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Analysis of a Self-Propelled Particle Model for Understanding Flocking Transition in Sperm[1] PAUL YANKA, JELANI LYLES, North Carolina A&T State University, DANIEL SUSSMAN, M. LISA MANNING, Syracuse University, CHIH-KUAN TUNG, North Carolina A&T State University — Self-propelled particle (SPP) model has been used to derive useful knowledge in active matter systems for more than two decades. When there is no alignment between particles, there is a known phase separation of a condensed phase and a dilute phase solely due to the volume exclusion called motility induced phase separation (MIPS). When there is alignment between particles, there is a flocking transition. The goal of our SPP model is to help us understand experimental observation, and we focus on showing that our model produces comparable results with known literature. When we used a quadratic repulsion potential with no alignment, cell density fluctuation was seen when 7,000 particles were placed in the system, similar to other observation from MIPS, while the mean squared displacement (MSD) scales linearly with time to show a purely diffusive motion. When alignment was introduced and flocking occurred, we saw the MSD to scale with time quadratically, in line with particles going in a fixed direction. Along with the correlation function measurement, we have established a framework for the analysis of the SPP model, and we look to help better understand the origin of sperm flocking in experiments.

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