

Investigation of Charging of the Analogs of Individual Cosmic Dust Grains by Photoelectric Emissions; Investigators: P.I.-Dr M.M. Abbas C.I. D. Tankosic Collaborators: Dr. J. Spann, Dr. P.Craven Dr. E.West, R. Hoover

The Main Dust Charging Processes in Astrophysical Environments are:

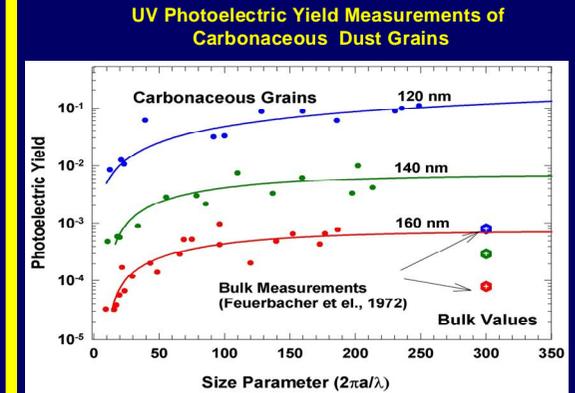
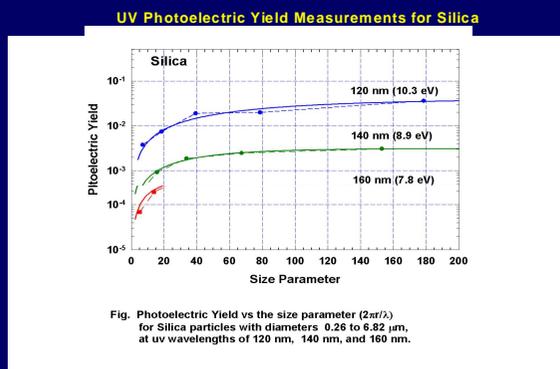
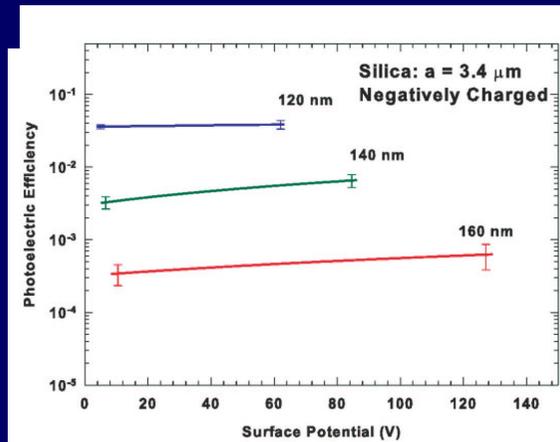
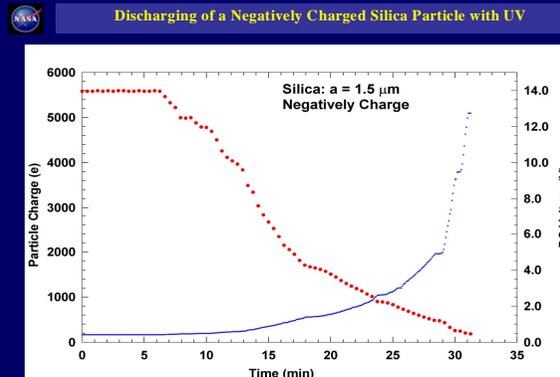
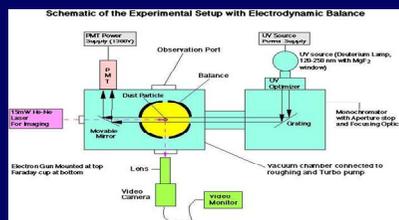
- UV photoelectric emissions
- Electron collisions with electron capture at low electron energies
- Secondary electron emission process with electron energies > few hundred eV, ejecting electrons from the grain charging it positively
- Ion collisions neutralize a charged grain by recombination with electrons from the grain

Charging Properties of Individual Dust Grains

- Optical and charging properties of individual micron/submicron size dust are expected to be substantially different from the corresponding values measured on bulk materials.
- No rigorous theoretical models for calculation of the charging properties of individual micron size dust grains are available. Basic quantities such as, the photoelectric yields, and secondary electron emission yields, have to be determined by experimental methods.
- First photoelectric emission measurements on individual Interstellar type & Apollo 11 & 17 dust grains have been made at NASA/MSFC.

Experimental Setup for Photoelectric Measurements

- UV Source, Deuterium Lamp 15 watts, Broad-band spectrum; MgF₂ window
- Monochromator 0.2 meter concave holographic vacuum UV; Resolution: 8 nm,
- PMT: CsI photocathode MgF₂ window; Wave length range: 115 nm < λ < 200 nm



Conclusions:

- First measurements of photoelectric yields of individual Apollo-17, Luna 24, and JSC-1 simulant dust grains of ~ 0.1 to 8 micron radii have been obtained.
- Measurements indicate a size dependence of the yields, increasing with grain size to asymptotic values by an order of magnitude.
- The asymptotic values of the yields are higher than the bulk values reported in the literature by factors of ~ 15-35.