Abstract Submitted
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Cluster formation and self-assembly in stratified fluids: a novel mechanism for particulate aggregation[1] RICHARD MCLAUGHLIN, ROBERTO CAMASSA, University of North Carolina at Chapel Hill, DANIEL HARRIS, Brown, ROBERT HUNT, University of North Carolina at Chapel Hill, ZELIHA KILIC, Arizona State University — We experimentally observe and mathematically model a new fundamental attractive mechanism we have found in our laboratory by which particles suspended within stratification may self-assemble and form large aggregates without need for short range binding effects (adhesion). This phenomenon arises through a complex interplay involving solute diffusion, impermeable boundaries, and the geometry of the aggregate, which produces toroidal flows. We show that these flows yield attractive horizontal forces between particles. The collective motion we observed experimentally appears to solve jigsaw-like puzzles on its way to organizing into a large scale disc-like shape, with the effective force increasing as the collective disc radius grows. Control experiments with two objects (spheres and oblate spheroids) isolate the individual dynamics, which are quantitatively predicted through numerical integration of the underlying equations of motion. With this two-body information, we present simulations with hundreds of spheres which reproduce many of the features of our self-assembly experiments.

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