Giant radio flare of Cygnus X-3 detected by astronomers
7 December 2016, by Tomasz Nowakowski

Light curves before or during the flare at X-ray 15-50 KeV (top) and the multi-frequency data of the RATAN measurements (below). Characteristic X-ray states of the binary are marked. Credit: Trushkin et al., 2016.

March 2011, astronomers recorded a giant flare, and after this event, the source went into a state of dormancy.

The phase of quiescence was interrupted by the last giant radio outburst that took place in September 2016, and was predicted by a team of astronomers led by Sergei Trushkin of the Special Astrophysical Observatory (SAO) in Nizhnij Arkhys, Russia. The researchers observed Cygnus X-3 with SAO's RATAN-600 radio telescope as part of a long-term, multi-frequency monitoring campaign of microquasars.

"In the long-term multi-frequency monitoring program of the microquasars with RATAN-600, we discovered the giant flare from X-ray binary Cyg X-3 on September 13, 2016," the scientists wrote in the paper.

According to the research, Cygnus X-3's 2016 outburst interrupted a nearly five-and-a-half-year period of its quiescence. The flare of 2016 occurred after transition of the source to a 'hyper-soft' X-ray state, as in the case of the previous outburst in 2011.

The scientists revealed that the flux of the 2016 flare rose from 0.01 to 15 Jy at 4.6 GHz over five days. Afterward, the microquasar returned to a quiescent state on Oct. 18, 2016.

"The rise of the flaring flux is well fitted by an exponential law that could be a initial phase of the relativistic electrons generation by internal shock waves the jet," the team explained.

Besides detecting and characterizing the 2016 outburst, the researchers also found that during the period of dormancy preceding the latest flare, hard X-ray flux were strongly anti-correlated. They assume that this could be related with properties of the compact radio jets that form during a quiescent state, and strongly depend on a rate of accretion on
to a black hole or a neutron star.

"The accretion disk-jet coupling in X-ray binaries has been discussed during last 10 to 15 years, especially in the frame of the hardness-intensity diagram (HID) studies. (...) The spectral evolution of the giant flare is described by a single (during three to four days) ejection of the relativistic electrons, that moved with high velocity (0.5c) away from the binary and expanded as a conical structure," the paper reads.

The team plans to present the results of other observations of the Cygnus X-3's flare conducted using different telescopes, which could help in making a more thorough analysis of this microquasar's violent outbursts. New measurements will be published in the upcoming research papers.


© 2016 Phys.org