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{ CHANDRAYAAN-3 STUDY }

Ice may exist on Moon at more locations: Data

Press Trust of India

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NEW DELHI: Ice could be present at more locations right beneath the Moon's surface at the poles than previously thought, a study of data collected by the Chandrayaan-3 mission has suggested.

Large, yet highly local, changes in surface temperatures can directly affect the forming of ice, and looking into these ice particles can reveal "different stories about their origin and history", lead author, Durga Prasad Karanam, Faculty, Physical Research Laboratory, Ahmedabad told Press Trust of India.

This can also tell us about how ice accumulated and moved through the Moon's surface over time, which can provide insights into the natural satellite's early geologic processes, he said.

The findings are published in the journal Communications Earth and Environment.

The Chandrayaan-3 mission, launched by the Indian Space Research Organisation (ISRO) from Bengaluru, achieved a soft landing near the Moon's south pole on August 23, 2023. The landing site was named the "Shiv Shakti Point" three days later on August 26.

For this study, the researchers analysed temperatures measured at and to a depth of 10 centimetres beneath the lunar surface. Measurements were taken by the 'ChaSTE' probe on-board the Chandrayaan-3's Vikram lander.

The lander touched down at the edge of the Moon's south pole region, about 69 degrees south latitude.

At this landing site — "a Sun-facing slope angled at six degrees" — the authors found that temperatures peaked at about 82 degrees Celsius and dropped to -170 degrees Celsius in the night.

However, barely a metre away from the landing point — a flat surface — temperatures peaked at about 60 degrees Celsius.

"That slight slope resulted in an increased solar radiation at the ChaSTE penetration point," Karanam said.

Further, the team developed a model of how slope angle can affect surface temperature at a high lunar latitude, such as the

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latitude of the landing site.

The model indicated that, for slopes facing away from the Sun and towards the Moon's nearest pole, a slope inclined at an angle greater than 14 degrees may be cool enough for ice to accumulate close to the surface.

The slope conditions suggested by the model were found to be similar to those of landing points, proposed for NASA's manned mission to the Moon's south pole — the Artemis.

The authors, therefore, suggested that potentially, there could be multiple places on the Moon where ice can form and be accessed more easily than previously thought.

In response to PTI's question on the chances of ice turning into water on the Moon, Karanam said, "Water in liquid form cannot exist on the lunar surface because of (an) ultra-high vacuum. Therefore, ice cannot transform into liquid, but would rather sublimate to vapour form." As of the present understanding, Moon might not have had habitable conditions in the past," Karanam said. However, ice is a potential resource for future on-site exploration and habitability of the Moon, and that more measurements, such as those from ChaSTE, are needed to gain a comprehensive picture, he added.

"Techniques and strategies need to be developed for extraction and usage of ice for long-term sustainability on the Moon," the lead author said.

The authors wrote, "ChaSTE findings not only indicate fine-scale spatial variability in regolith temperatures but also suggest that high-latitude regions are potential sites for scouting water-ice, resource prospecting and habitation.

"Such sites are not only scientifically interesting but also pose less technical challenges for exploration in comparison with regions closer to the poles of the Moon," they wrote.