

# Package: fermicatsR (via r-universe)

September 17, 2024

**Title** Fermi Large Area Telescope Catalogs

**Version** 1.4

**Date** 2016-03-12

**Description** Data from various catalogs of astrophysical gamma-ray sources detected by NASA's Large Area Telescope (The Astrophysical Journal, 697, 1071, 2009 June 1), on board the Fermi gamma-ray satellite. More information on Fermi and its data products is available from the Fermi Science Support Center (<http://fermi.gsfc.nasa.gov/ssc/>).

**Depends** R (>= 3.1.0)

**Suggests** ggplot2

**License** CC0

**LazyData** true

**URL** <https://github.com/sazpark/fermicatsR.git>

**RoxygenNote** 5.0.1

**Repository** <https://sazpark.r-universe.dev>

**RemoteUrl** <https://github.com/sazpark/fermicatsr>

**RemoteRef** HEAD

**RemoteSha** ccab6f6adbef1144c122d3b1dfad611533fba9b8

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DF1	<i>IDF Catalog (First D3PO Fermi catalog of gamma-ray source candidates)</i>
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### Description

The Denoised, Deconvolved, and Decomposed Fermi Gamma-ray Sky: An application of the D3PO algorithm Selig, M. et al., *Astronomy and Astrophysics*, 581, 126 (2015).

### Usage

DF1

### Format

A data frame with 48 variables on 3106 gamma-ray sources.

### Details

FITS Filename: catalog\_1.fits

### Fields

**CandidateName** Candidate Name  
**GLON** Galactic Longitude, deg.  
**GLAT** Galactic Latitude, deg.  
**Flux** Total flux between 1-100 GeV, photon cm<sup>-2</sup> s<sup>-1</sup>  
**Emid1** Contributing energy band 1, T/F, Emin=0.60 GeV, Emid=0.85 GeV, Max=1.20 GeV  
**Emid2** Contributing energy band 2, T/F, Emin=1.20 GeV, Emid=1.70 GeV, Max=2.40 GeV  
**Emid3** Contributing energy band 3, T/F, Emin=2.40 GeV, Emid=3.40 GeV, Max=4.80 GeV  
**Emid4** Contributing energy band 4, T/F, Emin=4.80 GeV, Emid=6.79 GeV, Max=9.60 GeV  
**Emid5** Contributing energy band 5, T/F, Emin=9.60 GeV, Emid=13.58 GeV, Max=19.20 GeV  
**Emid6** Contributing energy band 6, T/F, Emin=19.20 GeV, Emid=27.15 GeV, Max=38.40 GeV  
**Emid7** Contributing energy band 7, T/F, Emin=38.40 GeV, Emid=54.31 GeV, Max=76.80 GeV  
**Emid8** Contributing energy band 8, T/F, Emin=76.80 GeV, Emid=108.61 GeV, Max=153.60 GeV  
**Emid9** Contributing energy band 9, T/F, Emin=153.60 GeV, Emid=217.22 GeV, Max=307.20 GeV  
**Distance1** Distance1, deg.  
**Association1a** Primary association

**Association1b** Association1b  
**Association1c** Association1c  
**Distance2** Distance2, deg.  
**Association2a** Association2a  
**Association2b** Association2b  
**Association2c** Association2c  
**Distance3** Distance3, deg.  
**Association3a** Association3a  
**Association3b** Association3b  
**Association3c** Association3c  
**Distance4** Distance4, deg.  
**Association4a** Association4a  
**Association4b** Association4b  
**Association4c** Association4c  
**Chi2\_PL** Chi-squared (power-law fit), See Equation (2) of Selig et al. (2015)  
**Chi2\_LP** Chi-squared (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**Chi2\_EXP** Chi-squared (exponential cut-off fit), See Equation (4) of Selig et al. (2015)  
**Gamma\_PL** Spectral index (power-law fit), See Equation (2) of Selig et al. (2015)  
**Unc\_Gamma\_PL** Uncertainty in the spectral index (power-law fit), See Equation (2) of Selig et al. (2015)  
**Gamma\_LP** Spectral index (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**Unc\_Gamma\_LP** Uncertainty in the spectral index (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**Gamma\_EXP** Spectral index (exponential cut-off fit), See Equation (4) of Selig et al. (2015)  
**Unc\_Gamma\_EXP** Uncertainty in the spectral index (exponential cut-off fit), See Equation (4) of Selig et al. (2015)  
**K\_PL** Normalization (power-law fit), See Equation (2) of Selig et al. (2015)  
**Unc\_K\_PL** Uncertainty in the normalization (power-law fit), See Equation (2) of Selig et al. (2015)  
**K\_LP** Normalization (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**Unc\_K\_LP** Uncertainty in the normalization (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**K\_EXP** Normalization (exponential cut-off fit), See Equation (4) of Selig et al. (2015)  
**Unc\_K\_EXP** Uncertainty in the normalization (exponential cut-off fit), See Equation (4) of Selig et al. (2015)  
**Beta\_LP** Beta index (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**Unc\_Beta\_LP** Uncertainty in the Beta index (log-parabola fit), See Equation (3) of Selig et al. (2015)  
**Ec\_EXP** Energy cut-off (exponential cut-off fit), See Equation (4) of Selig et al. (2015)  
**Unc\_Ec\_EXP** Uncertainty in the energy cut-off (exponential cut-off fit), See Equation (4) of Selig et al. (2015)

## Source

<http://wwwmpa.mpa-garching.mpg.de/ift/fermi/>

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fermicatsR	<i>fermicatsR (v 1.4): A package containing catalogs from the Fermi Large Area Telescope.</i>
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## Description

Since its launch from the Kennedy Space Center on the 11th of June 2008, the Large Area Telescope (LAT, <https://www-glast.stanford.edu>), on board the Fermi Gamma-ray Space Telescope (formerly GLAST) has been performing an all-sky survey of the gamma-ray sky at energies between 20 MeV and 300 GeV. The LAT Collaboration, consisting of more than 400 scientists at over 90 universities and laboratories in 12 countries, has produced a number of catalogs and lists of gamma-ray sources, at various phases of the mission. The fermicatsR package provides some of these catalogs in the form of the following data sets: FGL0, FGL1, FGL2, FGL3, LAC3\_LO, LAC3\_HI, FHL1, FHL2, FIG1, and pulsars. For an application of the fermicatsR package, see Saz Parkinson et al., "Classification and Ranking of Fermi LAT Gamma-ray Sources from the 3FGL Catalog using Machine Learning Techniques", *The Astrophysical Journal*, **820**, 8 (2016).

## fermicatsR

The following is a brief description of the data sets available within the fermicatsR package and their corresponding Fermi LAT catalogs/lists.

- FGL0: Fermi LAT Bright Gamma-ray Source List, 205 gamma-ray sources, using 3 months of data [Abdo et al., *ApJS*, **183**, 46 (2009)]
- FGL1: Fermi LAT First Source Catalog, 1451 gamma-ray sources, using 11 months of data [Abdo et al., *ApJS*, **188**, 405 (2010)]
- FGL2: Fermi LAT Second Source Catalog, 1873 gamma-ray sources, using 24 months of data [Nolan et al., *ApJS*, **199**, 31 (2012)]
- FGL3: Fermi LAT Third Source Catalog, 3034 gamma-ray sources, using 48 months of data [Acero et al., *ApJS*, **218**, 23 (2015)]
- LAC3\_LO: Fermi LAT Third Catalog of Active Galactic Nuclei - Low Galactic Latitude ( $|GLAT| < 10$  deg.), 182 sources, using 48 months of data [Ackermann et al., *ApJ*, **810**, 14 (2015)]
- LAC3\_HI: Fermi LAT Third Catalog of Active Galactic Nuclei - High Galactic Latitude ( $|GLAT| > 10$  deg.), 1591 sources, using 48 months of data [Ackermann et al., *ApJ*, **810**, 14 (2015)]
- FHL1: First Fermi-LAT Catalog of Sources Above 10 GeV, 514 high-energy gamma-ray sources, using 36 months of data [Ackermann et al., *ApJS*, **209**, 34 (2013)]
- FHL2: The Second Catalog of Hard Fermi-LAT Sources, 360 gamma-ray sources, using 80 months of data [Ackermann et al., *ApJS*, **222**, 5 (2016)]

- FIG1: The First Fermi-LAT Inner Galaxy point source catalog, 48 gamma-ray sources, using 62 months of data [Ajello et al., ApJ, **819**, 44 (2016)]
- DF1: The First D3PO Fermi catalog of gamma-ray source candidates, 3106 sources, using 6.5 years of data [Selig et al., A&A, **581**, 126 (2015)]
- pulsars: Fermi LAT List of Detected Pulsars [<https://confluence.slac.stanford.edu/x/5Jl6Bg>], 205 gamma-ray pulsars, last updated 2016-02-22

For more details on any of these data sets, type 'help(dataset)' or go to the Fermi Science Support Center (FSSC) web page (<http://fermi.gsfc.nasa.gov/ssc/data/access/>). You can also contact me directly with your questions.

### Author(s)

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### Examples

```
# Variability index vs Curvature significance of 2FGL sources, color-coded by source class
data(FGL2)
if (require("ggplot2")) {
  qplot(log(Signif_Curve), log(Variability_Index), data = FGL2, color = CLASS1)
}
# Distribution of spindown luminosities of LAT-detected gamma-ray pulsars
data(pulsars)
hist(log10(pulsars$Edot),
     xlab = "Log(Spindown Luminosity) (erg/s)",
     ylab = "Number of pulsars",
     main = "LAT-Detected Gamma-ray Pulsars")
```

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FGL0

*0FGL Catalog (Fermi Large Area Telescope Bright Gamma-ray Source List)*

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### Description

Fermi Large Area Telescope Bright Gamma-ray Source List (0FGL). Abdo, A. A. et al., The Astrophysical Journal Supplement Series, 183, 46 (2009).

### Usage

FGL0

### Format

A data frame with 21 variables on 205 gamma-ray sources.

### Details

FITS Filename: gll\_psc3month\_BSL\_v2.fit

**Fields**

- Source\_Name** 0FGL JHHMM.m+DDMM, constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively
- RA** Right Ascension, J2000, deg, 3 decimal places
- DEC** Declination, J2000, deg, 3 decimal places
- GLON** Galactic Longitude, deg, 3 decimal places
- GLAT** Galactic Latitude, deg, 3 decimal places
- Conf\_95\_Radius** Radius of 95% confidence region, deg, 3 decimal places
- Sqrt\_TS** Square root of likelihood TS from 200 MeV - 100 GeV analysis, used for the TS > 100 cut, 1 decimal place
- Flux\_100\_1000** Flux 100 MeV to 1 GeV (i.e.,  $\log_{10} E = 2-3$ ),  $10^{-8} \text{ cm}^{-2} \text{ s}^{-1}$ , 2 decimal places
- Unc\_Flux100\_1000** 1 sigma uncertainty on F\_23, same units and precision. A 0 in this column indicates that the entry in the F\_23 flux column is an upper limit.
- Flux1000\_100000** Flux for 1 GeV to 100 GeV (i.e.,  $\log_{10} E = 3-5$ ),  $10^{-8} \text{ cm}^{-2} \text{ s}^{-1}$ , 2 decimal places
- Unc\_Flux1000\_100000** 1 sigma uncertainty on F\_35, same units and precision.
- Variability\_Flag** T indicates < 1% chance of being a steady source on a weekly timescale
- Sqrt\_TS23** Square root of TS for the 100 MeV to 1 GeV range, 1 decimal place
- Sqrt\_TS35** Square root of TS for the 1 GeV to 100 GeV range, 1 decimal place
- ASSOC\_GAM1** Identification or positional associations with 3EG, EGR, or AGILE sources
- ASSOC\_GAM2** Identification or positional associations with 3EG, EGR, or AGILE sources
- ASSOC\_GAM3** Identification or positional associations with 3EG, EGR, or AGILE sources
- CLASS1** Class designation for associated source. Capital letters indicate firm identifications; lower-case letters indicate associations: Pulsar (PSR), Pulsar wind nebula (pwn), High-mass X-ray binary (hxb), BL Lac type of blazar (bzb), FSRQ type of blazar (bzq), Uncertain type of blazar (bzu), Radio galaxy (rdg), Globular cluster (glb), Special case - potential association with SNR or PWN (x), Unassociated ( ).
- CLASS2** 2nd class designation for associated source
- ASSOC1** Name of identified or likely associated source
- ASSOC2** Alternate name of identified or likely associated source

**Source**

<http://heasarc.gsfc.nasa.gov/W3Browse/fermi/fermilbs1.html>

FGL1

*1FGL Catalog (Fermi Large Area Telescope First Source Catalog)***Description**

Fermi Large Area Telescope First Source Catalog (1FGL). Abdo, A. A. et al., The Astrophysical Journal Supplement Series, 188, 405 (2010).

**Usage**

FGL1

**Format**

A data frame with 89 variables on 1451 gamma-ray sources.

**Details**

Initial Release: 14 Jan 2010 Latest Release: gll\_psc\_v03.fit (9 February 2010)

**Fields**

**Source\_Name** 1FGL JHHMM.m+DDMM[c], constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively; 'c' indicates that based on the region of the sky the source is considered to be potentially confused with Galactic diffuse emission

**RA** Right Ascension, J2000, deg, three decimal places

**DEC** Declination, J2000, deg, three decimal places

**GLON** Galactic longitude, deg, three decimal places

**GLAT** Galactic latitude, deg, three decimal places

**Conf\_68\_SemiMajor** Semimajor radius of 68% confidence region, deg, three decimal places

**Conf\_68\_SemiMinor** Semiminor radius of 68% confidence region, deg, three decimal places

**Conf\_68\_PosAng** Position angle of 68% confidence region, deg. east of north, 0 decimal places

**Conf\_95\_SemiMajor** Semimajor radius of 95% confidence region, deg, three decimal places

**Conf\_95\_SemiMinor** Semiminor radius of 95% confidence region, deg, three decimal places

**Conf\_95\_PosAng** Position angle of 95% confidence region, deg. east of north, 0 decimal places

**Signif\_Avg** Significance derived from likelihood TS for 100 MeV\342\200\223100 GeV analysis, one decimal place

**Pivot\_Energy** Energy at which error on differential flux is minimal, in MeV

**Flux\_density** Differential flux at Pivot\_Energy, in  $\text{cm}^{-2} \text{MeV}^{-1} \text{s}^{-1}$

**Unc\_Flux\_Density** 1 sigma error on differential flux at Pivot\_Energy, in  $\text{cm}^{-2} \text{MeV}^{-1} \text{s}^{-1}$

**Spectral\_Index** Best-fit power-law slope

**Unc\_Spectral\_Index** 1 sigma error on best-fit power-law slope

**Flux1000** Integral flux from 1 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux1000** 1 sigma error on integral flux from 1 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Energy\_Flux** Energy flux from 100 MeV to 100 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Unc\_Energy\_Flux** 1 sigma error on energy flux from 100 MeV to 100 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Curvature\_Index** Measure of how spectrum follows power law (currently simple chi-squared)

**Flux30\_100** Integral flux from 30 to 100 MeV (not filled)

**Unc\_Flux30\_100** 1 sigma error on integral flux from 30 to 100 MeV (not filled)

**Sqrt\_TS30\_100** Square root of the TS between 30 and 100 MeV (not filled)

**Flux100\_300** Integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux100\_300** 1 sigma error on integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS100\_300** Square root of the TS between 100 to 300 MeV

**Flux300\_1000** Integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux300\_1000** 1 sigma error on integral flux from 300 MeV to 1 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS300\_1000** Square root of the TS between 300 MeV to 1 GeV

**Flux1000\_3000** Integral flux from 1 to 3 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux1000\_3000** 1 sigma error on integral flux from 1 to 3 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS1000\_3000** Square root of the TS between 1 to 3 GeV

**Flux3000\_10000** Integral flux from 3 to 10 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux3000\_10000** 1 sigma error on integral flux from 3 to 10 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS3000\_10000** Square root of the TS between 3 to 10 GeV

**Flux10000\_100000** Integral flux from 10 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux10000\_100000** 1 sigma error on integral flux from 10 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS10000\_100000** Square root of the TS between 10 to 100 GeV

**Variability\_Index** Measure of source variability (currently simple chi-squared)

**Signif\_Peak** Source significance in peak interval in sigma units

**Flux\_Peak** Peak integral flux from 100 MeV to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux\_Peak** 1 sigma error on peak integral flux, in  $\text{cm}^{-2} \text{s}^{-1}$

**Time\_Peak** Time of center of interval in which peak flux was measured

**Peak\_Interval** Length of interval in which peak flux was measured

**Flux\_History.1 ... Flux\_History.11** Integral flux from 100 MeV to 100 GeV in time interval 1 ... 11, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux\_History.1 ... Unc\_Flux\_History.11** Error on the integral flux from 100 MeV to 100 GeV in time interval 1 ... 11, in  $\text{cm}^{-2} \text{s}^{-1}$ , using the method indicated in **Unc\_Flag\_History** column and added in quadrature with 3% systematic component.

**Unc\_Flag\_History.1 ... Unc\_Flag\_History.11** 1 if it is half of the difference between the 2 sigma upper limit and the maximum likelihood value given in **Flux\_History**; 0 if it is the 1 sigma uncertainty derived from a significant detection in the interval.



- X0FGL\_Name** Name of the corresponding 0FGL source, if any
- ASSOC\_GAM1** Identification or positional associations with AGILE source
- ASSOC\_GAM2** Identification or positional associations with 3EG source
- ASSOC\_GAM3** Identification or positional associations with EGR source
- TEVCAT\_FLAG** Positional association with a TeVCat source, P for angular size < 40', E for extended, N if no TeV association
- CLASS1** Class designation for most likely association. Capital letters indicate firm identifications; lower-case letters indicate associations: Pulsar (PSR), Pulsar wind nebula (PWN), Supernova remnant (SNR), Globular cluster (GLC), Micro-quasar object (MQO), High-mass binary (HXB), Blazar of the BL Lac type (BZB), Blazar of the FSRQ type (BZQ), Non-blazar active galaxy (AGN), Active galaxy of uncertain type (AGU), Normal galaxy (GAL), Starburst galaxy (SBG), Unassociated source ( ).
- CLASS2** 2nd class designation for associated source.
- ASSOC1** Name of identified or likely associated source.
- ASSOC2** Alternate name of identified or likely associated source.
- Flags** Binary coding. See Table 4 of 1FGL paper for the definition of the various Analysis Flags.

### Source

[http://fermi.gsfc.nasa.gov/ssc/data/access/lat/1yr\\_catalog/](http://fermi.gsfc.nasa.gov/ssc/data/access/lat/1yr_catalog/)

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FGL2

*2FGL Catalog (Fermi Large Area Telescope Second Source Catalog)*

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### Description

Fermi Large Area Telescope Second Source Catalog (2FGL). Nolan, P. L. et al., The Astrophysical Journal Supplement Series, 199, 31 (2012).

### Usage

FGL2

### Format

A data frame with 137 variables on 1873 gamma-ray sources.

### Details

Initial Release: 11 July 2011 Latest Release: gl\_psc\_v09.fit (18 May 2015)

**Fields**

**Source\_Name** 2FGL JHHMM.m+DDMM[c/e], constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1' , respectively; 'c' indicates that based on the region of the sky the source is considered to be potentially confused with Galactic diffuse emission; e indicates a source that was modeled as spatially extended (see Section 3.4 of 2FGL paper)

**RAJ2000** Right Ascension, J2000, deg, three decimal places

**DEJ2000** Declination, J2000, deg, three decimal places

**GLON** Galactic longitude, deg, three decimal places

**GLAT** Galactic latitude, deg, three decimal places

**Conf\_68\_SemiMajor** Semimajor radius of 68% confidence region, deg, three decimal places

**Conf\_68\_SemiMinor** Semiminor radius of 68% confidence region, deg, three decimal places

**Conf\_68\_PosAng** Position angle of 68% confidence region, deg. east of north, 0 decimal places

**Conf\_95\_SemiMajor** Semimajor radius of 95% confidence region, deg, three decimal places

**Conf\_95\_SemiMinor** Semiminor radius of 95% confidence region, deg, three decimal places

**Conf\_95\_PosAng** Position angle of 95% confidence region, deg. east of north, 0 decimal places

**Signif\_Avg** Significance derived from likelihood TS for 100 MeV\342\200\223100 GeV analysis, one decimal place

**Pivot\_Energy** Energy at which error on differential flux is minimal, in MeV

**Flux\_density** Differential flux at Pivot\_Energy, in  $\text{cm}^{-2} \text{MeV}^{-1} \text{s}^{-1}$

**Unc\_Flux\_Density** 1 sigma error on differential flux at Pivot\_Energy, in  $\text{cm}^{-2} \text{MeV}^{-1} \text{s}^{-1}$

**Spectral\_Index** Best-fit photon number power-law index. For LogParabola spectra, index at Pivot\_Energy; for PLEXPcutoff spectra, low-energy index.

**Unc\_Spectral\_Index** 1 sigma error on Spectral\_Index

**Flux1000** Integral flux from 1 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux1000** 1 sigma error on integral flux from 1 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Energy\_Flux100** Energy flux from 100 MeV to 100 GeV obtained by spectral fitting, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Unc\_Energy\_Flux** 1 sigma error on energy flux from 100 MeV to 100 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Signif\_Curve** Significance (in sigma units) of the fit improvement between power-law and either LogParabola (for ordinary sources) or PLEXPcutoff (for pulsars). A value greater than 4 indicates significant curvature.

**SpectrumType** Spectral type (PowerLaw, LogParabola, PLEXPcutoff)

**beta** Curvature parameter (Beta) for LogParabola. NULL for other spectral types

**Unc\_beta** 1 sigma error on Beta for LogParabola. NULL for other spectral types

**Cutoff** Cutoff energy as  $\exp(-E/\text{Cutoff})$  for PLEXPcutoff, in MeV. NULL for other spectral types.

**Unc\_Cutoff** 1 sigma error on cutoff energy for PLEXPcutoff, in MeV. NULL for other spectral types.

**PowerLaw\_Index** Best-fit power-law index. Equal to Spectral\_Index if SpectrumType is PowerLaw.

**Flux30\_100** Integral flux from 30 to 100 MeV (not filled)

**Unc\_Flux30\_100** 1 sigma error on integral flux from 30 to 100 MeV (not filled)

**Sqrt\_TS30\_100** Square root of the TS between 30 and 100 MeV (not filled)

**Flux100\_300** Integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux100\_300** 1 sigma error on integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS100\_300** Square root of the TS between 100 to 300 MeV

**Flux300\_1000** Integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux300\_1000** 1 sigma error on integral flux from 300 MeV to 1 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS300\_1000** Square root of the TS between 300 MeV to 1 GeV

**Flux1000\_3000** Integral flux from 1 to 3 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux1000\_3000** 1 sigma error on integral flux from 1 to 3 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS1000\_3000** Square root of the TS between 1 to 3 GeV

**Flux3000\_10000** Integral flux from 3 to 10 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux3000\_10000** 1 sigma error on integral flux from 3 to 10 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS3000\_10000** Square root of the TS between 3 to 10 GeV

**Flux10000\_100000** Integral flux from 10 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux10000\_100000** 1 sigma error on integral flux from 10 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS10000\_100000** Square root of the TS between 10 to 100 GeV

**Variability\_Index** Sum of  $2 \times \text{Log}(\text{Likelihood})$  comparison between the flux fitted in 24 time segments and a flat light curve over the full two-year catalog interval. A value greater than 41.64 indicates  $< 1\%$  chance of being a steady source.

**Signif\_Peak** Source significance in peak interval in sigma units

**Flux\_Peak** Peak integral flux from 100 MeV to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux\_Peak** 1 sigma error on peak integral flux, in  $\text{cm}^{-2} \text{s}^{-1}$

**Time\_Peak** Time of center of interval in which peak flux was measured

**Peak\_Interval** Length of interval in which peak flux was measured

**Flux\_History.1 ... Flux\_History.24** Integral flux from 100 MeV to 100 GeV in time interval 1 ... 24, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux\_History.1 ... Unc\_Flux\_History.24** Error on the integral flux from 100 MeV to 100 GeV in time interval 1 ... 24, in  $\text{cm}^{-2} \text{s}^{-1}$ , using the method indicated in **Unc\_Flag\_History** column and added in quadrature with 3% systematic component.

**Unc\_Flag\_History.1 ... Unc\_Flag\_History.24** 1 if it is half of the difference between the 2 sigma upper limit and the maximum likelihood value given in **Flux\_History**; 0 if it is the 1 sigma uncertainty derived from a significant detection in the interval.

**Extended\_Source\_Name** Cross-reference to the ExtendedSources extension for extended sources, if any.

**0FGL\_Name** Name of the corresponding 0FGL source, if any.

**1FGL\_Name** Name of the corresponding 1FGL source, if any.

**ASSOC\_GAM1** Identification or positional associations with AGILE (1AGL)source

**ASSOC\_GAM2** Identification or positional associations with 3EG source

**ASSOC\_GAM3** Identification or positional associations with EGR source

**TEVCAT\_FLAG** Positional association with a TeVCat source, P for angular size < 40', E for extended, N if no TeV association

**ASSOC\_TEV** Name of likely corresponding TeV source from TevCat.

**CLASS1** Class designation for most likely association. Capital letters indicate firm identifications; lower-case letters indicate associations: Pulsar, identified by pulsations (PSR), Pulsar, no pulsations seen in LAT yet (psr), Pulsar wind nebula (PWN), Supernova remnant (SNR), Supernova remnant/pulsar wind nebula (spp), Globular cluster (glc), High-mass binary (HMB), Nova (NOV), Blazar of the BL Lac type (BZB), Blazar of the FSRQ type (BZQ), Non-blazar active galaxy (AGN), Radio galaxy (RDG), Seyfert galaxy (SEY), Active galaxy of uncertain type (AGU), Normal galaxy (GAL), Starburst galaxy (sbg), Unassociated source ( ).

**CLASS2** 2nd class designation for associated source.

**ASSOC1** Name of identified or likely associated source.

**ASSOC2** Alternate name of identified or likely associated source.

**Flags** Binary coding. See Table 3 of 2FGL paper for the definition of the various Analysis Flags.

## Source

[http://fermi.gsfc.nasa.gov/ssc/data/access/lat/2yr\\_catalog/](http://fermi.gsfc.nasa.gov/ssc/data/access/lat/2yr_catalog/)

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FGL3

*3FGL Catalog (Fermi Large Area Telescope Third Source Catalog)*

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## Description

Fermi Large Area Telescope Second Source Catalog (3FGL). Acero, F. et al., The Astrophysical Journal Supplement Series, 218, 23 (2015).

## Usage

FGL3

## Format

A data frame with 224 variables on 3034 gamma-ray sources.

## Details

Initial Release: 9 January 2015 Latest Release: gll\_psc\_v16.fit (18 May 2015)

**Fields**

- Source\_Name** 3FGL JHHMM.m+DDMM[c/e], constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively; 'c' indicates that based on the region of the sky the source is considered to be potentially confused with Galactic diffuse emission; e indicates a source that was modeled as spatially extended (see Section 3.4 of 2FGL paper)
- RAJ2000** Right Ascension, J2000, deg, three decimal places
- DEJ2000** Declination, J2000, deg, three decimal places
- GLON** Galactic longitude, deg, three decimal places
- GLAT** Galactic latitude, deg, three decimal places
- Conf\_68\_SemiMajor** Semimajor radius of 68% confidence region, deg, three decimal places
- Conf\_68\_SemiMinor** Semiminor radius of 68% confidence region, deg, three decimal places
- Conf\_68\_PosAng** Position angle of 68% confidence region, deg. east of north, 0 decimal places
- Conf\_95\_SemiMajor** Semimajor radius of 95% confidence region, deg, three decimal places
- Conf\_95\_SemiMinor** Semiminor radius of 95% confidence region, deg, three decimal places
- Conf\_95\_PosAng** Position angle of 95% confidence region, deg. east of north, 0 decimal places
- ROI\_num** ROI number (cross-reference to ROIs extension)
- Signif\_Avg** Source significance (in sigma units) derived from likelihood TS for 100 MeV\342\200\223300 GeV analysis, one decimal place
- Pivot\_Energy** Energy at which error on differential flux is minimal, in MeV
- Flux\_density** Differential flux at Pivot\_Energy, in  $\text{cm}^{-2} \text{MeV}^{-1} \text{s}^{-1}$
- Unc\_Flux\_Density** 1 sigma error on differential flux at Pivot\_Energy, in  $\text{cm}^{-2} \text{MeV}^{-1} \text{s}^{-1}$
- Spectral\_Index** Best-fit photon number power-law index: For LogParabola spectra, index at Pivot\_Energy; for PLEXPcutoff spectra, low-energy index.
- Unc\_Spectral\_Index** 1 sigma error on Spectral\_Index
- Flux1000** Integral flux from 1 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$
- Unc\_Flux1000** 1 sigma error on integral flux from 1 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$
- Energy\_Flux100** Energy flux from 100 MeV to 100 GeV obtained by spectral fitting, in  $\text{erg cm}^{-2} \text{s}^{-1}$
- Unc\_Energy\_Flux** 1 sigma error on energy flux from 100 MeV to 100 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$
- Signif\_Curve** Significance (in sigma units) of the fit improvement between power-law and either LogParabola (for ordinary sources) or PLEXPcutoff (for pulsars). A value greater than 4 indicates significant curvature.
- SpectrumType** Spectral type (PowerLaw, LogParabola, PLEXPcutoff, PLSuperExpCutoff)
- beta** Curvature parameter (Beta) for LogParabola. NULL for other spectral types
- Unc\_beta** 1 sigma error on Beta for LogParabola. NULL for other spectral types
- Cutoff** Cutoff energy ( $E_c$  for equation 2 of 3FGL paper) for PL(Super)ExpCutoff, in MeV. NULL for other spectral types.
- Unc\_Cutoff** 1 sigma error on cutoff energy for PLEXPcutoff, in MeV. NULL for other spectral types.

**Exp\_Index** Exponential index (b of Equation 2 of 3FGL paper) for PLSuperExpCutoff. NULL for other spectral types

**PowerLaw\_Index** Best-fit power-law index. Equal to Spectral\_Index if SpectrumType is Power-Law.

**Flux30\_100** Integral flux from 30 to 100 MeV (not filled)

**Unc\_Flux30\_100** 1 sigma error on integral flux from 30 to 100 MeV (not filled)

**nuFnu30\_100** Spectral energy distribution between 30 and 100 MeV (not filled)

**Sqrt\_TS30\_100** Square root of the TS between 30 and 100 MeV (not filled)

**Flux100\_300** Integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux100\_300** 1 sigma error on integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**nuFnu100\_300** Spectral energy distribution between 100 and 300 MeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS100\_300** Square root of the TS between 100 to 300 MeV

**Flux300\_1000** Integral flux from 100 to 300 MeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux300\_1000** 1 sigma error on integral flux from 300 MeV to 1 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**nuFnu300\_1000** Spectral energy distribution between 300 and 1 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS300\_1000** Square root of the TS between 300 MeV to 1 GeV

**Flux1000\_3000** Integral flux from 1 to 3 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux1000\_3000** 1 sigma error on integral flux from 1 to 3 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**nuFnu1000\_3000** Spectral energy distribution between 1 and 3 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS1000\_3000** Square root of the TS between 1 to 3 GeV

**Flux3000\_10000** Integral flux from 3 to 10 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux3000\_10000** 1 sigma error on integral flux from 3 to 10 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**nuFnu3000\_10000** Spectral energy distribution between 3 and 10 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS3000\_10000** Square root of the TS between 3 to 10 GeV

**Flux10000\_100000** Integral flux from 10 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux10000\_100000** 1 sigma error on integral flux from 10 to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**nuFnu10000\_100000** Spectral energy distribution between 10 and 100 GeV, in  $\text{erg cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS10000\_100000** Square root of the TS between 10 to 100 GeV

**Variability\_Index** Sum of  $2x\text{Log(Likelihood)}$  comparison between the flux fitted in 48 time segments and the average flux over the full catalog interval. A value greater than 72.44 over 48 intervals indicates  $< 1\%$  chance of being a steady source.

**Signif\_Peak** Source significance in peak interval in sigma units

**Flux\_Peak** Peak integral flux from 100 MeV to 100 GeV, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux\_Peak** 1 sigma error on peak integral flux, in  $\text{cm}^{-2} \text{s}^{-1}$

**Time\_Peak** Time of center of interval in which peak flux was measured, in MET s

**Peak\_Interval** Length of interval in which peak flux was measured

**Flux\_History.1 ... Flux\_History.48** Integral flux from 100 MeV to 100 GeV in time interval 1 ... 48, in  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux\_History.1 ... Unc\_Flux\_History.48** Error on the integral flux from 100 MeV to 100 GeV in time interval 1 ... 48, in  $\text{cm}^{-2} \text{s}^{-1}$ , using the method indicated in Unc\_Flag\_History column and added in quadrature with 3% systematic component.

**Unc\_Flag\_History.1 ... Unc\_Flag\_History.48** 1 if it is half of the difference between the 2 sigma upper limit and the maximum likelihood value given in Flux\_History; 0 if it is the 1 sigma uncertainty derived from a significant detection in the interval.

**Extended\_Source\_Name** Cross-reference to the ExtendedSources extension for extended sources, if any.

**X0FGL\_Name** Name of the corresponding 0FGL source, if any.

**X1FGL Name** Name of the corresponding 1FGL source, if any.

**X2FGL Name** Name of the corresponding 2FGL source, if any.

**X1FHL Name** Name of the corresponding 1FHL source, if any.

**ASSOC\_GAM1** Identification or positional associations with AGILE (1AGL)source

**ASSOC\_GAM2** Identification or positional associations with 3EG source

**ASSOC\_GAM3** Identification or positional associations with EGR source

**TEVCAT\_FLAG** Positional association with a TeVCat source, P for angular size < 40', E for extended, N if no TeV association

**ASSOC\_TEV** Name of likely corresponding TeV source from TevCat.

**CLASS1** Class designation for most likely association. Capital letters indicate firm identifications; lower-case letters indicate associations: Pulsar, identified by pulsations (PSR), Pulsar, no pulsations seen in LAT yet (psr), Pulsar wind nebula (PWN), Supernova remnant (SNR), Supernova remnant/pulsar wind nebula (spp), Globular cluster (glc), High-mass binary (HMB), Binary (BIN), Nova (NOV), Star-forming region (SFR), Compact Steep Spectrum Quasar (css), Blazar of the BL Lac type (BLL), Blazar of the FSRQ type (FSRQ), Non-blazar active galaxy (AGN), Radio galaxy (RDG), Seyfert galaxy (SEY), Blazar candidate of uncertain type (BCU), Normal galaxy (GAL), Starburst galaxy (sbg), Narrow line Seyfert 1 (NLSY1), Soft spectrum radio quasar (ssrq), Unassociated source ( ).

**CLASS2** 2nd class designation for associated source.

**ASSOC1** Name of identified or likely associated source.

**ASSOC2** Alternate name of identified or likely associated source.

**Flags** Binary coding. See Table 3 of 3FGL paper for the definition of the various Analysis Flags.

## Source

[http://fermi.gsfc.nasa.gov/ssc/data/access/lat/4yr\\_catalog/](http://fermi.gsfc.nasa.gov/ssc/data/access/lat/4yr_catalog/)

FHL1

*1FHL Catalog (First Fermi-LAT Catalog of Sources Above 10 GeV)***Description**

The First Fermi-LAT Catalog of Sources Above 10 GeV (1FHL). Ackermann, M. et al., The Astrophysical Journal Supplement Series, 209, 34 (2013). FITS Filename: gll\_psch\_v07.fit, released 29 July 2013.

**Usage**

FHL1

**Format**

A data frame with 39 variables on 514 sources.

**Fields**

**Source\_Name** 1FHL JHHMM.m+DDMM, constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively

**RAJ2000** Right Ascension, J2000

**DEJ2000** Declination, J2000

**GLON** Galactic longitude, deg.

**GLAT** Galactic latitude, deg.

**Conf\_95\_SemiMajor** Long radius of error ellipse at 95% confidence level

**Conf\_95\_SemiMinor** Short radius of error ellipse at 95% confidence level

**Conf\_95\_PosAng** Position angle of the 95% long axis from celestial north, positive toward increasing RA (eastward)

**Signif\_Avg** Source significance in sigma units (derived from TS)

**Pivot\_Energy** Energy at which error on differential flux is minimal, in GeV

**Flux\_Density** Differential flux at Pivot\_Energy,  $\text{cm}^{-2} \text{GeV}^{-1} \text{s}^{-1}$

**Unc\_Flux\_Density** 1 sigma error on differential flux at Pivot\_Energy,  $\text{cm}^{-2} \text{GeV}^{-1} \text{s}^{-1}$

**Spectral\_Index** Best fit photon number power-law index

**Unc\_Spectral\_Index** 1 sigma error on Spectral\_Index

**Flux** Integral photon flux from 10 to 500 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux** 1 sigma error on integral photon flux from 10 to 500 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Energy\_Flux** Energy flux from 10 to 500 GeV obtained by spectral fitting,  $\text{erg cm}^{-2} \text{s}^{-1}$

**Unc\_Energy\_Flux** 1 sigma error on energy flux from 10 to 500 GeV,  $\text{erg cm}^{-2} \text{s}^{-1}$

**Flux10\_30GeV** Integral flux from 10 to 30 GeV,  $\text{cm}^{-2} \text{s}^{-1}$



**Unc\_Flux10\_30GeV.1** (lower) 1 sigma error on integral flux from 10 to 30 GeV,  $\text{cm}^{-2} \text{s}^{-1}$ , set to NaN if 1 sigma interval contains 0

**Unc\_Flux10\_30GeV.2** (upper) 1 sigma error on integral flux from 10 to 30 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS10\_30GeV** Square root of Test Statistic between 10 and 30 GeV

**Flux30\_100GeV** Integral flux from 30 to 100 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux30\_100GeV.1** (lower) 1 sigma error on integral flux from 30 to 100 GeV,  $\text{cm}^{-2} \text{s}^{-1}$ , set to NaN if 1 sigma interval contains 0

**Unc\_Flux30\_100GeV.2** (upper) 1 sigma error on integral flux from 30 to 100 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS30\_100GeV** Square root of Test Statistic between 30 and 100 GeV

**Flux100\_500GeV** Integral flux from 100 to 500 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux100\_500GeV.1** (lower) 1 sigma error on integral flux from 100 to 500 GeV,  $\text{cm}^{-2} \text{s}^{-1}$ , set to NaN if 1 sigma interval contains 0

**Unc\_Flux100\_500GeV.2** (upper) 1 sigma error on integral flux from 100 to 500 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS100\_500GeV** Square root of Test Statistic between 100 and 500 GeV

**Variability\_BayesBlocks** Number of Bayesian Blocks found (1 for non-variable)

**Extended\_Source\_Name** Cross-reference to the Extended Sources extension for extended sources, if any

**ASSOC\_GAM** Name of corresponding source in gamma-ray catalog, if any

**TEVCAT\_FLAG** P if positional association with non-extended source in TeVCat, E if associated with an extended source in TeVCat, N if no TeV association

**ASSOC\_TEV** Name of TeV association, if any

**CLASS1** Class designation for most likely association. Capital letters indicate firm identifications; lower-case letters indicate associations: Blazar of the BL Lac type (BZB), Blazar of the FSRQ type (BZQ), Active galaxy of uncertain type (AGU), Pulsar, identified by pulsations above 10 GeV (HPSR), Pulsar, identified by pulsations in LAT, excluding HPSR (PSR), Pulsar, no pulsations seen in LAT yet (psr), Supernova remnant (SNR), Pulsar wind nebula (PWN), Unclear whether SNR or PWN (spp), Radio galaxy (RDG), High-mass binary (HMB), Normal galaxy (GAL), Star forming region (SFR), LBV star (lbv), Unassociated source ( ).

**CLASS2** Class designation for alternate association, if any

**ASSOC1** Name of identified or most likely associated source

**ASSOC2** Name of alternate association, if any

## Source

<http://fermi.gsfc.nasa.gov/ssc/data/access/lat/1FHL/>

FHL2

*2FHL Catalog (Second Catalog of Hard Fermi-LAT Sources)***Description**

The Second Catalog of Hard Fermi-LAT Sources (2FHL). Ackermann, M. et al., The Astrophysical Journal Supplement Series, 222, 5 (2016). FITS Filename: gl\_psch\_v08.fit, released 16 Sept 2015.

**Usage**

FHL2

**Format**

A data frame with 42 variables on 360 sources.

**Fields**

**Source\_Name** 2FHL JHHMM.m+DDMM, constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively. A Source\_Name ending with "e" indicates an extended source.

**RAJ2000** Right Ascension, J2000

**DEJ2000** Declination, J2000

**GLON** Galactic longitude, deg.

**GLAT** Galactic latitude, deg.

**Pos\_err\_68** Position uncertainty at 68% confidence level

**TS** Test Statistic

**Spectral\_Index** Best fit photon number power-law index

**Unc\_Spectral\_Index** 1 sigma error on Spectral\_Index

**Intr\_Spectral\_Index\_D11** Intrinsic spectral index computed using the Dominguez et al. (2011b) EBL model

**Unc\_Intr\_Spectral\_Index\_D11** 1 sigma uncertainty on the intrinsic spectral index computed using the Dominguez et al. (2011b) EBL model

**Intr\_Spectral\_Index\_G12** Intrinsic spectral index computed using the Gilmore et al. (2012) EBL model

**Unc\_Intr\_Spectral\_Index\_G12** 1 sigma uncertainty on the intrinsic spectral index computed using the Gilmore et al. (2012) EBL model

**Flux50** Integral photon flux from 50 GeV to 2 TeV, photon cm<sup>-2</sup> s<sup>-1</sup>

**Unc\_Flux50** 1 sigma uncertainty on integral flux from 50 GeV to 2 TeV, photon cm<sup>-2</sup> s<sup>-1</sup>

**Energy\_Flux50** Energy flux from 50 GeV to 2 TeV, erg cm<sup>-2</sup> s<sup>-1</sup>

**Unc\_Energy\_Flux50** 1 sigma error on energy flux from 50 GeV to 2 TeV, erg cm<sup>-2</sup> s<sup>-1</sup>

**Flux50\_171GeV** Integral photon flux from 50 to 171 GeV, cm<sup>-2</sup> s<sup>-1</sup>

**Unc\_Flux50\_171GeV.1** (lower) 1 sigma error on integral photon flux from 50 to 171 GeV,  $\text{cm}^{-2} \text{s}^{-1}$ , set to NaN if 1 sigma interval contains 0

**Unc\_Flux50\_171GeV.2** (upper) 1 sigma error on integral photon flux from 50 to 171 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS50\_171GeV** Square root of Test Statistic between 50 and 171 GeV

**Flux171\_585GeV** Integral photon flux from 171 to 585 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux171\_585GeV.1** (lower) 1 sigma error on integral photon flux from 171 to 585 GeV,  $\text{cm}^{-2} \text{s}^{-1}$ , set to NaN if 1 sigma interval contains 0

**Unc\_Flux171\_585GeV.2** (upper) 1 sigma error on integral photon flux from 171 to 585 GeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS171\_585GeV** Square root of Test Statistic between 171 and 585 GeV

**Flux585\_2000GeV** Integral photon flux from 585 GeV to 2 TeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Unc\_Flux585\_2000GeV.1** (lower) 1 sigma error on integral photon flux from 585 GeV to 2 TeV,  $\text{cm}^{-2} \text{s}^{-1}$ , set to NaN if 1 sigma interval contains 0

**Unc\_Flux585\_2000GeV.2** (upper) 1 sigma error on integral photon flux from 585 GeV to 2 TeV,  $\text{cm}^{-2} \text{s}^{-1}$

**Sqrt\_TS585\_2000GeV** Square root of Test Statistic between 585 GeV and 2 TeV

**Npred** Predicted number of photons from the source

**HEP\_Energy** Highest photon energy, GeV

**HEP\_Prob** Probability that the HEP is coming from the source,  $\geq 0.85$

**ROI** Region of interest number

**ASSOC** Name of the most likely associated source

**ASSOC\_PROB\_BAY** Probability of association from the Bayesian method

**ASSOC\_PROB\_LR** Probability of association from the likelihood ratio method

**CLASS** Class designation for most likely association. Capital letters indicate firm identifications; lower-case letters indicate associations: Pulsar (psr), Pulsar wind nebula (pwn), Supernova remnant (snr), Supernova remnant/Pulsar wind nebula (spp), High-mass binary (hmb), Binary (bin), Star-forming region (sfr), BL Lac type of blazar (bll), BL Lac type of blazar with prominent galaxy emission (bll-g), FSRQ type of blazar (fsrq), Non-blazar active galaxy (agn), Radio galaxy (rdg), Radio galaxy/BL Lac (rdg/bll), Blazar candidate of uncertain type I (bcu I), Blazar candidate of uncertain type II (bcu II), Blazar candidate of uncertain type III (bcu III), Normal galaxy, or part (gal), Galaxy cluster (galclu), Unassociated source ( ).

**Redshift** Redshift (when available) of the most likely associated source

**NuPeak\_obs** Observed Synchrotron peak frequency, Hz

**X3FGL\_Name** Name of the most likely associated source in 3FGL

**X1FHL\_Name** Name of the most likely associated source in the 1FHL

**TeVcat\_Name** Name of the most likely associated source in the TeVCat

## Source

<http://fermi.gsfc.nasa.gov/ssc/data/access/lat/2FHL/>

FIG1

*1FIG (First Fermi-LAT Inner Galaxy point source Catalog)***Description**

First Fermi-LAT Inner Galaxy point source Catalog (1FIG). Ajello, M. et al., The Astrophysical Journal, 819, 44 (2016).

**Usage**

FIG1

**Format**

A data frame with 31 variables on 48 gamma-ray sources.

**Details**

Results from Table 3 and Table 7 of the journal article.

**Fields**

**Source\_Name** 1FIG JHHMM.m+DDMM, constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively

**GLON** Galactic Longitude, degrees

**GLAT** Galactic Latitude, degrees

**dTH** Deltatheta, 95% confidence region, deg

**TS** Test Statistic

**F\_PSR\_INT** 1-100 GeV flux, Pulsars Intensity-scaled,  $10^{-9}$  ph cm<sup>-2</sup> s<sup>-1</sup>

**F\_PSR\_IND** 1-100 GeV flux, Pulsars Index-scaled,  $10^{-9}$  ph cm<sup>-2</sup> s<sup>-1</sup>

**F\_OB\_INT** 1-100 GeV flux, OBstars Intensity-scaled,  $10^{-9}$  ph cm<sup>-2</sup> s<sup>-1</sup>

**F\_OB\_IND** 1-100 GeV flux, OBstars Index-scaled,  $10^{-9}$  ph cm<sup>-2</sup> s<sup>-1</sup>

**TYPE** Spectral type, PowerLaw (PL) or LogParabola (LP)

**A\_PSR\_INT** alpha, Pulsars Intensity-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta \log(E/E_b)}$

**UNC\_A\_PSR\_INT** uncertainty in alpha, Pulsars Intensity-scaled

**B\_PSR\_INT** beta, Pulsars Intensity-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta \log(E/E_b)}$

**UNC\_B\_PSR\_INT** uncertainty in beta, Pulsars Intensity-scaled

**EB\_PSR\_INT** Eb, Pulsars Intensity-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta \log(E/E_b)}$

**A\_PSR\_IND** alpha, Pulsars Index-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta \log(E/E_b)}$

**UNC\_A\_PSR\_IND** uncertainty in alpha, Pulsars Index-scaled

**B\_PSR\_IND** beta, Pulsars Index-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta \log(E/E_b)}$

**UNC\_B\_PSR\_IND** uncertainty in beta, Pulsars Index-scaled  
**EB\_PSR\_IND** Eb, Pulsars Index-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**A\_OB\_INT** alpha, OBstars Intensity-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**UNC\_A\_OB\_INT** uncertainty in alpha, OBstars Intensity-scaled  
**B\_OB\_INT** beta, OBstars Intensity-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**UNC\_B\_OB\_INT** uncertainty in beta, OBstars Intensity-scaled  
**EB\_OB\_INT** Eb, OBstars Intensity-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**A\_OB\_IND** alpha, OBstars Index-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**UNC\_A\_OB\_IND** uncertainty in alpha, OBstars Index-scaled  
**B\_OB\_IND** beta, OBstars Index-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**UNC\_B\_OB\_IND** uncertainty in beta, OBstars Index-scaled  
**EB\_OB\_IND** Eb, OBstars Index-scaled, for spectral model  $dN/dE \sim (E/E_b)^{-\alpha - \beta} \log(E/E_b)$   
**ASSOC\_3FGL** 3FGL association

### Source

<http://adsabs.harvard.edu/abs/2016ApJ...819...44A>

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LAC3_HI	<i>3LAC_HI (Third Catalog of Active Galactic Nuclei Detected by the Fermi Large Area Telescope - High Galactic Latitude)</i>
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### Description

Third Catalog of Active Galactic Nuclei (3LAC). Ackermann, M. et al., The Astrophysical Journal, 810, 14 (2015).

### Usage

LAC3\_HI

### Format

A data frame with 26 variables on 1591 gamma-ray sources.

### Details

High Galactic Latitude ( $|GLAT| > 10$  deg.) Sources.

**Fields**

**Source\_Name** 1FIG JHHMM.m+DDMM, constructed according to IAU Specifications for Nomenclature; m is decimal minutes of R.A.; in the name R.A. and decl. are truncated at 0.1 decimal minutes and 1', respectively

**GLON** Galactic Longitude, degrees

**GLAT** Galactic Latitude, degrees

**ASSOC\_3FGL** 3FGL Source Name (JHHMM.m+DDMM)

**VHE** Display this very-high-energy AGN data (table10)

**Cln** Source in Clean sample: Y=Yes, N=No

**CName** Name of the counterpart source

**RAJ2000** Radio counterpart right Ascension (J2000)

**DEJ2000** Radio counterpart declination (J2000)

**Sep** Angular separation with counterpart source, deg.

**PosErr** 95% error radius, deg.

**SpCl** Optical class (G1)

**SEDCI** SED class

**lognu** Log frequency of observer-frame position of synchrotron peak (NupSyn-Meas)

**lognuRf** Log frequency of rest-frame position of synchrotron peak (NupSyn-Rf)

**z** Redshift

**Prob** Bayesian probability

**LR.RG** Likelihood Ratio reliability for Radio-gamma-ray association

**LR.XGP** Likelihood Ratio reliability for X-ray-gamma-ray association

**logCpt** Compton Dominance in log scale

**FRad** Radio flux

**n\_FRad** Flag on FRad

**FX** X-ray flux; units of  $1e-13\text{erg/cm}^2/\text{s}$

**Vmag1** USNO V band magnitude

**Vmag2** SDSS V band magnitude

**ARO** Rest frame, broadband radio-optical spectral index

**AOX** Rest frame, broadband optical-X-ray spectral index

**Source**

<http://adsabs.harvard.edu/abs/2015ApJ...810...14A>

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LAC3_LO	<i>3LAC_LO (Third Catalog of Active Galactic Nuclei Detected by the Fermi Large Area Telescope - Low Galactic Latitude)</i>
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**Description**

Third Catalog of Active Galactic Nuclei (3LAC). Ackermann, M. et al., The Astrophysical Journal, 810, 14 (2015).

**Usage**

LAC3\_LO

**Format**

A data frame with 20 variables on 182 gamma-ray sources.

**Details**

Low Galactic Latitude ( $|GLAT| < 10$  deg.) Sources.

**Fields**

**GLON** Galactic Longitude, degrees

**GLAT** Galactic Latitude, degrees

**ASSOC\_3FGL** 3FGL Source Name (JHHMM.m+DDMM)

**VHE** Display this very-high-energy AGN data (table10)

**CName** Name of the counterpart source

**RAJ2000** Radio counterpart right Ascension (J2000)

**DEJ2000** Radio counterpart declination (J2000)

**Sep** Angular separation with counterpart source, deg.

**PosErr** 95% error radius, deg.

**SpCl** Optical class (G1)

**SEDCI** SED class

**lognu** Log frequency of observer-frame position of synchrotron peak (NupSyn-Meas)

**lognuRf** Log frequency of rest-frame position of synchrotron peak (NupSyn-Rf)

**z** Redshift

**Prob** Bayesian probability

**LR.RG** Likelihood Ratio reliability for Radio-gamma-ray association

**FRad** Radio flux

**n\_FRad** Flag on FRad

**FX** X-ray flux; units of  $1e-13$  erg/cm<sup>2</sup>/s

**LR.XG** Likelihood Ratio reliability for X-ray-gamma-ray association

**Source**

<http://adsabs.harvard.edu/abs/2015ApJ...810...14A>

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pulsars

*pulsars (Public List of LAT-Detected Gamma-Ray Pulsars)*

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**Description**

Fermi Large Area Telescope List of Detected Pulsars <https://confluence.slac.stanford.edu/display/GLAMCOG/Public+List+of+LAT-Detected+Gamma-Ray+Pulsars>

**Usage**

pulsars

**Format**

A data frame with 8 variables on 205 gamma-ray pulsars:

**Details**

Last Updated: 2016-02-22

**Fields**

**PSR** Pulsar name, PSR JHHMM+DDMM, constructed using the RA and Dec

**RAJ\_deg** Right Ascension, J2000, degrees

**DECJ\_deg** Declination, J2000, degrees

**P\_ms** Period, milliseconds

**Edot** Spin-down luminosity, erg/s

**Codes** b=Pulsar is in a binary system, e=Pulsar was detected in gamma rays by EGRET/COMPTEL, g=Discovered in LAT gamma-ray data, m=Millisecond pulsar, p=Pulsar was discovered by the PSC, r=Discovered in the radio and/or Gamma-ray pulsations detected using the radio ephemeris, u=Discovered using a Fermi-LAT seed position, x=Discovered in the x-ray and/or Gamma-ray pulsations detected using the X-ray ephemeris.

**Refs** References (see web page for details)

**date\_public** Date made public (all gamma-ray pulsars announced prior to 2016 are listed as being announced 2014-11-06)

**Source**

<https://confluence.slac.stanford.edu/display/GLAMCOG/Public+List+of+LAT-Detected+Gamma-Ray+Pulsars>



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