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Buckling and Transport of Semiflexible Filaments in Cellular Flows HARISHANKAR MANIKANTAN, DAVID SAINTILLAN, University of Illinois at Urbana-Champaign — A slender elastic filament placed in a lattice of counter-rotating vortices is known to move as a random walker. Such a cellular flow has also been compared to experiments on actin transport across myosin beds. We present numerical results that for the first time include the effect of Brownian fluctuations on these transport properties. A semiflexible filament is modeled based on slender-body theory for Stokes flow, and incorporates Euler-Bernoulli elasticity as well as thermal fluctuations. We consider inextensible biopolymers of length of the order of persistence length (actin, microtubules etc). In a hyperbolic external flow, such an elastic filament is susceptible to a buckling instability that drives it between stagnation points in the lattice. The velocity distribution of the filament is bimodal in the non-Brownian case, and systematically flattens out with thermal fluctuations. Also, filaments are shown to spend time waiting in a cell before being pushed out by a random fluctuation. Such a waiting time distribution might indicate sub-diffusive transport as against diffusive transport seen in the non-Brownian case. We also study the distribution of mass of the filament across the lattice, and discuss how persistence length affects its preferred position in a unit cell.

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