



XTRA: An ExtraTerrestrial Regolith Analyzer for Lunar Soil

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Platform: Fixed Lander or Rover

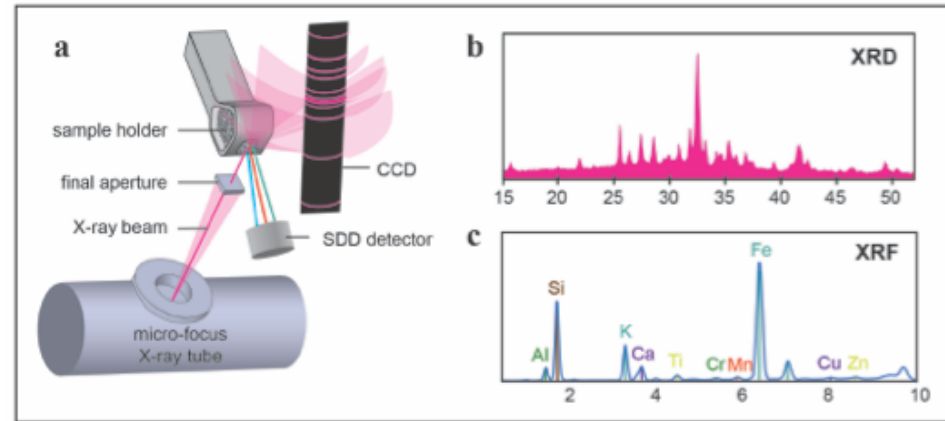
Science:

- SCEM Concept 2: Understand the structure and composition of the lunar interior (mineralogy).
- SCEM Concept 3: Study key planetary processes through the diversity of lunar crustal rocks (mineralogy and elemental composition).
- SCEM Concept 4: Understand volatile sources at the lunar poles (water-bearing minerals).
- SCEM Concept 5: Understand thermal and compositional evolution of the Moon (mineralogy).
- Prospect for and evaluate lunar regolith materials for ISRU (Fe-bearing minerals).

Objectives:

- Identify and quantify major and minor minerals in as-received lunar regolith.
- Determine the crystal chemistry (composition) of individual major minerals in lunar regolith.
- Determine the concentrations of major elements & detect minor elements ($10 < Z < 26$) in lunar regolith.
- Determine the quantity and composition of amorphous component(s) in lunar regolith.

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Loose soil is delivered to a sample holder having a thin mylar window. **a)**, a collimated X-ray beam strikes the sample through the mylar window at a shallow angle, causing diffraction and fluorescence events. **b)**, an X-ray diffraction pattern is recorded by a CCD detector in reflection geometry. **c)**, An X-ray fluorescence spectrum is recorded by a Silicon Drift Diode detector.

Key Milestones: (project start date 01/01/19)

- XRD/XRF Geometry Refinement Complete 06/19
- XTRA Subsampling System (XSS) Prototype Complete @ TRL-5
- XTRA Baseline Performance Requirements Validated 06/20
- Sample Acquisition and Delivery (SA/D) and XSS Verification and Validation complete 10/20
- XSS Environmental testing complete @ TRL-6 01/21
- XRD & XRF calibration complete 09/21
- XTRA I&T Complete @ TRL-6 12/21

TRL 4 to 6