Paper ID: 100507
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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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MIRORES: A COMPACT FAR-INFRARED SPECTROMETER FOR LUNAR ORE IDENTIFICATION AND FUTURE ISRU MISSIONS

Abstract

Lunar ore minerals such as pyrite, troilite, and ilmenite contain noble and base metals as well as other resources needed to establish self-sustaining lunar bases and support long-term exploration. These minerals are prime targets for in-situ resource utilization (ISRU) because they can yield critical materials for lunar infrastructure. For example, iron sulfides (pyrite, troilite) could provide raw feedstock for solar cell fabrication, while ilmenite can supply iron, titanium, oxygen (for propellant), and helium-3 (a potential fusion fuel). Notably, these ore minerals exhibit distinctive absorption features in the far-infrared (20–40m) that are far stronger than those of common lunar silicates or other rock-forming minerals. Spectral modeling suggests that even modest ore concentrations (10–20