Professorship of Lunar and Planetary Exploration
TUM School of Engineering and Design
Technical University of Munich

TUM

Engineering Project (Bachelor Aerospace)

Exploring the Lunar Exosphere with LADEE NMS Data

theoretical/numerical project
Start date: Summer Semester 2025

Topic:

This project invites bachelor aerospace engineering students to delve into planetary science by analyzing processed density readings from the LADEE Neutral Mass Spectrometer (NMS). The focus is on understanding the thin veil of gases around the Moon by investigating how the exosphere varies with spatial and temporal conditions. Through hands-on experience in Julia programming and data analysis, students will not only visualize these variations but also gain insights into the instrument's design and measurement techniques. The project aligns with the broader goal of enhancing students' capabilities in scientific computing, data interpretation, and professional communication, thereby preparing them for more advanced research challenges in their bachelor's theses.

Tasks:

- **Data Acquisition and Preparation:**
  - Locate and retrieve the full inventory of processed particle density readings from LADEE NMS datasets.
  - Understand and interpret the accompanying metadata and data formats.

- **Data Analysis and Visualization:**
  - Use Julia to load, process, and clean the lunar exosphere datasets.
  - Generate plots that reveal variations in exospheric density as functions of location, time, and other environmental conditions using appropriate scientific color maps.

- **Instrument Review:**
  Investigate the LADEE NMS instrument to comprehend the methodology behind the measurements.

- **Scientific Communication:**
  - Prepare a clear, concise report (10-15 pages per student) using a provided LaTeX template, ensuring proper citations and adherence to the official TUM citation guide.
  - Collaborate to deliver a short, in-person group presentation summarizing findings and methodologies.

Requirements:

- Interest in numerical modelling and data analysis.
- Previous programming experience; willingness and ability to learn Julia.
- Experience with or willingness to adopt reference management tools for proper citation.
- Demonstrated ability to work collaboratively in small groups and communicate results clearly.
- Good command of the English language

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