Search for Dispersed Pulses at Declinations from $+56^\circ$ to $+87^\circ$

S. A. Tyul'bashev*, M. A. Kitaeva*, S. V. Logvinenko*, and G. E. Tyul'basheva*

a Lebedev Physical Institute, Russian Academy of Sciences, Pushchino Radio Astronomy Observatory, Astro Space Center, Pushchino, 142290 Russia

b Institute of Mathematical Problems of Biology, Russian Academy of Sciences, Branch of the Keldysh Institute of Applied Mathematics, Pushchino, 142290 Russia

*e-mail: serg@prao.ru

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Abstract—A survey of the northern hemisphere at the frequency 111 MHz is carried out. The total accumulation time for each point of the survey area was at least one hour. When searching for dispersed pulses, we detected 75 sources of pulsed radiation. More than 80% of these sources are known pulsars seen in the antenna side lobes. In twelve known pulsars, from one to several hundred pulses were detected. In four pulsars (J0157+6212, J1910+5655, J2337+6151, and J2354+6155), the narrowness of the strongest pulses and the ratio of peak flux densities in the strongest pulses and in the middle profile indicate that they may be pulsars with giant pulses. We detected one new rotating radio transient (RRAT) J0812+8626 with the dispersion measure $DM = 40.25$ pc/cm$^3$.

Keywords: pulsar, rotating radio transient (RRAT), giant pulse

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1. INTRODUCTION

In 2006, a new class of pulsars was discovered — rotating radio transients (RRAT) [1]. These pulsars emit irregularly (sporadically) appeared dispersed pulses. Regular (pulsar) radiation from rotating transients is often not detected. Over the past 15 years after the discovery of the RRAT, approximately one hundred rotating transients have been discovered when conducting new surveys and reprocessing data from early surveys. Basically, RRATs were detected in surveys on the search for pulsars (see ATNF Pulsar Catalog1 and RRATalog2). Almost all RRATs are found on the world’s largest radio telescopes. These are radio telescopes Parks (64 m), Arecibo (300 m), Green Bank (100 m), Pushchino (200 × 400 m). When searching for RRATs, the most important factor is the instantaneous sensitivity of the radio telescope, which depends on the effective area and, therefore, on the geometric dimensions of the antenna.

Until now, the nature of rotating transients and their place among ordinary second pulsars have not been determined. On average, RRATs have periods and magnetic fields longer than those of canonical (ordinary) second pulsars and often lie close to the death line in the dependence $P/\dot{P}$ [2, 3]. According to the hypothesis of Popov et al. [4], the location of RRAT in the dependence $P/\dot{P}$ suggests that they may be an intermediate class between pulsars with strong magnetic fields (magnetars, XINS) and ordinary second pulsars. The distribution of heights above the Galaxy plane, the distribution of the RRAT pulse widths is the same as for ordinary pulsars [5]. The average time between appearing pulses can be from minutes to tens of hours [1, 6]. According to [7], the appearance of pulses obeys the Poisson distribution, and according to [8, Fig. 6], clustering of pulses is observed in some RRATs. The pulse energy distribution can be lognormal, the sum of two lognormal distributions, lognormal with a power-law tail, power-law, and broken power-law, that is, the distributions are the same as for ordinary pulsars [7, 9–13]. According to some estimates, the number of rotating transients can be twice as large as the population of ordinary second pulsars [14]. An attempt to find an evolutionary relationship between pulsars and rotating transients was made in [9, 14].

Unfortunately, the small number of detected RRATs and the difficulties with their study due to the sporadic appearance of pulses do not allow us to give an unambiguous answer about the nature of rotating transients. Since the time of the pulse appearance is unpredictable, and the average time between the detected pulses is long, then in order to study the properties of rotating transients and select a preferred hypothesis about their nature, an increase in the total number of transients and long-term observations last-

1 https://www.atnf.csiro.au/people/pulsar/psrcat/
2 http://astro.phys.wvu.edu/rratalog/
ing tens or hundreds of hours for each point in the sky are necessary.

In this paper, we consider the search for dispersed pulses in a survey carried out with the Big Scanning Array (BSA) radio telescope of Lebedev Physics Institute (LPI) of the Academy of Sciences.

2. OBSERVATIONS

The BSA LPI radio telescope used for the survey is a meridian antenna with four independent beam systems. Two ray systems are used to search for pulsars and transients. One of them (BSA3) has fixed (non-switchable) beam positions in height, covering declinations from $-9^\circ$ to $+55^\circ$. BSA3 carries out a daily sky survey used for a number of scientific tasks, including the search for pulsars and RRATs [15–17]. Another system of beams is movable (BSA1), and allows observations at declinations from $-15^\circ$ to $+87^\circ$. For BSA1 for observations, we can choose from one to eight beams, sequentially lined up in the vertical plane according to declination. The size of one beam is approximately $0.5^\circ \times 1^\circ$. The BSA1 radio telescope was used in this study. Another beam system is used to control the antenna condition. For the latter system of beams, the possibility of creating an additional operable multibeam radio telescope is being considered, consisting of beams with fixed coordinates covering declinations from $+55^\circ$ to $+87^\circ$. Some details about the capabilities of the BSA LPI antenna after its reconstruction can be found in [15]. The central observation frequency is 110.3 MHz and the bandwidth is 2.5 MHz.

To conduct the survey, a new recorder based on the Field Programmable Gate Array (FPGA) was developed in BSA1, which is an analogue of the 96 channel recorder already operating on the BSA3 radio telescope. Structurally, the previously developed recorder is a set of modules. There are 12 modules in the recorder, each of which serves 8 beams of the BSA LPI. The modules are installed on the PCI bus of two industrial computers (PCs). The principles of construction, element base, software for conducting observations of this recorder are described in [6].

The algorithm of the new two-module recorder was supplemented with the ability to control the transfer of data from the hardware to the random access memory (RAM) of the computer via the PCI bus in the direct access channel (DAC) mode. For this, changes were made to the firmware of the FPGA of the recorder modules and to the radio astronomy observation program. Thanks to these changes in the recorder, the possibility to use the selective operation mode of individual modules and, accordingly, the selective data transfer mode has appeared. This reduced the load on data transmission and registration channels, made it possible to use a computer widely used in industry and a common operating system (OS) (Windows 10 PRO).

This mode provided stable joint operation of both the observational program and the standard system OS services, as well as the possibility for the operator to perform the functions of control over the experiment.

The observational program is integrated into the system for observing pulsars with the BSA radio telescope. The participation of an operator in the observation process is minimized. New drivers have been developed for the recorder modules to work under Windows 10 64-bit OS. For this, we used the Microsoft software for driver development—Windows Driver Kit (WDK). When checking the recorder in “hard” operating modes, no data recording errors were found when two modules were operating simultaneously with a time resolution of 3.072 ms and a spectral resolution of 19.53125 kHz (128 spectral channels). By changing the temporal resolution, for example, 2 times to 6.144 ms, we can increase the spectral resolution up to 256 spectral channels. The parameters for the time and frequency resolution are limited by the speed of data recording to the hard disk, the amount of RAM allocated in the system area and the limited resources of the computer when the OS system services, observation and service programs work together.

For the survey, we chose declinations $+56^\circ < \delta < +87^\circ$ that were inaccessible for observations with the BSA3. The survey was carried out in eight spatial beams covering approximately three degrees in declination. The BSA LPI Program Committee allocated 9 or 10 days per month for the survey. We fixed a set of declinations for survey on all selected days. For the next month, we selected new declinations. Thus, for 10 months, a single survey of declinations covering $31^\circ$ was carried out.

The observations began in April 2019. By the end of December 2020, each point in the sky with declination between $+56^\circ$ and $+87^\circ$ had at least 9 observation sessions, which corresponds to continuous observations of at least one time hour. The survey area is about 4000 square degrees. Basically, these are observations at high galactic latitudes and in the anti-center of the Galaxy.

The recording was carried out in a total band of 2.5 MHz, divided into 128 frequency channels with a channel width of 19.53 kHz. The selected polling time was 3.072 ms. The observations were carried out around the clock. One file was recorded every hour 24 files are recorded per day. The calibration signal, common for all radio telescopes implemented with the BSA LPI antenna, is supplied 6 times a day. It looks like OFF—ON—OFF (calibration step). At the specified time, the antenna is turned off for five seconds (OFF mode), then when the antenna is turned off, the calibration signal of the known temperature is turned on for five seconds (ON mode), then the calibration signal is turned off, and another five-second recording is made. After recording the calibration step, the antenna turns on. The fixed height of the calibration

## SEARCH FOR DISPERSED PULSES

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step in the units of the analog-to-digital converter (ADC) has a strong dependence on the ambient temperature and varies both in different seasons and during the day (for more details, see [18]). In this paper, the calibration step was used to equalize the gain in the frequency channels.

3. RESULTS

The search for dispersed impulses was carried out using a specially developed program written in terms of the C# language in the Microsoft Visual Studio envelope. Data processing and search for events — impulses with signs of dispersion delay are performed in several stages. At the first stage, for the set of dispersion measure specified in the processing parameters, all events exceeding the specified signal-to-noise ratio (SNR) are found and recorded. Further, a sequential analysis is carried out in order to filter out interference and repeated detections of the same event. Events caused by impulse noise are eliminated. The time areas corresponding to the record of the calibration step are rejected. During the processing on a long time interval (several days, weeks), time intervals are determined that correspond to signals from already identified space objects, including signals in the side lobes and in neighboring beams. By decision of the operator, such areas can be entered into a table located in external files, and are not involved in processing. From the remaining set of events, groups are selected that may result from the presence of a single signal with a dispersion lag in the record. For each of these groups, only one event (graphic file) with the highest SNR value is selected and left. The graphic file contains the impulse profile, the dynamic spectrum of the impulse, as well as other technical parameters of the event: the file name in which the detected impulse is recorded, the pulse SNR, the DM estimate, the coordinates of the pulse in right ascension, the coordinates of the BSA beam in declination, and others. These measures make it possible to reduce the number of events requiring further manual processing. The rejected events are recorded in folders corresponding to the beam and sidereal time in which they are recorded.

During a blind search, 75 directions in the sky were found, from which dispersed signals are observed. The analysis showed that some of the pulses belong to known pulsars observed in the main beam, some of the pulses are associated with known pulsars observed in the side lobes of the antenna, and some of the pulses remained unidentified.

The pulses of known pulsars detected in the side lobes of the BSA LPI pose a serious problem in identification. If several impulses are found on a given day, then in addition to the dispersion measure, one can roughly estimate the upper value of the period and, accordingly, obtain possible multiple periods. The obtained estimates of the period and the dispersion measure make it possible to check the strong pulsars included in the survey as candidates for identification. On the other hand, it may turn out that a strong pulsar is outside the survey area, and there is no period estimate for the detected transient. We cannot guarantee the absence of false detection of new transients due to the complex distribution of the side lobes of the BSA LPI, but we are making every possible effort to exclude such cases. In the side lobes of the antenna, we detected 13 pulsars outside the survey area. For example, the pulsar J1509+5531, located outside the studied area, was detected 333 times in the side lobes of the BSA LPI. In different directions, pulses of the pulsar were detected from 1 to 101 times (see Fig. 1 for an example of the pulse from PSR J1509+5531). In some of the known pulsars located in the observation area, pulses in the side lobes are also detected.

Figure 2 shows the coordinates of the directions of the dispersed pulses that we found. The crosses indicate 13 pulsars found in the side lobes and located outside the study area. It can be seen that the side lobes have a complex distribution, but all detected pulses have close right ascension with respect to the pulsars that generated the observed pulses. The known pulsars found in the side lobes, which have fallen into the observed area, are not shown in order not to make the figure heavier.

If a pulsar is found in the main beam, then it is easy to identify. The obtained estimates of the dispersion measure and the coordinates in right ascension and declination make it possible to select candidates for identification in the ATNF. Subsequent verification of the candidates by averaging the raw data with the period and dispersion measure taken from the ATNF makes the identification unambiguous. If no regular emission from the pulsar was detected, the object was placed on the RRAT candidate list.

Analysis of the detected pulses showed that we observed 12 known pulsars in the main beam and one new RRAT. The remaining 62 sources of pulsed radiation are radiation from well-known pulsars in the side lobes of the BSA LPI. For the identified pulsars and the detected RRAT, flux density estimates were made using calibration sources. The calibration sources were chosen so that their declination coordinates were close to the coordinates of the detected object, and right ascension differed by no more than two time hours. The calibration source candidates were selected from the Pushchino catalog of discrete sources [19], which was made at a frequency of 102.5 MHz. It was shown in [18] that when the flux density of the calibration source is recalculated to a frequency 111 MHz, the corrections will be insignificant. Assuming that the spectral indices \( S \sim \nu^{-\alpha} \) for all calibration sources are equal to one, the flux densities at 111 MHz will be 0.94 of the flux densities at 102.5 MHz. The calibr-
Fig. 1. Example of a service pattern created by the search program for each detected pulse. The profile of one pulse of the pulsar J1509+5531, detected in the side lobe of the BSA LPI in the direction α₂₀₀₀ = 15°32′; δ₂₀₀₀ = 62°15′ (top). The dynamic spectrum of the pulse (bottom). The horizontal axis shows the recording duration in points. 110 points correspond to ~338 ms of raw data recording. The vertical axis of the dynamic spectrum presents frequencies. The top of the dynamic spectrum corresponds to a frequency 111.49 MHz, and the bottom—to a frequency 109.01 MHz.

Fig. 2. Schematic representation of the observation area, on which the coordinates of the detected dispersed pulses are marked. Horizontal coordinates are shown in right ascension, and vertical coordinates are coordinates in declination. Crosses mark observations of known sidelobe pulsars. Numbers 1—13 in the lower part of the plot indicate pulsars whose coordinates are outside the studied area: 1—J0332+5434; 2—J0826+2637; 3—J0837+0610; 4—J0922+0638; 5—J0946+0951; 6—J1509+5531; 7—J1543+0929; 8—J1823+0550; 9—J2022+2854; 10—J2022+5154; 11—J2113+2754; 12—J2219+4754; and 13—J2305+3100. The filled circles show the locations of the 12 pulsars detected in the main beam, the filled square is the discovered new rotating radio transient.
tion sources were B0245+603 (44.3 Jy), B0733+806 (32.3 Jy), B0735+744 (12.6 Jy), B0742+576 (14.2 Jy), B1107+651 (12.0 Jy), B1656+572 (13.6 Jy), B1752+586 (10.0 Jy), B1858+568 (17.4 Jy), B2159+652 (28.1 Jy), and B2356+620 (27.2 Jy).

Table 1 shows the characteristics of the detected pulses for identified pulsars. The first and second columns of the table show the name of the source in the J2000 notation according to its detection at the BSA LPI and according to the identification in the ATNF catalog. Since the directional diagram of the BSA LPI is of the order of a degree, the accuracy of our coordinates is low, and therefore the names may not coincide. We provide both names so that we can compare the accuracy of the coordinates. The third column gives the number of pulses detected in the main beam. Columns 4–7 show the peak flux density of the strongest detected pulse ($S_{p1}$), the half-width of this pulse, the peak flux in the mean profile ($S_{p2}$), and the half-width of the mean profile. The average profile was created for the same session when the strongest impulse was observed. The strongest impulse itself was not excluded when constructing the average profile. Estimates show that eliminating a strong impulse will result in a decrease in $S_{p2}$ by 15–20%. Columns 8–10 contain estimates of the integrated flux density at 111 MHz ($S_{int}$), at 135 MHz [20], and at 102.5 MHz [21]. When obtaining estimates of the flux density at 111 MHz, we considered that the position of the BSA beams in the sky is fixed, and the pulsar can be located above or below the beam. Therefore, corrections were made to the flux density, considering the features of the BSA LPI as an antenna array. For the pulsars J0750+57 and J1706+59, discovered in 2014 [22], the ATNF catalog contains the coordinates of the pulsars with a low accuracy. Therefore, no correction was made for the discrepancy between the beam coordinate and the pulsar coordinate. For these pulsars, our estimate of the flux density can be underestimated by several times. Column 11 shows the quotient of columns 4 and 6, that is, the value of how many times the peak flux density of the strongest pulse differs from the peak flux density in the average profile for the same day.

The asterisk in the first column marks the pulsars observed both in the main beam and in the side lobes. The labels “St” [22] and “S” [20] in the second column indicate papers with the first detection of these pulsars. These studies on the search for pulsars were going on at about the same time as our survey on the search for new pulsars and transients. We confirm the detection of these pulsars at 111 MHz. The asterisk in the ninth column shows the expected flux density of pulsar J0814+7429 at 135 MHz. We also refine the dispersion measure for the pulsars J0750+57 ($DM = 26.75 \pm 0.25$ pc/cm$^3$) and J1706+59 ($DM = 30.5 \pm 0.25$ pc/cm$^3$), which we determined from the strongest observed pulses.

Figure 3 shows the average profiles and strongest pulses for the known pulsars found in the survey. It can be seen that the half-widths of the strongest pulses are much smaller than the half-widths of the mean profiles of the pulsars. We can estimate based on columns 5 and 7 of Table 1 how many times the strongest pulses are much smaller than the half-widths of the mean profiles of the pulsars. We can estimate based on columns 5 and 7 of Table 1 how many times the strongest pulse is narrower than the average profile. The largest difference in the pulse half-width and the mean profile is for the pulsar J1910+5655, where the half-widths differ by 19.8 times. The smallest difference in half-widths is for the pulsar J2354+6155, where the half-widths of the mean profile and the strongest pulse differ by a factor of 1.3. The median value of the half-width difference falls to 4–5.

According to column 11 of Table 1, the peak flux density of the strongest pulses is usually ten or more times the peak flux density in the mean profile of pulsars. According to the study of pulsars with giant

| Name_{LPA} | Name_{ATNF} | N | $S_{p1}$, Jy | $W_{el}$, ms | $S_{p2}$, Jy | $W_{el2}$, ms | $S_{int}$, mJy | $S_{135}$, mJy | $S_{102}$, mJy | $S_{p1}/S_{p2}$ |
|-------------|-------------|---|-------------|--------------|-------------|--------------|--------------|---------------|---------------|----------------|
| J0140+6008*| J0141+6009  | 562| 241.5       | 12.3         | 14.3        | 33.8         | 394          | 102.6         | —             | 16.9           |
| J0158+6223 | J0157+6212  | 2 | 17.7        | 12.3         | 0.65        | 64.5         | 17.8         | 4.8           | 52            | 27.2           |
| J0653+8054*| J0653+8051  | 15| 15.5        | 6.1          | 0.7         | 27.6         | 16           | 13.1          | 16            | 22.1           |
| J0750+5724 | J0750+57(St)| 1 | >14         | 6.1          | >0.27       | 24.6         | >6           | —             | —             | —              |
| J0814+7436*| J0814+7429  | 62| 781.4       | 6.1          | 56.3        | 61.4         | 2674         | *358.8        | 1080          | 13.9           |
| J1058+6504 | J1059+6459(St)| 3  | 4.2         | 12.3         | 0.62        | 33.8         | 5.8          | —             | —             | 6.8            |
| J1706+5958 | J1706+59(St)| 24| >9.0        | 6.1          | >0.55       | 58.4         | >22          | 15.7          | —             | —              |
| J1843+5640*| J1840+5640  | 757| 235.4       | 6.1          | 21.4        | 21.5         | 275          | 55.0          | 50            | 11             |
| J1911+5654 | J1910+5655(S)| 2  | 28.5        | 3.1          | 0.26        | 61.4         | 46.7         | —             | —             | 109            |
| J2225+6527*| J2225+6535  | 94 | 55.5        | 3.1          | 6.0         | 27.6         | 242          | 126.3         | —             | 9.3            |
| J2336+6145*| J2337+6151  | 346| 77.6        | 9.2          | 2.4         | 27.6         | 132.4        | 28.7          | 75            | 32.7           |
| J2354+6158 | J2354+6155  | 2 | 50.6        | 12.3         | 1.6         | 15.4         | 26           | 10.5          | 30            | 31.6           |
search for dispersed pulses carried out with the LPI BSA [23], there are a number of features that distinguish a pulsar with giant pulses from an ordinary pulsar. Two features that can be verified from our data are the small width of the giant pulse in comparison with the average profile and the difference between the peak flux density of the giant pulse and the integrated flux density by a factor of 30 (strong criterion) or 10 (weak criterion) or more.

Among 12 pulsars in Table 1, for two pulsars, such an estimate could not be made; for two other pulsars, the peak flux densities differ by less than 10 times. Eight pulsars satisfy the weak criterion, and four of these
eight pulsars satisfy the strong criterion. Therefore, four pulsars are good candidates for giant pulse pulsars.

Separate studies are required in order to check whether the sources found from dispersed pulses are pulsars with giant pulses. In particular, one of the objects (B0809+74/J0814+7429) was specially studied in [23] as a candidate for pulsars with giant pulses. For the pulsar, almost $2.8 \times 10^5$ pulses were found, of which 49 met the “giant pulse pulsar” criterion, namely, their peak flux density of 1500–2000 Jy was 30 or more times higher than the peak flux density in the middle profile. The energy distribution of pulses turned out to be lognormal with a power-law tail. According to the authors, the energy distribution of pulses they constructed and the observed drift of subpulses for this source indicate that the pulsar J0809+7429 has anomalously strong, but not giant pulses.

In addition to the known pulsars, a source was found that could not be identified. For J0812+8626, indicated in Fig. 2 by a filled rectangle, two pulses at $DM = 40.25 \pm 0.25 \text{ pc/cm}^2$ were detected. The distance between the pulses was found to be 47.58 s. The search for periodic radiation in the direction of the source in the summed power spectra and in the summed periodograms was carried out. Since we had at least 9–10 days of observations in the direction of each source, the incoherent addition of the power spectra [24, 25] and periodograms [26] for all days of observations allowed us to increase the sensitivity when searching for periodic radiation by about 2–3 times. The peak flux density of the found pulses is $S_p = 10$ and 4.5 Jy, the half-width of the profile is $W_e = 10 \text{ ms}$. The upper limit estimate of the flux density is $S_{\text{int}} < 2 \text{ mJy}$ (if $0.5 \text{ s} < P < 10 \text{ s}$). Since the appearance of RRAT pulses is sporadic, the true coordinates of the source can appear anywhere in the radiation pattern. Here are the formal coordinates of J0812+8626: $\alpha_{2000} = 08^h12^m30^s \pm 2.5''$; $\delta_{2000} = 86^\circ26' \pm 15''$ (see Fig. 4). The exact coordinate of the transient is not known; therefore, it is not possible to make corrections to the flux density taking into account the position of the BSA LPI beams relative to the source. The reported peak flux densities are lower estimates. The real flux density of these pulses can be 1.5–2 times higher.

4. DISCUSSION OF THE RESULTS

We found 13 sources of pulsed radiation when we searched for dispersed impulses in an area covering approximately 4000 square degrees. Twelve of them turned out to be known pulsars, in which from 1 to 757 pulses were detected. Four of the twelve pulsars (J0750+57, J1059+6459, J1706+59, and J1910+5655) were discovered in recent searches for pulsars at 1400 MHz (Green Bank [22]) and at 135 MHz (LOFAR [20]), and we confirm their detection at 111 MHz. For two (J0750+57 and J1706+59), we have refined the estimate of $DM$. Comparison of the half-widths of the strongest pulses of all 12 pulsars and the half-widths of the mean profiles of these pulsars shows that the mean profiles are 1.5 to 20 times wider than the strongest pulses. A comparison of the peak flux densities of the strongest pulses and average profiles shows that four pulsars (J0157+6212, J1910+5655, J2337+6151, and J2354+6155) are good candidates for giant pulse pulsars. The best candidate is the pulsar J1910+5655. The peak flux density of its strongest pulse is 109 times the peak flux of the middle profile. The half-widths of the strongest impulse and the average profile differ by a factor of 20.

One of the hypotheses about the nature of RRATs was proposed in [27]. According to the proposed hypothesis, rotating transients are ordinary pulsars with an unusually long tail in the energy distribution of pulses. It is assumed that the integrated flux density of these pulsars is below the detection threshold for a given radio telescope, and individual pulses from the distribution tail are strong enough to detect them. The limiting sensitivity for the BSA LPI in the search for periodic radiation is 5–10 mJy [16], the limiting sensitivity of the BSA LPI in the search for pulsed radiation.
is about 2 Jy [17]. Let us select the numbers, multiplying by which the integral flux density of the pulsar will decrease to 5 mJy, and multiply the peak flux density of the strongest pulse of the given pulsar by the selected number. We get: J0141+6009 (3.1 Jy); J0157+6212 (5.0 Jy); J0653+8051 (4.8 Jy); J0814+7429 (1.5 Jy); J1059+6459 (3.6 Jy); J1840+5640 (4.3 Jy); J1910+5655 (3.1 Jy); J2225+6535 (1.1 Jy); J2337+6151 (2.9 Jy); and J2354+6155 (9.7 Jy). Thus, out of 10 pulsars for which the peak flux density has been estimated, when the pulsar is removed such a distance that its integrated flux density drops to 5 mJy, individual pulses will not be visible only for two pulsars (J0814+7429 and J2225+6535).

The hypothesis [27] may be valid for a part of the sample of ordinary second pulsars. At the same time, as shown in [2, 3], the typical RRAT periods are many times larger than the typical periods of second pulsars. Therefore, some of the observed rotating transients belong to some other sample. It is possible that part of the RRAT sample is associated with giant pulses. In [12, 13], for several RRATs, it was possible to show that the observed pulses can be giant pulses of pulsars.

We detected two pulses of the new RRAT J0812+8626. The detected number of pulses only allows us to speak about the detection of RRAT, but does not make it possible to carry out any analysis.

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