Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Fast Lagrangian-averaged transport of particles in streaming flows[1] MATHIEU LE PROVOST, JEFF D. ELDREDGE, University of California, Los Angeles — Viscous streaming is an efficient method to transport, trap or cluster inertial particles in a fluid, used in biomedicine, microfluidics... Nonetheless, current methods to simulate the long term behavior of inertial particles are computationally expensive due to the nonlinearity and stiffness of the Maxey-Riley equation when applied to the wide disparity of time scales of oscillation and mean convection in streaming flows. To handle these issues, we propose a novel framework called Fast Lagrangian Averaged Transport to efficiently compute the Lagrangian-averaged motion of inertial particles. Two key ingredients are used to get this improved performance. First, we derive an asymptotic expansion for an Eulerian inertial particle velocity field for small Stokes number about the Eulerian fluid particle velocity field. Secondly, we decompose the motion of an inertial particle into a mean (slow) and fluctuating (rapid) component derived from an Eulerian disturbance field evaluated at the mean Lagrangian position of the particle. Linearized equations for the disturbance field are derived, and solved using an Immersed Boundary Method. Our method is assessed on the transport generated by one or two weakly oscillating cylinders. Computations are up to 300 times faster with this new method.

[1]National Science Foundation under grant 1538824

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Date submitted: 10 Jul 2019 Electronic form version 1.4