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Space weathering effects of the Europa's surface

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Abstract

The heavy energetic ions of the Jovian plasma (H^+, O^+, S^+, C^+) can either erode the surface of Europa via ion sputtering (IS), ejecting up to 1000 H_2O molecules per ion, or break the chemical bonds of the ejected species which can afterwards form new substances by radiolysis (e.g. O_2). Photons impinging the Europa's surface can also result in surface neutral atom release via photon stimulated desorption (PSD). In this work, we study the efficiency of these two processes (IS and PSD) in releasing water molecules. We simulated the density that these two processes, finding that they alone cannot sustain the tenuous atmosphere observed by the Galileo Orbiter. In order to distinguish the action of the IS with respect to other surface release mechanisms, we make an estimation of the signal of the sputtered high energy atoms (SHEA). This information on the energy distribution of the neutral flux together with atmosphere composition analysis can be utilized in the framework of a the future EJSM space mission for remote investigation of the properties of Europa's surface as well as for understanding its composition and the global evolution history of the body.