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Hydrodynamics of interphase chromatin[1] ACHAL MAHAJAN, University of California San Diego, WEN YAN, Center for Computational Biology, Flatiron Institute, New York, ALEXANDRA ZIDOVSKA, Center for Soft Matter Research, Department of Physics, New York University, MICHAEL J. SHELLEY, Center for Computational Biology, Flatiron Institute, New York and Courant Institute of Mathematical Sciences, New York University , DAVID SAINTILLAN, University of California San Diego — Recent spectroscopy experiments on interphase chromatin have uncovered the existence of long-ranged coherent sub-diffusive motions on the scale of microns and persisting for seconds. These motions were found to be ATP-dependent suggesting the involvement of molecular motors. Motivated by these observations, we use Brownian dynamics simulations to elucidate the effects of microscale activity on the behavior and spatiotemporal dynamics of long flexible polymer chains in viscous solvents. We develop a coarse-grained model where active events are modeled as stochastic force dipoles, which drive long-ranged fluid flows inside an ellipsoidal nucleus. Numerical simulations based on a boundary integral formulation along with a kernel-independent fast multipole method demonstrate the key role played by hydrodynamic interactions and topological constraints in driving large-scale motions and chromatin reconfigurations.

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