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Title: Modeling Ejecta from Shocked Metals

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Modeling Ejecta from Shocked Metals

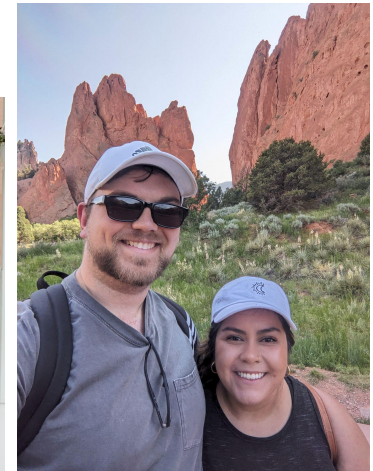
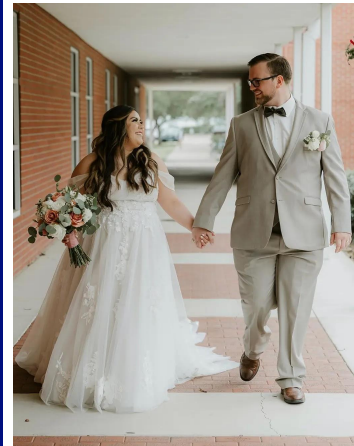
Students: Jordan N. Hoffart, Julia L. Marshall
Mentors: Jesse M. Canfield, Bryan E. Kaiser

XCP Computational Physics Student Summer Workshop
Quick Look
August 15, 2023

Jordan Hoffart

Texas A&M University

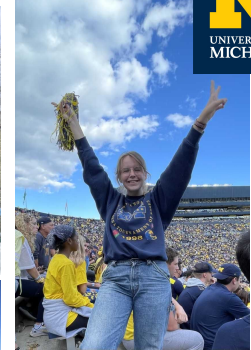
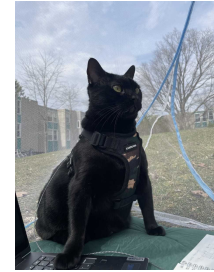
- 4th year Math PhD student at Texas A&M University
- Research interests in finite element methods for coupled multiphysics systems
- Hobbies: music, traveling, and hiking



Julia Marshall

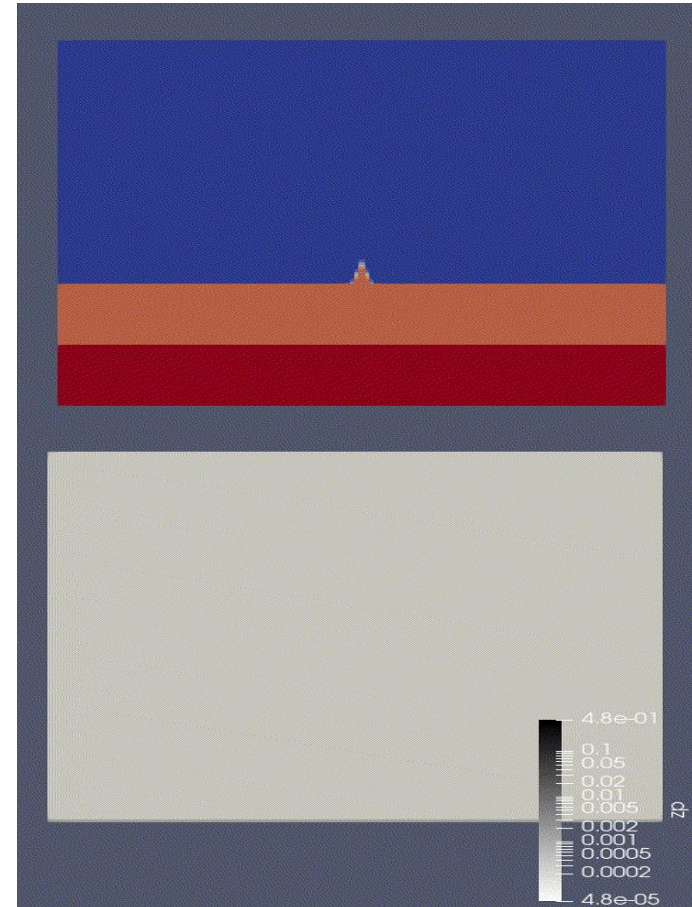
University of Michigan

- 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!

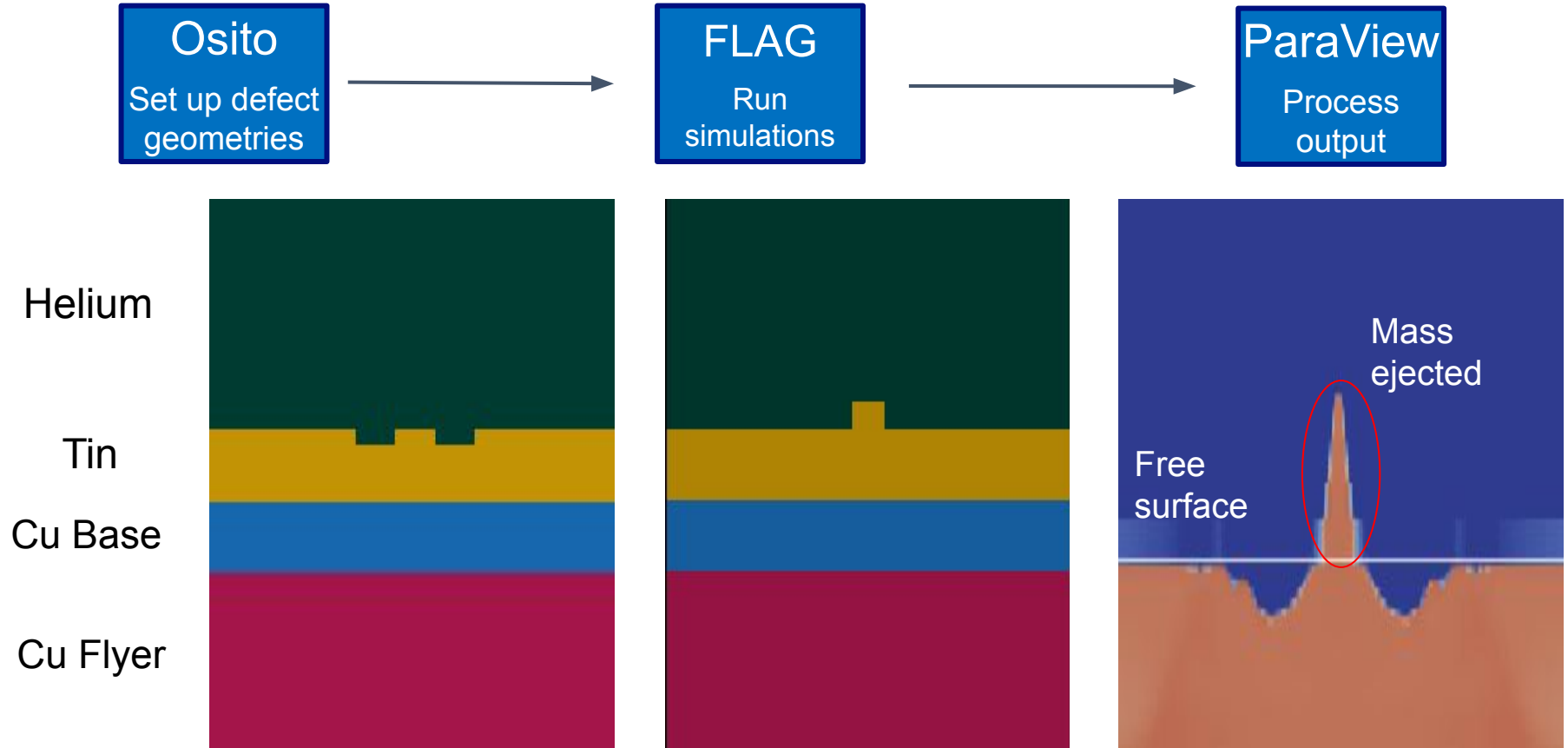


Motivations

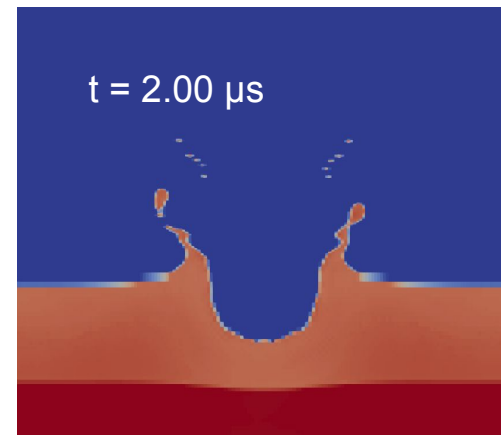
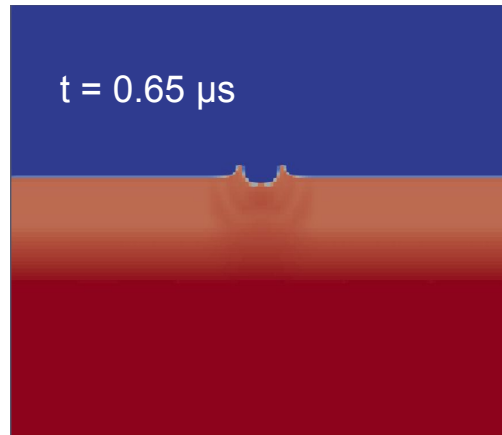
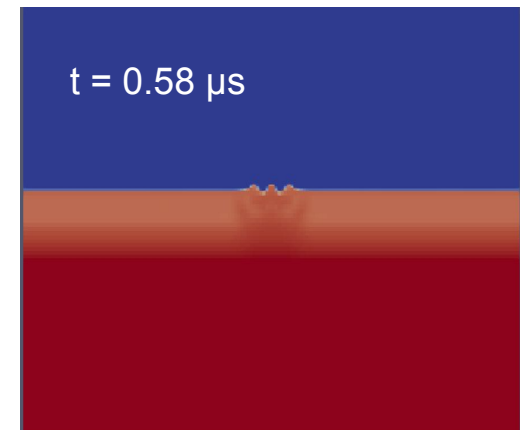
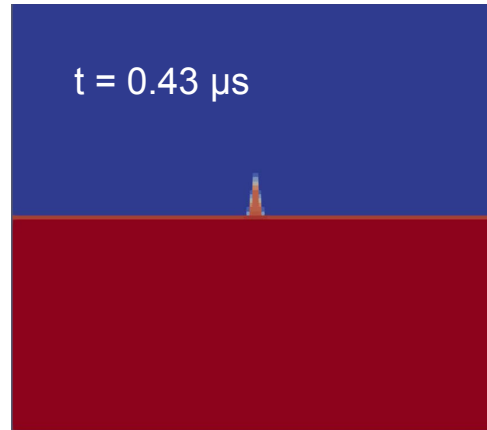
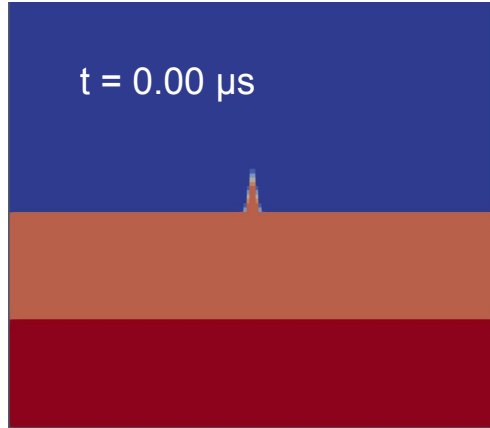
- Previous work looked at the mass ejected from single cavity defects
- Richtmyer Meshkov Instability (RMI): driving force for ejecta
- The amount of outflow highly depends on the initial configuration of the defect
- In this work, we investigate:
 - Bump-like defects
 - Multiple defects, with varying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



Methods



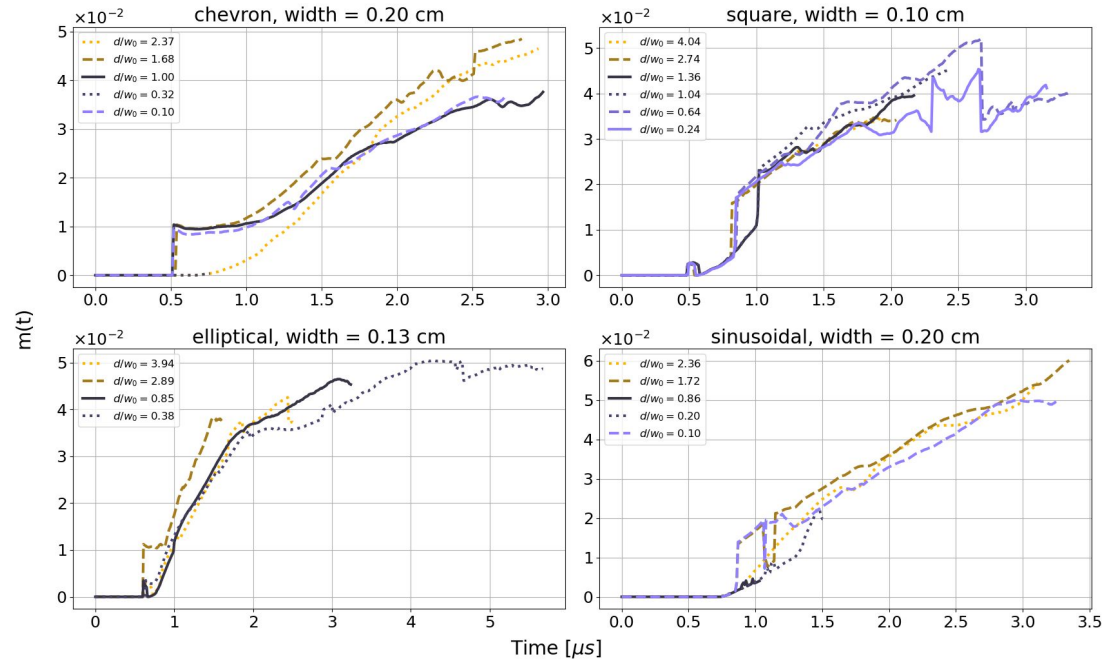
Simulation Snapshots



Results of the Spacing Study

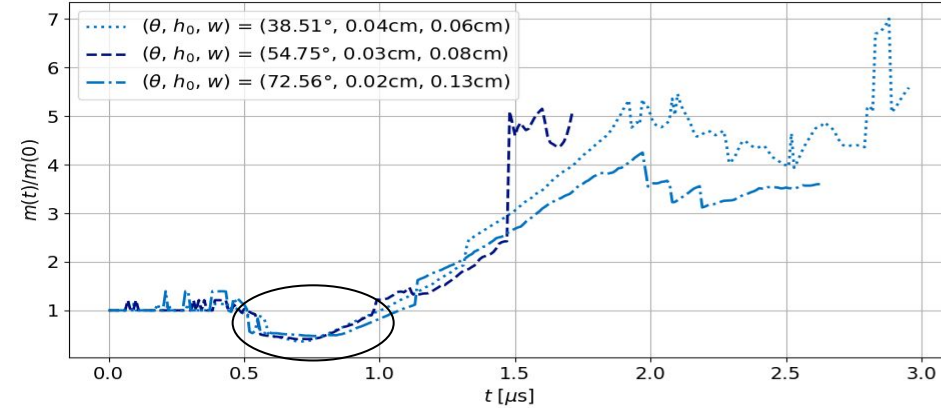
- Constant volume between defect shapes
- Varied d , the distance between two defects
- Ran at two resolutions: (240x450) and (320x600)
- Amount of ejected mass seems unaffected by separation distance, though the jetting phenomena is variable

Mass Ejected Above Free Surface

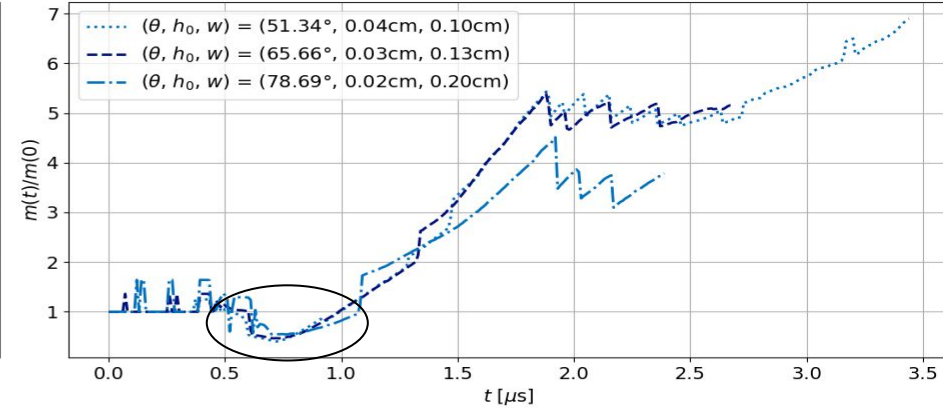


Results of Bump Defect Study

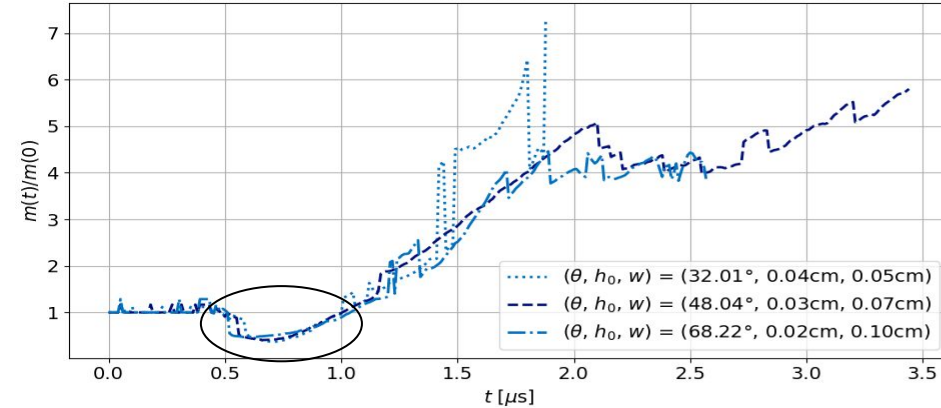
elliptic bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



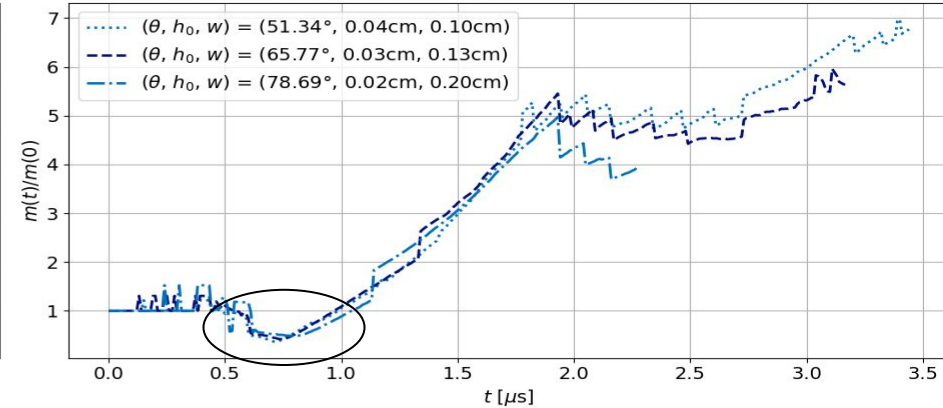
chevron bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



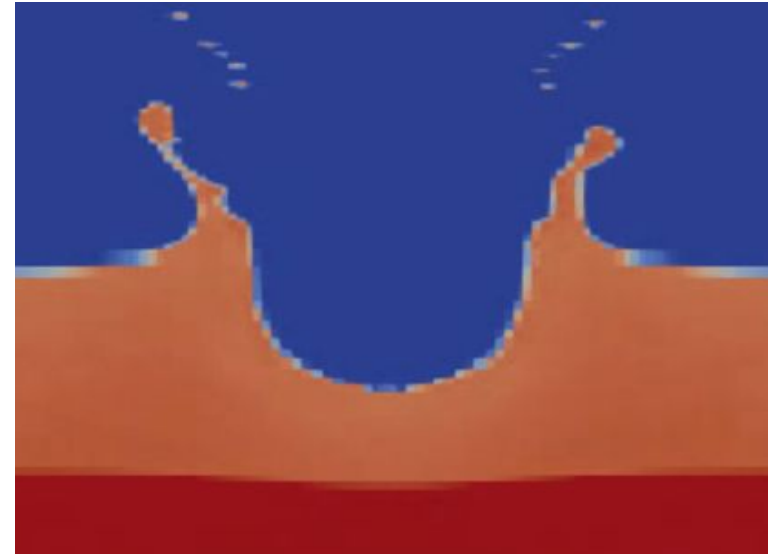
rectangular bump defects, constant $V = 0.002\text{cm}^3$, $(N_x, N_z) = (160, 600)$



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)