

Moon South Pole Mapping by LEND Instrument

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Abstract

The Lunar Exploration Neutron Detector (LEND) is operating on orbit around the Moon on-board the Lunar Reconnaissance Orbiter (LRO) spacecraft more than eight years since LRO launch at June 18, 2009. The primary scientific goals for the LEND experiment is to investigate presence and determine average amount of hydrogen in upper (~1 m depth) subsurface layer of the Lunar regolith with high spatial resolution and to test the hypothesis what the permanently shadowed regions (PSRs) at circumpolar regions are the main reservoirs of a large deposition of water ice on the Moon [1,2].

It was found [3,4] from the LEND observations what not all large PSRs contain a detectable amount of hydrogen but there are neutron suppression regions (NSRs) with statistically significant suppression of neutron flux. The NSRs partially overlap or include PSRs in craters Cabeus, Shoemaker, Haworth (on South) and Rozhdestvensky U (on North) but significant part of their area spread out at sunlit terrains [5,6]. This means what hydrogen may exist under a thin dry regolith layer. The majority of PSRs do not contain any significant additional concentrations of hydrogen in comparison with the sunlit areas around them. In addition, the specially developed method allows to estimate the water equivalent hydrogen (WEH) in top ~1 meter regolith using LEND data [7]. These publications uses the LEND dataset from September 16, 2009 until April 1, 2015.

Now we have a three additional years of data accumulation in the LEND experiment. Therefore, in this talk, we would present the updated maps of epithermal neutron counting rate and WEH for the South Polar region. Some interesting local areas (Cabeus and Shoemaker craters) will be discussed in more details.

References

- [1] Mitrofanov I. G. et al.: Experiment LEND of the NASA Lunar Reconnaissance Orbiter for High-Resolution Mapping of Neutron Emission of the Moon, *Astrobiology*, Volume 8, Issue 4, pp. 793-804, 2008, DOI:10.1089/ast.2007.0158
- [2] Mitrofanov I. G. et al.: Lunar Exploration Neutron Detector for the NASA Lunar Reconnaissance Orbiter, *Space Science Reviews*, Volume 150, Issue 1-4, pp. 183-207, 2010, DOI:10.1007/s11214-009-9608-4
- [3] Litvak M.L. et al.: Global maps of lunar neutron fluxes from the LEND instrument, *Journal of Geophysical Research*, Volume 117, CiteID E00H22, 2012, DOI:10.1029/2011JE003949.
- [4] Mitrofanov I. G. et al.: Testing polar spots of water-rich permafrost on the Moon: LEND observations onboard LRO, *Journal of Geophysical Research*, Volume 117, CiteID E00H27, 2012, DOI:10.1029/2011JE003956.
- [5] Boynton, W. V. et al.: High spatial resolution studies of epithermal neutron emission from the lunar poles: Constraints on hydrogen mobility, *Journal of Geophysical Research*, Volume 117, CiteID E00H33, 2012, DOI:10.1029/2011JE003979.
- [6] Sanin A.B. et al.: Testing lunar permanently shadowed regions for water ice: LEND results from LRO, *Journal of Geophysical Research*, Volume 117, CiteID E00H26, 2012, DOI:10.1029/2011JE003971.
- [7] Sanin A.B. et al.: Hydrogen distribution in the lunar polar regions, *Icarus*, Volume 283, Pages 20–30, 2017, DOI:10.1016/j.icarus.2016.06.002