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Plasma, meteoroid and photons against the Jupiter's icy moons.

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Abstract

The Jupiter's moons are continuously irradiated by solar photons, dust, electrons and intense ion fluxes of H^+, C^+, O^+ and S^+ in the energy range from keV to MeV [1]. All these agents produce effects on the icy surfaces like chemical and structural modification (space weathering) and particle release. The knowledge of the effectiveness of these processes in this environment is important in order to understand the evolution of the moons and their interactions within the Jupiter's system. The interaction is dependent by impacting fluxes as well as by surface characteristics.
In this presentation, we estimate the various agents in the different Jovian moons: Europa, Ganymede and Callisto, considering different radiation environment as well as different intrinsic characteristics. In fact, Europa has a harsh radiation environment and it is completely exposed to it. On the contrary, Callisto is located at the edge of the radiation belt, thus would experience a minor interaction with plasma. Finally, Ganymede has an internal dipolar magnetic field that protects the surface to radiation in the equatorial region. In particular, a first attempt to evaluate the plasma precipitation in this more complicated environment is done.
Furthermore, while the surface composition is mainly water, on Europa, there are traces of hydrate compounds, H_2O_2, SO_2 and CO_2. On Ganymede and Callisto the estimated minor components are CH, H_2O_2, SH, SO_2, CO_2 and CN [2] and H_2CO_3 from a carbon radiolysis cycle [3]. Variations in albedo among the moons and among different regions are signature of different surface composition and/or aggregation status.
The effects of the interaction are also evaluated in this presentation. Photon stimulated desorption, sublimation, dust impact and ion sputtering and back-scattering processes are described and considered [4].

References

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