ID de la contribución : **303** Tipo : **Talk**

Twelve Years of Multiwavelength Monitoring of PG 1553+113: Evidence for a Two-Zone SSC Emission

miércoles, 5 de noviembre de 2025 16:45 (15)

PG 1553+113 is a BL Lac object located at redshift z = 0.433. It is one of the most luminous extragalactic sources in the very-high-energy (VHE, E > 100 GeV) gamma-ray band, and it has been detected by all currently operating Imaging Air Cherenkov Telescopes (IACTs). A key feature of this source is the evidence of quasi-periodic modulation in high-energy (HE, E > 100 MeV) gamma rays detected by Fermi-LAT, with a period of about 2.2 years. Optical data also confirm a similar modulation pattern.
In this contribution, we present a comprehensive dataset spanning over a decade of MAGIC observations, complemented by simultaneous multiwavelength data from instruments operating in other energy bands. Detailed analysis of intra-band correlations, complemented by a search for periodic emission, suggest that the emission mechanism may be described by using a two-zone synchrotron-self compton (SSC) model, with two distinct electron populations. The low-energy population is responsible for the emission in optical, UV and HE gamma-ray photons, while X-ray and VHE gamma rays are produced by an additional high-energy population. Very remarkably, in April 2019, PG 1553+113 exhibited its highest VHE flux ever recorded. To interpret the observed spectral energy distribution, we tested, for the first time, a two-zone SSC model. We will demonstrate how our model aligns with recent observational results and the resulting intra-band correlations.recent observational results and the resulting intra-band correlations.

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Clasificación de la sesión : Gamma Rays

Clasificación de temáticas : Gamma rays