

GRANDMA GRB campaign

Work package - C

Photometry & Spectroscopy Tools

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Activities-campaigns

- ZTF/Fink alerts

GRANDMA Observations of ZTF/Fink Transients during Summer 2021:

- 4 months of observations from June to September 2021
- 37 telescopes involved + 26 amateur astronomers

GRANDMA telescopes were able to do a first observation mostly less than a day before the first alert provided by Fink

We were able to trigger observation also before the classification as no KN of the alert in the majority of the cases

We classified the transient alerts in SSO corresponds to Solar System Object, CV to cataclysmic variable, and SN to supernova given by our post-observation analysis months after

DEDICED TO CREATE A NEW CAMPAIGN TO FIX SOME POINTS MISSED IN THE PREVIOUS CAMPAIGN

Miscommunication through email: few updates about the observations

Communication between telescope teams and FA

Naming slack images on onwcloud: not following header and not controlling the quality of the images



GRB campaign

- Observational strategy was created
- Training for both telescope teams and FA
- Slack channels dedicated to #grbalerts and # shifters were done: to facilitate communication
- Active discussion on #observations slack channel
- Weekly GRANDMA call to give a report
- Logbooks



GRB Campaign

GRANDMA – GRB campaign – 20.03.2022 to 15.05.2022

20 telescopes involved to follow-up GRBs from SWIFT-BAT
→ Goal : find optical transients and perform follow-up
→ Preparing the O4 campaign (shifts rota, online analysis)

❖ **10 + 1 (INTEGRAL) GRBs detected in 9 weeks by Swift-BAT**

❖ **FROM 11 SWIFT-BAT GRBS GRANDMA TELESCOPES WERE ABLE TO DETECT 3 AFTERGLOWS:**

GRB 220403B: GRANDMA observations

- We clearly detect the afterglow within the first hour.
- The GRANDMA telescope network responded to the alert of GRB 220403B (Klingler et al., GCN 31820). The first observations started 8 min after the BAT trigger time.

<https://gcn.gsfc.nasa.gov/gcn/gcn3/31883.gcn3>

GRB 220514A: GRANDMA observations

- Long GRB detected by INTEGRAL
- Observatories within GRANDMA network The first observations were obtained with TNT, starting 1.57 h after the Fermi/GBM and INTEGRAL/IBAS trigger time, in which we detect the afterglow
- We furthermore detect the optical afterglow with MOSS 7.95h after trigger
 - at a magnitude of 20.18 +/- 0.15 mag in a Clear image
- <https://gcn.gsfc.nasa.gov/gcn3/32058.gcn3>

GRB 220427A: GRANDMA observations

- Early Optical Afterglow Detection: Afterglow at C ~ 15.7 mag
- The GRANDMA telescope network responded promptly to the alert of GRB 220427A
- The light curve peaked around 4.5 min after the burst
- Results to be published

<https://gcn.gsfc.nasa.gov/gcn/gcn3/31991.gcn3>

Swift/BAT & Konus/WIND

Long GRB $T_{90} = 57.2$ s

Fluence = $2.5 \cdot 10^{-6}$ erg/s/cm²

$E_{\text{peak}} = 260$ keV

See part dedicated JG.



GRB Campaign

GRANDMA – GRB campaign – 20.03.2022 to 15.05.2022

Afterglow not detected by GRANDMA (1/11)

GRB 220412A: GRANDMA observations

- We did not detect the optical afterglow within the first 24 h.
 - Upper limits are given in the AB system, at 3-sigma.
 - The observations were contaminated by the moon.
 - These upper limits are consistent with previous reports of detections by RATIR and the upper limits provided by UVOT.
- <https://gcn.gsfc.nasa.gov/gcn/gcn3/31903.gcn3>

Afterglow detected by RATIR

Optical detection by other telescopes (7/11)

GRB 220319A: GRANDMA observations

- Upper limit of amateur astronomers up to 20. from 14 min post BAT alert
 - Ali-50 observed the source 5.6h post alert with 20.1 upper limit in clear
 - No credible UVOIR found by GRANDMA and other colleagues
- <https://gcn.gsfc.nasa.gov/gcn3/31785.gcn3>

GRB 220325A: GRANDMA observations

- Upper limit from SNOVA-NOWT-KAO-C2PU with 21 in r-band after 4h
 - No optical detection found by GRANDMA and other colleagues
- <https://gcn.gsfc.nasa.gov/gcn3/31804.gcn3>

GRB 220408A: GRANDMA observations

- The first observations started 0.63 h after the SWIFT BAT trigger time.
 - We did not detect the optical afterglow within the first 24 h.
 - Upper limits are given in the AB system, at 3-sigma
- <https://gcn.gsfc.nasa.gov/gcn/gcn3/31884.gcn3>



GRB Campaign

GRB 220412B: GRANDMA observations

- Very hard to observe (Moon + no good position)
- Not addressed personal messages to observers for this GRB
- Optical upper limits collected by MITSuME Akeno

GRB 220430A: GRANDMA observations

- The first observations started 34 min after the SWIFT BAT trigger time
- We did not detect any optical transient within the XRT error box during the first 2.9 hours
- We report our 3-sigma upper limits.

<https://gcn.gsfc.nasa.gov/gcn/gcn3/31977.gcn3>

GRB 220501A: GRANDMA observations

1st optical observation did by GRANDMA/TJML

- We recorded a stack of 8 x 60 s unfiltered images in the range from 28.8 to 38.9 minutes after the trigger
- We did not detect any optical counterpart of GRB 220501A in the BAT error circle to a limiting magnitude $r(AB) > 16.0$ mag

<https://gcn.gsfc.nasa.gov/gcn/gcn3/31984.gcn3>

GRB 220404A: GRANDMA observations* No observations

- Alert too close to the Sun for a majority of observers
- Ali-50 triggered observations 7 min post alert, data are processed

Scientific products of the GRB campaign

- General paper of the campaign: “GRANDMA Observations of GRBs during Spring 2022”
- Dedicated paper to GRB220427A (under discussion, JG)

Proposes achieved:

- Trained the teams over two months as they do not have any experience with GRBs
- Improve the tool of how to receive a GRANDMA alert and the communication between shifter and telescope teams
- Improved responses of the team after a GRB alert
- Manage the images on dedicated platform



GRB Campaign

Paper of the campaign (leader Iara)

Paper writing team:

Vini, Zumrud, Sebnem, Cristina, Felipe, Eric B., Thomas

Antonio and Alex (?) will help for GRB expertise

Jean-Grégoire will also lead the GRB campaign scientific exploitation related to 220427A

Prop A : can be a section of the article

Prop B.: a separate article

One part of the article will be related to methods for the photometry especially on upper limits, and Thomas Thussenot can take care of this part

Other GRANDMA members will join of course, like Eric, and Damien for the prompt and XRT exploitation.

link to the draft:

<https://www.overleaf.com/2152641592mzmytcgsnppm>



Paper of the campaign

What have already been decided, meeting of May 26th, first actions

- FITS images are corrected named (header) on owncloud:

GRB220319A

GRB220325A.... Vini

GRB220403B

GRB220404A... Zumrud

GRB220408A

GRB220412A (no data, just upper limits)

GRB220412B... Sebnem

GRB220427A... JG

GRB220430A

GRB220501A... Cristina

GRB220514A... Felipe

Roadmap

1. Contact telescope teams to add their info in the paper (lara)
Update table with telescope teams (lara)
2. Collect ALL observations with calibrated data
3. Ask teams to performed photometry data with their own software and STDpipe
4. What we want to demonstrate ?
 - the GRBase, Kann plot, do we have missed some occasion to detect the afterglow counterpart ?
 - Do we have monopolize enough facilities ? and use the instruments correctly ? (filters, nIR ?)
 - Is our network enough efficient to follow-up GRB ?
5. GRB space analysis
 - For GRB with detections, which additional analysis can we perform for gamma-ray, X-ray, UVOT data ?
 - Assumption of redshift ?
 - Which models ?

GRB220427A

“Swift detection of a burst with an optical counterpart”

White, B, U, V, W1, W2, M2 detection

Followed by several GRANDMA telescopes

Detected by Tarot and Les Makes, Clear =>

Detected by several outside GRANDMA teams
from g band to z band



GRB220427A

“Swift detection of a burst with an optical counterpart”

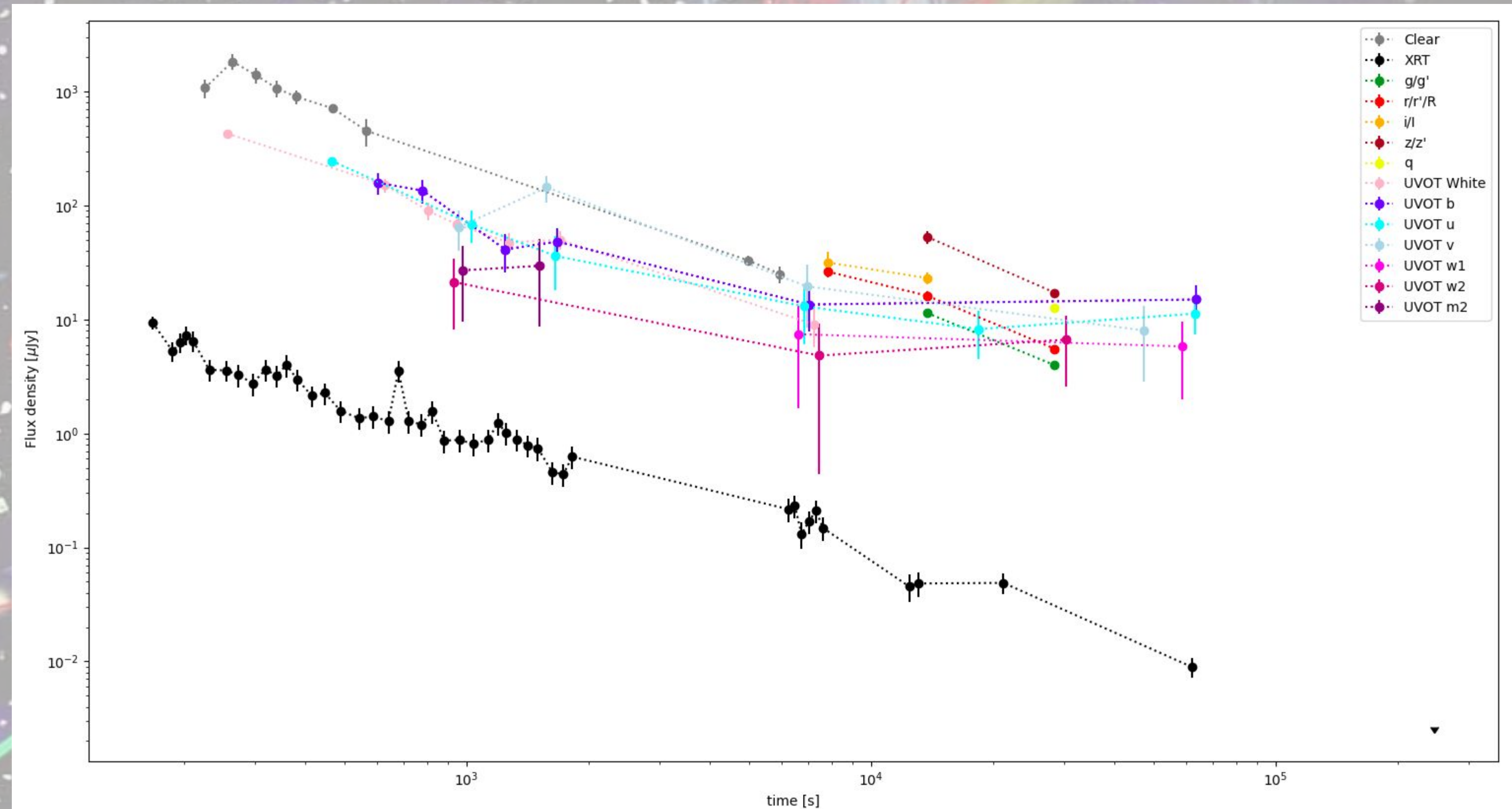
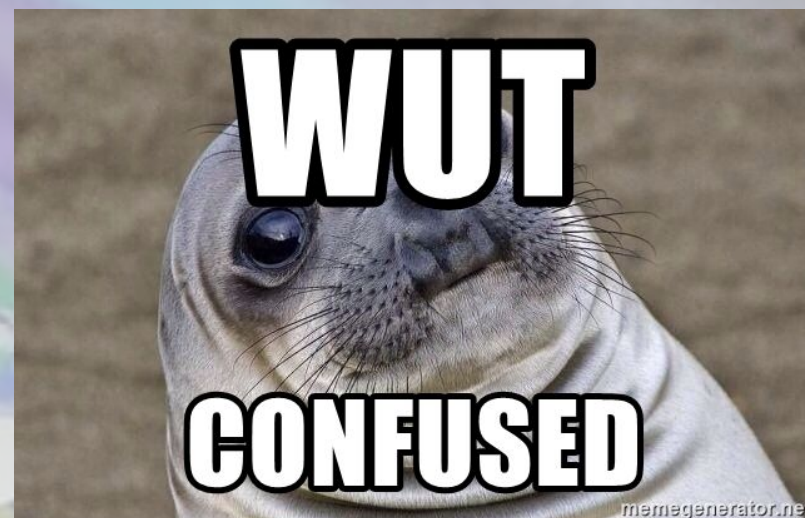
White, B, U, V, W1, W2, M2 detection

Followed by several GRANDMA telescopes

Detected by Tarot and Les Makes, Clear =>

Detected by several outside GRANDMA teams
from g band to z band

(including q band)



GRB220427A

Host galaxy photometry available for several optical band + NIR band

SED Fitting?

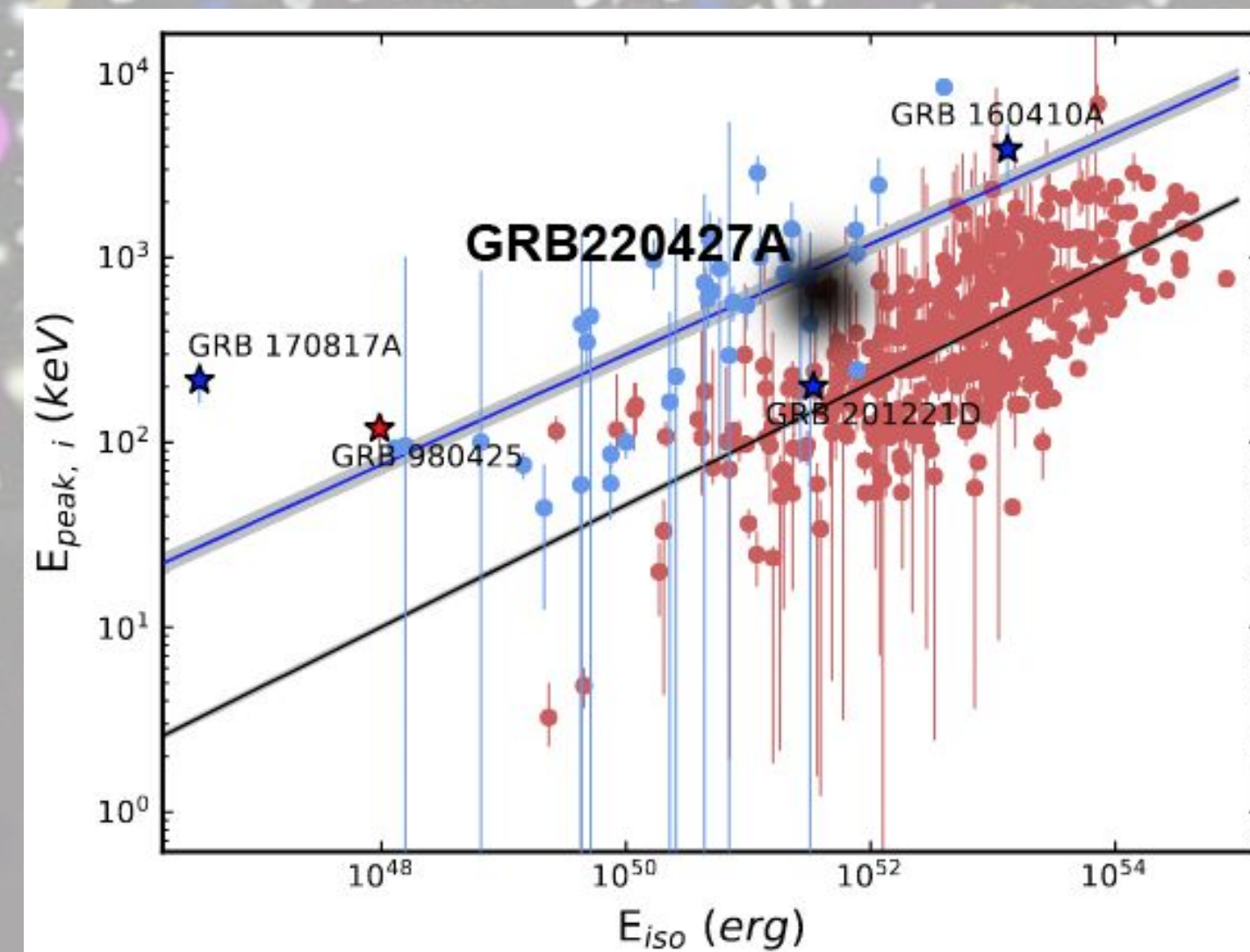
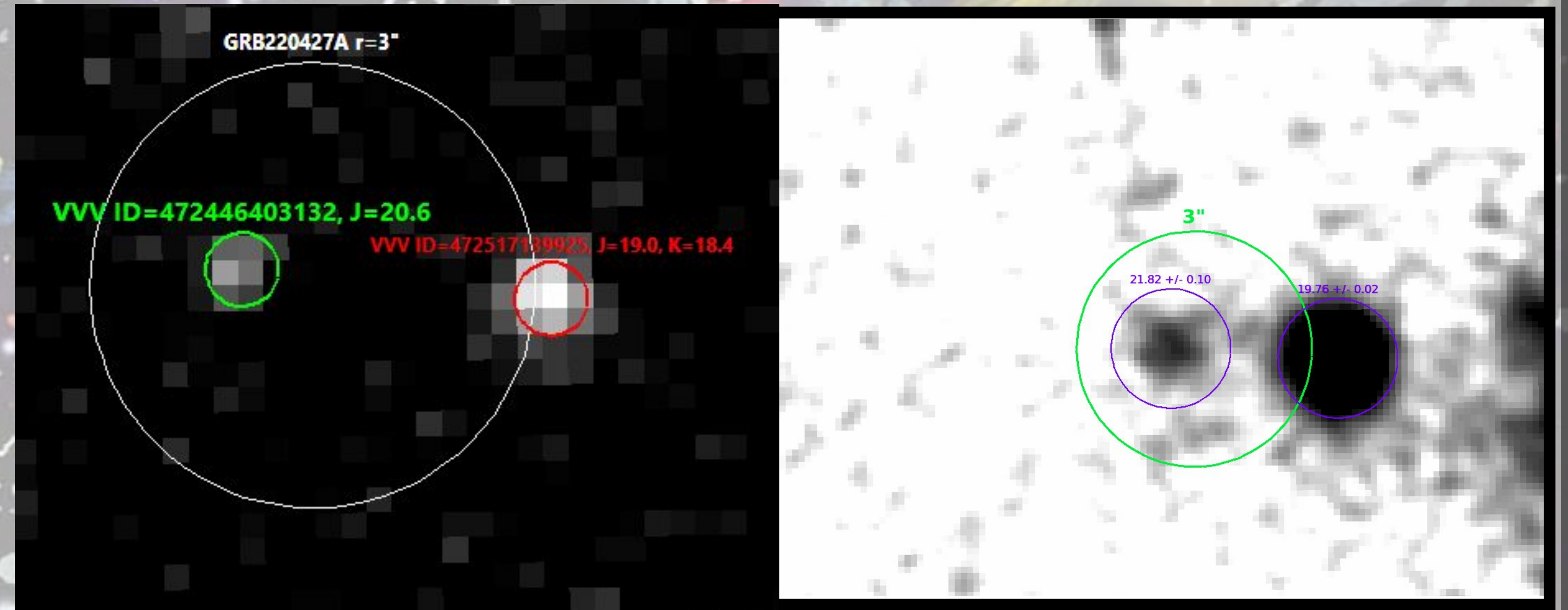
Hint for unusual High energy emission

High energy analysis?

Relatively well sample afterglow lightcurve

MCMC parameters with IAP tools?

Host galaxy



GRB220427A

Host galaxy photometry available for several optical band + NIR band

SED Fitting?

Hint for unusual High energy emission

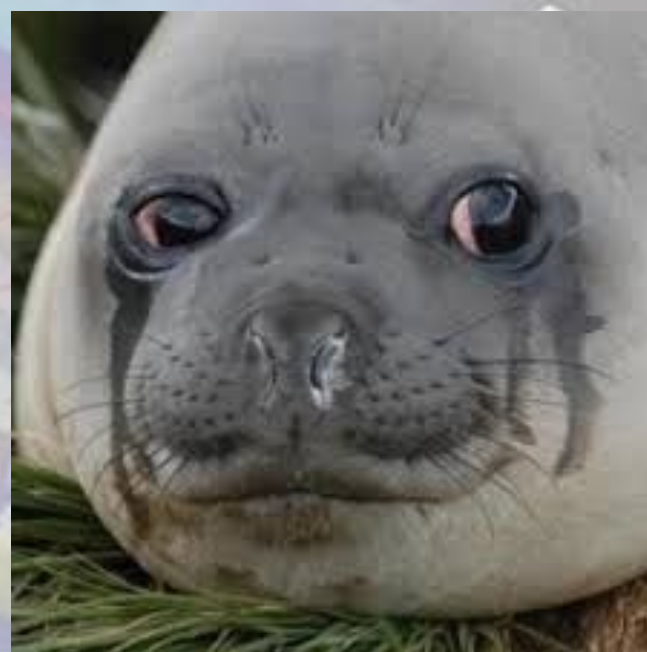
High energy analysis?

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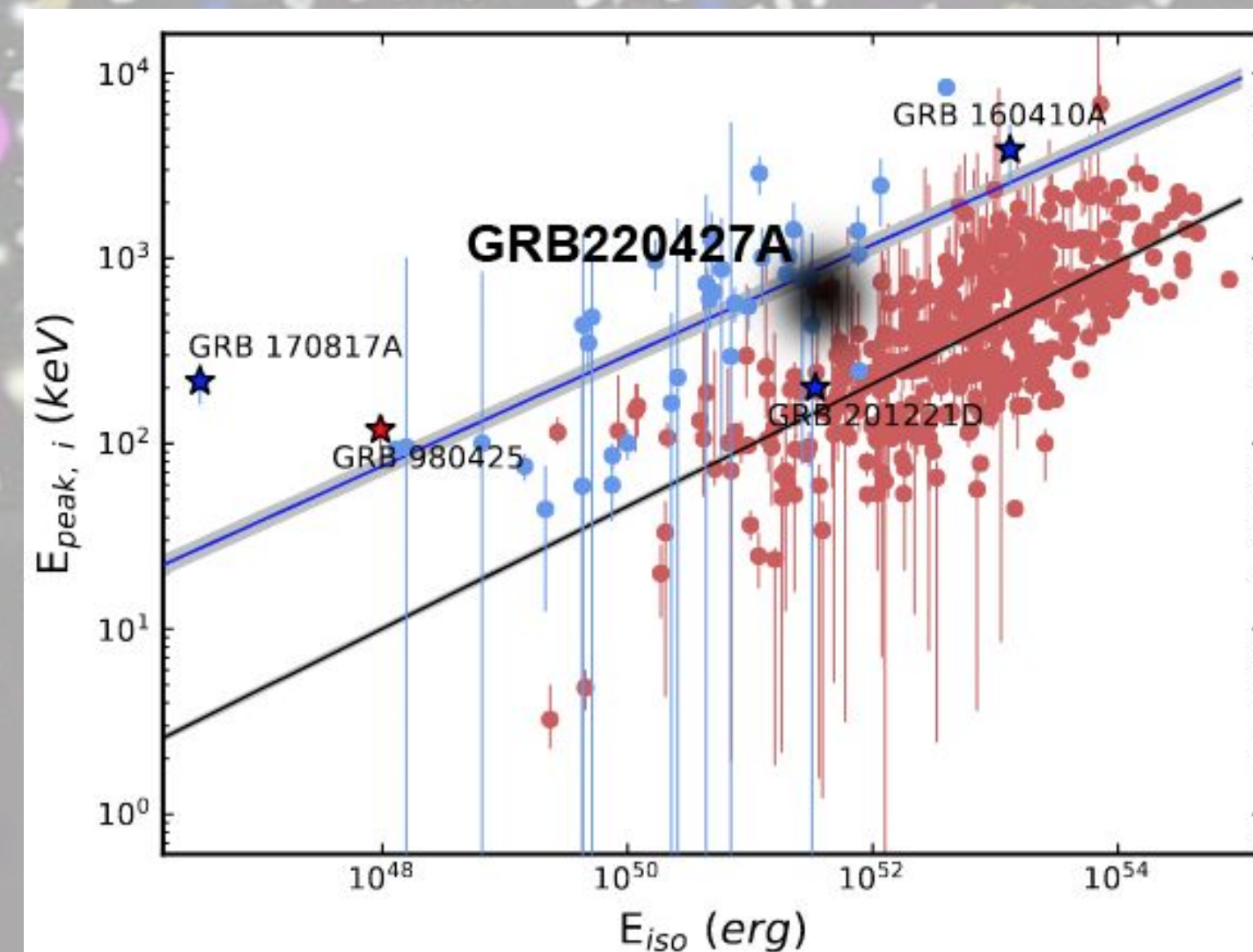
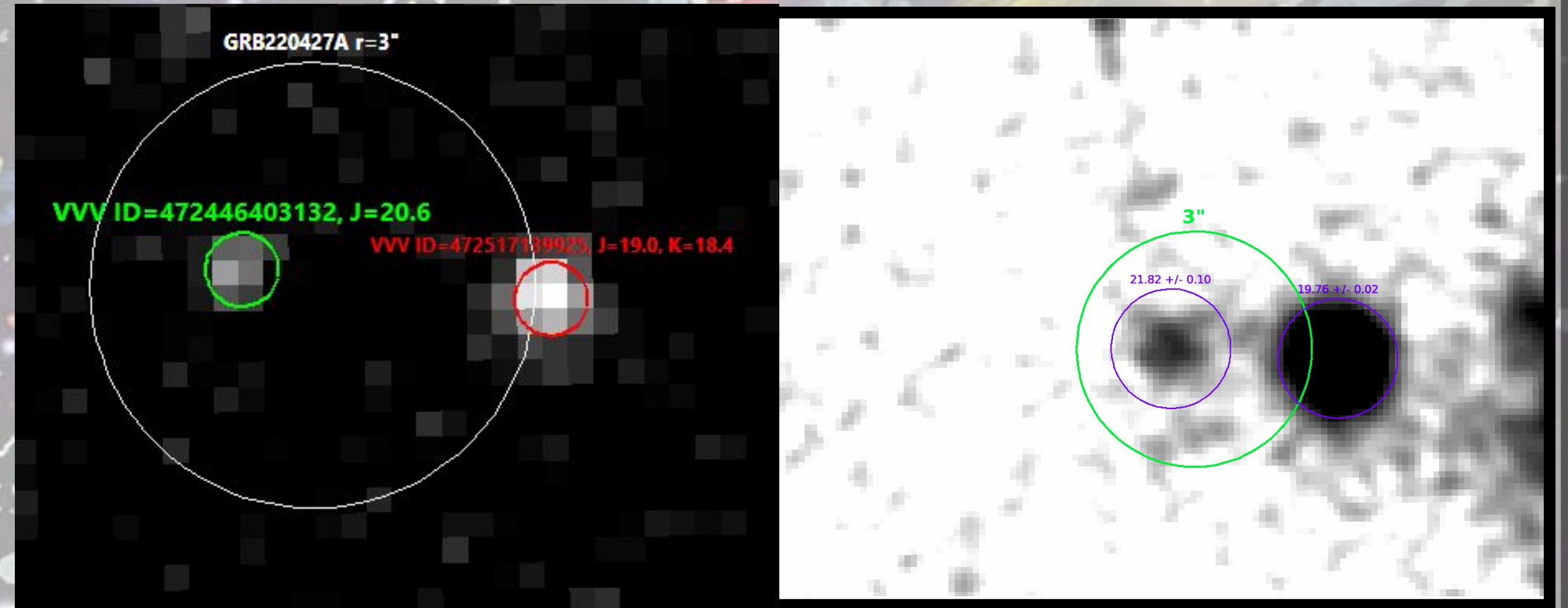
MCMC parameters with IAP tools?

No redshift

Felipe IR spectrum?



Host galaxy



Next up

Neutrino follow-up campaign:

- Observational strategy to be design
- Starting date
- Period of observations
- Scientific products



Thierry P. talk

Suggestion:

UP FOR DISCUSSION

ZTF follow-up for “more training”

To motivate the teams - (as we have hours in SOAR and OPD for example)

- One month training (?) - is that enough
- Channel of alerts: fink_kilonova
- FAs: check fink_kilonova channel to decide which alert should be follow; warn telescope teams
- Scientific products: to be decided by the core team (??)
- Telescope teams to participate in
- Ideas/suggestions ?

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