Ice Photochemistry

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The surfaces of astronomic objects are subjected to continuous irradiation by solar and interstellar photons. Modification of mass transfer/evolution and chemical composition in the frozen surfaces are thus expected to occur. The study of photolysis effects in ices is important in order to improve our understanding of the surface evolution of the planetary icy satellites and rings, comets, interstellar medium and grains, and dense molecular clouds. Therefore, we need laboratory simulation studies of photoprocessing of realistic cosmic ice analogs. We have studied ice photochemistry and provided photolysis data in the UV and EUV regions for several important cosmic ice systems. In this work we report our experimental results on the measurements of initial destruction yields of parent ice molecules and the initial production yields of chemical species produced through EUV photolysis of N_2+CH_4 (1:1), H_2O+CH_4+NH_3 (1:1:1), and CO+CH_4+NH_3 (1:1:1) ice systems at 16 K. An intense synchrotron radiation source at the National Synchrotron Radiation Research Center (NSRRC) has been used to provide the required photons while a FTIR spectrometer system has been utilized to measure the absorbances of the features of photolyzed products. We have identified HCN, OCN^-, CH_2N_2, CN^- anions, and $HCOCH_3$ in the ice systems. The initial production yields of a given species are found to depend on ice systems. The results will be discussed in detailed.

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