Searching for Correlation between Neutron Albedo and Near-IR Albedo of Mars Surface Using HEND/Odyssey and MOLA/MGS Data. N.E.Demidov[1], W.V.Boynton[2], D.A.Gilichinsky[1], M.L.Litvak[3], A.S.Kozyrev[3], I.G.Mitrofanov[3], A.B.Sanin[3], R.S.Saunders[4], D.E.Smith[5], V.I.Tretykov[3] and M.T.Zuber[6], [1] Institute of Physical-Chemical and Biological Problems of Soil Science, Puschino, Russia, *nikdemidov@mail.ru*, [2] University of Arizona, Tucson, USA, [3] Institute for Space Research, Moscow 117997, Russia, [4] NASA Headquarters, Washington D.C., USA, [5] NASA Goddard Space Flight Center, Greenbelt, USA, [6] Department of Earth, Atmospheric and Planetary Science, Massachusetts Institute of Technology, Cambridge, USA

Introduction. Neutron albedo of Mars is produced by bombardment by galactic cosmic rays. Flux of albedo neutrons characterizes the content of water in the soil within 1-2 meters of subsurface (1-3). Albedo of Martian surface for visible light determines heating of the subsurface by absorbed sunlight. Searching for correlation between neutron albedo and near-IR albedo of Mars may allow us to determine the depth structure of water ice permafrost of the planet.

Data Analysis. For neutron albedo the data from the High Energy Neutron Detector (HEND) on Mars Odyssey (4) was used. The data for Martian surface radiometry at 1064 nm from the Mars Orbital Laser Altimeter (MOLA) on Mars Global Surveyor (5) was used for near-IR albedo. Values for neutron and near-IR albedo were coregistered (72 pixels, 5°x5°) along 5° latitude bands around Mars. HEND data for latitude bands within (60°S - 60°N) were accumulated over the period of 4 years from 2002 to 2006. For bands at high northern latitudes >60°N and high southern latitudes >60°S the fractions of HEND data were used from the northern summer Ls = 90°-180° and the southern summer Ls= 270°- 360°, respectively. The MOLA data used correspond to summer of the same years: Ls=150-165° for north and Ls=330-345° for south, respectively.

The presence of cross-correlation was tested for 72 values individually at each latitude band, which excludes the effect of different solar illumination at different latitudes. We also exclude polar regions >80° from our analysis, because at these regions visual albedo characterizes the brightness of residual ice deposits rather than thermal heating of subsurface.

Results. Latitude profiles of cross-correlation coefficients are presented in Figure 1 for epithermal and fast neutrons. Cross correlation is significant at the confidence level of 3σ, when the coefficient is equal to 0.325. There is no evidence for correlation between the values of neutron and near-IR albedo in the broad equatorial belt (40°S- 40°N).

Strong negative correlation is found within two broad latitude belts: in the north (40°N – 80°N) and south (40°S – 60°S). The scatter plots of these values are illustrated in Figure 2. The negative sign means that increase of near-IR albedo leads to decrease of neutron emission.

On the other hand, no significant correlation is seen within the latitude belt (60°S- 80°S) at south.

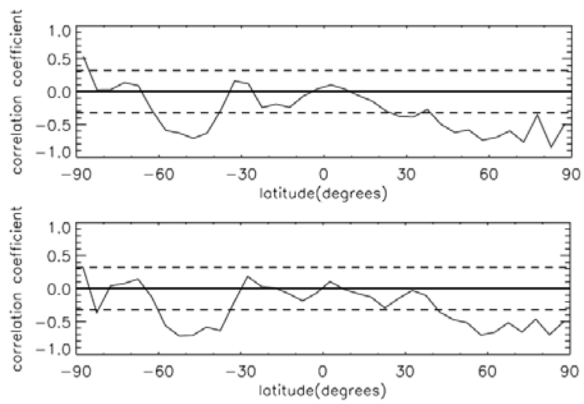

Figure 1. Latitude profile of correlation coefficient between near-IR albedo and albedo of epithermal neutrons (*top*) and fast neutrons (*bottom*). Confidence levels (3σ) are shown by dashed lines.

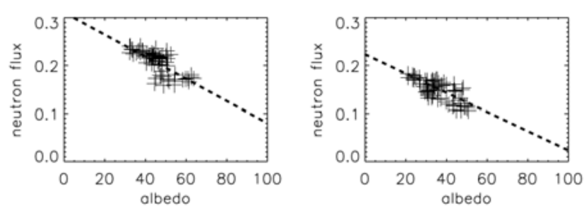

Figure 2. Scatter plots of near-IR and neutron albedo for bands 47.5°S (*left*) and 57.5°N (*right*).

Conclusions. We interpret the negative correlation between neutron albedo and near-IR albedo within latitude belts (40°–80°N) at north and (40°-60°S) at south to mean that water ice in these belts is buried below the dry skin layer, which thickness is determined by heating of subsurface material by sunlight. Higher near-IR albedo means less heating and correspondingly smaller thickness of dry skin layer. It is known that smaller skin layer above water ice corresponds to smaller neutron flux (6). Vice versa, smaller near-IR albedo means more heating and correspondingly greater thickness of dry skin layer. That corresponds to higher neutron flux (6).

Implications of this result for models of layering structure of water ice permafrost on Mars are presented in (7).

Refrences: [1] W.Feldman et al., *Science*, **297**, 75, 2002; [2] I.Mitrofanov et al., *Science*, **297**, 78, 2002; [3] W.Boynton et al., *Science*, **297**, 81, 2002; [4] W.Boynton et al., *Space Sci. Rev*. **110**, issue 1, 37, 2004; [5] Xiaoli Sun, G.A.Neumann, J.B.Abshire and M.T.Zuber, *Applied Optics*, vol. **45**, No.17, 2006; [6] I.Mitrofanov et al., *Solar Syst. Res*., **38** (4), 253, 2004 ; [7] I.Mitrofanov et al., this issue.