EPSC Abstracts
Vol. 5, EPSC2010-815, 2010
European Planetary Science Congress 2010
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Relativistic electron fluxes in vicinity of Jupiter's moon Europa

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Currently several projects of sending research space vehicles to Jupiter and its Galilean moons in the next ten years are being developed. In particular Russia proposed the project of Europa lander.

Europa is located inside the region of highly-intensive energetic particle fluxes of Jupiter's radiation belt, therefore the spacecraft will be exposed to high radiation hazard. The radiation dose under shielding compared to that for "Galileo" spacecraft during 2 months in Europa's orbit is equal to nearly 1 megarad; the major contribution to it belongs to relativistic electrons.

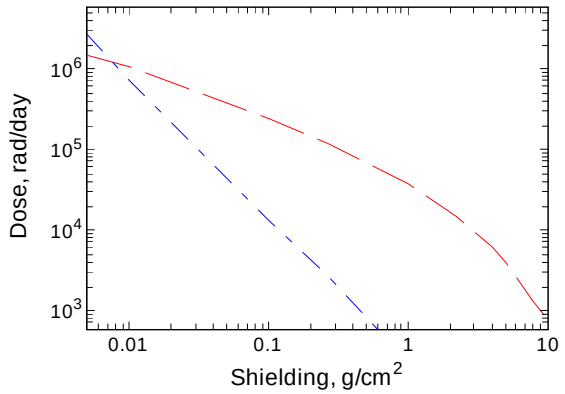

Figure 1. Radiation doses from electrons (dash line), and protons (dash-dot line) under different shielding in Europa's orbit.

However, near Europa part of the flux will be shaded by the moon. This reduction of the fluxes is sufficiently nonuniform and differs for various particle energies and pitch-angles and for the surface and the low-altitude orbit. This is caused by several factors: complexity of particle trajectories near Europa and in Jupiter's magnetosphere in general, difference of Europa's orbital plane from Jupiter's geomagnetic equator plane, certain disturbance of Jupiter's magnetic field in vicinity of Europa, diffusion of particles, possibly electric fields and Europa's tenuous atmosphere.

These factors were put in the basis of developing the model of spatial distribution of energetic particle fluxes near Europa and on its surface. Distribution of relativistic electron fluxes taking into account several of the mentioned above factors has been computed. Comparison with the results received by other researches has been made.

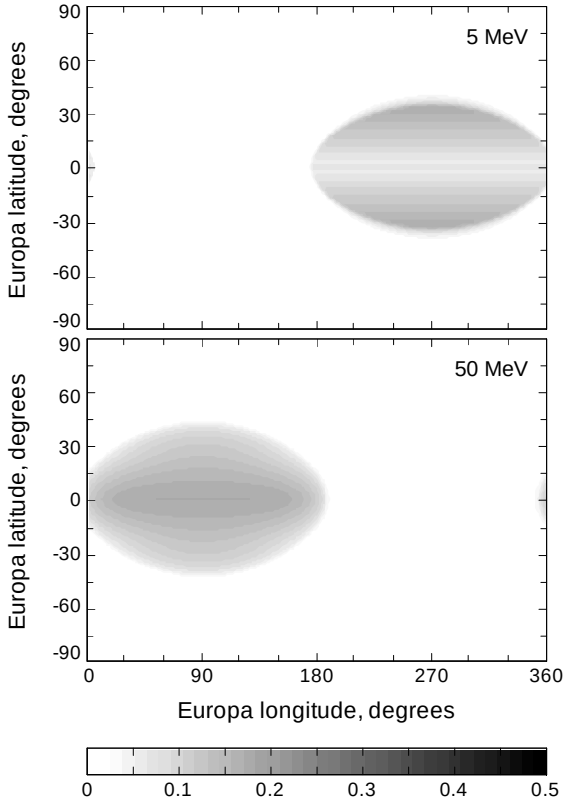

Figure 2. Fluxes of electrons with E = 5 and 50 MeV on Europa's surface taking into account their guiding center motion in Jupiter's magnetosphere and Larmor motion near Europa, relative to flux without Europa.

The results of our modeling can be used for choosing the optimal orbit of the spacecraft around Europa and the landing site.