WIND INDUCED DUST EROSION IN LOW GRAVITY.

M. Kruss, T. Demirci, G. Musiolik, B. Schrinski, G. Wurm, *Faculty of Physics, University of Duisburg-Essen, Lotharstr. 1, 47057 Duisburg, Germany*.

Introduction

Dust storms can regularly be observed on the Martian surface. In the early 80's experiments in wind channels on Earth were carried out to investigate this phenomenon and lead to the conclusion that dust cannot be lifted up by typical wind speeds on Mars [1]. There have been many discussions about the mechanisms responsible for dust lifting and new ideas are introduced until recently. Besides wind induced movement (see fig. 1), dust particles can also be lifted up by other mechanisms like thermal creep through the porous ground of Mars [2]. Nevertheless, no experiments have been conducted under altered gravitational levels. Results from experiments under 1 g were solely extrapolated to Martian gravity [1]. Until today reduced g experimental data is still missing.

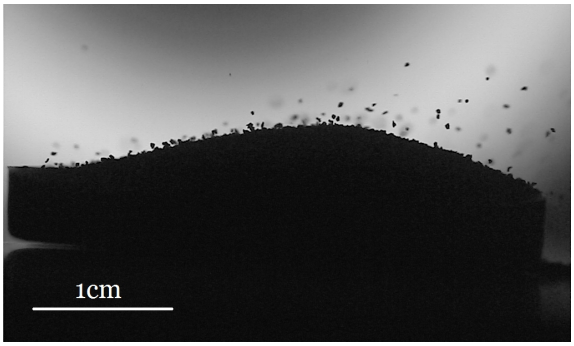

Figure 1: Erosion of an exemplary dust bed.

Microgravity experiment

We designed an experiment for parabolic flights in the framework of ESA's "Fly Your Thesis! 2016" to measure the wind speeds which are needed for dust to be lifted up in various gravitational environments. We use the Martian soil analogue JSC Mars 1a as dust sample. The dust bed is placed inside of a small wind channel operated with CO_2 at 6 mbar in analogy to the Martian atmosphere. The wind speed can be varied. The entire wind channel is placed inside a centrifuge (see fig. 2) which rotates at up to 2 Hz to simulate different gravitational potentials. This setup offers the possibility to investigate dust lifting in the range of 0 - 1 g during the state of microgravity in a parabolic flight. The dust bed is observed optically by a high-speed camera to determine erosion rates at different wind velocities.

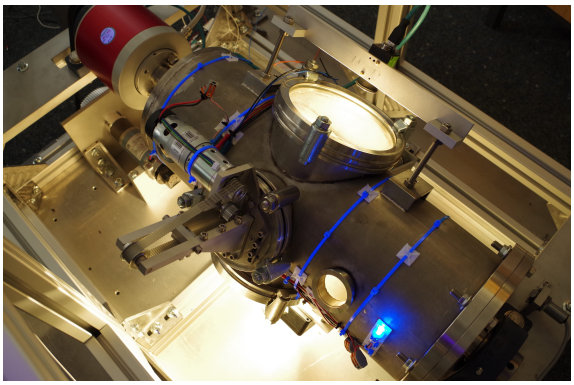

Figure 2: Image of the centrifuge which is supposed to be installed in the aircraft for parabolic flights.

Conclusion

We will present results at the conference if the experiments are successful. Our possible results can give an insight how the sticking properties in a dust bed behave in different gravitational environments. In particular we are able to measure experimentally, whether solely air flow can be responsible for dust saltation on Mars. The results will provide new important findings and could be relevant for rover missions or even manned space missions to Mars in the future.

References

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[2] C. de Beule, G. Wurm, T. Kelling, M. Kuepper, T. Jankowski, J. Teiser: The martian soil as a planetary gas pump, Nature Physics 10, pp. 17-20, 2014.