On the energy distribution of single pulses from radio pulsars

A. V. Bilous[1,2*], M. V. Popov[2], O. M. Ulyanov[3]

[1]Moscow Institute of Physics and Technology, Moscow, Russia

[2]Astro Space Center of Lebedev Physical Institute, Moscow, Russia

[3]Institute of Radio Astronomy of NAS of Ukraine, Kharkiv, Ukraine

In this work we study two phenomena of short abrupt increase of pulsar radio emission – Giant Pulses (GPs) and Abnormally Intensive Pulses (AIPs). Both of them are quite rare phenomena – so far they are known only for a handful of pulsars. GPs are detected in the range from 23 MHz to 15 GHz[†] and consist of the series of very short, bright and highly polarized bursts. AIPs were discovered recently [1] at decimeter wavelengths, and, similar to GPs, they are narrower and much more brighter than the average profile of radio emission.

Our efforts are concentrated to determine the energy distribution of single pulses. It is known that GP energies are distributed by the power law, and the exponent depends on the pulsar, observed frequency and range of pulses widths [2]. The exponent typically varies from -0.9 to -3.2 for the cumulative distribution. In this work, we study (for the first time) the energy distribution of GPs from the Crab pulsar at 600 and 1650 MHz with respect to their widths. The energy distribution of AIPs is obtained from observations of B0809+74 at 23 MHz. We compare the distributions of GPs and AIPs to the appropriate distribution of regular pulses. Other statistical properties of GPs and AIPs are also discussed. The results can be used to set the constrains on the theories of pulsar radio emission.

References

[1] O. M. Ulyanov, V. V. Zaharenko, A. A. Konovalenko et.al. The discovery of single pulses from pulsars 0809+74; 0834+06; 0943+10; 0950+08; 1133+16 at decimeter wavelengths. Radiofizika i Radioastronomiya, vol.11, # 2, pp. 113–133 (2006).

[2] M. V. Popov, B. Stappers. Statistical properties of giant pulses from the Crab pulsar. A & A 470, 1003–1007 (2007).

*E-mail: hanna.bilous@gmail.com

[†]For example, see the results of our recent multifrequency observational campaign of the Crab pulsar at http://dunbar.phys.wvu.edu/∼vlad/projects/crab2007/