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Longitudinal fluctuations and higher cumulants of biopolymers in the strong stretching limit LIPENG LAI, Massachusetts Institute of Technology and Singapore University of Technology and Design, JIANSHU CAO, Massachusetts Institute of Technology — Biopolymers, such as actins and spectrins, are important constituents in cytoskeletons. Previous studies revealed that the mechanical properties of cytoskeletons, which are essential to the functions of living organisms, are largely dictated by the elastic properties of individual polymers. Here we studied the fluctuations of individual biopolymers when they are strongly stretched with very small transverse deformations. Based on the Worm-like chain (WLC) model, general formulae for the fluctuations and higher cumulants of the end-to-end distance along the stretching direction (longitudinal) are obtained when the energy of the semi-flexible chains retains a quadratic form (e.g., when the polymer is subject to a point force at the end or a constant plug flow with the other end fixed). Our results are consistent with previous theoretical and experimental work. Besides providing additional criteria to check the region of validity of the WLC model, the results may also provide more insights into the study of the elastic properties of polymers and cytoskeletal networks. Furthermore, our results can also be generalized to other situations when the polymers are rod-like. A good example is the actin network, where the actin segments are stiff due to their large persistence length.

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