NUCLEOBASES AND OTHER PREBIOTIC SPECIES FROM THE UV IRRADIATION OF PYRIMIDINE IN ASTROPHYSICAL ICES.
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**Introduction:** Nucleobases are aromatic N-heterocycles that constitute the informational subunits of DNA and RNA, and are divided into two families: pyrimidine bases (uracil, cytosine, and thymine) and purine bases (adenine and guanine). Nucleobases have been detected in meteorites \([1,2]\) and their extraterrestrial origin confirmed by isotope measurement \([3]\). Although no N-heterocycles have been individually identified in the ISM \([4,5]\), the \(6.2\-\mu m\) interstellar emission feature seen towards many astronomical objects suggests a population of such molecules is likely present \([6]\). We report on a study of the formation of pyrimidine-based molecules, including nucleobases and other species of prebiotic interest, from the ultraviolet (UV) irradiation of pyrimidine in low temperature ices containing \(\text{H}_2\text{O}, \text{NH}_3, \text{CH}_3\text{OH},\) and \(\text{CH}_4\), to simulate the astrophysical conditions under which prebiotic species may be formed in the interstellar medium, protosolar disk, and icy bodies in the Solar System.

**Experimental:** Gas mixtures were prepared in a glass mixing line (background pressure \(\sim10^4-10^5\) mbar; relative proportions between components were determined by their partial pressures). Gas mixtures were then deposited on an Al foil attached to a 15-20 K cold finger and simultaneously irradiated with an \(\text{H}_2\) lamp emitting UV photons (Lyman \(^\alpha\) and a continuum centered around 160 nm). After irradiation samples are warmed to room temperature, at which time any remaining residues are recovered to be analyzed with liquid and gas chromatographies.

**Results:** These experiments showed that the UV irradiation of pyrimidine mixed in these ices at low temperature leads to the formation of several photo-products derived from pyrimidine, including the nucleobases uracil \([7,8]\) and cytosine \([8]\), as well as their precursors 4(3H)-pyrimidone and 4-aminopyrimidine \([7,8]\). Theoretical quantum calculations on the formation of 4(3H)-pyrimidone and uracil from the irradiation of pyrimidine in pure \(\text{H}_2\text{O}\) ices are in agreement with their experimental formation pathways \([9]\). In those residues, other species of prebiotic interest such as urea and the amino acids glycine and alanine are also be identified \([8]\). Pyrimidine derivatives containing \(\text{CH}_3\) groups, including the nucleobase thymine, are also seen, but are made with much lower efficiencies \([10]\), perhaps explaining why this nucleobase has yet to be identified in meteorites.