



The Changing Face of Earth's
Nearest Neighbor:
Science Results from the Lunar
Reconnaissance Orbiter
Plus: Celebrate the Moon
on
October 8!

Brooke C. Hsu

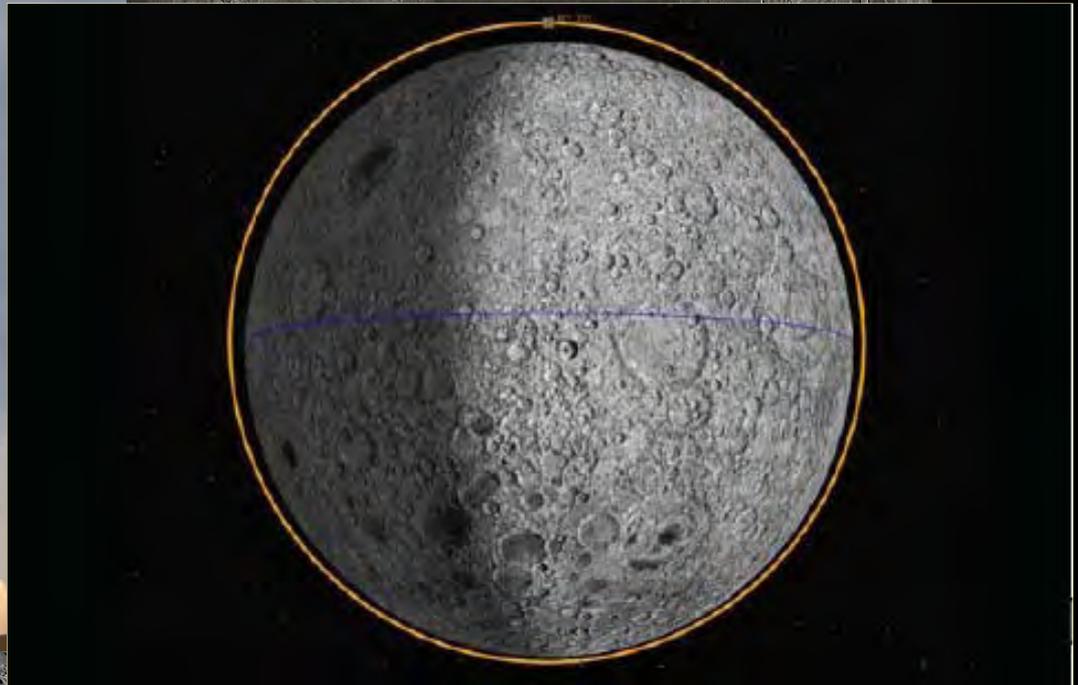
LRO Education and Public Outreach Lead
Director, International Observe the Moon Night



LRO Overview

Launch: June 18, 2009

3 mos. later: 50 km
quasi-circular orbit





LRO Instruments and Investigations



LOLA: Lunar Orbiter Laser Altimeter

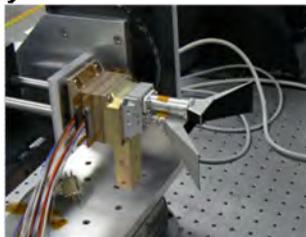
- Topography
- Slopes
- Roughness



Full Orbit
Autonomous

LROC/WAC: Wide-Angle Camera

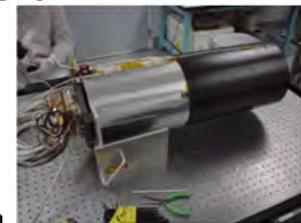
- Global Imagery
- Lighting
- Resources



Day Side
Autonomous

LROC/NACs: Narrow-Angle Cameras

- Targeted Imagery
- Hazards
- Topography



Day Side
Timeline Driven

LR: Laser Ranging

- Topography
- Gravity



GSFC LOS
Autonomous

DLRE: Diviner Lunar Radiometer Exp.

- Temperature
- Lighting
- Hazards
- Resources



Full Orbit
Autonomous

Mini-RF: Synthetic Aperture Radar

- Tech Demonstration
- Resources
- Topography



Polar Regions
Timeline Driven

CRaTER: Cosmic Ray Telescope...

- Radiation Spectra
- Tissue Effects



Full Orbit
Autonomous

LEND: Lunar Explr. Neutron Detector

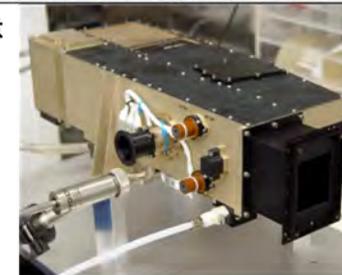
- Neutron Albedo
- Hydrogen Maps



Full Orbit
Autonomous

LAMP: Lyman-Alpha Mapping Project

- Water-Frost
- PSR Maps



Night Side
Autonomous

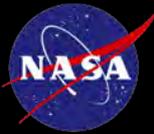


Around the Moon: Lunar Environment

What is the environment like near and around the Moon?

Radiation environment

Surface temperatures



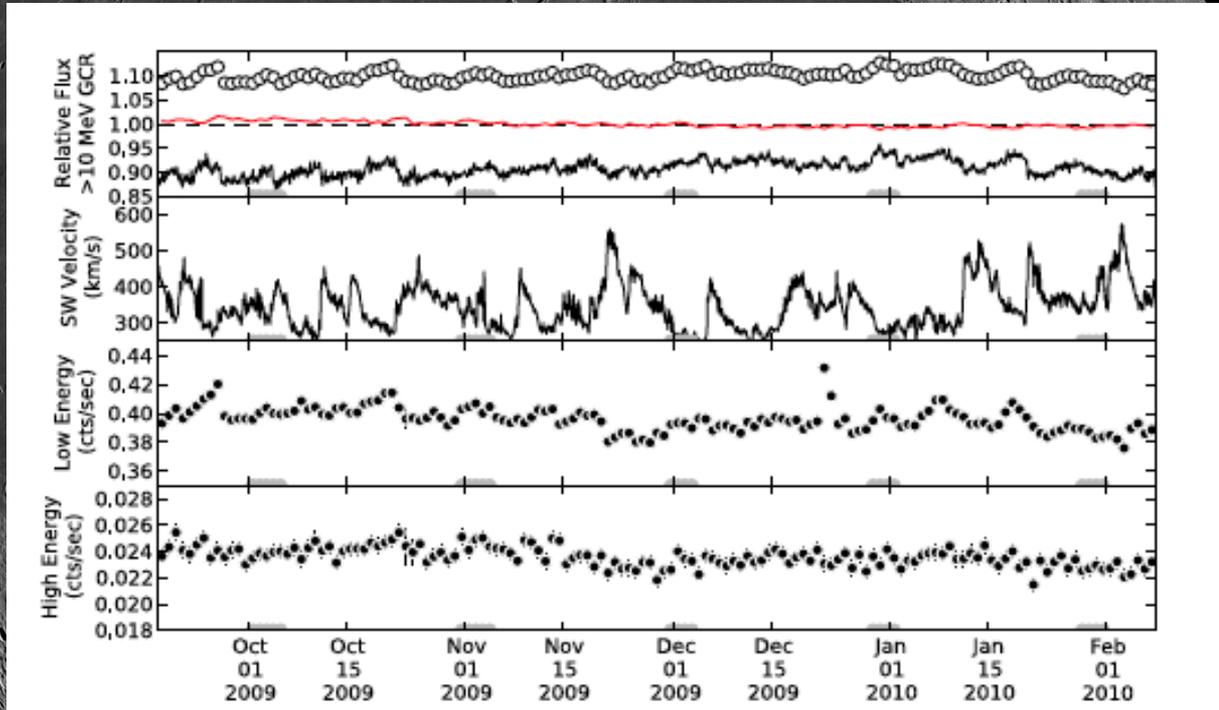
Around the Moon: Lunar Environment



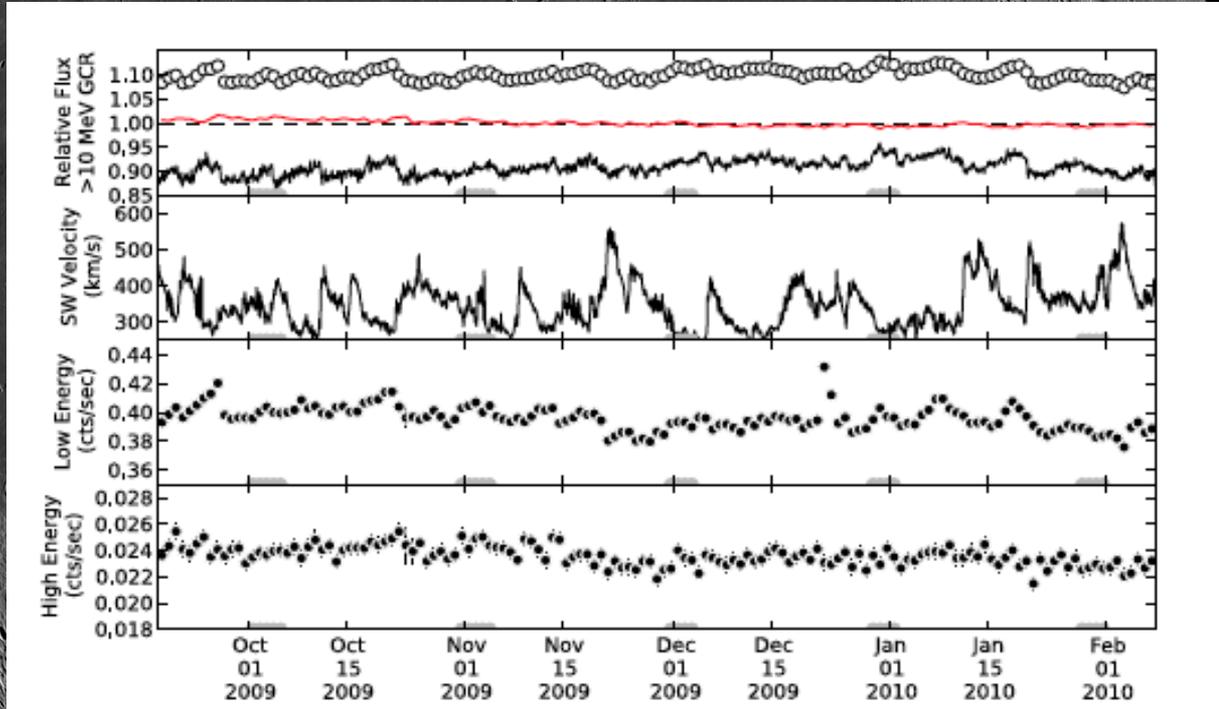
Cosmic Radiation

- High energy ionized particles
 - Galactic Cosmic Rays (GCRs – mostly protons)
 - Solar Energetic Particles (SEPs – mostly protons)
 - Secondary particles (lunar)
- Heavier ions (He, C, O, Fe) more destructive ion-per-ion
 - Flux varies with the solar cycle
 - More complex magnetic field structures at solar maximum limit access of GCRs to inner solar system
 - SEPs more common at solar maximum
- Difficult to shield against
 - Penetrates thick materials easily
 - Fragments from shielding material can increase radiation dose

Earth Magnetosphere Shielding?



Earth Magnetosphere Shielding?



NOPE!



Around the Moon: Lunar Environment

The Moon's thermal environment

- Regolith (lunar soil) has different thermal characteristics than bedrock
- Temperatures are latitudinally and topographically controlled
- Craters near the poles remain in shadow, similarly, peaks can remain in (near) constant daylight

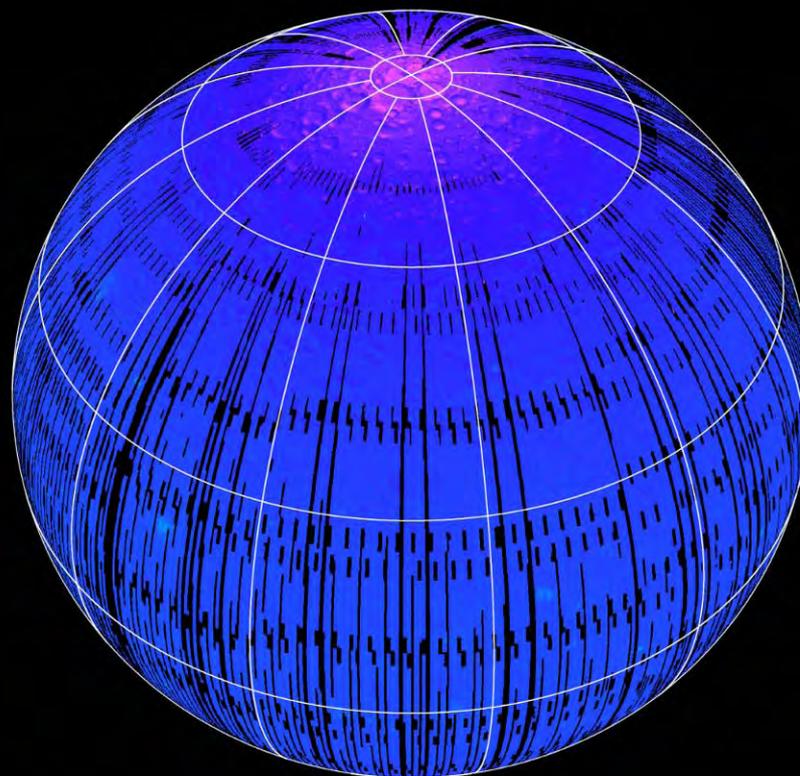
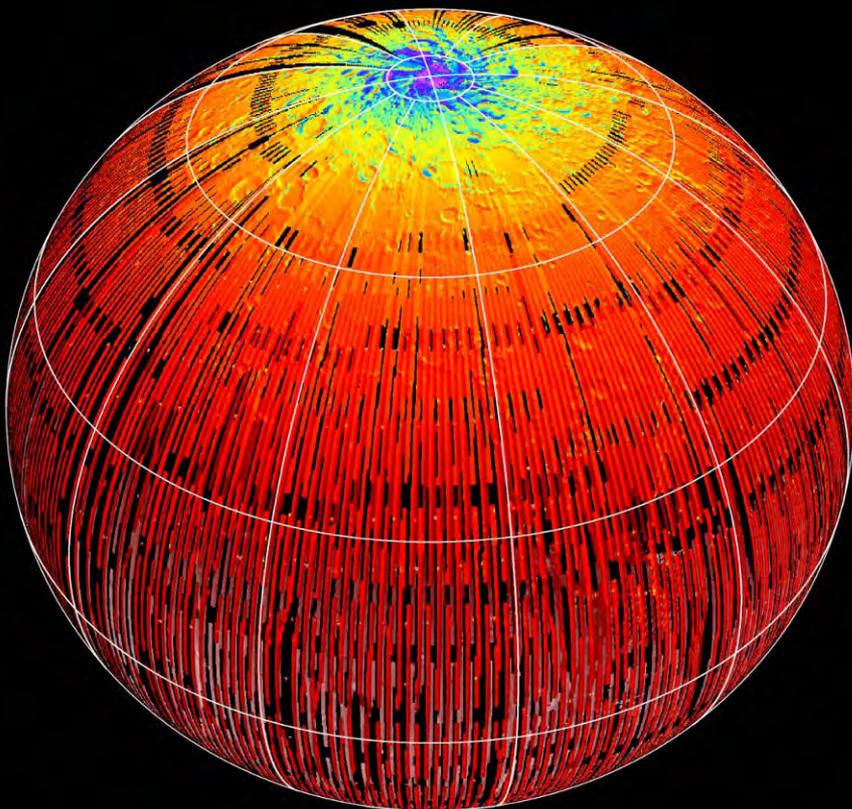


Around the Moon: Lunar Environment

Diviner Channel 8 Daytime Temperature (K)

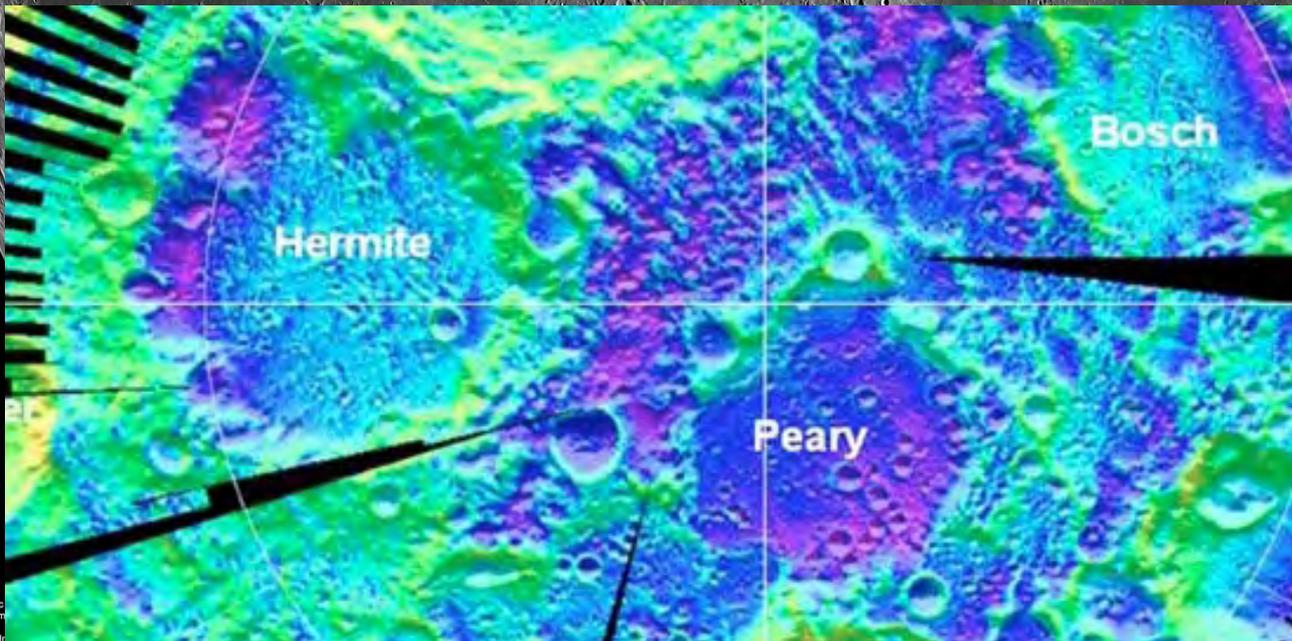


Diviner Channel 8 Nighttime Temperature (K)



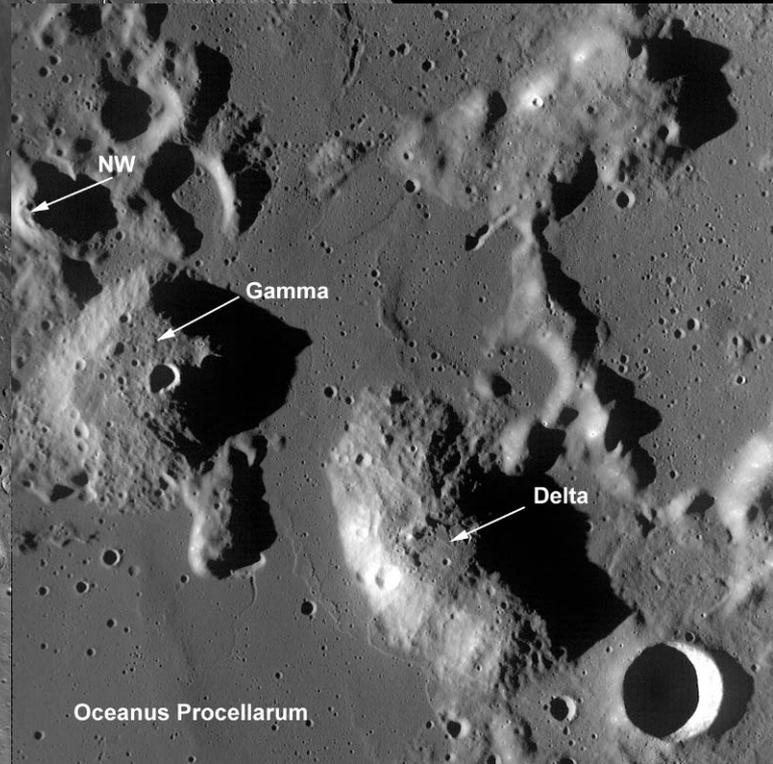
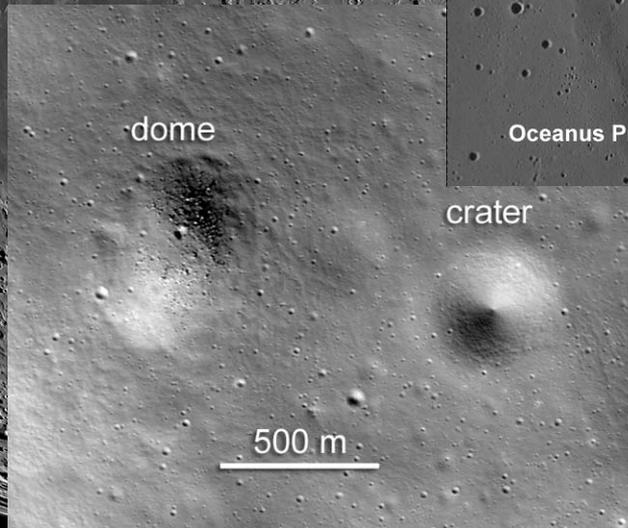
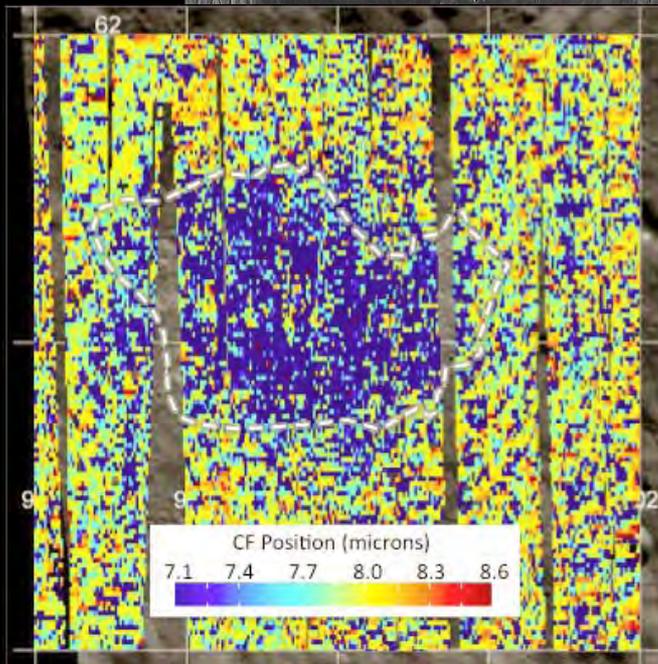
Around the Moon: Lunar Environment

- Coldest place ever measured in Solar System – Hermite Crater (North Pole) 25K
- Temperatures indicate thermal stability for water ice at poles



On the Moon: Discoveries on the Lunar Surface

Silicic volcanism –
On near and far side





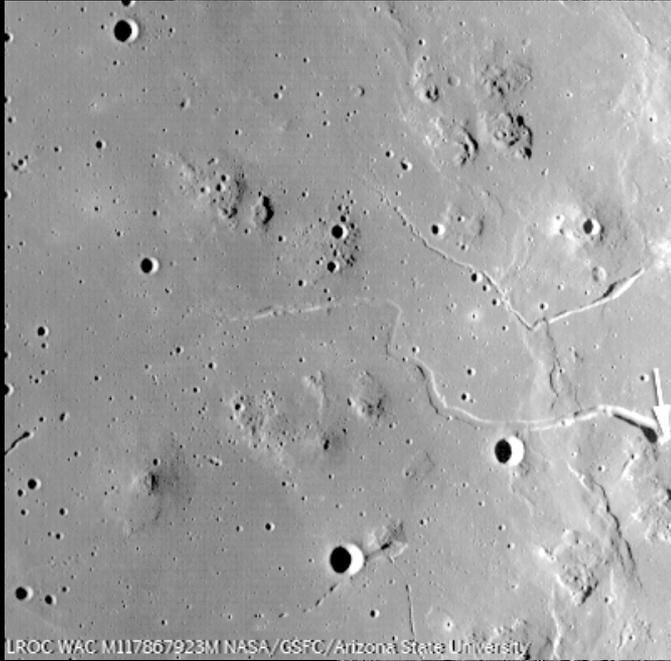
On the Moon: Discoveries on the Lunar Surface

What are large and small scale features that have been discovered and what do they tell us about the Moon's evolution?

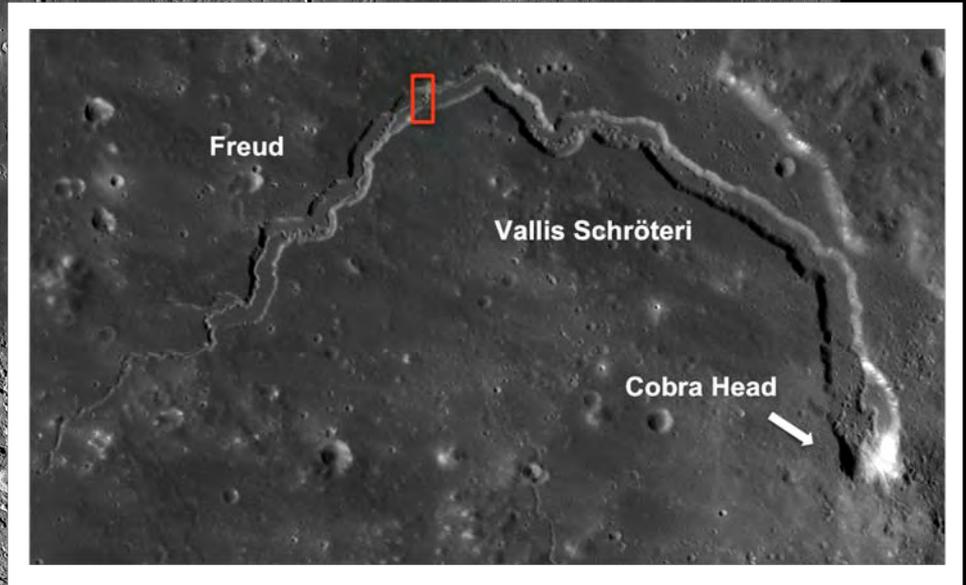
- Diversity of volcanism
- Cooling history of the Moon
- Landing obstacles

On the Moon: Discoveries on the Lunar Surface

“Shield” type volcanism on the Moon



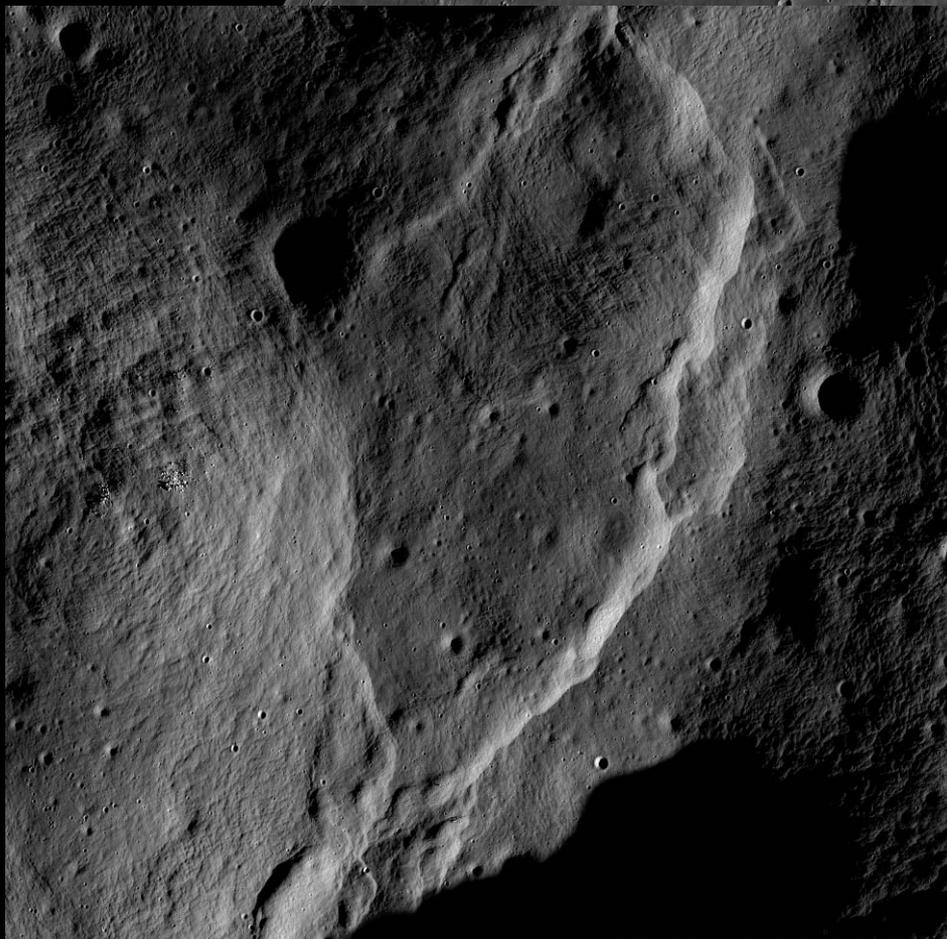
LROC WAC M117867923M NASA/GSFC/Arizona State University





On the Moon: Discoveries on the Lunar Surface

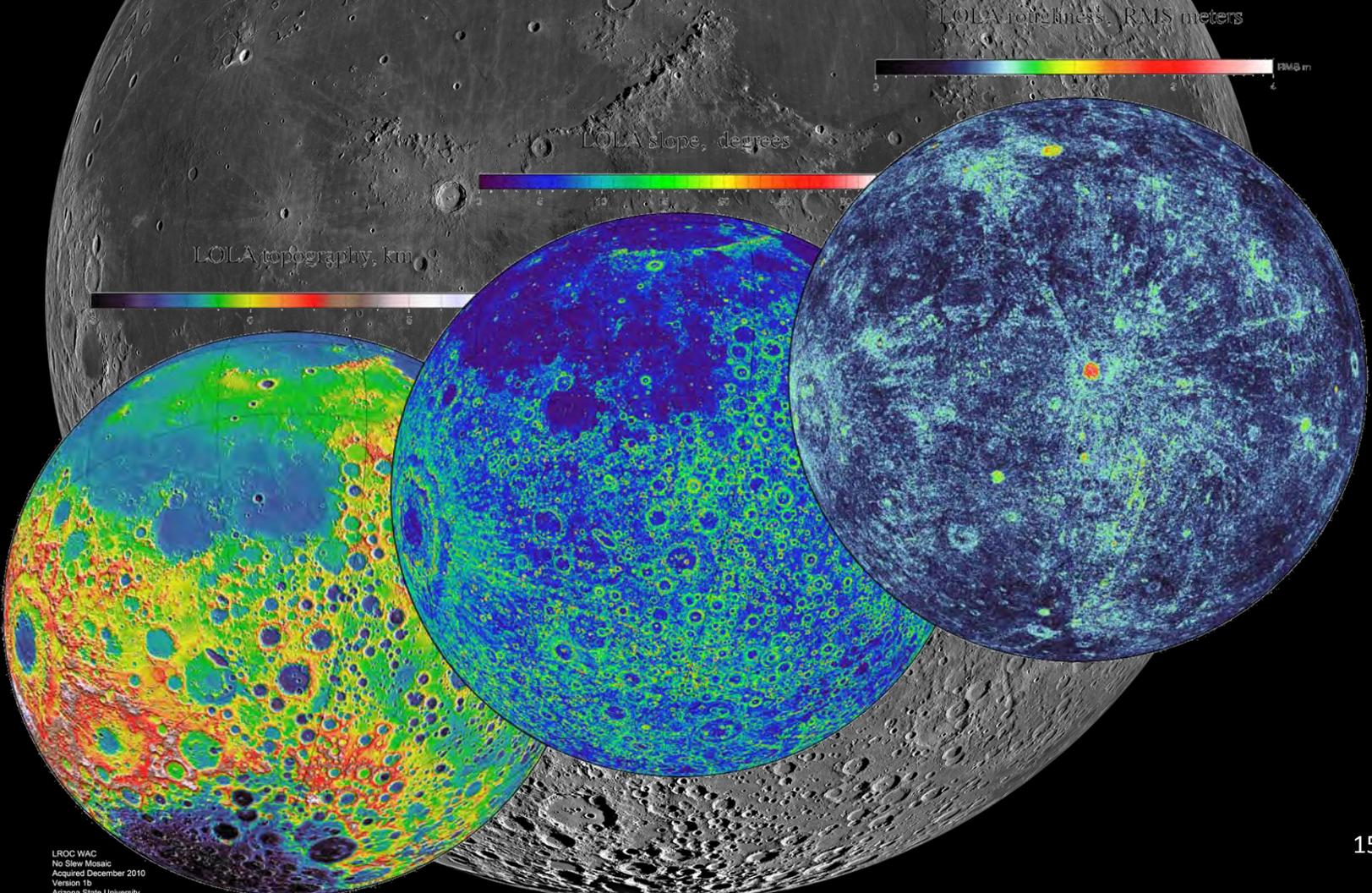
The incredible shrinking Moon!





On the Moon: Discoveries on the Lunar Surface

Topography, slopes, surface roughness





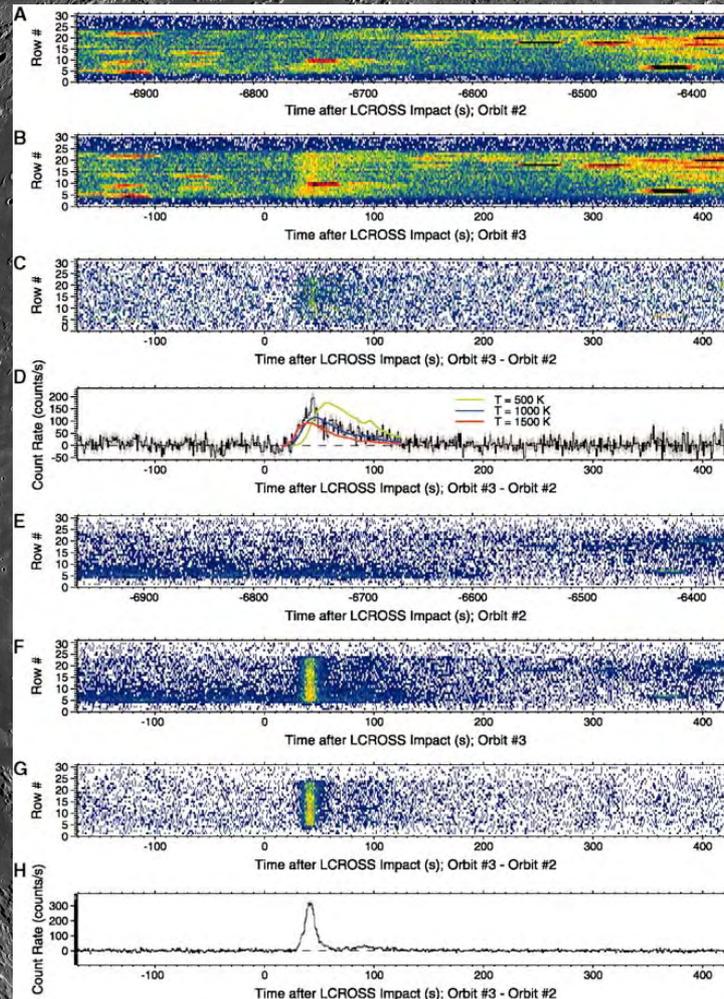
On the Moon: Discoveries on the Lunar Surface

Rock abundances



LR
No Slew Mosaic
Acquired December 2010
Version 1b
Arizona State University

Of the Moon: Volatiles

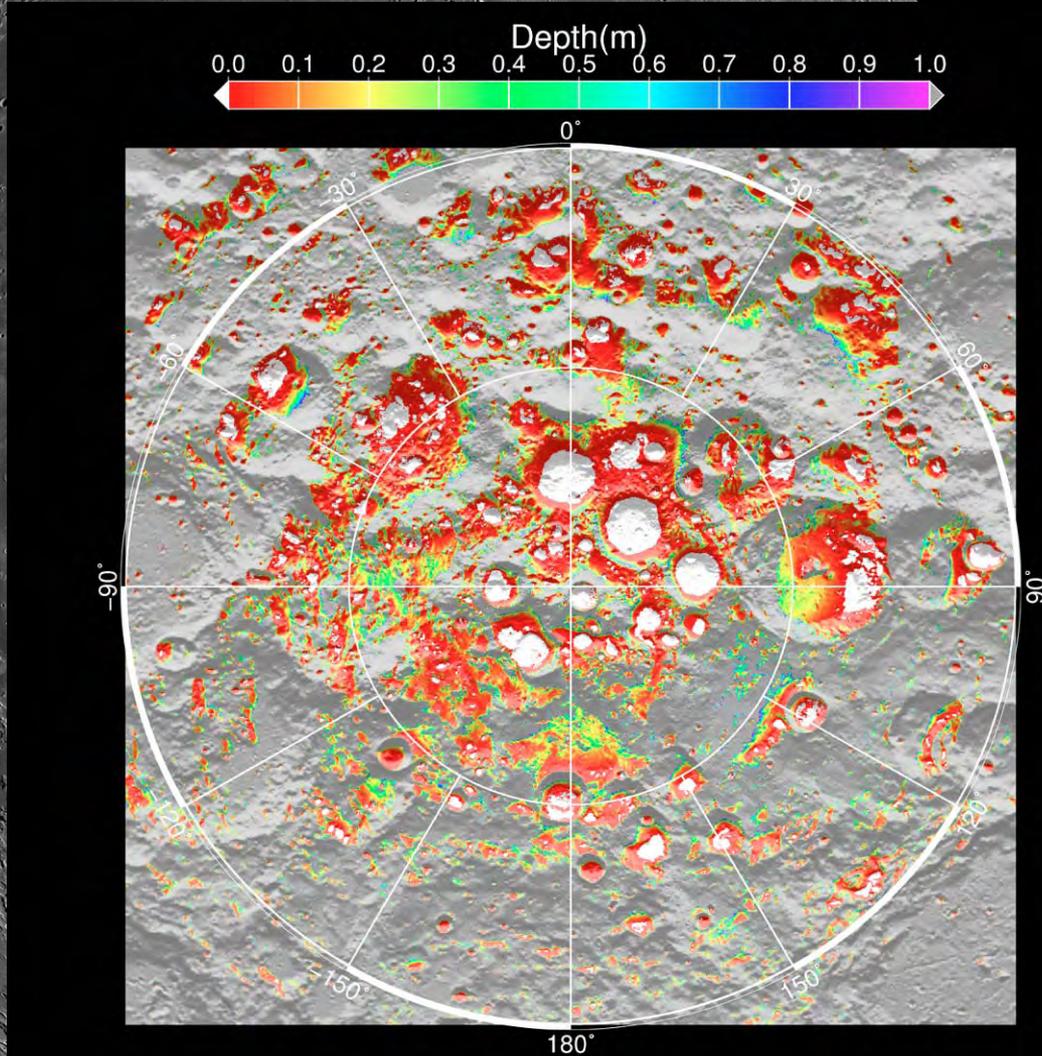


LAMP detects water at LCROSS impact site



Of the Moon: Volatiles

Water, water everywhere!





And now...

International Observe the Moon Night!