

SEARCH FOR HIGH-REDSHIFT BLAZARS WITH *Fermi*/LAT

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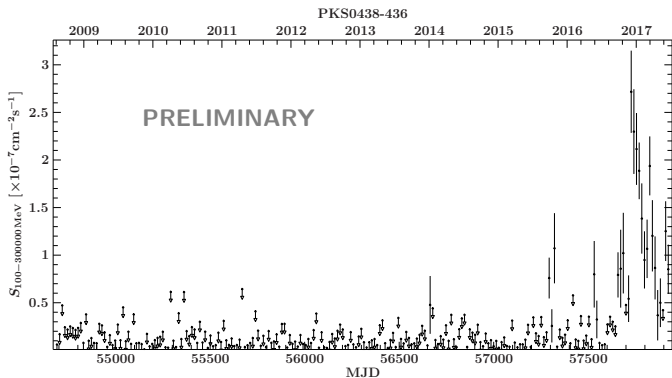
eXtreme19 in Padova
January 22th, 2019



High- z ($z > 2.5$) blazars are extreme targets as:

- most powerful class of γ -ray sources
- black-hole masses on the order of $10^9 M_{\odot}$
- important targets to study blazar evolution models

⇒ **But: High- z blazar are underrepresented in
Fermi catalogs**



- Detected first on 11th Dec. 2016 in a daily flare by Cheung (2016)
 - Undetected in *Fermi*/LAT catalogs (including FL8Y)
 - large redshift of $z = 2.83$
- ⇒ **Search for high- z blazars on short (\sim monthly) time scales**

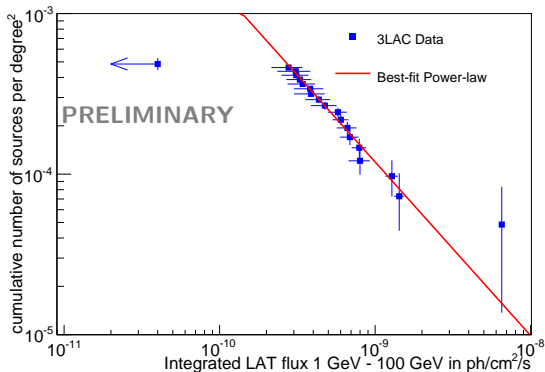
Choose $z \geq 2.5$ blazars with a radio flux density of more than 50 mJy from

- Roma BZCAT Multifrequency Catalogue of Blazars
- Shanghai Astronomical Observatory (SHAO) list of high-redshift radio-loud quasars

⇒ Generate 9+ years monthly light curves for a total sample of 176 selected γ -ray undetected sources.

DETECTION POTENTIAL

3LAC blazars with $z \geq 2.5$:

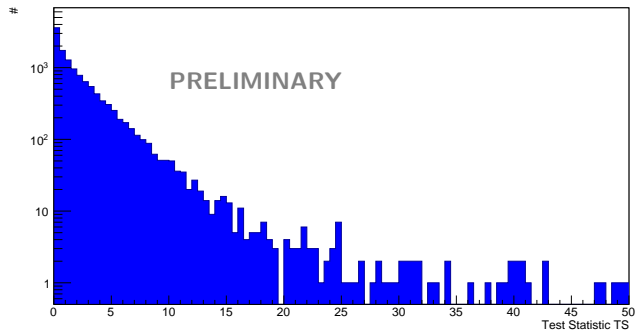


- $\log N - \log S_{max}$ diagram of high-z blazars taken from 3LAC
- Upper Limit for PKS 0438–43 at $4 \times 10^{-11} \text{ ph}/\text{cm}^2/\text{s}$
⇒ **How many flare do we expect to detect?**

Estimate amount of flaring high-z sources:

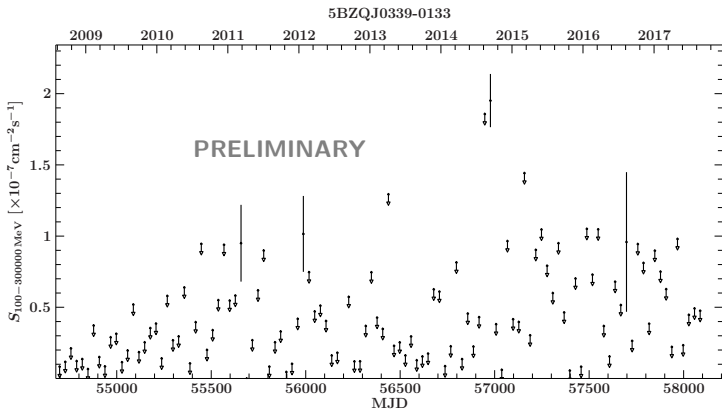
- PL extrapolation would expect ~ 140 detectable flares
- 3/19 known high-z blazars showed flaring activity in past 10 years $\rightarrow \sim 16\%$
- $3/19 \times 140 \sim \mathbf{22}$ **new** flares should be detectable

\Rightarrow **What did we detect?**



- 15 intervals are detected at a $TS \geq 25$ level
- 411 intervals are detected at a $TS \geq 9$ level

⇒ **Which sources are detected?**



- Detected in 4 monthly intervals.
- $z = 3.2$

⇒ **One of the most distant blazars detected with
Fermi/LAT**

Sources responsible for $TS \geq 25$ detections:

Source Name	RA J2000	DEC J2000	z	Detections $TS \geq 25$
5BZQ J0009+0625	2.32	6.43	2.69	1
5BZQ J0339-0133	54.75	-1.55	3.20	4
5BZQ J0434-4355	68.51	-43.93	2.65	4
5BZQ J1441-1523	220.44	-15.39	2.64	2
5BZQ J2219-2719	334.90	-27.32	3.63	1
5BZQ J2321-0827	350.33	-8.46	3.16	3

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- 6 previously undetected γ -ray sources detected
 \Rightarrow **More such associations are expected from $TS < 25$ detections**

- 6 new blazars are found as γ -ray emitters.
- More possible source associations are expected.

Such a search can be easily applied on any kind of γ -ray undetected source, such as e.g. neutrino track-like event positions, GW events, FRBs, EHBLs,