SWEEPS: A NEW SPACE WEATHERING CHAMBER

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Introduction

SWEEPS, or the **S**pace **W**eathering **E**nvironment for **E**xploring **P**lanetary **S**urfaces, is a new simulated environment system designed to mimic multiple environments throughout the Solar System, including, but not limited to:

- cometary environments
- icy satellites and ocean worlds
- airless bodies or exospheres such as asteroids, the Moon, and Mercury.

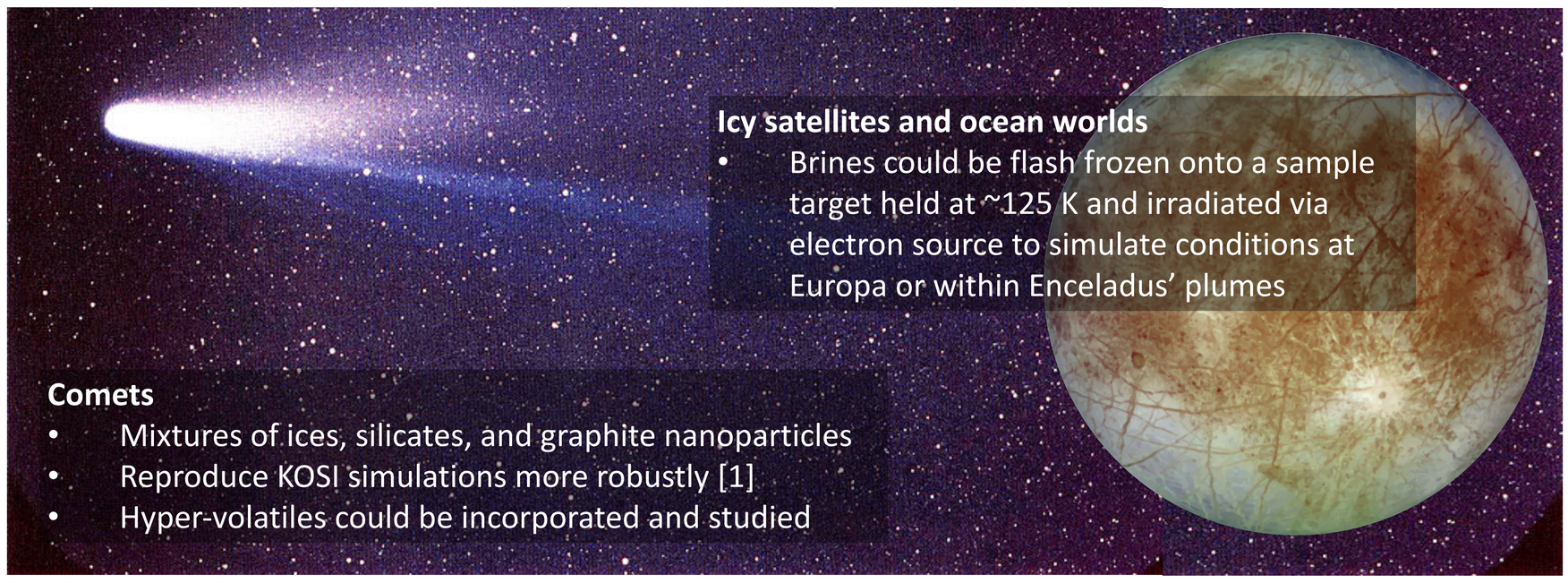
The design for the system is based around a custom-built cryostat with an extended sample holder that can host condensed gases, liquids, powders, and solids at temperatures ranging from ~10K to ~1000K. The simulated environment system is composed of two chambers: A sample preparation chamber and a measurement chamber.

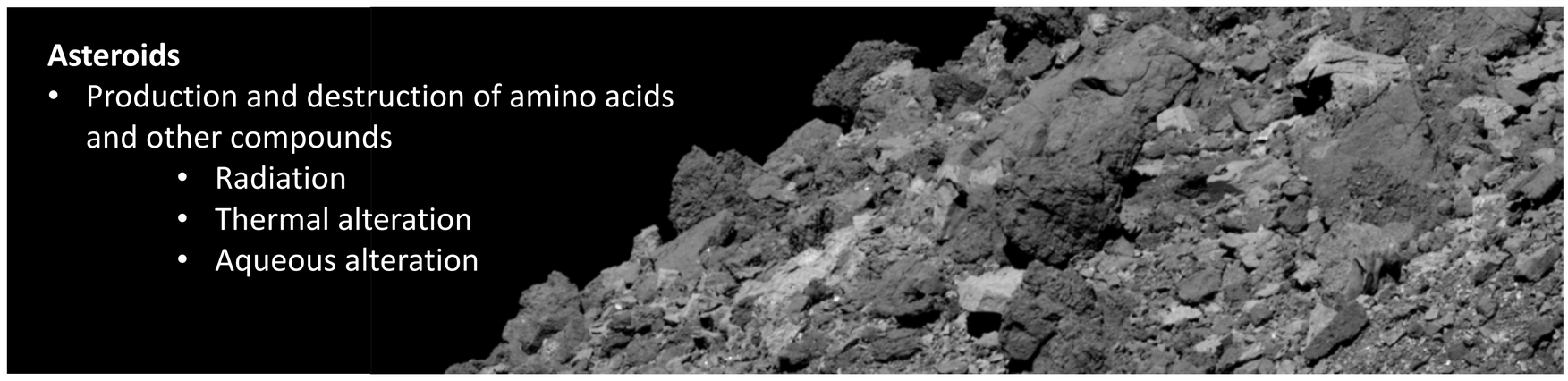
Sample Preparation Chamber

- Load-lock sample bay: independently exposed to vacuum/air/gases

Measurement Chamber

- Bidirectional diffuse reflectance (0.4-25 µm)
- Directly compare results to remote observations of incidence angle (i) = 0° and emission angle (e) = 30°
- Quadrupole mass spectrometer, electron source, UV source, etc.





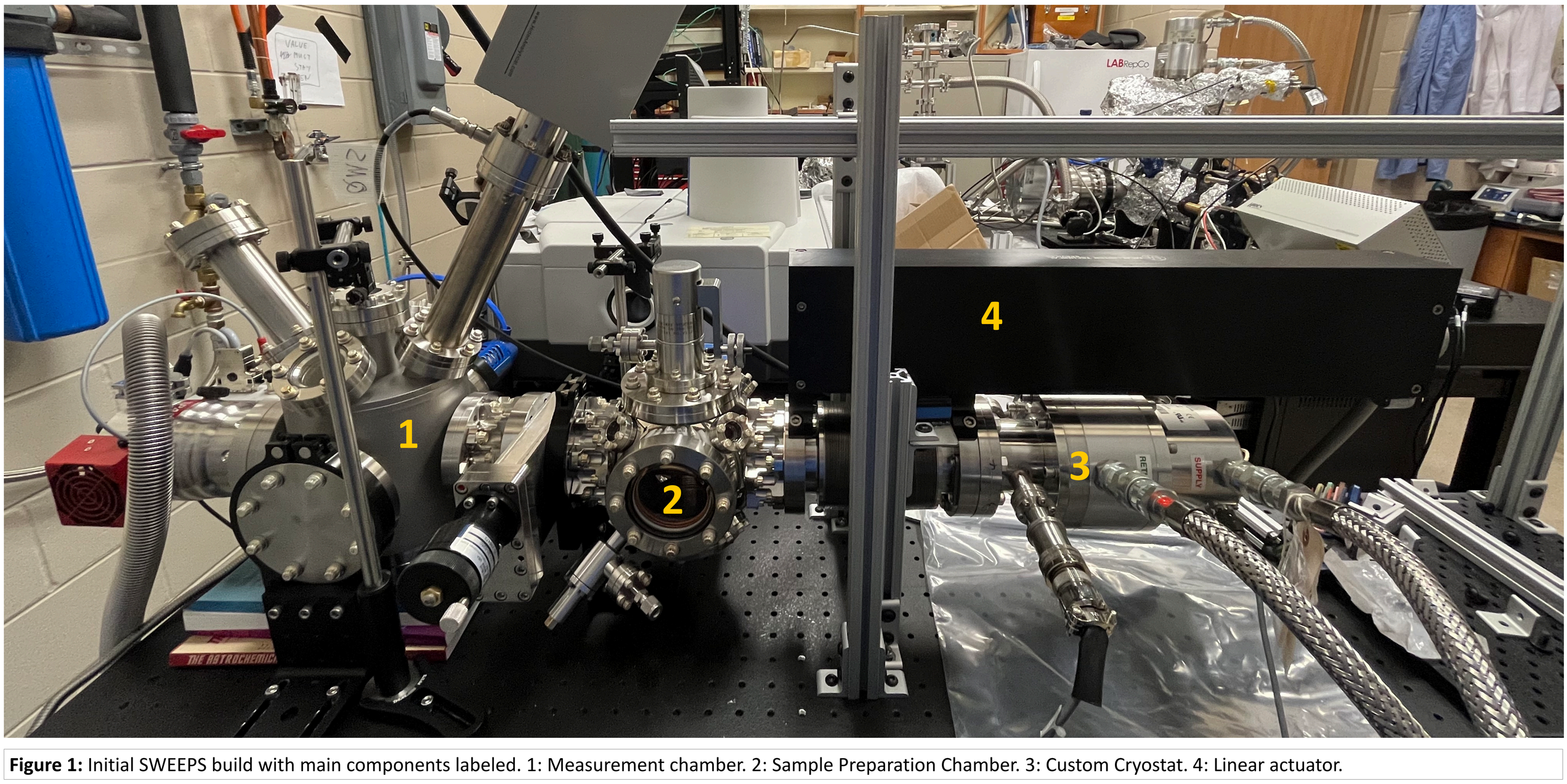
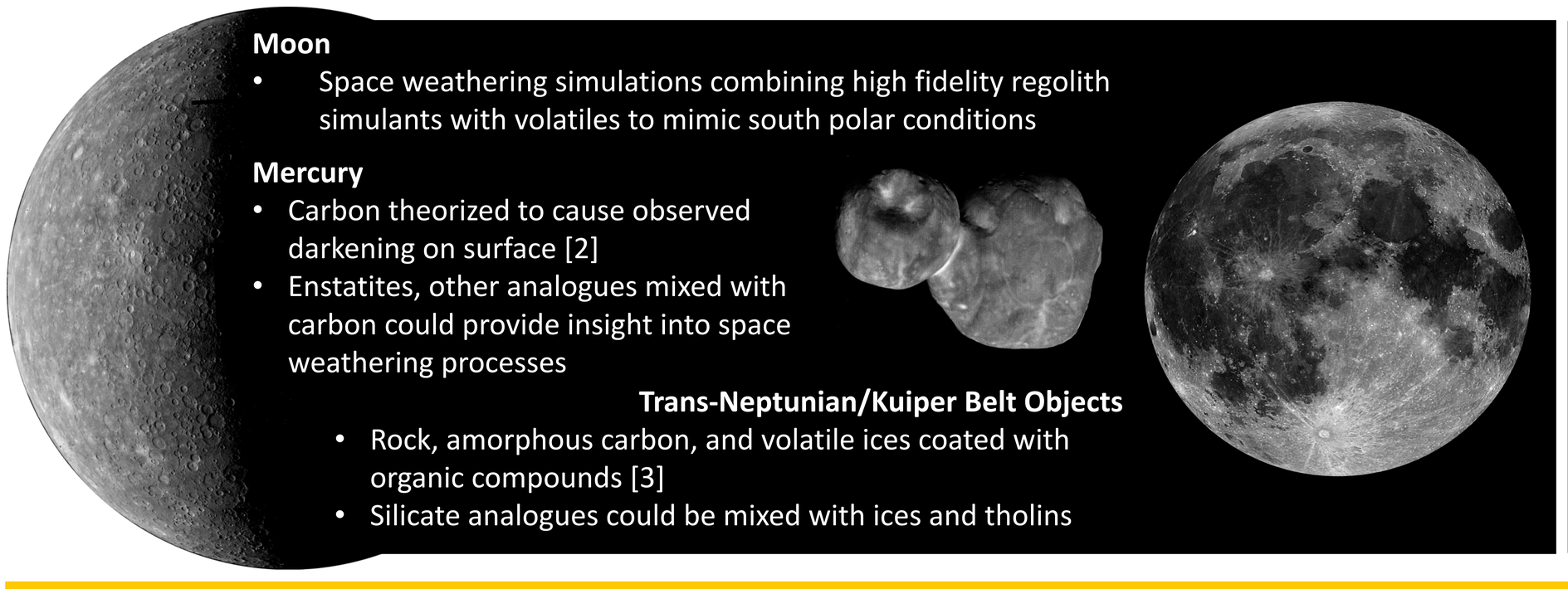


Figure 1: Initial SWEEPS build with main components labeled. 1: Measurement chamber. 2: Sample Preparation Chamber. 3: Custom Cryostat. 4: Linear actuator.



Future Work

This chamber is currently being built by the Bennett Lab at the University of Central Florida. Very shortly, we plan to complete the build and begin initial testing of the chamber using a range of particle size fractions of well-characterized San Carlos olivine. Reflectance measurements in the TIR region of the electromagnetic spectrum will be made under ambient conditions and compared to known spectra to ensure that the chamber is functioning as we expect. Further testing will occur with VNIR measurements of Exolith Lab's lunar highlands and lunar mare simulants (LHS-1 and LMS-1, respectively) [4].

[1] Grün, E., et al. (1989). International Astronomical Union Colloquium, 116, no. 1, pp. 277-297. doi.org/10.1017/s0252921100109728. [2] Klima, R., et al. (2018). Geophysical Research Letters, 45, no. 7, pp. 2945-2953., doi.org/10.1002/2018gl077544. [3] Fernández-Valenzuela, E., et al. (2021). The Planetary Science Journal. 2, no. 1, p. 10. doi.org/10.3847/psj/abc34e. [4] Exolith Lab, Center for Lunar and Asteroid Surface Science (2022). https://exolithsimulants.com | This work was directly supported by NASA's Solar System Exploration Research Virtual Institute cooperative agreement notices SSERVI 80NSSC19M0214 for the Center for Lunar and Asteroid Surface Science (CLASS).