The Fermi-LAT Light Curve Repository
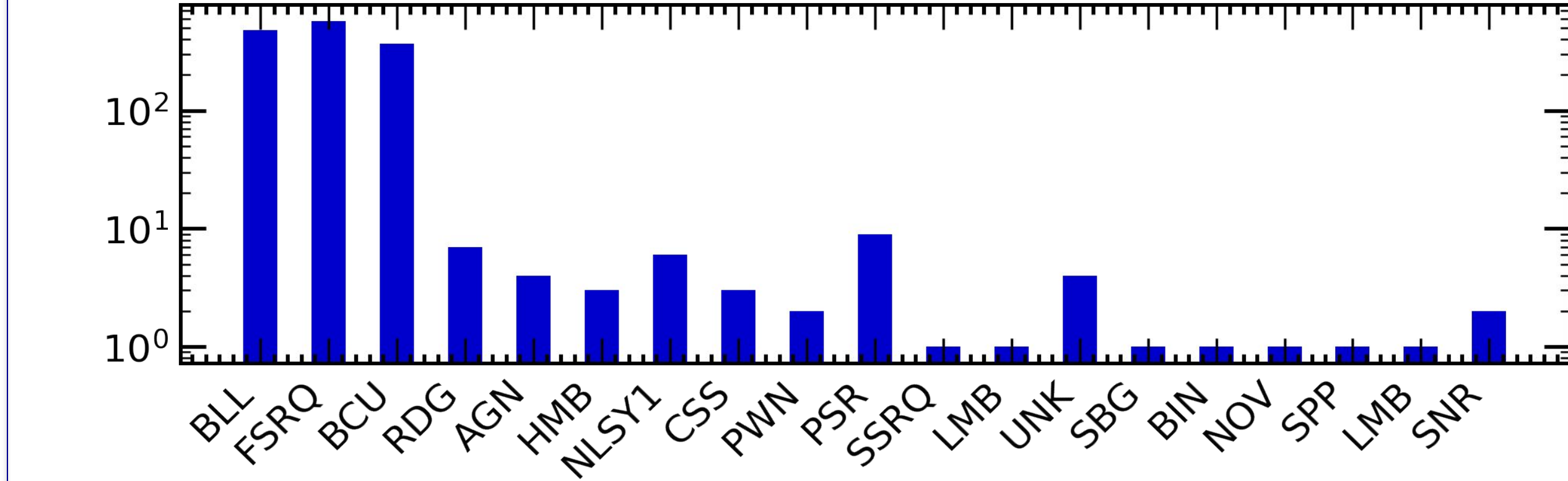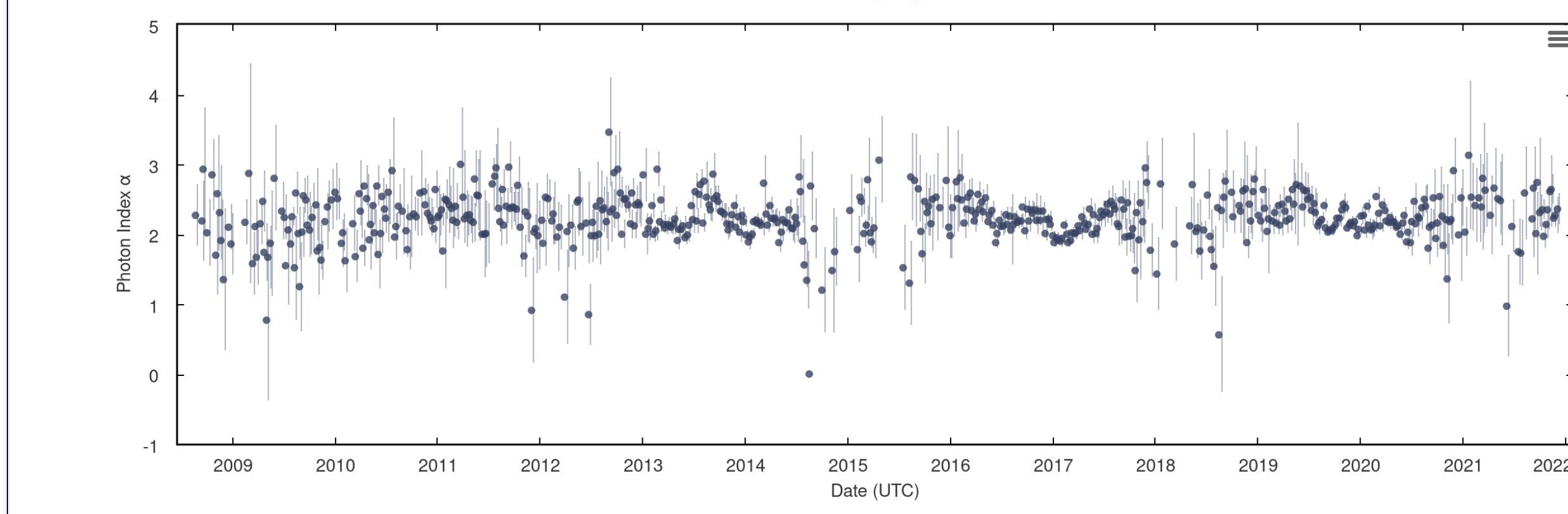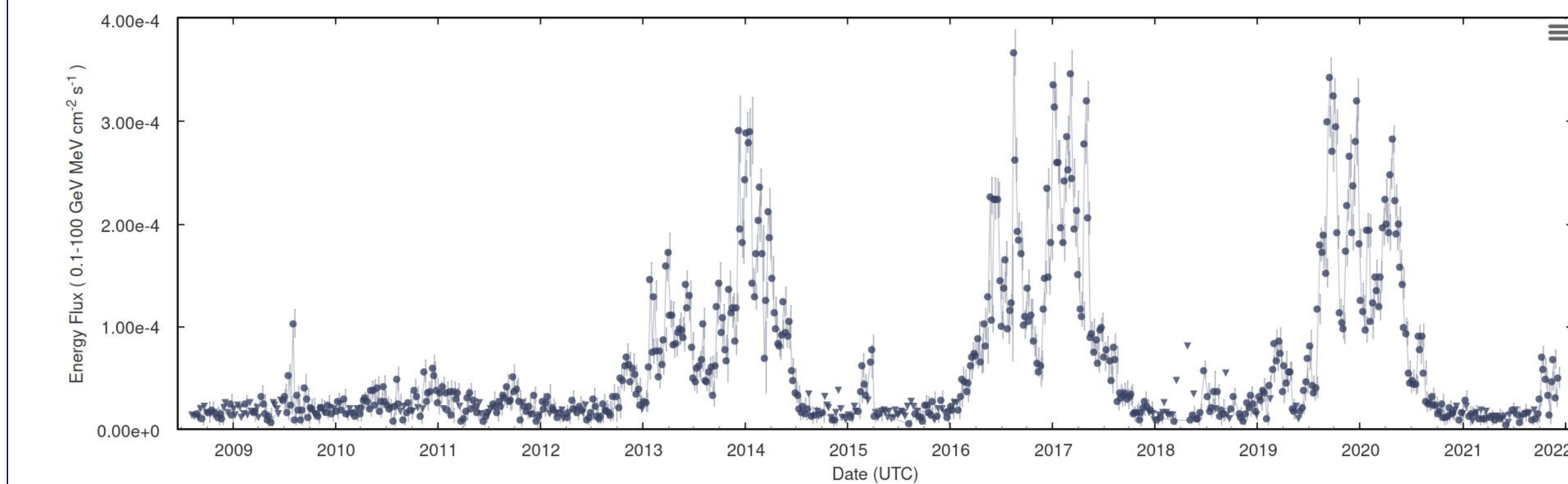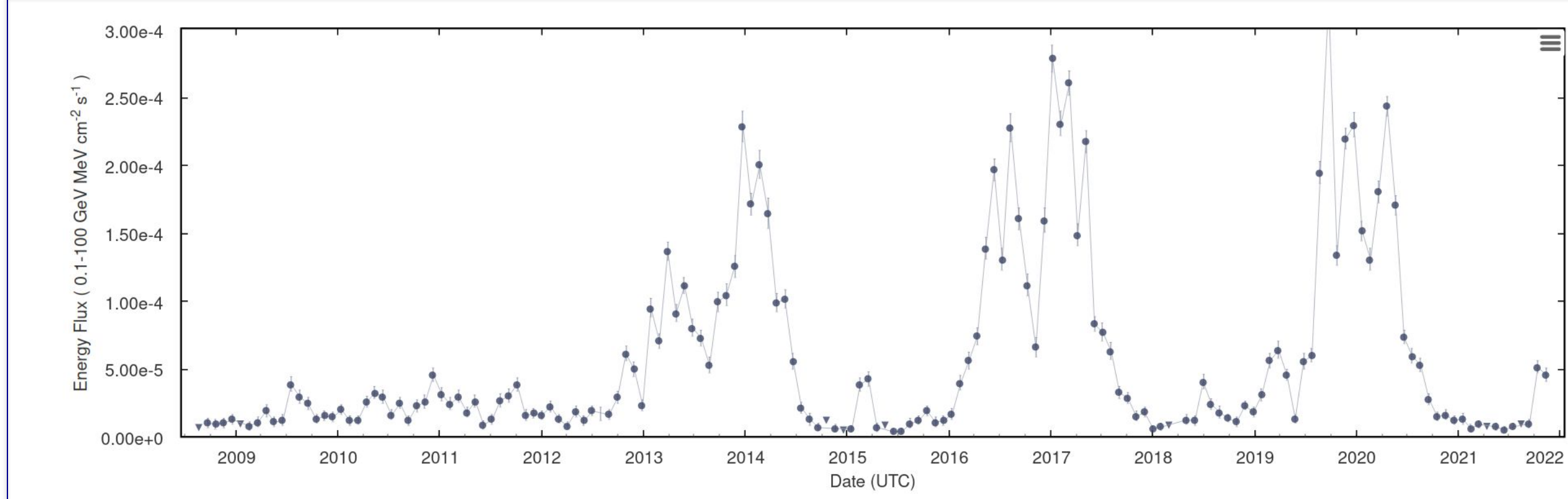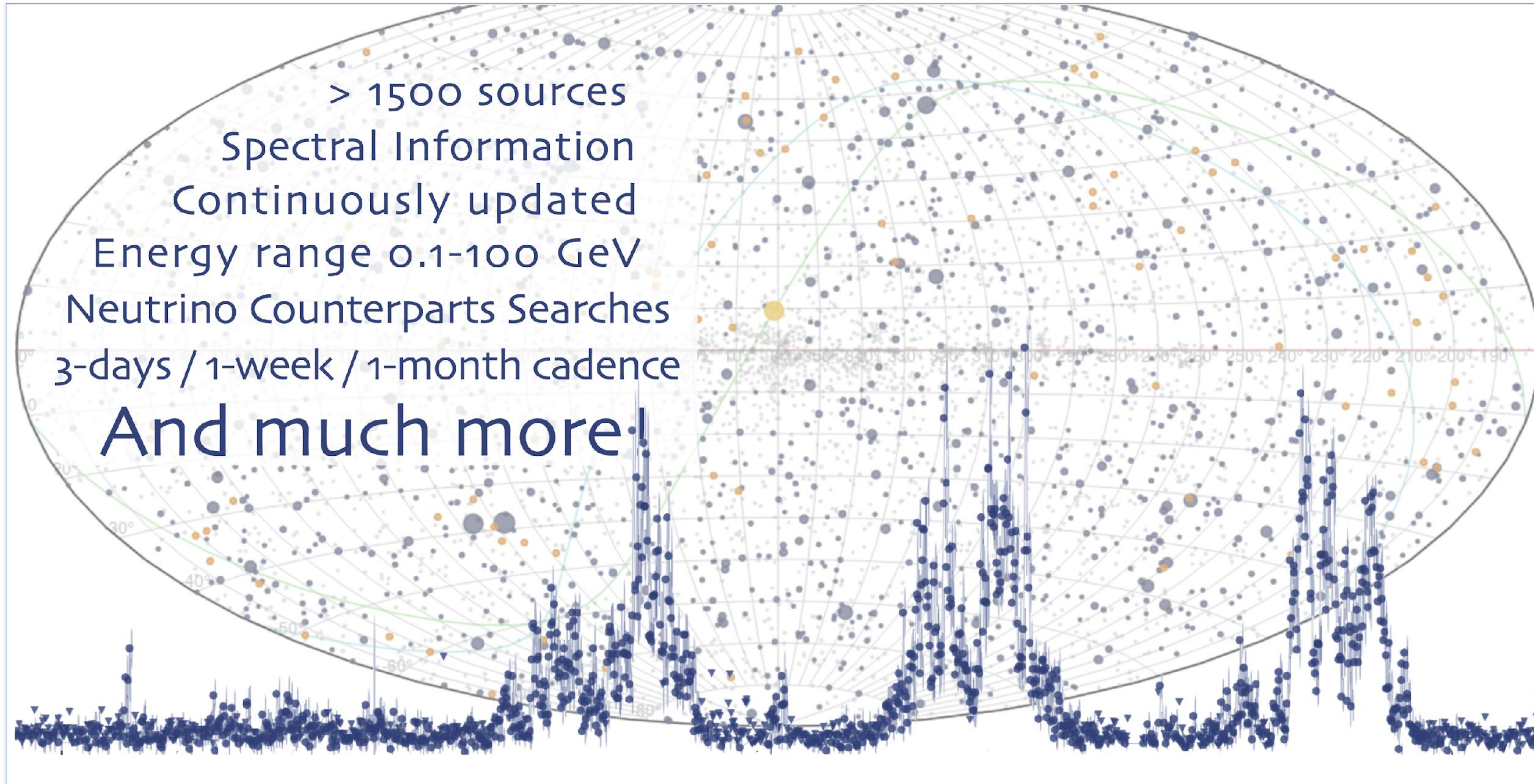
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Website: fermi.gsfc.nasa.gov/ssc/data/access/lat/lcr/

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Summary: *The Fermi-LAT light curve repository (LCR) consists of a public library of gamma-ray light curves for variable Fermi-LAT sources on a variety of timescales. The LCR aims to provide publication-quality light curves on timescales of days, weeks, and months for over 1500 sources deemed variable in the 4FGL-DR2 catalog. The repository consists of light curves generated through a full-likelihood analysis of the source and surrounding region, providing calibrated flux and photon index measurements for each time bin. Hosted at NASA's HEASARC, the library provides users with access to this continually updated light curve data, serving as a resource to the time-domain and multi-messenger communities.*

> 1500 sources
Spectral Information
Continuously updated
Energy range 0.1-100 GeV
Neutrino Counterparts Searches
3-days / 1-week / 1-month cadence
And much more!

Likelihood analysis summary

- Unbinned likelihood analysis.
- Time bins: 3-day, 1 week and 1 month.
- Energy range: 100 MeV – 100 GeV.
- Instrument response function: P8R3_SOURCE_V3.
- Acceptance cone (ROI): 12 deg radius.
- Zenith angle cut (zmax): 90 deg.
- Upper limits confidence level: 95% (Bayesian profile).
- Variability index cut > 21.67. This corresponds to a 99% confidence level for 10 points (one per year): 1525 sources, or 26.34% of the 4FGL-DR2.
- GRB episodes excluded.
- Two step fit strategy.
  - 1st fit: only normalization set free and spectral index is fixed to catalog value.
  - 2nd fit: both normalization and spectral index are set free.

- Both sets of light curves (LCs), one with the spectral parameter fixed and another one with the spectral parameter free, are provided.
- Iterative likelihood fit using tighter fit tolerances ranging from [1, 1-e4, 1e-8].
- The spectral model used is that of the 4FGL-DR2, e.g. photon index (Γ) for power-law or α for logparabola (β is fixed).
- Flux is extracted for all fits that yield TS > 1.
  - 95% Bayesian ULs for TS < 9.
  - Users can choose the minimum TS level, to 1, 2, 3 or 4, for flux estimation.

Webpage & resources

- Review Usage Notes for analysis details, data modeling, fitting strategy & caveats: fermi.gsfc.nasa.gov/ssc/data/access/lat/lcr/about.html
- Data overlays: GRB & IceCube neutrino alerts with arrival times and locations.
- Catalog search: Keyword option
- 3-, 7-, 30-day binned light curves.
- Index free and fixed options.
- TS options.
- You will download all data, including non-convergent, unconstrained and possibly TS<0. Data need to be cleaned before used.
- Data in two formats: CSV, JSON. See Table and JSON File Description: fermi.gsfc.nasa.gov/ssc/data/access/lat/lcr/table_description.html
- When downloading the data, label "cadence=daily" refers to 3-day binned LC.
- See the LCR FAQ: fermi.gsfc.nasa.gov/ssc/data/access/lat/lcr/FAQ.html

Central picture: *3-day light curve of S5 1044+71 overlapping a sky map showing LCR sources in dark gray, and IceCube neutrino alerts in orange.* **Above, from top to bottom**: *1 month light curve of the same source; 1-week light curve; alpha values for 1-week light curve; LCR demographics.*

Citing and getting involved

- Add a link to the webpage: fermi.gsfc.nasa.gov/ssc/data/access/lat/lcr/
- Cite the Atel, Kocevski et al. (2021), ATel#15110: www.astronomerstelegram.org/?read=15110
- Contribute through: github.com/dankocevski/LightCurveRepository