A new method to generate dust with astrophysical properties

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In interstellar and interplanetary space, the size distribution and composition of dust grains play an important role. For example, dust grains determine optical and ultraviolet extinction levels in astronomical observations, dominate the cooling rate of our Galaxy, and sets the thermal balance and radiative cooling rates in molecular clouds, which are the birth place of stars. Dust grains are also a source of damage and failure to space hardware and thus present a hazard to space flight. To model the size distribution and composition of dust grains, and their effect in the above scenarios, it is vital to understand the mechanism of dust-shock interaction. We demonstrate a new experiment which employs a laser to subject dust grains to pressure spikes similar to those of colliding astrophysical dust, and which accelerates the grains to astrophysical velocities. The new method generates much larger data sets than earlier methods; we show how large quantities (thousands) of grains are accelerated at once, rather than accelerating individual grains, as is the case of earlier methods using electric fields. We also measure the in-flight velocity (~4 km/s) of hundreds of grains simultaneously by use of a particle image velocimetry (PIV) technique.

8th International Conference on High Energy Density Laboratory Astrophysics
March 15-18, 2010
California Institute of Technology
Pasadena, California, USA
http://hedla2010.caltech.edu/