STATUS OF THE GALILEO INTERIM RADIATION ELECTRON MODEL

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ABSTRACT

Measurements of the high energy, omni-directional electron environment by the Galileo spacecraft Energetic Particle Detector (EPD) were used to develop a new model of Jupiter's trapped electron radiation in the jovian equatorial plane for the range 8 to 16 Jupiter radii (1 jovian radius = 71,400 km). 10-minute averages of these data formed an extensive database of observations of the jovian radiation belts between Jupiter orbit insertion (JOI) in 1995 and 2002. These data were then averaged to provide a differential flux spectrum at 0.174, 0.304, 0.527, 1.5, 2.0, 11.0, and 31 MeV in the jovian equatorial plane as a function of radial distance. This omni-directional, equatorial model was combined with the original Divine model of jovian electron radiation to yield estimates of the out-of-plane radiation environment. That model, referred to here as the Galileo Interim Radiation Electron (or GIRE) model, was then used to calculate the Europa mission dose for an average and a 1-sigma worst-case situation. The prediction of the GIRE model is about a factor of 2 lower than the Divine model estimate over the range of 100 to 1000 mils (2.54 to 25.4 mm) of aluminum shielding, but exceeds the Divine model by about 50% for thicker shielding. The model, the steps leading to its creation, and relevant issues and concerns are discussed. While work remains to be done, the GIRE model clearly represents a significant step forward in the study of the jovian radiation environment, and it is a useful and valuable tool for estimating that environment for future space missions.

KEY WORDS: Jupiter, Radiation Models, Radiation Belts, Galileo Spacecraft, Europa, High Energy Electrons, Trapped Particles, Space Radiation