AN UNIDENTIFIED LUNAR COSMIC RAY SIGNAL THAT DEPENDS ON ALTITUDE AND SOLAR ZENITH ANGLE. A. W. Case[1], J. C. Kasper[1], , H. E. Spence[2], M. J. Golightly[2], N. E. Schwadron[2], J. B. Blake[3], M. Looper[3], J. E. Mazur[3], L. W. Townsend[4] and C. J. Zeitlin, [1]Harvard-Smithsonian Center for Astrophysics (corresponding author: tonycase@cfa.harvard.edu), [2]University of New Hampshire, [3]The Aerospace Corporation, [4]University of Tennessee-Knoxville, [5]Southwest Research Institute - Boulder

Abstract:

The CRaTER [1] team continues to investigate a specific subset of events in which particles cause a significant energy deposit in a single detector facing the Moon without a signal in any other detector.

The source of these events is unknown and under active investigation. The leading theory is that the events are due to solar x-ray photons. Figure 1 shows the number of these events as a function of altitude on the dayside and nightside of the moon. Note the marked rise in the unknown source of the events as altitude to the lunar surface falls, suggesting the signature of some lunar interaction process that has yet to be identified. The new orbit of LRO brings it to low altitudes (<35 km) over a more significant fraction of time. This will allow the CRaTER team to investigate new dependencies of the altitude-dependent source that might be critical for identifying it as a physical or instrumental effect.

Another clue to the source of these events is the response of the CRaTER detectors as a function of the orientation of the detectors with respect to the Sun (Figure 2). In comparison to the nightside, on the dayside of the Moon the count-rate exhibits a distinct behavior that is consistent with that of solar x-rays incident on the CRaTER detectors. The CRaTER team is still investigating possible instrumental causes of this signal, but has ruled out the most obvious thermal effects that may be causing the signal. The extended mission will allow the CRaTER team to further isolate the signal and develop a complete theory to explain the cause. This would be the first direct measurement of the quiet-time solar x-ray flux.

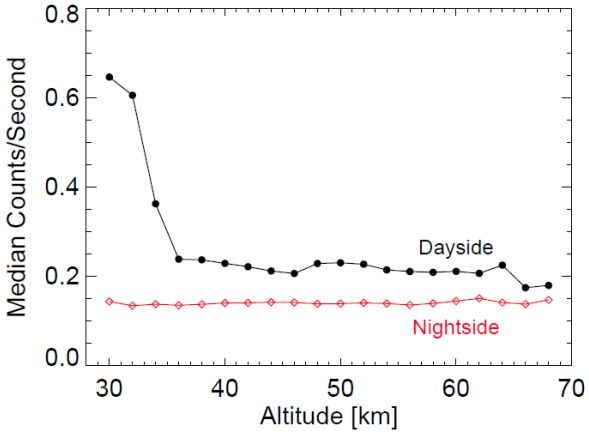

Figure 1: Count-rate of selected cosmic ray events as measured by the CRaTER instrument. The altitude-dependent signal is only seen when LRO is in sunlight.

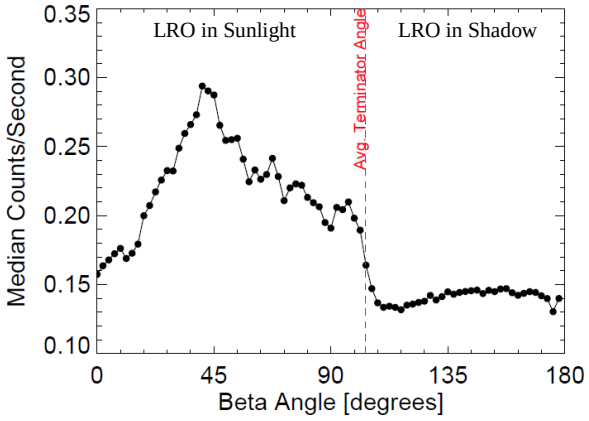

Figure 2: Count-rate of selected cosmic ray events as a function of the detector's orientation to the Sun. The beta angle is defined as the Sun-Moon Center-LRO angle. The signal is only seen when the spacecraft is in sunlight.

References:

[1] Spence, H. E., et al. (2010), Space Science Reviews, doi:10.1007/s11214-009-9584-8, CRaTER: The Cosmic Ray Telescope for the Effects of Radiation Experiment on the Lunar Reconnaissance Orbiter Mission