Astronomers observe blazar S5 0836+710 during high activity period, detect two gamma-ray flares

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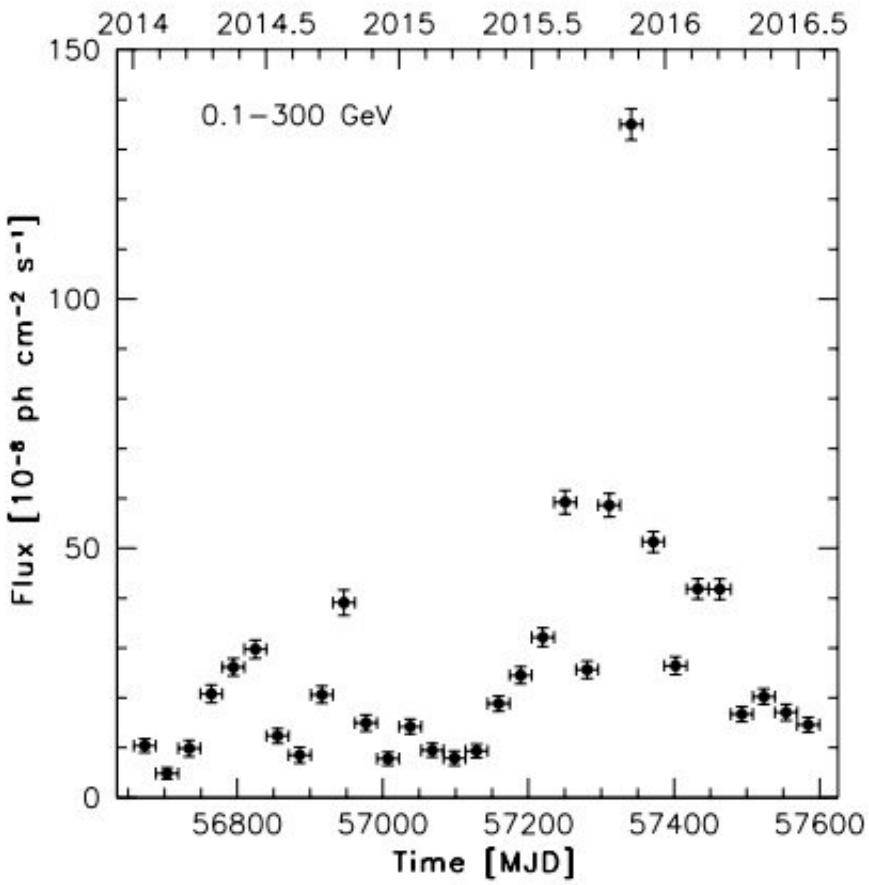

Integrated flux LAT light curve of S5 0836+710 obtained using an LP in the 0.1–300 GeV energy range during 2014 January–2016 July with 30-day time bins. Credit: Orienti et al., 2019.

Italian astronomers have conducted multi-band observations of the high-redshift blazar S5 0836+710 during its period of high activity. The monitoring campaign resulted in the detection of two major gamma-ray flares from this source and provided more insights on the object's properties. The findings are available in a paper published October 18 on arXiv.org.

Blazars are very compact quasars associated with supermassive black holes at the centers of active, giant elliptical galaxies. Based on their optical emission properties, astronomers divide blazars into two classes: flat-spectrum radio quasars (FSRQs) that feature prominent and broad optical emission lines, and BL Lacertae objects (BL Lacs), which do not.

Of special interest are high-redshift blazars (with redshifts above 2.0) hosting massive black holes and the most powerful relativistic jets. They are among the most powerful objects in the universe. Finding and observing new blazars at high redshifts could be crucial for providing insights into many phenomena of the universe, including the evolution and space density of massive black holes.

At a redshift of 2.18, S5 0836+710 is a FSRQ with a relativistic jet having a helical structure and a black hole with a mass of around 5 billion solar masses. Many observations of this blazar since the 1990s have been conducted, revealing its variability in gamma-rays and identifying its high activity phases. The source entered an active phase in March 2011 that lasted until January 2012. During this period, it reached a daily apparent gamma-ray luminosity of approximately 800 quattuordecillion erg/s.

New research published by a team of astronomers led by Monica Orienti of the Institute for Radio Astronomy of the National Institute for Astrophysics (INAF) in Bologna, Italy, reveals that S5 0836+710 experienced another period of high activity that commenced in August

2015. Using NASA's Fermi and Swift spacecraft, as well as the Very Long Baseline Array (VLBA), the researchers performed a multi-band (from radio to gamma-rays) monitoring campaign of the blazar in the high activity state, hoping to disclose more details about its nature.

"In this paper, we reported on results of a broadband monitoring campaign, from radio to gamma-rays, of the high-redshift FSRQ S5 0836+710 following a period of high activity detected by Fermi-LAT," the paper reads.

The observations detected gamma-ray flares from S5 0836+710 on August 2 and November 11, 2015. During these two events, the apparent isotropic gamma-ray luminosity exceeded 100 quindecillion erg/s, with a doubling time scale of about three hours. The astronomers explained that such doubling time suggests that the size of the emitting region in S5 0836+710 (with a radius estimated to be about 0.002 light years) is comparable to the gravitational radius for this source.

According to the researchers, such high gamma-ray activity may be related to a new superluminal component that emerged from the core in April 2015 at the peak of the radio activity. When it comes to the blazar 's short gamma-ray variability, the astronomers propose a strong turbulence in the jet plasma or magnetic reconnection as an explanation.

Moreover, the study found that S5 0836+710 exhibits smaller variability in X-rays and also in optical and ultraviolet bands when compared to gamma-rays. This, according to the scientists, could mean that the X-ray emission is produced by the low-energy tail of the same electron distribution that produces the gamma-ray emission through inverse Compton scattering, and that the optical-ultraviolet part of the spectrum has a large contribution from the accretion disc.

More information: Radio VLBA polarization and multi-band

monitoring of the high-redshift quasar S5 0836+710 during a high activity period, arXiv:1910.08568 [astro-ph.HE]
arxiv.org/abs/1910.08568