LEND experiment onboard LRO: testing local areas with high concentrations of hydrogen at the lunar poles.
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Analysis of radio reflection signatures radar measurements onboard NASA's Clementine lunar mission has led to the conclusion that there could be local spots around both lunar poles with high content of water ice at shallow subsurface [1]. Explanation of these observations was suggested according to the *Model I* of water ice deposits at the *Permanently Shadowed Regions* (PSRs), which postulates that water vapor of a comet after collision could condense on the surface of "cold traps" of PSR. The *Model I* suggests that collision of Moon with a comet results to condensation of evaporated water vapor at permanently shadowed bottoms of polar impact craters, which work like "cold traps" for water molecules. Soon after the Clementine mission accomplishment, the data from Neutron Spectrometer became available from another small NASA's Moon mission Lunar Prospector [2], [3]. The data from Lunar Prospector has shown the suppression of the flux of epithermal neutrons from the Moon surface around the poles (*Extended Suppression of Epithermal Neutrons*, or *ESEN*-effect). The *Model I* was proposed to explain the LP effect of neutron flux suppression at lunar poles [2], [3]. For using this model, one postulates that epithermal neutron flux at polar regions outside PSRs is about the same as at moderate latitudes of the Moon, but spots of PSRs have very strong suppression of epithermal neutron emission. This resolution scale of LP measurements is much larger than size of an individual PSR (about 10 – 30 km or smaller). Therefore, one cannot use the LP neutron data for direct test of the presence of local neutron suppressions at individual PSRs.

The model of ice deposits in PSRs was not the only one which was proposed to explain the *ESEN* effect at the lunar poles. Moreover, more recent radio data shown that there is no evidence for water ice at the south lunar pole [4]. The alternative *Model II* has also been considered, which takes into account the process of implantation of particles of solar wind into the lunar regolith (see [5] and [6] for review). It was shown that these protons of solar wind may produce H_2, OH, H_20 in the soil, which leakage rate depends on the temperature of subsurface layer. Much smaller outgasing rate from the cold surface of polar regions is thought to lead to much higher content of H nuclei over there. The surface of PSRs with temperatures < 50 K should correspond to the strongest suppression of epithermal neutrons, but another regions with small average exposure for solar irradiation could be also suppressed. On the other hand, the rate of protons implantation to the regolith could be smaller at PSRs than around them due to shadow for the flux of solar wind. Therefore, in accordance with the *Model (II)*, one could expect that effect of ESEN manifests the combination of conditions of solar protons implantation and solar illumination, and special variability of neutron emission represents the spatial variations of these conditions around the poles.

Remote sensing of lunar neutron emission from the orbit is thought to be the best experimental method for testing these *Models (I)* and *(II)* and for selection the main one, provided the spatial resolution of neutron measurements is high enough to measure emission of an individual PSR in comparison with the emission from the surrounding illuminated surface. This task was suggested, as the mission requirement, for the neutron instrument onboard NASA's Lunar Reconnaissance Orbiter (LRO, see [7] and [8]). *Lunar Exploration Neutron Detector* (LEND) was selected for the LRO for addressing to this mission requirement [9], [10].

Data of LEND observations of lunar neutron emission will be presented, which allow to test local areas with high concentration of hydrogen at lunar poles and to select either *Model (I)* or *(II)*, as the major factor for interpretation of the *ESEN* effect. Conclusion will be drawn that there are local spots of *Suppressed Neutron Regions* (SNRs) and lunar poles with rather high content of hydrogen/water ice, but they are not necessarily consistent with the PSRs at polar craters.

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