Summary
Measurement of the Isotropic Diffuse Gamma-ray Background

M. Rajagopal, M. Ackermann, M. Ajello

The isotropic diffuse γ-ray background (IGRB) comprises of all extragalactic diffuse emission that is not resolved into sources and is found to be approximately isotropic on large angular scales. The initial measurement of the IGRB intensity with the *Fermi* Large Area Telescope (LAT) was performed in 2010 using the first 10 months of sky-survey data. After improvements were made in event selection and characterization of cosmic-ray backgrounds, a second measurement using 50 months of LAT data allowed for a refinement and a better understanding of the IGRB measurement, this time covering an energy range from 100 MeV to 820 GeV. The result was a spectrum defined by a power law with exponential cutoff with a spectral index of 2.32±0.02. A total intensity of $(7.2\pm0.6) \times 10^{-6}$ cm^{-2} s^{-1} sr^{-1} above 100 MeV was seen with about +15%/-30% systematic uncertainty attributed to Galactic diffuse foregrounds. This systematic uncertainty dominates the measurement uncertainties over most of the observed energy range. In the current analysis, therefore, the primary goal is to refine the measurement of the IGRB, employing 8 years of Pass 8 *Fermi* data and the 4FGL source catalog. A reduction of the systematic uncertainties arising from the DGE emission will be achieved through improved modeling of this emission, as well as a careful selection of analysis regions. A few other improvements including, wider energy range (between 50 MeV onwards), larger dataset, more powerful fitting techniques etc., will also be achieved in the current analysis.

The spectrum of the IGRB is determined as part of a multi-component all-sky maximum likelihood fit of the expected counts from a parametrized γ-ray emission model to the observed LAT count maps. The emission model consists of template maps that describe the various diffuse emission contributions and the point sources compiled in the 4FGL catalog. Maps and sources are corrected for exposure and convolved with the LAT PSF individually for each of the four event classes (PSF0 -- PSF3) defined for the Pass 8 datasets that comprise events of different angular reconstruction quality. Several regions of the sky are excluded from the analysis. The masks for this have been developed with the specific goal to reduce the Galactic foreground uncertainties, while retaining sufficient statistics and information for performing the analysis.

The main goal of this work is to provide a new and accurate measurement of the IGRB. To do this, the IGRB spectral fits are performed using the analysis technique, masks and foreground model all designed to minimize systematic uncertainties introduced by foreground components. The foreground models are being refined, and systematic variations of the default model being considered to quantify the remaining systematic uncertainty, before a new measurement of the IGRB can be published.