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HIGH RESOLUTION OH MASER SURVEY IN STAR FORMING REGIONS

A. E. Ruiz-Velasco,[1] V. Migenes,[1] V. Slysh,[2] and I. E. Val'tts[2]

RESUMEN

Presentamos los resultados de un rastreo de alta resolución de máseres de OH en Regiones de Formación Estelar Galáctica con el propósito de estudiar la emisión máser y establecer una lista de candidatos adecuados para realizar un seguimiento con instrumentos de mayor resolución. Se utilizó el *Very Long Baseline Array* (VLBA) para observar las transiciones del máser de OH en 1665, 1667, 1612 y 1720 MHz dentro de 41 regiones. Éstas son las primeras observaciones de alta resolución que se realizan en la mayor parte de las fuentes. Se detectaron 30 sitios de emisión máser en alguna o varias transiciones, con nuevas detecciones en 4 fuentes, y donde aproximadamente 40% de la muestra exhibe estructura muy compacta. Finalmente consideramos que el espectro observado en W75N muestra el estado inicial de una ráfaga del máser de OH en la línea de 1665 MHz, la cual es la primera que se conoce

ABSTRACT

We present results of a high resolution survey of OH masers in Galactic Star Forming Regions in order to study the maser emission and establish a list of suitable candidates for higher resolution instruments follow up. We used the Very Long Baseline Array (VLBA) to observe the 1665, 1667, 1612 and 1720 MHz OH maser transitions within 41 regions. These are the first high resolution observations for most of the sources. For all the transitions 30 sites of maser emission were detected, 4 of the sources have new detections, and approximately 40% of the sources in the sample exhibit highly compact structure. Finally we consider that the spectrum observed in W75N shows the early stage of a long period OH maser flare in the 1665 MHz line, the first of its kind.

Key Words: **MASERS — POLARIZATION — STARS: FORMATION**

1. INTRODUCTION

In this paper we present results of a VLBA survey of OH masers in galactic Star Forming Regions (SRF) to study the high angular and spectral resolution characteristics of the maser emission, and to establish a list of suitable candidates for higher resolution instruments. Due to the limited sensitivity of the large VLBI baselines only very strong and compact sources are detected.

2. OBSERVATIONS

We selected 41 galactic radio sources, most of them previously known to be high mass SFR or compact HII regions. Observations were conducted in January 2001 with the NRAO's[3] Very Long Baseline Array using all the 10 antennas.

The data was observed with a 250 kHz band width and processed with 256 channels so a spectral resolution of 0.98 KHz ($0.17\,km\,s^{-1}$) was achieved. We observed four OH maser transitions: 1665, 1667, 1612 and 1720 MHz, in RCP and LCP polarization modes. We used the VLBA in a snap-shot mode, observing every source with a 6 minutes scan, providing a sensitivity of $\sim 60\,mJy\,beam^{-1}$ and an angular resolution of 4.3 mas. The data were processed using the NRAO's AIPS software package with the spectral line VLBI data reduction standard protocol.

3. RESULTS

We obtain spectra for a total of 30 sources, fifteen with high compact structure and strong emission.

We measured the corresponding magnetic field for 3 Zeeman pairs: −2.86 mG in GRS 10.62-0.38 (1667 MHz), 3.93 mG in GRS 12.89+0.49 (1665 MHz) and 2.4 mG in Cepheus A (1667 MHz).

The spectra of some sources are shown in Fig.1. The spectra are composed of an average over all baselines within the specified range. The name and frequency observed for each source is indicated in a subcaption located under the spectrum panel. The horizontal axis shows the LSR radial velocity in $km\,s^{-1}$

[1] Departmento de Astronomía, Universidad de Guanajuato. Apdo. Postal 144, C.P. 36000, Guanajuato, Gto., México (alma, vmigenes@astro.ugto.mx).

[2] Astro Space Center of the Lebedev Physical Center of RAS, Profsoyuznaya Str. 84/32, 117997 Moscow, Russia (vslysh, ivaltts@asc.rssi.ru).

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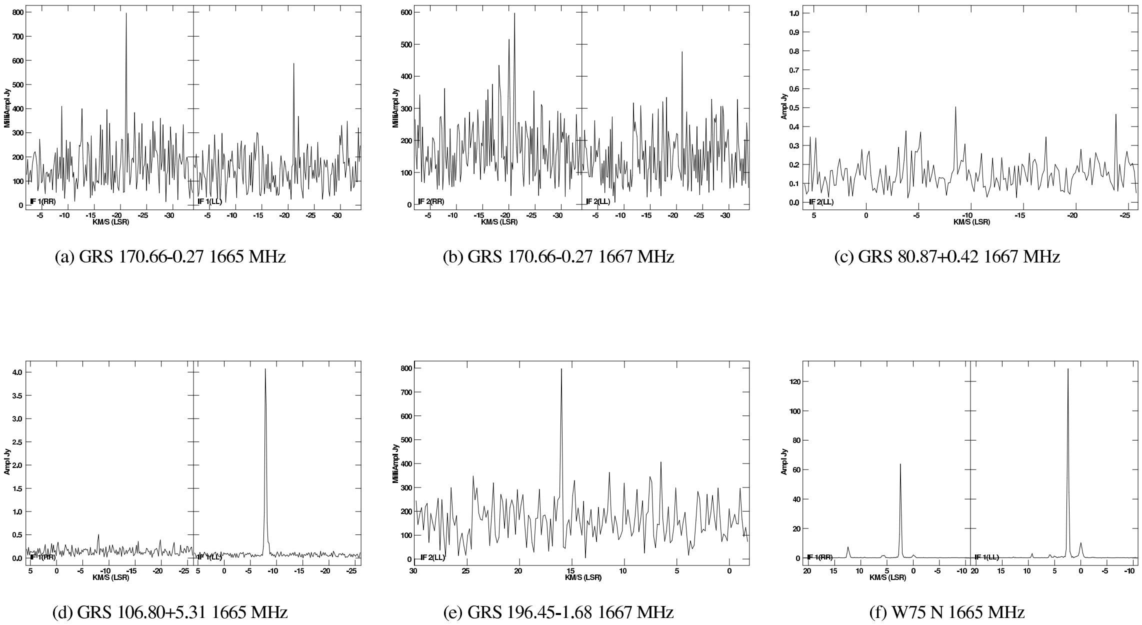

(a) GRS 170.66-0.27 1665 MHz

(b) GRS 170.66-0.27 1667 MHz

(c) GRS 80.87+0.42 1667 MHz

(d) GRS 106.80+5.31 1665 MHz

(e) GRS 196.45-1.68 1667 MHz

(f) W75 N 1665 MHz

Fig. 1. Spectra of the sources with new detections (a), (b), (c), (d), (e) and the progenitor of the flare in W75 N (f).

and the vertical axis shows the flux intensity in Janskys.

We found new detections in four sources: *GRS 170.66-0.27* (Fig. 1a and 1b), *GRS 80.87+0.42* (Fig. 1c), *GRS 106.80+5.31* (Fig. 1d) and *GRS 196.45-1.68* (Fig. 1e).

3.1. *OH maser flare (W75N)*

W75 is a well known region of active high-mass star formation located at a distance $\leq 2\,kpc$ (Odenwald & Schwartz 1993). It contains three main radio continuum sources, one of them (VLA 2) harboring a UCHII region (Torrelles et al. 1997)

The 1665 MHz spectrum show 5 strong features spread over a velocity range of 15 $km\,s^{-1}$, where the stronger has a flux of 130 Jy (LCP) and 62 Jy (RCP) at the radial velocity of 2.4 $km\,s^{-1}$ (Fig. 1f).

A flare of radio emission in the 1665 MHz line was discovered in 2003, with a flux density of >1000 Jy (Alakoz et al, 2005). Its radial velocity of $2\,km\,s^{-1}$ and position means it is associated with VLA 2. This is the first OH maser flare ever reported, with an increase in the intensity by a factor of 7 in a period of <3 years. The emission has a high degree of linear polarization ($>80\%$).

In our VLBA spectrum we identify the precursor of the flare, that appears to come from the same VLA 2 radio source.

4. CONCLUSIONS AND FUTURE WORK

A high resolution OH maser survey was made with the VLBA over 41 galactic SFR. We obtained high resolution spectra for 30 of them.

We report the discovery of five new maser emission sites: two in the 1665 MHz line, three in the 1667 MHz.

We observed a weak flare in the source W75 N, proposed to be a precursor of the powerful flare occurred during the summer of 2004: The brightest OH maser flare ever reported. We are preparing new interferometric observations for this source with the EVN.

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REFERENCES

Alakoz, A. V., Slysh, V. I., Popov, M. V., & Val' tts I. E. 2005, Astronomy Letters in press, astro-ph/0501539
Odenwald, S. F., & Schwartz, P. R. 1993, ApJ, 405, 706
Torrelles, J. M., Gómez, J. F., Rodríguez, L. F., Ho, P. T., Curiel, S., & Vázquez, R. 1997, ApJ, 489, 744