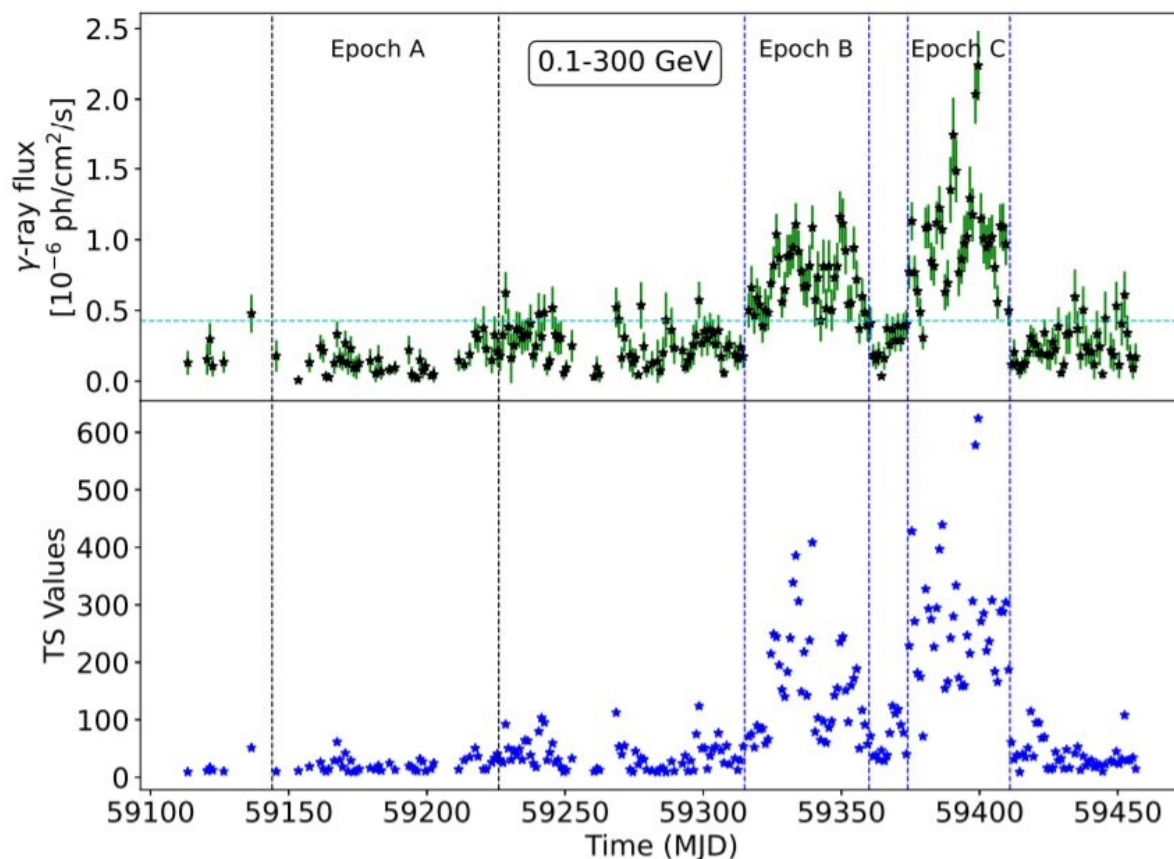


Blazar Ton 599 investigated by Indian astronomers

December 22 2021, by Tomasz Nowakowski



One-day binned gamma-ray light curve of Ton 599 (upper panel) with the test statistics (TS) values corresponding to each flux value (lower panel). Credit: Rajput and Pandey, 2021.

Using NASA's Fermi spacecraft, researchers from the Indian Institute of Astrophysics in Bangalore, India, have conducted a gamma-ray flux and spectral variability study of a blazar known as Ton 599, during its recent flaring activity. Results of the research, published December 13 on the arXiv pre-print server, shed more light on the properties of this source.

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.

At a redshift of 0.725, Ton 599 (also known as 4FGL J1159.5+2914) is a strongly polarized and a highly optically violent variable FSRQ. In 2017 it went through a protracted flaring condition spanning the full electromagnetic spectrum. More recently, from July to September 2021, the quasar exhibited a bright flare in gamma-rays.

Bhoomika Rajput and Ashwani Pandey decided to observe Ton 599 using Fermi when it entered its recent flaring state, with the aim of investigating the blazar's gamma-ray emission process and its consequences during the flaring condition.

"We present here the results of our γ -ray flux and spectral variability study of the blazar Ton 599, which has been recently observed in the γ -ray flaring state," the researchers wrote in the paper.

From the Fermi data, Rajput and Pandey generated a one-day binned light curve of Ton 599 for a period of about one year (September 2020-August 2021). The final gamma-ray light curve contains 256 confirmed measurements of this blazar. For this period, the maximum gamma-ray flux detected was at a level of $0.00000224 \text{ ph/cm}^2/\text{s}$.

Based on the observations, the astronomers identified three epochs of different flux states of Ton 599: quiescent, pre-flaring, and main-flaring. The largest gamma-ray flux variations were found for the main-flaring epoch (about 0.35 percent), while during the pre-flaring epoch, the source exhibited variations at a level of 0.22 percent. However, no significant [flux](#) variation was detected in the quiescent epoch.

The researchers found that the log parabola (LP) model best describes the gamma-ray spectra of Ton 599 during all the three epochs. This indicates that the GeV gamma-ray spectrum of this [blazar](#) is curved.

The authors of the paper also estimate that the size of the gamma-ray emitting region is approximately 103 billion kilometers. They added the location of the [gamma-ray](#) emitting blob of Ton 599 could be outside its broad line region (BLR).

More information: Bhoomika Rajput, Ashwani Pandey, γ -ray Flux and Spectral Variability of Blazar Ton 599 during Its 2021 Flare. arXiv:2112.06681v1 [astro-ph.HE], arxiv.org/abs/2112.06681

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