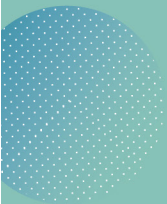




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Gamma-ray calorimetry of Seyfert winds

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Abstract

Two stacking analyses with the Fermi Large Area Telescope (LAT) detected GeV emission from local radio-quiet Seyferts, one selected by an X-ray ultra-fast outflow (UFO) and one hard-X-ray-bright, with similar luminosities attributed to different mechanisms: wind-driven shocks and the accretion-disk corona. Aims: We investigate how efficiently Seyfert outflows convert mechanical power into GeV photons, whether the two detections require distinct mechanisms, and how Seyferts compare with low-ionization nuclear emission-line regions (LINERs). Methods: We perform no new reduction of Fermi-LAT data, but homogenize published measurements to 0.1–100 GeV, place local mechanical accelerators on a common gamma-ray luminosity versus mechanical-power diagram, and express the gamma-ray efficiency as a fraction of the fiducial complete-calorimetry efficiency of 2.5%. We then infer the ambient density required for proton-proton losses. Results: Seyfert winds have a calorimetric fraction of 0.020 (+0.018, −0.011) for an acceleration efficiency of 0.1, a factor of 13.5 (5.3–37) below starburst superwinds, which have a calorimetric fraction of 0.26 (+0.37, −0.16). The probability that the contrast exceeds a factor of three is 95%, and the result is independent of acceleration parameters common to both classes. The contrast is conditional on the adopted wind kinetic powers and collapses only if every wind is placed at its minimum launch radius. The implied densities, approximately 10 and 100 cm^{−3}, are consistency values because density, shock radius, and speed are degenerate. The two Seyfert stacking detections agree within a factor of 1.75 in gamma-ray output per unit Eddington luminosity, but their 95% interval, 0.26–24, is too broad to distinguish them. A third stack of 186 low-luminosity AGN extends the comparison 1.5 dex lower in AGN power. Conclusions: GeV detectability of a non-jetted AGN is set by the product of mechanical power and calorimetric fraction. LINER outflows fail primarily on power, while, for the adopted wind energetics, UFO-selected Seyfert winds have a low calorimetric efficiency. Starburst superwinds reach the GeV-detectable regime through their combination of mechanical power and calorimetry.

