

**RADIATION EFFECTS ON THE ICY SATELLITES AND RING PARTICLES** R. E. Johnson<sup>1</sup>, A. R. Hendrix<sup>2</sup>, T. A. Cassidy<sup>1</sup>, <sup>1</sup> Wilsdorf Hall, University of Virginia, Charlottesville, VA 22902 (rej@virginia.edu), <sup>2</sup> JPL, , 4800 Oak Grove Dr., MS 230-250, Pasadena, CA, 91109 (arh@jpl.nasa.gov)

**Introduction:** Icy materials in the outer solar system are exposed to both the solar UV and plasma radiation. The incident radiation produces defects, sputtering and radiation-induced chemistry [6, 8, 11]. Such effects can be seen in the composition of the ambient neutrals and plasma as well as in the reflectance spectra.

One of the more important effects is the decomposition of ice by the incident radiation:  $2\text{H}_2\text{O} + \text{radiation} \rightarrow 2\text{H}_2 + \text{O}_2$  [5,12] and the production of peroxide [2, 8]. The very volatile molecules,  $\text{H}_2$  and  $\text{O}_2$ , can escape into the gas phase. The efficiency of escape depends on the defect density, the surface temperature and on how deep into the surface they are produced. Volatile formation and loss to space has been shown to compete with surface sputtering for production of ambient neutrals about the icy satellites and rings [11, 13, 14, 15, 17].

Since the more volatile species,  $\text{H}_2$ , is lost preferentially, the trace surface species in an ice matrix tend to be oxidized [10,11]. In addition, depending on the temperature oxygen molecules can be trapped as micro-bubbles [1,7] in which  $\text{O}_3$  can then be produced, as seen in the surfaces of a number of icy satellites [16].

Although the decomposition and sputtering of ice have dominated the discussion of radiation effects for some time, the incident radiation can drive other interesting chemistry. For instance, radiation can also drive-off hydrogen from ammonia, methane, and hydrogen sulfide trapped in a surface [9], hydrocarbons and organics are degraded [10], and carbonates and sulfates can be formed and destroyed in a quasi-steady state [11].

**Discussion:** The above effects will be reviewed for the icy bodies in the outer solar system. Particular emphasis will be on recent analysis of Cassini data for the rings and the icy satellites and on evidence for such processing from a recent analysis of the Galileo UVS data will be described [4].

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