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The results of Waseda radio transient survey

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We report on several radio transients and a possibly long-term variable radio source detected by interferometric drift scan observation at Waseda Nasu Pulsar Observatory. Since May 2004, we have carried out the routine observations to search for radio transients and variable radio sources in our observable region, +32 deg< δ <+42 deg. In our observations, approximately 10 radio transients were detected by October 2006. Although these transients have still not been identified, we could find that these have mainly following three features. a) Most of transients were detected just once (only 1 transient was detected at the same position for two days). b) The distributions of radio transients could be isotropic in our observable region. c) These transients have a flux density on the order of Jy scale because the noise level of our system is approximately 300 mJy. To identify what type of objects these radio transients were, we have developed an alert system. If this alert system completes, we will obtain the positional information of detected radio transients within 70-min at a maximum from an appearance of the transients. By obtaining the positional information as soon as possible, we can carry out follow-up observations of these with other radio observatories.

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1. Radio transients & a possibly variable source

In this section, we describe two types of radio source that detected by interferometric drift-scan at Waseda Nasu Pulsar Observatory. One is the radio transients, and the other is a possibly variable radio source WJN J1955+3600.

1.1 Radio transients

Since wide-field survey program was started at Waseda Nasu Pulsar Observatory in 2004 we detected interesting phenomena, we call these "*Radio Transients*". With this program, we have detected several radio transients between 2004 and 2006. Although most of these phenomena were detected once, only one burst was lasting 2 days (Fig. 1).

However the origin of these burst phenomena and the detailed burst durations still have not been identified, in the nature of interferometric drift-scan observation utilizing earth rotation we have carried out.

Currently, we know that the distribution of radio transients could be isotropic in our observable region. And so, we calculated the log N- log S relation of radio transients and compared it with that of Gamma Ray Bursts (Fig. 2).

The detailed burst duration and spectral information of radio transients are needs to identify the origin of radio transients. While the burst is lasting, it is important to track it and to observe it at other wavelengths simultaneously. Now we are developing the new observing and analysis system to carry out collaborative observation with other radio observatories soon after detecting bursts.

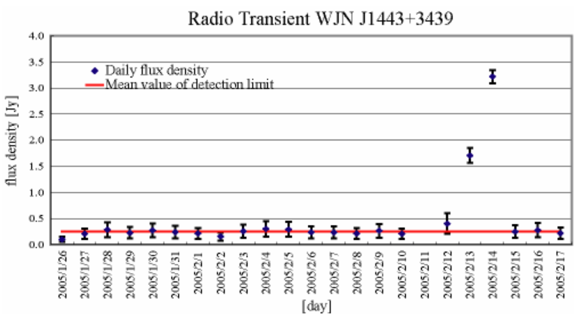

Fig. 1: The light curve of WJN J1443+3439. The flux density of this burst exceeded extremely detection limit of our system (~300 mJy) on Feb 13 and 14, 2005 [1].

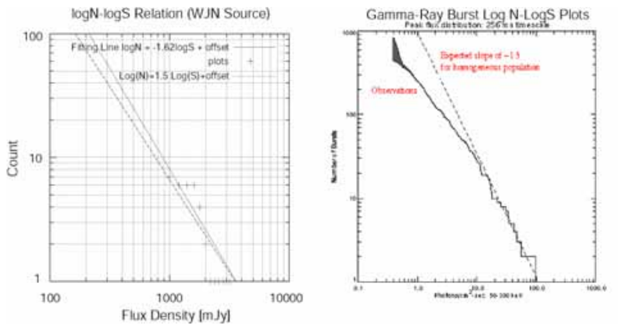

Fig. 2: Comparing Log N-Log S relation of radio transients with that of Gamma-Ray Bursts (GRBs).

1.2 A possibly variable radio source

In addition, we detected a possibly variable radio source WJN J1955+3600 in 2005 and 2006 (Fig. 3). The flux density of WJN J1955+3600 was approximately 1.2-1.5 Jy and there are several radio counterparts within the positional error. Even 4C+35.47 (0.4-0.8 Jy), the strongest source of these counterparts, is only half of WJN J1955+3600 in flux density (Fig. 4). 4C+35.47 was observed at 1.4 GHz several times between 1970s and 1990s (Ohio, Green Bank Telescope (GBT), NVSS). If WJN J1955+3600 corresponds to 4C+35.47, 4C+35.47 has a possibility of long-term variable radio source such as Seyfert galaxy NGC 1275 (3C84).

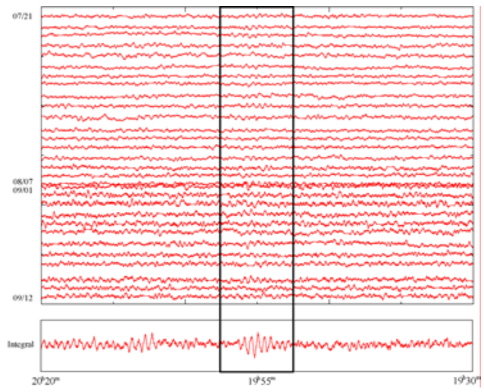

Fig. 3: The fringe data of each date and an integrated data of WJN J1955+3600. The fringe data bounded by rectangular is WJN J1955+3600.

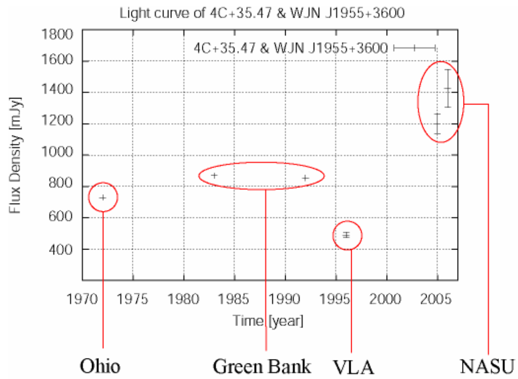

Fig. 4: The light curve of WJN J1955+3600 (observed at Nasu) and 4C+35.47 (observed at Ohio, GBT, VLA) [2, 3].

2. An alerting system

To observe with other radio telescope while the burst is lasting, we have developed new observing and analysis system (Fig. 5). This system will have a section observation mode. 1 section time of this mode is 60-min (55-min: observing mode and 5-min: writing the data to HDD). And then, analysis program runs to search for radio transients. This section is repeated 24 times a day. If this new system will complete, we can obtain the positional information of the burst within approximately 70-min at the most from detection. So, we should obtain the information to identify the origin of radio transients more than now. This new system will start running on Oct 2007.

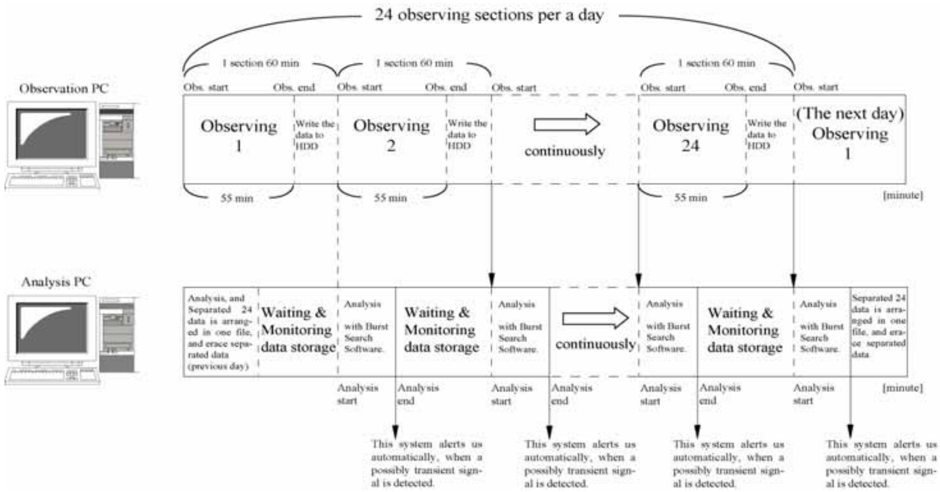

Fig. 5: The block diagram of new observing and analysis system at Nasu Pulsar Observatory

References

[1] Niinuma, K., et al. 2007, ApJ, 657, L37.

[2] Ehman, J. R., Dixon, R. S., Ramakrishna, C. M., & Kraus, J. D. 1974, AJ, 79, 144.

[3] NASA/IPAC Extragalactic Database, http://nedwww.ipac.caltech.edu/.