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Simulating the plasma - ice interaction in the lab for Jupiter's icy moons

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The surfaces of Jupiter's icy moons are continually irradiated by charged particles from the Jovian plasma environment. This irradiation triggers chemical reactions in the surface ice and also acts as an atmospheric release process. Remote observations, theoretical modelling, and laboratory experiments must be combined to understand this plasma-ice interaction.

In this presentation, we concentrate on recent and ongoing experimental work at our facility. We first quantified the sputtering yields for various ion species (1 – 100 keV) and electrons (0.1 – 10 keV) hitting pure water ice or salty water ice of varying porosity and thickness, ranging from 100 nm to 1 cm. We then shifted our attention to studying the chemical and physical alterations in ice samples upon irradiation. To this end, we irradiated 1 cm thick porous samples of water ice with an electron beam at energies representative of the Jovian plasma and monitored the sample with a camera in the visible and near-infrared spectral range.