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THE RADIATION DOSE AND ITS EFFECT ON THE MISSION OF THE JUPITER SYSTEM EXPLORATION

Abstract

Due to the biological, geological and planetary science interests on the Jupiter icy moons Europa, Ganymede and Callisto, several projects on exploring Jupiter are under detailed consideration. Those interests are partially raised by the measurement and analysis of the Galileo, which suggests the icy moons have water ocean underneath the surface crust. Considering the general features of Jupiter, Jupiter has a strong planet magnetic field. Charged particles, primarily electron and protons, are stably trapped within a specific volume of space outside the Jupiter, and form a strong radiation belt. In contrast to the radiation belt of Earth (Van Allen belt), the flux of low energy protons in Jupiter's radiation belt is ten times higher than that in Van Allen belt, while the flux of high energy electrons is usually 2-3 orders larger as well. Therefore the primary radiation shield design is main concern during the radiation hardness assurance in the Jupiter mission In this paper, we used the GIRE(Galileo Interim Radiation Environment) model to evaluate the radiation level within the Jupiter system. Charged particle fluxes of elliptical orbit with non-zero inclination, equatorial orbit, polar orbit were investigated and analysed separately. Furthermore, in order to assess the evaluated orbiting radiation exposure and dose effects for unmanned spacecraft exploration mission to the Jupiter, the radiation dose calculation is performed by using the Monte Carlo radiation transport method. The numerical simulation results are essential for planning the future exploration for Jupiter system