

The Third Catalog of Hard *Fermi*-LAT Sources (3FHL)

The background of the slide features a large, oval-shaped image of the Fermi-LAT satellite in space. The satellite is a complex structure with a central body and two large, rectangular solar panel arrays extending outwards. It is positioned against a dark blue background filled with numerous small, bright orange and red stars, representing the galaxy. A prominent, bright orange and red horizontal band of light, likely representing the galactic plane or a specific region of interest, runs across the middle of the image. The satellite is oriented diagonally, with its solar panels pointing towards the bottom right.

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On behalf of the *Fermi* LAT Collaboration
Seventh International Fermi Symposium
Garmisch-Partenkirchen, Germany
15-20 October, 2017

Outline – Three Questions

- **Who did the work?**
- **How was it done?**
- **What are some of the results?**

Reference: Ajello, M. et al. 2017, ApJS 232, 18

<https://fermi.gsfc.nasa.gov/ssc/data/access/lat/3FHL/>

Who - Key Participants

Alberto Dominguez, team lead

Benoit Lott

Sara Cutini

Marco Ajello

Pascal Fortin

Jean Ballet

Seth Digel

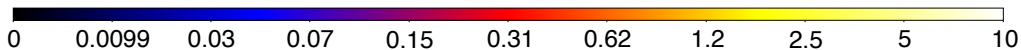
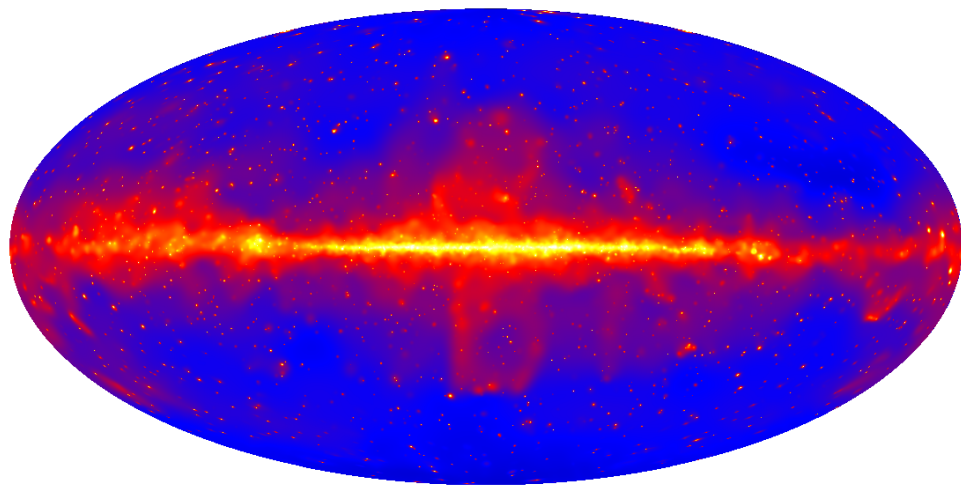
Dario Gasparrini

David Paneque

Pablo Saz Parkinson

and others

Construction of 3FHL



Adaptively smoothed counts map

Energy Range: 10 GeV -2 TeV

Duration: 7 years

Pass 8 data, Source-class

Unbinned likelihood using PSF types

Zenith angle $< 105^\circ$

Minimum 4 photons/source

Median point source localization accuracy: 2.3 arcmin radius (95%)

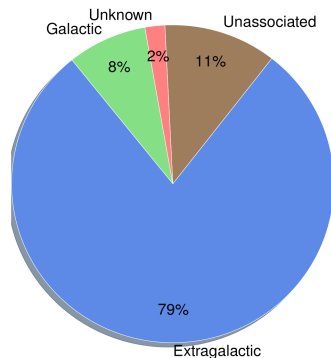
48 spatially extended sources

The 3FHL Catalog

1556 sources:

79% extragalactic, 8% Galactic

13% unassociated

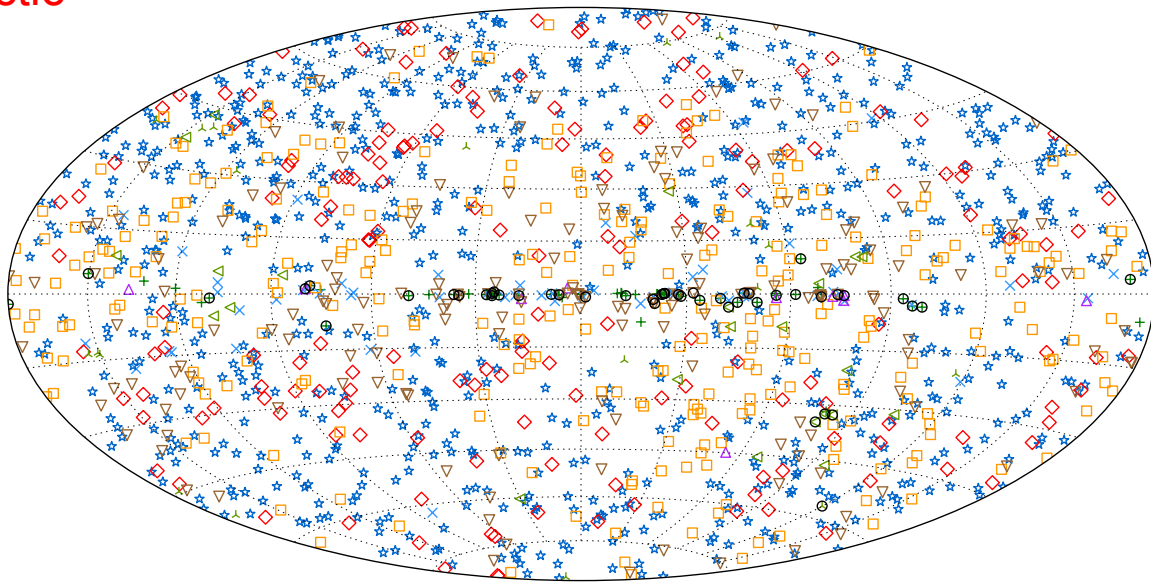


1286 in 3FGL

133 in TeVCat

211 new sources (not in 1FHL/
2FHL/3FGL/TeVcat)

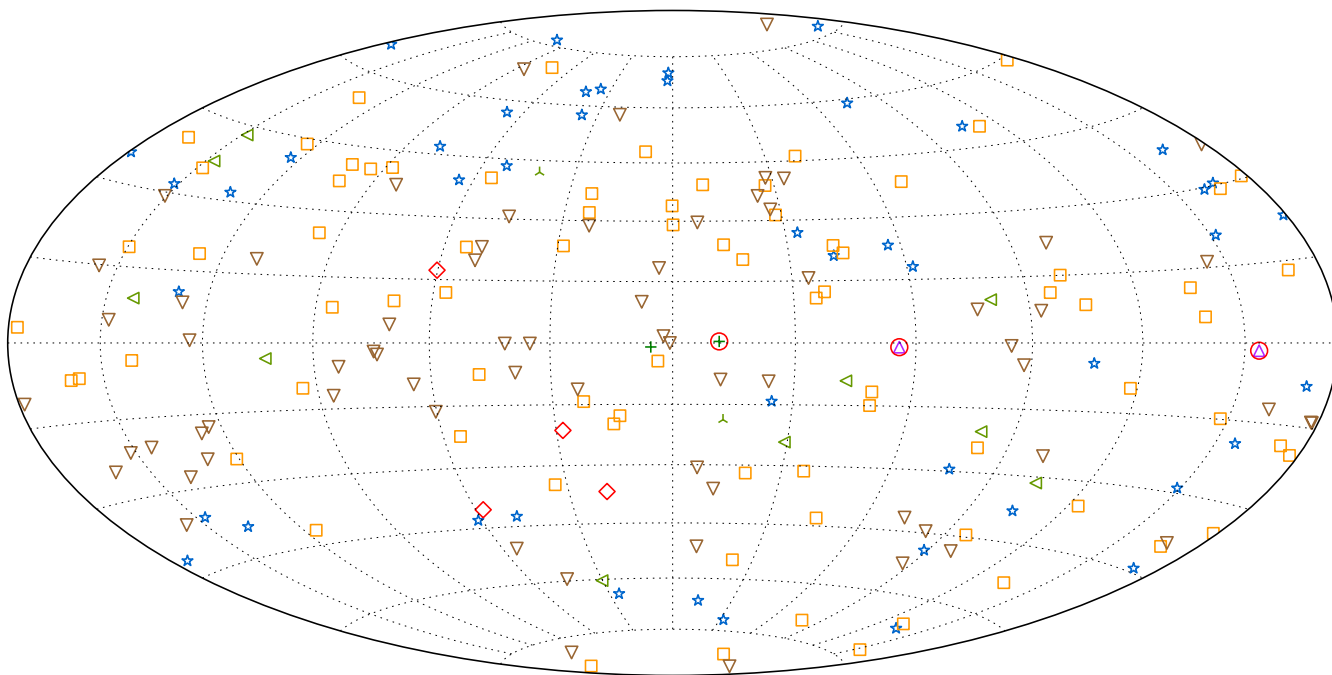
16 with redshift > 2



+	SNRs and PWNe	*	BL Lacs	□	Unc. Blazars	△	Other GAL	▽	Unassociated
×	Pulsars	◇	FSRQs	▲	Other EGAL	◀	Unknown	○	Extended

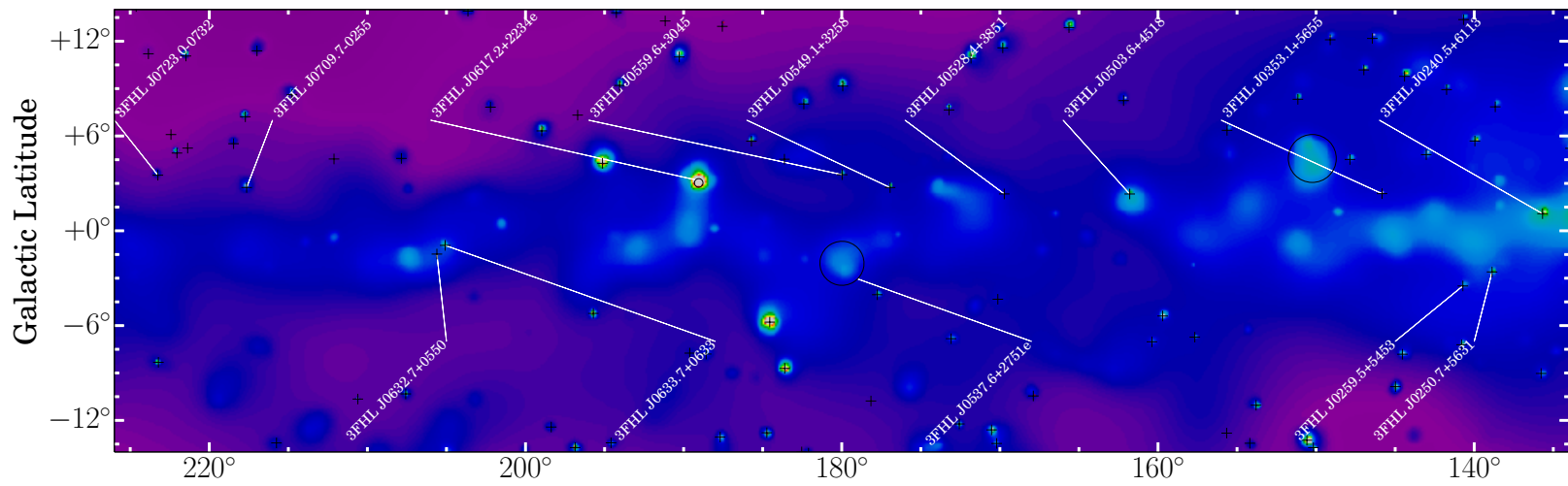
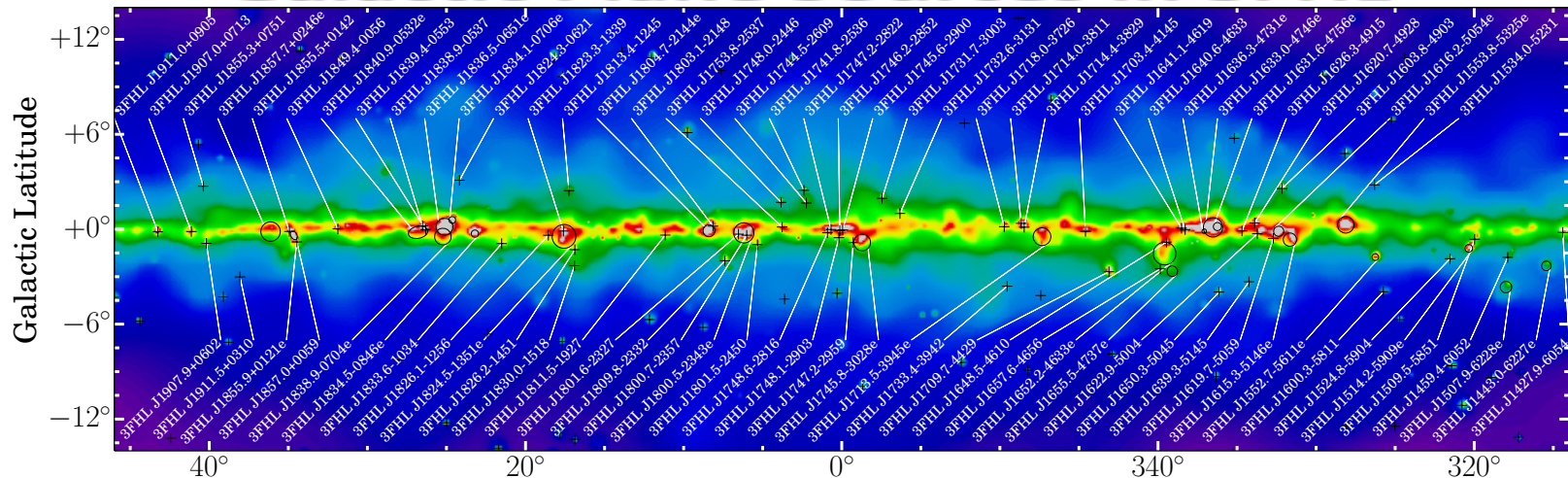
New Sources in the 3FHL Catalog

214 sources not included in previous LAT catalogs. 3 of these have been seen by IACTs.

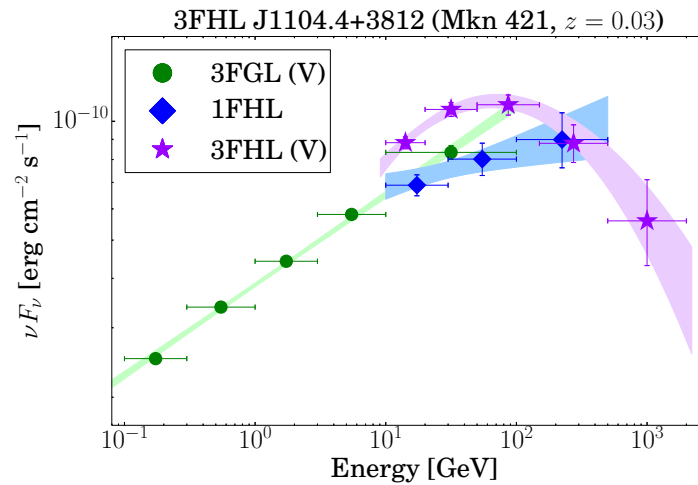
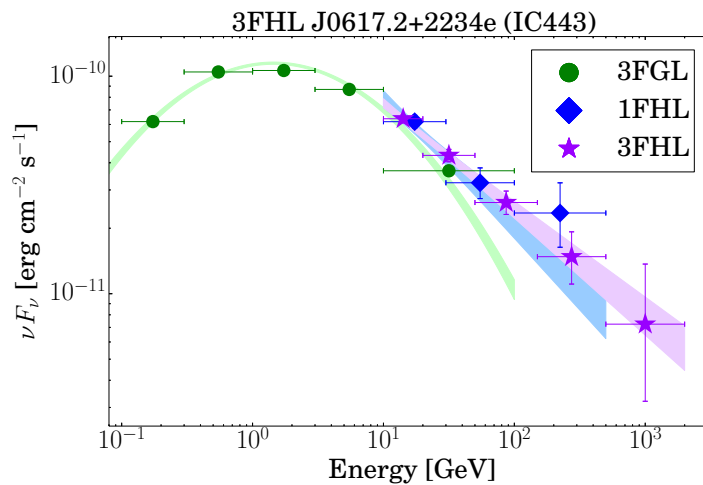
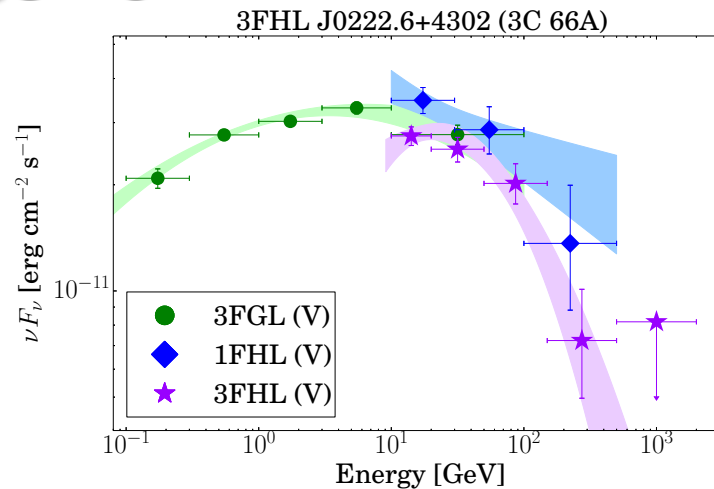
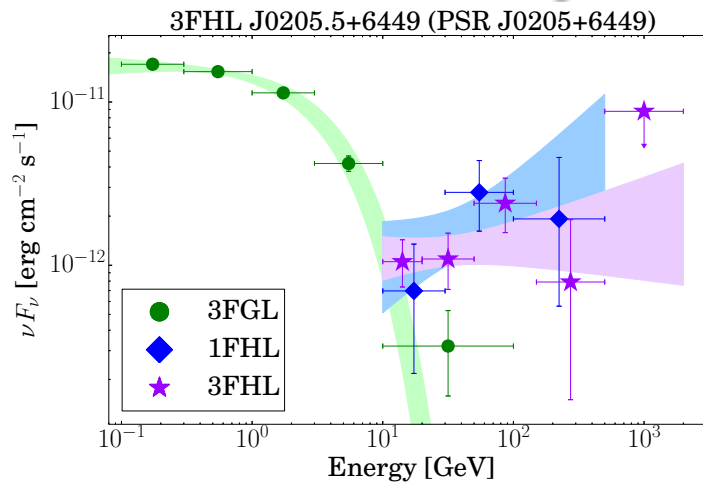


+	SNRs and PWNe	★	BL Lacs	□	Unc. Blazars	△	Other GAL	▽	Unassociated	○	TeVCat
×	Pulsars	◇	FSRQs	▲	Other EGAL	◁	Unknown	◊	Extended		

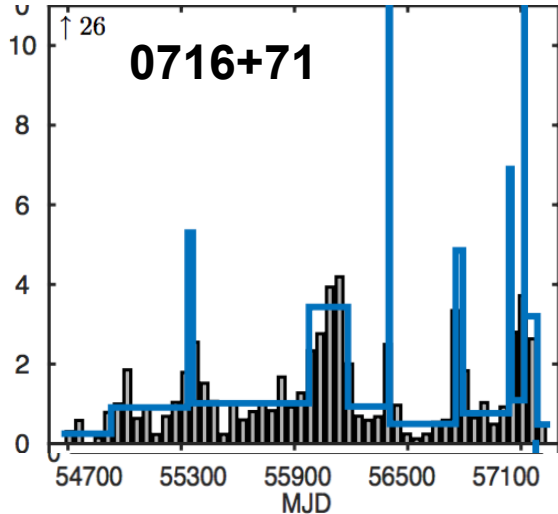
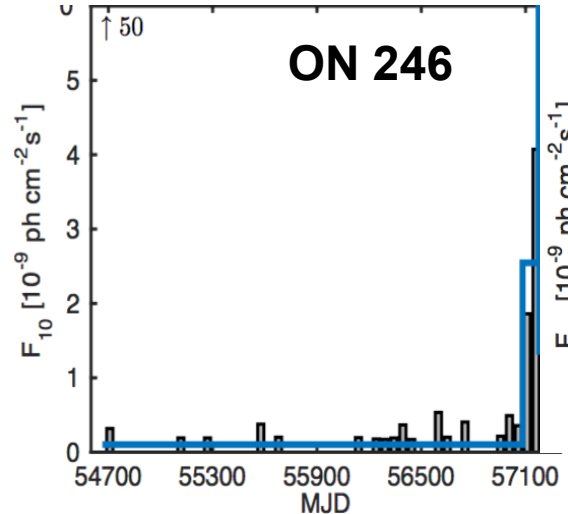
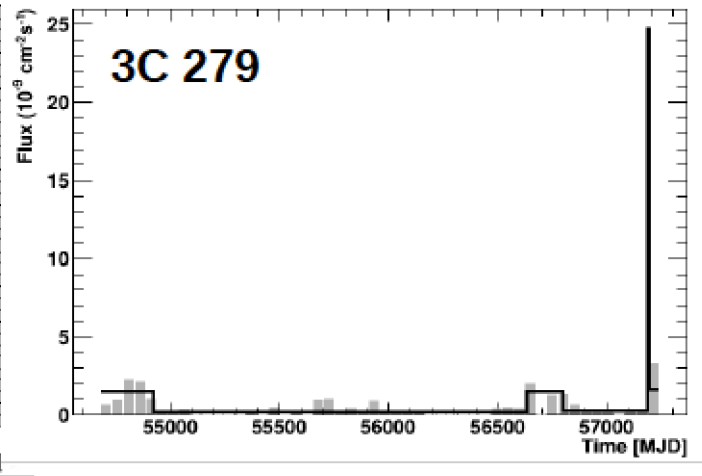
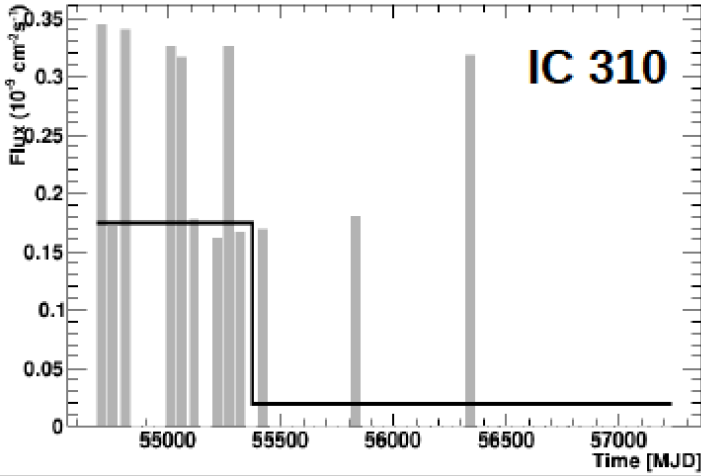
Galactic Plane Sources in 3FHL



Sample Energy Spectra



Variability Samples

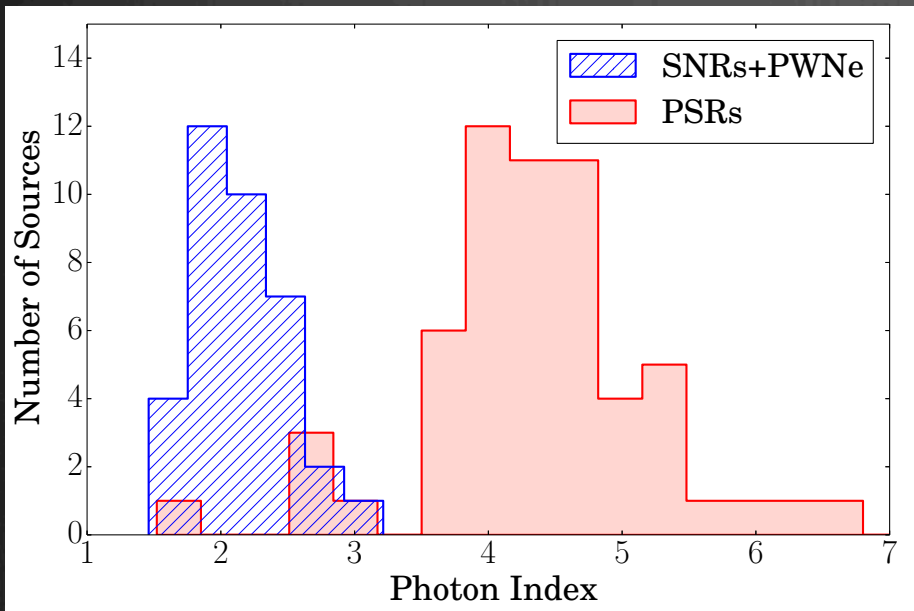


Bayesian Block Analysis

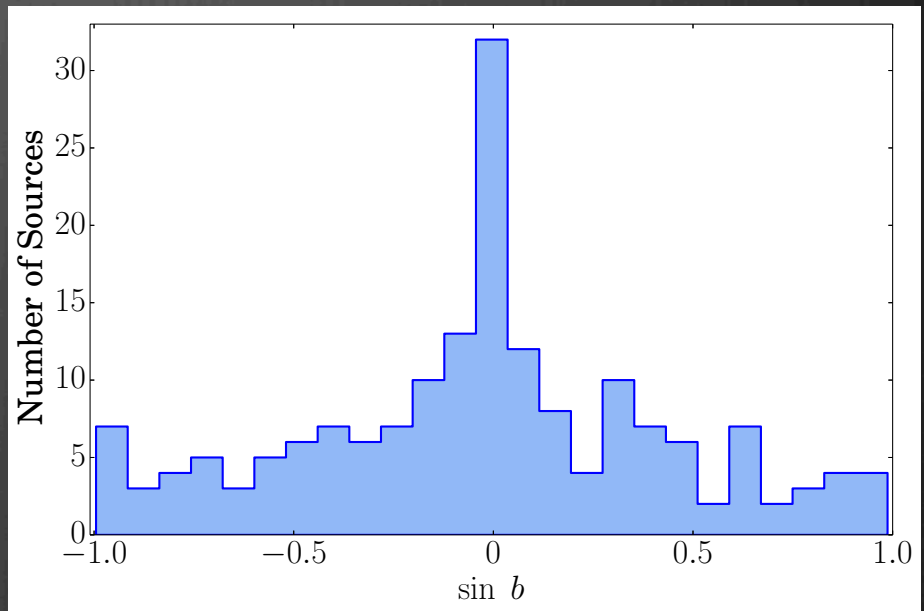
163 variable sources

Almost entirely AGN

Some Source Characteristics

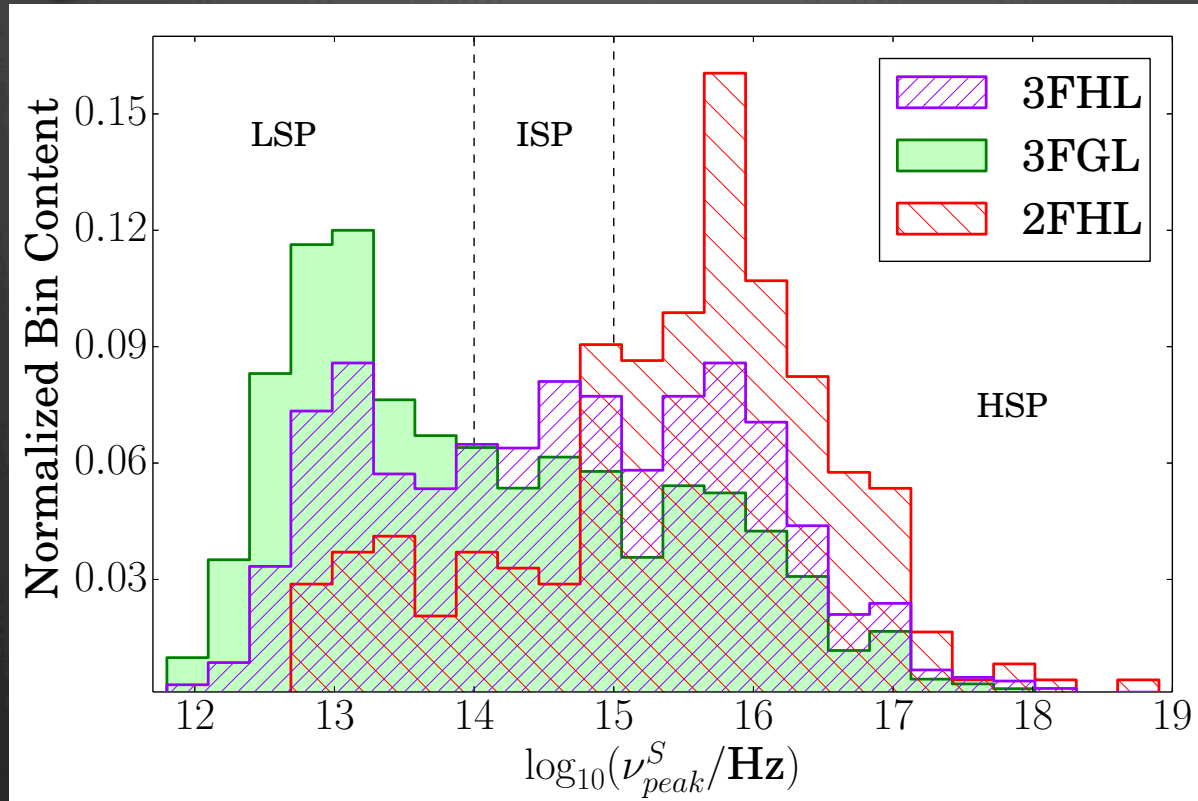


PSRs tend to be softer than SNRs+PWNe



Latitude distribution of unassociated sources.

Extragalactic sources - multiwavelength



Distribution of AGN synchrotron peak frequencies

Extragalactic Background Light (EBL)

3FHL sources provide valuable information about the EBL

Talks on this topic by Marco Ajello, Justin Finke, and Alberto Dominguez on Thursday

Summary

- **The 3FHL catalog contains 1556 sources above 10 GeV, a factor of 3 more than the previous LAT survey at these same energies (1FHL). 211 of these have not been seen before.**
- **About 79% of the sources are extragalactic sources with a rich variety of AGNs.**
- **At these energies, pulsars have steeper spectra than SNRs/PWNe. Unassociated sources are a mixture of Galactic and isotropic.**