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Mechanism and Structure of Subsurface Explosions in Granular Media SHUYUE LAI, RYAN HOUIM, ELAINE ORAN, Univ of Maryland-College Park — Numerical simulations of explosions in granular media were performed with an unsteady multidimensional fully compressible model, which solves two sets of coupled Euler equations, one for the gas and one for the granular medium. An explosive charge, buried in the granular medium, is modeled by a pocket of high-pressure and high-temperature gas. The initial conditions were determined based on an estimate of subsurface conditions on a comet. A series of simulations were performed in which the charge was buried at 3 m and 1.5 m and the particle volume fractions and the coefficient of restitution varied in the ranges 0.25 to 0.45 and 0 to 1, respectively. The simulations show the process of granular shock formation and propagation as a blast wave is created during the explosion. The blast wave initiates the particle motion and the particles accumulate to form a granular shock. The granular shock, in turn, produces a weak gas shock following it. There is a power law that relates the granular-shock radius to the explosion time: R ~$t^{0.4}$, which is consistent with the results found by G. I. Taylor for 3-D spherical shock waves. The exponent of the power law remains at 0.4 regardless of the volume fraction and the elasticity of the granular material. For denser granular flows, the intergranular stress becomes stronger, and so the granular shock propagates at a higher velocity.

Shuyue Lai
Univ of Maryland-College Park

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