Astronomy with Millimeter and Submillimeter Wave Interferometry
ASP Conference Series, Vol. 59, 1994
M. Ishiguro and Wm. J. Welch (eds.)

SiO (J=2-1) Observations of W49A with NMA: Evidence of Infall Motion toward Massive Core

Ryosuke MIYAWAKI
Department of Science Education, Fukuoka University of Education, Munakata, Fukuoka, 811-41, Japan
Masahiko HAYASHI
Department of Astronomy, Faculty of Science, The University of Tokyo, Bunkyo-ku, Tokyo, 113, Japan
and
Tetsuo HASEGAWA
Institute of Astronomy, Faculty of Science, The University of Tokyo, Mitaka, Tokyo, 181, Japan

ABSTRACT We observed W49A with NMA. We found rotational infall motion toward massive core. The rotational velocity and the infall velocity are 2 ± 1 km s^{-1} /pc and 5 ± 2 km s^{-1}, respectively.

Introduction

W49A has a rotating cluster of massive stars (Dreher *et al.* 1984; Welch *et al.* 1987). We have observed SiO distribution of W49A with NMA. In this poster, we reveal infall gas toward one of massive stars of rotating necklace.

Shell Structure of Position Velocity Map

We observed W49A on 1991 from January to April using the Nobeyama Millimeter Array (NMA) turned at the frequencies of SiO (v=0;J=2-1) and $H^{13}CO^+$ (J=1-0) with a velocity resolution of 1.08 km s^{-1}. The size of the synthesized beam were 4."7x 3."8 (PA=-65.2°)(uniform weighting). Position velocity map of A-A' cut through component G parallel to long axis of rotating necklace (Figure 1) has a shell structure in SiO emission. The feature has absence at redshifted emission with velocity width less than ~1km s^{-1} except edge of south, which is narrower than single dish results (Downes *et al.* 1982; Hashick *et al.* 1990; Miyawaki *et al.* 1992a). The radius of ring is 15" or 0.9 pc. The center of shell is, if this is spherical, assumed to be around at δ(1950) = 9°01'15".5 of component G. The central velocity is V_{LSR}~6-8 km s^{-1} which is assumed to be the same velocity of recombination lines. There is also shell structure in C-C' cut perpendicular to A-A' cut. The thickness of shell structure along short axis of rotating necklace is assumed to be less than 20" or 1.2 pc. While $H^{13}CO^+$ has no shell structure but strong peak at δ(1950) = 9°01'14".

Bipolar Outflow or Accretion Shock

The SiO emission may be assumed to arise from an interaction region between the bipolar outflow and dense gas as low mass star forming regions. Bipolar outflow

https://doi.org/10.1017/S0252921100019655 Published online by Cambridge University Press

associated with component G (Scoville *et al.* 1986) should also affect surrounding molecular gas because the dense molecular gas and dust concentrate around component G. This shell structure is, however, assumed to be not due to an affect of bipolar outflow.

Another probability of infall gas is more probable as Welch *et al.* (1987) suggested. The suggestion that SiO emission is assumed to be optically thick (Hashick *et al.* 1990) may support that redshifted emission is self-absorbed. A simple model of the acrreting and rotating ring with constant velocities is well fitted this shell structure as shown in Figure 1. The rotational velocity and the infall velocity are 2±1 km s^{-1} /pc and 5±2 km s^{-1}, respectively. On the other hand, direction of short axis has no rotation and faster infall motion, whose velocity is ~8-10 km s^{-1}.

The redshifted emission at δ(1950) = 9° 01'14" is assumed to be blended with a part of shell structure and the other because $H^{13}CO^{+}$ emission is also seen at this position (Miyawaki *et al.* 1992a), which is supported by works of shock chemistry (*e.g.*, Iglesias *et al.* 1978). The accretion shock may stand around component G. The acrreting mass rate is calculated to be $0.06 M_{\odot} yr^{-1}$, where the infall velocity is 5 km s^{-1} and the density is $n(H_2)=10^5 cm^{-3}$ This high mass accretion rate is caused by results of formation of W49A massive core, which may be formed by cloud collision such as Sgr B2 (Hasegawa *et al.* 1992; Miyawaki *et al.* 1992b).

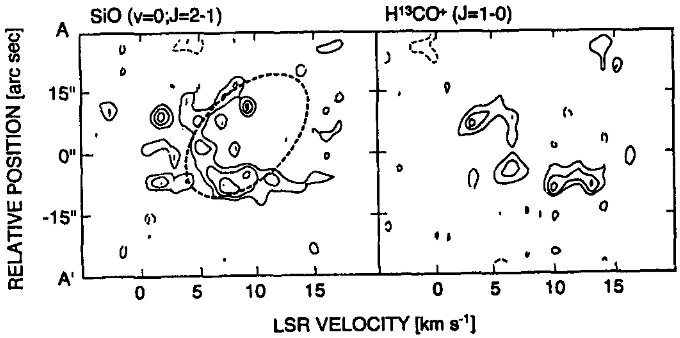

Figure 3: Position velocity maps of SiO (v=0;J=2-1) (left) and $H^{13}CO^{+}$ (J=1-0) (right) emissions toward W49A along a cut of A-A' shown. Reative positions from δ(1950) = 9°0 1'15" are indicated in vertical scale and LSR velocities are indicated in horizontal scale. The contour level of both are 0.2 Jy/beam from 0.4 Jy/beam.

REFERENCES

Downes, D.*et al.* 1982, APJL, 252, L29.
Dreher, J. W.*et al.* 1984, APJ, 230, 768.
Haschick, A., D.*et al.* 1990, APJ, 352, 630.
Hasegawa, T.*et al.* 1992, APJL, submitted.
Iglesias, E. R. *et al.*, 1978, APJ, 226, 851.
Miyawaki, R.*et al.* 1992a in preparation.
Miyawaki, R.*et al.*1992b in preparation.
Scoville, N. Z.*et al.* 1986, APJ, 303, 416.
Welch, W. J.*et al.* 1987, Science , 238, 1550.

https://doi.org/10.1017/S0252921100019655 Published online by Cambridge University Press