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Search for gamma-ray emission from AGNs with ultra-fast-outflows as candidate cosmic-ray accelerators

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Recent X-ray observations of active galactic nuclei (AGNs) have revealed the widespread existence of ultra fast outflows (UFOs), i.e. powerful outflows of baryonic material with velocities $>$10,000 km s^{-1}($\sim$0.03 c), seen as variable, blueshifted absorption lines of ionized heavy elements. They have been interpreted as winds driven by the accretion disk, and may be responsible for feedback onto their host galaxies that result in the observed M-sigma relation. In such outflows, various types of shocks are likely to form, either external shocks due to interaction with the ambient medium, or internal shocks due to inhomogeneities within the flow. Such shocks can accelerate electrons and protons to high energies and potentially induce nonthermal emission in various wavebands. In this context, we have searched for gamma-ray emission from AGNs with known UFOs, using Fermi-LAT data $>$100 MeV spanning more than 6 years. The AGN sample of Tombesi et al 2010 is used, with 42 radio-quiet AGNs listed as UFO candidates based on a systematic search for blueshifted Fe K absorption lines. In our current analysis, no significant gamma-ray excess is found from any object in the sample. We compute 95% confidence level gamma-ray upper limits (UL) for all analyzed sources, yielding a mean value for the integrated photon flux ($\geq$100\,MeV) UL of $\sim 3 \times 10^{-9}$ photons cm^{-2} s^{-1}, and in the range of 10^{41}-10^{45} erg s^{-1} for ULs on the gamma-ray luminosity (100 MeV-100 GeV). To assess the properties of this UFO sample, we systematically compared these results with infra-red and radio observations, as well as the estimated kinetic power of the outflow. Our Fermi-LAT upper limits can constrain the ratio of gamma-ray luminosity to outflow kinetic power down to values as low as 0.001. The obtained results impose important constraints on emission models.

Collaboration

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88

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