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Transition to collective motion and mixing in suspensions of micro-rotors[1] PETIA VLAHOVSKA, ENKELEIDA LUSHI, Brown University — Self-organization of active objects has attracted considerable attention recently, in particular in the context of living matter. Hydrodynamic interactions play a crucial role in the emerging behavior when the objects are immersed in fluid, especially in the low Reynolds number regime. While self-propelled active objects have been extensively investigated, the collective behavior of rotating active particle has received limited attention.To elucidate the transition to collective behavior and especially the role of multi-body hydrodynamic interactions, we numerically study systems of co- and counter-rotating spheres by varying the mixture ratio as well as the total volume fraction. We show that while macroscopic patterns emerge with increasing volume fraction in all the mixtures, the organization of the 100-0 and 50-50 mixtures are different in nature. The 50-50 rotor mixtures generate macroscopic fluid flows that are larger in magnitude and more chaotic, due to the propensity of rotors of opposite spins to pair up and co-swim. The properties of these generated fluid flows are investigated, and in particular we show that the mixing of a passive dye field is more efficiently done by 50-50 rotor mixtures.

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