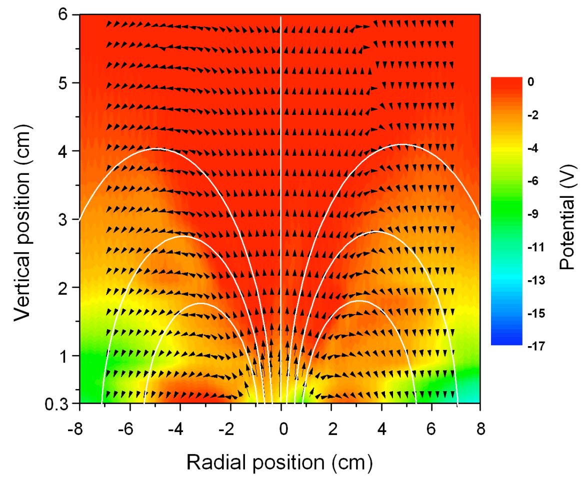
ELECTRIC POTENTIALS IN MAGNETIC DIPOLE FIELDS NORMAL AND OBLIQUE TO A SURFACE IN PLASMA: UNDERSTANDING THE SOLAR WIND INTERACTION WITH LUNAR MAGNETIC ANOMALIES.

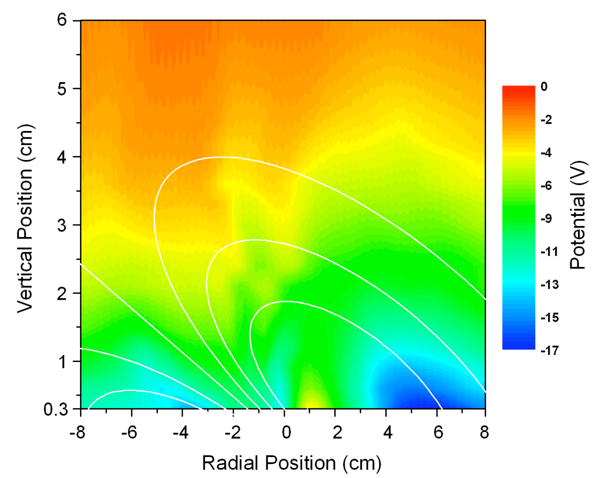
X. Wang[1,3], C. T. Howes[1,3], M. Horányi[1,2,3], and S. Robertson[2,3]. [1] Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, Colorado 80309 (xu.wang@colorado.edu), [2] Department of Physics, University of Colorado, Boulder, Colorado 80309, [3] NASA Lunar Science Institute: Colorado Center for Lunar Dust and Atmospheric Studies, Boulder, Colorado, 80309.

Abstract: We have performed a series of laboratory experiments to investigate the solar wind plasma interaction with moderate strength magnetic anomalies on the lunar surface. In these regions the solar wind electrons are magnetized but the ions remain unmagnetized. In our previous work [1], we have studied the electrical environment above an insulating surface in a magnetic dipole field oriented parallel to the surface in plasma. In this paper, we create a dipole field oriented both normal and oblique to the surface. When the dipole field is normal to the surface, the measurements show a large potential rise on the surface and a bump in the potential in the sheath in the magnetic cusp region. These results are due to significant magnetic mirror effects on the electrons in addition to their electrostatic reflection. The electrons are shielded from the dipole wings, causing the surface in the middle of the wings to charge positively, while the surface in the side of the wings charges negatively. When the dipole field intersects the surface at an oblique angle, an asymmetric potential distribution develops, which matches the orientation of the magnetic field. Our experimental results indicate that surface charging processes can be largely modified near the lunar surface in the magnetic anomaly regions, creating extreme surface electrical environments compared to the solar wind absorbing regions.

References:

[1] Wang, X., M. Horányi, S. Robertson (2012) JGR, 117, A06226.





Top: Potential contours above the surface with the magnetic field vectors (black arrows) and the field lines (white lines) of a magnetic dipole. **Bottom:** Potential contours above the surface in the dipole field oriented 45 degrees to the surface.