

# Blazar 1ES 0806+524: Analysis, Study and Features

Alessandro Di Gioia, Giuseppe Di Muccio and Giuseppe Capasso

Liceo Scientifico Telesi@, Telese Terme italy

E-mail: digioia.a.studente@iistelese.it

**Abstract.** This report is about the source 1ES0806+524, a blazar that is part of the active galactic nuclei that is still being studied by experts today. We will see how we obtained the data and how to read them, then we will analyze the physical properties of this blazar.

## 1. Introduction

Blazars are active galactic nuclei (AGN) characterized by a supermassive black hole at the center of the host galaxy, which emits powerful jets of high-energy particles aimed almost exactly at Earth. These objects are among the brightest and most energetic in the Universe. 1ES0806+524 was first detected in the very high energy (VHE) gamma-ray band by the VERITAS telescope between 2006 and 2008.

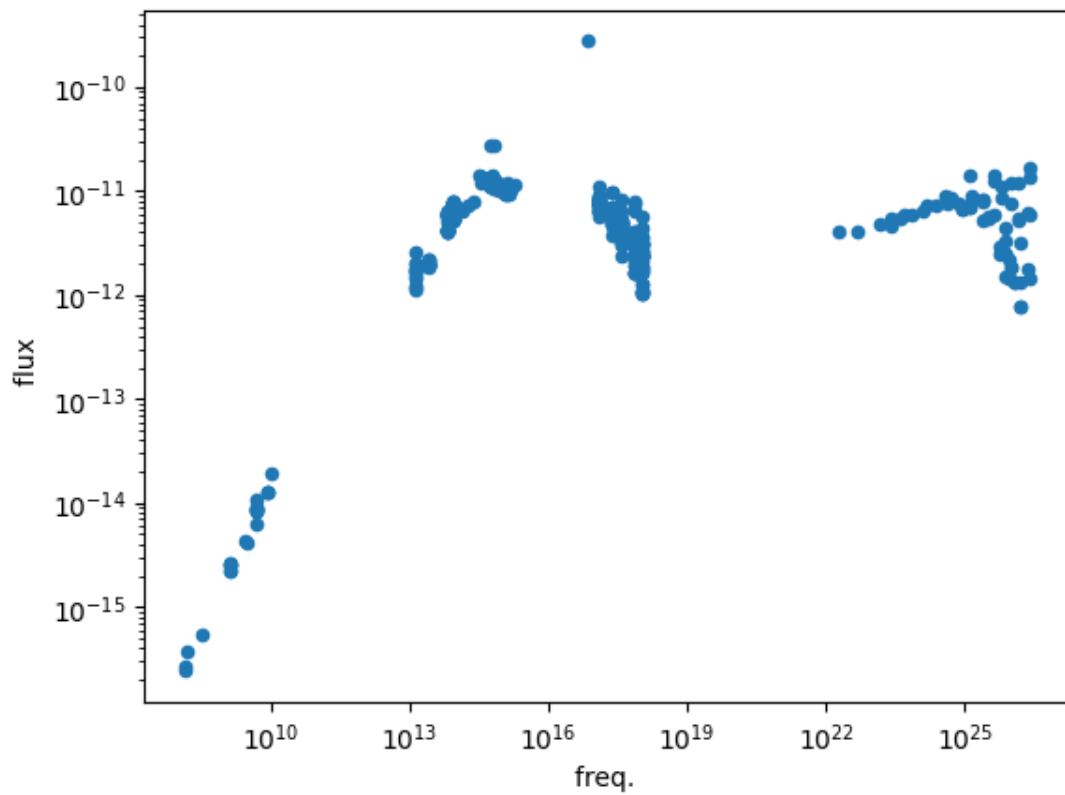
### *1.1 origin of the activity*

On November 26, 2024, we went to Naples for the International Cosmic Day, where we followed a general lesson on blazars and the cosmos, and then obtained data thanks to machines made available to us and after analyzing them we made a presentation, which was shown on Zoom with people from all over the world connected for the International Cosmic Day. Subsequently, in the second lesson held at our headquarters, we were assigned different sources and we were given different sites (such as Firmamento or TevCat) that allowed us to have the information and data necessary to be able to write this article.

## 2. Research methods

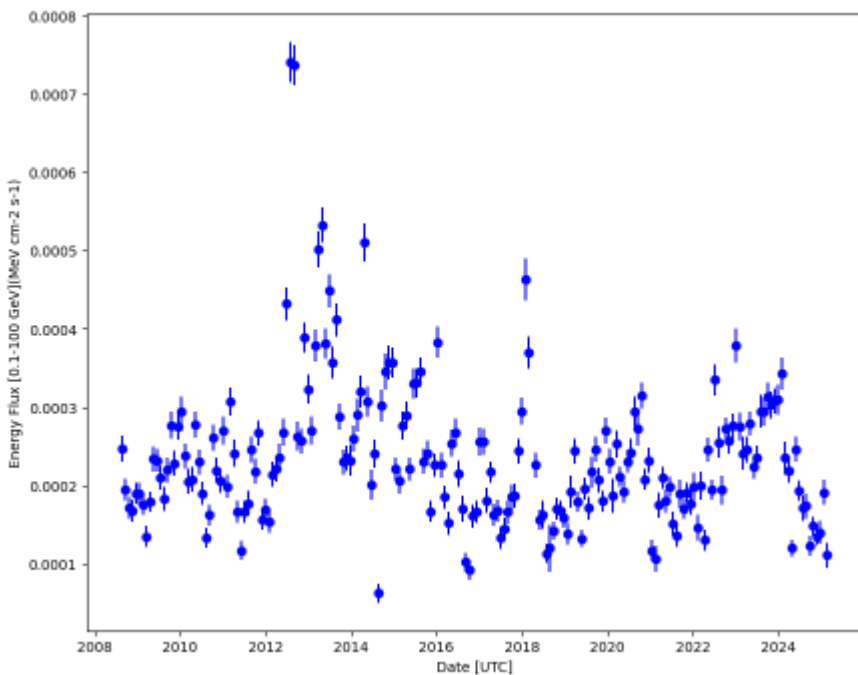
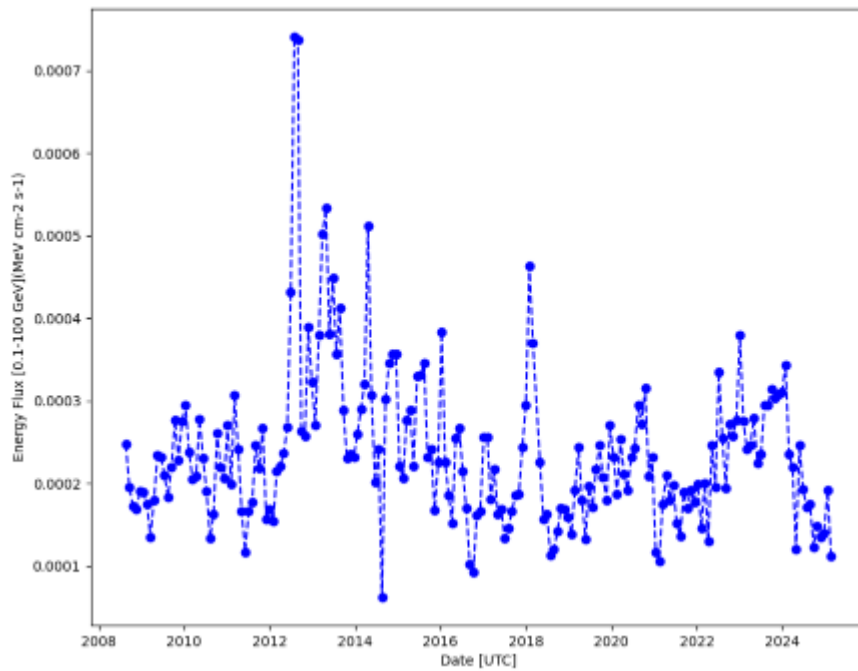
To obtain the data useful to us, as already mentioned, we used different sites to see the graphs and information that interested us, but we were also taught how we could obtain this data ourselves. To do this we used Google Colab, where we obtained the SED (Spectral Energy

Distribution) graph



The graph shows us the double-peaked energy spectrum, which is typical of blazars: the first peak, which extends from radio waves to X-rays, is due to synchrotron emission generated by electrons accelerated in the jet's magnetic field; the second peak, in the gamma-ray band up to TeV, is produced by the inverse Compton effect, in which electrons transfer energy to low-energy photons.

We then also found the light curve graph using Python



The graph shows the evolution of energy flow over time, from 2008 to 2025. The data show significant fluctuations, with particularly high peaks between 2012 and 2014, followed by a gradual decline and greater stability in the following years. However, variations persist, indicating a possible cyclical activity or transitory events.

### 3. Results

The source 1ES 0806+524 is a blazar of the BL Lacertae type, a subclass of active galactic nuclei (AGN) characterized by strong relativistic emission and variability on multiple time scales. Located at a redshift of  $z \approx 0.138$ , this object emits intensely in the radio, optical, X-ray and gamma-ray bands, with emission dominated by the relativistic jet oriented nearly along the Earth's line of sight. Its radiation is typically explained by a two-component model: the first is synchrotron radiation, due to relativistic electrons spiraling in the jet's magnetic field, which dominates in the radio, optical and soft X-ray frequencies; the second is inverse Compton emission, which occurs when the same electrons transfer energy to low-energy photons, producing radiation in the hard X-ray and gamma-ray bands. 1ES 0806+524 was detected by the Fermi-LAT satellite in gamma rays and by Cherenkov telescopes in ultra-high energy, confirming its nature as a TeV source. Its multi-band variability and the possible association with particle acceleration phenomena in relativistic jets make it an ideal laboratory for the study of high-energy astrophysics and relativistic plasma physics.

### 4. Conclusion and final remarks

The study of the source 1ES 0806+524 has allowed to characterize its multi-band variability and emission mechanism, confirming its nature as a BL Lacertae blazar with a relativistic jet pointed towards the Earth. The analysis of data collected by observatories such as Fermi-LAT in gamma rays and Cherenkov telescopes in high energies has highlighted a strong synchrotron and inverse Compton emission, confirming the presence of particles accelerated to extreme energies. The research required a combination of data from long-term observations, highlighting the variability of the source and its relation to theoretical models of blazars. This work represents an important step in the understanding of high-energy astrophysics, offering ideas for future studies on similar sources and on the particle acceleration processes in relativistic jets.

### References

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