

# **3D Visualization of Solar Disk: Radiation Assessment of Solar Particle Events at Mars and Earth**

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Between 2002 and 2003, the MARIE (Martian Radiation Environment Experiment) instrument onboard the 2001 Mars Odyssey spacecraft provided some unique data from the Martian orbit. The orbit alignment of Mars-Sun-Earth provided a wealth of opportunity between 180 degrees (August 2002) and 0 degrees (October 2003). During this time, the MARIE data included the background GCR (Galactic Cosmic Rays) and several SPE (Solar Particle Events) enhanced radiation dose-rate measurements at Mars. The MARIE instrument provided a unique data set of radiation dose-rate at Mars from the active regions on the solar disk facing the Mars side and there were no indications of these events towards the Earth at that time. Nearly 40 times increase in the quiet-time GCR dose-rate was noted from about 25 mrad/day to nearly 1000 mrad/day at Mars. Radiation dose-rate enhancement was not observed toward the Earth or in the Low Earth Orbit (LEO) during this time. Understanding the active regions on the Sun that are likely to result into SPE on the far side will also be of concern for future deep space explorations beyond LEO. We present our approach in depicting SPE with 3D visualization of solar disks facing Mars and Earth. We present the assessment of SPE activity between 2004 and 2005 towards Mars along with an estimated dose-rate during an SPE at Mars and towards Earth.