MOLECULAR CONTENT OF THE HELIX NEBULA

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Multiple transitions of H_2CO, HCO^+, and CO were detected at nine positions across the planetary nebula NGC 7293, the Helix Nebula, using the 12m telescope and the Submillimeter Telescope (SMT) of the Arizona Radio Observatory (ARO). A complete map of the nebula has also been made in the J = 1 $\rightarrow$ 0 transition of HCO^+ at 89 GHz. HCO^+ emission was found to be widespread across the Helix, and is coincident with the ionized gas as traced in optical images. A complex velocity structure is apparent in the HCO^+ spectra, as well. The CO and H_2CO data (J = 1 $\rightarrow$ 0, 2 $\rightarrow$ 1, and 3 $\rightarrow$ 2) were modeled using a radiative transfer code at the nine positions observed in the Helix. Kinetic temperatures were typically found to be in the range $T_{kin} \approx$ 20 - 45 K and the gas density on the order of $n(H_2) \approx 10^5$ cm^{-3} at these positions. The column densities for CO, H_2CO, and HCO^+ were determined to be 10^{15}, 10^{12}, and 10^{11} cm^{-2} respectively, corresponding to fractional abundances, relative to H_2, of f $\approx 10^{-4}$, 10^{-7}, and 10^{-8}. The extended distribution of HCO^+ suggests that dense clumps may exist throughout the nebula. Hence, the chemistry of evolved planetary nebulae may be more active than previously thought.