AMMONIA OBSERVATIONS OF THE MOLECULAR CLOUD NEAR S106

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The region surrounding the optical nebula S106 has been mapped in the J=1,K=1 (1,1) transition of ammonia with a 2.2 arc min. beam. The source is observed as two components with the HII region sandwiched between them. It is likely that the asymmetry of the optical nebula is produced by preferential escape of u.v. radiation from the central source of excitation in directions of reduced density within the molecular condensation. Observations of the (1,1) and (2,2) transitions yield a kinetic temperature for the NH_3 molecules in the range 18-22K. There is evidence for "clumpiness" in the distribution of matter.

Optically the Sharpless HII region S106 has a bipolar appearance, its two halves being separated by a dust cloud. Behind the central dust lies a powerful infra-red source which appears to be heated by a single star (Sibille et al., 1975, Eiroa et al., 1979). Eiroa et al. estimate its distance at 500 pc. HII continuum maps (e.g., Israel and Felli, 1978) reveal an intricate structure for the ionised material. Sibille et al. suggested that the appearance of the nebula arises from its preferential expansion in directions of reduced density perpendicular to the plane of a disc. General models for the radiation transfer in this situation have been developed by Kandel and Sibille (1978), and for the hydrodynamics by Bodenheimer et al. (1979). However, the CO structure in the surrounding 20×25 arc min. molecular cloud appears, if anything, to be extended along the nebulosity (Lucas et al., 1978).

Using the SRC Appleton Laboratory 25m telescope ($\eta_B \approx 0.37$) we have mapped the (1,1) transition of interstellar ammonia at 23.7 GHz in S106 (see figure 1). A tempting interpretation of our map is indeed that of a thick disc- or ring-like structure, in slow rotation, seen nearly edge on. The central 'saddle' could result from absorption of radiation from the background HII region by the ammonia molecules. Observations of the hyperfine ratios of the (1,1) transition at the emission peak allow an estimate of its optical depth $\tau \sim 2$ and, with an observation of the (2,2) transition, the rotation temperature $T_{21} \sim 18K$. H_2CO observations (Lucas et al., 1978) have yielded an estimate of the

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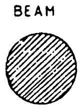

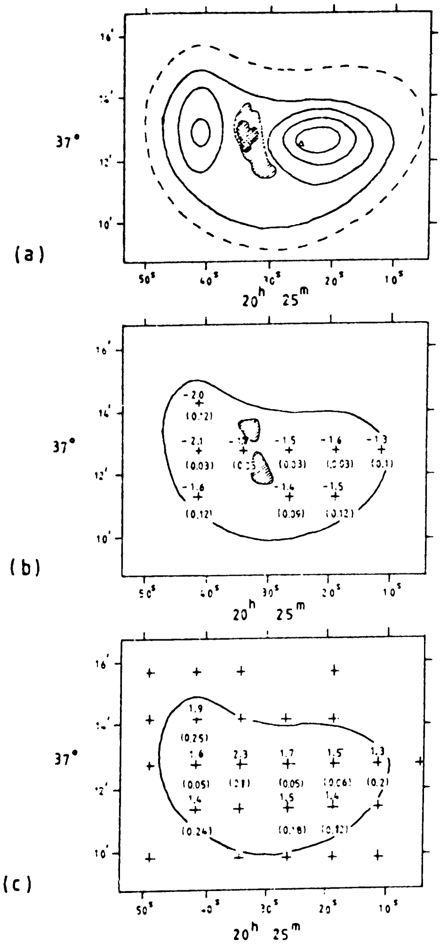

Figure 1.
(a) Map of observed peak antenna temperature for NH3(1,1) line in S106 observed with 2.2 arc min. and 0.43 km s^{-1} resolution. Contour interval 0.1K. Dashed contour 0.1K. Superimposed is a sketch of the HII region derived from the 5 GHz continuum map of Israel and Felli (1978). The triangle marks the position of the H_2O maser (Cesarsky et al., 1978).

(b) Observed LSR velocity (km s^{-1}) as a function of position in S106. Superimposed is a sketch of the optical emission derived from a POSS print.

(c) Line widths (FWHM in km s^{-1}) as a function of position across the source. The crosses mark positions observed. The noise is not constant at all positions but it is at worst 0.08K r.m.s. in a single channel (width 0.43 km s^{-1}).

In figures (b) and (c) the 0.2K contour is shown, and estimates of the 1σ errors are given in brackets.

molecular hydrogen density $n_{H_2} \sim 5.10^4$ cm^{-3}. Comparing our apparent excitation temperature (knowing τ) with that predicted from n_{H_2} suggests the existence of clumping within the source, with filling factor ~0.25.

REFERENCES

Bodenheimer, P., Tenorio-Tagle, G., and Yorke, H.W.: 1979, Astrophys J. 233, pp. 85-96.

Cesarsky, C.J., Cesarsky, D.A., Churchwell, E., and Lequeux, J.: 1978, Astron. Astrophys. 68, pp. 33-39.

Eiroa, C., Elsässer, H., and Lahulla, J.F.: 1979, Astron. Astrophys. 74, pp. 89-92.

Kandel, R.S., and Sibille, F.: 1978, Astron. Astrophys., 68, pp. 217-228.

Israel, F.P., and Felli, M.: 1978, Astron. Astrophys. 63, pp. 325-334.

Lucas, R., Le Squéren, A.M., Kazès, I., and Encrenaz, P.J.: 1978, Astron. Astrophys. 66, pp. 155-160.

Sibille, F., Bergeat, J., Lunel, M., and Kandel, R.: 1975, Astron. Astrophys. 40, pp. 441-446.