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Author: Ms. Sophia Casanova
ispace, inc., Luxembourg

MAGPIE: A EUROPEAN LUNAR ROVER CONCEPT FOR INVESTIGATING ICE STABILITY AND REGOLITH PROPERTIES

Abstract

The Moon's polar regions contain water ice deposits that could provide critical resources for future exploration. The MAGPIE (Mission for Advanced Geophysics and Polar Ice Exploration) mission concept, developed by ispace Europe in collaboration with European partners, is designed to investigate ice stability zones in these regions and assess the physical properties of the lunar regolith. MAGPIE is a mid-sized rover equipped with scientific instruments to characterise surface and subsurface volatiles, evaluate regolith properties, and demonstrate mobility in challenging lunar environments. The rover will operate in illuminated zones with targeted excursions into shadowed regions, leveraging neutron spectrometry, ground-penetrating radar, and mass spectrometry to assess near-surface ice stability. This study presents an overview of the rover's science objectives, instrument suite, operational constraints, and expected contributions to resource prospecting. The findings will inform future exploration strategies and enhance our understanding of volatile retention in lunar regolith.