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Transport of Flexible Filaments in Cellular Flows SHIYUAN HU, New York University, JUNJUN CHU, Tongji University, MICHAEL SHELLEY, New York University, JUN ZHANG, NYU Shanghai — The transport and dispersal of suspended objects by flows depends on the interplay between the object's morphology and internal mechanics with the flow at various length scales. We study the transport of flexible filaments in a time independent and spatially periodic cellular flow, focusing on the regime where the size of the structure is comparable with the size of background flow cells. Using experiments and numerical simulations, we show that this regime has surprisingly rich dynamics. Several transport states are identified: ballistic states, trapping states, Brownian walks, and Lvy walks. In particular, we identify a transition from Brownian walks to Lvy walks as filament length is decreased. The positional dynamics of filaments is also shown to be chaotic, even in the limit of rigid filaments. The emergence of chaos and different types of random walks is attributed to the nonlocal interactions between the filaments and the flow. Our results open up new possibilities for the dynamic sorting of filaments according to their length and flexibility.

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