

Probing the population of pulsar halos with Fermi-LAT

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Over the past years, the detection of extended gamma-ray emission surrounding young and middle-aged pulsars has been reported in the GeV and TeV domains. This emission is interpreted as inverse-Compton scattering of ambient photons by halos of energetic electron/positron pairs accelerated in pulsars and their wind nebulae and confined in their vicinity by a mechanism yet to be elucidated. These pulsar halos offer an opportunity to probe the transport properties of energetic particles in the vicinity of their accelerators. As an emerging population of gamma-ray sources, halos can be expected to have a non-negligible contribution to the GeV–TeV emission from the Galaxy in the form of yet unidentified sources and/or spatially unresolved gamma-ray emission. We have performed a systematic search for extended > 10 GeV emission components along the Galactic plane using 13 years of Fermi-LAT data. We have found about 60 such components with angular sizes up to a few degrees, a fraction of which may be pulsar halos. We assess the likelihood of the latter possibility by comparing the properties of the whole sample of extended components to the predictions of a population synthesis model. We then present a short list of promising halo candidates possibly associated with TeV sources, together with dedicated analyses in which we investigate more in depth the morphology and spectrum of these selected targets.

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