Space Radiation and its Biological Effects

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Galactic cosmic rays (GCR) and solar cosmic radiation (SCR) are the primary sources of the radiation field in space. Whereas the GCR component comprises all particles from protons to heavy ions with energies up to 10^{11} GeV, the SCR component ejected in Solar Energetic Particle (SEP) events consist mostly of protons, with a small percentage of heavy ions with energies up to several GeV. Fluxes of GCR particles are very low, around some particles cm^{-2} s^{-1}, fluxes of solar protons may reach to 10^{10} particles cm^{-2} released over several hours. GCR expose biological systems and humans to quite low mean dose rates not leading to acute radiation effects, but the exposure cause an additional risk of carcinogenesis, degenerative tissue effects, damages to the central nervous system and accelerated aging. Exposures to SPE particles also contribute to the listed risks, but in addition may cause acute effects, like mortality, morbidity and performance degradation. To prevent exposures due to solar particles spacecraft can be equipped with shelters, but shielding is not effective against GCR. While effects of high doses are relatively good investigated and reasonable understood, the biological effects caused by heavy ions are poorly understood. Mitigation of the effects of heavy ions is one of the most important challenges to be solved for the exploration of the solar system. The contribution describes the radiation field, its biological effects and measures to be necessary to limit the exposures in space missions to acceptable levels. Laser driven ion acceleration can provide an advanced tool to study heavy ion effects in order to close gaps of knowledge.