

Flaring States of 1ES 1218+304 and Detection of W Comae from LHAASO Observation

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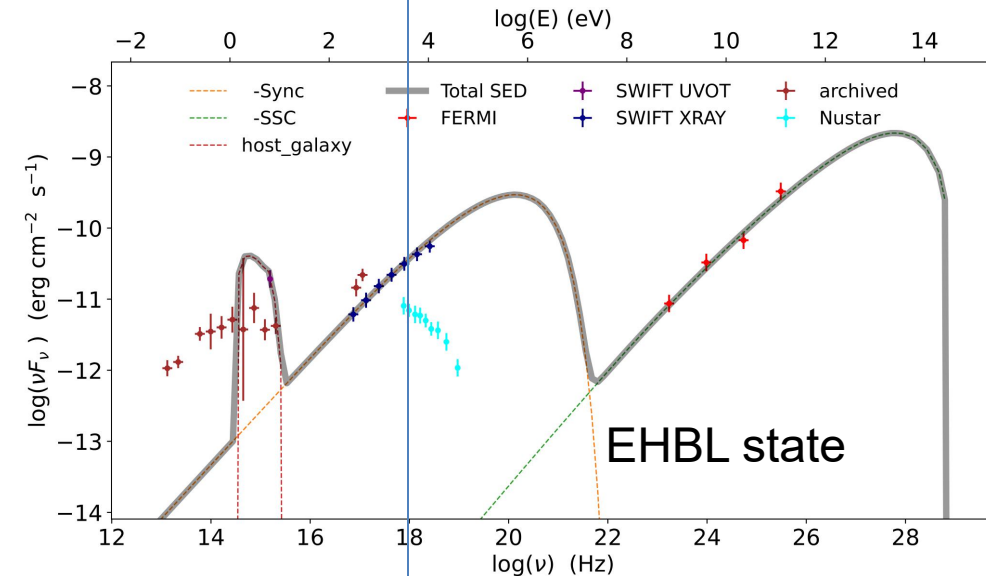
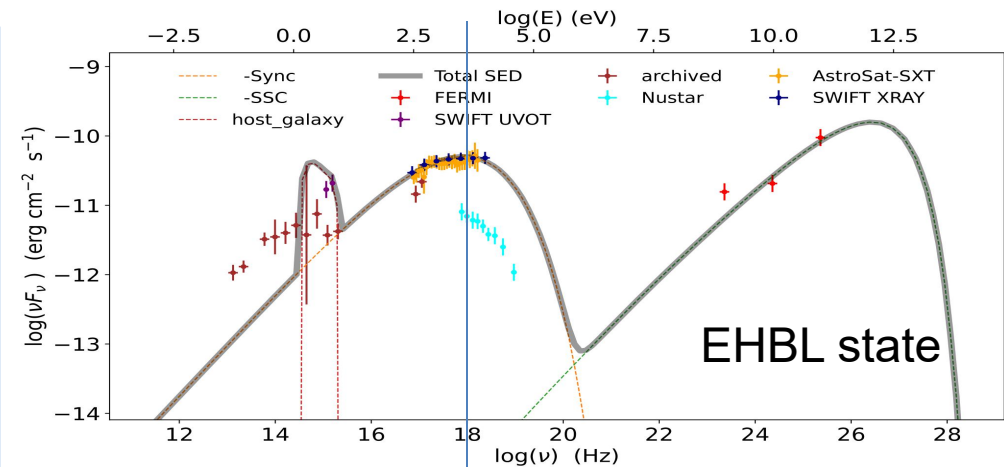
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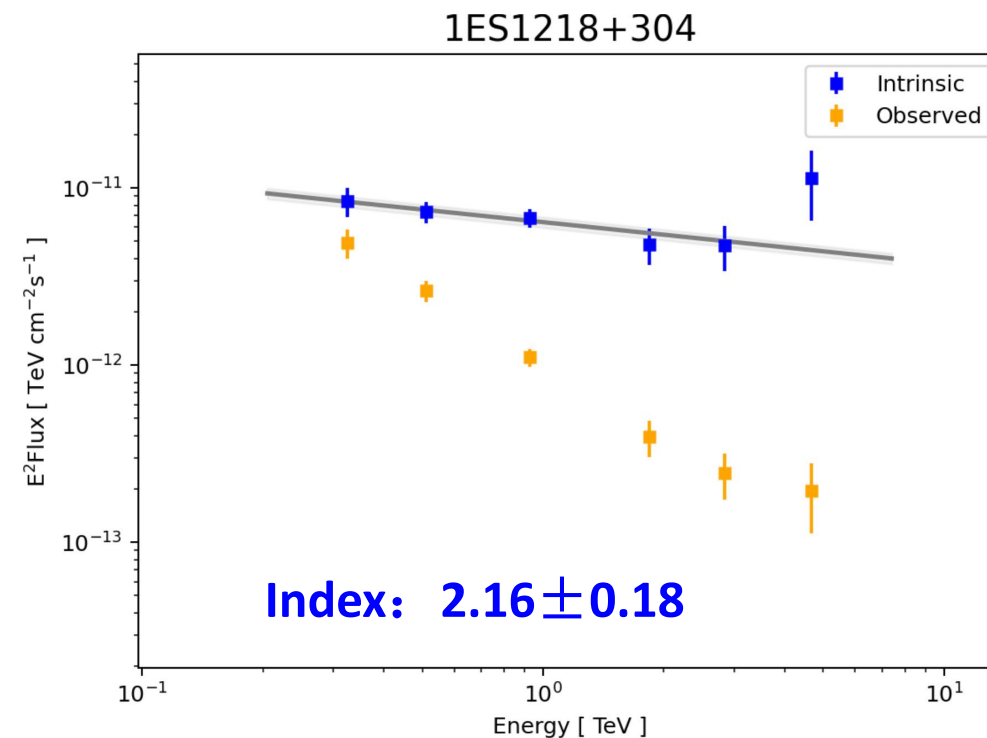
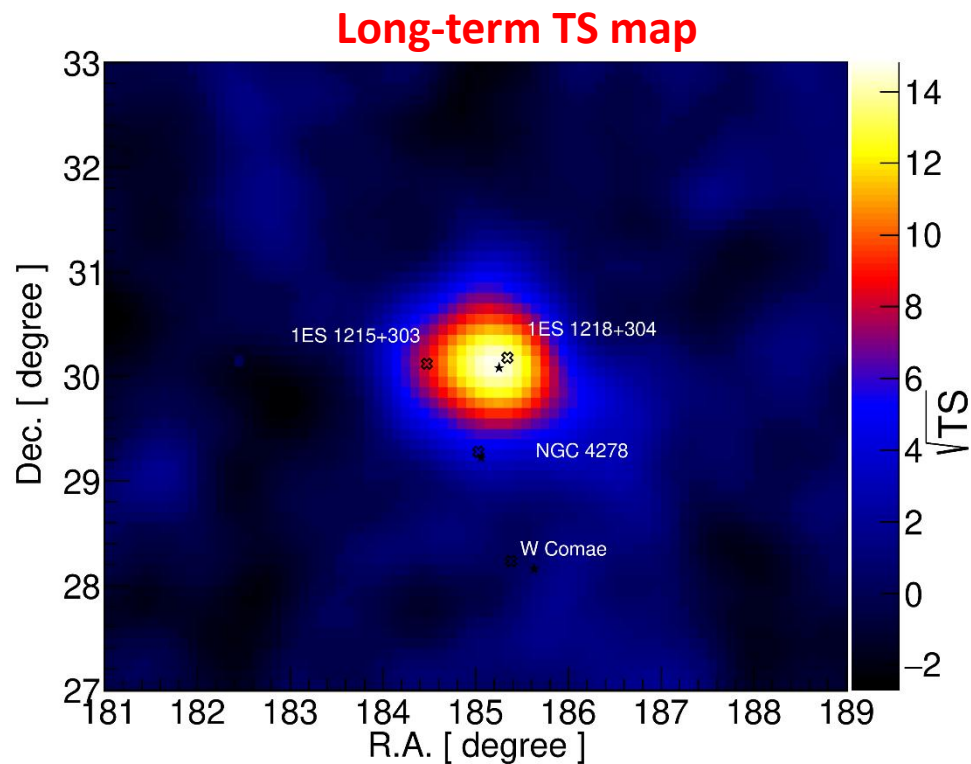


Introduction

- **1ES 1218+304 is known for temporary EHBL**
- Located at a redshift of $z = 0.182$
- **Radio:** detected at 408 MHz by the Bologna Northern Cross Telescope Survey (1970). OVRO at 15 GHz proved to be one of the faintest radio sources among the Northern TeV-blazars and very weakly variable (2016)
- **Optical:** ATOM showed bluer-when-brighter features.
- **X-ray:** Detected by XMM-Newton, Swift, Suzaku and NuSTAR, showed various strengths of X-ray flaring activity and 0.3–10 keV states differing **by a factor up to 20 in brightness**, and **the third brightest blazar during the strongest flare**.
- **Gamma-ray:** Observed by Fermi-LAT and MAGIC (TeV, in 2005) and VERITAS (**TeV, a very hard spectrum ~ 1.5** in 2009).
- **LHAASO:** large field of view, high duty cycle, and excellent sensitivity, making it ideal for **long-term observations and detecting in VHE**, **to study the nature from HBL to EHBL state**



Long-term SED



- For point or extended source, the TS values show little difference
- For different morphological models, PEC and LP are not better than PL

Light Curve: Multi-Wavelength

■ Multi-wavelength Light Curves

LHAASO-WCDA (0.3 TeV - 8 TeV)

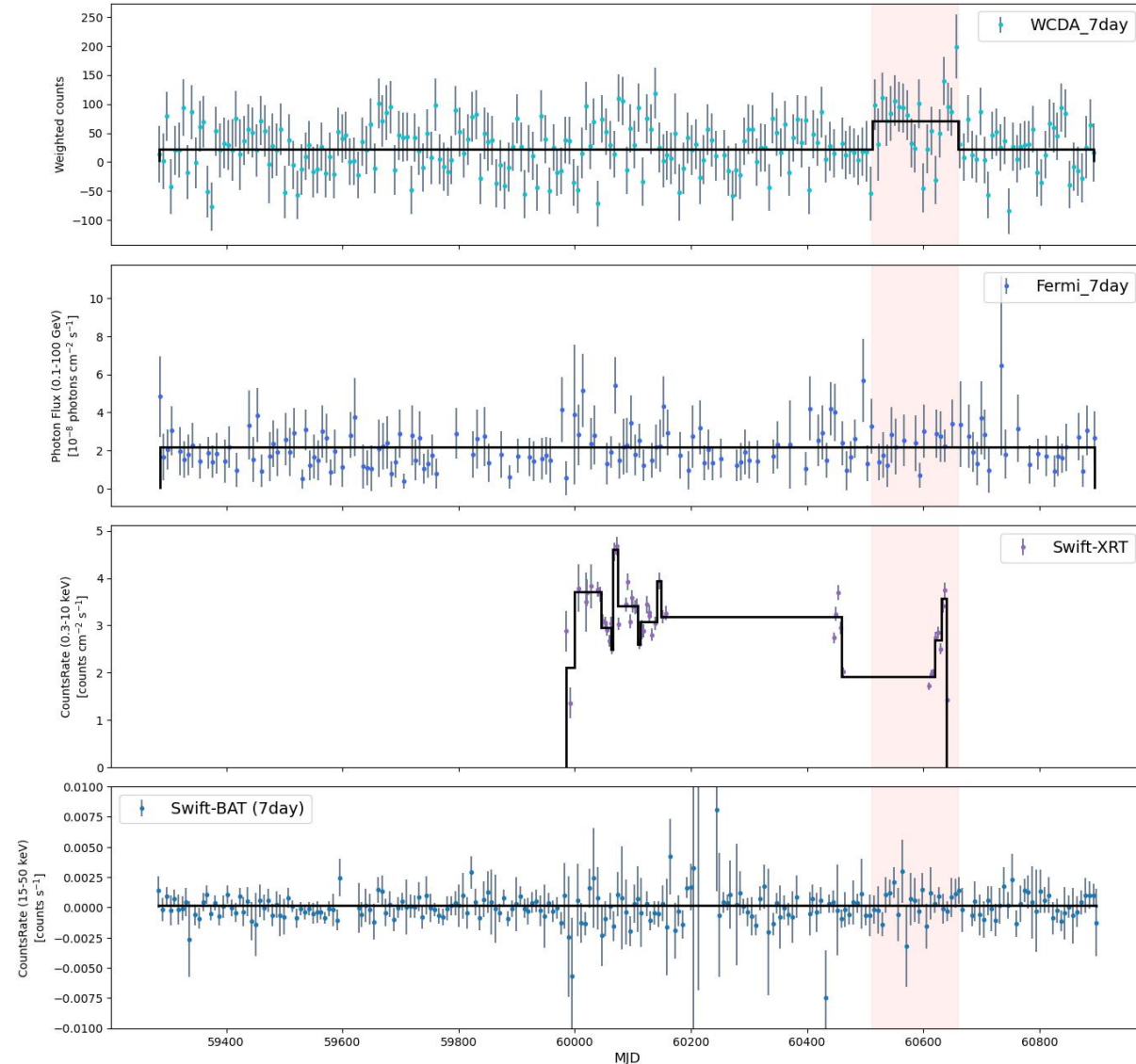
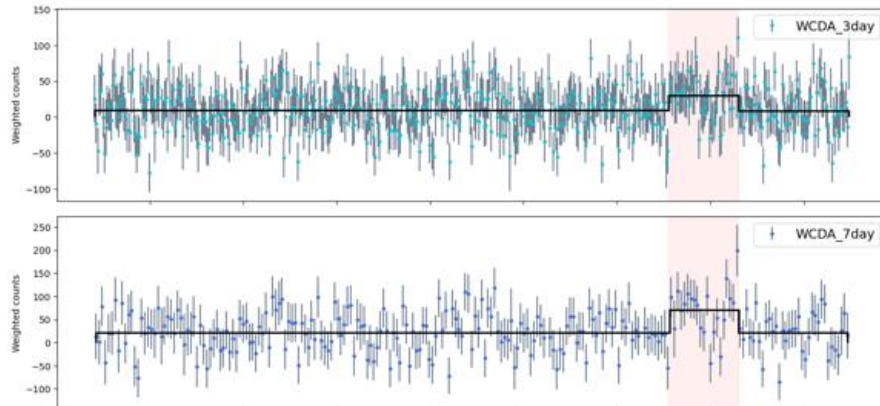
Fermi-LAT (100 MeV - 100 GeV)

Swift-XRT (0.3 - 10 keV)

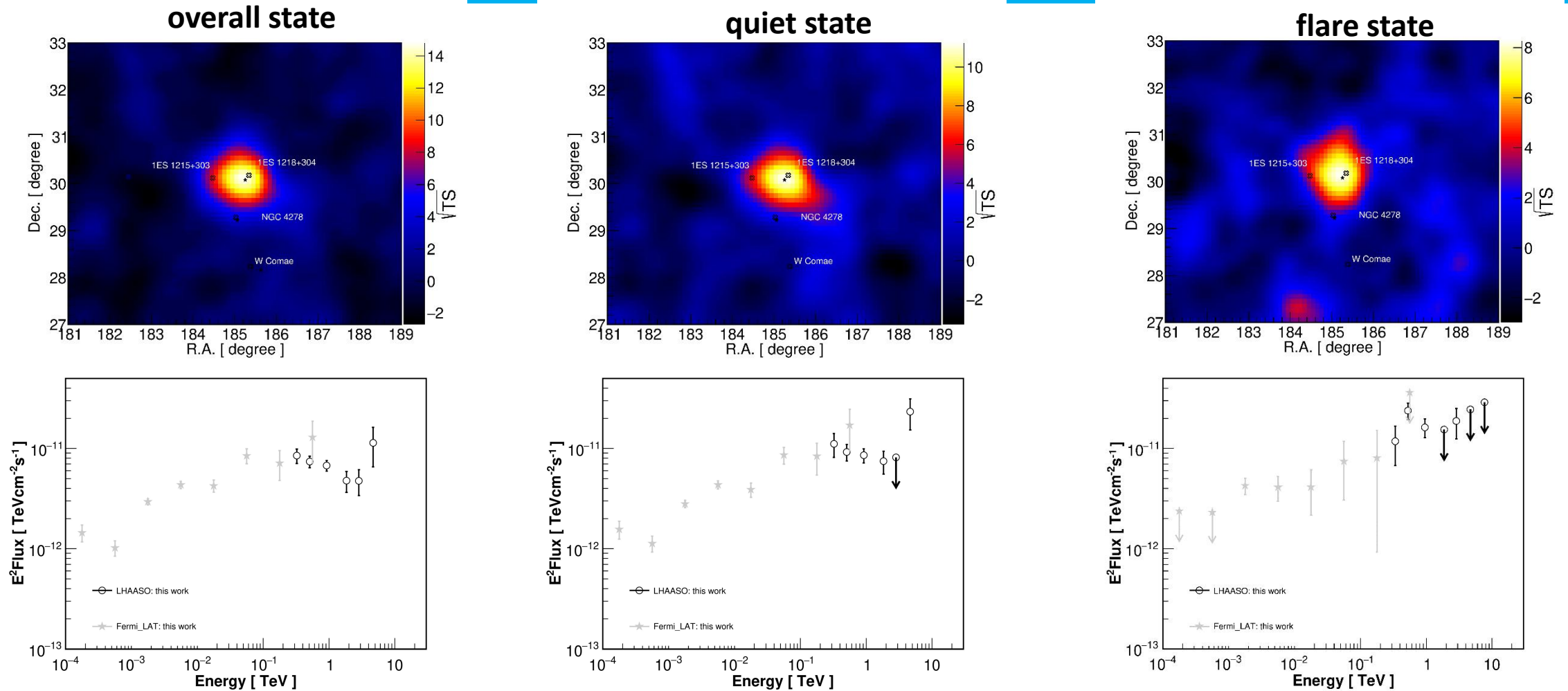
Swift-BAT (15 - 50 keV)

- Bayesian block method applied to identify flares during the active phase (p -value threshold: 0.05).

- **One active periods** was identified in the TeV light curve

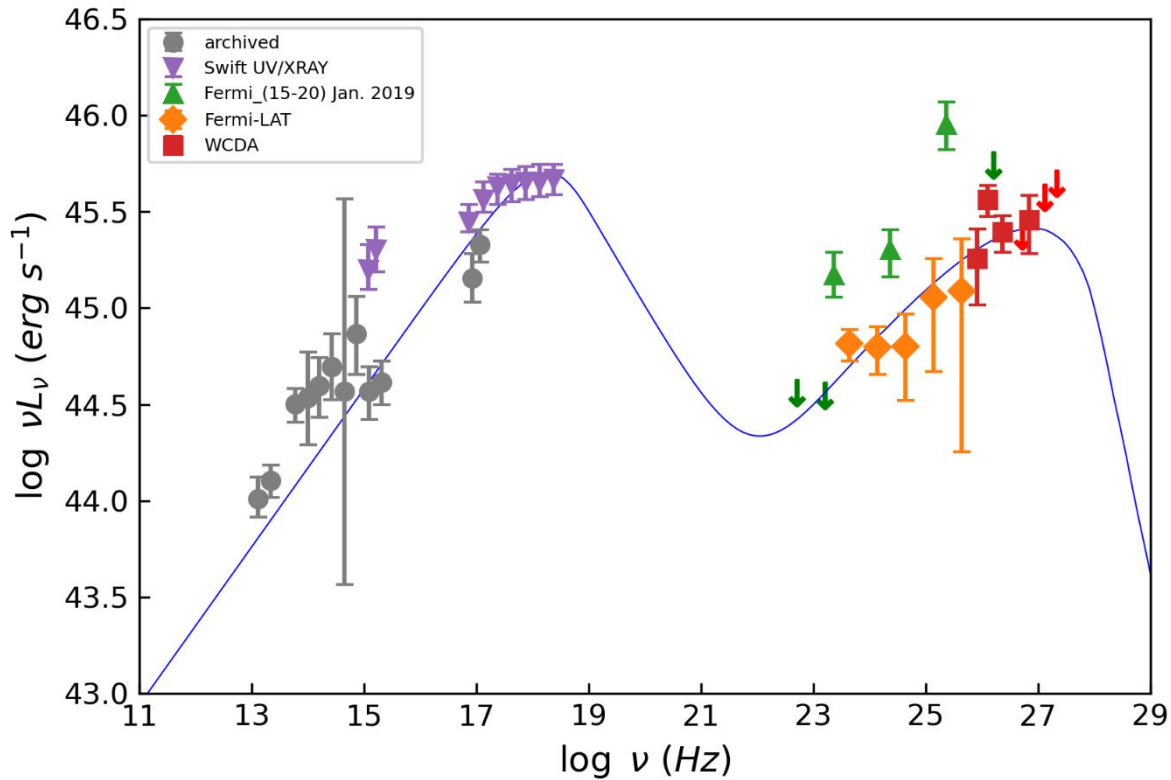


TS map and SED



- 1ES 1218+304 was observed 14.7σ by WCAD and **one flare state was detected at 8.3σ .**
- For the long-term and quiet period, Fermi's SED is well-matched with the WCDA.

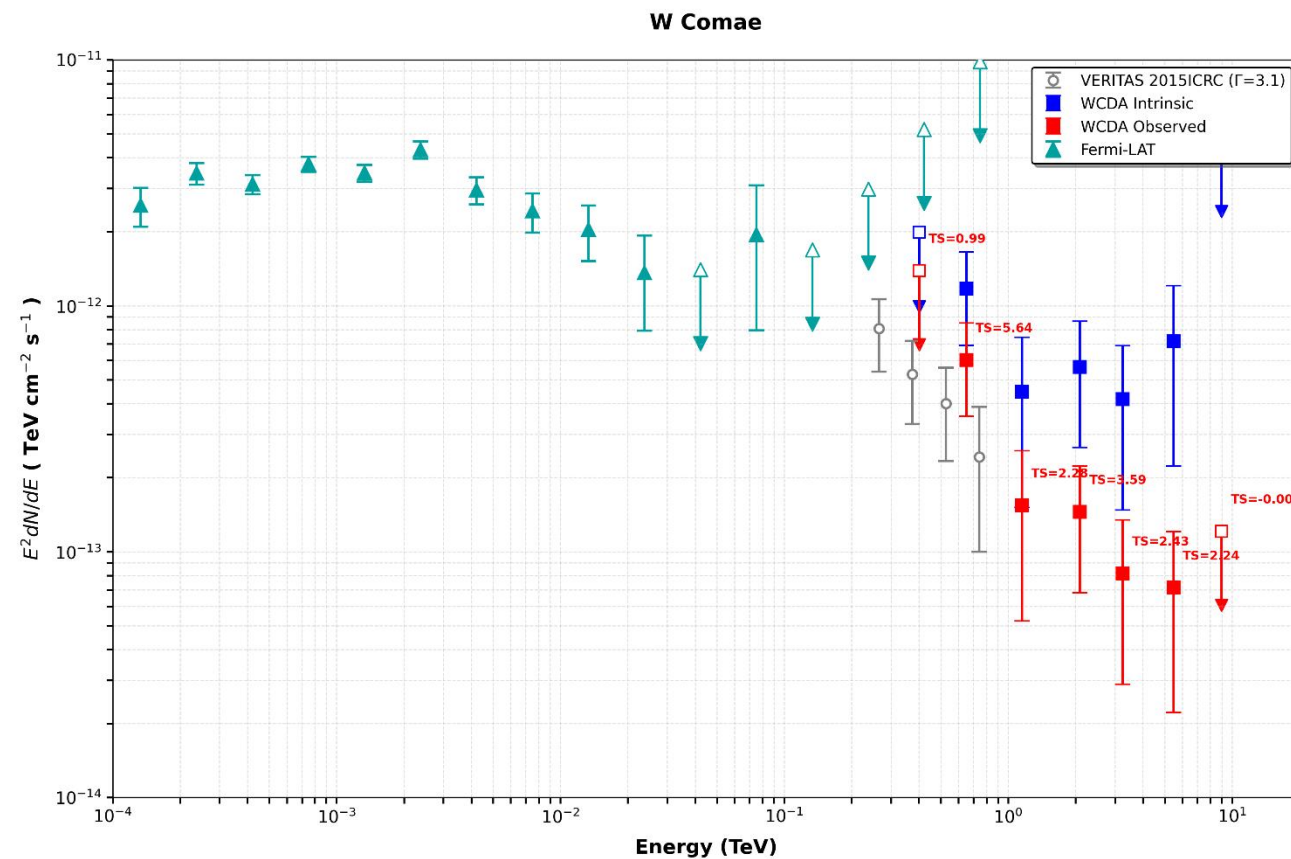
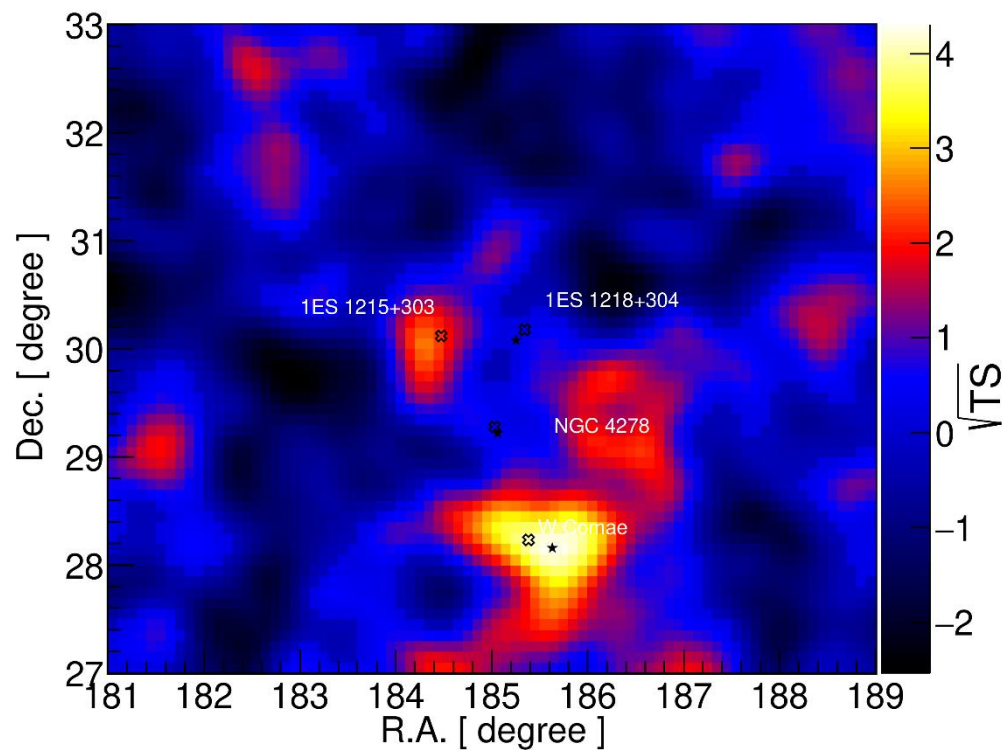
Model of 1ES 1218+304



Physical Quantity	Symbol	Value	Unit
Doppler factor	δ	30	—
Magnetic field	B	0.0026	G
Emission region radius	R	1.6×10^{17}	cm
Initial Lorentz factor	γ_0	1.3×10^6	—
Minimum Lorentz factor	γ_{\min}	2	—
High-energy spectral index	p_1	2.02	—
Low-energy spectral index	p_2	3.6	—
Jet power	P_{jet}	5.6×10^{46}	erg s^{-1}

- Broad-band SED of 1ES 1218+304 modelled using a one-zone SSC model
- The x-ray data is based on historical average data, not the the same period as outburst
- Next work, further analysis of multi-band data, such as Radio-IR-optical-X-ray

W Comae : TS map and SED



■ W Comae was detected at 4.1σ , 0.23° from the IACT position

W Comae : Light Curve

■ Multi-wavelength Light Curves

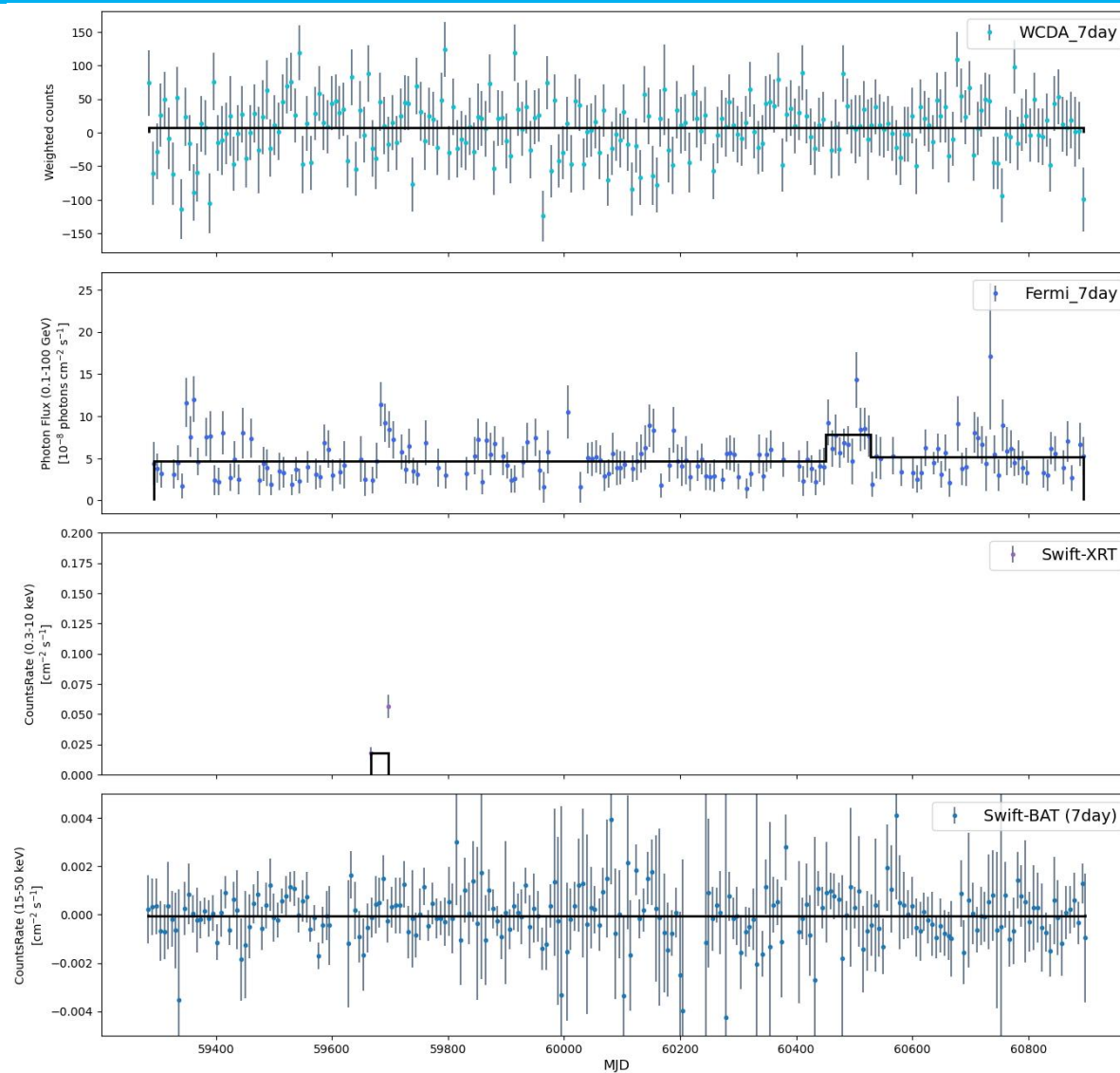
LHAASO-WCDA (0.4 TeV - 9 TeV)

Fermi-LAT (100 MeV - 100 GeV)

Swift-XRT (0.3 - 10 keV)

Swift-BAT (15 - 50 keV)

■ **No active period** was identified in the TeV light curve



Summary

Thanks for your attention!

- 1ES 1218+304 was observed 14.7σ by WCAD and one flare phase was detected at 8.3σ .
- For the long-term and quiet period, Fermi's SED is well-matched with the WCDA.
- W Comae was detected at 4.1σ
- Next work, further analysis of multi-band data, such as Radio-IR-optical-X-ray

