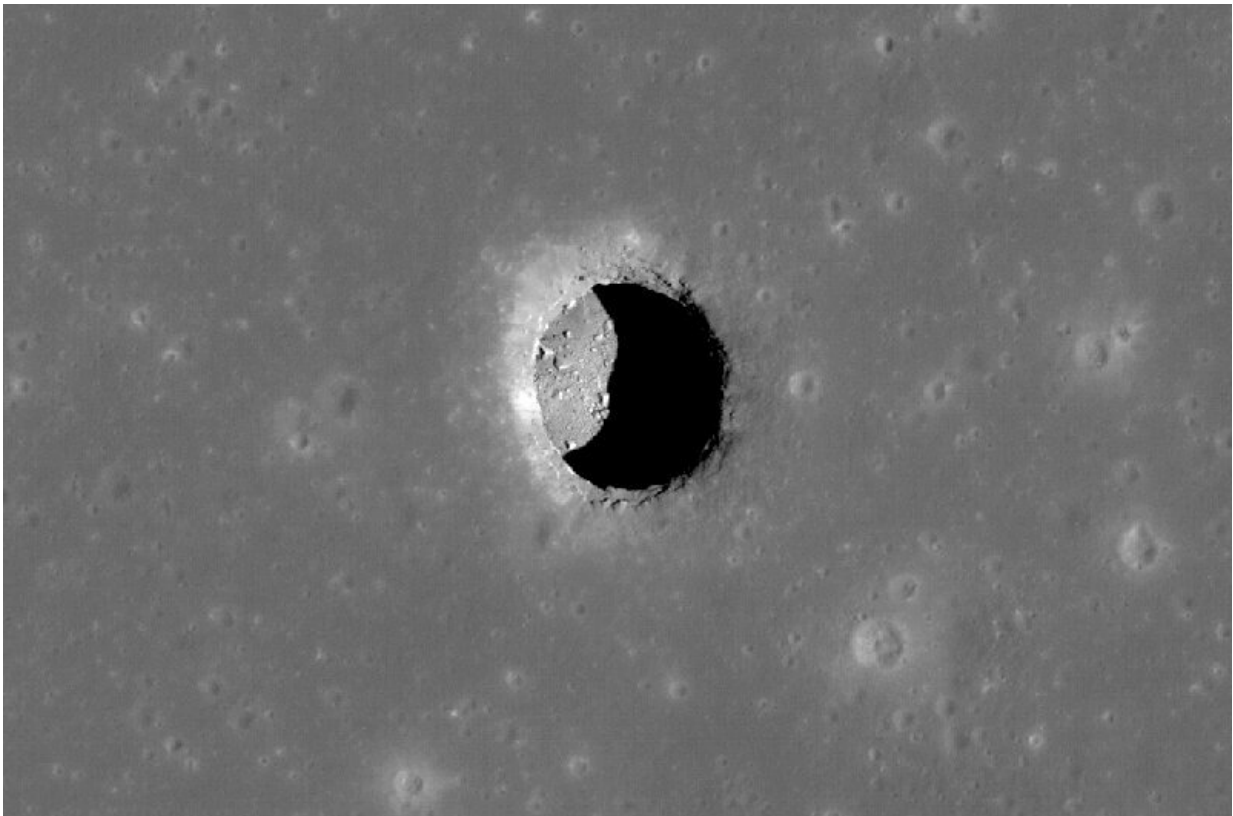


Lunar Reconnaissance Orbiter finds lunar pits harbor comfortable temperatures

July 26 2022, by Bill Steigerwald



This is a spectacular high-Sun view of the Mare Tranquillitatis pit crater revealing boulders on an otherwise smooth floor. This image from LRO's Narrow Angle Camera is 400 meters (1,312 feet) wide, north is up. Credit: NASA/Goddard/Arizona State University

NASA-funded scientists have discovered shaded locations within pits on

the Moon that always hover around a comfortable 63 F (about 17 C) using data from NASA's Lunar Reconnaissance Orbiter (LRO) spacecraft and computer modeling.

The pits, and caves to which they may lead, would make thermally stable sites for [lunar exploration](#) compared to areas at the Moon's surface, which heat up to 260 F (about 127 C) during the day and cool to minus 280 F (about minus 173 C) at night. Lunar exploration is part of NASA's goal to explore and understand the unknown in space, to inspire and benefit humanity.

Pits were first discovered on the Moon in 2009, and since then, scientists have wondered if they led to caves that could be explored or used as shelters. The pits or caves would also offer some protection from [cosmic rays](#), [solar radiation](#) and micrometeorites.

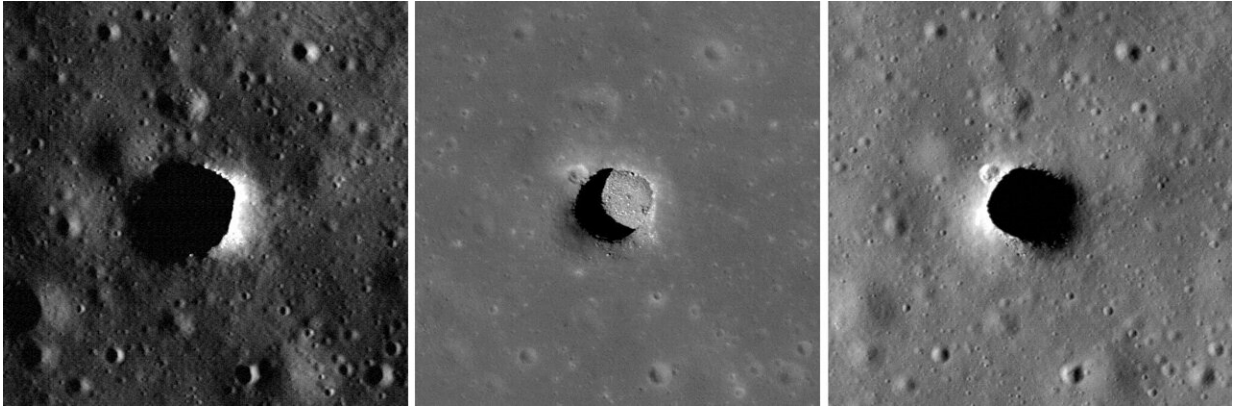
"About 16 of the more than 200 pits are probably collapsed [lava tubes](#)," said Tyler Horvath, a doctoral student in planetary science at the University of California, Los Angeles, who led the new research, recently published in the journal *Geophysical Research Letters*.

"Lunar pits are a fascinating feature on the [lunar surface](#)," said LRO Project Scientist Noah Petro of NASA's Goddard Space Flight Center in Greenbelt, Maryland. "Knowing that they create a stable thermal environment helps us paint a picture of these unique lunar features and the prospect of one day exploring them."

Lava tubes, also found on Earth, form when [molten lava](#) flows beneath a field of cooled lava or a crust forms over a river of lava, leaving a long, hollow tunnel. If the ceiling of a solidified lava tube collapses, it opens a pit that can lead into the rest of the cave-like tube.

Two of the most prominent pits have visible overhangs that clearly lead

to caves or voids, and there is strong evidence that another's overhang may also lead to a large cave.



NASA's Lunar Reconnaissance Orbiter Camera has now imaged the Marius Hills pit three times, each time with very different lighting. The center panel, with the Sun high above, gives scientists a great view of the Marius Hills pit floor. The Marius pit is about 34 meters (about 111 feet) deep and 65 by 90 meters (approximately 213 by 295 feet) wide. Credit: NASA/GSFC/Arizona State University

"Humans evolved living in caves, and to [caves](#) we might return when we live on the Moon," said David Paige, a co-author of the paper who leads the [Diviner Lunar Radiometer Experiment](#) aboard LRO that made the temperature measurements used in the study.

Horvath processed data from Diviner—a thermal camera—to find out if the temperature within the pits diverged from those on the surface.

Focusing on a roughly cylindrical 328-foot (100-meter)–deep depression about the length and width of a football field in an area of the Moon known as the Mare Tranquillitatis, Horvath and his colleagues used

computer modeling to analyze the thermal properties of the rock and lunar dust and to chart the pit's temperatures over time.

The results revealed that temperatures within the permanently shadowed reaches of the pit fluctuate only slightly throughout the lunar day, remaining at around 63 F or 17 C. If a [cave](#) extends from the bottom of the pit, as images taken by LRO's Lunar Reconnaissance Orbiter Camera suggest, it too would have this relatively comfortable temperature.

The team, which included UCLA professor of [planetary science](#) David Paige and Paul Hayne of the University of Colorado Boulder, believes the shadowing overhang is responsible for the steady temperature, limiting how hot things gets during the day and preventing heat from radiating away at night.

A day on the Moon lasts about 15 Earth days, during which the surface is constantly bombarded by sunlight and is frequently hot enough to boil water. Brutally cold nights also last about 15 Earth days.

LRO is managed by NASA's Goddard Space Flight Center in Greenbelt, Maryland, for the Science Mission Directorate at NASA Headquarters in Washington. Launched on June 18, 2009, LRO has collected a treasure trove of data with its seven powerful instruments, making an invaluable contribution to our knowledge about the Moon. Diviner was built and developed by the University of California, Los Angeles, and NASA's Jet Propulsion Laboratory in Pasadena, California.

NASA is returning to the Moon with commercial and international partners to expand human presence in space and bring back new knowledge and opportunities.

More information: Tyler Horvath et al, Thermal and Illumination Environments of Lunar Pits and Caves: Models and Observations From

the Diviner Lunar Radiometer Experiment, *Geophysical Research Letters* (2022). [DOI: 10.1029/2022GL099710](https://doi.org/10.1029/2022GL099710)

Provided by NASA's Goddard Space Flight Center

Citation: Lunar Reconnaissance Orbiter finds lunar pits harbor comfortable temperatures (2022, July 26) retrieved 25 April 2024 from <https://phys.org/news/2022-07-lunar-reconnaissance-orbiter-pits-harbor.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.