Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Convergence of Beer's Law for Radiation Transmission in Particle-Laden Turbulent Flows[1] ARI FRANKEL, Stanford University, RICK RAUENZAHN, Los Alamos National Laboratory, GIANLUCA IACCARINO, ALI MANI, Stanford University — Discrete random particulate media have been shown to produce significant deviations from Beer's law for radiation transmission. Though particle-resolved ray tracing models can exactly resolve the transmission, the computational expense of such approaches can be prohibitive in settings involving many particles where the radiative transfer equation must be solved at every time step. In this work we investigate the validity of projecting Lagrangian particles onto an Eulerian concentration field and using Beer's law on a local basis. We take particle distributions produced from clustering in turbulent flows and perform both particle-resolved Monte Carlo ray tracing and Beer's law computations. We show that the error in the calculated transmission decreases as the grid is refined, but that the homogenization error increases rapidly as the grid size approaches the particle diameter.

[1]This work was supported by the PSAAP2 program at Stanford University.

Ari Frankel
Stanford University

Date submitted: 24 Jul 2015 Electronic form version 1.4