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Gamma-ray emission of flat-spectrum radio quasars in low states: the case of PKS 1510–089

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Blazars –active galactic nuclei (AGN) with their relativistic jets pointing towards the observer –dominate the extragalactic high-energy ($E > 100$ MeV) gamma-ray sky. It is believed that gamma rays in AGN are mostly produced in the so-called “blobs”–relativistic clouds of magnetized plasma propagating along the AGN jets.

Flat-spectrum radio quasars (FSRQs) are powerful blazars believed to contain broad line region (BLR) matter in the form of wind or clouds. The location of gamma-ray emission sites in FSRQs is uncertain. The MAGIC collaboration reported the detection of FSRQ PKS 1510-089 in its low (persistent) state of activity [Acciari et al., *A&A*, 619, A159 (2018)]. It is very unlikely that this low-state emission could have formed in one or two distinct blobs, so we assume that the emission has formed either in the jet itself or in many blobs.

In our work we investigate the location of the gamma-ray production site and the production mechanism of these gamma rays in the low state of PKS 1510-089. We perform Fermi Large Area Telescope (Fermi-LAT) data analysis using 12 years of its data and distinguish between the low and the high states of gamma-ray emission of PKS 1510-089. We obtain the spectral energy distribution ($SED = E^2 dN/dE$) of PKS 1510-089 averaged over its low-state periods and combine it with the SED measured with the MAGIC telescopes during the low-state period of PKS 1510-089.

We show that in the energy range from 100 MeV to 10 GeV the observed SED is well described with a log-parabolic gamma-ray spectrum, but at $E > 10$ GeV some excess is apparent. A possible scenario that could explain this excess includes primary proton interactions with BLR matter resulting in the production of secondary gamma rays. If this scenario is confirmed, it would provide evidence for: 1) acceleration of protons or nuclei in blazar jets, 2) interaction of these hadrons with the BLR matter in FSRQs, and 3) the production of sub-TeV gamma rays in FSRQs near the edge of the BLR.

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Is this abstract from experiment?

No

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

Yes

Details

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Internet talk

No

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