Sputtering of Europa by Solar Coronal Continuum X-ray Photons and Jovian Magnetospheric Charged Particles

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Positioned at an orbital distance of 9.47 R_J, Europa's amorphous icy surface is subjected to bombardment by photons of solar as well as energetic-charged particles, of Jupiter's Magnetospheric origin, which results in surface sputtering, leading to surface erosion.

In the present work, solar coronal continuum X-Ray photons and Jovian magnetospheric specie, viz., Electrons, and single-ionized Protons, Oxygen, Sulfur, Carbon and Sodium are considered as the source of surface sputtering on Europa. An analytical model for continuum emission generates X-rays from optically thin plasma whose electrons have Maxwellian energy distribution for wavelength range 1-100 Angstrom over a complete solar cycle. The fluxes for ions and electrons are taken from Galileo-EPD measurements with energies up to 100 MeV.

We present the efficiency of solar coronal continuum X-Ray emission in evoking surface sputtering. Calculations of nuclear and electronic stopping power of ions and electrons, their sputtering yields, production rates, estimation of the surface loss rates that can sustain an exosphere on Europa and profiles of energy versus yield/production rates for each of the species are presented.