Assessment of the effects of space radiation exposure
Simulation of Radiation Doses in the ISS "Kibo" Module and Lunar Base Model

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There are various barriers to the advancement of manned missions in the space, and space radiation exposure is one of the most significant issues. In this study, for the objective of tackling the radiation issues for human space activity and in anticipation of the full-scale start and construction of the lunar base, we present the estimates of radiation exposure to both the ISS Kibo module and the simple lunar base.
First, we modeled the shape of the ISS Kibo module, and simulated the radiation exposure inside the module during the GLE45 event on October 24 in 1989 and a massive influx of galactic cosmic rays using PHITS. The material of the module was set up as aluminum. As a result, the radiation dose was less than 100 mSv/event during the solar flare and 0.4 mSv/day during the galactic cosmic ray influx. Although there is no serious effect of acute damage during both solar flare and galactic cosmic ray influx, the exposure is higher than limits of effective dose of occupational exposure(20 mSv per year, averaged over defined periods of 5 years, and not exceed 50 mSv in any single year), which may increase the risk of cancer death. Next, we modeled the shape of the lunar base and simulated the radiation dose inside the base during the GLE45 event on October 24 in 1989 using the PHITS code. We changed the material and thickness of the wall so that the radiation dose inside the base could be lower than limits of effective dose of public exposure(1mSv/year). The results showed that the thickness of the wall were more than 300 cm for aluminum, steel, lead and regolith. Finally, on the basis of the annual probability of flare energies and their occurrences estimated from the observation by SOHO/ERNE, we will present possible accumulated radiation exposure to the lunar base for one solar cycle.

Keywords: Radiation exposure, ISS, Lunar base

