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Regimes of DNA confined in a nanochannel[1] LIANG DAI, Singapore-MIT Alliance for Research and Technology (SMART), PATRICK DOYLE, Department of Chemical Engineering, Massachusetts Institute of Technology (MIT) — Scaling regimes for polymers confined to tubular channels are well established when the channel cross-sectional dimension is either very small (Odjik regime) or large (classic de Gennes regime) relative to the polymer Kuhn length. In the literature, there is no clear consensus regarding the intermediate region and if subregimes even exist to connect these two classic bounding regimes. The confluence of emerging single DNA mapping technologies and a resurged interest in the fundamental properties of confined polymers has led to extensive research in this area using DNA as a model system. Due to the DNA molecule's properties and limitations of nanofabrication, most experiments are performed in this intermediate regime with channel dimensions of a few Kuhn lengths. Here we use simulations and theory to reconcile conflicting theories and show that there are indeed extended de Gennes, partial alignment and hairpin regimes located between the two classic regimes. Simulations results for both chain extension and free energy support the existence of these regimes.

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