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Radiation processes at Enceladus, Ganymede and other icy satellites

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We will present results from laboratory studies on the radiation effects on ammonia–water mixtures pertaining to the environment of Saturn's icy moon Enceladus. We show that ion irradiation destroys ammonia efficiently, and produces N_2 that could be the source of N^+ that has been detected in the exosphere. Warming the irradiated mixtures we observe outbursts of water and ice grains at temperatures much lower than those needed for sublimation of water ice. These radiation processes may explain the plume of water vapor and grains observed by Cassini at Enceladus.

In addition, we will present experimental results showing the production of ozone from pure water ice by ion irradiation. Simulating conditions on the icy satellites of the outer solar system, we condensed water *simultaneously* with irradiation, which enhanced the saturation ozone concentration by a factor of $\sim$40 to $\sim$3%. The enhancement is attributed to the buildup of the O_2 radiolysis product, which is prevented from diffusing out of the ice by water condensation on the ice surface. Ozone is produced between 60 and 150 K over a wide range of condensation rates, showing that O_3 and high concentrations of trapped O_2 can be formed on different icy environments. We will apply the laboratory results to the icy satellites of Jupiter and Saturn.