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Probing the mechanical unzipping of DNA NIKOS K. VOULGARAKIS, ALAN R. BISHOP, KIM O. RASMUSSEN, Theoretical Division and Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA — Recent advances in single-molecule force spectroscopy have made a systematic study of local melting in DNA possible. This provide new insight into important biological processes as replication and transcription. In this work, we present an extensive study of the micromechanical unzipping of DNA in the framework of the Peyrard-Bishop-Dauxois (PBD) model. The force required to separate the doubled strand is derived through analysis of the force-extension curve, while an estimation of the nucleation bubble size of the unzipping process is obtained by the distribution of the rapture force. Our findings are in very good agreement with existing experimental results; for example the force-temperature phase diagram obtained by the PBD model agrees excellently with recent constant-force experimental measurements of the lambda-phage DNA. Fundamental differences between the in vivo and vitro DNA unzipping, as predicted by the PBD model, are also discussed.

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