

Connecting radio to gamma-ray emission in blazars using common emission patterns

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28th New Mexico Symposium, Nov. 30, 2012

BACKGROUND



1017 γ -ray point sources associated with AGN (Ackermann et al. 2011)

- Where is high-energy emission in AGN produced?
- What is the dominant mechanism behind the production of high energy emission in AGN?

DIFFERENT γ -ray production scenarios



GB 1310+487

- ► FSRQ (z=0.501)
- Faint γ -ray counterpart (listed in 1FGL & 2FGL)

triggered by γ -ray flare

Adaptively binned γ -ray light curve:



(Sokolovsky et al. 2012; submitted to A&A)

GB 1310 + 487



- Flare 2 occured in rising stage of radio flare.
- Two γ-ray events precede two 15 GHz radio flares.
- Spectral evolution of the γ-ray emission.

Interpretation: Flare 1: External Compton dominated Flare 2: Synchrotron Self-Compton dominated

Direct relation between radio and γ -ray flares through a traveling shock?

The case of 3C 345

- ▶ FSRQ (z=0.593)
- ► Fermi/LAT γ-ray detected (Schinzel et al. 2011)
- Associated γ-ray emission with Compton-loss dominated region of the radio jet at up to 23 pc from the central engine (Schinzel et al. 2012)



FEATURES IN THE RADIO JET



PUTTING LAT AND VLBA TOGETHER



based on data from Schinzel et al. 2012

COMMON EMISSION REGIONS?

- 1. Using time between flares,
- 2. Using the measured speed of jet features
- 3. Assuming feature at 0.1 mas responsible for a γ -ray flare



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RESOLVED WITH 3 MM VLBI (GMVA)



Shock-Shock interaction and how we would observe it (MHD simulation for CTA 102):



SUMMARY

- GB 1310+487 hints a direct connection between radio and γ-ray emission.
- 3C 345 exhibits a complicated pattern in its γ-ray light curve, which can be disentangled using jet kinematics.
- When a feature observed in the radio jet of 3C 345 crosses distinct regions in the jet, then enhanced γ-ray emission is detected.
- In the case of 3C 345 we are able to spatially resolve the γ-ray emission regions using 3 mm VLBI!

What does this mean with respect to different γ -ray production scenarios?

- γ-rays are produced at various locations in the jet, including up to tens of pc from the central engine.
- γ-ray flares are not isolated events, they are connected to the intrinsic jet structure.
- ► Evidence for both the EC, as well as the SSC process. With EC dominating close to the central engine and SSC farther out in the Compton-losses dominated regime of the radio jet.