Geophysical Research Abstracts
Vol. 19, EGU2017-3495-1, 2017
EGU General Assembly 2017

Irradiation of a wide range of water ice samples in laboratory with electrons and heavy ions

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Airless bodies in space are subject to a continuous bombardment of charged particles from the plasma environment. This bombardment triggers chemical reactions in the surface and also acts as an atmospheric release process. The O_2 atmosphere around Europa, e.g., probably is the result of magnetospheric O^+ and S^+ ions sputtering the surface ice. We experimentally investigate the interaction of charged particles with water ice by irradiating samples with electrons (0.1 – 10 keV) and ions (1 – 100 keV). The water ice samples are prepared with various techniques, resulting in 100 nm ice films or centimeter-thick icy regolith with a range of grain sizes.

In this presentation, we summarize our results of all electron irradiation experiments. The results allow us to assess if sputtering due to electrons plays a role for the icy moons of Jupiter and Saturn compared to the better studied sputtering due to ions. We also will show our most recent results of multiply charged Ar^+ ions and ionized molecules (O_2^+ for instance) impacting water ice. Finally, we compare the results from thin and compact ice films with those from more realistic deep and porous samples and their respective relevance for the study of water ice sputtering in the laboratory.