

# An open catalog for TeV gamma-ray astronomy

Christoph Deil,<sup>1</sup> Arjun Voruganti,<sup>1</sup> Axel Donath,<sup>1</sup> Johannes King,<sup>1</sup>  
Catherine Boisson,<sup>2</sup> Konstancja Satalecka,<sup>3</sup> and Matthias Wegen<sup>3</sup>

<sup>1</sup>*MPIK, Heidelberg, Germany* [Christoph.Deil@mpi-hd.mpg.de](mailto:Christoph.Deil@mpi-hd.mpg.de)

<sup>2</sup>*LUTH, Observatoire de Paris, Meudon, France*

<sup>3</sup>*DESY, Zeuthen, Germany*

## Abstract.

The first cosmic TeV gamma-ray source detected from the ground was the Crab nebula in 1989. Since then, TeV astronomy has seen rapid growth. By now, over 160 sources have been detected. Measurements of source position, morphology, spectrum and sometimes lightcurves have been published, mostly in individual papers. Often the source parameters are not given in a machine-readable format, and even if they are, there is no common data format.

We present an effort to collect the available data on TeV sources, and curate it into an as-uniform and as-complete as possible form, and have it freely available for download at <https://github.com/gammapy/gamma-cat>. This poster presents the project idea and status, as well as its technical implementation, which includes YAML, ECSV, JSON and FITS files and Python scripts using Gammapy (<http://gammapy.org>), and several other Python packages. A web front-end to browse this TeV source catalog and other gamma-ray and multi-wavelength data is under development at <http://gamma-sky.net>.

## 1. Introduction

Other projects:

- Guillochon et al. (2016) and <https://astrocats.space/>
- Carosi et al. (2015) and <http://www.asdc.asi.it/tgevcats/>
- Wakely & Horan (2008) and <http://tevcat.uchicago.edu/>

Data:

- Open gamma formats: Deil et al. (2016) and <http://gamma-astro-data-formats.readthedocs.io/>
- Lightcurves: Tluczykont et al. (2010) and [https://astro.desy.de/gamma\\_astronomy/magic/projects/light\\_curve\\_archive/](https://astro.desy.de/gamma_astronomy/magic/projects/light_curve_archive/)
- H.E.S.S. data: <http://hess.obspm.fr/> and <https://www.mpi-hd.mpg.de/hfm/HESS/pages/home/sources/>

- VERITAS data: <http://veritas.sao.arizona.edu/veritas-science/veritas-results-mainmenu>
- MAGIC data: <http://vobs.magic.pic.es/fits/>

Tools:

- PyYAML: <http://pyyaml.org/>
- Astropy: Astropy Collaboration (2013)
- Gammapy: Donath et al. (2015)
- <https://github.com/andycasey/ads>

## 2. Usage

tbd

## 3. Implementation

tbd

## 4. Examples

### 4.1. Light curve

Example lightcurve, see Figure 1.

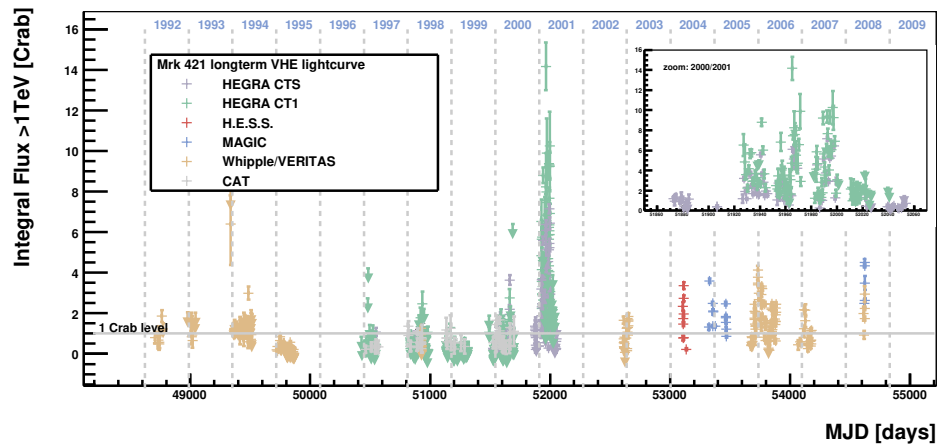


Figure 1. Lightcurve example.

## 5. Conclusions

Remember: gammatcat this is useful and awesome.

**Acknowledgments.** We thank Fabrizio Lucarelli, Gernot Maier, Konrad Bernlöhner and Tarek Hassan for useful discussions or feedback on gamma-cat. This research has made use of NASA's Astrophysics Data System Bibliographic Services, the SIMBAD database, operated at CDS, Strasbourg, France, the TeVCat online source catalog and the TeGeV catalog at ASDC, as well as the following astronomy Python packages: Astropy, Gammapy, ads.

## References

- Astropy Collaboration 2013, A&A, 558, A33  
Carosi, A., Lucarelli, F., Antonelli, L. A., & Giommi, P. 2015, ArXiv e-prints. 1510.08681  
Deil, C., et al. 2016, ArXiv e-prints. 1610.01884  
Donath, A., et al. 2015, ArXiv e-prints. 1509.07408  
Guillochon, J., Parrent, J., & Margutti, R. 2016, ArXiv e-prints. 1605.01054  
Tluczykont, M., Bernardini, E., Satalecka, K., Clavero, R., Shayduk, M., & Kalekin, O. 2010, A&A, 524, A48. 1010.5659  
Wakely, S. P., & Horan, D. 2008, in International Cosmic Ray Conference, vol. 3 of International Cosmic Ray Conference, 1341