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Study of the extreme flaring activity of Mrk501 during multi-wavelength observations in 2012

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Markarian 501 is a nearby (z=0.034) Very High Energy (>100GeV, VHE) emitting high-synchrotron-peaked BL Lac object. It is the third source discovered at VHE, by the Whipple Telescope in 1996, and it has been regularly observed since then. From 2008 onward, these observations have taken the form of organized multi-wavelength (MWL) campaigns where the source has been monitored for several months every year with excellent contemporaneous coverage from radio to TeV energies provided by more than 25 instruments.

During the 2012 MWL campaign, we detected an exceptional gamma-ray flare that reached ˜10 times the Crab nebula flux at energies above 1 TeV, together with a particularly hard VHE spectrum (spectral index ˜2), which remained hard during the days following the high activity. This represents the largest outburst seen from Mrk501 since the historical 1997 flare, which was reported by the previous generation of Cherenkov Telescopes, namely HEGRA, Whipple and CAT. During the highest VHE activity in June 2012, the peak position of the high-energy bump was measured to be at ˜2 TeV, which is twice larger than the peak position of the high-energy bump determined during the historical Mrk501 flare from 1997, and one of the highest ever measured peak position for any VHE source. The VHE observations from MAGIC/VERITAS were complimented by the large temporal coverage provided by the First G-APD Cherenkov Telescope (FACT), enabling for the first time a comparison of the data taken simultaneously by the FACT and MAGIC telescopes. This MWL campaign provided a unique dataset to probe the intrinsic properties of Mrk501. We will show the variability and correlations at different energies, and report on the evolution of the broadband SEDs with simultaneous multi-band observations. We will also show the difficulty to explain this outstanding flaring activity within the commonly used leptonic models.

Collaboration

MAGIC

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