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Statistical Measurement of the Gamma-ray Source Count Distribution as a Function of Energy

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Statistical properties of photon count maps have recently been proven to provide a sensitive observable for characterizing gamma-ray source populations and for measuring the composition of the gamma-ray sky with high accuracy. In this contribution, we generalize the use of the standard 1-point probability distribution function (1pPDF) to decompose the high-latitude gamma-ray emission observed with Fermi-LAT into: (i) point-source contributions, (ii) the Galactic foreground contribution, and (iii) a diffuse isotropic background contribution. To that aim, we analyze the gamma-ray data in five adjacent energy bands between 1 GeV and 171 GeV. We measure the source-count distribution dN/dS as a function of energy, and we demonstrate that our results extend current measurements from point-source catalogs to the regime of so far undetected sources. Our method improves the sensitivity for resolving point-source populations by about one order of magnitude in flux. The dN/dS distribution as a function of flux is found to be compatible with a broken power law. We derive upper limits on further possible breaks as well as the angular power of unresolved sources. We discuss the composition of the gamma-ray sky and future prospects and capabilities of the 1pPDF method.

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