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# ARCHITECTURE OF A CUBESAT MISSION TO MEASURE RADIATION DOSE ON CISLUNAR ORBITS

**Abstract**

The Moon and its vicinity has not been left untouched by humankind however the study of its radiation environment is not well known. This paper is focused on developing two cubesats to study radiations for deep space manned missions on the Gateway near the Earth-Moon Lagrangian (EML) points. Following this idea, a sectoral analysis of radiation effects on the different subsystems of the nanosatellites was performed. A complete 3D cubesat model with all required components was analysed with the advanced radiation dose analysis and shielding optimization software, FASTRAD. Different widths for the external sides of the cubesats have been selected to provide the best tradeoff between radiation protection and weight. Moreover, the most appropriate payload to perform a full field ion measuring for the mission was studied. This payload will measure the radiation along the orbit provided by the mission analysis to understand the ion spectra in the vicinity of the EML1/2. This radiation study can be used to validate different Galactic Cosmic Rays (GCR) models and Solar Particle Events (SPE) models. Furthermore, another important milestone is to show that a cubesat is able to measure radiations and perform its operations correctly in this type of environment. Thus, the subsystems were chosen to guarantee the feasibility of the operation of the cubesat for the orbit provided by the mission analysis. This latter was done to determine transfers between a calibration and a science orbit on a Near Rectilinear Halo Orbit (NRHO) and Halo orbit respectively. This orbit will allow to fulfill the objective of this mission; measure the radiation dose in the cislunar environment. The goal will be to optimise the trajectory and minimise the cost of transfer so it is feasible for a cubesat. Lastly, the end-of-life phase of both cubesats must be analysed to prevent future debris around the EML points. Due to the small dimensions of the cubesat, the remaining amount of fuel still available for this last phase is highly reduced. To fulfill this demanding constraint a Moon impact scenario is chosen as disposal strategy, exploiting the cislunar multibody dynamics with the use of unstable manifolds in the CR3BP (Circular Restricted Three Body Problem). A large number of these are evaluated, with additional constraints of avoiding historical lunar heritage sites.