Passive neutron sensing of martian subsurface from onboard rovers: results from MSL/DAN and expectations from ExoMars/Adron-RM

Sergey Nikiforov, Igor Mitrofanov, Maxim Litvak, Maya Djachkova, Dmitriy Golovin, Denis Lisov, Alexey Malakhov, Maxim Mokrousov, Anton Sanin, and Vladislav Tretyakov
Space Research Institute (IKI), Moscow, Russia (nikiforov@np.cosmos.ru)

During more than 7 years, the NASA MSL Curiosity rover is successfully traversing across the Mars surface exploring Gale crater with the Dynamic Albedo of Neutron (DAN) instrument installed onboard. This year, next generation neutron spectrometer Adron-RM is ready to be launched to Mars as a payload of the ExoMars 2020 rover. The main objectives of these instruments are analogous and consist in the assessment of Water Equivalent Hydrogen (WEH) in the shallow martian subsurface.

The hydrogen presence significantly influences the neutron leakage spectrum because of neutron moderation and thermalization through collisions with hydrogen nuclei. As a result, the variations of neutron flux detected onboard in different energy bands correlate with subsurface hydrogen/water abundance.

In our study, we will demonstrate scientific potential and latest results of natural neutron background measurements (called as passive measurements) by DAN. We will provide assessment on average WEH content in the area of the ExoMars 2020 landing site, which could be expected from first measurements of Adron-RM.