

SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration - Part 2 (2B)

Author: Prof. Lawrence Taylor
University of Tennessee, United States

LIVING WITH ASTRONOMY ON THE MOON: MITIGATION OF THE EFFECTS OF LUNAR DUST.

Abstract

The only place in the entire Universe that never sees the Earth is the farside of the Moon, a relatively economical place to establish a base for astronomical observations, free from the radio-magnetic waves of the Earth. However, the major deterrent to successfully establishing such astronomy units on the Moon is the presence of the fine-grained, glassy, abrasive, ubiquitous lunar dust ($<20\ \mu\text{m}$ fraction of the soil), consisting of 20 wt% of the soil. With the absolute dryness and intense vacuum (10-12 torr) on the Moon contributing to electrostatic behavior of the dust, coupled with the reduced lunar $1/6$ th gravity ($160\ \text{cm/sec}^2$), dust is readily launched into the exosphere only to remain suspended as it travels widely. This dust problem must be alleviated if the lunar farside is to become astronomy friendly. Fortunately, a unique feature of this dust, namely the presence of nano-sized (3-33 nm) metallic iron, imparts a high magnetic susceptibility that lends itself to efficient filtration of dusts for habitats, and removal/collection of the dust. This property also permits the mass-moving of the lunar soil with a magnetic sucker, a series of circular electric magnets about a sealed tube, where the magnets turning on/off similar to with a mag-lev train. This ripple-effect magnetically moves the lunar soil/dust along the tube to the site where it is needed, thereby keeping the generation of lofted dust by normal regolith movers. The presence of the nanophase metallic Fe imparts yet another and strange property to lunar soil/dust. "If lunar soil is placed in a normal kitchen microwave oven (2.45 GHz), it will MELT at 1200-1400 °C, even before your tea-water boils" (Taylor Meek, 2005, J Aerosp. Engr.). Magnetrons with different frequencies and power settings will sinter/melt lunar soil to various depths. Thereby, it will be possible to mitigate against dust by using microwave energy to pave roads, build habitats, and even construction of rocket launching landing pads, complete with berms. Need a large radio antenna? Smooth out a crater into a parabolic shape, go up-down the entire crater with a lawn-mover-like microwave paver to sinter the soil and put on a melt/glass surface and voila.