EFFECTS OF THE UV RADIATION ON THE SURROUNDING GAS AND DUST

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Abstract. Two molecular clouds associated with well known reflection nebulosities have been studied in order to stablish the effects of the UV radiation on the surrounding gas and dust. Observations of the J=2→1 and J=1→0 transitions of CO and ^{13}CO have been carried out with the telescopes POM 1 and POM 2 towards the clouds associated with LKHα 198 and HD200775. The IRAS maps at 12, 25, 60 and 100 μm towards these globules have been also examined.

Fig. 1 shows the contours of the integrated intensity emission of the J=2→1 transition of CO, and of the 100 μm flux density superposed on the B POSS plate of LKHα 198. CO emission is not detected towards the reflection nebulosity and presents a sharp border this direction. Comparing the J=1→0 and J=2→1 transition of CO and ^{13}CO we found that the excitation temperature of the gas increases toward the reflection nebula. A higher kinetic temperature and a H_2 density of at least 5 10^3 cm^{-3} are required to explain ^{13}CO ratios. These densities are larger than the mean hydrogen density inside the cloud (500 - 10^3 cm^{-3}). The lack of CO emission toward the reflection nebulosity is not associated with a minimum in infrared emission. In fact, the infrared emission at 100 μm peaks between the star and the reflection nebulosity. Higher dust temperatures are also found towards this position where the dust seems to be heated by LKHα 198 and by the UV radiation illuminating the reflection nebulosity (see Fig. 1). Higher dust and gas kinetic temperatures towards the reflection nebulosity suggest that the lack of CO emission is due to be photodissociated the CO and ^{13}CO by the UV radiation.

Fig. 2 shows the B POSS plate of the nebulosity illuminated by HD200775 (NGC7023). The contours of the J=2→1 transition of ^{13}CO and of the 100 μm flux have been superposed on it. Note that the ^{13}CO contours delineate the regions with high visual extinction and that the star is actually located within a region of low extinction. However, the 100 μm flux density peaks at the position of the star because of the heating of the dust by the star. High angular resolution observations of the (1,1) and (2,2) lines of NH_3 (40") reveals that the gas is also being heated by the star and that ammonia is photodissociated in the regions closer to it (Fuente et al. 1990) . The ammonia clumps have also H_2 densities rather high ($\approx 10^4$ cm^{-3}.)

In summary, sharp boundaries containing small fragments with high density seems to appear in the interface between reflection nebulosities and molecular clouds, just adjacent to the photodissociation region produced by the UV radiation. Gas and dust with high excitation conditions are observed at these edges.

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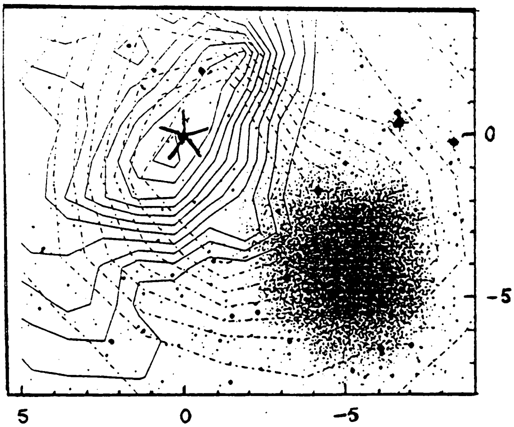

Fig. 1. POSS B plate of the reflection nebulosity located to the southwest of LKHα 198. The contours of the integrated intensity map of the J=2→1 transition of CO (solid line) and of the 100μm flux density map are superposed (dashed line). CO contours start with 2 K kms^{-1} and increase by steps of 2 K kms^{-1}. 100μm contours are 30, 40, 50, 60, 70, 80, 90, 100 MJy sr^{-1}.

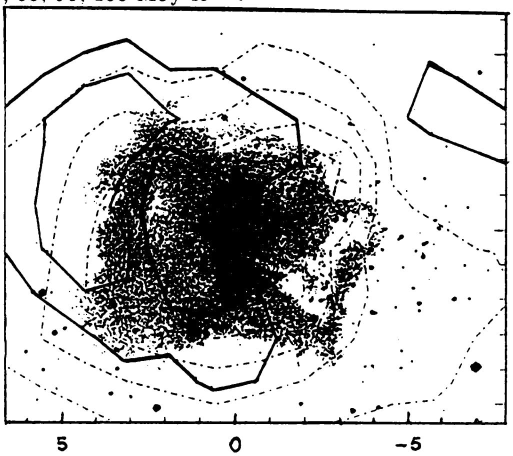

Fig. 2. POSS B plate of the reflection nebulosity illuminated by HD200775 (NGC7023). The map of the integrated intensity emission of the J=2→1 transition of ^{13}CO (solid line) and of the flux density at 100μm are superposed (dashed line). ^{13}CO contours are 6, 8 K kms^{-1} and those of 100μm are 100, 200, 300, 400, 500 MJy sr^{-1}.

References

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