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Radio Morphology of Gamma-ray Sources: Double-Lobed Radio Sources

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Abstract

The extragalactic gamma-ray sky is dominated by relativistic jets aligned to the observer's line of sight, i.e., blazars. A few of their misaligned counterparts, e.g., radio galaxies, are also detected with the Fermi-Large Area Telescope (LAT) albeit in a small number (~ 50), indicating the crucial role played by the jet viewing angle in detecting gamma-ray emission from jets. These gamma-ray emitting misaligned active galactic nuclei (AGN) provide us with a unique opportunity to understand the high-energy emission production mechanisms from a different viewpoint than the more common blazars. With this goal in mind, we have systematically studied the radio morphology of gamma-ray emitting sources present in the fourth data release of the fourth catalog of Fermi-LAT detected gamma-ray sources to identify misaligned AGN. By utilizing the high-resolution and sensitive MHz and GHz frequency observations delivered by the Very Large Array Sky Survey, Low-Frequency Array Two-metre Sky Survey, Faint Images of the Radio Sky at Twenty-Centimeters, and Rapid ASKAP Continuum Survey, here we present a catalog of 149 gamma-ray detected misaligned AGN, thus tripling the number of known objects of this class. Our sample includes a variety of radio morphologies, e.g., edge-darkened and edge-brightened, hybrids, wide-angle-tailed, bent jets, and giants. Since the gamma-ray emission is thought to be highly sensitive to the jet viewing angle, such an enlarged sample of gamma-ray detected misaligned radio sources will permit us to explore the origin of high-energy emission in relativistic jets and radio lobes and study AGN unification, in general.

