ELECTROSTATIC EFFECTS ON THE LUNAR SURFACE, T. Gold
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The large scale electric fields around the Moon and the mean
charges of surface grains of the soil can readily be seen to
result in forces that are much too small to cause any movement
of grains. However there are effects that are expected in the
environment of the Moon, where the charge on neighboring grains
is quite dissimilar, and where electric fields are set up on a
micron-scale. In such circumstances the forces on a grain may
well exceed not only gravity but also the adhesive force to the
neighbors that are in contact. Surface movement then results
and may cause surface transportation of lunar soil on a
g eo logically important scale.

We report here the laboratory experimentation and the
theoretical investigation of the effects that set up such
intense small scale fields. UV photons from the Sun, the solar
wind, and the plasma bombardment in the wake of the Earth all
need to be considered. While photon-produced electrostatic
effects are not large, they may cause some movement of surface
grains on the Moon. The free-stream solar wind has only
negligible effects. The electrons that reach energies of
several hundred volts in the region behind the Earth’s magnetic
bow-shock seem the most effective agency for causing surface
movement, and such movement caused by locally unstable electron
charging is readily demonstrated in the laboratory.

Photoelectrons are very numerous compared with the more
energetic electrons of the magnetosheath. It might be thought
that their action would be to destroy all the intense small-
scale electric fields, and to bring potential differences down
to the few volt range of the photoelectrons. This is, however,
not so. All localities in the complex surface geometry that can
receive electrons from the wide-angle electron bombardment, but
not photons from the narrow-angle solar illumination and that
charge up negatively cannot be discharged by photoelectrons.
A large fraction of the surface grains at any time are in that
situation, and therefore electron bombardment effects are
expected to be not greatly diminished by the presence of the
solar UV.

Magnetosheath electron bombardment provides an explanation
for the great difference in the appearance and surface
topography between the back and the front of the Moon, if
indeed surface erosion by such effects has played a major part
in shaping the surface.
Various interesting effects are noted in the laboratory tests. Such as the sorting of grains according to some features of their chemical composition that influence their secondary emission characteristics, and the impediment to transportation caused by a mixture of certain substances. These effects provide explanations for various seemingly strange properties of the lunar surface that have been noted.