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**Planetary structure and impact calculations using new mixture equations of state** A. CORREA, D.C. SWIFT, Lawrence Livermore National Laboratory, R.N. MULFORD, Los Alamos National Laboratory, S. HAMEL, Lawrence Livermore National Laboratory — Studies of the structure of icy planets and exoplanets, and of comet impacts, are hampered by limited high-pressure data on ices. We have recently predicted equations of state (EOS) for water-methane-ammonia mixtures using quantum molecular dynamics and equilibrium chemistry based on empirically-derived potentials. Here we use these EOS to predict astrophysical mass-radius relations with a firmer theoretical footing. We previously developed a hydrocode model of heterogeneous mixtures using stress and thermal equilibration among a set of homogeneous components, with each component described by its own EOS and constitutive model. We have extended this model to treat multiphase flow more completely, by including a particle velocity for each component, drag, and the evolution of particle sizes. An externally-applied bulk acceleration from hydrodynamics induces different accelerations in each component, according to the differences in mass density. This model is suitable for simulating the dynamic loading of asteroids and comet nuclei, where one component such as an ice may be vaporized, resulting in the acceleration of embedded particles of a less volatile material. The same model can be used to simulate some aspects of planetary evolution, such as differentiation.

Damian Swift
Lawrence Livermore National Laboratory

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