What's Eating Ozone?

M.J. Loeffler and R.L. Hudson, ApJL, 833, L9 (2016)

What is the science question?

Why are there so few detections of ozone on icy Solar System objects when ozone is readily made in the laboratory from the irradiation of relevant ice mixtures by energetic particles?

What were your findings?

We performed experiments that showed that at the temperatures of the Jovian icy satellites, such as Callisto (Figure 1), ozone readily reacts thermally with sulfur compounds that are likely present on these surfaces.

What is the impact?

These results give a possible explanation for the disparity in ozone detection between observations and what would be expected from laboratory experiments. For our laboratory experiments, we observed the decomposition of ozone through the following pathway:

$$2\ H_2O + SO_2 \rightarrow HSO_3^- + H_3O^+$$

$$O_3 + HSO_3^- \rightarrow HSO_4^- + O_2$$

Why does it matter to non-scientists?

The reality that these types of chemical reactions appear to be important at the colder temperatures found in our Solar System is particularly compelling considering that they can occur at any depth below the surface if the temperature is sufficient. Thus, environments such as subsurface oceans, which are speculated to exist on many of these objects, may also be effected by these types of processes.

Figure 1. Callisto, an icy satellite of Jupiter.

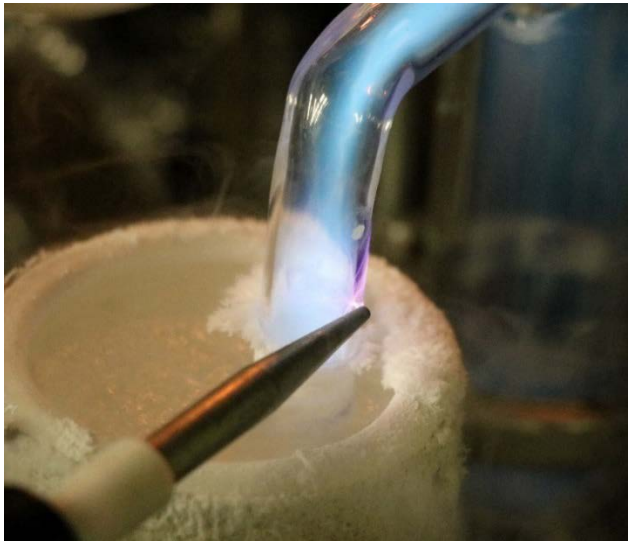

Figure 2. Image depicting the process of making O_3 for our experiments