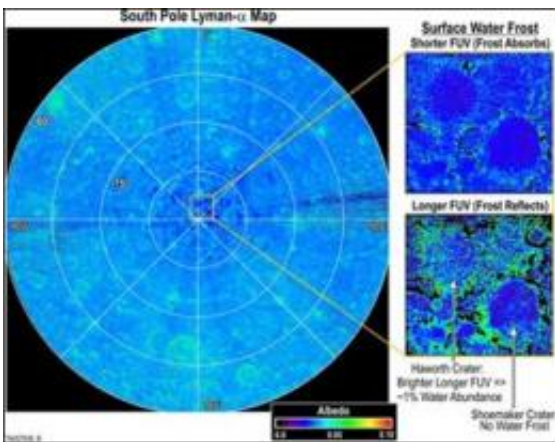


Lunar Reconnaissance Orbiter's LAMP reveals lunar surface features

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These images (insets) produced by the Lyman Alpha Mapping Project (LAMP) aboard NASA's Lunar Reconnaissance Orbiter reveal features at the Moon's northern and southern poles in the regions that lie in perpetual darkness. They shows many permanently shadowed regions, or PSRs, are darker at far-ultraviolet wavelengths (top) and redder than nearby surface areas that receive sunlight (bottom). The darker PSR regions are consistent with having large surface porosities — indicating "fluffy" soils — while the reddening is consistent with the presence of water frost on the surface.

New maps produced by the Lyman Alpha Mapping Project aboard NASA's Lunar Reconnaissance Orbiter reveal features at the Moon's northern and southern poles in regions that lie in perpetual darkness. LAMP, developed by Southwest Research Institute, uses a novel method to peer into these so-called permanently shadowed regions (PSRs),

making visible the invisible. LAMP's principal investigator is Dr. Alan Stern, associate vice president of the SwRI Space Science and Engineering Division.

The LAMP maps show that many PSRs are darker at far-ultraviolet wavelengths and redder than nearby surface areas that receive [sunlight](#). The darker regions are consistent with large surface porosities — indicating "fluffy" soils — while the reddening is consistent with the presence of water frost on the surface.

"Our results suggest there could be as much as 1 to 2 percent water frost in some permanently shadowed soils," says author Dr. Randy Gladstone, an Institute scientist in the SwRI Space Science and Engineering Division. "This is unexpected because naturally occurring interplanetary Lyman-alpha was thought to destroy any water frost before it could accumulate."

The LAMP team estimates that the loss of water frost is about 16 times slower than previously believed. In addition, the accumulation of water frost is also likely to be highly dependent on local conditions, such as temperature, thermal cycling and even geologically recent "impact gardening" in which micrometeoroid impacts redistribute the location and depth of volatile compounds.

Finding water frost at these new locations adds to a rapidly improving understanding of the Moon's water and related species, as discovered by three other space missions through near-infrared emissions observations and found buried within the Cabeus crater by the LCROSS impactor roughly two years ago. During LRO's nominal exploration mission, LAMP added to the LCROSS results by measuring hydrogen, mercury and other volatile gases ejected along with the water from the permanently shaded soils of the Moon's Cabeus crater.

"An even more unexpected finding is that LAMP's technique for measuring the lunar Lyman-alpha albedo indicates higher surface porosities within PSRs, and supports the long-postulated presence of tenuous 'fairy-castle' like arrangements of surface grains in the PSR soils," says co-author Dr. Kurt Retherford, a senior research scientist also in SwRI's Space Science and Engineering Division.

Comparisons with future LAMP maps created using data gathered from the Moon's day side will prove helpful for revealing more about the presence of water frost, as well as the surface porosities of the darker surface features observed. The LAMP team is also eager to apply the [Lyman-alpha](#) technique elsewhere on the Moon and on other solar system objects such as Mercury.

LRO's findings are expected to be valuable to the future consideration of a permanent Moon base. The permanently shadowed regions of the [Moon](#) are revealing themselves to be some of the most exotic places in the solar system, well worthy of future exploration, says Retherford. Any discovery of water frost and other resources in the area also could reduce the need to transport resources from Earth to a base at the pole.

More information: , "Far-Ultraviolet Reflectance Properties of the Moon's Permanently Shadowed Regions," by G.R. Gladstone, K.D. Retherford, A.F. Egan, D.E. Kaufmann, P.F. Miles, et al. *Journal of Geophysical Research* www.agu.org/journals/je/

Provided by Southwest Research Institute

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