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Fluctuation Theorems for Polymer Dynamics in Flow FOLARIN LATINWO, CHARLES M. SCHROEDER, Department of Chemical and Biomolecular Engineering, University of Illinois - Urbana — In this work, we discuss the application of the Crooks fluctuation theorem and the Jarzynski equality to study the dynamics of polymers in highly non-equilibrium fluid flows. The physics of polymer chains in flow strongly depends on the equilibrium and non-equilibrium steady state properties. From this viewpoint, the framework provided by Crooks and Jarzynski holds the potential open new routes for understanding polymer physics. We find that the general framework given by fluctuation theorems allows for the determination of equilibrium and non-equilibrium free energy landscapes of polymer solutions in flow. In particular, we use a combination of single molecule experiments and Brownian dynamics simulations to analyze individual polymer stretching trajectories in flow. Using this approach, we show that equilibrium properties such as polymer relaxation time and chain elasticity can be determined from a wide array of fundamental steady-state properties. Overall, our work connects the equilibrium and non-equilibrium properties of dilute polymer solutions, which provides a new platform to study the dynamics of flowing soft matter systems.

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