

# ANOMALY DETECTION IN FINK

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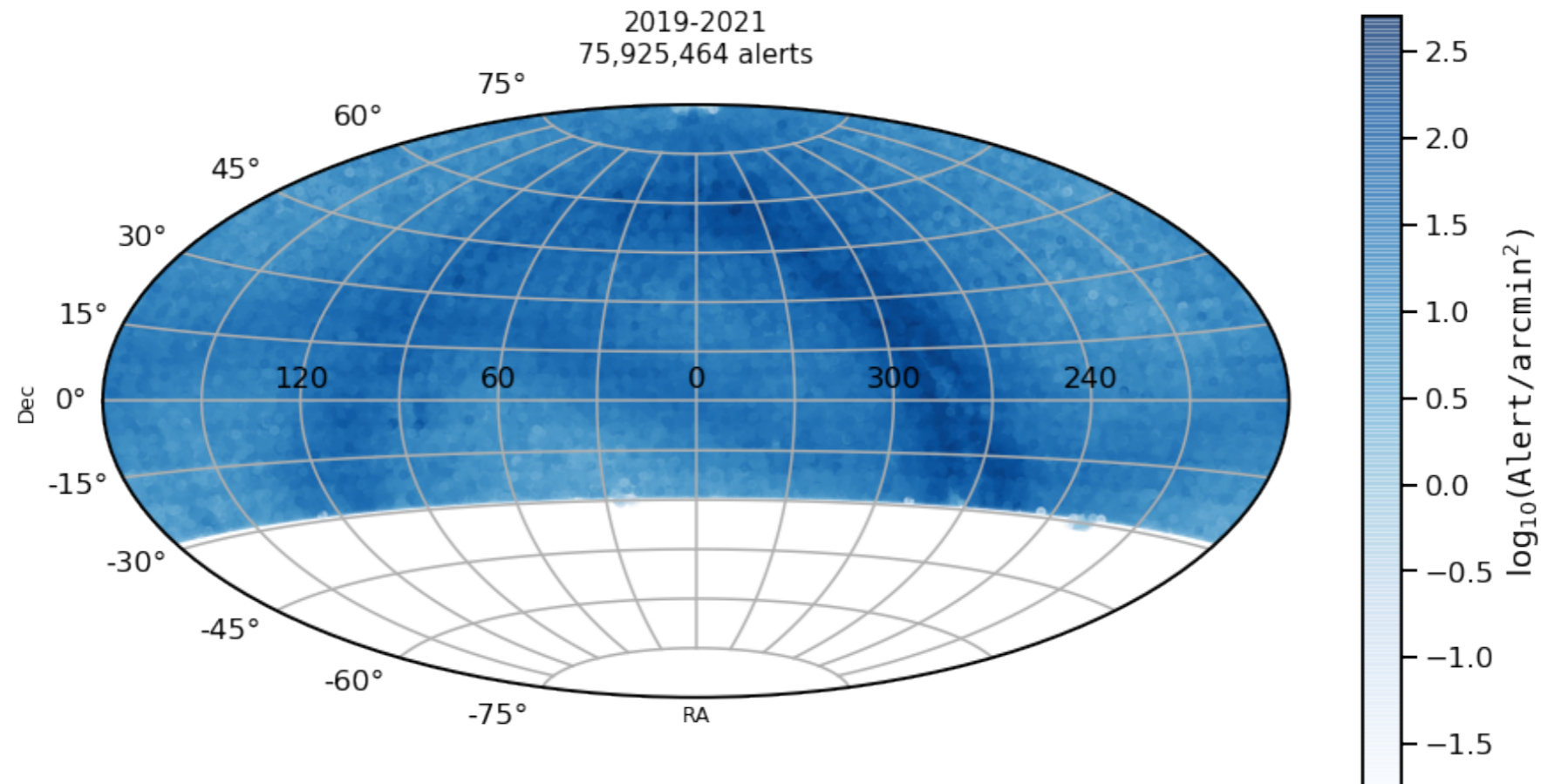
Maria Pruzhinskaya

on behalf of the Fink team

Laboratoire de Physique de Clermont

LSST-France  
7-9 June 2023

## ZTF/FINK STATISTICS

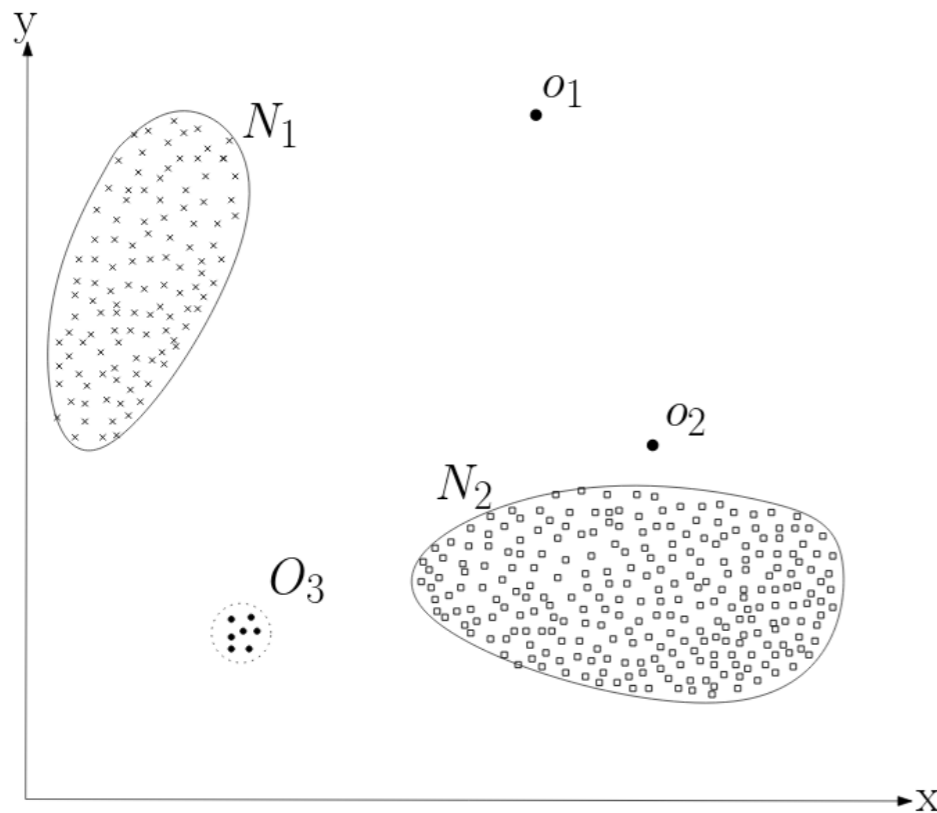


- ▶ 170 million alerts received, 114 million processed (<https://fink-portal.org/stats>)
- ▶ Typical nightly rates (200,000 alerts)

# WHAT DO YOU MEAN BY ANOMALY?

## MACHINE DEFINITION

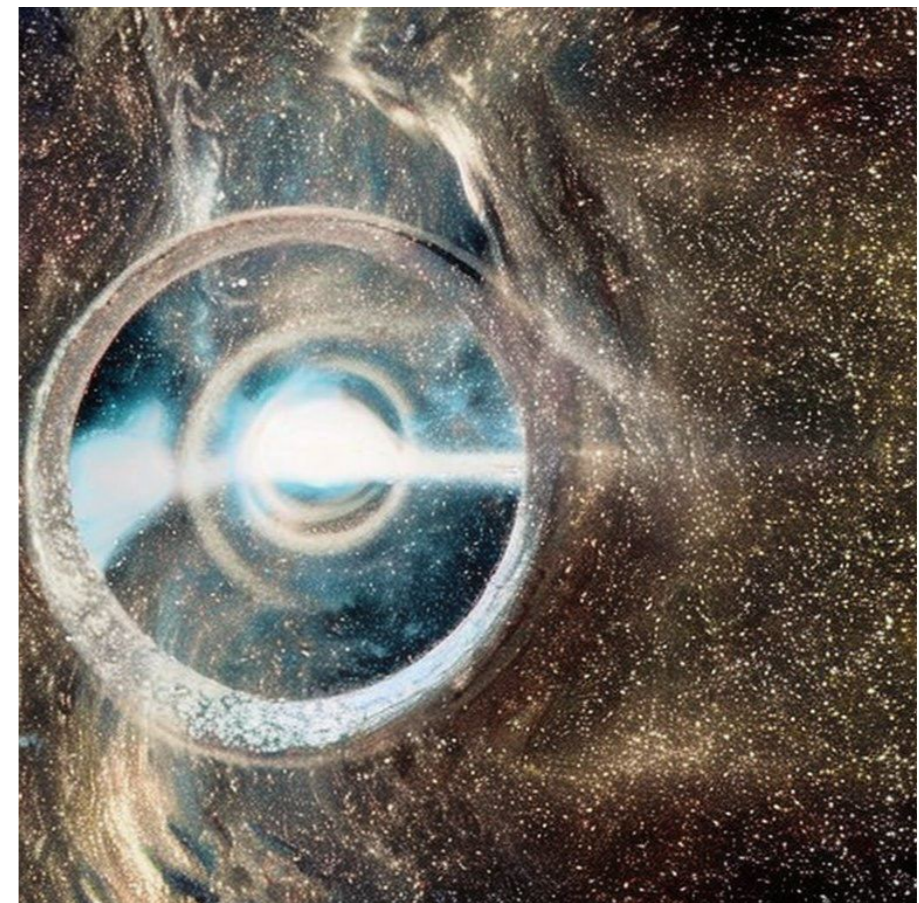
- ▶ Objects with high anomaly score  $\rightarrow$  not necessarily interesting for the expert



Chandola V., et al. 2009

## HUMAN DEFINITION

- ▶ Astrophysically interesting anomalies  $\rightarrow$  depends on the task

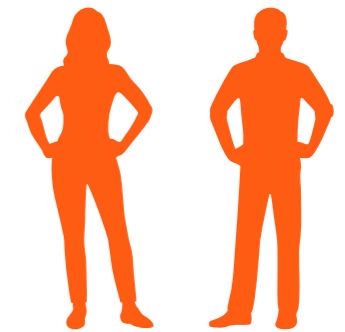
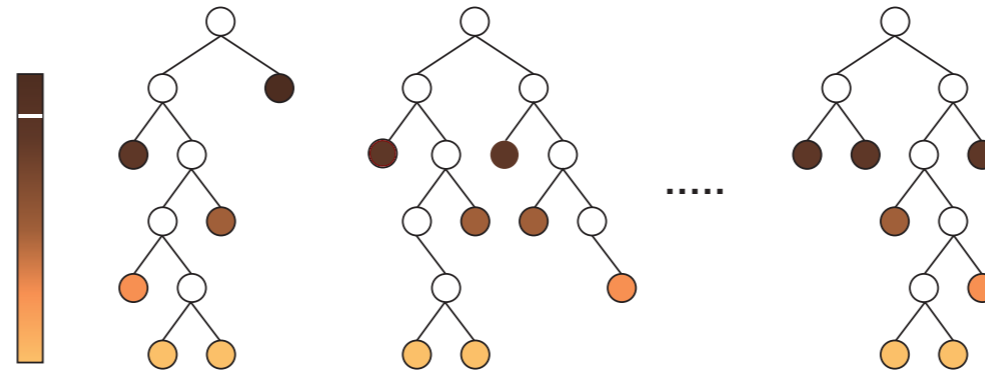
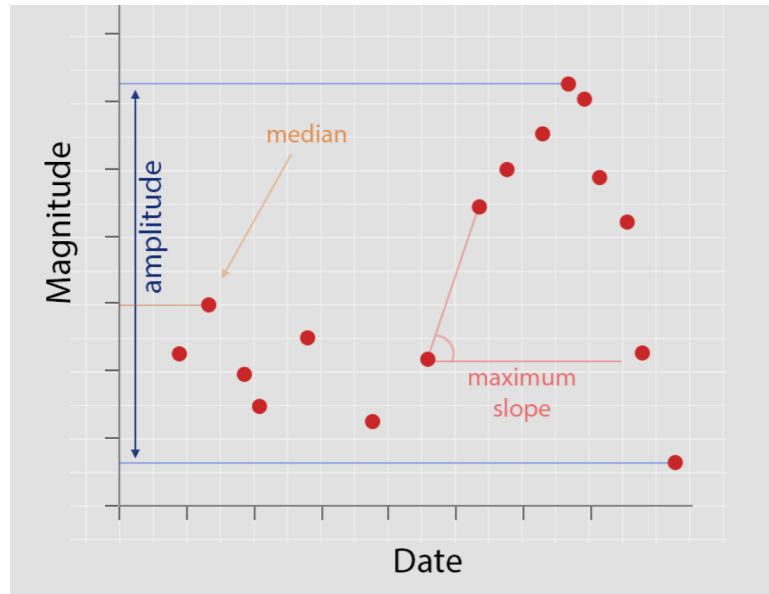


# FINK ANOMALY DETECTION

## ad features module

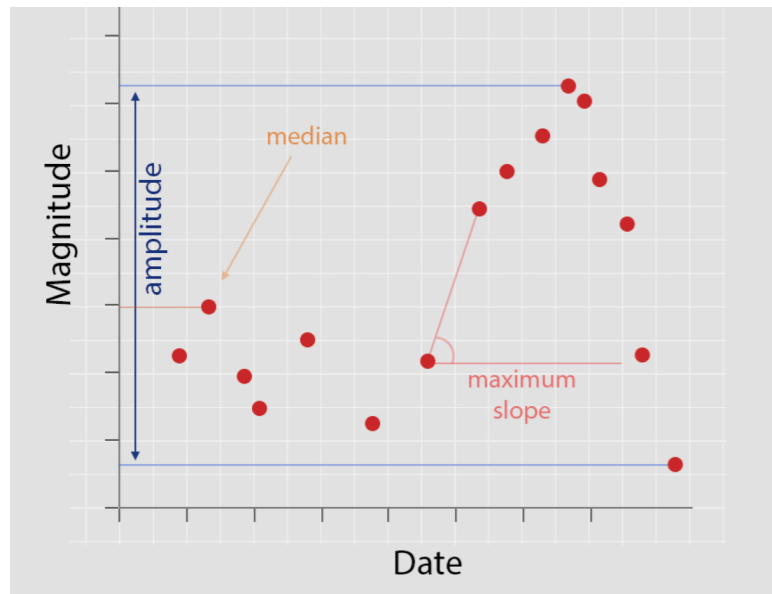
## anomaly detection module

## anomaly notification module

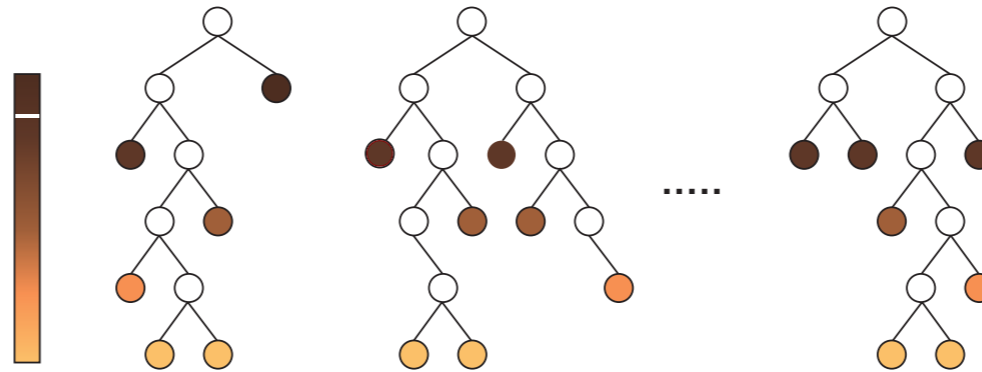


# FINK ANOMALY DETECTION

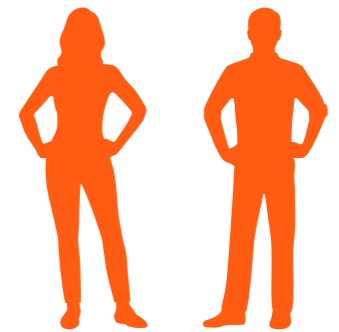
## ad features module




## anomaly detection module



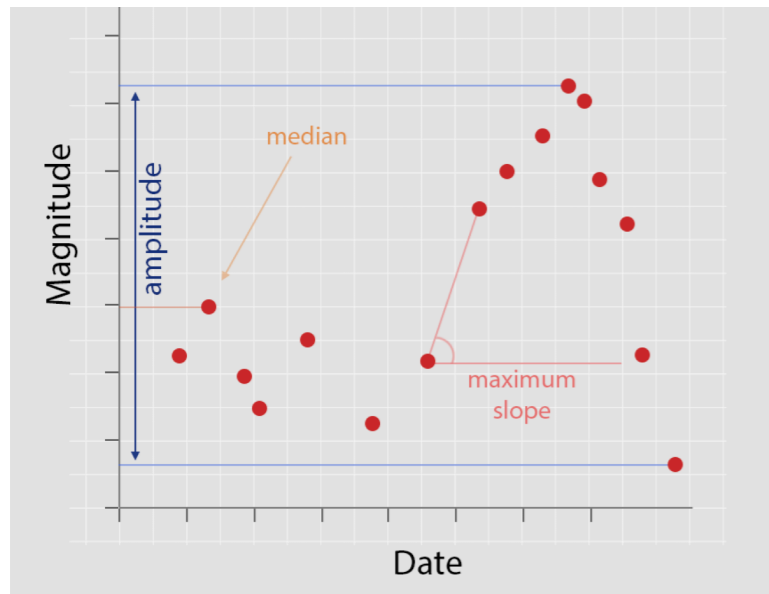
## anomaly notification module



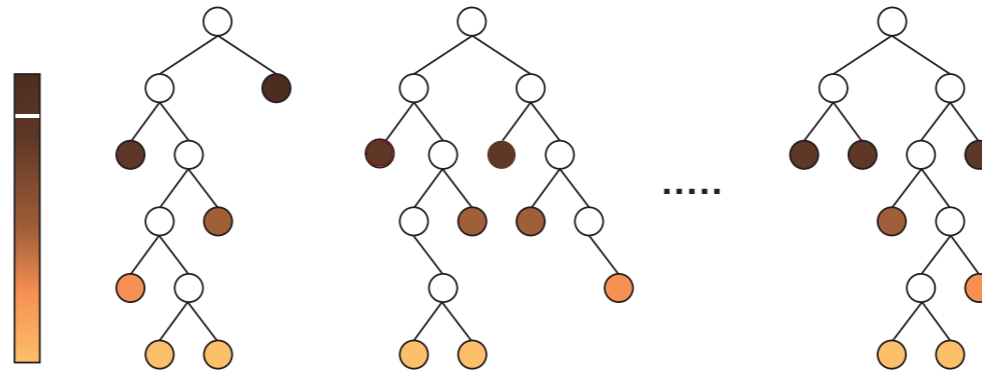
- ▶ 22 features (Malanchev et al., 2021  **SNAD**)
- ▶ ztf\_g and ztf\_r passbands

# FINK ANOMALY DETECTION

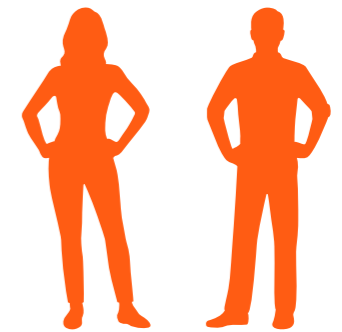
## ad features module



## anomaly detection module



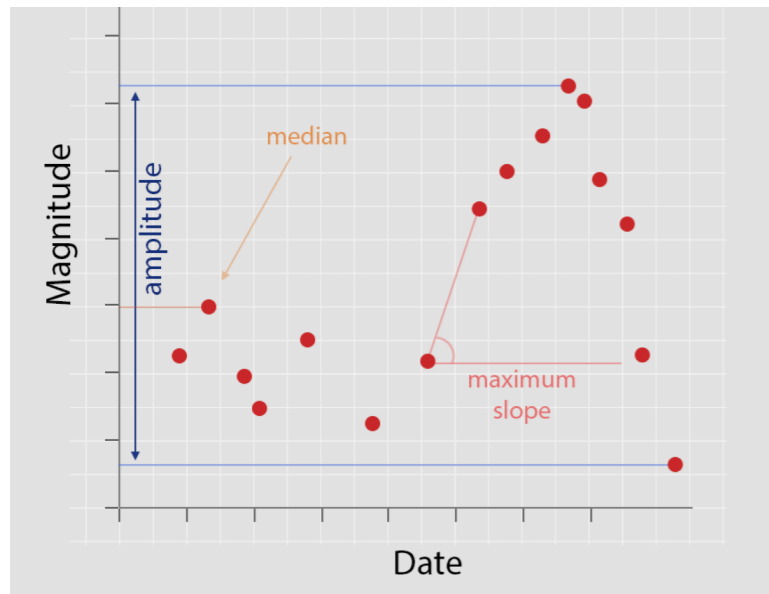
## anomaly notification module



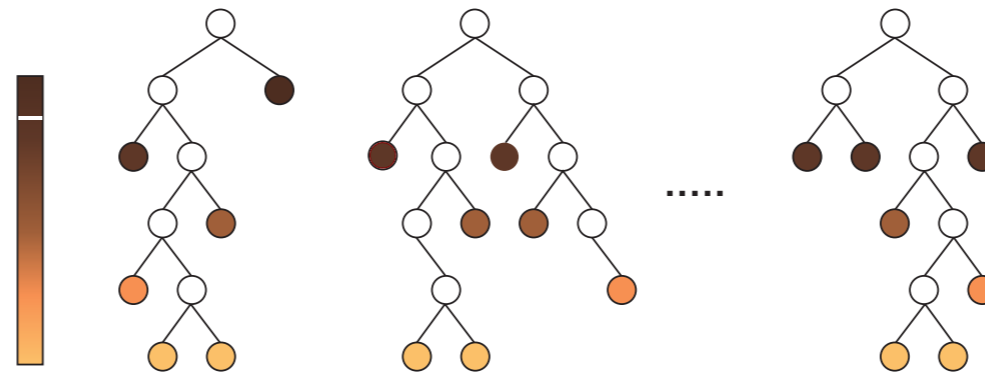
- ▶ Isolation forest applied to the LC features in both bands
- ▶ Resulting anomaly scores is averaged

# FINK ANOMALY DETECTION

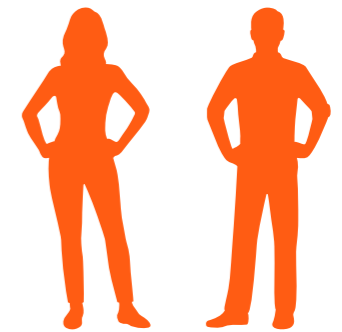
## ad features module



## anomaly detection module



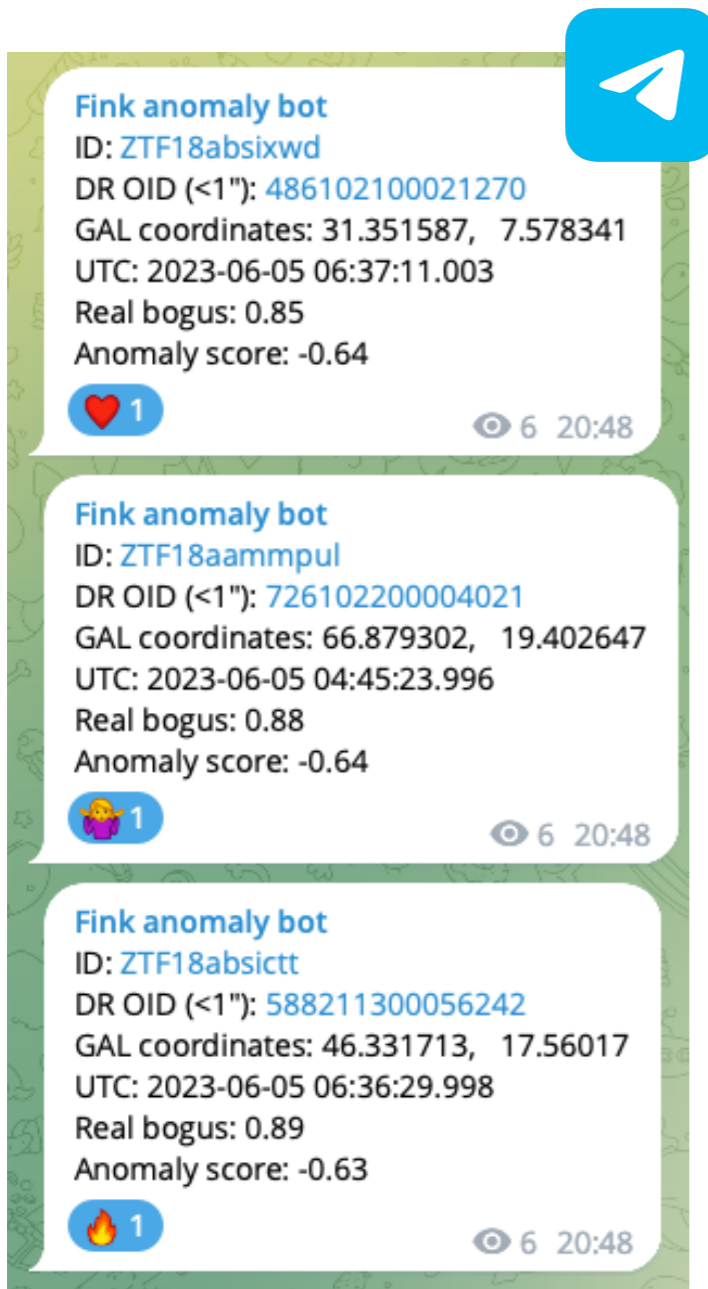
## anomaly notification module



- ▶ Domain expert analysis to discover and to debug

# SLACK AND TELEGRAM BOTS

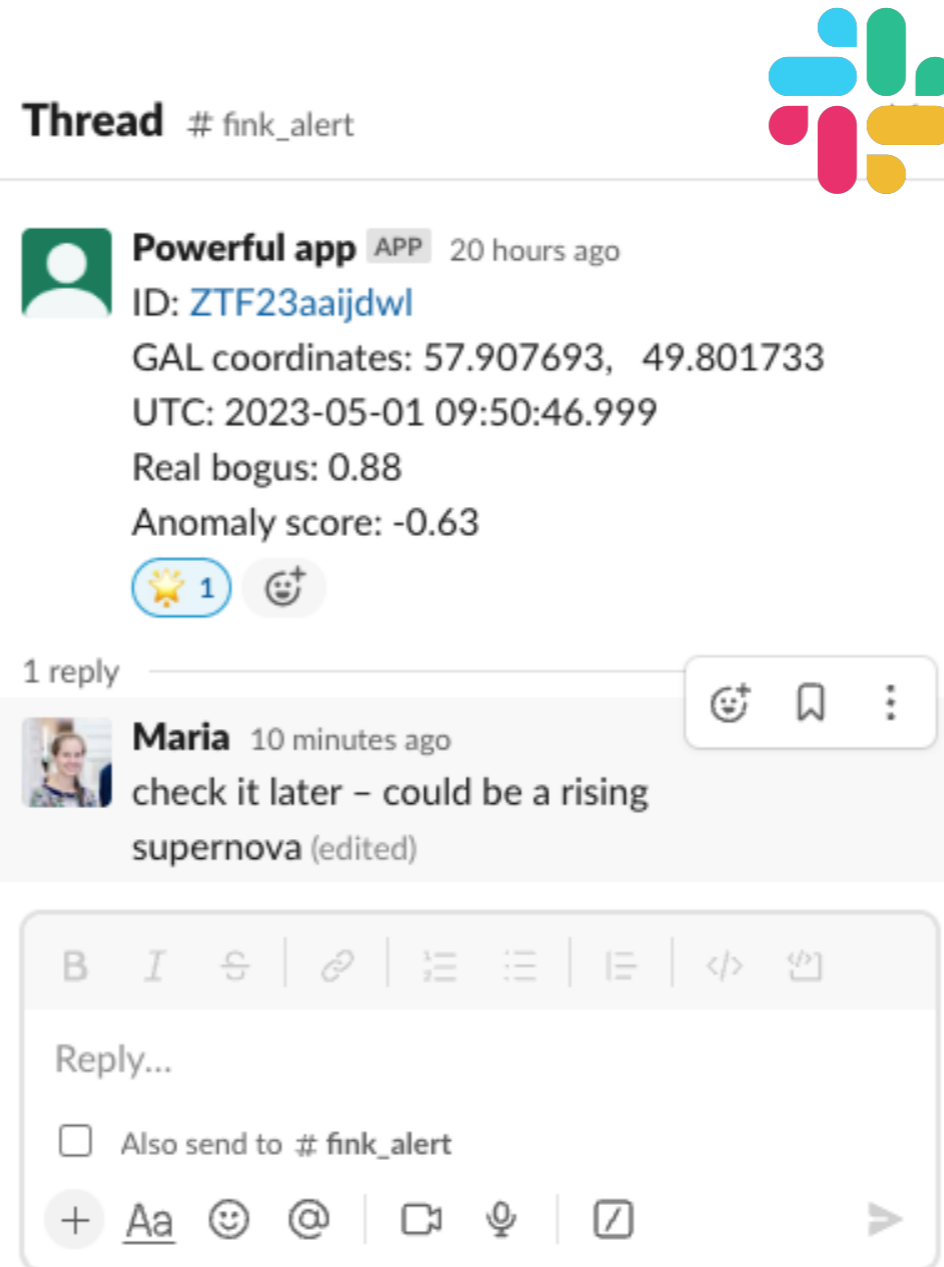
- ▶ TOP-10 anomalies each night



**Fink anomaly bot**  
ID: ZTF18absixwd  
DR OID (<1"): 486102100021270  
GAL coordinates: 31.351587, 7.578341  
UTC: 2023-06-05 06:37:11.003  
Real bogus: 0.85  
Anomaly score: -0.64

**Fink anomaly bot**  
ID: ZTF18aampul  
DR OID (<1"): 726102200004021  
GAL coordinates: 66.879302, 19.402647  
UTC: 2023-06-05 04:45:23.996  
Real bogus: 0.88  
Anomaly score: -0.64

**Fink anomaly bot**  
ID: ZTF18absictt  
DR OID (<1"): 588211300056242  
GAL coordinates: 46.331713, 17.56017  
UTC: 2023-06-05 06:36:29.998  
Real bogus: 0.89  
Anomaly score: -0.63

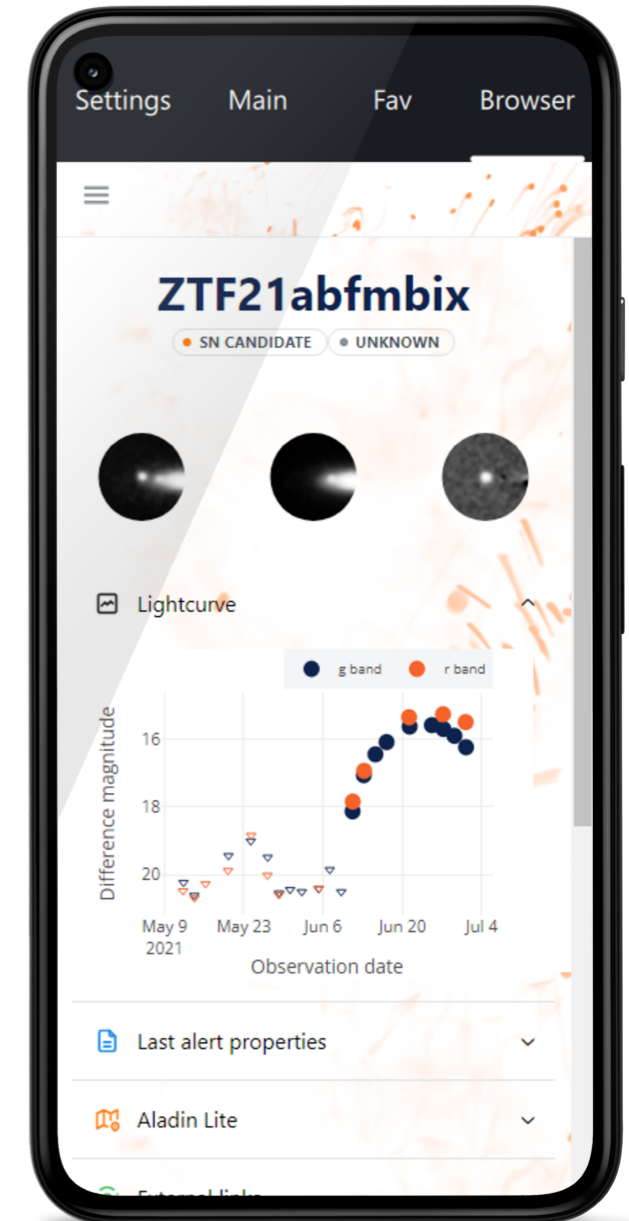


**Thread** # fink\_alert

**Powerful app** APP 20 hours ago  
ID: ZTF23aaijdwI  
GAL coordinates: 57.907693, 49.801733  
UTC: 2023-05-01 09:50:46.999  
Real bogus: 0.88  
Anomaly score: -0.63

1 reply

**Maria** 10 minutes ago  
check it later – could be a rising supernova (edited)

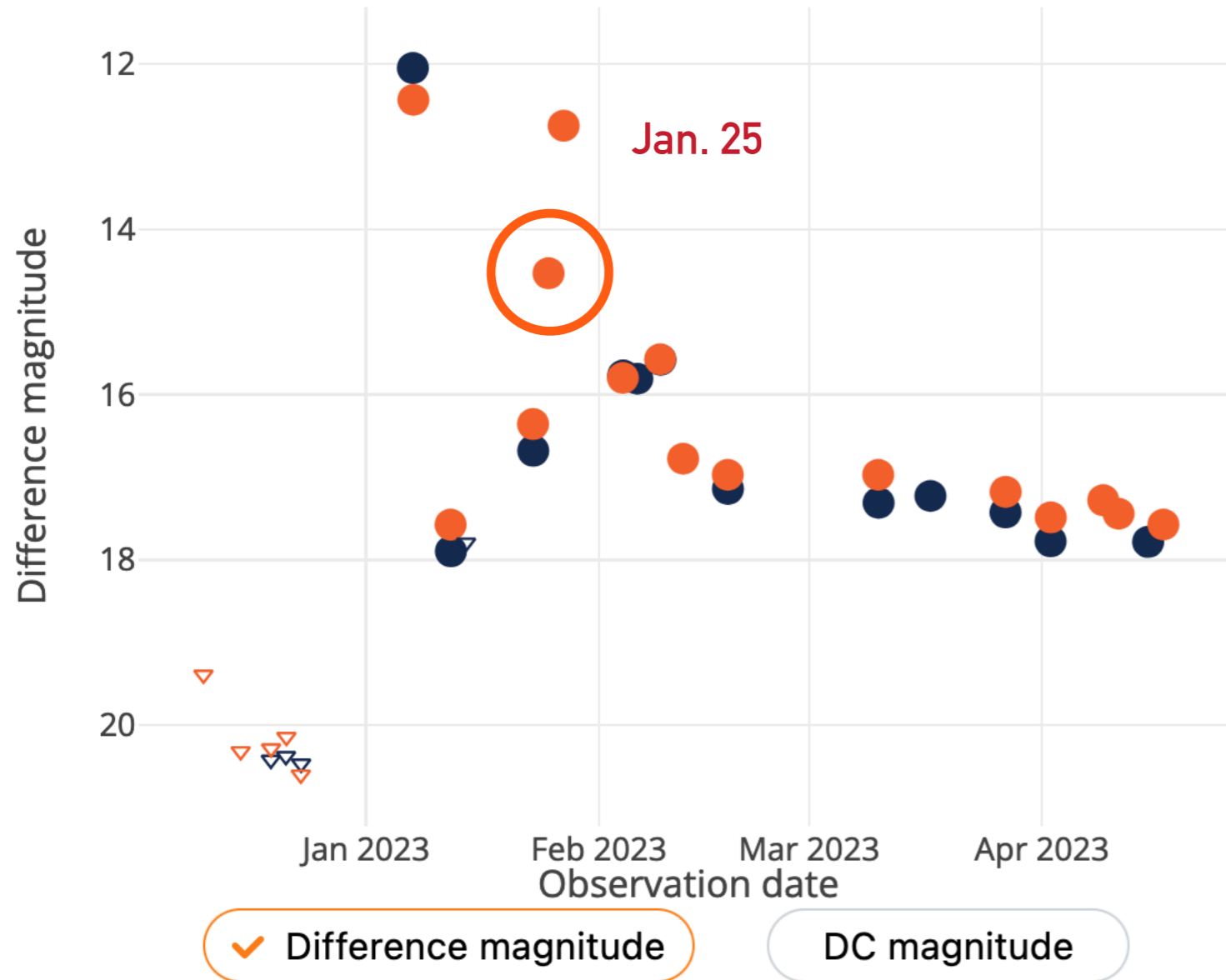




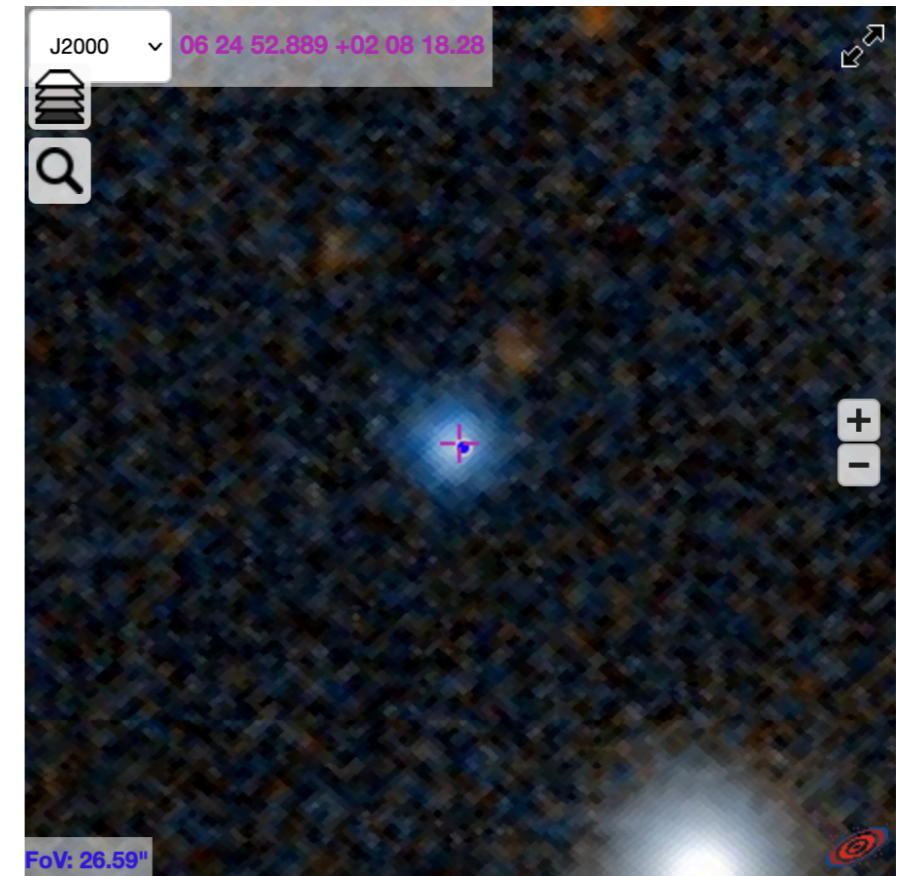
# FIRST NIGHT – FIRST ANOMALY

<https://fink-portal.org/ZTF23aaaatwl>

● g band ● r band

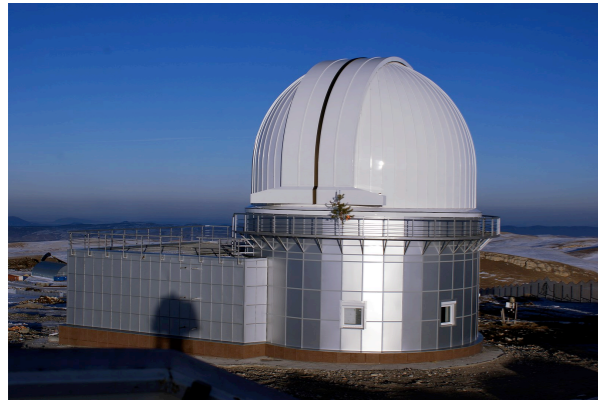


- ▶ ASASSN-23ac/PNV  
J06245297+0208207
- ▶ Simbad: WD candidate



REPORTED IN TNS AS AT 2023AWT

# FOLLOW-UP OBSERVATIONS



2.5M KGO



9.2M SALT

**AT 2023AWT**

~40 spectra

~hundreds observations in B,V,R,r

AM CVn of WZ Sge-type (only 3 known)



0.2M FOSC-ES32  
[2023TNSCR.231....1B]



0.6M KGO

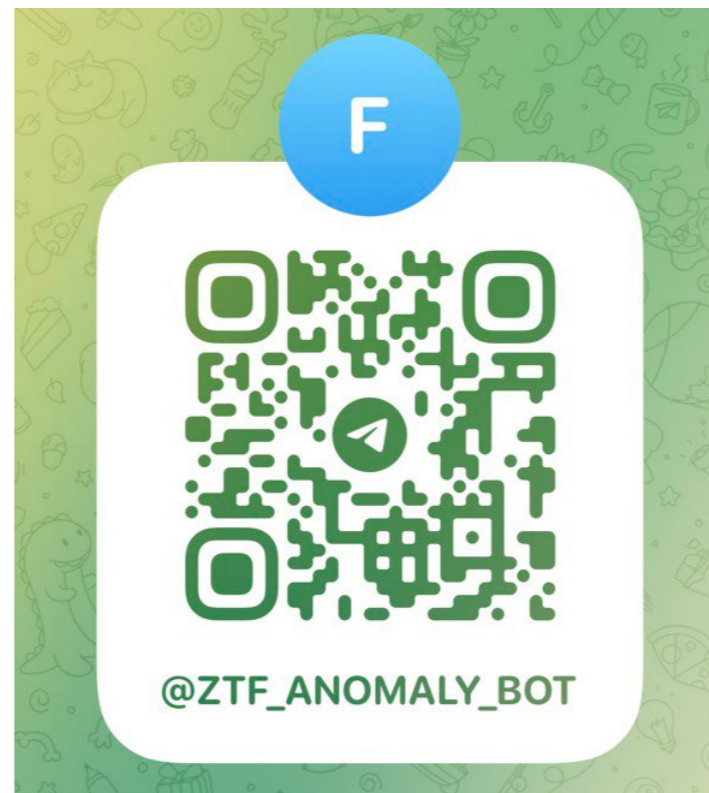


0.25M FRAM-ORM

# SUMMARY

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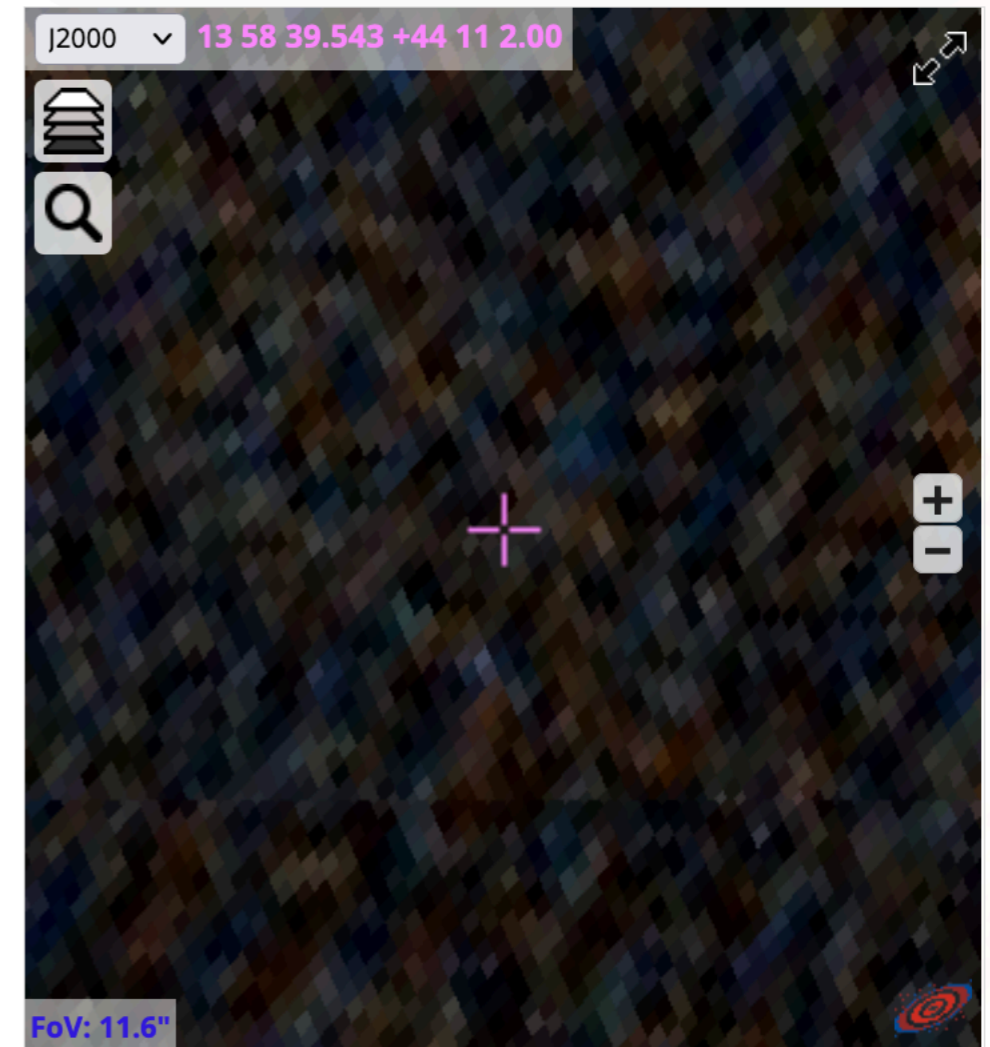
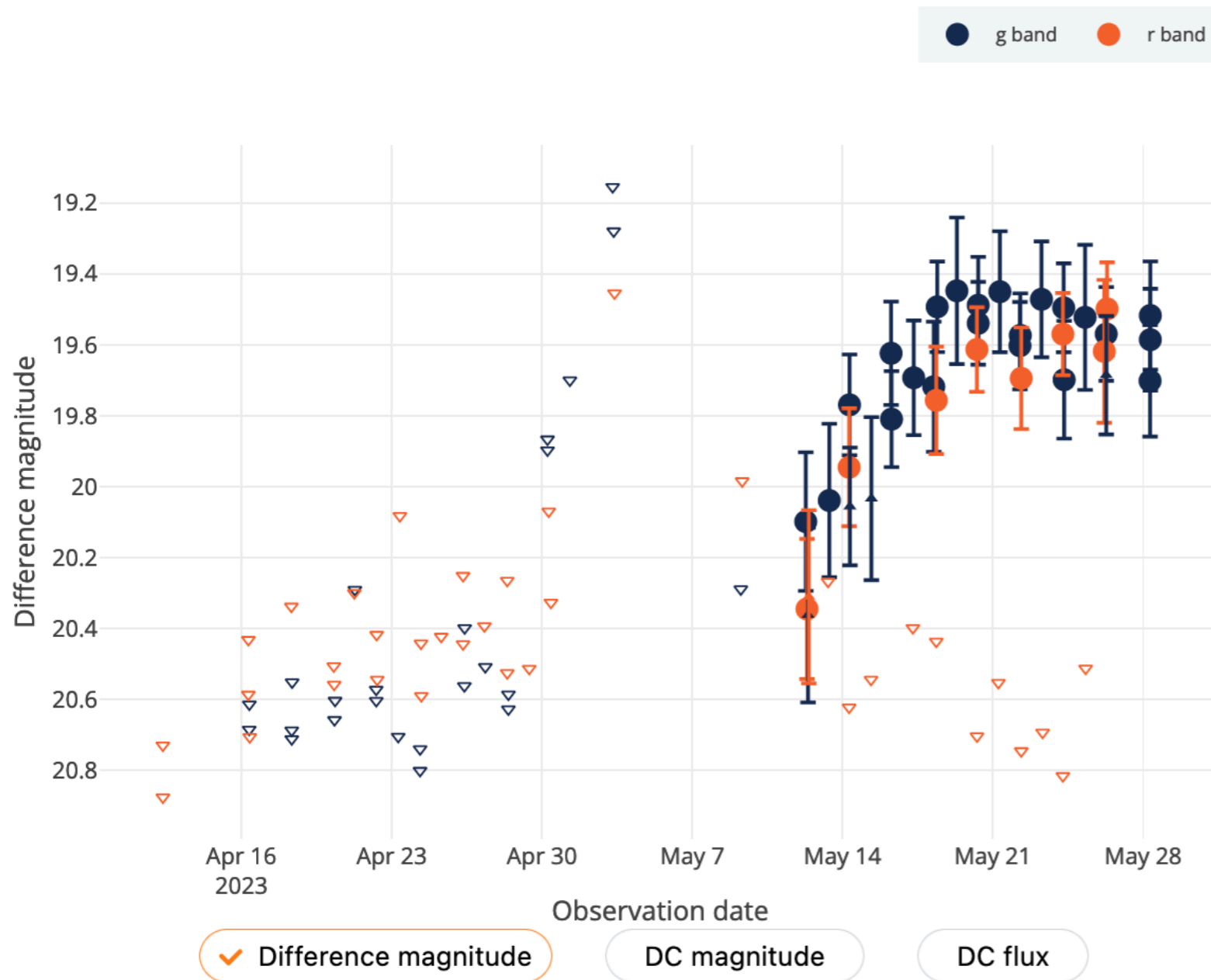
- ▶ Fink anomaly detection module is working and producing the first results
- ▶ First Fink outlier – ZTF23aaaatw – is an anomaly indeed. Probable type is AM CVn of WZ Sge-type: only 3 systems like this is known
- ▶ We performed the follow-up observations of ZTF23aaaatw and classified the object in a very short time-scale
- ▶ Slack and Telegram bots with TOP-10 anomalies are now available



**Stay tuned and join the channels!**

# OTHER OUTLIERS

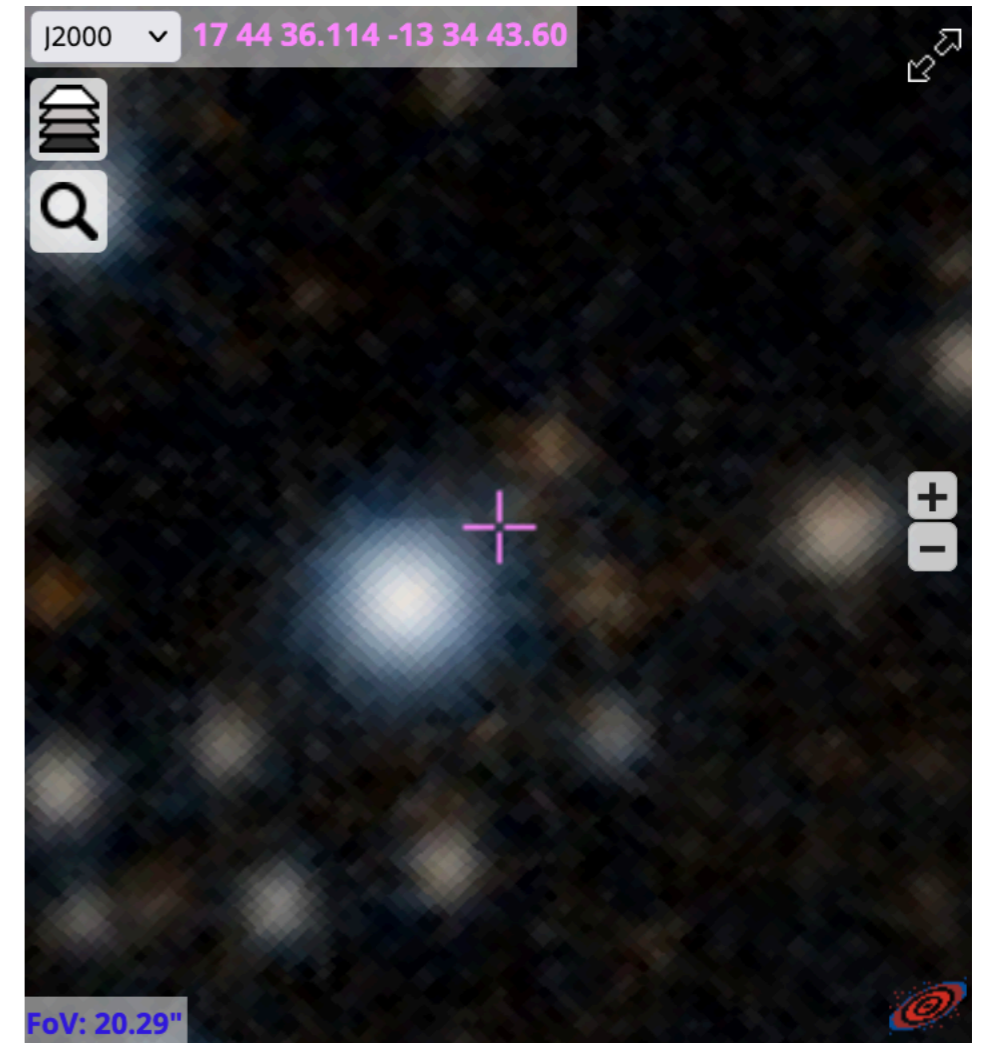
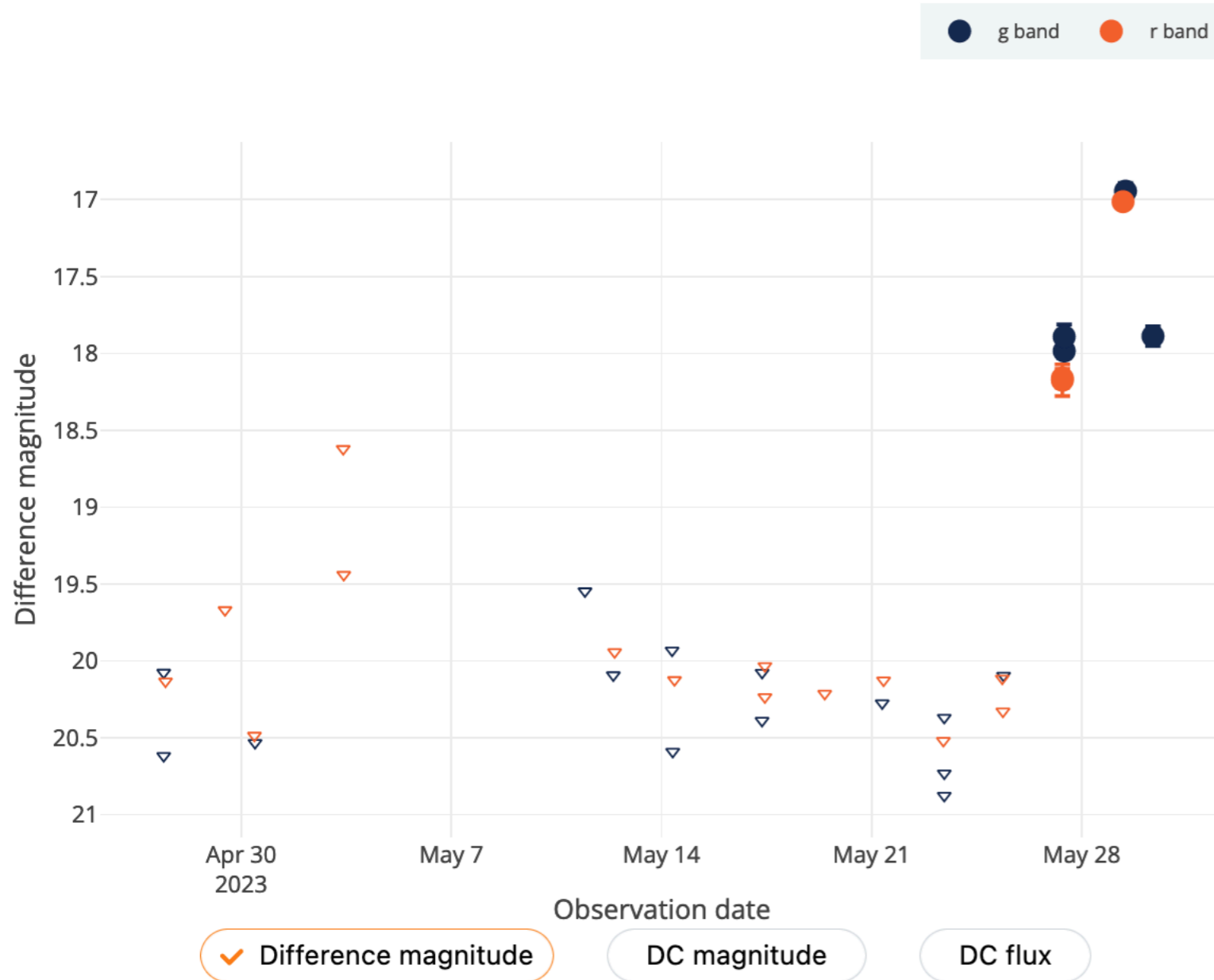
<https://fink-portal.org/ZTF23aajaimx>



REPORTED IN TNS AS AT 2023IRO

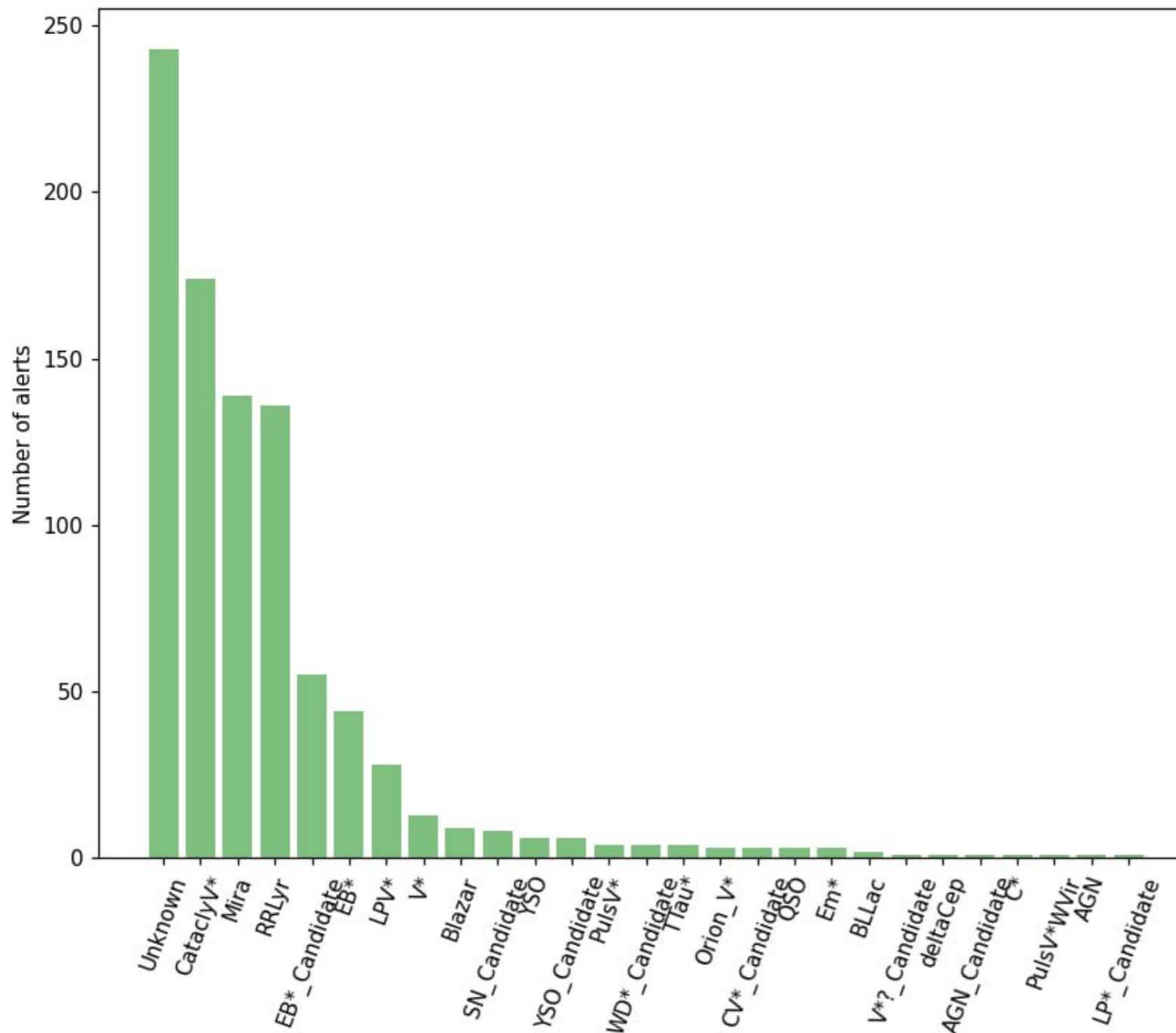
# OTHER OUTLIERS

<https://fink-portal.org/ZTF23aamcbjv>



# OTHER OUTLIERS

- ▶ analysis of 2 months observations (February-March)
- ▶ TOP-30 anomalies each night



Credit: Anastasia Baluta