



FREND experiment on ESA's TGO mission: science tasks, initial space data and expected results

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The main science tasks are presented in details of the Fine Resolution Epithermal Neutron Detector (FREND) onboard the ESA's Trace Gas Orbiter (TGO). They are (I) mapping of water distribution in the shallow subsurface of Mars with the special resolution about 40 km, (II) measuring of the seasonal depositions of atmospheric carbon dioxide on the southern and northern hemispheres of Mars, and (III) monitoring of galactic cosmic rays (GCRs) and solar particle events (SPEs) on the low Mars orbit.

The initial science data of FREND are described measured during the interplanetary cruise and at the initial stage of the orbital flight. These data allow to estimate the local radiation environment of TGO, which is produced by GCRs, and also the neutron albedo of the Mars surface, which is also produced by the bombardment by GCRs. Using the first FREND space data for in-space calibration, the background components are estimated for the future low-orbit mapping of neutrons from Mars.

Using the first experimental data, expected science results of FREND are discussed. It is shown that joint analysis of the orbital neutron data from FREND onboard the TGO, the orbital neutron data from HEND onboard the Mars Odyssey and the surface neutron data from DAN onboard the Curiosity rover should allow to characterize the ground water/ice distribution on the surface of Mars and also to build the seasonal maps of atmospheric CO₂ depositions for different intervals of Ls. Special and temporal variations of the Martian radiation environment should be measured as well. Finally, the most ambitious goal of the TGO multi-instrument studies could be testing the cross-correspondence between the water-rich spots on the surface with the local enhancements of methane in the atmosphere