LARGE SCALE DISSOCIATION OF MOLECULAR GAS AND STAR FORMATION IN M83

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Observations of the distribution of the CO-molecule in several prominent late-type galaxies indicate that the central H I depressions may very well be filled in with molecular gas. One such galaxy is M83 (NGC 5236) and, although the angular resolution of the CO-observations is insufficient to discern details on the scale of a spiral arm, it is known that CO is concentrated in the central regions within a radius of 1'. Furthermore, at a resolution of 50", the CO profile at the position of the nucleus is as bright in M83 as it is for example in NGC 6946, IC 346 and M51.

From recent H I observations with the VLA at a resolution of 10", and Hβ observations with TAURUS on the AAT at a resolution of ∿ 1.5", we can study the detailed relationship between dust lanes, H II complexes, and H I clouds. In one particular region of M83, no H I is found at the position of the dust lane. We suggest that the gas is molecular here, changing to the atomic state further downstream from the shock as a consequence of star formation.

The main results of this work are to be published in Nature (January 23, 1986).

CO OBSERVATIONS OF THE CENTRAL BAR OF M83

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ABSTRACT. CO observations of the nuclear region of the SABc galaxy M83 have been made with the 45-m telescope at NRO. A bar-like elongation of the CO emission along the optical bar and a velocity field which suggests noncircular motions are found. These results are consistent with predictions based on the theoretical model of barred spiral galaxies. The inflow and concentration of molecular gas in the nucleus of M83 may sup-

ply raw material which maintains a burst of star formation there.

To investigate the distribution and kinematics of the molecular gas of the nucleus of M83, we made CO (J = 1-0) line observations with the 45-m telescope of the Nobeyama Radio Observatory.

The observations were made in April and May 1985. The HPBW was 15" (270 pc at the distance of M83, 3.7 Mpc) and the mapped area was a 1' × 1' region around the nucleus. The center position of the map was chosen to be the optical center: $\alpha = 13^h34^m11^s.55$, $\delta = -29°36'42''.2$.

Figures 1 and 2 show contour maps of the integrated CO intensity and the CO peak velocity, respectively. The main results are:

(1) The distribution of the CO emission does not show a ring structure, which is predicted by many galaxy simulations (e.g. Tubbs 1982), but shows a concentration in the center of the galaxy.

(2) A bar-like elongation of the CO emission along the optical bar (PA = 45°) is found.

(3) The ridge of the CO emission is shifted from the major axis of the galaxy. Its extension seems to be along straight dust lanes on the bar.

(4) Velocity shifts of the CO gas from the circular rotation around the galaxy are seen across the ridge of the CO emission. The velocity shift is approximately 20 km s^{-1} on the galactic plane and its tendency is consistent with a gas flow into the nucleus of the galaxy.

(5) the overall feature of the integrated intensity is similar to those of the radio continuum and the Hα emission (Ondrechen 1985, de Vaucouleurs *et al.* 1983).

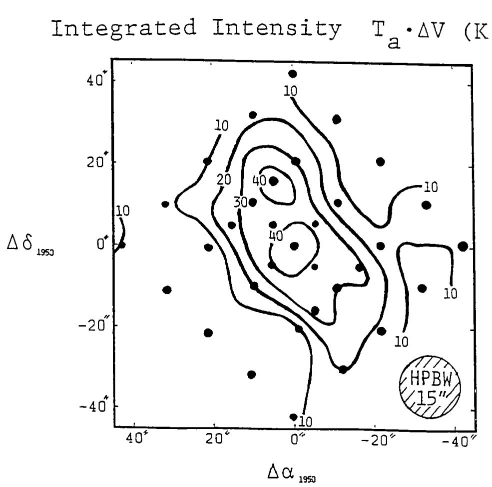

Fig. 1

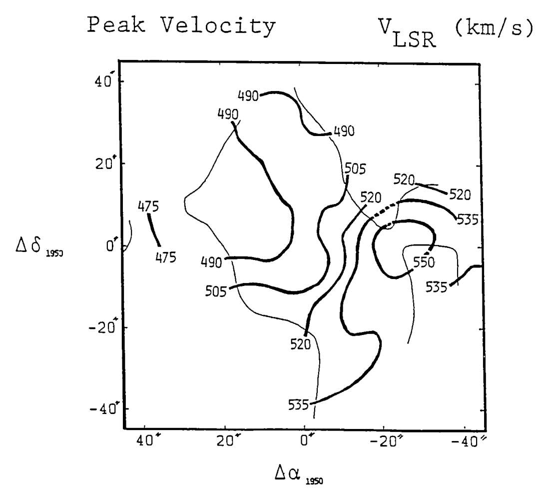

Fig. 2

The elongated distribution of the CO emission along the optical bar and the velocity shifts across the ridge of the CO emission both suggest that there exist shocked regions along the bar. Furthermore, the displacement of the CO ridge from the major axis implies that the shocked regions are associated with the straight dust lanes on the bar. The central peak of the CO emission may be due to the gas inflow along the optical bar. The inward flowing gas should supply the raw material for continuous nuclear star formation.

The distribution and kinematics of the CO emission are consistent with both the theoretical predictions (e.g. Sørensen *et al.* 1976, Roberts *et al.* 1979) and the Hα emission observations (Allen *et al.*1983).

Optical, infrared, UV, and X-ray observations suggest that the nucleus of M83 is the site of active star formation (Sérsic and Pastoriza 1965, Rieke 1976, Bohlin *et al.* 1983, Trinchieri *et al.* 1985). Similarities between the overall feature of the integrated CO intensity, that of the radio continuum, and that of the Hα emission suggest that "H II region-molecular cloud complexes" exist in the nuclear region of M83 and that the star formation is enhanced there.

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