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Observation of lunar neutron albedo along the 24th Solar cycle

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It is well known that the Sun is not a steady source of radiation and demonstrates quasi-periodic variations of its activity with an average period of 11 years. The variation in solar activity yields a number of important physical effects that impact the entire heliosphere. Some of these effects are important for human life, since variations of the solar wind and the interplanetary magnetic field in the Solar System may produce variations of geomagnetic field and Van Allen radiation belts. Moreover, after strong Solar Coronal Mass Ejection events global geomagnetic storms are possible.
Solar variability generates a strong modulation of the Galactic Cosmic Ray (GCR) flux inside the heliosphere and results in a modulation of the neutron albedo of the Moon and other celestial bodies that lack a strong global magnetic field. Observations of the lunar neutron albedo and its variability are quite important for future human missions on the Moon since they provide an understanding of that radiation environment on the surface and in the subsurface.
We have used the data of collimated and omnidirectional epithermal neutron detectors of the Lunar Exploration Neutron Detector (LEND) gathered from September 2009 up to present. This period covers the first half of the 24th Solar cycle from period of minimum solar activity with maximum lunar neutron albedo up to high solar activity and less neutron albedo. It was found that for the observed time period, the amplitude of neutron flux drops down by a factor of $\sim$1.7 after a maximal values observed at December 2009. We have compared LEND measurements with ongoing observations of GCR variability by neutron detectors on-board other spacecraft orbiting around Earth (BTN/ISS) and Mars (HEND/Odyssey). All neutron instruments show similar global trends and local variations. It was found that HEND on Martian orbit has detected highest amplitude of neutron flux variations ($\sim$1.8 times) and the peak of neutron flux occurred by a couple of months earlier (October 2009) than it was detected at the vicinity of the Earth and Moon.