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Kinetics of single DNA hairpin dissociation WILLIAM ROGERS, JOHN CROCKER, University of Pennsylvania — Over the past decade, groups have used a variety of single molecule techniques to study the unfolding and unbinding of nucleic acids, proteins and other biomolecules. While some experiments on the dissociation of nucleic acids find exponential lifetime distributions, as expected for a process governed by a single rate-limiting pathway, other experiments find nonexponential lifetime distributions. In our work, we address this discrepancy by probing the force dependence of a single DNA hairpin under thermal dissociation. We use a scanning line optical tweezers instrument to measure the bound lifetimes of two DNA-coated microspheres under negligible applied tension. The two microspheres share a user-specified potential along the scan direction and are strongly confined in the perpendicular dimensions. The trapping laser intensity is modulated synchronously with a resonant scanning mirror to null all optical contributions to the pair interaction potential near contact. In addition, the laser polarization can be rotated to produce a continuously adjustable optical repulsion, allowing the instrument to double as a passive force clamp over a modest range of applied tensions. This unique experimental approach allows us to investigate many of the proposed explanations for nonexponential kinetics in nucleic acid dissociation that have, until now, been difficult to isolate.

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