THE BRIGHTNESS DISTRIBUTION OF ORI A AT 4.1 mm IN THE 1_{01}–0_{00} LINE OF PARA-FORMALDEHYDE AND IN THE CONTINUUM

NORIO KAIFU and TETSUO IGUCH
University of Tokyo, Tokyo, Japan
and
MASAKI MORIMOTO
Tokyo Astronomical Observatory, Tokyo, Japan

Abstract. The 4.1-mm continuum emission shows a peak at the Trapezium stars and an extension to the west, where the molecular and IR sources are. The 4-mm line of para-formaldehyde has a similar distribution to that of the 3-mm line of HCN and extends more to the north than the 2-mm line of ortho-formaldehyde. This probably means a lower temperature in the northern part of the cloud.

Figure 1 shows a continuum map of Ori A at 4.1 mm. A contour unit corresponds to 1.6 K in brightness temperature. The half power beam width is 2.4′. The emission peak is found to coincide with the Trapezium stars, but there is an extension of emission in the western side where the molecular and IR sources are situated.

The 1_{01}–0_{00} line of formaldehyde (72.8381 GHz) was observed at ten positions over the molecular cloud, and the line was detected in all positions. In Figure 2 these observed points are shown as crosses surrounded by squares superimposed on the continuum map (dotted contours). Also superimposed in solid controus is the distribution of 2 mm line emission of orthoformaldehyde, observed by Thaddeus *et al.* (1971). Figure 3 shows the line profiles on the corresponding positions shown in Figure 2. The 4 mm line is found to be more extended to the north than the 2 mm line and has a very similar distribution to that of the 3 mm line of HCN (Snyder and Buhl, 1971).

Thaddeus *et al.* also observed the 2_{02}–1_{01} line of para-formaldehyde at points 2, 1 and 4 with antenna temperatures of 1.9, 1.5 and 0.7 K, respectively, and found the northern point (point 4) exhibiting much weaker emission than the southern points. For the 4 mm line, however, the emission continues to be strong to point 5 and shows very different intensity ratios across the source.

Either low density or low temperature in the northern part of the cloud can explain the difference, but we regard the latter as being more likely. Density variations alone can explain the intensity ratios among the formaldehyde and HCN lines but cannot explain the brightness temperature of the CO lines unless the temperature should be allowed to vary.

A fuller account of this work will be published in the *Astrophysical Journal.*

F. J. Kerr and S. C. Simonson, III (eds.), Galactic Radio Astronomy, 233–237.

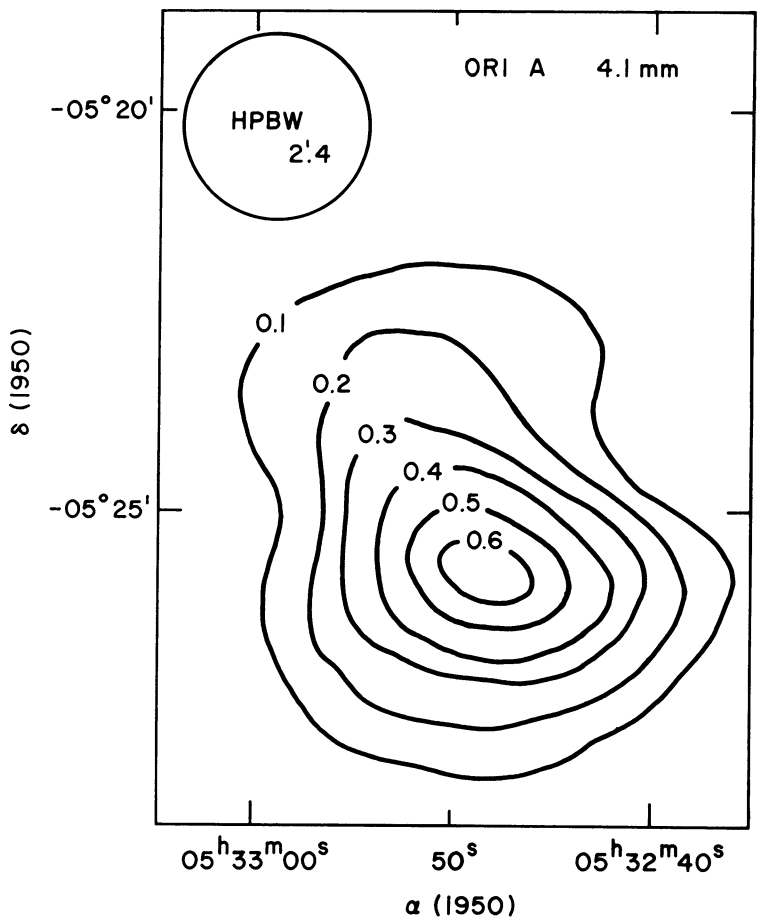

Fig. 1. Contour map of Ori A at 4.1 mm. A contour unit corresponds to 1.6 K in brightness temperature.

https://doi.org/10.1017/S0074180900026498 Published online by Cambridge University Press

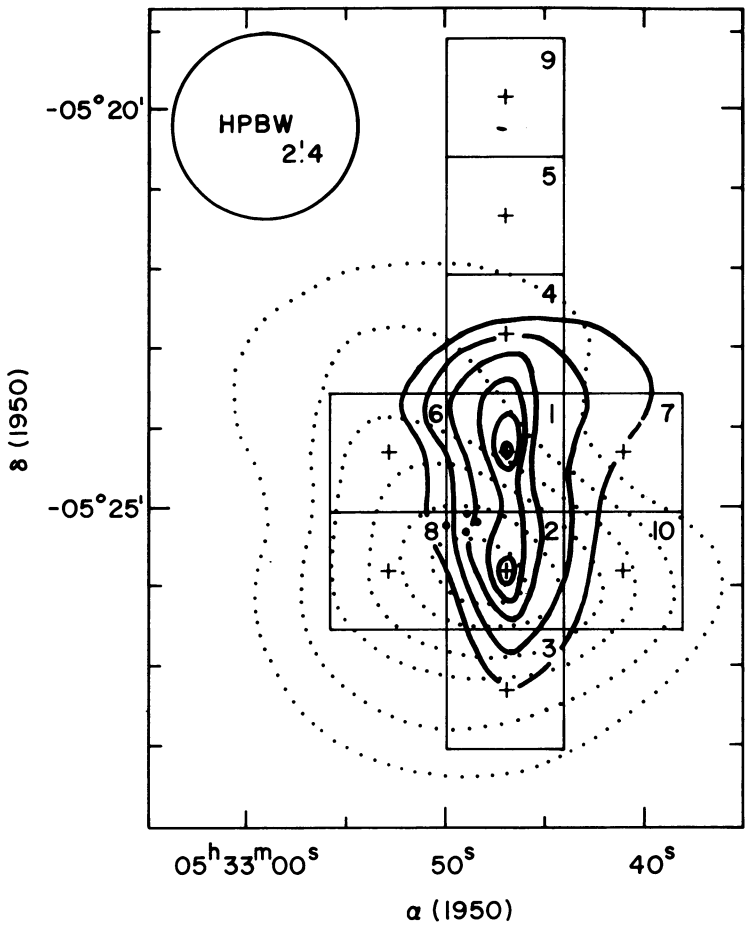

Fig. 2. Observed points for 1_{01}–0_{00} line of para-formaldehyde. Points are shown as crosses surrounded by squares superimposed on the continuum map (in dotted contours). Solid contours represent the distribution of the 2 mm line of ortho-formaldehyde from Thaddeus *et al.*

https://doi.org/10.1017/S0074180900026498 Published online by Cambridge University Press

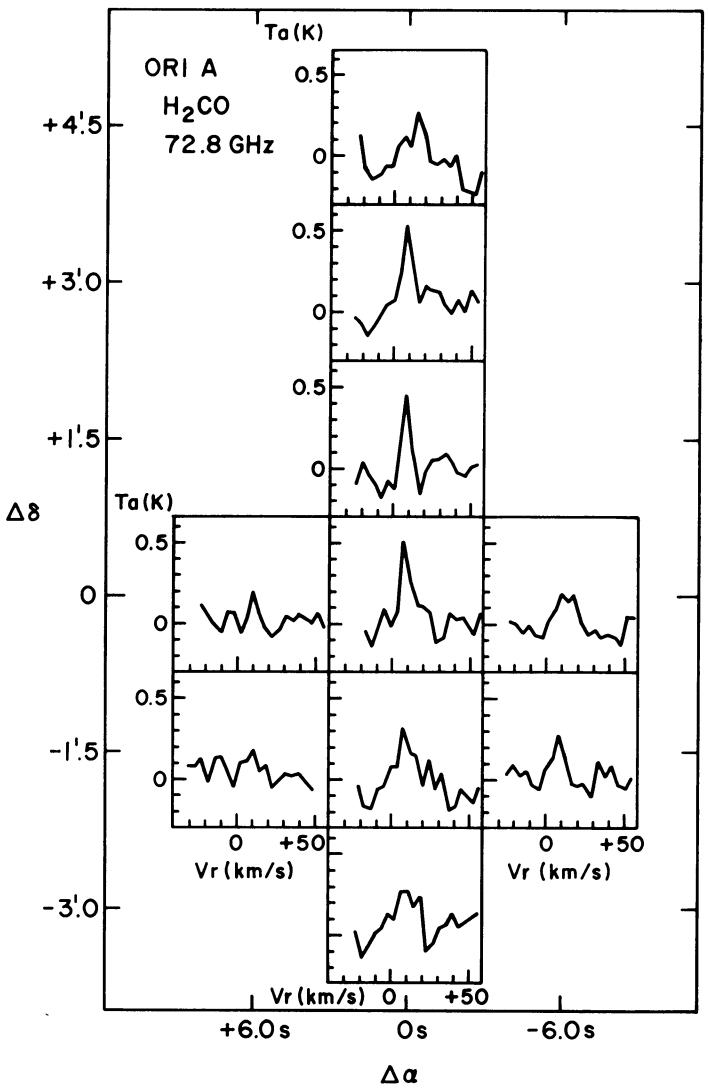

Fig. 3. Profiles of 1_{01}–0_{00} line of para-formaldehyde at the corresponding points.

https://doi.org/10.1017/S0074180900026498 Published online by Cambridge University Press

References

Snyder, L. E. and Buhl, D.: 1971, *Astrophys. J. Letters* **163**, L47.
Thaddeus, P., Wilson, R. W., Kunter, M., Penzias, A. A., and Jefferts, K. B.: 1971, *Astrophys. J. Letters* **168**, L59.

Norio Kaifu
Tetsuo Iguch
Dept. of Astronomy,
University of Tokyo,
Tokyo, Japan

Masaki Morimoto
Tokyo Astronomical Observatory,
Mitaka, Tokyo, Japan

DISCUSSION

Robinson: You state that you need very high densities and low temperatures. What are the numbers?

Morimoto: Particle densities I don't know. The temperature is exactly what you see at the CO line, that is, something like 28 K.

Zuckerman: The 4-mm continuum map of Orion that you showed peaked up at the position of the Trapezium. This is also true at 3 mm as described in a recent paper in the *Astrophysical Journal*. However, recent 1-mm measurements at Cal Tech with the 200-in. telescope show that the peak is at the Kleinmann-Low nebula, and the shape of the continuum contours agrees very well with the shape of the background molecular cloud as deduced from 2-cm H_2CO emission profiles. Thus, at wavelengths $\lesssim 1$ mm it appears that the bulk of the continuum radiation originates in the molecular cloud rather than the H II region whereas at wavelengths $\gtrsim 3$ mm the situation is reversed. It should be interesting to obtain an ~ 2 mm continuum map of Orion.

Morimoto: Our 4-mm contour shows a skirt stretched to and covering over the IR sources; it does not show much in the total flux.