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RESULTS FROM AN OH-MASER SURVEY IN THE GALACTIC PLANE (Research Note)

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RESUMEN

Una búsqueda de máseres de OH más intensos que 1.2 Jy (dentro de un error de 3σ) a 1665 MHz con un receptor de una sola polarización, ha sido completada en una franja de 1° de ancho a lo largo del disco galáctico (como ha sido definido a través de observaciones en H I) en el intervalo l = 220° a l = 325°. Hemos detectado 18 máseres de OH, confirmando 16 de los recientemente reportados en la literatura y añadiendo dos nuevos a la lista general.

ABSTRACT

A search for OH-masers within a 3σ level of 1.2 Jy, at 1665 MHz, with a single polarization receiver, has been completed on a strip 1° wide along the galactic disk (as defined by H I observations) in the range l = 220° to l = 325°. We detected 18 OH masers, confirming 16 recently reported in the literature and adding two new ones to the general list.

Key words: **MASERS – RADIO SOURCES**

I. INTRODUCTION

The galactic plane has been surveyed several ımes for OH-masers but in 1984 there was still a ırge region which had not been searched. This egion lies between l = 220° and l = 325° and at ıe same time is visible from the Observatory of ıe Instituto Argentino de Radioastronomía (IAR). 'his fact prompted us to start an OH-survey of ype I masers, at 1665 MHz, along the galactic disk, etween those galactic longitudes. We report here ıe results of this survey on a strip 1° wide along the alactic disk. It will be completed in the future with more sophisticated and sensitive receiver.

II. OBSERVATIONS AND RESULTS

The observations have been made with the 30 ı-IAR dish during several periods between August 984 and April 1988. Some additional observations ere performed in September 1989. At 1665 IHz the HPBW was 29′ (circular beam) and the perture efficiency η_a = 0.45, which means that a factor of 8.7 Jy/K had to be used to convert antenna temperatures, T_a, to flux densities, S_ν. A single linear polarization in the N-S direction was available. The receiver system temperature on cold sky was 85 K. Calibrations were made observing G267.9–1.1 (RCW 38), for which we adopted a peak flux density of −20.0 Jy. For more details on the telescope characteristics we refer to Bajaja *et al.* (1987).

At the backend we used a bank of 112 filters 10 kHz wide, covering a velocity range of 200 km s^{-1}. This velocity range was centered at V_{LSR} = 50 km s^{-1} for l < 290°, and at V_{LSR} = 0 km s^{-1} for l > 290°. The integration time per point was 20 min and the rms noise per channel was 0.4 Jy. Figure 1 shows the area of the sky observed. The observed points define a grid of 0.5° × 0.5° (l × b), 1° wide in b, which follows approximately the warp of the galactic disk as derived from H I observations.

All the positive detections were re-observed at 1667 MHz in order to reject those which corresponded to the normal emission of molecular clouds (not masers). In this way 18 genuine masers were detected above the 3σ level, particularly in the range 290° < l < 325° which includes part of the Local as well as of the Sagittarius arms. In the meantime, more than two years after we started this

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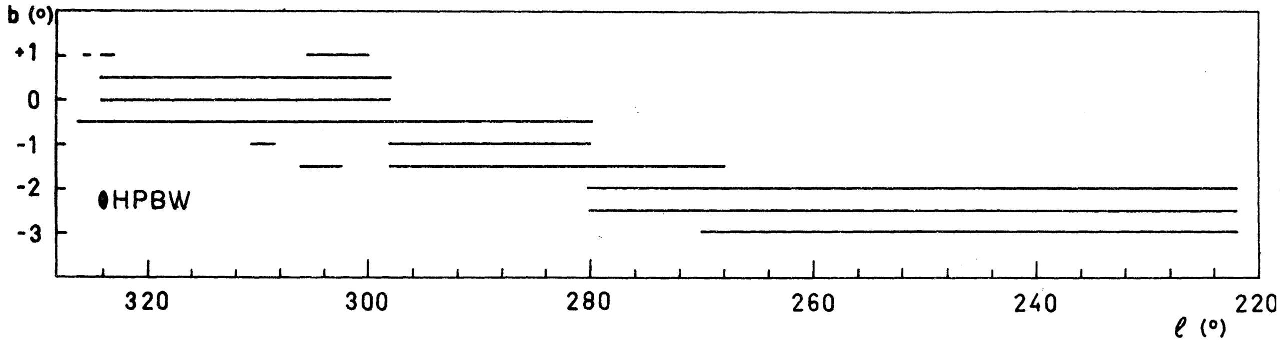


Fig. 1. Positions which have been observed searching for type I masers.

TABLE 1

MASERS DETECTED IN THE PRESENT SURVEY ALREADY REPORTED IN THE LITERATURE[a]

l (°)	*b* (°)	V_p (km s^{-1})	Identification	Ref.[b]
284.0	−0.5	−27.0		
284.5	−0.5	−27.0	G284-0.8	1
284.5	−1.0	−27.0		
291.5	−0.5	18.0	OH 291.57-0.43	2
301.0	0.0	−42.5	OH 301.14-0.23	2
301.0	1.0	−39.3	OH 300.97+1.15	2
305.0	0.0	−39.4		
305.0	0.5	−39.4	OH 305.20+0.21	2
305.5	0.0	−37.4	OH 305.21+0.03	2
305.5	0.5	−39.4	OH 305.36+0.15	2
308.5	0.0	−54.6		
308.5	0.5	−54.6		
309.0	0.0	−54.1	OH 308.92+0.12	2,3,4
309.0	0.5	−54.1		
309.5	0.5	−61.3		
310.0	0.0	−61.3	OH 309.92+0.48	2,3,4
310.0	0.5	−61.3		
311.5	0.0	34.4	OH 311.64-0.3	2
312.5	0.0	−61.2	OH 312.6+0.05	2
316.5	0.0	−21.7	OH 316.64-0.08	2
318.0	0.0	−52.8	OH 318.05+0.08	2
319.0	0.0	−37.4	OH 318.95-0.20	2
320.0	0.0	−67.8	OH 320.23-0.28	2,4
323.5	0.0	−69.4	OH 323.46-0.08	2

a. Listed are the galactic coordinates *l* and *b*, the peak velocity V_p in our detections (determined with a velocity resolution of 2 km s^{-1}), and previous identifications and references.
b. References: 1) Manchester *et al.* 1970; 2) Caswell and Haynes 1987*a*; 3) Robinson *et al.* 1974; 4) Robinson *et al.* 1971.

project, Caswell and Haynes (1987*a*) published new results obtained from observations with the Parkes telescope on a similar region of the sky. Sixteen of our detections confirm their results within our sensitivity and angular resolution limits (Table 1) but we can report also two new detections.

In view of the higher sensitivity and angular resolution of the Parkes telescope, and the fact that a two polarization receiver was used, we did not study in more detail the 15 sources detected also by Caswell and Haynes (1987*a*). In general, our data in Table 1 cannot be compared directly with the Parkes results because of the differences in the angular and velocity resolutions. About the new detected masers we determined first their positions more precisely scanning across the sources. At the improved positions we then made new observations with a bank of 74 crystal filters 2.2 kHz wide (0.4 km s^{-1} at 18 cm), at the four frequencies: 1612, 1665, 1667 and 1720 MHz. With an integration time of 130 min the rms noise in the obtained spectra was 0.38 Jy per channel. Only at 1665 MHz could we detect the signal of the masers. For the other frequencies the upper limit is 1.1 Jy per channel. The results of these observations are shown in Figure 2 while the main parameters derived from both profiles are given in Table 2.

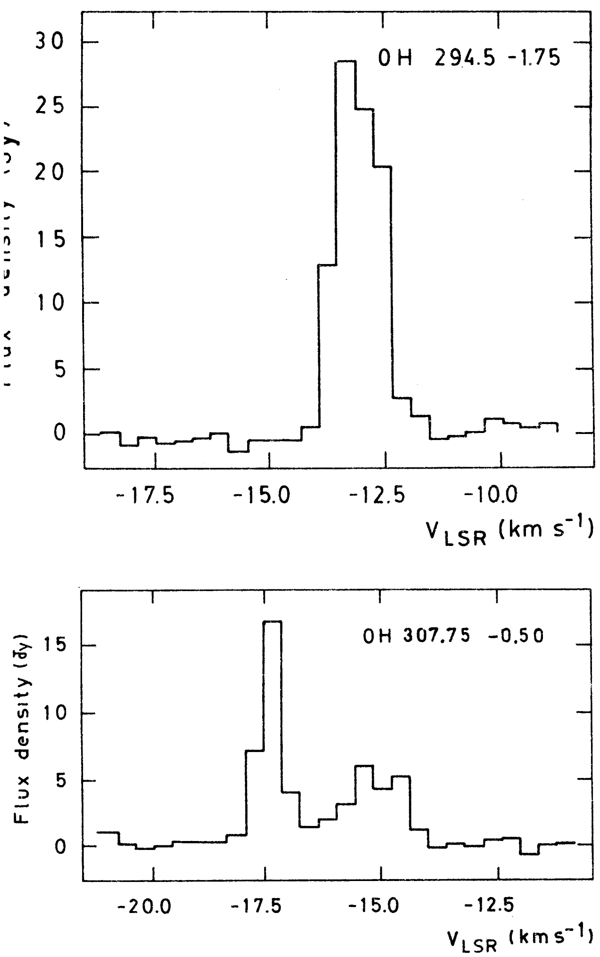
OH 294.5–1.75 is located in a region, between RCW 60, 61 and 62, of low continuum intensity (Haynes, Caswell and Simmons 1978) and in the center of a ring-like molecular gas feature (Cohen *et al.* 1985, cf. their Figure 2). The velocity profile of Figure 2*a* shows that there are at least two blended components at about −13 km s^{-1}.

OH 307.75–0.50 is located very close to the H II region G308.092–0.432, which has not been optically identified. The profile of Figure 2*b* shows that in this case we have two separated velocity components, a narrow one at about −17 km s^{-1} and a broader and weaker one at about −15 km s^{-1}. Caswell and Haynes (1987*b*) detected H_2CO

TABLA 2

NEW MASERS DETECTED IN THE PRESENT SURVEY

Source	R.A. (1950.0)	Dec. (1950.0)	Peak Flux Density (1665 MHz)	Total Flux	$V_{(LSR)}$
	h m s	° ′ ″	Jy	10^{-21} W m^{-2}	km s^{-1}
OH 294.50-1.75	11 32 48	−63 05 24	28.4	2.00	−13.0
OH 307.75-0.50	13 30 38	−62 43 12	16.9	0.65	−17.4
			6.1	0.50	−15.2



ʼig.2. Spectra of the detected new masers measured at .665 MHz with a velocity resolution of 0.5 km s^{-1}.

ıt −13 km s^{-1} and $H_{109\alpha}$ at −17 km s^{-1} on the H I region. The similarity in the velocities suggests hat the maser is associated with the H II region. If his is true, its distance, according to Caswell and Haynes (1987*b*), would be 9.4 kpc, assuming for the galactic center a distance of 8.5 kpc. In that case its OH-luminosity should be $L_{OH} = 2.7 \times 10^{-6} L_\odot$ under the assumption of isotropy.

After submitting this paper, we received the very recent publication by Braz *et al.* (1989) who observed several IRAS sources in the OH 18-cm lines and in the H_2O 1.3-cm line. Among these sources is included IRAS 11332-6258 which is close to OH 294.50−1.75. Their OH profile at 1665 MHz has a main feature at the same velocity as the one in our Figure 2 but the detailed structures show differences which could be attributed to the fact that they used left-hand circular polarization. The H_2O profile shows also the presence of a maser at the same velocity.

The other source, OH 307.75−0.50, was kindly checked for us by E. Scalise Jr. for H_2O-masers at 22 GHz with the radiotelescope of the Instituto de Pesquisas Espaciais (INPE) at Itapetinga, Brazil. The result in this case was negative. These observations were extended to the neighborhood of

TABLE 3

IRAS POINT SOURCES IN THE VICINITY OF OH 307.75–0.50[a]

IRAS Source	R.A. (1950.0) h m s	Dec. (1950.0) ° ′ ″
13295–6250	13 29 31.4	−62 50 10
13295–6235	13 29 35.0	−62 35 52
13297–6233	13 29 42.2	−62 33 51
13301–6246	13 30 09.4	−62 46 18
13302–6249	13 30 12.8	−62 49 48
13306–6248	13 30 37.7	−62 48 40
13309–6247	13 30 56.8	−62 47 44
13309–6241	13 30 59.3	−62 41 23
13314–6239	13 31 24.9	−62 39 04
13318–6239	13 31 49.5	−62 39 20

a. Checked for H_2O-masers.

G307.75−0.50, where 10 intense IRAS-sources are located within the HPBW of the IAR dish (Table 3). The integration times were 20 minutes for each source and the observing conditions were very good. No H_2O-maser was detected above a limit of 0.4 K, i.e., 8 Jy.

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