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Hydrodynamic self-organization and mixing in suspensions of micro-rotors[1] KYONGMIN YEO, IBM Research, ENKELEIDA LUSHI, PETIA VLAHOVSKA, Brown University — Self-organization of active objects has attracted considerable attention recently, especially in the context of living systems. Hydrodynamic interactions can 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. With increasing volume fraction, we observe the emergence of intriguing patterns such as lanes, vortices of same-spin rotors as well as dynamic crystals composed of both types of rotors. We consider how the motion of the rotating particles and fluid they collectively generate affects the dispersion or clustering of passive sphere particles or mixing of passive scalar fields in the system.

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