN HOF, Institute of Science and Technology Austria — Addition of long chain polymers is one of the most efficient ways to reduce the drag of turbulent flows. Already very low concentration of polymers can lead to a substantial drag and upon further increase of the concentration the drag reduces until it reaches an empirically found limit, the so called maximum drag reduction (MDR) asymptote, which is independent of the type of polymer used. We here carry out a detailed experimental study of the approach to this asymptote for pipe flow. Particular attention is paid to the recently observed state of elasto-inertial turbulence (EIT) which has been reported to occur in polymer solutions at sufficiently high shear. Our results show that upon the approach to MDR Newtonian turbulence becomes marginalized (hibernation) and eventually completely disappears and is replaced by EIT. In particular, spectra of high Reynolds number MDR flows are compared to flows at high shear rates in small diameter tubes where EIT is found at Re < 100.

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