Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Modeling and Simulation of Fluid Mixing for Laser Experiments and Supernova YONGMIN ZHANG, SUNY at Stony Brook, JAMES GLIMM, R. PAUL DRAKE, SRABASTI DUTTA, JOHN GROVE, DAVID SHARP — Recently, laboratory astrophysics has been playing an important role in the study of astrophysical systems, especially in the case of supernova explosions through the creation of scaled reproductions of astrophysical systems in the laboratory. In collaboration with a team centered at U. Michigan and LLNL, we have conducted front tracking simulations for axisymmetrically perturbed spherical explosions relevant to supernovae as performed on NOVA laser experiments, with excellent agreement with experiments. We have extended the algorithm and its physical basis for preshock interface evolution due to radiation preheat. The preheat simulations motivate direct experimental measurements of preheat as part of any complete study of shock-driven instabilities by such experimental methods. Our second focus is to study turbulent combustion in a type Ia supernova (SN Ia) which is driven by Rayleigh-Taylor mixing. We have extended our front tracking to allow modeling of a reactive front in SN Ia. Our 2d axisymmetric simulations show a successful level of burning. Our front model contains no adjustable parameters so that variations of the explosion outcome can be linked directly to changes in the initial conditions.

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Date submitted: 27 Jul 2005 Electronic form version 1.4