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The Stirling Planetary Ices Laboratory within the Stirling Centre for Astromaterials Research

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Summary

We present the Stirling Planetary Ices Laboratory, an environmental simulation facility that has been, and can be used for a wide range of planetary science applications. The laboratory is a facility of the Stirling Centre for Astromaterials Research (SCAR).

1. Introduction

The Stirling Planetary Ices Laboratory is used to investigate thermophysical processes of planets and minor bodies. Its facilities have been used to simulate the environmental conditions on Earth, Mars, comets and asteroids.

2. Equipment

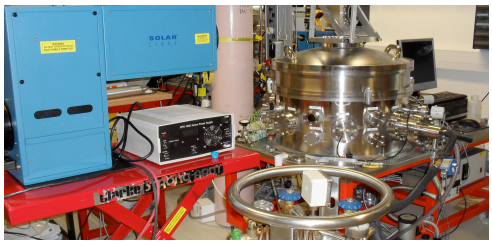

Figure 1: Standard setup for comet simulations with solar simulator to the left and DTVC to the right.

The equipment available for investigations (Figure 1) includes:

1. Dirty thermal vacuum chamber (DTVC) with cold shroud, capable of maintaining atmospheric pressures from 10^{-5} to 10^{3} mbar at temperatures as low as -140ºC. Mars atmospheric conditions can be maintained for periods exceeding several days;
2. LS1000R3 1000W Full Spectrum Solar Simulator to provide controlled solar input with zero airmass;
3. Ice making equipment for producing water and carbon dioxide ices of various morphologies;
4. Cold storage equipment for temperatures from -86ºC to room temperature;
5. Thermal and mechanical measurement suite.

3. Case studies

The Planetary Ices Laboratory was used to investigate light transmission through Mars dust contaminated snow under terrestrial atmospheric conditions [1]. It has also enabled us to verify theoretical models of arachneiform morphology on Mars [2]. Another application was the establishment of an important boundary condition for Mars atmospheric models, namely the e-folding scale of CO_2 ice [3]. The laboratory was also able to provide supporting measurements for the Rosetta mission, demonstrating subsurface ice hardening and dust agglomeration [4].

4. Future work

Currently, the Planetary Ices Laboratory is being used to run thermal simulations in support of the Hayabusa2 mission [5]. We plan to further explore the thermal processes on Mars, particularly in relation to the martian polar caps. The facility is available for collaborative projects. Please contact any of the authors to express an interest.

Acknowledgements

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References

[1] E. Kaufmann & A. Hagermann, 2015: Penetration of solar radiation into pure and Mars-dust contaminated snow. Icarus, Vol. 252, pp. 144-149.

[2] E. Kaufmann, & A. Hagermann, 2017: Experimental investigation of insolation-driven dust ejection from Mars' CO2 ice caps. Icarus, Vol. 282, pp. 118-126.

[3] H. E. Chinnery et al.: The Penetration of Solar Radiation into Carbon Dioxide Ice. JGR Planets, in press.

[4] E. Kaufmann & A. Hagermann: Constraining the parameter space of comet simulation experiments. Icarus, Vol. 311, pp. 105-112.

[5] M. Grott et al.: The MASCOT Radiometer MARA for the Hayabusa 2 Mission. Space Sci Rev Vol. 208, pp. 413–431, 2017.