ION IMPLANTATION AND THE ORIGIN OF MINOR SPECIES ON THE SURFACES OF ICY SATELLITES. G. Strazzulla, INAF-Osservatorio Astrofisico di Catania, Italy, (gianni@oact.inaf.it).

The surfaces of icy satellites are continuously irradiated by energetic ions mostly in the keV-MeV energy range. Being the penetration depth of the incoming ions much lower than the thickness of the target, they are stopped (implanted) into the ice. A complex “hot” chemistry is induced and molecules different from the original ones can be produced. Reactive ions (e.g., H, C, N, O, S) induce all of the effects of any other ion, but in addition have a chance to form new species containing the projectile. An ongoing research program performed at our laboratory has the aim to investigate ion implantation of reactive ions in many relevant ice mixtures. Among the recent results:

- The production of CO$_2$ after C implantation in water ice (figure 1). The measured yield (CO$_2$ molecules formed per impinging ion) has been measured to be 0.47 for implantation at 16 K and 4.2 at 77 K [1].
- The formation of sulfuric acid dissolved in water ice after S implantation in water ice (Figure 2). The measured yield is Y=0.65 equivalent sulfuric acid molecules per impinging 200 keV sulfur ion [2].
- H implantation in sulfur dioxide produces poly-SO$_3$ [3].

Figure 1: IR spectra (2430-2230 cm$^{-1}$) showing the formation of CO$_2$ after implantation of 30 keV carbon ions in water ice at 77 K.

Figure 2: IR spectra (3420-1020 cm$^{-1}$) of a water ice target before and after implantation of 200 keV sulfur ions at 80 K. The features observed after implantation testify to the formation of hydrogen peroxide and sulfuric acid dissolved in the ice.

In this talk I would like to stimulate a discussion between observers, modelers and experimentalists on the following question: are some of the minor species (e.g. CO$_2$, SO$_2$, O$_3$) observed as contaminants of icy moons, formed after implantation of reactive ions from planetary magnetospheres?

[The experimental work in Catania has been performed in the last years by the LASP Team and coworkers (G.A. Baratta, R. Brunetto, D. Fulvio, M. Garozzo, O. Gomis, S. Ioppolo, G. Leto, M.E. Palumbo, F. Spinella). This Research has been supported by Italian Space Agency contract n. I/015/07/0 (Studi di Esplorazione Sistema Solare)]

References: