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Atmospheric breakup of meteoroids[1] BASSEM EL-DASHER, DAMIAN SWIFT, BRUCE REMINGTON, Lawrence Livermore National Laboratory, ROBERTA MULFORD, Los Alamos National Laboratory, DESPINA MILATHIANAKI, SLAC National Accelerator Laboratory, LAURA CHEN, DANIEL EAKINS, Imperial College — When meteoroids enter a planetary atmosphere, breakup is governed by the Rayleigh-Taylor instability, mitigated by the strength of the meteoritic material. Particle sizes in the breakup cascade depend on the perturbation length scales exhibiting growth. The physics of meteoroid entry is thus related closely to experiments where strength at high pressure is inferred from the Rayleigh-Taylor growth of perturbations. There are significant discrepancies between predicted and observed breakup altitudes of meteoroids, which in turn reduce the accuracy of assessments of the impact threat from asteroids. Simulations, validated by laboratory experiments of instability growth, can play a role in understanding the breakup of meteoroids and thus the threat from asteroids. Continuum dynamics simulations provide more rigorous stress distribution than are usually used in breakup analyses, and can be used to calibrate compact expressions describing the breakup conditions. We have measured the strength of samples from Fe-rich meteorites using indentation and shock-loading experiments, and found them to be significantly stronger than was previously realized. This, together with the more accurate stress analysis, removes the altitude discrepancy for Fe-rich meteorites.

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