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Transport properties of a flexible fiber in cellular flows MICHAEL SHELLEY, Courant Institute, New York University, YUAN-NAN YOUNG, Department of Mathematical Sciences, New Jersey Institute of Technology — Recent experiments by V. Steinberg and his collaborators have used "low Reynolds turbulence" in elastic flows to demonstrate coil-stretch transitions of fluorescently labelled DNA molecules. With this as motivation, we consider the much simpler problem of an elastic fiber that moves in a periodic cellular flow. Our numerical simulations show that such a fiber can act as a spatially extended test particle whose internal dynamics can lead to complex transport properties across space. In some parameter regimes, we find that space can be divided into regions of fiber entrapment and fiber transport, with fibers either trapped near elliptic points, or being transported along the connecting manifolds of the hyperbolic points. We also find that fiber buckling near hyperbolic points can yield random walk behavior over long times, with the effective diffusivity showing little dependence on the effective rigidity of the fiber.

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