# Astronomy

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Fig. 1

Figure 1: Fig. 1

## Abstract

## Full Text

*Astronomy*

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# RADIO EMISSION OF THE TAURUS-A REGION AT A WAVELENGTH OF 8 mm

*(Presented by Academician D. V. Skobel' tsyn, 8 V 1961)*

In the course of carrying out a program of radio-astronomical investigations on the 22-m radio telescope of the P. N. Lebedev Physical Institute of the Academy of Sciences of the USSR ([1]), we observed the discrete radio source Taurus-A at a wavelength of 8 mm. The first record of the radio emission of this

**Fig. 1**

source was obtained on 21 VIII 1959. The antenna temperature proved to be equal to $T_A = 4.6°\text{K} \pm 25\%$.

Systematic observations were carried out in March–April 1961. A modulation radiometer of the usual type was used as the receiving device, the high-frequency part of which was placed near the focus of the parabolic reflector. The feed was a conical horn. The beamwidth at the 3 db level was about $2'$ in the $E$- and $H$-planes. During the measurements, calibration of the antenna temperature was performed by recording the radio emission of the atmosphere and of the "cold" equivalent of the antenna. The fluctuation sensitivity of the radiometer was 1.5°K for a time constant $\tau = 5$ sec.

Observations were carried out by the method of successive transits of the source through the beam pattern of a fixed antenna, which had been set in advance, by calculation, to the declination $\delta = 22°00'$. The position of the electrical axis was adjusted by the radio emission of Venus.

Figure 2 gives an example of a record of a source transit obtained on 18 III 1961. Noteworthy is the presence, in addition to the main maximum, close in position to the known source Taurus-A, of a second, smaller one shifted in right ascension by $\sim 36^s$.

For increasing the accuracy of the data obtained, several series of records were averaged. So far 21 records have been processed. In order to reduce the influence of systematic errors connected with inaccuracy in setting the axis of the

Fig. 2

Figure 2: Fig. 2

radio telescope, the records, in averaging, were divided into 5 groups close in parallactic angle.

The results of the processing are given in Fig. 1. The two maxima found on an individual record (Fig. 2) are systematically repeated in each averaged curve and apparently correspond to two sources of radio emission. The first source may be identified with the known source Taurus-A. Its right ascension is

$$\alpha_{1950} = 5^h31^m35^s \pm 05^s,$$

which differs by $5^s$ from the optical center of the Crab Nebula ([2]). The mean value of the antenna temperature of the source is $T_A = 4.5^\circ\mathrm{K} \pm 10\%$.

The mean angular size of the source at the 0.5 intensity level, obtained from the most reliable transit records with allowance for the width of the antenna beam pattern and the time constant of the radiometer (assuming a Gaussian form of the intensity distribution and of the antenna beam pattern), proved to be $4'5 \pm 1'$. With this angular size the brightness temperature of the source is $T_b = 6^\circ\mathrm{K} \pm 10\%$, and the flux density of its radio emission is $p = 500 \cdot 10^{-26}\ \mathrm{W\,m^{-2}Hz^{-1}} \pm 2.5\%$, which agrees satisfactorily with the spectral index of the source, 0.25, determined in ([3], [4]) from measurements at longer wavelengths.

The second maximum observed on all records is apparently a new source distinct from Taurus-A. Its right ascension is: $\alpha_{1950} = 5^h32^m10^s \pm 6^s$. The angular dimensions of the source in right ascension are $\varphi_{0.5} \simeq 2'5$. The antenna temperature is $T_A = 2.8^\circ\mathrm{K} \pm 10\%$, which corresponds to a brightness temperature $T_b = 7^\circ\mathrm{K} \pm 25\%$ and to a radio-emission flux density $p = 130 \cdot 10^{-26}\ \mathrm{W\,m^{-2}Hz^{-1}} \pm 25\%$.

The absence in the literature of any data on the observation of so intense a source at centimeter-, decimeter-, and meter-wavelength ranges apparently indicates a thermal mechanism of its radio emission. In this case, because of the difference in the spectra, the radio emission of the thermal source $\alpha_{1950} = 5^h32^m10^s$ may be masked by the radio emission of the source Taurus-A, which increases with increasing wavelength.

With a thermal mechanism of radio emission the emission measure of the source

**Fig. 2**

$\alpha_{1950} = 5^h32^m10^s$ according to the present measurements; $ME = 2.7 \cdot 10^6$. The absence of visible optical nebulae in this region indicates that the apparent emission measure of the source does not exceed 400. Consequently, the total absorption up to the source is greater than $8^m.7$. Taking, according to Parenago ([5]), the absorption in this region of the sky to be $2^m.3$ per 1 kpc, we find that the distance to the radio-emission source exceeds 3.8 kpc. Such an estimate of the distance makes it possible to estimate the linear dimensions of the source $2S$, its electron density $N_e$, and its mass $M/M_\odot$, which are $2S > 3$ pc, $N_e < 10^3$ cm$^{-3}$, and $M/M_\odot > 400$.

Apparently, this source is similar to the well-known bright nebulae NGC 1976 and NGC 6618.

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