

CO OBSERVATIONS of NGC 604

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NGC 604 is by far the brightest HII nebula in the nearby spiral galaxy M33. The gas in this region has about the same metallicity as the gas in the Large Magellanic Cloud (Diaz et al. 1987). In this respect the physical conditions in this nebula may resemble those in 30 Doradus. A one arcmin field centred on the eastern part of the ionized nebula has been observed in CO(2-1) and CO(1-0) using the IRAM 30m antenna and the OVRO interferometer. In CO(1-0) the IRAM and the OVRO data have been combined to produce high resolution maps including the emission at low spatial frequencies. A CO(1-0) map at 7" resolution (about 25 pc for the distance of M33) has been obtained; maps in both transitions at 12" resolution have also been produced. The distribution of total line emission (see Figure 1) is characterized by two prominent clouds plus diffuse emission. These clouds are resolved with typical virial masses of a few $10^5 M_{\odot}$. The peak brightness is 8K and the velocity width $\Delta V_{1/2}$ 8 km s⁻¹. The CO(2-1)/CO(1-0) brightness temperature ratio is 0.7. Based on LVG models (e.g. Castet et al., 1990) we conclude that the density must be about or at least 1000 cm⁻³. The virial mass to CO luminosity ratio for these clouds is identical to the one for Galactic GMCs (Solomon et al., 1987). These two molecular clouds are located on the edge of an HI concentration along the HI ridge of a M33 spiral arm feature. From the comparison of sensitive radio continuum VLA maps and an H α map (Viallefond et al., in preparation) we observe the counterpart of these gas concentrations in the distribution of the extinction; we conclude that one of the two molecular clouds, the brightest on the CO map in Figure 1, must be located inside the ionized halo of NGC 604; the position of this cloud also coincides with the peak of brightness on the near infrared map for the H₂ lines obtained by Israel et al. (1990); part of the HI may be photodissociated molecular gas. We suggest that the intense radiation field in NGC 604 compensates the metallicity deficiency to give a N_{H_2}/W_{CO} ratio similar to the Galactic one. The diffuse emission is detected over the entire field. The velocity fields as observed with the CO, the HI (data from Deul and van der Hulst, 1988), and the H α (e.g. Hippelein and Fried, 1984) lines are very similar, the main characteristic is an East-West gradient unrelated with

the general rotation of M33. High velocity molecular gas is also detected as a faint blue shifted wing of about 25 km s^{-1} on the global CO profile; its spatial distribution is diffuse. Finally double peaked profiles are observed in the vicinity of a large optical and radio continuum loop known to be associated with the presence of a Wolf-Rayet star. Obviously the kinematics is perturbed by the recent vigorous formation of massive stars in this unusually bright star forming region of M33.

References:

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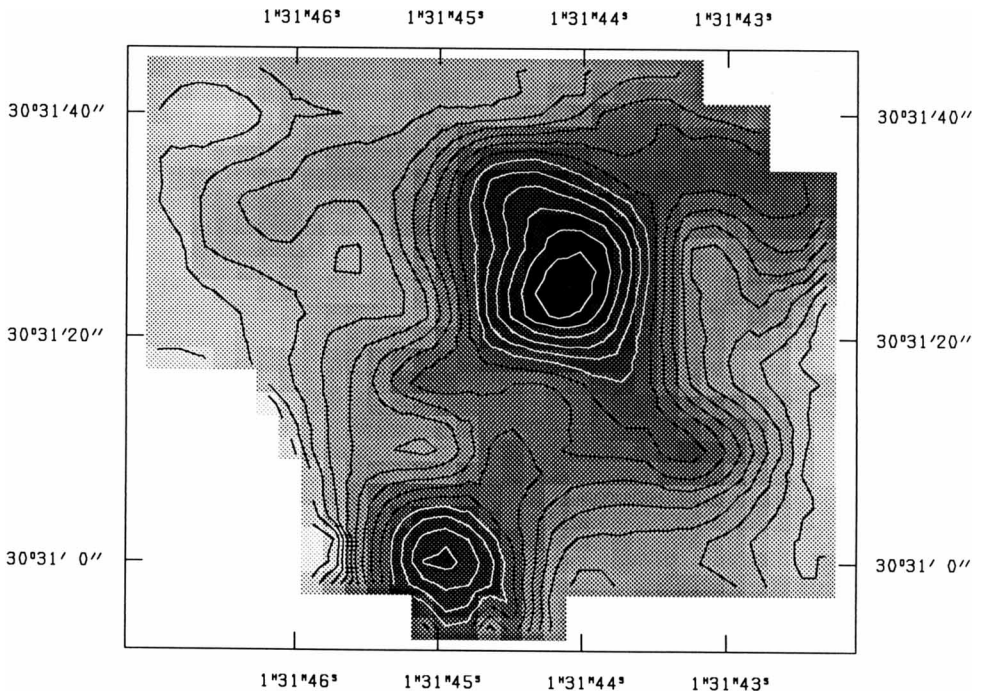


Figure 1: Distribution of the total emission in the CO(2-1) line. The resolution is $12''$ HPBW; contour levels are from 1 to 15 K km s^{-1} by step of 1 K km s^{-1} (T_{r}^* temperature scale).