The Lunar South Pole Environment

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Moon Phases 2020
Including Libration and Position Angle
South Up Edition

https://svs.gsfc.nasa.gov/4768
Two significant risks for lunar exploration of the south pole:

- The Dust.
- The Sun Angle.
The Dust

Lane & Metzger (2015).
A Dynamically Coupled System

The Dust

Halekas et al. (2005).
The Dust

The Dust

(A) Plasma and electron beam

(B) Electron beam

(C) UV

Wang et al. (2018)
The Dust
Horanyi et al. (2015).
The other side of Regolith… water ("volatiles").

Water mass estimates from LCROSS impactor are ~5%, equalling 10% by volume (Colaprete et al., 2010).

Water is potentially distributed in pore spaces or along grain boundaries (interstitial).

Credit: LPI/CLSE (Amy L. Fagan and David A. Kring)
The other side of Regolith... water ("volatiles").
The other side of Regolith… water ("volatiles").

Hayne, Aharonson & Schörghofer (2020)
The other side of Regolith... water ("volatiles").

Honniball et al. (2020)
The Sun Angle

Credit: NASA
The Sun Angle

Credit: NASA
The Sun Angle – contrast confusion
Mazarico et al. (2011).
The Sun Angle

Glaser et al. (2017).
The Sun Angle

Glaser et al. (2017).
Lunar Imaging Instrument Development

• Lunar Environment Imaging Apparatus (LEIA)
  • Builds on recent charge injection device demonstrations.

• Compact High-contrast Imager for Lunar Exploration and Operations (CHILEO).
  • Compact version of LEIA for lunar surface technology readiness levels.
Lunar Imaging Instrument Development

ISS demonstration flight, 2017.
Lunar Imaging Instrument Development

CADRE

COLDArm

Credits: NASA/JPL-Caltech

Courtesy NASA/JPL-Caltech.
Summary

- Complex electrostatics could increase intrinsic lunar exospheric dust density at the poles.
  - Dust causes operational issues.
  - But regolith can be a resource.
- The sun will be permanently low on the horizon at the south pole.
  - Lots of long shadows.
  - Introduces risk.
  - Can be addressed with high contrast ratio imaging.
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