

An open catalog for TeV gamma-ray astronomy

Christoph Deil¹, Arjun Voruganti¹, Axel Donath¹, Johannes King¹, Catherine Boisson², Konstancja Satalecka³, Matthias Wegen³

1. MPIK, Heidelberg, 2. Observatoire de Paris, Meudon, 3. DESY, Zeuthen



Introduction

gamma-cat is an open data collection and source catalog for TeV gamma-ray astronomy.

The idea and implementation is similar to the other open astronomy catalogs at <https://astrocats.space/>

- Fully **open access**. Download all data and use as you like.
- Fully **open collaboration**. Request or add data on Github.

Dataset

- Collection of published TeV source measurements (position, morphology, spectra, light curves).
- Currently mainly H.E.S.S., VERITAS, MAGIC, plan to add HAWC
- Final scope not decided yet: Fermi-LAT? Diffuse emission models?

Usage

- **Source catalog**. A flat table in ECSV and FITS format.
- **Full data collection**. A set of files with hierarchical (JSON format) and tabular (ECSV and FITS format) data.
- **gammapy.catalog** — Python classes to query gamma-cat and work with spectra, images, light curves, ...
- **gamma-sky.net** — Browse gamma-cat and compare Fermi-LAT and other multi-wavelength data.

Links

- Project on Github: github.com/gammapy/gamma-cat



- Map and catalog view online: gamma-sky.net



- Query and analysis with Gammipy: docs.gammapy.org



- Data formats: gamma-astro-data-formats.readthedocs.io

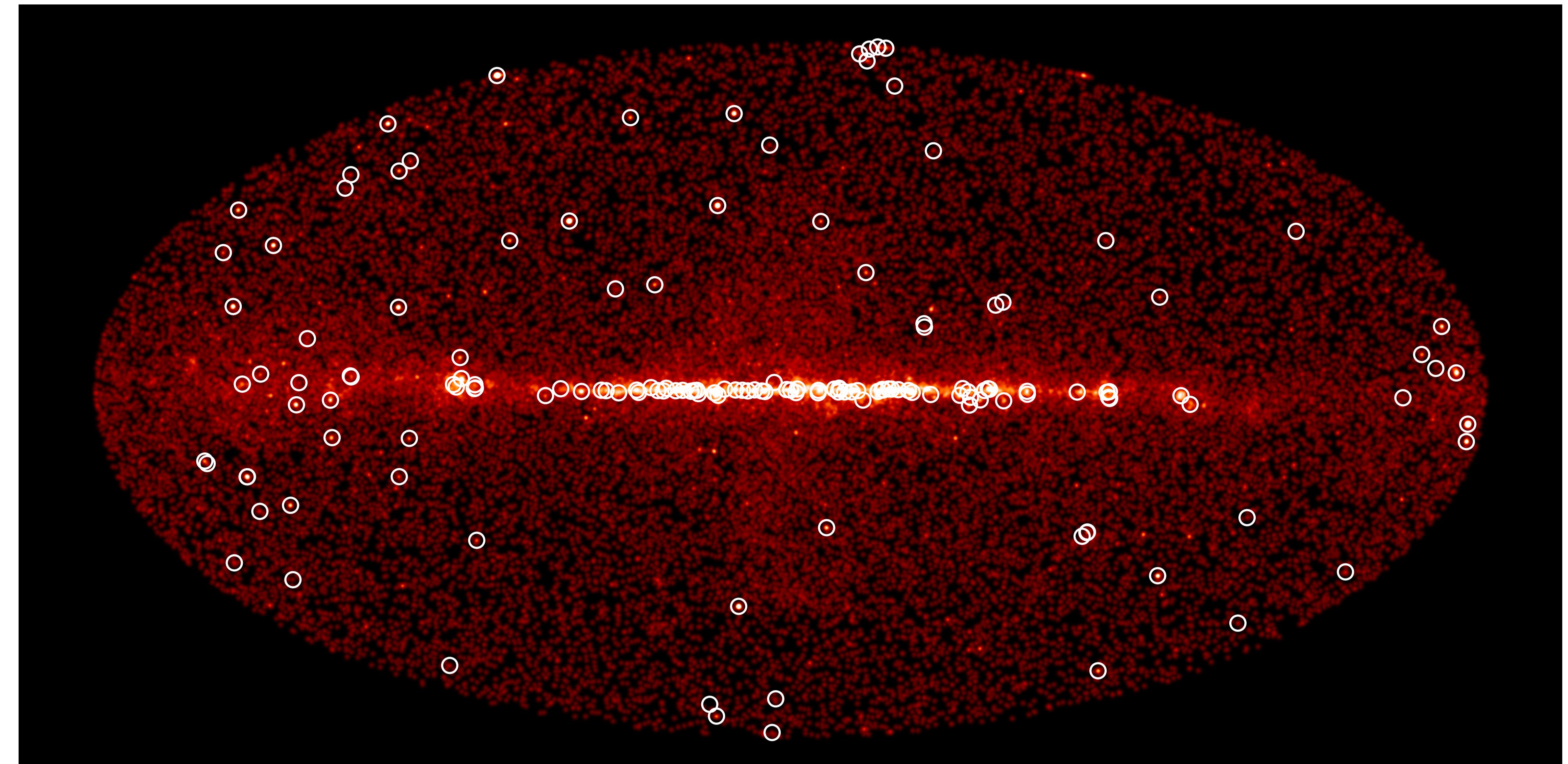


Figure 1: TeV gamma-ray sources from gamma-cat (white circles, 163 sources, status: October 2016) Background smoothed counts image: gamma-ray sky above 50 GeV, Fermi-LAT 2FHL dataset.

Implementation

- Input data of published TeV measurements is added as YAML and ECSV format text files.
- Python scripts are used to combine and clean the available data.
- Git for version control. Github for collaboration
- Data collection and format specification (at gamma-astro-data-formats, see [1]) is both work in progress.

Use cases

- Use gamma-cat on gamma-sky.net to quickly look up what TeV sources are known for a given region of the sky.
- Get TeV source morphology, spectrum or light curve for a given source and use in multi-wavelength data analysis.
- Do archival or source population studies.
- Use gamma-cat as sky model input for the planned CTA data challenge.
- ...

Status & Plans

- The project was started in August 2016.
- Adding data from previous collections and entering new data is ongoing.
- We present it here for the first time. Feedback and contributions welcome!

Examples

The figures illustrate the type of data that we are collecting in gamma-cat.

- Figure 1: source positions
- Figure 2: spectra
- Figure 3: light curves

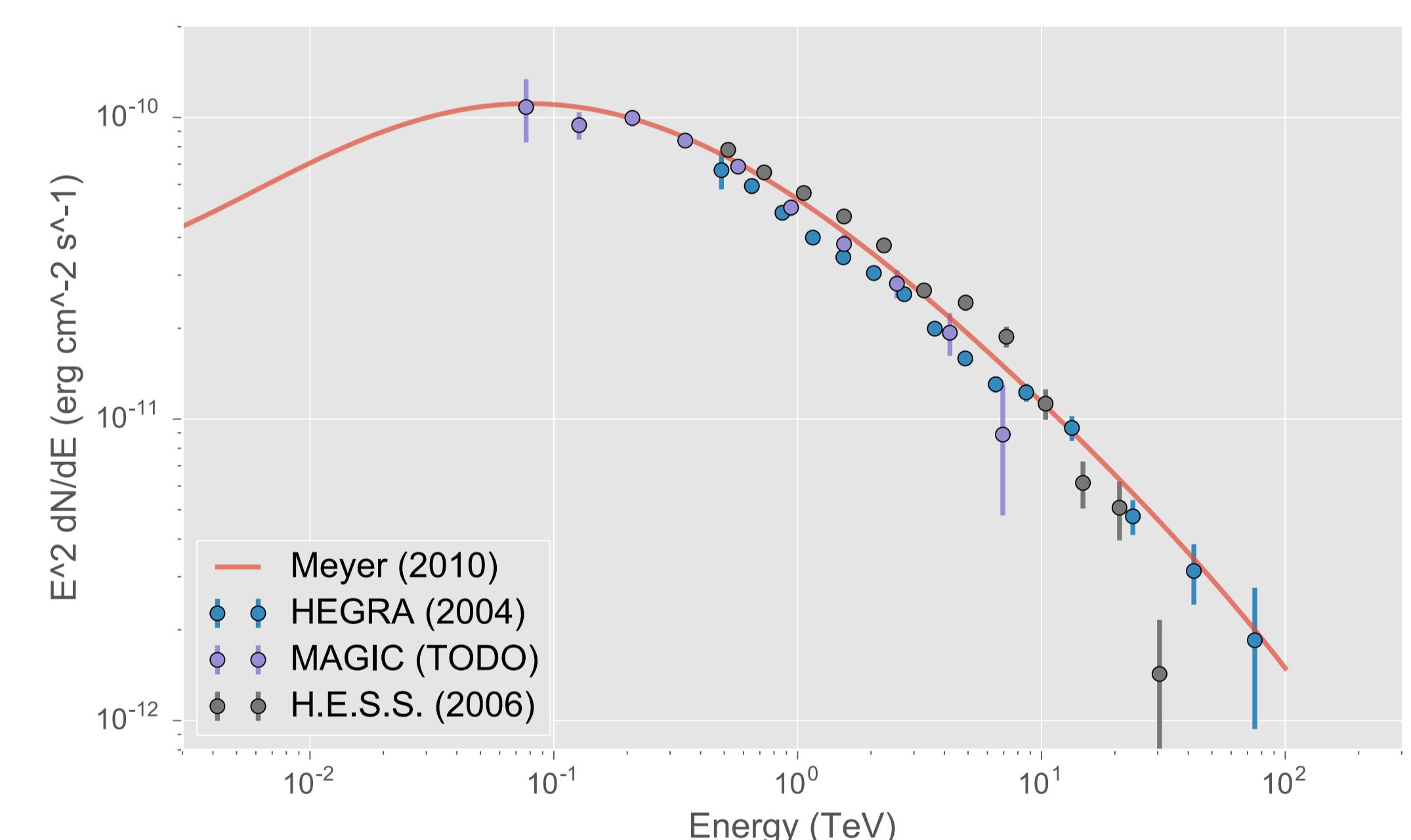


Figure 2: TeV spectral measurements for the Crab nebula (a subset of the data used in [2])

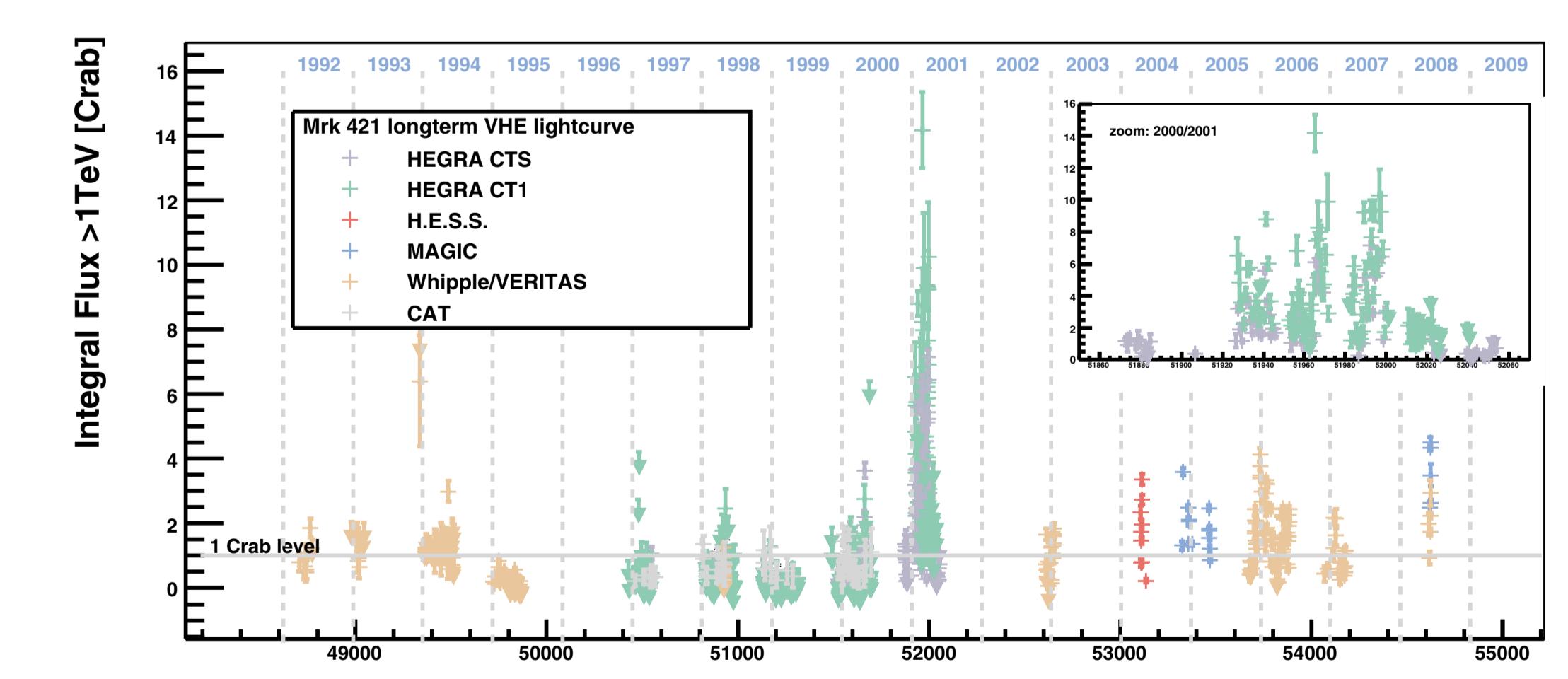


Figure 3: Long-term light curve of Mrk 421 with data from many telescopes and papers.

Figure from [3].

References

- [1] Deil et al. (2016), [arXiv:1610.01884](https://arxiv.org/abs/1610.01884)
- [2] Meyer et al. (2010), [A&A, 523A, 2M](https://doi.org/10.1051/0004-6361/200913202)
- [3] Tluczykont et al. (2010), [A&A 524, A48](https://doi.org/10.1051/0004-6361/200913202)