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DETECTION OF TWO NEW WATER VAPOR EMISSION SOURCES IN THE SOUTHERN HEMISPHERE

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RESUMO

Duas novas fontes maser de vapor de água foram detectadas durante pesquisa realizada na direção de regiões H II galáticas do hemisfério sul. A mais intensa delas foi descoberta na direção da fonte OH 351.78−0.54, que é atualmente a fonte de OH mais brilhante no céu. A outra fonte foi detectada nas proximidades da região H II compacta G 345.645+0.010.

ABSTRACT

Two new H_2O maser emission sources were detected during a survey made towards southern galactic H II regions. The most intense was discovered in the direction of the brightest OH maser source now in the sky, OH 351.78−054. The other source was found near the compact H II region G 345.645+0.010.

Key words: MASERS – NEBULAE-H II REGIONS

I. INTRODUCTION

Type I OH masers, compact H II regions and infrared sources are often associated with water vapor masers. A number of these sources in the southern hemisphere were thus selected to be observed at the 1.35 cm H_2O line. This article reports on the two new H_2O masers detected during this program.

II. OBSERVATIONS AND RESULTS

The observations were performed with the 13.7 m antenna at the Itapetinga Observatory[1], Atibaia, São Paulo, Brazil, during April and October, 1980. At the frequency of 22.2 GHz, the half-power beamwidth is 4.5. A ruby travelling wave maser, which gave a total system temperature in the range of 200 to 400°K, was used as a preamplifier. Spectral information was provided by a 47 channel spectrometer, each channel having a 100 kHz bandwidth (velocity resolution 1.35 km s^{-1}). Two vertically polarized feed horns were used in the beam-switching on-on observing mode. The flux density scale is relative to Virgo A assumed to have a flux density of 21.4 Jy at 22.2 GHz.

The data were corrected for atmospheric and radome attenuation. Table 1 summarizes the observational parameters of the two new H_2O masers and Figure 1 shows their spectra.

a) H_2O 345.645+ 0.010

This maser has a double-peaked spectrum, similar to the ones often observed in late-type maser stars. It was detected on April 13, 1980. Observational evidence indicates that it is not at the same position of the compact H II region measured by Haynes *et al.* (1979) but it is situated slightly north of it. The H_2O position, given in Table 1, was determined by interpolating a grid

1. Itapetinga Observatory is presently operated by INPE/CNPq.

TABLE 1

TWO NEW H_2O MASER EMISSION SOURCES

H_2O source	(1950) α	(1950) δ	V_{LSR} (km s^{-1})	Flux (Jy)
345.645+0.10	$17^h\ 02^m\ 48^s$	−40° 45′ 26″	− 8.7	60
			−15.4	50
351.78−0.54	17 23 20.9	−36 06 46.0	− 2.0	400

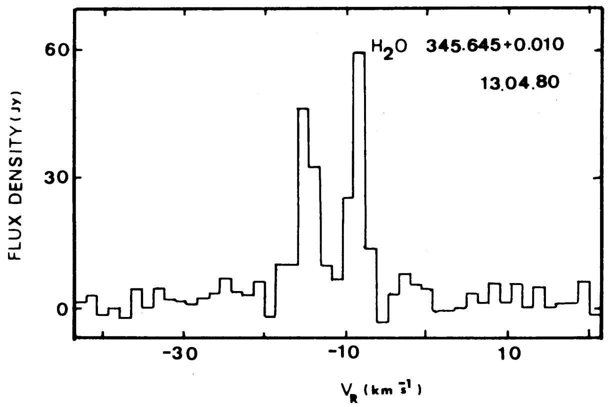

Fig. 1. Spectrum of the new source H_2O 345.645+0.010.

of observations separated by one-half of the beamwidth and centered on the detection position.

The strong H_2O maser, 345.69–0.09 (Johnston *et al.* 1972; Batchelor *et al.* 1980), is located about 6'.3 away from the new source. In the same region, Epchtein and Lépine (1981) found two infrared sources with characteristics of late-type stars. No OH maser is reported in the literature to be near the new maser. The only OH maser in this region (Robinson *et al.* 1974) seems to be associated with 345.69–0.09. The spectrum of the source (Figure 1) displays two intense features at –15.4 km s^{-1} and –8.7 km s^{-1} with flux densities of 50 Jy and 60 Jy, respectively. Another observation made on October 9 showed that the feature at –15.4 km s^{-1} decreased to a flux density of 20 Jy and that the feature at –8.7 km s^{-1} increased to 85 Jy.

b) *H_2O 351.78–0.54*

This H_2O maser was found towards OH 351.78–0.54, which is now the brightest OH source in the sky and displays emission at 1665 and 1667 MHz (Caswell and Haynes 1979). Haynes *et al.* (1979) detected a continuum source at 5 GHz in this direction, with a flux density of 0.3 Jy.

The spectrum shown in Figure 2 taken on October 5, presents a sharp peak with a flux density of 400 Jy at –2 km s^{-1}, the same radial velocity of the OH emission. Two weak symmetrical features are present at 11.5 km s^{-1} and –15.5 km s^{-1} with flux densities of 38 Jy and 32 Jy, respectively.

No systematic observations of the source could be done due to the bad weather conditions during October and November.

The results listed in Table 2, obtained from four more observations, indicate that this source presents rapid intensity variations.

Further H_2O observations and infrared measurements are desirable in order to understand better the nature of the new H_2O masers.

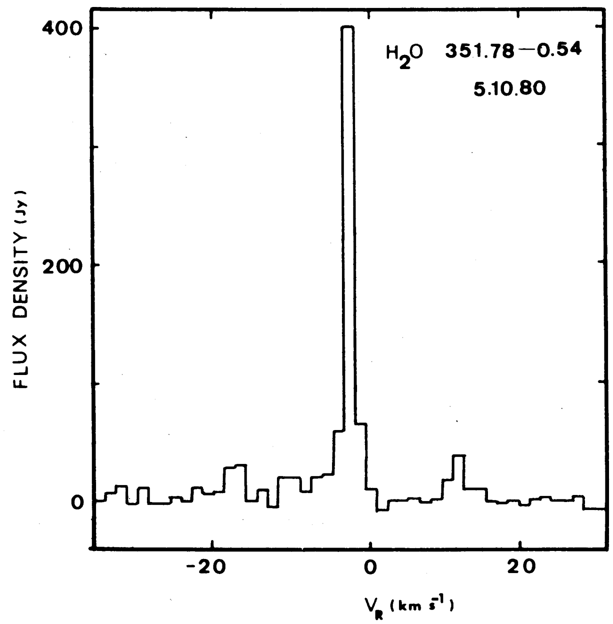

Fig. 2. Spectrum of the new source H_2O 351.78–0.54.

The maser receiver used in the observations was built at Haystack Observatory as a result of a bilateral scientific agreement established between the U.S. and Brazilian governments. This research was partialy supported by FINEP.

TABLE 2

OBSERVATIONS OF H_2O 351.78–0.54 IN 1980

Date	Peak intensity (Jy)
Oct 5	400
Oct 6	470
Oct 9	360
Oct 10	460
Nov 17	240

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DISCUSSION

Mirabel: ¿Puedes comentar sobre la relación entre emisión en H_2O con emisión en OH?
Braz: Cerca del 75% de las regiones con emisión de H_2O presentan emisión maser de OH. En muchos casos los objetos no coinciden, pero pueden estar asociados.
Bitran: ¿Cuál es el error de la determinación de intensidades?
Braz: El error en las medidas de los objetos detectados es menor que 5%.
Rayo: ¿Se conoce la razón de la variabilidad de las fuentes?
Braz: No, sería necesario observar en el infrarrojo y en las líneas de H_2O simultáneamente a fin de verificar como varía la emisión en las dos regiones, y averiguar si el bombeo se debe a fotones infrarrojos.

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