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Abstract

Full Text

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Clarifying the nature of the radiation of anomalously excited hydroxyl (OH) depends to a large extent on the reliable identification of OH-emission regions with various optical objects. To solve this problem, accurate measurements of the coordinates of the OH-emission regions are necessary.

Fig. 1. Single transit records of the object NMLCyg at velocities −24.2 and +21 km/sec. Minute marks and the antenna-temperature scale are indicated.

In 1969, at the Main Astronomical Observatory of the Academy of Sciences of the USSR, measurements were undertaken of the right ascensions of four sources of hydroxyl emission. Two sources had been discovered in 1968 and turned out to be nearly coincident with the infrared objects NMLCyg ([1]) and VYCMa ([2]). The OH radio line in these sources has its greatest intensity at a frequency of 1612 MHz, and its profile is characterized by the presence of two emission regions that differ strongly in radial velocity. Such a difference may be connected with rotation, expansion, or contraction of a gas cloud. In this case it is important to measure the position at each radial velocity separately. The other two sources, W 49 and Sagittarius-B2, possess a complex structure both in the continuous spectrum and in OH emission, and measurement of the coordinates of the various details of the radio-line profile is also very important.

The observations were carried out on the Large Pulkovo Radio Telescope (BPR) in the meridian, with the antenna fixed. The width of the BPR beam in the

Fig. 2. Transit records of VYCMa at velocities −6.4 and −10.5 km/sec relative to the local standard of rest

Figure 2: Fig. 2. Transit records of VYCMa at velocities −6.4 and −10.5 km/sec relative to the local standard of rest

Fig. 3. Transit curves of the radio source W49 in the continuum spectrum (1) and in the OH line (2)

Figure 3: Fig. 3. Transit curves of the radio source W49 in the continuum spectrum (1) and in the OH line (2)

horizontal direction is 6′. For observations of infrared stars, a two-horn system was used (the separation between the horns was 2λ). In the study of W 49 and Sagittarius-B2, the reference sig-

nal was obtained from a matched load cooled to the temperature of liquid helium. The constancy of the setting of the feeds in the BPR focus was monitored with a theodolite. The inaccuracy of the setting contributed no more than $0^s.2$ to the error in measuring the coordinate. As the high-frequency amplifier, a two-resonator maser with a gain of 23 db

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and with a passband of 10 MHz, developed in the Oscillations Laboratory of the P. N. Lebedev Physical Institute of the USSR Academy of Sciences, was used. The maser gain is practically constant within the frequency interval ±4 MHz, which is significant for spectral observations. Behind the maser there was a superheterodyne receiver with a passband of 5 MHz for recording radiation in the continuum spectrum with a time constant of 6 sec. The intensity of the radio line was measured in five channels 10 kHz wide with a time constant of 20 sec. The frequency positions of the channels were selected specially for each source. The accuracy of channel tuning was 1 kHz. The noise temperature of the system together with the antenna proved to be 120°K. The mean square of the fluctuations of a single record is 0.044°K in the continuum-spectrum channel and 0.53°K in the spectral channels.

The culmination times of the sources were determined after correcting the records for the smoothing effect of the time constant by minute ···

by the marks from the stellar quartz clocks of the time service of the Main Astronomical Observatory. The position in space of the BPR beam-pattern diagrams during observations of infrared stars was determined from bright discrete sources with known coordinates:

$$\left.\begin{array}{ll} \text{Cygnus-A} & \alpha_{1950.0} = 19^h57^m43^s.0, \\ \text{Orion-A} & \alpha_{1950.0} = 5^h32^m51^s.0, \end{array}\right\} \quad (3)$$

$$\begin{array}{ll} \text{Omega Nebula} & \alpha_{1950.0} = 18^h17^m35^s.7, \\ \text{Sagittarius-A} & \alpha_{1950.0} = 17^h42^m29^s.4. \end{array} \quad (4)$$

In this case the determination of the position of the beam pattern during observation of the object NMLCyg was carried out using the source Cygnus-A without changing the setting of the BPR antenna.

Observations of the infrared objects NMLCyg and VYCMa were carried out at a frequency of 1612 MHz. For NMLCyg, emission of the OH line was recorded with radial velocities of −24.2; 18.5; +21 km/sec relative to the local standard of rest. Figure 1 gives samples of individual records at two radial velocities. The results of measuring the antenna temperature and the coordinates of the OH sources are given in Table 1. It is seen that, within the measurement errors, the right ascensions of the three spectral components coincide. However, it is difficult to speak of coincidence of the OH emission region with the infrared object because of the uncertainty of the coordinate of the latter (see Table 1).

There are at present no other measurements of the coordinates of OH emission regions near NMLCyg.

For the infrared object identified with the variable star VYCMa, emission of the OH line was recorded at velocities of −10.5; −6.4; +45.5; +49.7; +52.8 km/sec. Figure 2 gives individual records in two channels. The results of measuring the antenna temperature and the coordinates of the OH sources are given in Table 1. To within the measurement errors, the right ascensions of the spectral components coincide with one another, and also with the star VYCMa, which confirms the result of work ([2]).

Observations of the sources W 49 and Sagittarius-B2 were carried out at a frequency of 1665 MHz. Figure 3 gives copies of records of the source W 49 in a continuous–

Table 1

	T_A, °K	$\alpha_{1950.0}$	Note
NMLCyg			
−24.2 km/sec	8.9	$20^h44^m31^s.0 \pm 0^s.9$	
−18.5 km/sec	5.0	$20^h44^m32^s.0 \pm 1^s.5$	
+21.0 km/sec	4.4	$20^h44^m33^s.0 \pm 2^s.0$	

	T_A, °K	$\alpha_{1950.0}$	Note
Mean over all channels	–	$20^h 44^m 31^s.0 \pm 0^s.6$	
IR star	–	$\left\{ \begin{array}{l} 20^h 44^m 39^s \\ 20^h 44^m 33^s \end{array} \right.$	(5)(6)
VYCMa			
−10.5 km/sec	4	$7^h 20^m 53^s.6 \pm 3^s.0$	
−6.4 km/sec	6.5	$7^h 20^m 56^s.1 \pm 2^s.0$	
+45.5 km/sec	3		
+49.7 km/sec	2.5	$7^h 20^m 54^s.3 \pm 1^s.5$	Mean over three channels
+52.8 km/sec	4		
Mean over all channels	–	$7^h 20^m 54^s.8 \pm 0^s.7$	
Star	–	$7^h 20^m 54^s.5$	(7)
from −11.34 to −2.6 km/sec	–	–	
from −23.8 to +54.67 km/sec	–	$7^h 20^m 55^s.0 \pm 0^s.6$	(2) Mean in the indicated range

spectrum and in the OH emission line at a radial velocity of +16.8 km/sec. The coordinates of the OH emission sources at different radial velocities were measured with respect to the position of the western (thermal) component of the source W 49. The results of the measurements are given in Table 2. It should be noted that the coordinates both of the source in the continuous spectrum and of various details of the spectral profile of the OH emission line, measured by different authors, differ very strongly from one another.

Table 2

V, km/sec	T_A, °K	$\alpha_{\mathrm{OH}} - \alpha_{\mathrm{src}}$
+11.9	4.0	$-0^{\mathrm{s}}5 \pm 3^{\mathrm{s}}$
+16.8	16.6	$+1^{\mathrm{s}}5 \pm 1^{\mathrm{s}}$
+18.4	5.3	$+0^{\mathrm{s}}5 \pm 3^{\mathrm{s}}$
+20.2	3.3	$+3^{\mathrm{s}} \pm 3^{\mathrm{s}}$
+20.9	10.7	$-1^{\mathrm{s}} \pm 1^{\mathrm{s}}$

The OH emission line in the source Sagittarius-B2 was measured by us at a radial velocity of +67.7 km/sec. An antenna temperature of 6° K was recorded. The right ascension of the detail is $17^h 43^m 53^s \pm 5^s$ (1950.0). It should be noted that there is good agreement with the position of the north-eastern component of the emission source in the direction of the Galactic center (8).

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Note: Figure translations are in progress. See original paper for figures.