Hands-on: Academic presentation

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Caveats

Most of you are aware of how to write a scientific contribution → this talk could be boring!

This is a compilation of a few suggestions that could be helpful especially for Ph.D. candidates

I will not discuss the use of AI in paper preparation. It could be worth an entire session. I have my own view, ask me during the welcome cocktail session if you are interested

We will have groups hands-on, prepare your laptop!

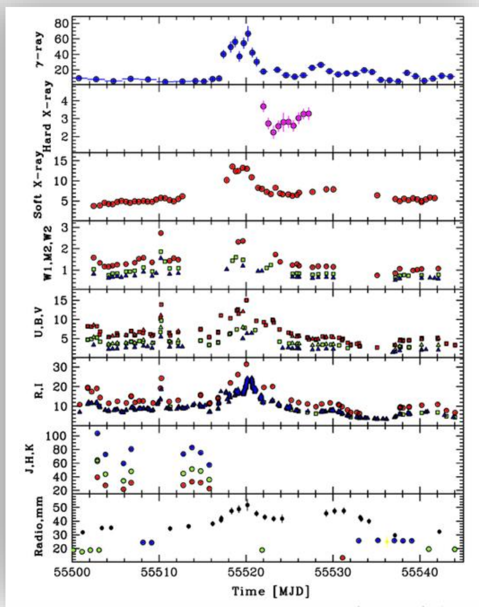
Layout

- Description (20m)
- Hands-on work, divided in groups (20m)
- Groups presentations (20m)

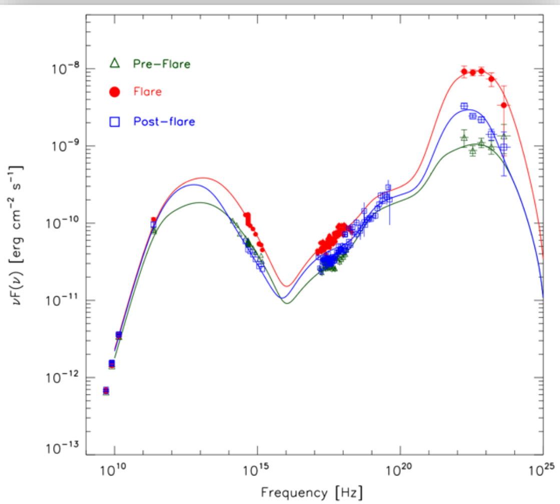
The knowledge arrow

Data collection → **Data analysis** → **Interpretation** → **And then?**

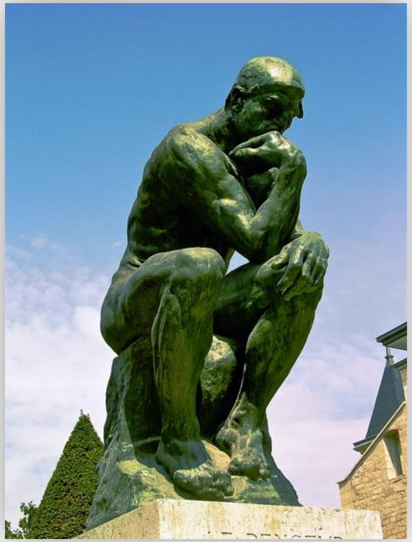
See Tarek's hands-on



See Guillem's hands-on



See Axel's hands-on



Different tools for different needs

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DI ASTROFISICA

Fast (t<1d)

The Astronomer's Telegram

NASA General Coordinates Network

Flaring and transients events, MWL studies

Slow (t>1mo)

Astronomy & Astrophysics

THE ASTROPHYSICAL JOURNAL

Monthly Notices of the Royal Astronomical Society

90% of astrophysical studies

Outstanding

Science

nature

Breakthrough discoveries

Let's start with the basics...

Fast (t<1d)

The Astronomer's Telegram

NASA General Coordinates Network

Flaring and transients events, MWL studies

The Astromer's Telegram (ATel)

Title
Concise and informative.

Subject
Choose keywords accurately

Source and telescope
Report name, coordinates, distance and counterpart

Preliminary results
Report flux/luminosity, spectrum and other relevant info on why issuing an ATel

Ancillary information
MWL coverage? Link to products, …

Fermi-LAT detection of enhanced gamma-ray activity from the FSRQ PKS 2155-83

ATel #17229; *Adithiya Dinesh (Universidad Complutense de Madrid), Giovanni La Mura (INAF-O. A. Cagliari), on behalf of the Fermi Large Area Telescope Collaboration*
on ***15 Jun 2025; 17:45 UT***
Credential Certification: Adithiya Dinesh (adinesh@ucm.es)

Subjects: Gamma Ray, >GeV, AGN, Blazar

Tweet

The Large Area Telescope (LAT), one of the two instruments on the Fermi Gamma-ray Space Telescope, has observed enhanced gamma-ray activity from a source positionally consistent with the flat-spectrum radio quasar PKS 2155-83, also known as 4FGL J2201.5-8339 (The Fermi-LAT collaboration 2020, ApJS, 247, 33), with coordinates R.A. = 330.58014 deg, Dec. = -83.63662 deg (J2000; Petrov et al., 2011, MNRAS, 414, 2528), and redshift z=1.867 (Chen et al., 2024, ApJS, 271, 20).

Preliminary analysis indicates that this source was in an elevated gamma-ray emission state on June 13, 2025, with a daily averaged gamma-ray flux (E>100MeV) of (1.1+/-0.2) X 10^-6 photons cm^-2 s^-1 (statistical uncertainty only). This corresponds to a flux increase of a factor of 30 relative to the average flux reported in the fourth data release of the fourth Fermi-LAT catalog (4FGL-DR4, Ballet et al. 2023, arXiv:2307.12546). The corresponding photon index is 2.5+/-0.2, and is consistent with the 4FGL-DR4 value of 2.50+/-0.02 within the uncertainties. The Fermi-LAT Collaboration has previously reported flaring activity from this source in ATel #2373.

Because Fermi normally operates in an all-sky scanning mode, regular gamma-ray monitoring of this source will continue. A preliminary light curve for PKS 2155-83 can be accessed via the Fermi-LAT Light-Curve Repository and the Monitored Source List. We encourage multifrequency observations of this source. For this source, the Fermi-LAT contact person is Eric Wallace (wallacee@uw.washington.edu).

The Fermi-LAT is a pair conversion telescope designed to cover the energy band from 20 MeV to greater than 300 GeV. It is the product of an international collaboration between NASA and DOE in the U.S. and many scientific institutions across France, Italy, Japan and Sweden.

Prepare a **template** !

Let's start with the basics...

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Slow (t>1mo)

Astronomy & Astrophysics

THE ASTROPHYSICAL JOURNAL

Monthly Notices of the Royal Astronomical Society

90% of astrophysical studies

Journal paper – PKS 1830-211 flare

In Spring 2019 the flat-spectrum radio-quasar (FSRQ) PKS 1830-211 exhibited an intense and prolonged gamma-ray activity

The AGILE Collaboration issued an ATel on this event and started a multi-wavelength observational campaign

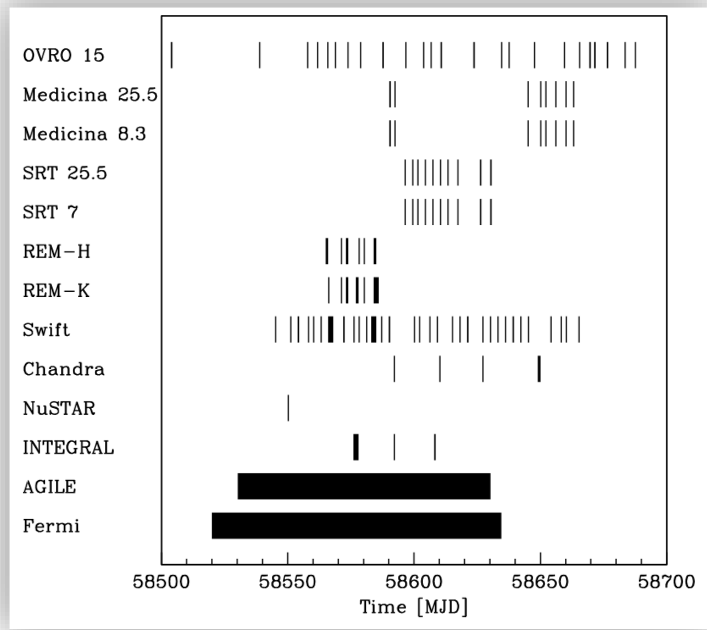
We also started writing a paper, while we were analysing and interpreting data

Radio

IR/Opt/UV

X-ray

γ-ray



Journal paper – part 1

Title
Concise and informative.

Abstract
It should report the main findings and the main conclusions.

Keep it short!

Keywords
Mainly statistical use.
Useful to search engines.

Multiwavelength observations of the lensed quasar PKS 1830-211 during the 2019 γ-ray flare

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Affiliations are listed at the end of the paper

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ABSTRACT

PKS 1830-211 is a γ-ray emitting, high-redshift (z =2.507 ± 0.002), lensed flat-spectrum radio quasar. During the period 2019 mid-February to mid-April, this source underwent a series of strong γ-ray flares that were detected by both AGILE-GRID (Gamma-Ray Imaging Detector) and *Fermi* Large Area Telescope (*Fermi*-LAT), reaching a maximum γ-ray flux of $F_{E>100\,\mathrm{MeV}} \approx 2.3 \times 10^{-5}$ photons cm^{-2} s^{-1}. Here, we report on a coordinated campaign from both on-ground [Medicina, Owens Valley Radio Observatory (OVRO), Rapid Eye Mount (REM), and Sardinia Radio Telescope (SRT)] and orbiting facilities (AGILE, *Fermi*, *INTEGRAL*, *NuSTAR*, *Swift*, and *Chandra*), with the aim of investigating the multiwavelength properties of PKS 1830-211 through nearly simultaneous observations presented here for the first time. We find a possible break in the radio spectra in different epochs above 15 GHz, and a clear maximum of the 15 GHz data approximately 110 d after the γ-ray main activity periods. The spectral energy distribution shows a very pronounced Compton dominance (> 200) which challenges the canonical one-component emission model. Therefore, we propose that the cooled electrons of the first component are re-accelerated to a second component by, for example, kink or tearing instability during the γ-ray flaring periods. We also note that PKS 1830-211 could be a promising candidate for future observations with both Compton satellites [e.g. enhanced ASTROGAM (e-ASTROGAM)] and Cherenkov arrays [Cherenkov Telescope Array Observatory (CTAO)] which will help, thanks to their improved sensitivity, in extending the data availability in energy bands currently uncovered.

Key words: acceleration of particles – radiation mechanisms: non-thermal – relativistic processes – quasars: individual: PKS 1830-211 – quasars: supermassive black holes – gamma rays: galaxies.

Journal paper – part 2

Introduction

- Main **properties** of the object/class
- Most relevant **literature**
- **Purpose** of your studies
- **Layout** of the paper and the definition of main constant and assumptions – for example, the cosmological parameters

1 INTRODUCTION

PKS 1830-211 is a high-redshift blazar ($z = 2.507 \pm 0.002$, Lidman et al. 1999) that is gravitationally lensed by a spiral galaxy at $z = 0.886$ (Wiklind & Combes 1996), as shown by the two radio lobes located 1 arcsec apart from each other (A e B components, Lovell et al. 1998). The lensed counterparts were also observed in the near-infrared (NIR) and optical energy bands by the *Hubble Space Telescope* and the Gemini Observatory (Courbin et al. 2002). The source was observed in X-rays by both *XMM–Newton* and *Chandra*, enabling for a study of the complex soft X-ray behaviour in detail (De Rosa et al. 2005; Dai et al. 2008). PKS 1830-211 is a well-known γ-ray source above 100 MeV, identified as such by Mattox et al. (1997) and subsequently listed in both the AGILE (Verrecchia et al. 2013; Bulgarelli et al. 2019) and *Fermi*-LAT (Abdollahi et al. 2020)

Cite **seminal works**, not only the most recent and/or your advisor's ones!

Journal paper – part 3

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Summary of observations

- Avoid detailed description of the instrument and data analysis, put them in the Appendix, unless it is a brand-new telescope, e. g., Vera Rubin Observatory

- Highlight the most important plots or observations, MWL light-curves, spectra and tables

2 SUMMARY OF OBSERVATIONS AND FLARE DEFINITION

The detection of γ-ray flares from PKS 1830-211 triggered a large multiwavelength observing campaign, involving both on-ground [Medicina, Owens Valley Radio Observatory (OVRO), REM, and Sardinia Radio Telescope (SRT)] and orbiting facilities (AGILE, *Fermi*, *INTEGRAL*, *NuSTAR*, *Swift*, and *Chandra*).

Fig. 1 shows the multiwavelength coverage as a function of time of the different instruments, while Table 1 reports the different energies covered by our campaign. These observations allow us to reconstruct an almost simultaneous SED spanning about 15 decades in energy. The detailed description of each facility, data reduction, data analysis, and the presentation of the results can be found in Appendix A (γ-ray data), Appendix B (X-ray data), Appendix C (IR, optical, and UV data), and Appendix D (radio data). The *Fermi*-LAT 12-h binning allows us to obtain a detailed description of the different γ-ray flares. We anticipate here the method we used for selecting the different γ-ray flares time intervals.

'Unbinned light curves' were produced for the brightest flaring periods following the procedure described in Pacciani (2018), by means of a photometric method. Gamma-rays are collected within

Be concise. The reader is interested in the main issues.

Journal paper – part 4

Result and Discussion

- The most important Section
- Remember: a null result is a result, although it makes the paper harder to be accepted!
- Main results, comparison with models and theories.

3 RESULTS AND DISCUSSION

3.1 Multiwavelength data

Fig. 3 shows the PKS 1830-211 multiwavelength light curves. From top to bottom, we show the radio (OVRO 15 GHz, Medicina 8.3 and 25.5 GHz, and SRT 7 and 25.5 GHz), IR (REM *H* and *K* bands), X-ray (*Swift*/X-ray Telescope, XRT and *Chandra*), and γ-ray (AGILE-GRID, Gamma-Ray Imaging Detector and *Fermi*-LAT) data, respectively. The source reached its maximum flux ($F_{E>100\,\mathrm{MeV}} = (2.28 \pm 0.25) \times 10^{-5}$ photons cm^{-2} s^{-1}) around April 24 (MJD=58597.25 $\pm$ 1.0), as shown in panel (d). This flux level

Discuss alternative models, not only your favourite ones! **Smoking guns are important!**

Journal paper – part 5

Conclusions

- Briefly report your major findings
- Use bulleted/numbered lists
- Put prospects for future work/improvements, but do not anticipate too much!
- Emphasize any possible “smoking gun” !

4 SUMMARY AND CONCLUSIONS

In this paper, we presented the multiwavelength behaviour, from radio frequencies up to the γ-ray energy band, of the lensed quasar PKS 1830-211 during multiple flaring episodes that occurred in the period 2019 mid-February to mid-April through nearly simultaneous observations presented here for the first time. We can summarize our findings as follows:

(i) The *Fermi*-LAT data show three major γ-ray flares, F1 (MJD 58575.2–58576.1), F2 (MJD 58595.0–58598.8), and F3 (MJD 58601.5–58603.4), respectively. The minimum variability time-scale for $E > 100$ MeV is $t_{\rm var} = 0.15$ d, while it emerges there could be a slightly enhanced fractional variability when considering the lower energy threshold ($E > 100$ MeV) with respect to the higher one ($E > 300$ MeV). Moreover, we confirm the higher fractional variability in the γ-ray energy band with respect to the one at lower frequencies. Another interesting result is on γ-ray spectral variability as a function of the flux. As already noted for other sources (3C 454.3, Vercellone & Romano 2014, in the 0.2–10 keV energy band) there is a roughly achromatic increase of the γ-ray emission. This could be explained, for example, with the dominance of the external Compton emission mechanism in the γ-ray energy band.

(ii) X-ray data show moderate variability during the whole observing period. A detailed analysis of *Chandra* data show a hint of variability of the absorbing column density in the lensing galaxy.

(iii) Radio data show an interesting behaviour. Investigating the data in the frequency range 7–25.5 GHz, we find a spectral break above 15 GHz, with a decrease of the flux density at the highest frequency in the observed time range. Similar breaks in the radio spectra could be found in other extragalactic jetted sources, due to radio flux variability at different wavelengths in times. Moreover,

Journal paper – part 6

Appendix

- Observatories description
- Details on the data reduction and analysis
- Plots and tables illustrating the data analysis which are useful but do not represent major results

On-line data

- e.g., CDS

APPENDIX A: GAMMA-RAY OBSERVATIONS

A1 AGILE data

The AGILE satellite (Tavani et al. 2009) is a mission of the Italian Space Agency (ASI) devoted to high-energy astrophysics. The AGILE scientific instrument combines four active detectors yielding broad-band coverage from hard X- to γ-ray energies: a Silicon Tracker (ST; Prest et al. 2003, 30 MeV–50 GeV), a co-aligned coded-mask hard X-ray imager, Super–AGILE (SA; Feroci et al. 2007, 18–60 keV), a non-imaging CsI Mini–Calorimeter (MCAL; Labanti et al. 2009, 0.3–100 MeV), and a segmented Anti-Coincidence System (ACS; Perotti et al. 2006). Any γ-ray detection is obtained by the combination of ST, MCAL, and ACS; these three detectors form the AGILE-GRID. A ground segment alert system allows the AGILE team to perform the full AGILE-GRID data reduction and the preliminary quick-look scientific analysis (Pittori 2013; Bulgarelli et al. 2014; Pittori & The Agile-Ssdc Team 2019).

PKS 1830-211 underwent an exceptionally bright active phase in γ-rays which started at the end of 2019 February and lasted approximately 2 months, as preliminarily reported in Lucarelli et al. (2019), Pittori et al. (2019a, b), Angioni (2019), and Cardillo et al. (2019). We carried out the analysis of the AGILE-GRID consolidated data (archive `ASDCSTDk`) above 100 MeV with the new `Build_25` scientific software, `FM3.119` calibrated filter, `H0025` response

Resources

ATel (free)
GCN(free)

A&A (mostly free)
MNRAS (page charges)
ApJ (page charges)

Nature (page charges)
Science (page charges)

NED & SIMBAD
Database for source properties

HEASARC
Data, SW, tools, almost everything for X-ray and γ-ray astrophysics

ADS
Literature database

Gammapy
Data analysis for γ-ray and VHE telescopes

Overleaf
Powerful tool for writing papers in LaTex and sharing projects

ORCID
Unique scientist identifier

Hints

Figures and plots

Use large fonts. Use large symbols. Use colours wisely

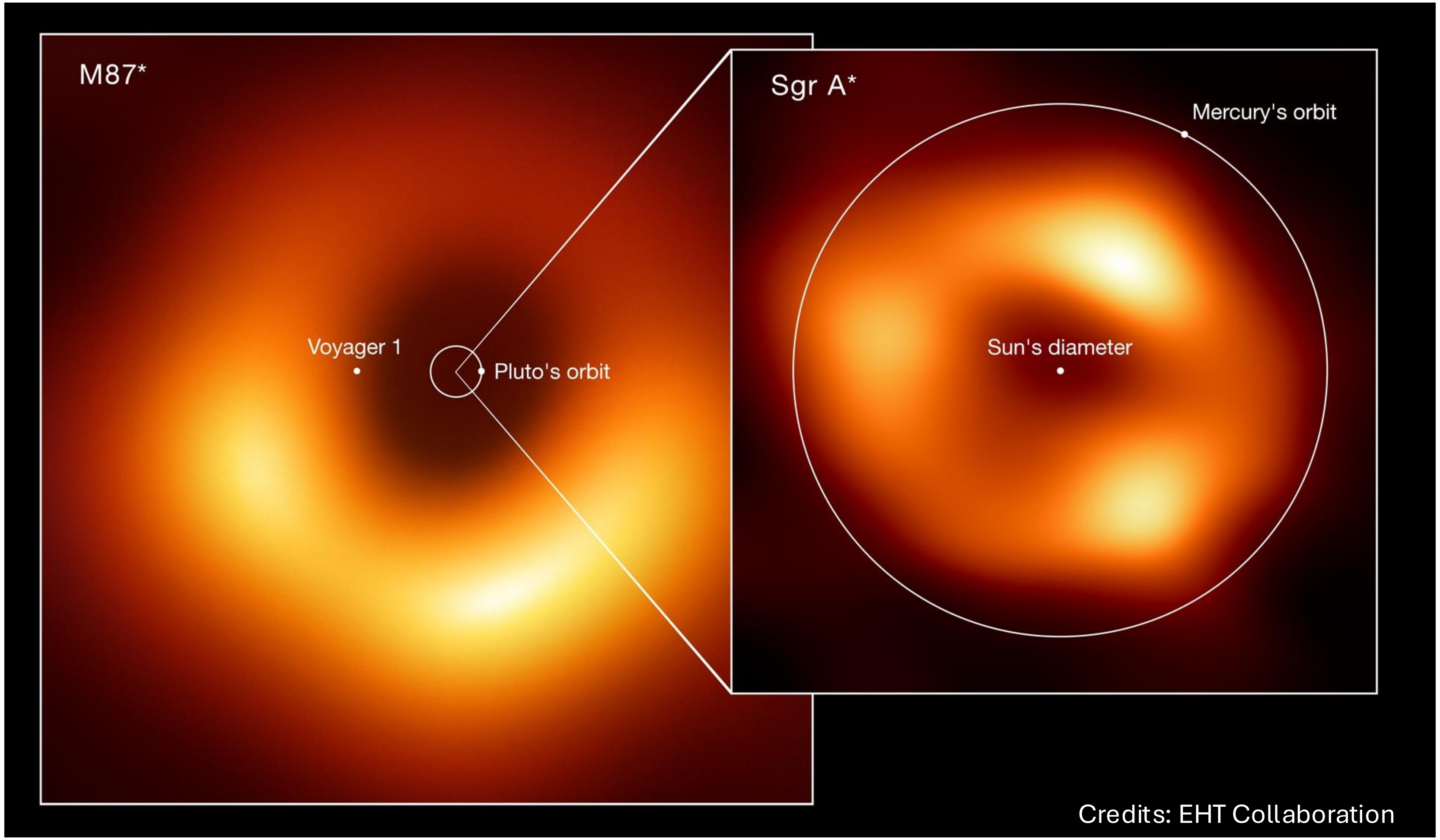
Literature

Read, read & read. Do not quote a paper without having read at least the abstract and the discussion session

Programming

Insert as many comments as you can. The code should be readable (and usable) after your Ph.D. dissertation

Did you find a smoking gun?



Contact your Science Communication Office. High impact on the general public
See Rossella’s and Carla’s Hands-on

Hands-on (examples are fake ones!)

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Theme #1 – ATel

The MAGIC telescopes react to a *Swift*/XRT detection on enhanced flux from the blazar Mrk 501.

Integrating from 2025-05-01 to 2025-05-03 for a net integration time of 5 hr they obtain a flux of about 80% of the Crab Nebula and a photon index of 2.7 +- 0.15

Theme #2 – Abstract

Swift, Fermi/LAT and MAGIC observed the radio-galaxy M 87 for a long-term monitoring campaign lasting about 1 month.

They detected coordinated variability of about 30%, a flare lasting about 1 week and interpreted the data in the framework of leptonic model

Theme #3 – Data description

Describe your latest observation / data acquisition

Make a preliminary colour plot summarizing your observation with a colour-blind friendly palette (see link1 and link2 for useful references)