Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Pressure wave reflection off a shock-accelerated particle curtain[1]
DANIEL FREELONG, CAROLINA SHAHEEN, University of New Mexico, GUSTAAF JACOBS, San Diego State University, PETER VOROBIEFF, University of New Mexico — We present an experimental and numerical study of a planar shock interaction with a falling particle curtain, where massive particles account for about 5% of the curtains volume before the shock arrives, and the remaining volume is filled with air at atmospheric pressure. Experiments are conducted at the University of New Mexico shock tube at Mach numbers between 1.2 and 2.0. A multiphase Atwood number characterizing the initial conditions under consideration approaches unity, suggesting that the particle inertia likely dominates the post-shock curtain movement. Despite the modest volume fraction of the particles, even a relatively thin (2 mm) curtain produces a reflected pressure wave in experiments. This pressure wave can be reproduced numerically with a computationally inexpensive one-dimensional model based on a particle source in cell (PSIC) method. We also compare experimental and numerical results characterizing the post-shock propagation of the curtain, and discuss what dimensionless parameters besides the multiphase Atwood number are necessary to characterize the flow.

[1]This research is funded by the DTRA grant HDTRA-18-1-0022. Professors Jacobs and Vorobieff also acknowledge partial support from NSF grant 1603915.

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Date submitted: 10 Aug 2020 Electronic form version 1.4