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Elastic Instabilities of Polymer Solutions in Extensional Flows<sup>1</sup> PAULO ARRATIA, University of Pennsylvania, JERRY GOLLUB, Haverford College & University of Pennsylvania — When flexible polymer molecules (in dilute solution) pass near the hyperbolic point of a microchannel cross flow, they are strongly stretched. As the strain rate is varied at low Reynolds number <0.01, tracer and particle-tracking experiments show that molecular stretching produces two flow instabilities, one in which the velocity field becomes strongly asymmetric, and a second in which it fluctuates non- periodically in time. The flow is strongly perturbed even far from the region of instability, and this phenomenon can be used to produce mixing. Bulk flow instabilities are not observed in dilute solutions of rigid polymers or Newtonian fluids under similar conditions.

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