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Stretch-coil transition of a semiflexible filament in extensional flow HARISHANKAR MANIKANTAN, DAVID SAINTILLAN, University of California San Diego — We present a theoretical model for the fluctuation-rounded buckling transition of a semiflexible polymer placed in extensional flow. The competition between elastic rigidity and line tension developed in the polymer backbone can trigger a buckling instability, and the effect of thermal fluctuations on this bifurcation has recently gathered significant attention. While this problem has been studied experimentally and computationally before, the exact nature of the stochastic transition is yet to receive a full quantitative treatment. Motivated by the findings of recent experiments and our own numerical simulations, we approach this analytically by expanding a slender-body equation for the polymer around the first deterministic buckled mode at the onset of the instability. This leads us to a Ginzburg-Landau model for the amplitude of the buckled shape, solving which reveals an expression for a stochastic supercritical bifurcation. This solution captures the smooth transition from a stretched state to a buckled state as the extensional flow strength is increased. It matches excellently with full numerical simulations, and corroborates the conclusions drawn from recent microfluidic experiments.

Harishankar Manikantan
University of California San Diego

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