

PLANETARY XRD/XRF BEYOND CHEMIN: NEW DEVELOPMENTS TOWARD SMALLER INSTRUMENTS.

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The NASA CheMin XRD/XRF instrument (Figure 1) has been successfully deployed in the Mars Science Laboratory (MSL) mission for more than 5 years. CheMin established the quantitative mineralogy of the Mars soil, characterized the first habitable environment on another planet, and provided the first in-situ evidence of Martian silicic volcanism. CheMin is now employed in the characterization of the depositional and diagenetic environments of lacustrine mudstones that comprise the lower strata of Mt. Sharp. CheMin as-designed is restricted to Flagship-class missions like MSL due to its size, mass and power. Deployment of XRD/XRF on smaller rovers (MER type) and landers requires further miniaturization. For a decade, we have been developing new miniaturized flight components allowing smaller XRD/XRF instruments to be deployed in mission with reduced payload capacity compared to MSL. Several proto-flight instrument developments will be presented, targeting specific planetary applications to the Moon (Figure 2), Mars (Figure 3) and Venus.

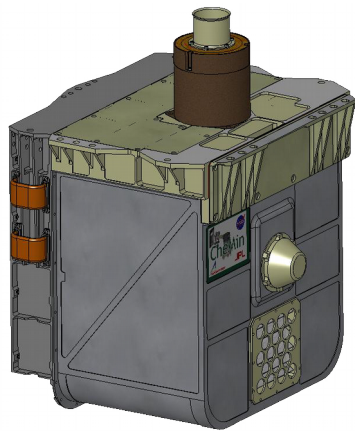


Figure 1: CheMin uses a transmission geometry to analyze powdered samples collected by Curiosity's drill and scoop (size $\sim 30 \times 30 \times 30 \text{ cm}^3$)

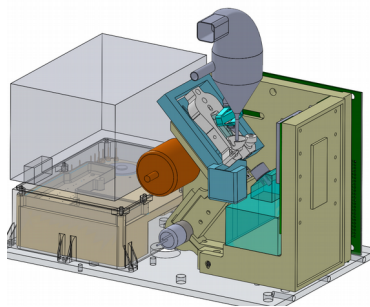


Figure 2: Preliminary design of XTRA, a lunar XRD/XRF in reflection geometry. XTRA will analyze a regolith sample pneumatically collected and delivered to the instrument cyclone/funnel. XTRA is being developed to TRL6 under NASA DALI funding.

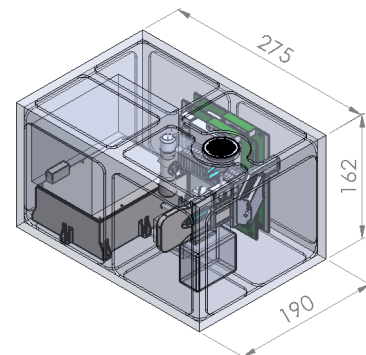


Figure 3: CheMinX uses a similar transmission geometry as CheMin, provides improved XRD and XRF resolution and allows a reduction in volume of the instrument by a factor of 3.