



# OUTER SOLAR SYSTEM EXPERIMENTAL LABORATORIES AT THE ARKANSAS CENTER FOR SPACE AND PLANETARY SCIENCES



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## INTRODUCTION

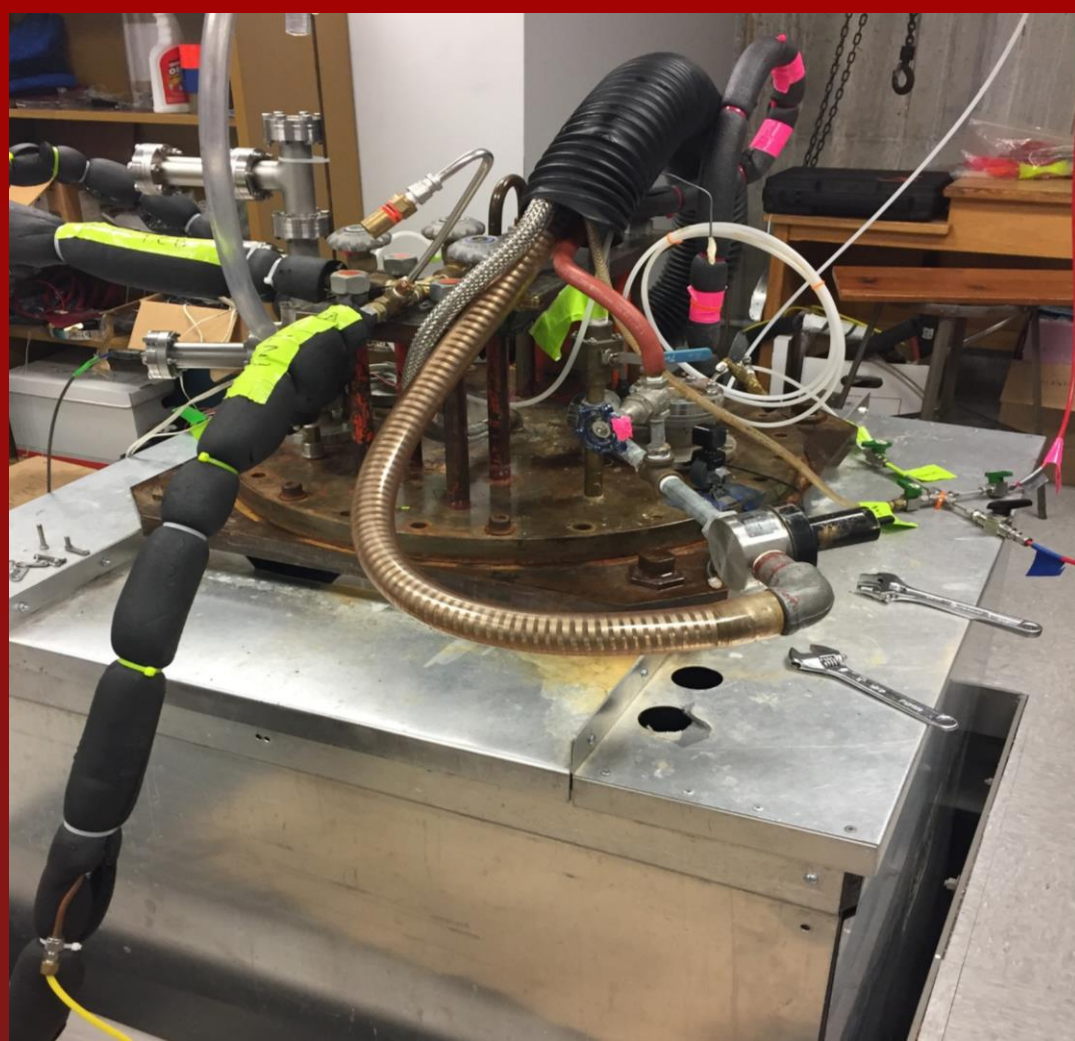
The University of Arkansas (UA) Fulbright College of Arts and Sciences, College of Engineering, and the Graduate School along with multiple science and engineering departments have all supported the development of the Center for Space and Planetary Sciences and the W.M. Keck Laboratory for Planetary Simulations. Its main contributors have been Ph.D. program student projects, summer interns, and several collaborations interested in surface-atmosphere or geologic regolith studies.

## IMPACT

- The technology of constructing these chambers to supplement current planetary missions
- Advance the technology used for future payloads by subjecting early-stage components to those specific and extreme conditions
- The knowledge gained from a simulation laboratory has provided insight to the various of terrestrial and icy bodies in the Solar System
- Scientists are welcome to propose to NASA to use the facility's chambers.

## TITAN SIMULATION LAB

- Height: 2.08 m, Diameter: 0.61 m
- Retains temperature at 94K and 1.5 bar pressure using liquid nitrogen and gas, respectively [1].
- Reports via FTIR and multi-camera system. Raman spectroscopy coming soon.



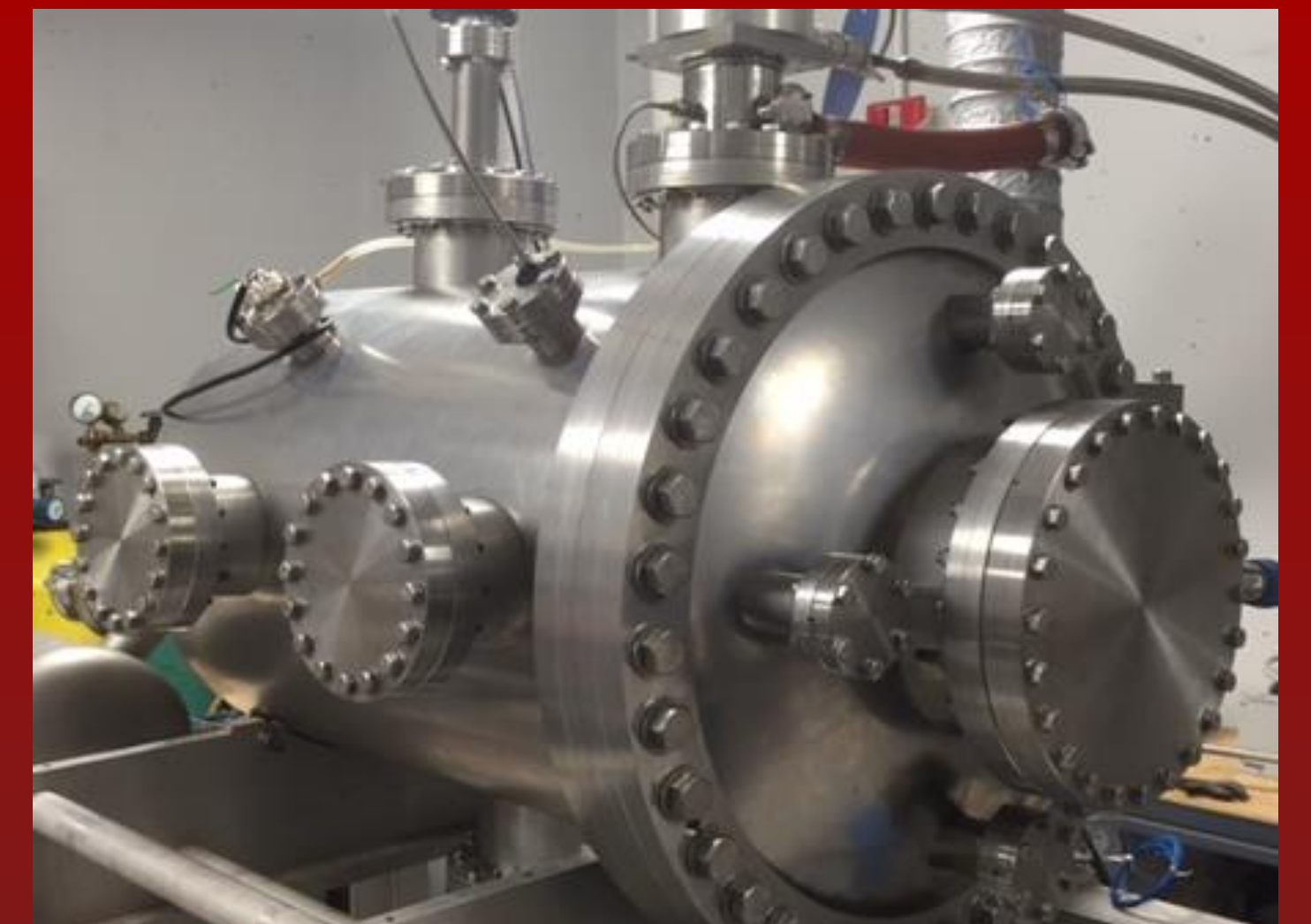
Exterior top portion of the Titan Simulation Chamber

## RESEARCH AREAS

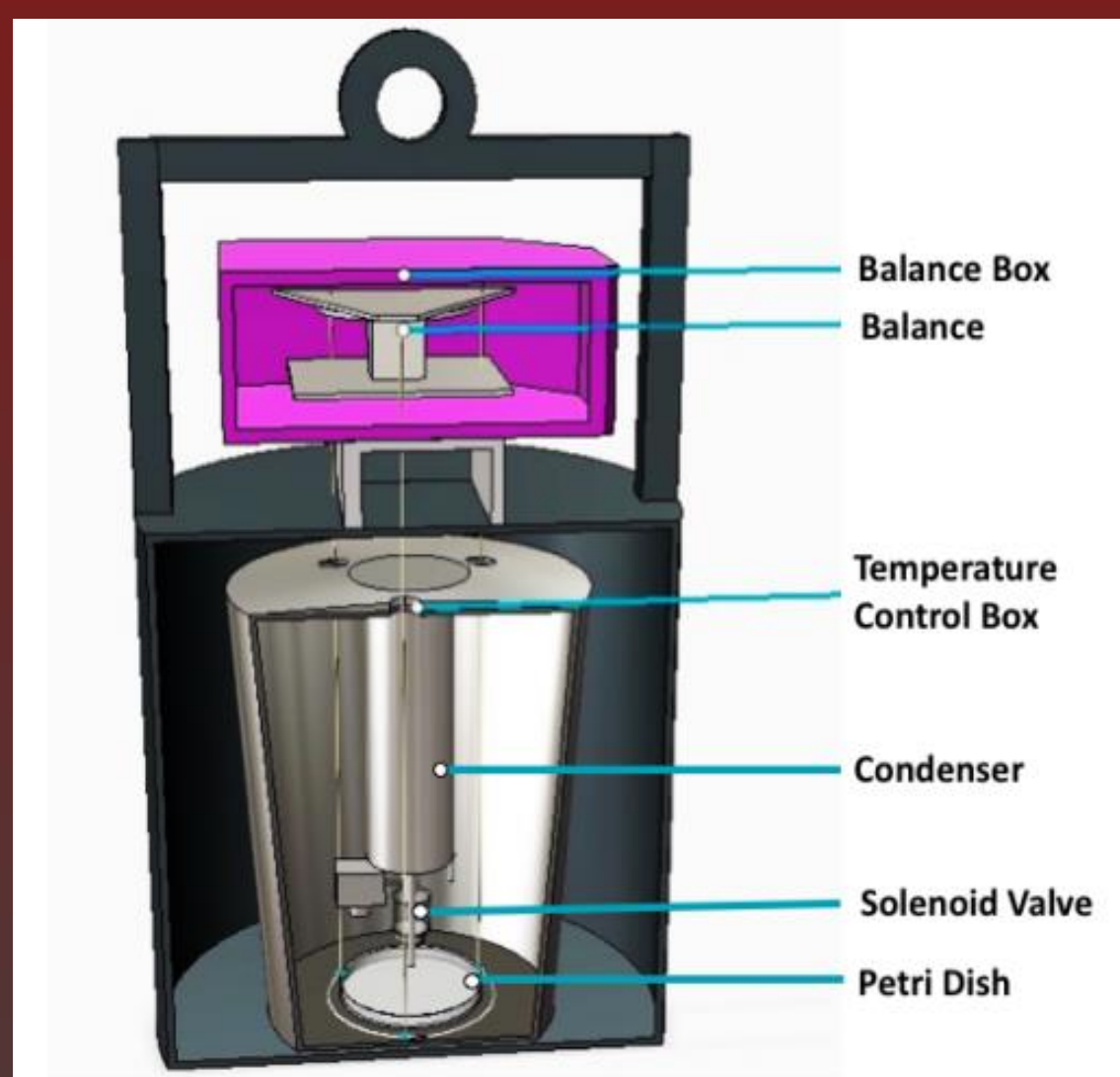
- **Ices and lakes on Titan:** Evaporation rates of liquid methane and methane/ethane mixtures, nitrogen dissolution, particulate effects, tholins, evaporite compositions, freezing of hydrocarbons [2-5]
- **Ices on Pluto:** Infrared analysis and identification of candidate Pluto surface ices, identification of phases, ternary methane-nitrogen-carbon monoxide studies
- **Planetary geomorphology:** Application of experimental and remote sensing methodologies to investigation of processes on Titan and other icy bodies.

## PLUTO SIMULATION LAB

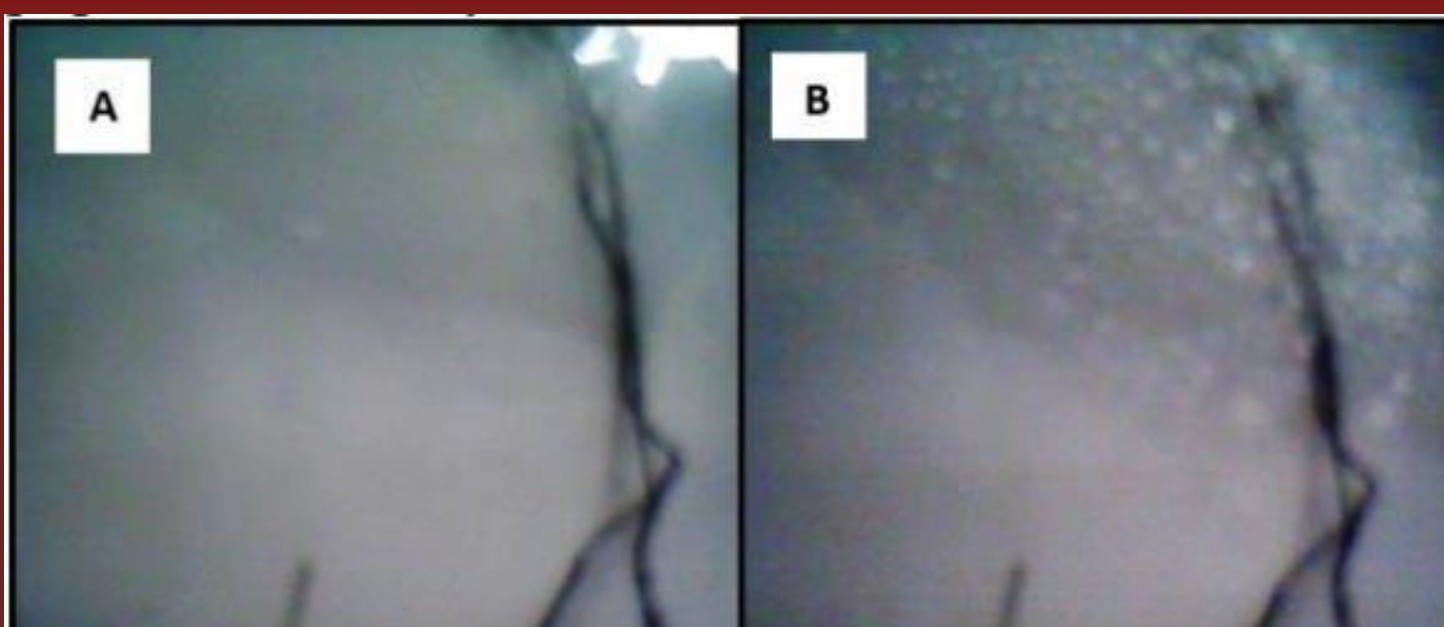
- Length: 1.3 m, Diameter: 0.45 m
- Simulations at 44 K +/- 10 K and 14 microbar [6].
- A gas-mixing chamber is included in the design to pre-mix volatile gases for ice phase studies [7]
- FTIR and camera capabilities



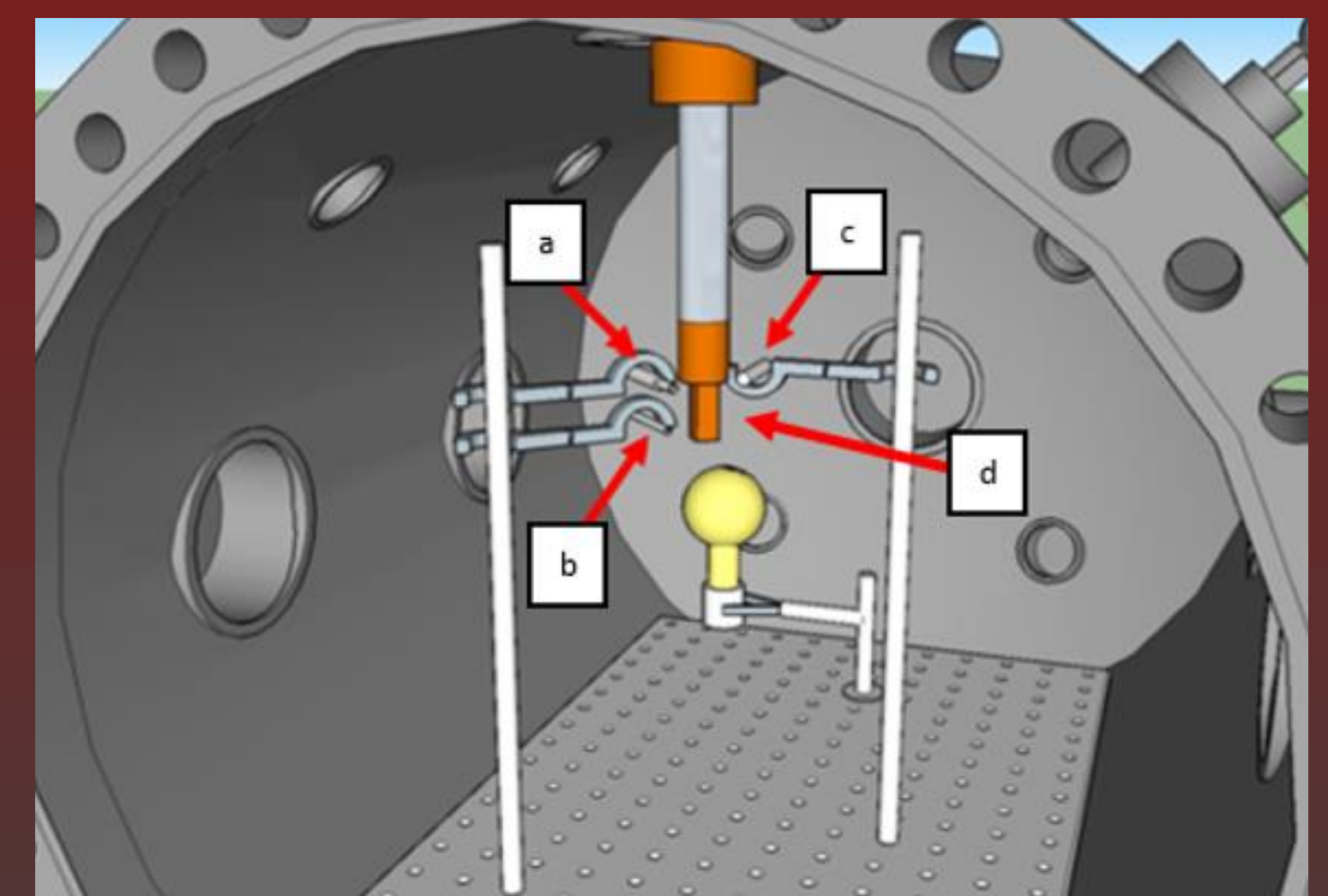
Exterior of the Pluto Simulation Chamber



3D schematic of the Titan Simulation Chamber interior design



Before (A) and after (B) a bubbling event recorded in the Titan Simulation Chamber



3D schematic of the Pluto Simulation Chamber interior design. a) FTIR; b) gas feed-through; c) camera source; d) cold head stage/condenser

[1] Wasiak, F., Luspay-Kuti, A., Blackburn, D., Roe, L., Chevrier, V., (2011), EPSC-DPS Abstract, v6, p548. [2] Farnsworth, K., McMahon, Z., Laxton, D., Chevrier, V., Luspay-Kuti, A., Singh, S., (2016), 47 LPSC Abstract, 2380. [3] Singh, S., Chevrier, V., Roe, L., Luspay-Kuti, A., Wagner, A., (2013), AAS-DPS-45, 302.03. [4] Neighbour, D., Singh, S., Chevrier, V., (2016), 47 LPSC Abstract, 1483. [5] Barnett, K., Chevrier, V., (2016), 47 LPSC Abstract, 1814. [6] McMahon, Z., Ahrens, C., Chevrier, V., (2016), 47 LPSC Abstract, 1728. [7] Ahrens, C., McMahon, Z., Chevrier, V., Elwood-Madden, M., (2016), 47 LPSC Abstract, 1469.



Carbon monoxide-methane ice mixture synthesized in the Pluto Simulation Chamber

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