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CS(3-2) in Nearby Starburst Galaxies M82 and NGC253

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Dense gas in molecular cloud cores is essential in researches of extragalactic star formation (e.g. Solomon, Downes, and Radford[1]). To determine the physical relations between star-forming regions and dense gas, we have observed CS (J=3→2) in starburst galaxies M 82 and NGC253. The $J = 3$ level of CS is 14.1 K and the critical density for excitation is 4×10^5 cm^{-3}.

Maps of the CS (J=3→2) of NGC253 are illustrated in Fig. 1. The fraction of continuum emission is so small that it has not been subtracted in Fig. 1. The CS (J=3→2) emission is separated in velocity; the red- and blue-velocity components are located west and east of the nucleus, respectively. This is similar to the HCN (J=1→0) and HCO^+ (J=1→0) maps by Carlstrom *et al.*[2].

A map of the 2 mm continuum and maps of the CS (J=3→2) of M82 are illustrated in Fig. 2. The continuum has been subtracted at each visibility spectrum before the CS (J=3→2) maps are made. The CS (J=3→2) emission is distinctly stronger in the east side of the center than in the west side. This is quite different from any other tracer; centimeter-[3] and millimeter-wave radio continuum (Figure 2 and ref. [2]), mid-infrared continuum[4], HI[5], CO (J=1→0)[6], CO (J=2→1)[7], HCN (J=1→0)[2], and HCO^+ (J=1→0)[2] show two peaks with similar strengths (or rather stronger in the west). The upper limit at the west side is consistent with the CS (J=3→2) spectrum by Mauersberger *et al.*[8]. The peculiar distribution of CS (J=3→2) in M82 is not explained simply by the difference between the temperatures of the dense gas in both sides of the center since the multi-line study by Wild *et al.*[9] indicates that the line strengths of higher transitions of CO, $C^{18}O$, HCN, and HCO^+ are not weak at the west peak. The underlying mechanism for this difference is not yet understood.

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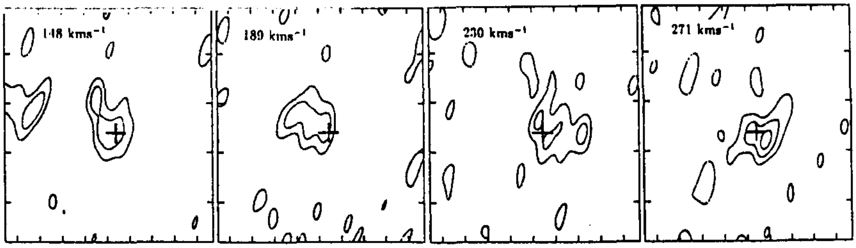


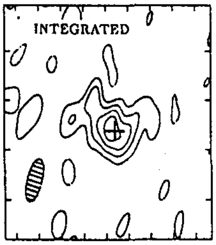
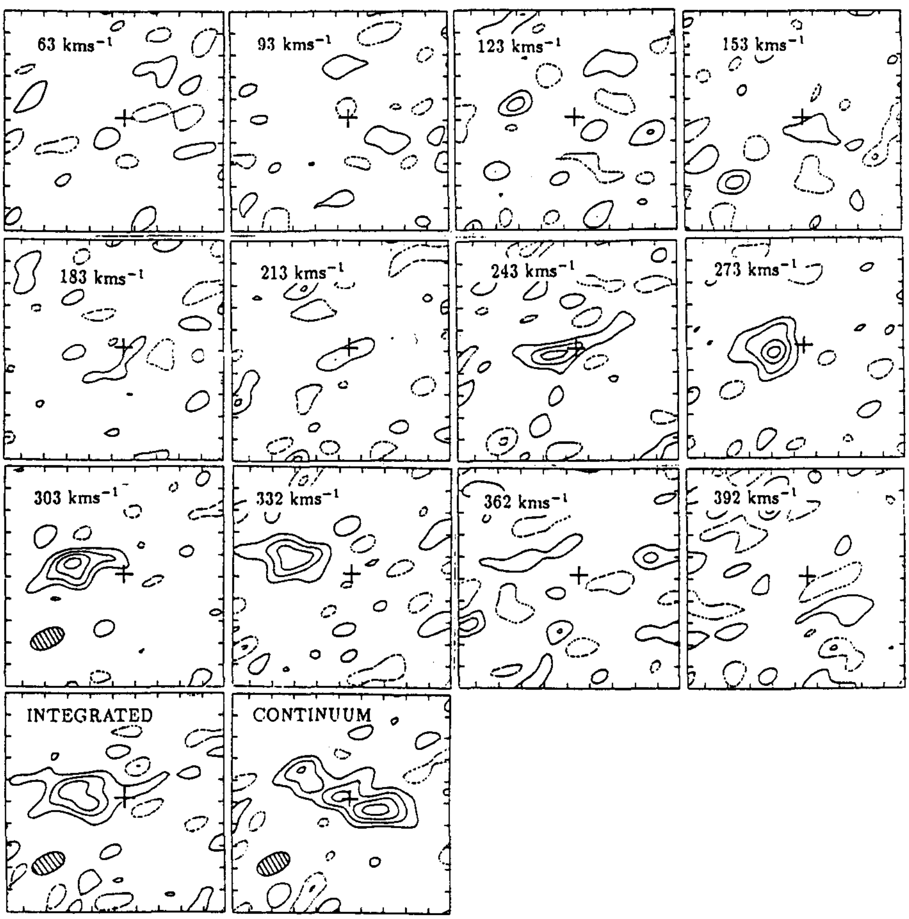


Figure 1 CS (J=3→2) maps of NGC 253. The separation between adjacent tick marks on the declination axis is 15″.

Figure 2 CS (J=3→2) maps and a 2 mm continuum map of M 82. The separation between adjacent tick marks on the declination axis is 5″.



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