

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

Author: Dr. Hendrik Kolvenbach
ETHZ, Switzerland, hendrik.kolvenbach@mavt.ethz.ch

Dr. Anna Mittelholz
ETHZ, Switzerland, anna.mittelholz@erdw.ethz.ch

Dr. Simon Stähler
ETHZ, Switzerland, simon.staehler@erdw.ethz.ch

Mr. Joseph Church
ETHZ, Switzerland, jchurch@ethz.ch

Dr. Valentin Bickel
Max-Planck Institute for Solar Systems Research, Germany, bickel@mps.mpg.de

Dr. Özgür Karatekin
Royal Observatory of Belgium, Belgium, ozgur.karatekin@observatory.be

Prof. Svein-Erik Hamran
University of Oslo, Norway, s.e.hamran@its.uio.no

Prof. Marco Hutter
ETHZ, Switzerland, mahutter@ethz.ch

LUNARLEAPER - A MISSION CONCEPT TO EXPLORE THE LUNAR SUBSURFACE WITH A
SMALL-SCALE LEGGED ROBOT**Abstract**

LunarLeaper is a mission proposed for the 2023 ESA call for small lunar missions. Its goal is to investigate the lunar subsurface, particularly focusing on lunar pits, also known as skylights. These collapse features on the lunar surface potentially offer access to subsurface lava tube systems that could serve as habitats for future human explorers. Additionally, lunar pits provide a view into the geological past of the Moon, exposing valuable information about the magnitude, timing, and composition of volcanic flows along their edges. The LunarLeaper is a highly versatile, 10kg-class legged robot designed to autonomously navigate the challenging terrain around the Marius Hills pit, one of the identified skylights believed to connect to a substantial underground cave system. This pit is situated in one of the Moon's youngest and enigmatic volcanic provinces. Leveraging a combination of established geophysical and imaging methods, such as a ground penetrating radar and gravimeter, LunarLeaper can characterize the terrain along the traverse. We aim to answer questions about lunar geology, including whether volcanic rilles represent surface manifestations of extensive cave systems, the timing of lunar lava flow events, and how the composition of lunar volcanism has evolved over time. LunarLeaper's primary objectives include confirming if the Marius Hills pit is connected to the hypothesized cave system and assessing its suitability for potential human exploration and habitation.