

Simulation of ASTROD I test mass charging due to solar flares

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The ASTROD I test mass will become charged due to cosmic-ray and solar high energy particles during the spacecraft traveling in the space environment. The charging of the test mass will result in Coulomb forces between the test mass and the surrounding electrodes. In earlier work, using GEANT 4 and a simplified ASTROD I geometry, we have found a net charging rate of (24.2 ± 7.3) e[±]/s for primary protons at solar minimum. Here we have simulated the charging process with a more accurate and more realistic model of the spacecraft configuration due to solar flares and cosmic-ray protons and alpha particles. The amount of charge deposited per second on the ASTROD I test mass is obtained by using GEANT 4 toolkits. The value increases or decreases by approximately one order of magnitude for strong (weak) solar flares. We also estimated the magnitude of the acceleration noise due to charging of test mass by solar flares and cosmic-ray.