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MARS SYSTEM RADIATION ENVIRONMENT MODELING FOR THE LIULIN-PHOBOS INVESTIGATION OF THE PHOBOS SAMPLE RETURN MISSION

Abstract

Radiation environmental models have been developed in the framework of the LIULIN-PHOBOS investigation that will be onboard the PHOBOS SAMPLE RETURN mission by the Russian Space Agency RKA. This instrument package has been delivered to Russian Space Agency RKA in 2009 to be integrated onboard the spacecraft. These models are for the surface of the satellite Phobos, for the circum-Martian space, as well as for the cruise phase. Models first developed for the Moon have been adapted to the Phobos geophysical environment, then Mars-rescaled time-dependent primary particles fluxes have been transported through the Phobos environment. The already developed Mars radiation environment model has been used for the circum-Martian space calculations, whereas for the cruise phase a tool for radiation shielding analysis developed for manned deep space missions has been used. The tool allows obtaining radiation dose and dose rates for different interplanetary mission scenarios, composed of at least one out of three main segments, namely the launch and the interplanetary cruise phase, the planetary approach /departure and orbit insertion/escape phase, and the planetary surface phase. For each individual phase the respective radiation environment is taken into account, along with its variations with time. Only Galactic Cosmic Rays (GCR) and Solar Particle Events (SPE) are considered during the interplanetary cruise phase. Examples of results of the analysis for the LIULIN-PHOBOS experiment of PHOBOS SAMPLE RETURN mission will be given, along with comparisons between the Lunar, Martian and Phobos radiation environment results.