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Optical Nanodozers: A New Tool for Probing Single-Molecule Conformation and Confinement Free Energy in Cavities of Adjustable Nanoscale Dimension AHMED KHORSHID, WALTER REISNER, McGill University — Experiments probing single-molecule DNA statics and dynamics in nanoconfined systems are typically performed via fluoresence microscopy, yielding access to information regarding molecule conformation but no direct information regarding nanoscale forces. In our experiment we combine two single-molecule manipulation tools, optical trapping and nanoconfinement, to develop a novel assay that can yield information regarding both molecule conformation and forces experienced in confinement. Polystyrene beads are trapped inside 300x300nm silica nanochannels. These beads are then used as "nano-pistons" or "nanodozers," to apply compressive forces to single-molecules confined inside the nanochannels. In particular, a single nanodozer is used to push a DNA molecule against a nanoslit barrier, enabling measurements of force versus molecule compression. By carefully calibrating our trap via assessing Brownian motion of the nanochannel confined bead we are able to obtain a force-compression curve that we are comparing to polymer physics models for a cavity confined chain. In addition, we can determine the force required to drive the polymer across the entropic barrier as the critical force applied when the polymer jumps out of the cavity and over the slit.

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