BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Center for Space Physics

2024—2025 SPACE PHYSICS SEMINAR SERIES

Isotopic Insights into Lunar Volatile Depletion and Surface Evolution

The Moon is severely depleted in moderately volatile elements (MVEs) compared to Earth, a characteristic likely established during the giant impact and the lunar magma ocean stage, before the Moon's surface solidified. Although most volatile losses happened early, small amounts have continued to escape from the lunar surface due to space weathering. Studying the isotopic compositions of MVEs provides a way to trace both the early depletion processes and the ongoing effects of space weathering.

In this presentation, I will explore the isotopic signatures of MVEs in lunar igneous samples and surface soils to gain insights into the Moon's volatile history. Isotopic compositions in lunar basalts suggest that lunar volatile loss occurred under evaporative conditions during the proto-lunar disk stage, possibly driven by magnetorotational instability. Additionally, K and Rb isotopic compositions of lunar soils offer valuable insights into space weathering processes on the Moon. Space weathering leads to the generation of the tenuous lunar atmosphere, which is constantly lost to space and replenished by micrometeorite impact vaporization, solar wind sputtering, and photon-stimulated desorption. The K and Rb isotopic data of lunar soils suggest that meteorite impact vaporization dominates over solar wind sputtering as the primary source of the lunar atmosphere.

Thursday, October 17th

3:30 - 4:30 p.m.

725 Commonwealth Ave | Room 502

Prof. Nicole Xike Nie
MIT - Earth, Atmospheric & Planetary Sciences