SPACE LIFE SCIENCES SYMPOSIUM (A1)
The International Space Station in LEO and the Deep Space Habitat in Cis Lunar Space as platforms for simulated Mars voyages (4)

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A NEW APPROACH TO SPACE RADIATION SUPERCONDUCTING SHIELDS

Abstract

Deep-space missions will result in extended exposure of astronauts to space radiation, eventually leading them to deal with late and acute effects. Current countermeasures include passive shielding, however, to significantly reduce the effective dose to the crew, large amounts of optimized materials would be necessary and this solution is not compliant with the existing weight restrictions to space missions. The EU FP7 SR2S Project - Space Radiation Superconducting Shield - attempted for the first time to design an active shielding system, using magnets based on MgB2 superconductors. The multidisciplinary design activities have been supported by extensive detailed Geant4 Monte Carlo simulations. The structures and radiation transport through both magnetic fields and materials in a deep-space mission scenario have been considered. The large production of secondary particles arising from the passage of space radiation through the shielding structures was characterized with the intent of minimize it using accurate material selection and proper mass distributions around the habitat. The results of this work and the correlated simulations activities are reported, together with a comparison of the performances between active shielding and mass-equivalent passive ones. We also present results of realistic analysis and experimental studies of some key technologies which are necessary to develop such a shield (superconducting cable, cryogenics, quench protection, heat removal).