

Theoretical study suggests huge lava tubes could exist on moon

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The city of Philadelphia is shown inside a theoretical lunar lava tube. A Purdue University team of researchers explored whether lava tubes more than 1 kilometer wide could remain structurally stable on the moon. Credit: Purdue University/courtesy of David Blair

Lava tubes large enough to house cities could be structurally stable on the moon, according to a theoretical study presented at the Lunar and Planetary Science Conference on Tuesday (March 17).

The volcanic features are an important target for future human space exploration because they could provide shelter from cosmic radiation, meteorite impacts and temperature extremes.

Lava tubes are tunnels formed from the lava flow of volcanic eruptions. The edges of the lava cool as it flows to form a pipe-like crust around the flowing river of lava. When the eruption ends and the lava flow stops, the pipe drains leave behind a hollow tunnel, said Jay Melosh, a

Purdue University distinguished professor of earth, atmospheric and planetary sciences who is involved in the research.

"There has been some discussion of whether lava tubes might exist on the moon," he said. "Some evidence, like the sinuous rilles observed on the surface, suggest that if lunar lava tubes exist they might be really big."

Sinuous rilles are large channels visible on the [lunar surface](#) thought to be formed by [lava flows](#). The sinuous rilles range in size up to 10 kilometers wide, and the Purdue team explored whether lava tubes of the same scale could exist.

David Blair, a graduate student in Purdue's Department of Earth, Atmospheric and Planetary Sciences, led the study that examined whether empty lava tubes more than 1 kilometer wide could remain structurally stable on the moon.

"We found that if lunar lava tubes existed with a strong arched shape like those on Earth, they would be stable at sizes up to 5,000 meters, or several miles wide, on the moon," Blair said. "This wouldn't be possible on Earth, but gravity is much lower on the moon and [lunar rock](#) doesn't have to withstand the same weathering and erosion. In theory, huge lava tubes - big enough to easily house a city - could be structurally sound on the moon."

Blair worked with Antonio Bobet, a Purdue professor of civil engineering, and applied known information about lunar rock and the moon's environment to civil engineering technology used to design tunnels on Earth.

The team found that a [lava tube](#)'s stability depended on the width, roof thickness and the stress state of the cooled lava, and the team modeled a

range of these variables. The researchers also modeled lava tubes with walls created by lava placed in one thick layer and with lava placed in many thin layers, Blair said.

Only one other study, published in 1969, has attempted to model lunar lava tubes, he said.

Provided by Purdue University

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