

Ice on the Moon and Mercury

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We study the putative ice deposits in permanently shaded regions on the Moon and Mercury. Observational data suggest that the ice deposits on the Moon are relatively impure, being highly mixed with the regolith [1]. In contrast, the deposits on Mercury appear to be pure and are covered by dry regolith [2]. If permanently shaded regions contain ice on both planets, what accounts for the inferred differences in the deposits? They may be the result of differing weathering rates on the two bodies, their unique impact histories, or selection effects from the observation methods. We discuss the available data and results from modeling [3,4,5,6]. We find that the most suitable explanation for the Mercury observations is that a comet deposited an ice layer at least 50 cm thick in the northern cold traps less than 50 Myr ago. We explore several scenarios to explain the lunar data.

Although many unknowns remain in the modeling of these systems, upcoming missions will constrain these parameters. We report on how Lunar Reconnaissance Orbiter, MESSENGER, Bepi-Colombo, and ground-based measurements might provide data to which we can compare model results.

Keywords: Moon; Mercury; exospheres; ice deposits; space weathering; Lunar Reconnaissance Orbiter; MESSENGER; volatile evolution; comparative planetology

References

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