Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Application of Filtered Spherical Harmonics Radiation Transport to High-Speed Reactive Flow RYAN HOUIM, ELAINE ORAN, University of Maryland — Radiative heat transfer is an important, but often neglected, process in high-speed reacting and multiphase flow applications. Some scenarios, such as dust explosions in coal mines, can have regions that are nearly transparent and other regions with high dust concentration that are optically thick. Most approximations to the radiative transfer equation (RTE) are not valid in both limits simultaneously. Issues also arise when solving approximations to the RTE that can often require the solution of elliptic equations. Many compressible hydrodynamic codes use explicit time-marching and block-structured adaptive-mesh-refinement algorithms. Adapting these codes to solve elliptic equations is not always straightforward. Recently, filtered spherical harmonics (FP_N) approximations to the RTE have been developed. The FP_N equations are hyperbolic and, as a result, can be solved using algorithms that are similar Godunovs method for compressible fluid flow. The FP_N model is also valid in optically thick and thin situations provided that the order, N, is high enough. We show that the FP_N equations are a promising alternative to traditional RTE approximations. Challenging test cases that involve both free-streaming and optically thick regions will be presented.

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Date submitted: 31 Jul 2015 Electronic form version 1.4