PHYS 607: On the formation and destruction cycle of solid carbonic acid in the solar system

Abstract: Water-rich ices have been detected on the surface of many objects exposed to energetic processing in the Solar System. For instance, Mercurys north pole and Martian polar caps are continuously bombarded by solar wind particles. Most of the icy moons belonging to Jupiter and Saturn are embedded in the magnetospheres of their respective planets, hence exposed to energetic ions and electrons. Furthermore, comets, trans-Neptunian objects (TNOs) and Kuiper belt objects (KBOs) are all exposed to galactic cosmic rays and solar wind ion bombardment for billions of years. Thus, it is likely that new solid species are continuously synthesized and destroyed on the surface of the aforementioned objects. On the example of the formation and destruction of frozen carbonic acid upon 1 keV electron irradiation of water:carbon dioxide ice mixtures, I will present complementary VUV and FTIR laboratory spectra to discuss the degree of molecular complexity reached by the interaction of electrons and Solar System relevant ices. Results will be reviewed in light of past and future astronomical observations (e.g., JUICE mission).

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