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Multi-material hydrodynamics modeling of asteroid impacts at oblique shock interfaces ROSEANNE CHENG, TARIQ ASLAM, Los Alamos National Laboratory — We present a new Eulerian multi-material hydrodynamics code to simulate the mechanics of impact crater formation. It is based on the open source astrophysical radiation magnetohydrodynamics with adaptive mesh refinement code Athena++. The hydrodynamics method is a directionally unsplit, high-resolution shock capturing Godunov scheme. We have developed and implemented a new multi-material capability into Athena++, where the evolution of several materials (gas and/or solids) is modeled in a fluid approximation with a set of conservative equations coupled to the basic hydrodynamic equations. Each material is governed by a separate equation of state (EOS) where we assume pressure equilibrium closure for mixed cells. The current implementation includes analytic EOS, but an extension to tabular form is straightforward. In this talk, we describe the numerical method and apply it to early-time models of asteroid impacts into boundary layers of water and granite. Each layer is modeled using a Mie-Grüneisen EOS based on experimental shock data. We focus the study on oblique shocks and compare simulation results with analytic solutions from shock polar analysis. We discuss the coupling to strength and fracture models with this code.

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