Probing dim 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 dim point sources just below the 3FGL flux limit. In order to be able to draw conclusions about the flux distribution of point sources at the dim end, we employ a Bayesian trans-dimensional MCMC framework by taking samples from the space of catalogs consistent with the observed gamma-ray emission in the inner Milky Way. The software implementation, PCAT (Probabilistic Cataloger), is designed to efficiently explore that catalog space in the crowded field limit such as in the galactic plane, where the model PSF, point source positions and fluxes are highly degenerate. We thus generate fair realizations of the underlying MSP population in the inner galaxy and constrain the population characteristics such as the radial and flux distribution of such sources.

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