

EUV Photolysis of Mixed Ices Containing CO, H₂O, NH₃, and CH₄

C. Y. ROBERT WU¹, D. L. JUDGE¹, B.-M. CHENG²

¹*University of Southern California*

²*National Synchrotron Radiation Research Center*

We report our experimental results on the spectral identification of IR absorption features produced through photon-induced chemical reactions in the cometary-type ices and icy satellites of planetary systems. Specifically, we have carried out EUV-VUV photolysis of H₂O+CH₄+NH₃ (1:1:1), CO+CH₄+NH₃ (1:1:1), and H₂O+CO+NH₃ (1:1:1) mixed ice systems at 10 K. One of the important questions is whether or not the HCN, XCN, CN-, OCN-, and CH₂N₂ are produced through EUV and/or UV photolysis of ices. The common products observed in the present study are CO₂, HCO, and H₂CO. Light hydrocarbons are identified in the photolysis of the H₂O+CH₄+NH₃ (1:1:1) and CO+CH₄+NH₃ (1:1:1) icy systems while the broad XCN feature at 2160 cm⁻¹ is observed in the photolyzed mixed ices of H₂O+CH₄+NH₃ (1:1:1) and H₂O+CO+NH₃ (1:1:1). However, the sharp feature at 2090 cm⁻¹ for HCN and at 2099 cm⁻¹ for the CH₂N₂ are observed only in the photolysis of the CO+CH₄+NH₃ (1:1:1) ices at 30.4 nm and 58.4 nm. Furthermore, we have also tentatively assigned two other features at 2070 cm⁻¹ for CN- and 2026 cm⁻¹ for HCCO radical in this ice sample. The experimental results, the production yields of the photon-induced reaction products, the destruction yields of the parent icy molecules, and the possible photochemistry and reaction mechanisms of ices will be presented and discussed.