COMPACT AMMONIA SOURCES TOWARD THE G10.5+0.00 H II REGION COMPLEX

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We present the characteristics of three distinct compact molecular sources that we detected with the VLA, in the (2,2) and (3,3) inversion transition lines of NH_3, toward the $\ell = 10.5°$, $b = 0.0°$ galactic direction. The densest and hottest cloud is associated with the G10.47+0.03 cluster of ultracompact H II regions. It exhibits a core-halo structure, with a core of $\sim$ 0.08 pc in size surrounded by an envelope of $\sim$ 0.25 pc in diameter. The rotational temperature of the ammonia gas rises from $\sim$ 25 K in the outer parts of the halo to $\sim$ 75 K at the center of the core. The ammonia column density rises from $\sim 4 \times 10^{17}$ cm^{-2} in the envelope region to $\sim 4 \times 10^{18}$ cm^{-2} in the central position. Assuming an [H_2/NH_3] abundance ratio of 10^6, we derive H_2 densities of 6×10^5 cm^{-3} for the halo and 1×10^7 cm^{-3} for the core, and a total molecular mass of $\sim$ 500 $M_\odot$. The NH_3 emission from the core region is remarkably broad in velocity; the linewidths of the main lines being $\sim$ 12 km s^{-1}. The observed velocity structure of the ammonia emission indicates that the halo is slowly rotating, with an angular velocity of 9.5 $\pm$ 1.1 km s^{-1} pc^{-1}, while the gas in the core is undergoing rapid motions.

A second cloud, having an angular size of $\sim 13''$ and a linewidth of 3.5 km s^{-1}, is found toward the G10.46+0.03 complex region of ionized gas. It has a rotational temperature of 48 $\pm$ 6 K and a NH_3 column density of $\sim 1 \times 10^{16}$ cm^{-2}. The velocity structure of the ammonia emission suggests that this cloud is probably expanding, with a velocity of $\sim$ 2 km s^{-1}. The third cloud, at $\ell = 10.48°$, $b = 0.03°$, has a size of $\sim 9''$, a linewidth of 3.5 km s^{-1}, and is not associated with detectable radio continuum emission. It may represent a molecular core in the earliest stage of gravitational collapse prior to the formation of a massive star.

THE ABUNDANCE OF CH$^+$ IN TRANSLUCENT MOLECULAR CLOUDS: TESTING SHOCK MODELS

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Observations of interstellar absorption lines of CH$^+$ in the (0,0) and (1,0) bands of the $A^1\Pi - X^1\Sigma^+$ system are presented for 17 stars with reddenings up to $E_{B-V} \approx 1.5$ mag. Complementary data on interstellar CH in the (0,0) bands of the $A^2\Delta - X^2\Pi$ and $B^2\Sigma^- - X^2\Pi$ systems and C_2 in the $A^1\Pi_u - X^1\Sigma_g^+$ system have been obtained as well. The derived CH$^+$ column densities continue to increase with total column density, and values up to 10^{14} cm^{-2} are reported for highly-reddened lines of sight. In most cases, the CH$^+$ and CH absorptions are dominated by a single strong component, with weaker features displaced by a few km s^{-1}. No significant velocity difference is found between CH$^+$ and neutral species such as CH and CN for this sample of randomly oriented lines of sight. The CH$^+$ abundance shows an inverse correlation with density in the cloud as derived from the measured C_2 excitation. For the two clouds with the largest density, HD 62542 and HD 94413, no CH$^+$ absorption is found with CH$^+$/CH<0.03 and 0.14 respectively. The CH$^+$ findings do not support a single-shock origin for the formation of the ion. Alternative formation mechanisms are considered such as hot atom or molecule reactions or reactions in warm turbulent boundary layers, but detailed predictions must await a better physical description of the heating processes and turbulence. Serendipitous observations of Ca I and Ca II lines suggest electron densities in the clouds similar to those derived from the CN rotational excitation.