NASA SCIENCE HIGHLIGHT: Science Mission Directorate (SMD)

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NASA Science Highlight: Planetary Program Support

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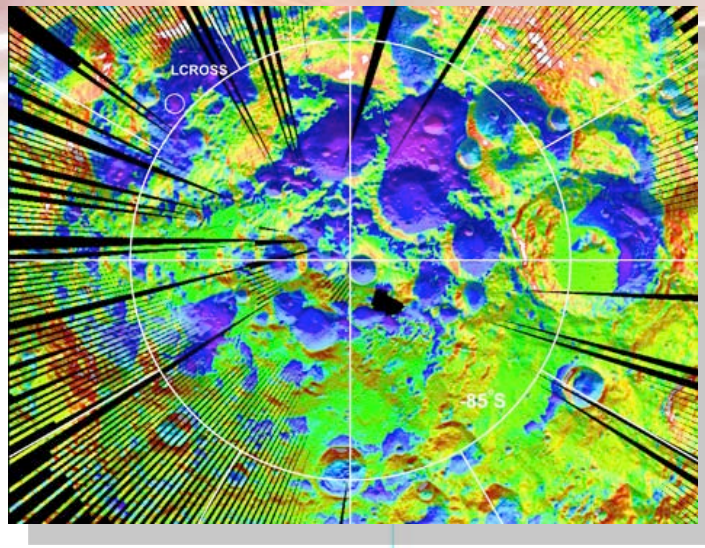
Regional Lunar Surface Temperatures, Albedos, and Thermo physical Properties from LRO's Diviner Instrument



The Lunar Reconnaissance Orbiter's (LRO) Diviner instrument created this temperature map of the Moon's south polar region. It reveals intensely cold impact craters that are potential cold traps for water ice and other icy compounds.

The Diviner Lunar Radiometer Experiment (DLRE) on NASA's Lunar Reconnaissance Orbiter (LRO) is the first instrument to map the global thermal state of the Moon and its diurnal and seasonal variability. Diviner began mapping in July 2009 and last month globally mapped the Moon over 10 hours of local time (two five-hour blocks separated by twelve hours). Scientists presented global maps of surface temperature, solar albedo and infrared emissivity.

Near-surface temperatures on the Moon (and by analogy, Mercury) are controlled by the physical and thermal properties within the first few meters of the surface, such as the local slope, bulk density, thermal conductivity, heat capacity, albedo, and emissivity (and any variations with depth or temperature). These, in turn, can be properties of the composition, particle size and packing, mechanical re-working, and weathering of the material. Diviner is a push-broom radiometer that measures solar reflectance and infrared emission in nine spectral bands spanning 0.3 to 400 microns. Spatial resolution is 0.5 km within and along Diviner's 21-pixel swath. LRO is in a polar, inertially fixed orbit that results in global coverage each Earth month and local time/seasonal coverage over an Earth year.

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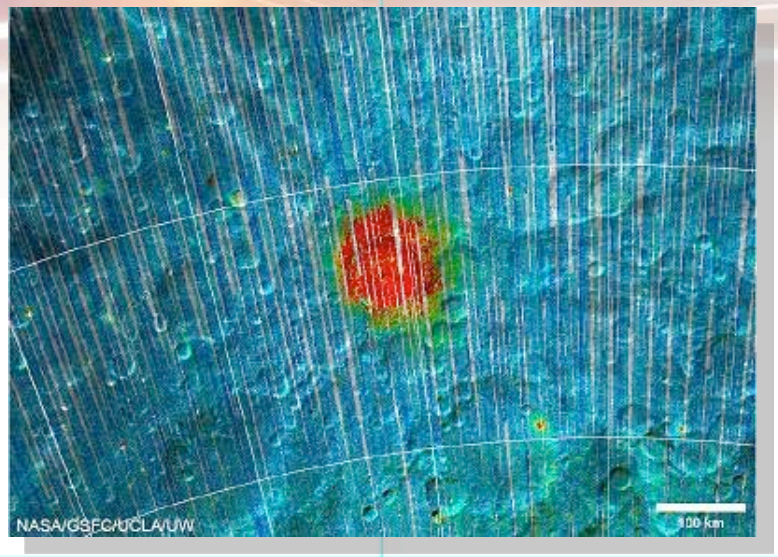
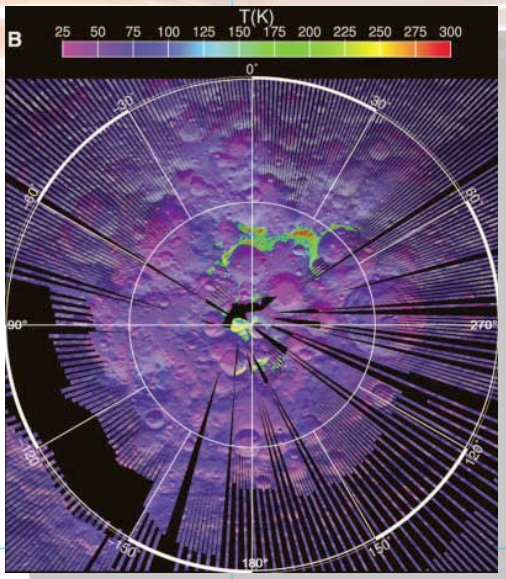


Diviner's temperature measurements over time

"Only Time will Tell"

Existing knowledge of the Moon's near-surface structure comes from Apollo in situ measurements as well as prior thermal and radio observations. Diviner has allowed scientists to more accurately derive and map regolith density and conductivity structure, roughness, and rock abundance using the combination of Diviner's local time and spectral coverage.

Regional Lunar Surface Temperatures, Albedos, and Thermophysical Properties from LRO's Diviner Instrument



Diviner's night time bolometric measurements

Implications:

The Diviner Lunar Radiometer Experiment (DLRE) on NASA's Lunar Reconnaissance Orbiter (LRO) is the first investigation to map the global thermal state of the Moon and its diurnal and seasonal variability. Diviner's temperature maps reveal a lunar surface dominated by the effects of mechanical re-working from impacts, but retaining important differences in thermal behavior due to exposures of blocky material or unusually thick concentrations of loosely packed fines, as an example.

Significance to Solar System Exploration:

As LRO is pioneering NASA's efforts to renew exploration of the Moon, Diviner's temperature maps can be used to determine the thermal and physical properties of the Moon's surface, and therefore better characterize and assess the safety of future landing sites.