

Modeling Ejecta from Shocked Metals

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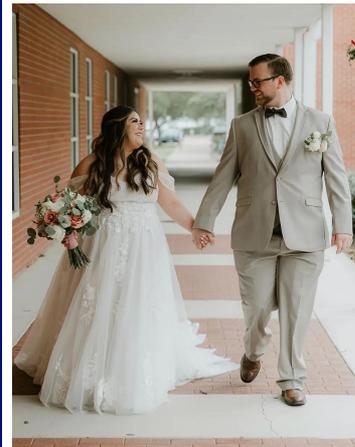
XCP Computational Physics Student Summer Workshop
Quick Look
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Jordan Hoffart

Texas A&M University

- 4th year Math PhD student at Texas A&M University
- Research interests in finite element methods for coupled multiphysics systems
- Hobbies: music, traveling, and hiking



Julia Marshall

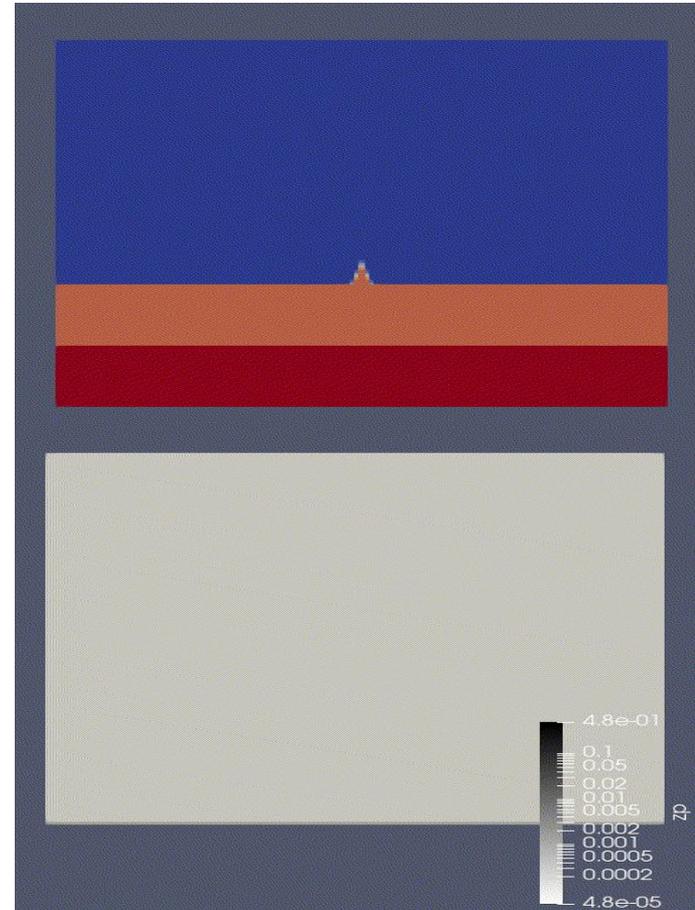
University of Michigan

- Rising senior at the University of Michigan studying Nuclear Engineering and German
- Research interests in computational plasma physics for fusion energy applications
- Hobbies: rock climbing, hiking and quilting!



Motivations

- Previous work looked at the mass ejected from single cavity defects
- Richtmyer Meshkov Instability (RMI): driving force for ejecta
- The amount of outflow highly depends on the initial configuration of the defect
- In this work, we investigate:
 - Bump-like defects
 - Multiple defects, with varying distance between them



Methods

Osito

Set up defect geometries



FLAG

Run simulations



ParaView

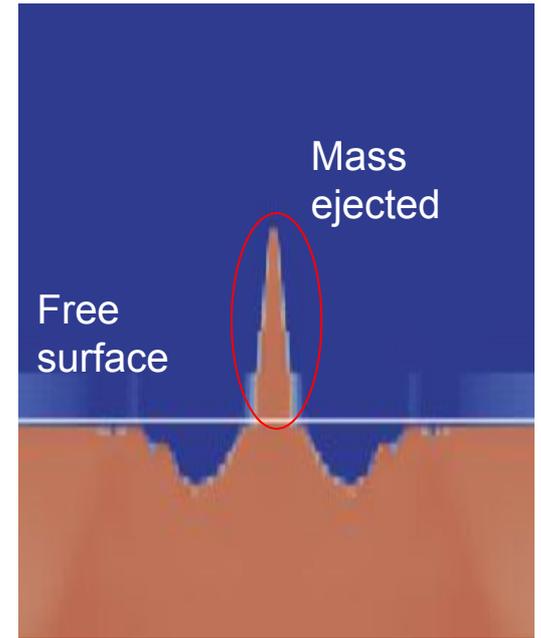
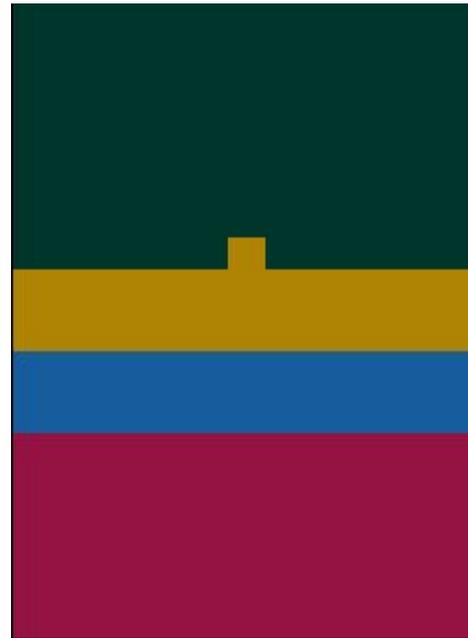
Process output

Helium

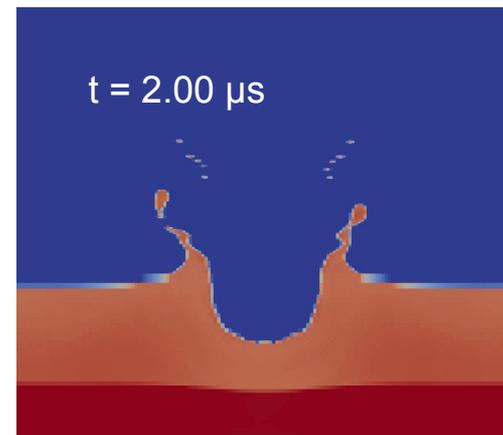
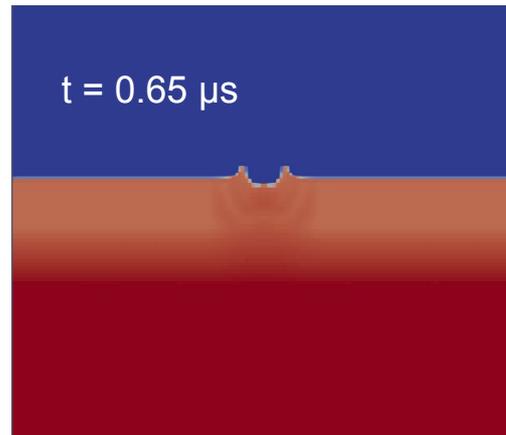
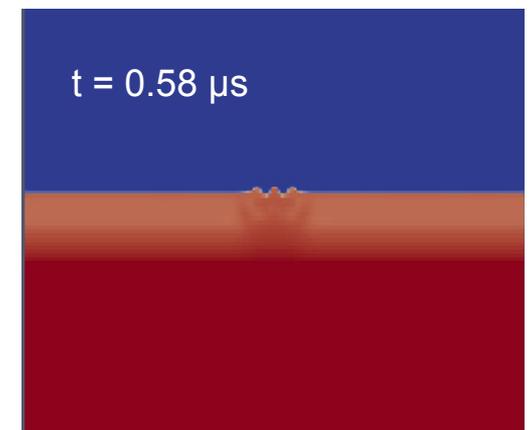
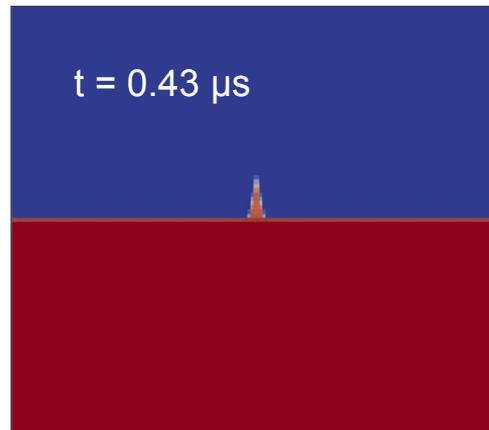
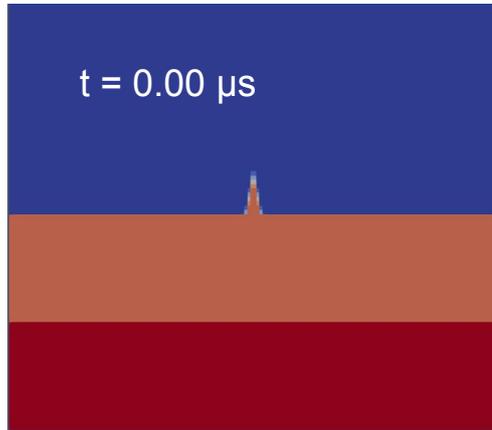
Tin

Cu Base

Cu Flyer



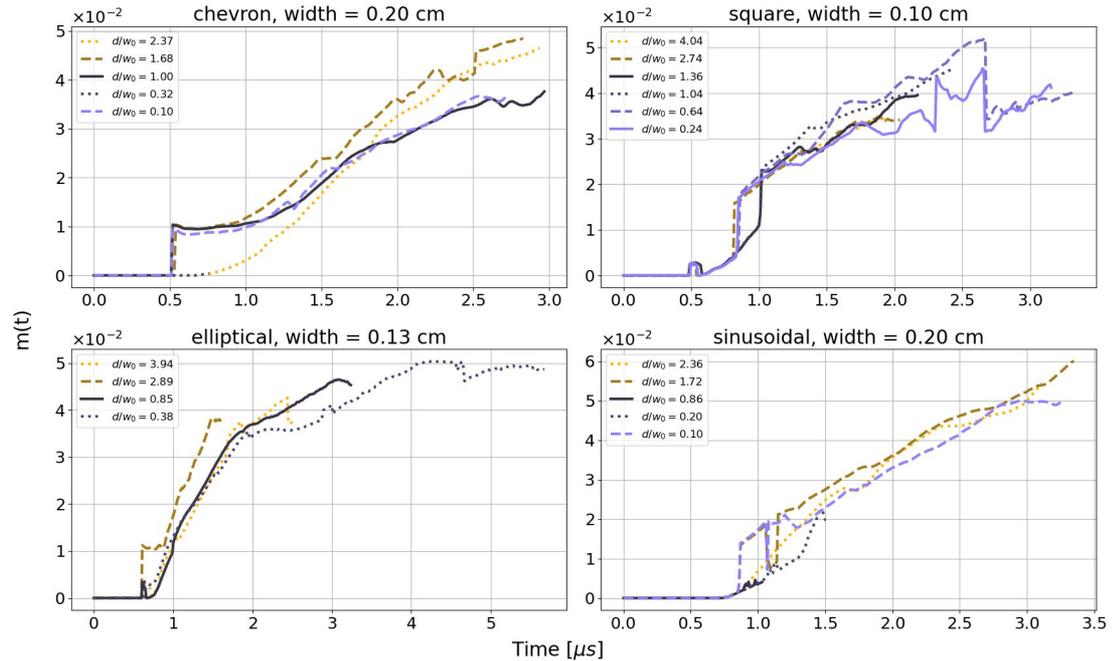
Simulation Snapshots



Results of the Spacing Study

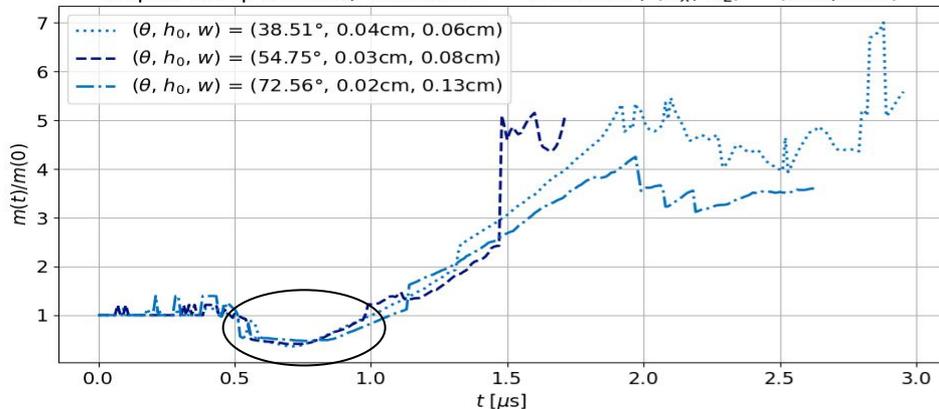
- Constant volume between defect shapes
- Varied d , the distance between two defects
- Ran at two resolutions: (240x450) and (320x600)
- Amount of ejected mass seems unaffected by separation distance, though the jetting phenomena is variable

Mass Ejected Above Free Surface

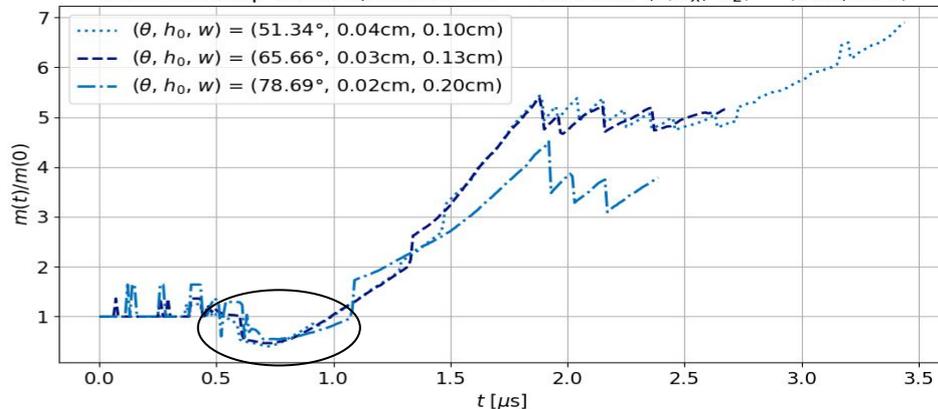


Results of Bump Defect Study

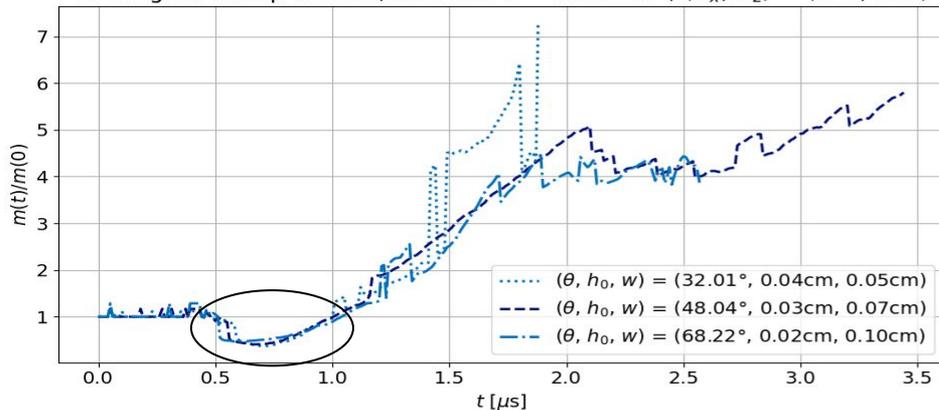
elliptic bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



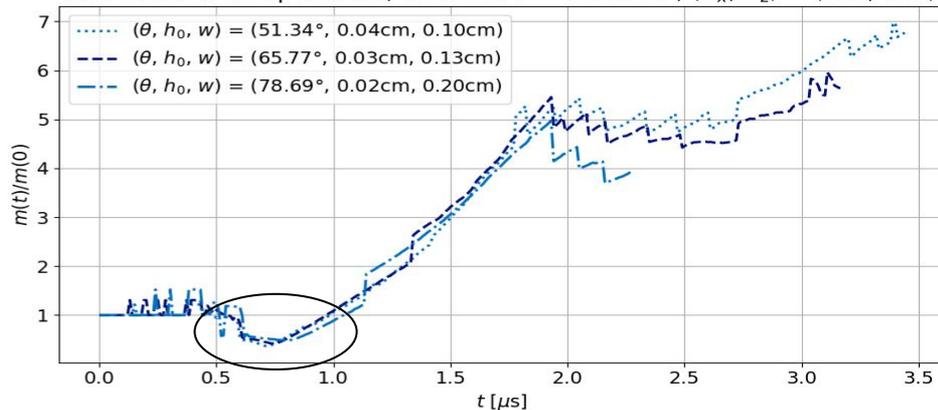
chevron bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



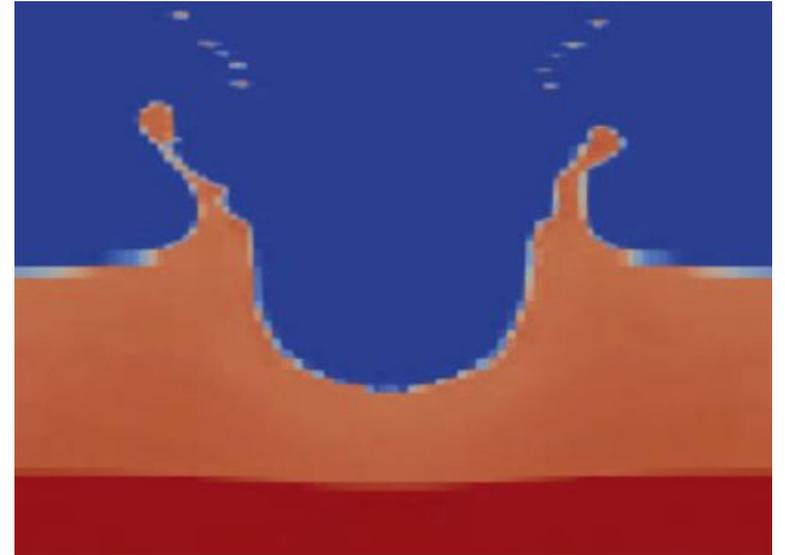
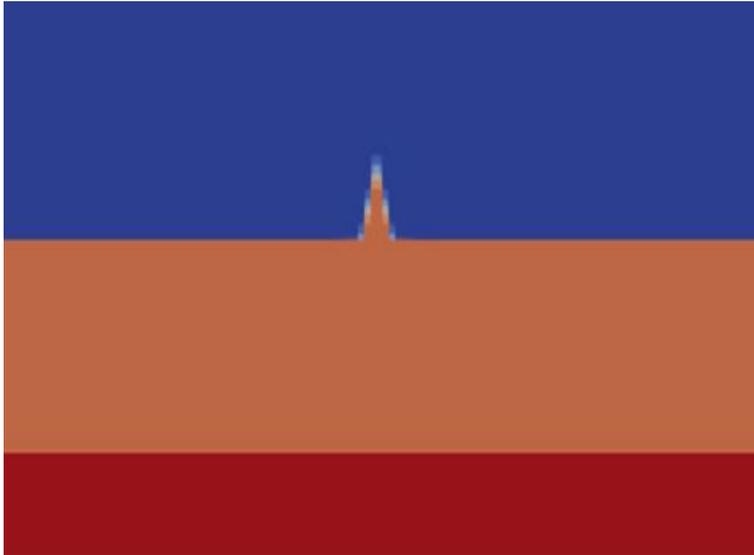
rectangular bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



half-sinusoid bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



Super-bubble formation



Future Work

- Quantify simulation and post-processing error
- Improve free surface tracking
- Run a grid convergence study

This work will be presented at the Annual Meeting of the American Physical Society (APS) - Division of Plasma Physics (DPP), 2023-10-30/2023-11-03 (Denver, Colorado, United States)