

# Laboratory Studies of the Optical Properties and Condensation Processes of Cosmic Dust Particles

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A laboratory facility for levitating single isolated dust particles in an electrodynamic balance has been developing at NASA/Marshall Space Flight Center for conducting a variety of experiments of astrophysical interest. The objective of this research is to employ this innovative experimental technique for studies of the physical and optical properties of the analogs of cosmic grains of 0.2-10 micron size in a chamber with controlled pressure/temperatures simulating astrophysical environments. In particular, we will carry out three classes of experiments to investigate the microphysics of the analogs of interstellar and interplanetary dust grains:

(1) Charge characteristics of micron size single dust grains to determine the photoelectric efficiencies, yields, and equilibrium potentials when exposed to UV radiation. These measurements will provide the much-needed photoelectric emission data relating to individual particles as opposed to that for the bulk materials available so far.

(2) Infrared optical properties of dust particles obtained by irradiating the particles with radiation from tunable infrared diode lasers and measuring the scattered radiation. Specifically, the complex refractive indices, the extinction coefficients, the scattering phase functions, and the polarization properties of single dust grains of interest in interstellar environments, in the 1-25 micron spectral region will be determined.

(3) Condensation experiments to investigate the deposition of volatile gases on colder nucleated particles in dense interstellar clouds and lower planetary atmospheres. The increase in the mass or  $m/q$  ratio due to condensation on the particle will be monitored as a function of the dust particle temperature and the partial pressure of the injected volatile gas. The measured data will permit determination of the sticking efficiencies of volatile gases of astrophysical interest.

Preliminary results based on photoelectric emission experiments on 0.2-6.6 micron size silica particles exposed to UV radiation in the 120-200 nm spectral region will be presented.