A High Resolution CO Map of M51

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Observations of the CO (1–0) emission in two fields of M 51 were taken with the Berkeley-Illinois-Maryland Array at Hat Creek, California from May 1988 to February 1989. When combined with two previously observed fields (Lo *et al.* 1988), a complete map of the central $5' \times 4'$ at a resolution of $7'' \times 10''$ was obtained. The project is part of an ongoing high-resolution survey of the molecular, atomic, and ionized gas distributions in nearby spiral galaxies.

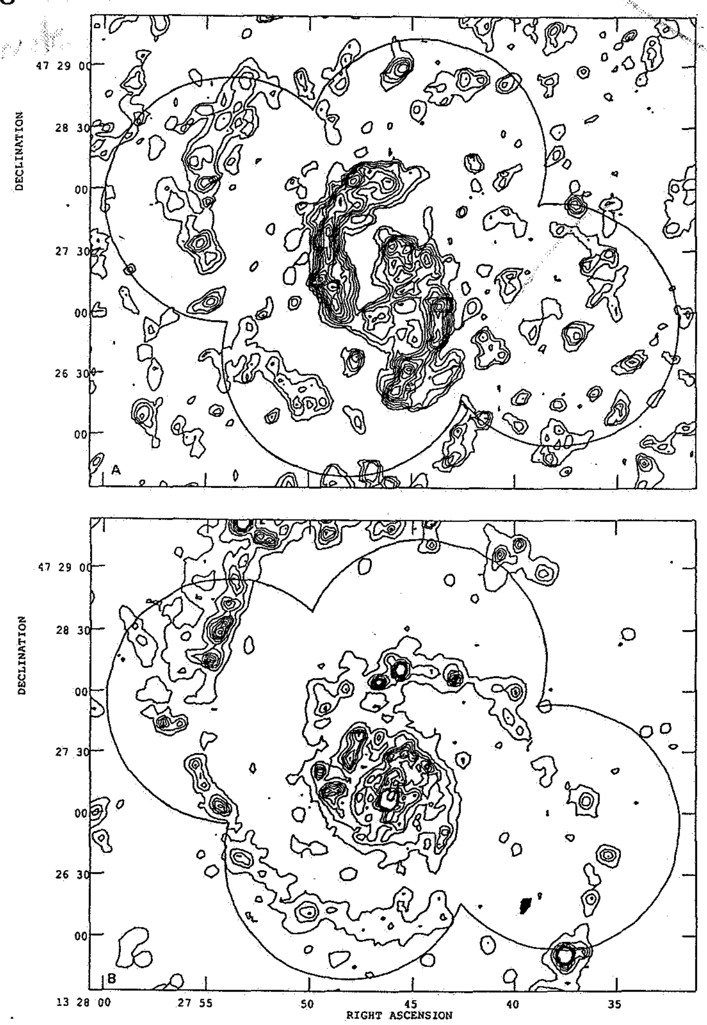

Figure 1. a.) Preliminary CO intensity map of M 51. The lowest contour corresponds to 10 Jy/beam km/sec, with successive contours at intervals of 10 Jy/beam km/sec. The half-power beam widths (2′) of the four fields are superposed. b.) The Hα emission from the same region, from Tilanus *et al.* (1988). The HPBW from the four fields in figure 1a are drawn in for comparision.

Eleven different array configurations (three baselines each) were used on each of the two fields. Four long-spacing configurations and one compact configuration were added to the existing data from the previously observed fields. For each field, the spectrometer was set to an effective bandwidth of 290 MHz (750 km/sec) with a resolution of 3.25 km/sec, centered at v_{LSR}= 470 km/sec. The channel maps were averaged to 10.4 km/sec resolution before cleaning. The typical rms noise of a map was 0.2–0.3 Jy/beam, with a typical signal to noise of 4–6:1 for the two fields. The four cleaned fields were mosaiced using a routine described by Mundy *et al.* (1986).

Figure 1a presents a preliminary map of the integrated CO intensity distribution for the four fields. The lowest contour is 10 Jy/beam km/sec; successive contours are in 10 Jy/beam km/sec intervals. Figure 1a clearly shows that the CO emission displays spiral structure. Figure 1b displays the Hα emission at a similar resolution (from Tilanus *et al.* 1987). On a global scale, the CO emission is seen to be fairly well correlated with the Hα emission (as well as the 21 cm H I emission, radio continuum emission and dust lanes; Tilanus *et al.* 1987). On small scales, however, the CO is generally seen to be upstream (peaked on the dust lanes) of the HI and Hα emission, consistent with previous results on M 51 (Lo *et al.* 1988; Vogel *et al.* 1988). While many of the peaks correlate (see figure 1), there are occasional anti-correlations in the distributions of the CO and Hα emission.

The two recently observed fields (the northern and western fields in figure 1a) can be compared to the results of the interferometric study of Vogel *et al.* (1988 - hereafter VKS). Since the shortest spacing in the current survey is shorter than that of VKS, we expect to see more of the extended emission. This is evident when comparing the width of the spiral arms in each survey; ours are a bit broader. While some of the peaks in this region correspond to the peaks in VKS, several of them do not. These discrepancies are probably because of the low signal to noise inherent in observations of this nature.

Single-dish maps are currently being readied for inclusion with the interferometer data. These will help fill the short-spacing hole in the UV plane, and serve to recover the flux missing from the interferometer maps.

References

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