

Color Changes in Ices Due to Irradiation by Ultraviolet and X-Ray Photons

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The photometric colors of various solar system objects may depend on not only the composition, but also the processing history for each body. Whether significant color differences between objects can be explained by irradiation has not been investigated thoroughly in a lab environment. The time scale of any observed changes is also of interest, specifically with regards to whether changes are continuous and gradual or more sudden and dramatic.

We will present results from a new instrument constructed in our lab. This instrument allows irradiation of ice films with ions, X-rays or UV photons. The ices irradiated will be CO_2 and $\text{CO}_2/\text{H}_2\text{O}$ mixtures, which can be grown at temperatures down to 10 K. Analysis will be done with visible photometry and IR spectroscopy using a Nicolet FTIR system. Gas-phase mass spectrometry and X-ray Photoelectron Spectroscopy results will also be presented. The convoluted spectra of visible colors over standard astronomical filter ranges will be correlated with ice temperature and irradiation dosage. The results will be compared with observational data to determine if the laboratory experiments can be a useful tool in the arrival at a model for observed color changes in the solar system.