Cometary Volatiles: Icy Grains and Drivers of Activity

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We have understood for some time that the activity of most comets is driven by the sublimation of H_2O ice, at least when they are near the sun, say within 2.5 ot 3 AU. The identification of icy grains in cometary comae has been reported occasionally over a few decades for comets active at large distances. In the absend of IR spectra, we have no way of distinguishing "dust" from icy grains in cometary comae, although a bluish color in the visible and near-IR would suggest ice. We have also observed outbursts of comets at large heliocentric distance, during which gaseous CO has been detected, suggesting that CO is the driver of activity at heliocentric distance beyond 3 AU.

Although observations of CO_2 go back to comet Halley, the usually high abundance of CO_2 was only realized with the *AKARI* survey and the role of CO_2 in driving the activity of comets that release even more H_2O became clear from the *EPOXI* flyby of 103P/Hartley 2. The frequent, high abundance of CO_2 is an interesting constraint on the formation of comets, because gaseous CO_2, unlike CO and H_2O, is not generally observed in the interstellar medium or protoplanetary disks.

The observations of Hartley 2 also showed that a significant part of the "dust" in the cometary coma could be ice, even at 1 AU from the sun. Furthermore, the ice in the coma comes primarily from the interior of the nucleus rather than from the ice that is observed on the surface, but only in parts of the nucleus that have just passed sunrise (on both 9P/Tempel 1 and Hartley 2). There are still issues with the current modeling of the icy grains but the data are being analyzed in multiple ways in order to get a clearer picture.

This talk will provide a more detailed overview of the abundances of volatiles in various comets and the processes that lead to the grains in the coma.