In-Situ Cohesion Quantification and Sample Collection Through Electrostatic Lofting

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Target: Small, Airless Body Surfaces

Science:

- Quantitative measurement of cohesion in regolith for small bodies
  - Existing cohesion measurement concepts rely on reconstruction of engineering data or require a reaction force to be supplied by the lander (e.g. during penetrometry)
- Enables size-specific regolith sampling, eliminating the need to sieve before *in situ* analysis

Objectives:

- Investigate key instrument functions, building on existing models of natural electrostatic dust lofting
  - model plasma between attractor and surface
  - model and experimentally verify lofting of dust clumps
  - model trajectories for sample collection
- Model key instrument requirements to assess feasibility
  - power required to hold attractor plate at required electric potential
  - required camera resolution and lighting
- Experimentally demonstrate key instrument functionality
  - induce dust lofting via attractor plate
  - collect sample on attractor plate

CoIs: None.

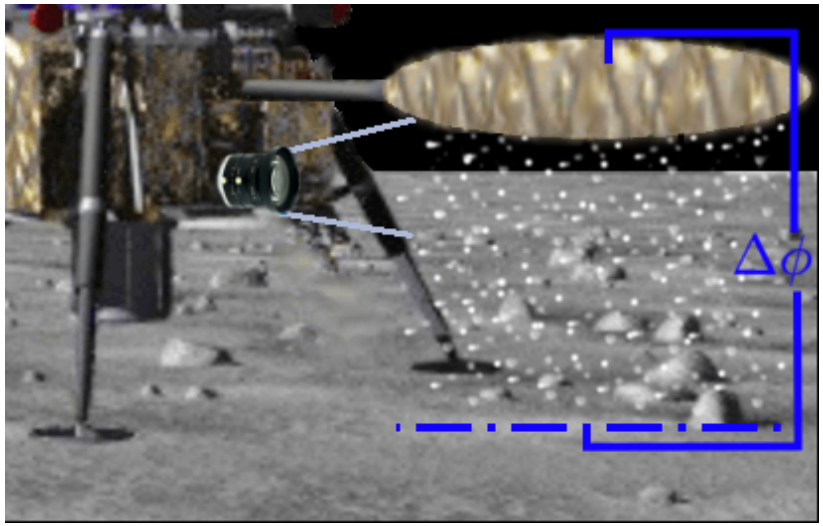

Figure Caption: The proposed instrument exploits the phenomenon of electrostatic dust lofting to measure regolith cohesion and collect sample. The instrument consists of an attractor plate, whose electric potential can be controlled, and a camera. The electric field at the surface is modified by controlling the electric potential of the attractor plate. Regolith grains are electrically charged by the solar wind plasma and UV radiation. When the electrostatic force on a dust grain overcomes gravity and cohesion, the dust grain will be lofted. The lofted grain size (mm-cm) is observed by the camera. Since the electrostatic force and gravitational force on the grain is know, the cohesive force can be derived.

Key Milestones:

- Y1: Model electrostatic dust lofting in instrument context
- Y2: Progress to TRL 3, begin experimentation
- Y3: Progress to TRL 4, exp. demonstrate key functionality

TRL 2 to 4