CO OBSERVATIONS OF A REGION WITH STRONG POLARIZATION IN M31

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ABSTRACT. A region with strong radio polarization in the SW of M31 was observed in the ^{12}CO(1-0) line. The results are compared with the radio continuum, HI and Hα. The CO emission appears to be correlated with the total radio emission, but anticorrelated with the polarized intensity.

1. Observations

In order to investigate the possible effect of molecular clouds on the structure and strength of the magnetic field as traced by the polarized radio continuum emission a strongly polarized region in the SW of M31 was observed in the ^{12}CO(1-0) line with the IRAM 30-m dish on Pico Veleta (near Granada, Spain). High-resolution HI maps (Brinks and Shane, 1984) and an Hα-CCD picture obtained with the 1.2-m telescope on Calar Alto Observatory (Neininger and Beck, priv. comm.) of this region are also available. In CO 85 positions were observed along 3 lines (Figure 1), one along the spiral arm (I, 35 points) and two perpendicular to it (IIa and b, each 25 points). The points were spaced at 11" which is about half the HPBW of 23" at λ2.6 mm.

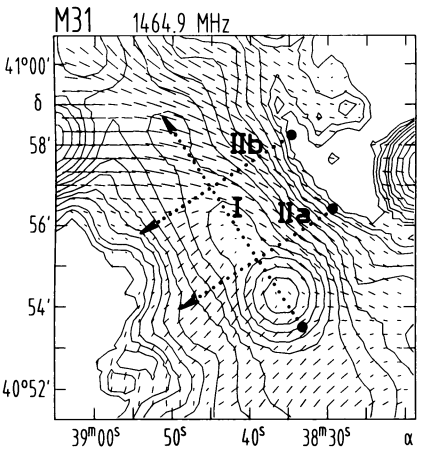

Fig. 1. Contour map of total radio continuum emission at λ20 cm and observed E-vectors of lengths proportional to polarized intensity (HPBW = 75"). The lines of points observed in CO are superimposed.

As can be seen in Figure 1 the lines of positions were chosen across areas of strongly varying polarization properties at λ20 cm (Loiseau et al., 1987). They also cross the OB association A66 (van den Bergh, 1964). Near the crossing point of I and IIb an Hα ring is situated associated with the HI hole no. 42 (Brinks and Bajaja, 1986).

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2. Results

In Figure 2 the integrated CO emission is shown, smoothed along the lines to the HPBW of 75" of the radio continuum data. Comparison of the various data yields the following conclusions: *1)* The coincidence of maxima in TP and CO indicates that the number of relativistic electrons and/or the strength of the magnetic field perpendicular to the line of sight are enhanced in the molecular clouds observed here. Although a global correlation between radio surface brightness and integrated CO emission has been reported for some nearby galaxies (Israel and Rowan-Robinson, 1984) a correlation on the scale of a few kpc is noted here for the first time. *2)* The anticorrelation between PI and CO shows that depolarization effects are enhanced in molecular clouds, possibly because of enhanced turbulence causing irregularities in the distribution of ionized gas and/or in the magnetic field structure. The strong gradients in PA near minima in PI also indicate variations in ionized gas content and/or magnetic field structure in the molecular clouds (see Berkhuijsen and Beck, this volume).

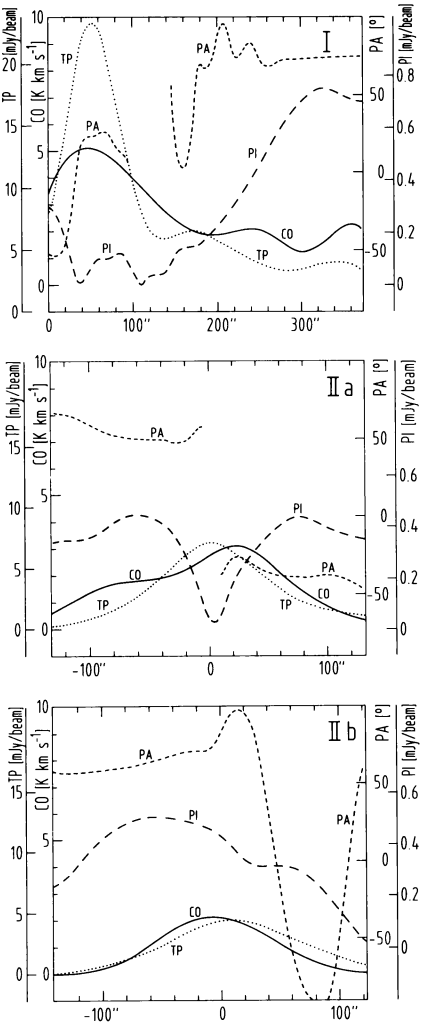

Fig. 2. Comparison of the integrated intensity of CO (HPBW = 75") with total power (TP), polarization intensity (PI) and polarization angle (PA) at λ20 cm.

The velocity of the CO (unsmoothed data, not shown) is very well correlated with that of one of the HI components, but the peak intensities are generally not at the same position.

CO is present around and within the Hα ring, but not systematically distributed. At a resolution of 75" the Hα ring has no noticeable effect on PA or PI.

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