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Radiation Fields, Effects and Risks in Human Space Missions (5)

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LOW-EARTH ORBIT AS ANATURAL LAB FOR RADIOBIOLOGICAL STUDIES OF AN
INTERPLANETARY FLIGHT

Abstract

In this paper, we demonstrate that radiation environment created with the Galactic Cosmic Rays (GCRs) inside the spacecraft during the interplanetary flight can be reproduced on the low-Earth orbit. Since GCR radiation cannot be shielded with a reasonable shielding mass it is one of the main issues of concern for long-term interplanetary flights. Thus, it is essentially important to understand long-term GCR influence on astronauts during the mission and in long-term perspective. High kinetic energies, variety on particle species, low-intensity irradiation during long time periods makes almost impossible to reproduce GCR irradiation condition on-ground using accelerator facilities. Moreover, during space flight a complex of factors affects astronauts at the same time: radiation, microgravity and geomagnetic field. There is no guaranty that the simultaneous effect of these factors is just sum of effects of factors effecting separately. At the moment, the only experience of simultaneous effect of all these factors is the experience of the International Space Station (ISS) mission. In this paper, we demonstrate that GCR irradiation of astronaut inside the spacecraft on the ISS orbit during solar minimum is mostly similar to the GCR irradiation in the interplanetary space during solar maximum. Potentially, it can be made much similar if spacecraft for low-Earth orbit mission is designed having as a reference the spacecraft for the interplanetary mission.