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Probing faint gamma-ray point sources in the inner Milky Way using PCAT

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Poisson regression of the Fermi-LAT data in the inner Milky Way reveals an extended gamma-ray excess. An important question is whether the signal is coming from a collection of unresolved point sources, possibly old recycled pulsars, or constitutes a truly diffuse emission component. Previous analyses have relied on non-Poissonian template fits or wavelet decomposition of the Fermi-LAT data, which find evidence for a population of faint point sources just below the 3FGL flux limit. In order to test this hypothesis, we use a Bayesian, transdimensional, and hierarchical inference framework, PCAT (Probabilistic Cataloger), by sampling from the posterior catalog space of faint point sources consistent with the observed gamma-ray emission in the inner Milky Way. By marginalizing over faint point sources, we constrain their spatial and spectral distributions. We then compare the performance of probabilistic cataloging with that of fluctuation analysis when inferring unresolved point sources in the low signal-to-noise limit.

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