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DRACO MISSION: MEASURING RADIATION DOSES ABOUT THE EARTH-MOON LAGRANGIAN POINTS

Abstract

Future missions will bring humans to the Moon, Mars and beyond, which presents tighter constraints on the maximum radiation dose acceptable for them. Astronauts are protected by standards and cannot undergo just any radiation dose as they can be fatal or linked to illnesses later in life. Additionally, it is not well known if a cubesat will be able to withstand the radiations of the cislunar environment. Thus, this paper is focused on the study of radiations for deep space manned missions near the Earth-Moon Lagrangian (EML) points using cubesats. This study consists in determining the most abundant particles' fluence and fluxes depending on their origin (solar, intergalactic or extra-galactic) and solar cycle phase. A complete 3D model with all the required components was analysed with the advanced radiation dose analysis and shielding optimization software, FASTRAD. To execute the mission, an analysis of the cubesats' transfers in the Circular Restricted Three Body problem (CR3BP) deployed from the Gateway onto Halo orbits about EML1/2 points for data acquisition was performed. The orbit choice was done using multiple parameters such as stability, station keeping costs etc., to determine the most cost efficient and goal oriented orbit. These transfers are computed using direct Lambert arcs or patched invariant manifolds to optimise over the time and cost. Lastly, the end-of-life phase of both cubesats must be analysed to prevent future debris around the Earth-Moon Lagrangian points. A Moon impact is chosen as a disposal strategy, as it fulfils the demanding constraint of having little amount of fuel still available for this last phase. Transfers and unstable manifolds are computed in the CR3BP and an analysis is done in terms of departure position, impact time, site of impact and transfer cost, with additional constraints of avoiding historical lunar heritage sites.