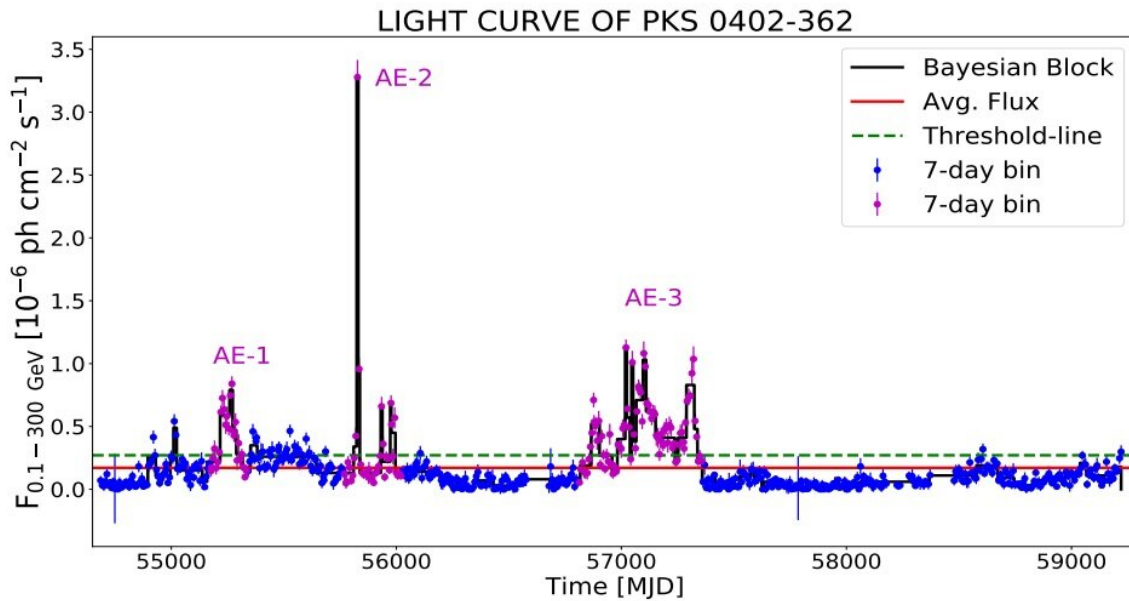


# Observations investigate long-term behavior of gamma-ray blazar PKS 0402-362

March 16 2023, by Tomasz Nowakowski



Fermi-LAT light curve of PKS 0402-362 in seven-day binning. Credit: Das et al., 2023.

Indian astronomers have analyzed observational data of a gamma-ray blazar known as PKS 0402-362, collected in the timespan of nearly 13 years. The study, published March 7 in the *Monthly Notices of the Royal Astronomical Society*, provides crucial information regarding the long-term behavior of this blazar.

Blazars are very compact quasars associated with [supermassive black holes](#) (SMBHs) at the centers of active, giant elliptical galaxies. They belong to a larger group of active galaxies that host [active galactic nuclei](#) (AGN), and are the most numerous extragalactic gamma-ray sources. Their characteristic features are relativistic jets pointed almost exactly toward the Earth.

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.

PKS 0402-362 (also known as 4FGL J0403.9-3605) is an FSRQ at a redshift of 1.42. The [blazar](#) is a consistent gamma-ray emitter, which has been monitored for years with NASA's Fermi gamma-ray space telescope.

In order to get more insights into the behavior of PKS 0402-362, a group of astronomers led by Avik Kumar Das of the Indian Institute of Science Education and Research Mohali in India, decided to analyze a huge dataset of the data obtained with Fermi's Large Area Telescope (LAT).

"We study the long-term behavior of the bright gamma-ray blazar PKS 0402-362. We collected approximately 13 years of Fermi-LAT data between Aug 2008 to Jan 2021 and identified three bright gamma-ray activity epochs," the researchers wrote in the paper.

As noted in the study, the long-term observational campaign of PKS 0402-362 revealed multiple activity epochs (AEs) of different durations that spread over 12 years of the observed time. Among the three identified epochs, designated AE-1, AE-2 and AE-3, AE-2 turned out to be the brightest one with flux more than 20 times the average [gamma-ray](#) flux.

Based on the collected data, the astronomers found that the size of the broad-line region (BLR) of PKS 0402-362 is about 0.75 light years. By comparing this size with the location of the emission region, the researchers concluded that the emission region is located just at the boundary of the BLR.

The authors of the paper added that the long-term correlation study of PKS 0402-362 suggests that broadband emissions are co-spatial, and the variability study indicates that they are produced within the BLR. They also found that like in other known FSRQs, the accretion disk of PKS 0402-362 dominates the optical-ultraviolet emission which is visible across the flaring states of this blazar.

"A dominant accretion disk is observed for this source which is well fitted by the combination of synchrotron and the thermal disk emission. This source has a strong accretion disk as it was also observed by Müller et al. (2018), which makes this source a good candidate to explore the disk-jet connection, which is out of scope for this paper," the authors of the study concluded.

**More information:** Avik Kumar Das et al, Gamma-ray flares and broadband spectral study of PKS 0402-362, *Monthly Notices of the Royal Astronomical Society* (2023). [DOI: 10.1093/mnras/stad702](https://doi.org/10.1093/mnras/stad702). On *arXiv*: [arxiv.org/pdf/2303.03039.pdf](https://arxiv.org/pdf/2303.03039.pdf)

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