Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Elasto-inertial turbulence in straight pipes at low Reynolds numbers GEORGE CHOUEIRI, BJÖRN HOF, IST Austria — An early point of contention in the study of polymer drag reduction had been whether polymers delay transition to turbulence or cause it to occur at earlier Reynolds numbers (Re). Recent results have shown that at low polymer concentrations, the subcritical transition to Newtonian type turbulence (NTT) is delayed; however at higher concentrations an elastic instability is encountered which results in a distinct flow state dubbed elasto-inertial turbulence (EIT). Here transition is continuous, fluctuation and friction levels are considerably lower than those for NTT and flow structures are qualitatively different. Several factors can influence the necessary Re for transition to occur for a specific polymer concentration; these include the type of polymer, its molecular weight, the solution viscosity and the proximity of the wall boundaries. By controlling these factors, we have found that chaotic motions can be measured at Re of the order of 1 even in straight smooth pipes as opposed to curved microchannels where curved streamlines cause a purely elastic instability. Furthermore we found that low-Re EIT is closely connected to turbulence that exists on the maximum drag reduction asymptote for polymer solutions with Re several orders of magnitude higher.

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Date submitted: 31 Jul 2017 Electronic form version 1.4