MOLECULAR CLOUD PROPERTIES IN THE BARRED GALAXY NGC 7479

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Bars are considered to be an important fueling mechanism for nuclear starburst activity, and are believed to be a dynamical result of gravitational interactions and merging. Furthermore, in a recent study, Das & Jog (1995) suggest that the dynamical impact of a bar will also have important consequences for cloud properties in the bar and nucleus. NGC 7479 is a barred galaxy with an unusually long and strong bar. At a distance of D=32 Mpc the bar length is $\approx$10 kpc. We selected NGC 7479 for a study of cloud properties in bars because of its proximity and because molecular gas is distributed along the whole length of the bar (e.g. Quillen *et al.* 1995).

We have obtained high resolution maps of CO, ^{13}CO and HCN 1–0 of the inner 1′ of NGC 7479 using the Caltech six-element OVRO array. The naturally weighted synthesized beam sizes are $4.''5\times4.''3$ for CO, $5.''7\times4.''3$ for ^{13}CO and $7''\times5''$ for HCN. At D=32 Mpc, 1″ is 155 pc.

The CO emission extends over the whole length of the bar. The distribution has a central concentration with a FWHM size of $7''.5\times2''.6$ (1200×400 pc at D=32 Mpc). There is no sign of a "twin peaks" structure (as coined by Kenney *et al.* 1992) perpendicular to the bar, perhaps suggesting that there are no x_2 antibar orbits. The line intensity ratio CO/^{13}CO 1–0 varies over the bar. The CO/^{13}CO ratio at the bar ends, 6-10, is typical for cold molecular gas in quiescent galactic disks. At bar radius $r = 7''-20''$ ^{13}CO is

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 251-252.

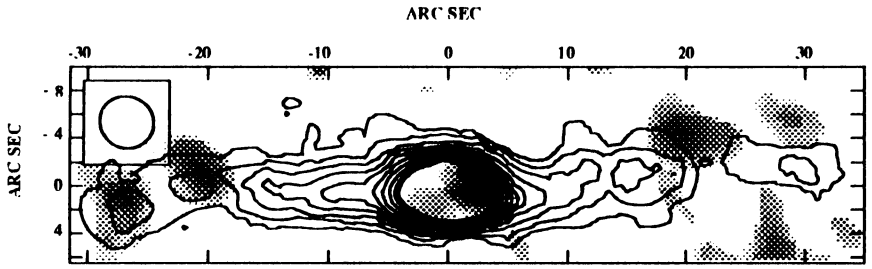

Figure 1. The ^{13}CO 1–0 integrated intensity map (in grayscale) overlaid (peak flux 1.7 Jy beam^{-1}kms^{-1}) on the CO 1–0 integrated intensity map (contour levels are 5%, 10% ... 50% of the peak flux, which is 77 Jy beam^{-1}kms^{-1}). The figure has been rotated -90°, north is to the right.

not detected and the ratio is higher, $\gtrsim 20$. Although we detect ^{13}CO in the inner 10″, the ratio there is still high, 15-35. The ^{13}CO peak is offset from that of CO with 1.″5. HCN 1–0 emission is detected only in the nucleus, whith a CO/HCN 1-0 line ratio $\approx$ 11.

The high CO/^{13}CO ratio may mean that there is a large amount of diffuse molecular gas in the bar. This diffuse, intercloud medium (ICM) is probably made up of low density ($n \lesssim 10^3$ cm^{-3}), gravitationally unbound, molecular gas. For a given column density, N, the ^{13}CO 1–0 line emission from gravitationally unbound gas will be weaker than that from self-gravitating clouds, because the $N/\delta V$ is lower for the unbound gas. Hence, the ICM will be difficult to detect in the ^{13}CO 1–0 line.

Cloud disription due to the tidal field is one mechanism that could produce a diffuse ICM. As a bound cloud moves in a bar potential or elliptical orbit, the tidal field across it will vary in time. This produces both internal heating of the cloud and clump evaporation from the outer regions of the cloud (Das & Jog, 1995). The evaporated cloud mass will become part of the low density, molecular ICM. Another possible source of the ICM is off center cloud collisions leading to gas being sheared off the colliding clouds and forming trailing extensions in the interstellar medium (Hausman 1981).

In contrast to the bar region, the relative faintness of the ^{13}CO 1-0 line in the nucleus of NGC 7479 is likely to be an effect of high kinetic temperatures and densities.

References

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