Contribution ID: **1003** Type: **Poster**

On gamma rays as predictors of UHECR flux in AGNs

The origin of the ultra-high-energy cosmic rays (UHECRs) remains one of the most important questions of astroparticle physics. Active galactic nuclei (AGNs) have been considered important source candidates due to different possible acceleration sites and mechanisms. The detection of very-high-energy gamma rays from AGNs points to the current particle acceleration in these objects and the observed gamma-ray luminosity has been used as a proxy for the UHECR luminosity in phenomenological studies. However, recent works have shown that considering catalogs of AGNs as potential UHECR sources leads to a bad agreement with data. In particular, the arrival direction map is badly described, with a strong hotspot and dipole direction uncorrelated with the observed data. In this work, we propose that intrinsic source properties, such as the intrinsic gamma-ray luminosity or the radiation power of the jet, are more appropriate proxies for the UHECR luminosity of a source than the observed gamma-ray luminosity. We show that this assumption releases the tension between the predictions from AGN catalogs and the data. The tension between the observed and modeled dipole directions can be reduced from 5.9 (2.1) σ to 2.5 (1.1) σ for energies above 8 EeV (32 EeV).

Collaboration(s)

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Session Classification: PO-1

Track Classification: Cosmic-Ray Indirect