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Collective dynamics of run-and-turn microswimmers with finite directional memory[1] HAMID KARANI, Brown University, YIXUAN CAO, PETIA VLAHOVSKA, Northwestern University — Swimming bacteria and motile colloids perform diverse types of random-walks at the individual level. A population of these active particles exhibit complex collective behaviors. While most of previous numerical models on self-organization in such active matter systems have focused on density and motility-induced pattern formation, we report on the effect of finite directional memory on the emerging collective dynamics. Inspired by our recent experimental findings on colloidal random-walkers, we conduct two-dimensional numerical analysis of correlated random walkers in a confined domain with alignment, anti-alignment and repulsion interactions. We elucidate the role of directional memory on controlling how the long-term patterns evolve from locally short-term transient dynamics. More specifically, we show that the run time and degree of directional memory play a crucial role in establishing different stable collective states in a confined system; e.g. a giant single vortex vs. dynamic vortex lattice. Our findings show the potential for dynamic transitioning between states at constant concentration and activity (speed) of active particles by solely tuning the directional memory of individual random walkers.

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