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Optical Nanodozers AHMED KHORSHID, WALTER REISNER, McGill University, TAKAHIRO SAKAUE, Kyushu University — Experiment, simulation and scaling analytics are converging on a comprehensive picture regarding the equilibrium behaviour of nanochannel confined semiflexible, self-avoiding chains. Yet, strongly non-equilibrium behaviour of confined polymers is largely unexplored from either an experimental or theoretical point of view. Combining optical trapping and nanofluidics, we have developed a "nanodozer" assay for quantifying confined polymer dynamics. An optical trap is used to slide a nanosphere at a fixed velocity along a nanochannel. The trapped bead acts as a permeable gasket, letting fluid escape but preventing the polymer from passing. As the sliding bead comes in contact with a nanochannel extended DNA, the molecule is dynamically compressed, undergoing transient dynamics characterized by a traveling concentration "shock-wave" before reaching a final steady state with a ramp-like concentration profile. Remarkably, these strongly non-equilibrium measurements can be quantified via a simple nonlinear convective-diffusion formalism and yield insights into the local blob statistics, allowing us to conclude that the compressed nanochannel confined chain exhibits mean-field behaviour.

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