



HIGP Hawai'i Institute of
Geophysics & Planetology

Water and Hydroxyl Features at Reiner Gamma

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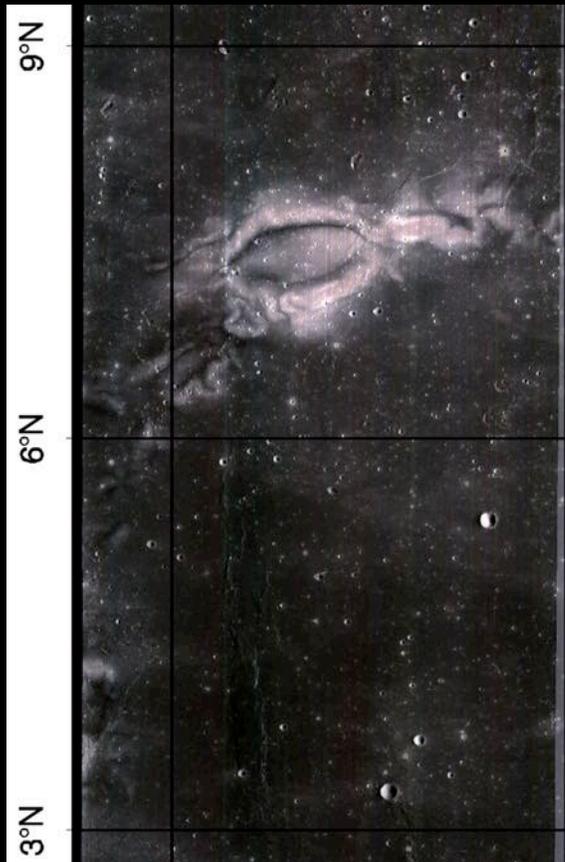
Lunar Swirls



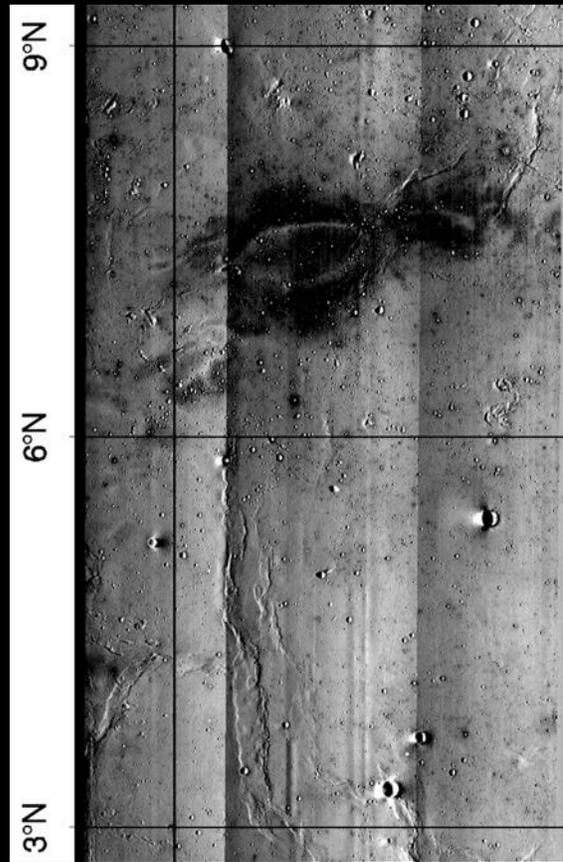
- Bright Albedo Patterns
- Associated with Magnetic Fields
- Protected from Solar Wind
 - Less Space Weathering
 - Less hydrogen implantation

Previous Work at Reiner Gamma

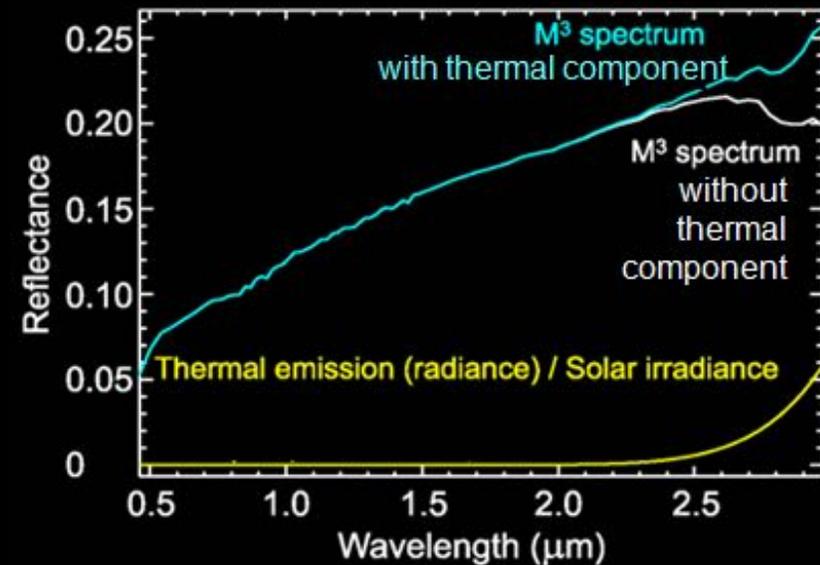
Reflectance



OH Abundance



- OH differences have been observed on and off the swirl in M3 data (Kramer et al 2011)



Ground Based Telescopic Observations of Lunar Hydroxyl

- NASA InfraRed Telescope Facility-IRTF
 - Observations from 1.6-4.0 microns
 - Able to be used as an Imaging Spectrometer
- Varied solar reflected and thermal emitted contributions
 - Observed at three phase angles including opposition
 - Observed during local partial eclipse
 - All observations within Earth's magnetotail
 - Very low solar wind flux

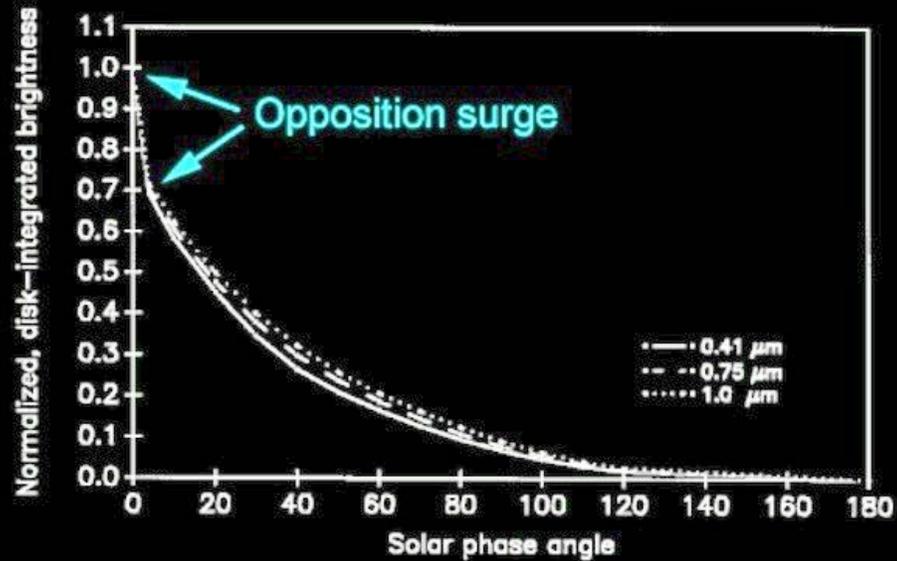
Ground based observations of swirl



IRTF



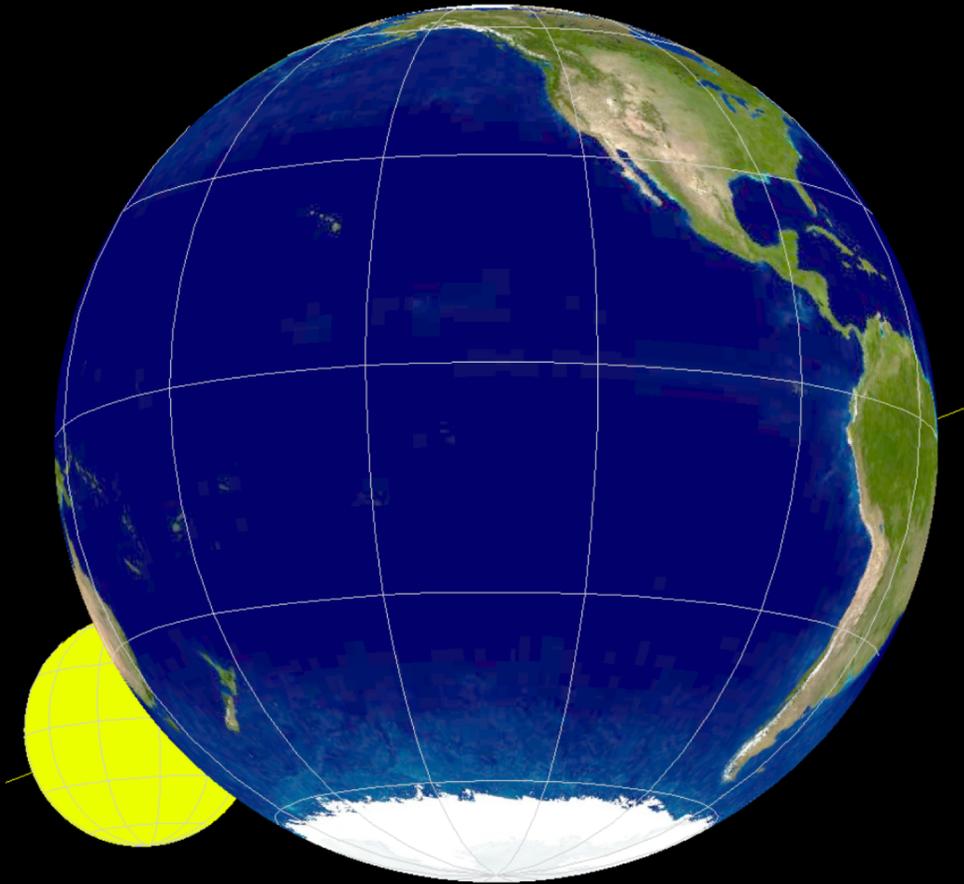
Reflectance Enhancement at Opposition Surge



- Reflected light increases at low phase angles
- Temperature stays constant
- Ratio of reflected to thermal flux is increased

Buratti et al 1996

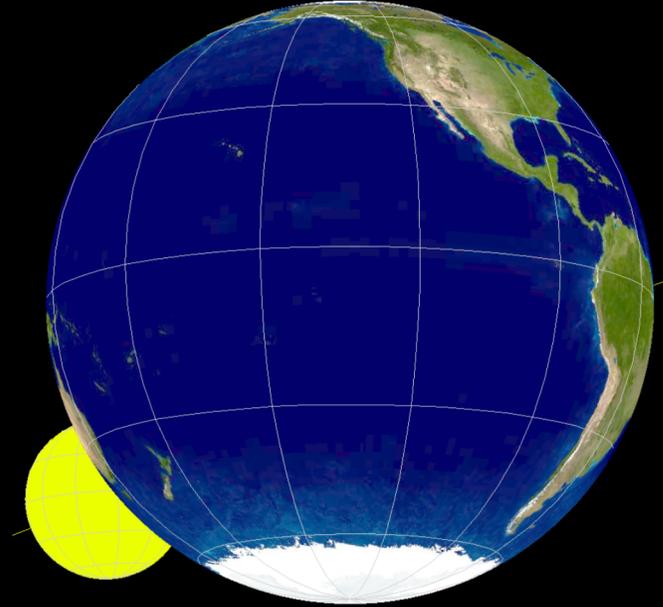
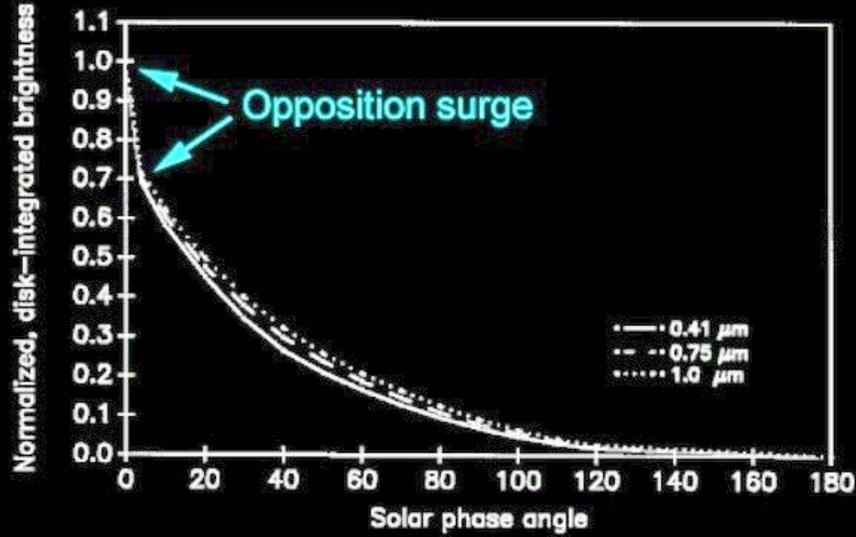
Partial Eclipse



- In partial eclipse solar flux is reduced
- Phase angle remains constant

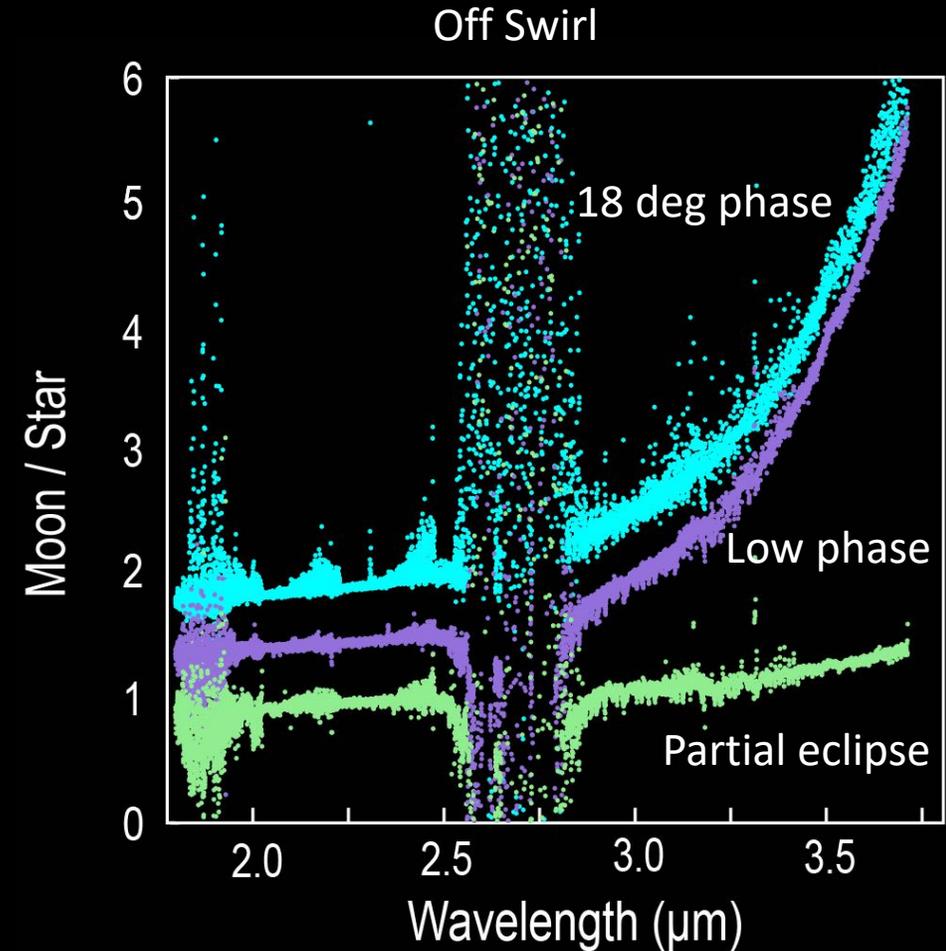
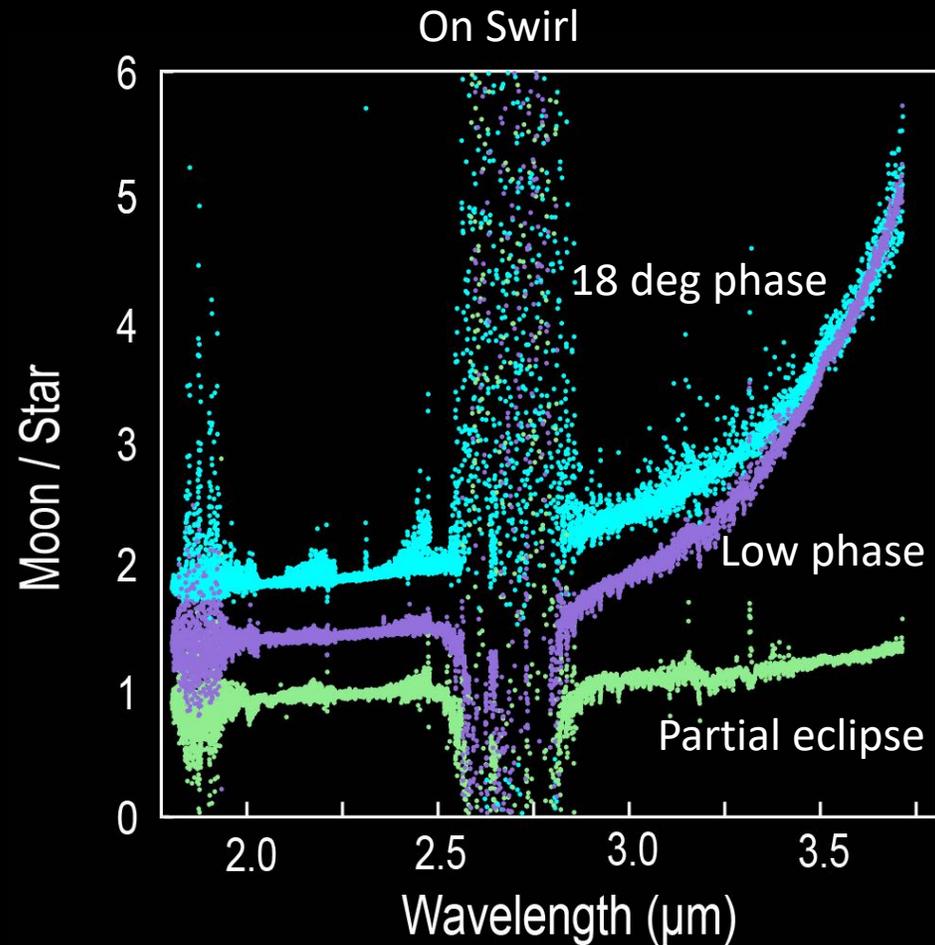
Earth Viewed From the Moon During Partial Lunar Eclipse.

Observing Conditions Summary

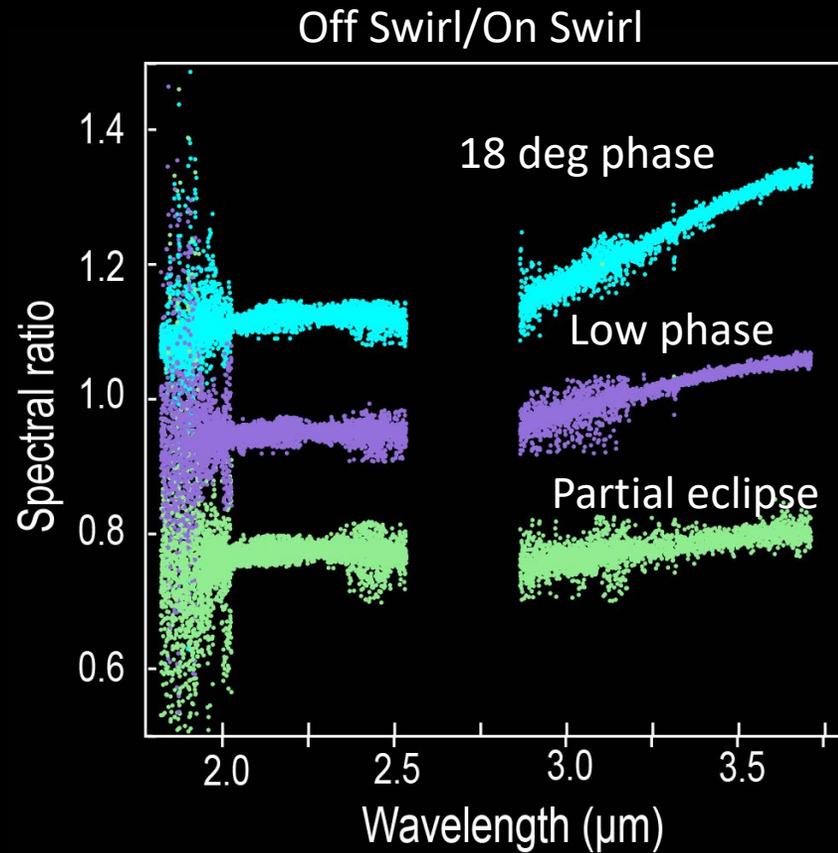


Date	Phase Angle	Incidence Angle	Relative Photometric Intensity	Relative Solar Illumination	Net Received Solar	Radiative Temperature
Oct 23	18	73	1	1	1	280K
Jan 21	3	57	2.4	1	2.4	330K
Jan 21 Eclipse	1.5	58	2.3	0.3	0.7	240K

Results-Comparison of thermal contribution



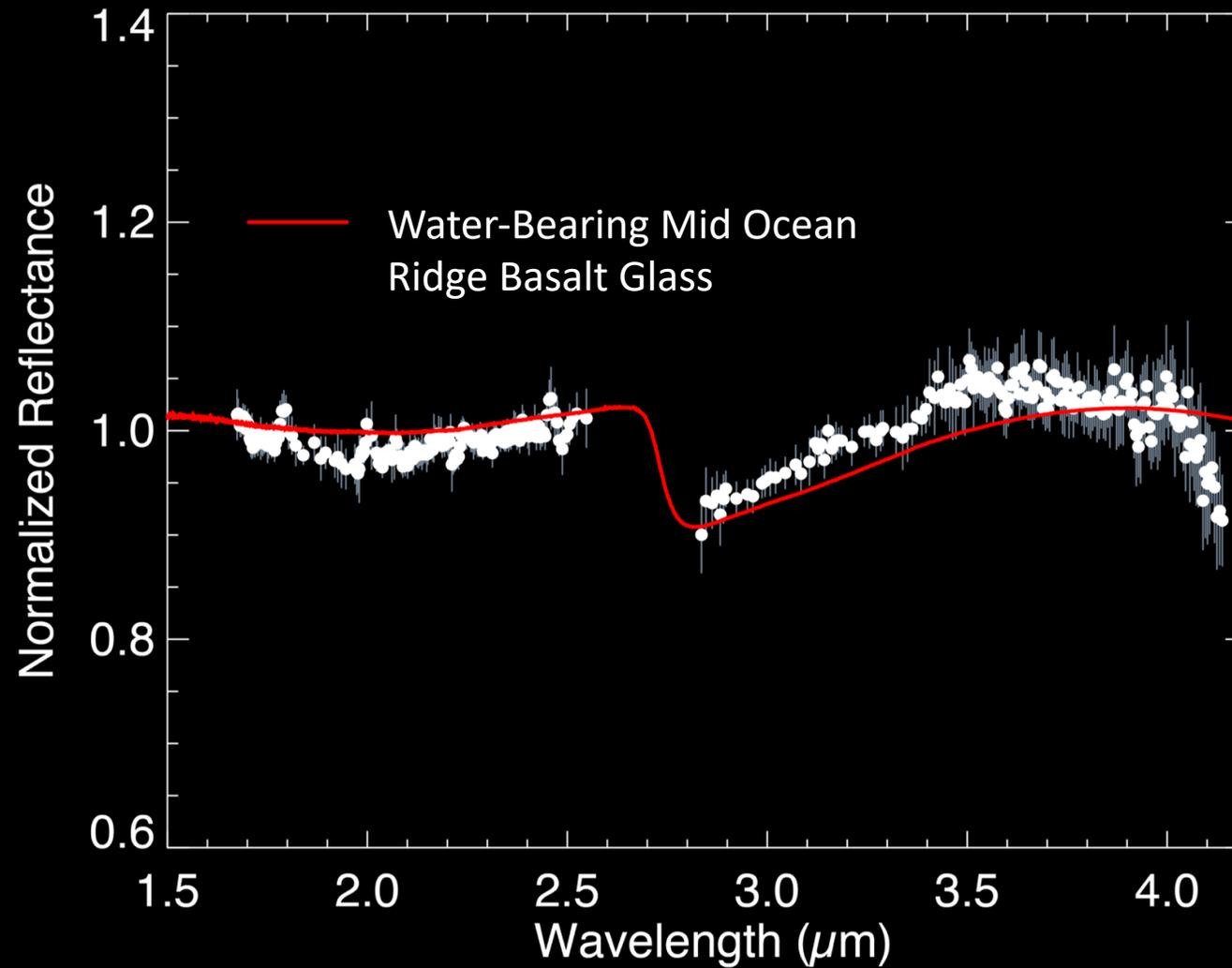
Results-Comparison of Thermal Contrast



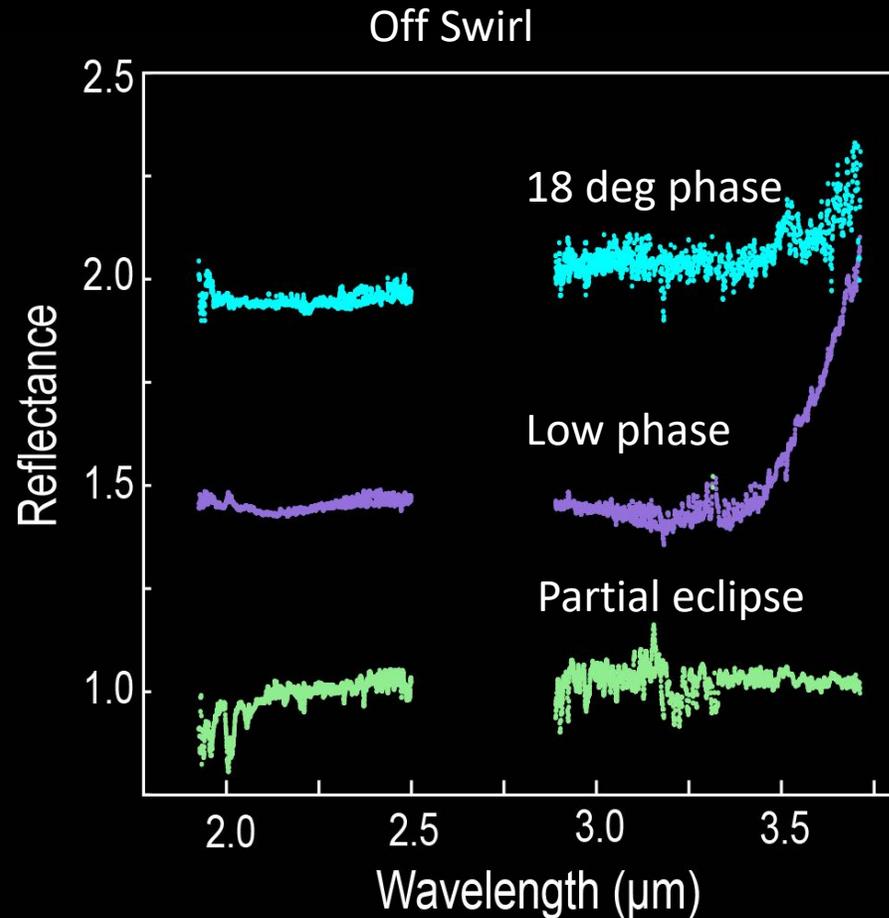
- Ratio of off swirl spectrum to On swirl spectrum
- Thermal contrast shown in slope at longer wavelengths
- Eclipse has lowest contrast

What water on the moon looks like

Sulpicius Gallus - Pyroclastic deposit

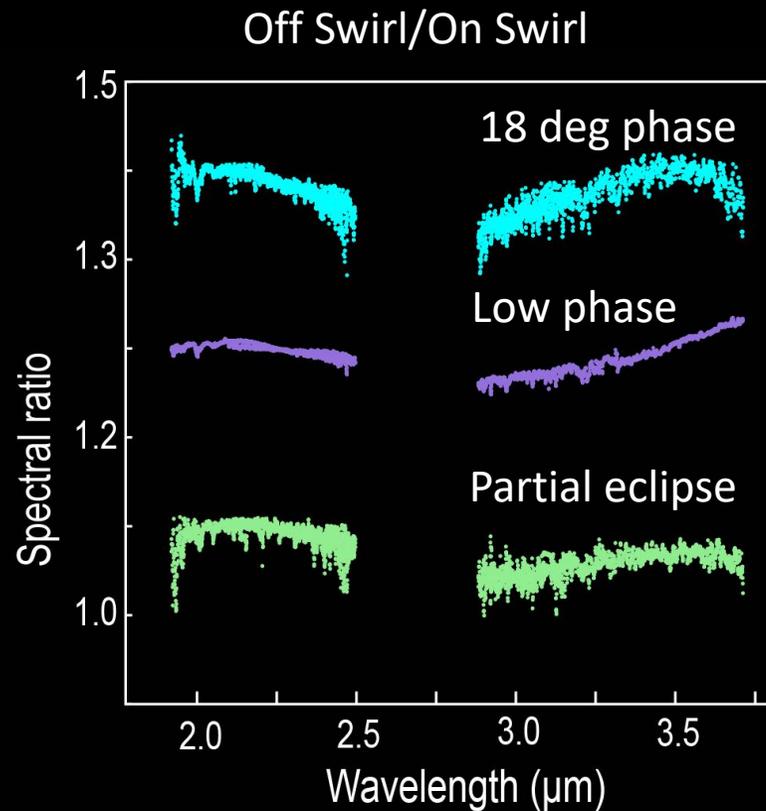


Maria Reflectance Spectra Thermally Corrected



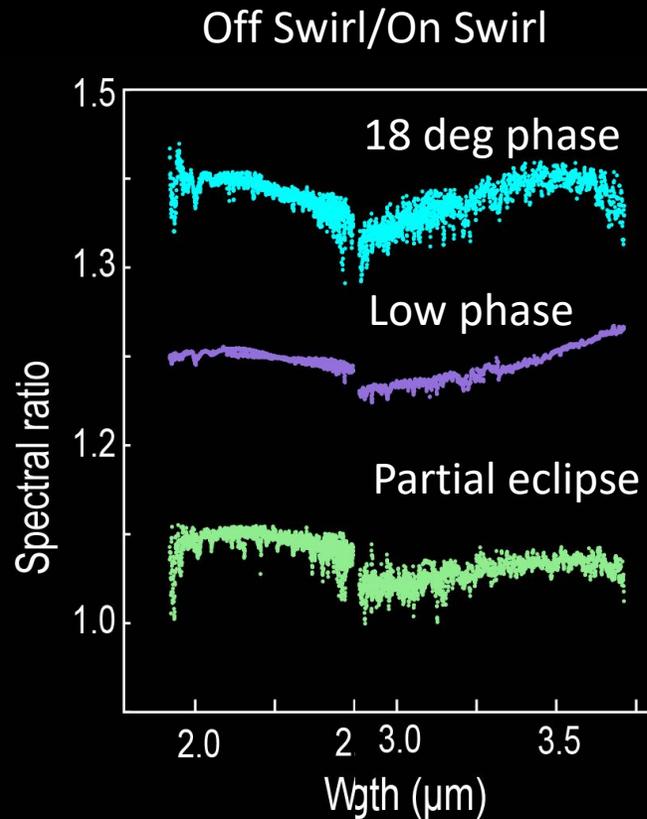
- Kramer et al 2011 showed Maria with stronger hydroxyl feature
- Very weak in telescopic data

Maria / swirl ratios



- Ratio spectra show stronger band when off swirl has a larger band
- Swirls contain less hydroxyl than surrounding Maria
- Consistent with prior results

Maria / swirl ratios



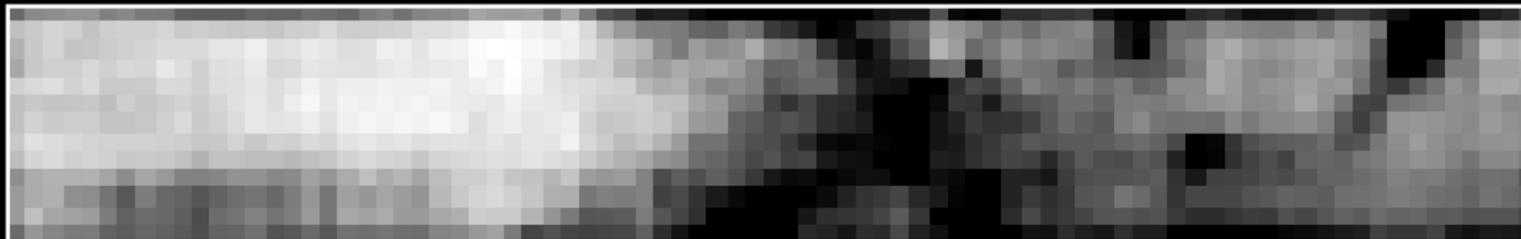
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Band depth image

Reflectance



OH Abundance



Conclusions

- OH absorption varies on and off the Swirl even under these different conditions
- This strengthens the conclusions of Kramer et al 2011
- Hydroxyl absorption feature in maria present in magnetotail

Questions?

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