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Radiation environments near the Jovian satellites

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Abstract

Plasma and charged particles trapped in Jupiter's corotating magnetosphere overtake Europa and Ganymede in their orbits. These satellites are therefore continuously bombarded with charged particles over a wide range of energies. Ganymede's surface is somewhat shielded from the full Jovian particle flux because of its own magnetic field. In fact, data from the Galileo spacecraft Energetic Particles Detector (EPD) reveal that fluxes of charged particles on closed Ganymede field lines are much lower than fluxes at other locations along Ganymede's orbit. At Europa, the Jovian radiation environment is more intense than at Ganymede and there is no such shielding of its surface. Some attenuation of the Jovian environment in the inner magnetosphere comes about because of Iogenic and other neutrals. In the past, we have also pointed out that the radiation environment very close to Europa is somewhat asymmetric in energetic electrons. Trapped electrons in the energy range just below about 25 MeV, are expected to precipitate preferentially along the low latitude, trailing hemisphere of Europa. This is due to the fact that their speeds along the magnetic field line, approximately in the direction of Europa's axis, are far higher than the speeds at which these particles are drifting past the moon in the corotation direction. How and to what extent the radiation environments of these inner satellites are attenuated is of interest for future missions to these moons. For a spacecraft in low altitude orbit, the moon's particle shadow will reduce dose and improve functioning. Furthermore, the nature of the radiation environment close to the moon will reveal details about the body itself and the nature of its interaction with the magnetosphere. In this talk, we will review data and modeling of the radiation environments near Europa and Ganymede. We will also consider new work on this subject.