

APERTURE SYNTHESIS CO OBSERVATIONS OF M51 WITH THE NOBEYAMA MILLIMETER ARRAY (NMA)

Tomoka TOSAKI¹, Ryohei KAWABE², Masato ISHIGURO², Sachiko K. OKUMURA^{2,3}, Koh-Ichiro MORITA², Takashi KASUGA², Sumio ISHIZUKI⁴

1 Department of Astronomy, Tohoku University, Japan

2 Nobeyama Radio Observatory, National Astronomical Observatory, Japan

3 Department of Earth & Astronomy, College of Arts and Sciences, University of Tokyo, Japan

4 Department of Astronomy, Faculty of Science, University of Tokyo, Japan

We present 6" (460 pc at a distance of 9.6 Mpc) resolution CO(J=1-0) map of the central region of the grand-design spiral galaxy M51 and very preliminary 4" (180pc) resolution CO(J=1-0) map of the arm regions, using the Nobeyama Millimeter Array (NMA). The central 3kpc region (1') was mapped with a velocity resolution of 20km/s, and the rest with 10km/s.

The obtained maps show a bar-like distribution of molecular gas in the central region, with a size of 2kpc and mass of $4 \times 10^8 M_{\odot}$ (figure 1). The position angle of the bar-like structure, -45° , is coincident with that of optical and infrared oval structures (Pierce 1986, Gatley 1990). The central CO velocity structure shows the existence of non-circular motions, and is very similar to that obtained in H α (Tully 1974). Our results are consistent with the idea that there exists a gravitational oval potential field in the center. There is a depression in the molecular gas in the central 200pc region.

In the arms region CO emission has very clumpy structures (figure 2). These clumps have a typical H₂ mass of $10^7 M_{\odot}$, a size of 200pc and a brightness temperature of 6-20K in a 4" beam. These clumps are clustering to form more massive components, each of which is composed of several velocity components and has a size of 500pc, a mass of $5 \times 10^7 M_{\odot}$ and velocity width 50km/s. Each cluster tend to closely contact with a giant HII region which is the downstream edge of the cluster.

We have undertaken the CO mapping of the entire M51 galaxy with the Nobeyama Millimeter Array. This project is now going on: out of about 40 fields needed, we have already observed 15 fields.

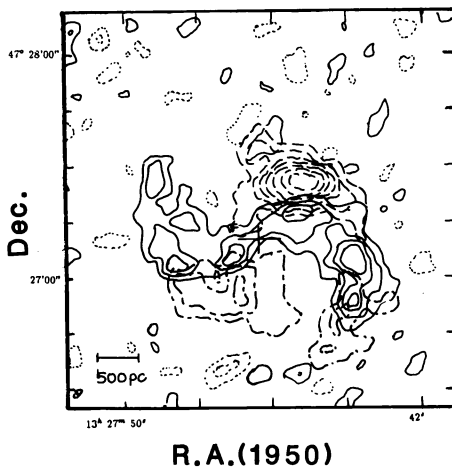


Figure 1: The composition of 3 velocity components of the central region of M51. The dashed lines are 440-499 km/s, the solid lines are 499-557 km/s and the dash-dotted lines are 557-616 km/s.

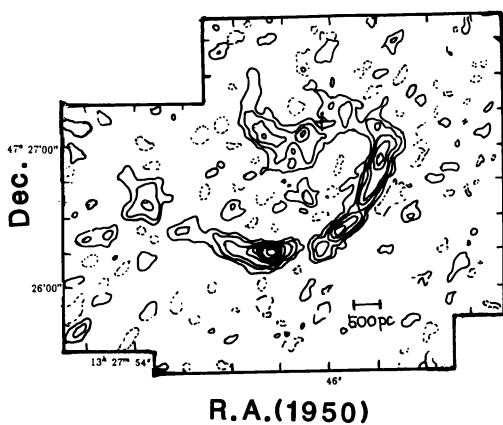


Figure 2: Total CO intensity map of the arm region of M51.

References

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 Gatley I. (1990) *Private Communication*
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