

ANOMALY DETECTION IN FINK

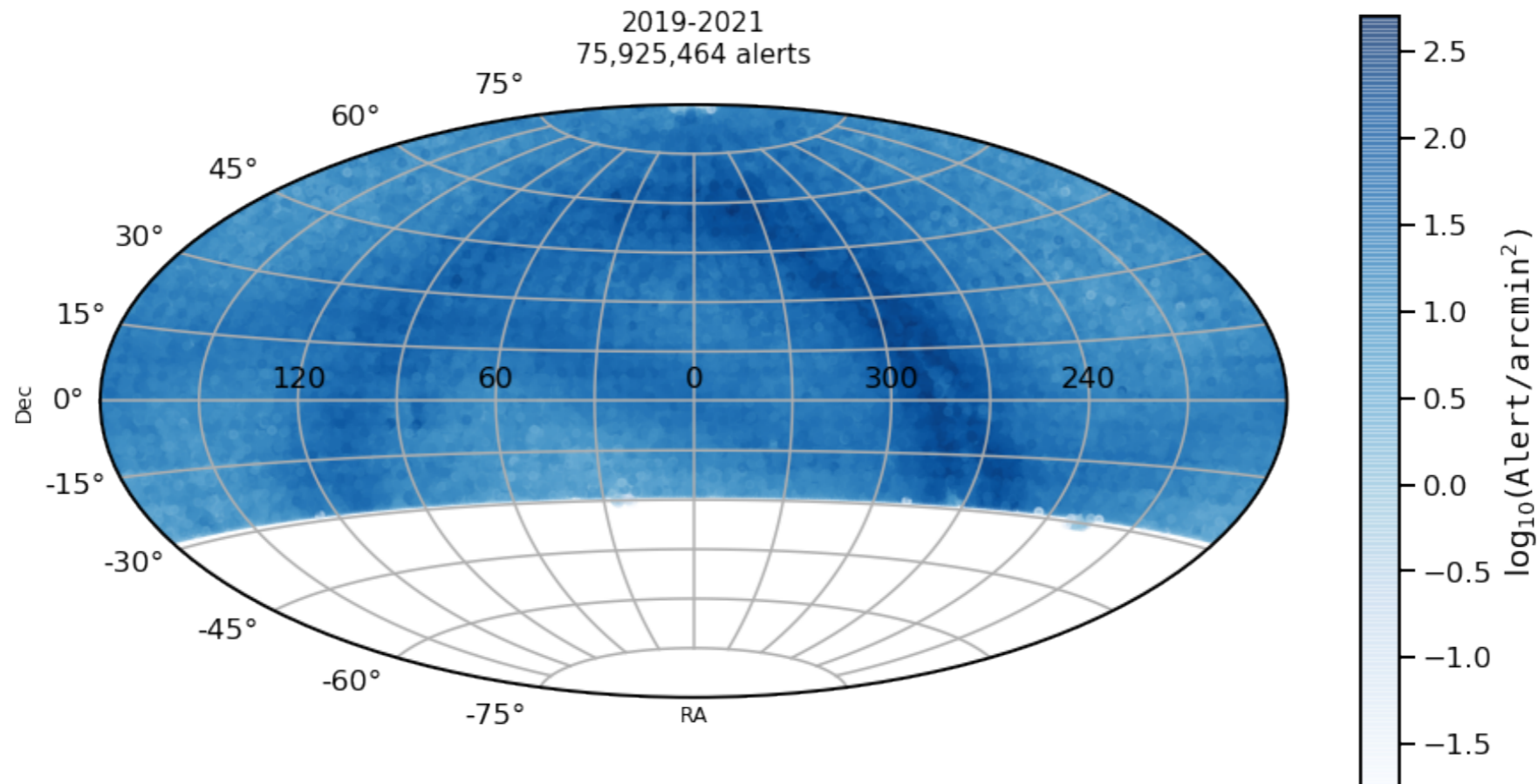
Maria Pruzhinskaya

on behalf of the Fink team

Laboratoire de Physique de Clermont

LSST-France
13-15 December 2023

ZTF/FINK STATISTICS

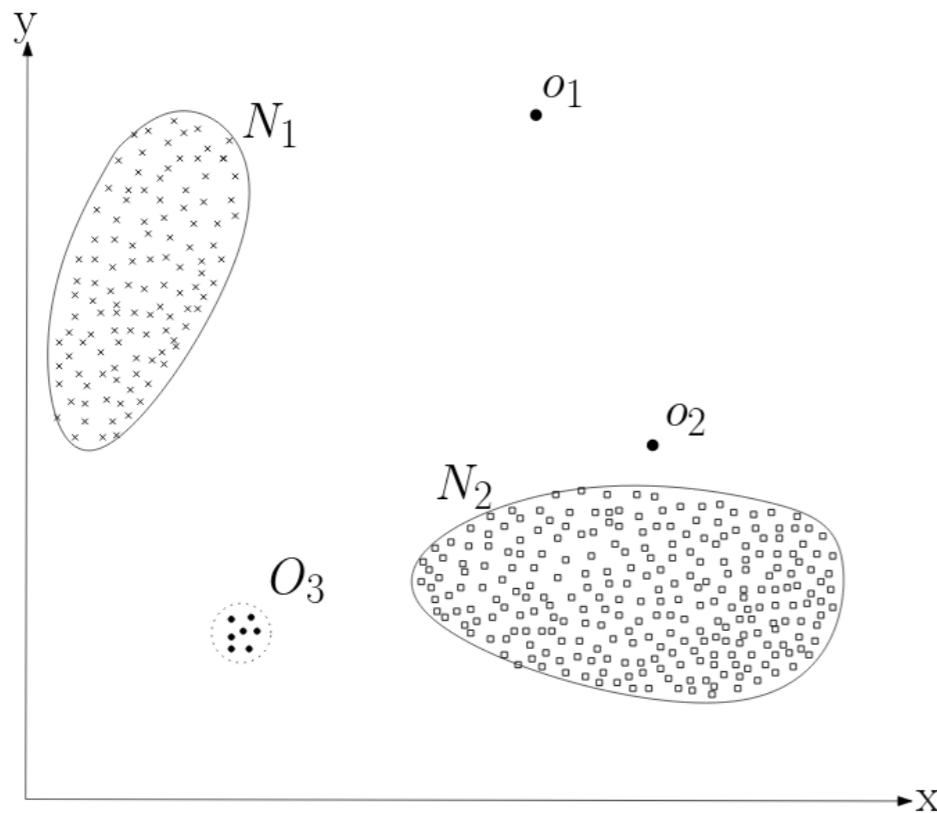


- ▶ 170 million alerts received, 114 million processed (<https://fink-portal.org/stats>)
- ▶ Typical nightly rates (200,000 alerts)

WHAT DO YOU MEAN BY ANOMALY?

MACHINE DEFINITION

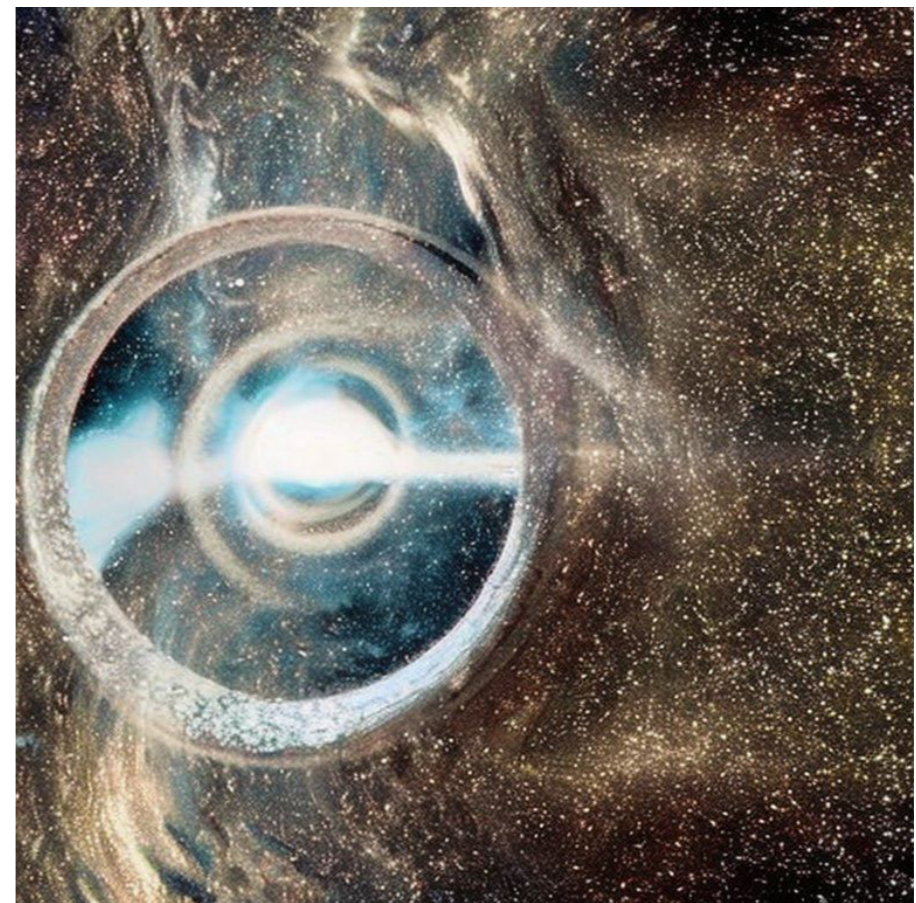
- ▶ Objects with high anomaly score \rightarrow not necessarily interesting for the expert



Chandola V., et al. 2009

HUMAN DEFINITION

- ▶ Astrophysically interesting anomalies \rightarrow depends on the task

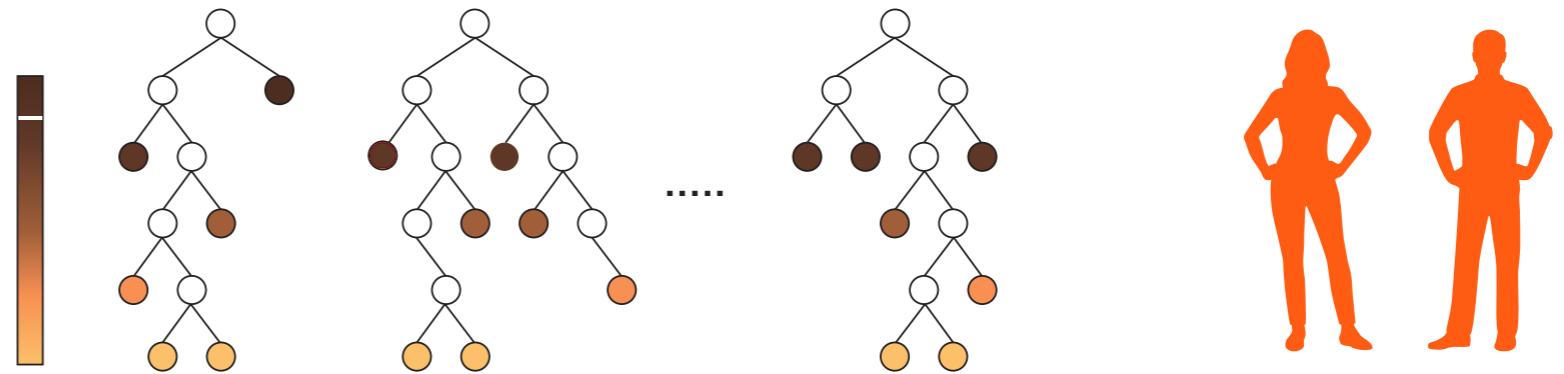
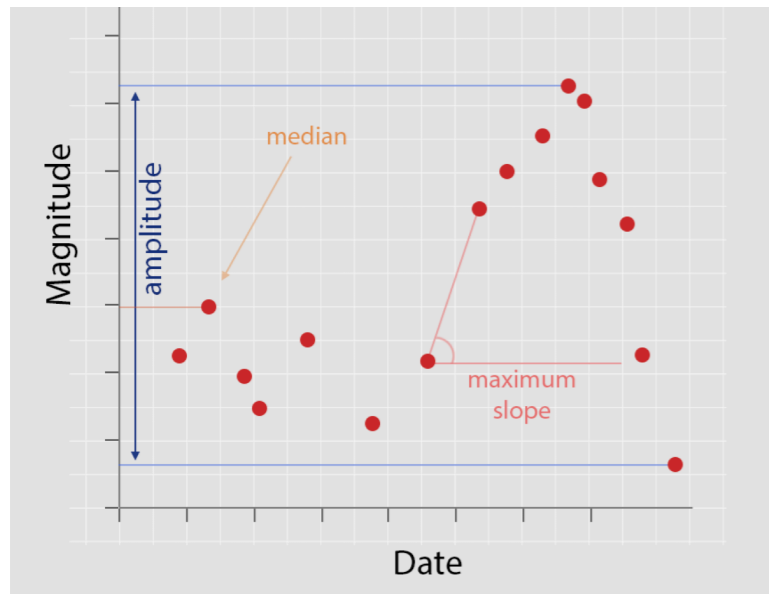



FINK ANOMALY DETECTION

ad features module

anomaly detection module

anomaly notification module

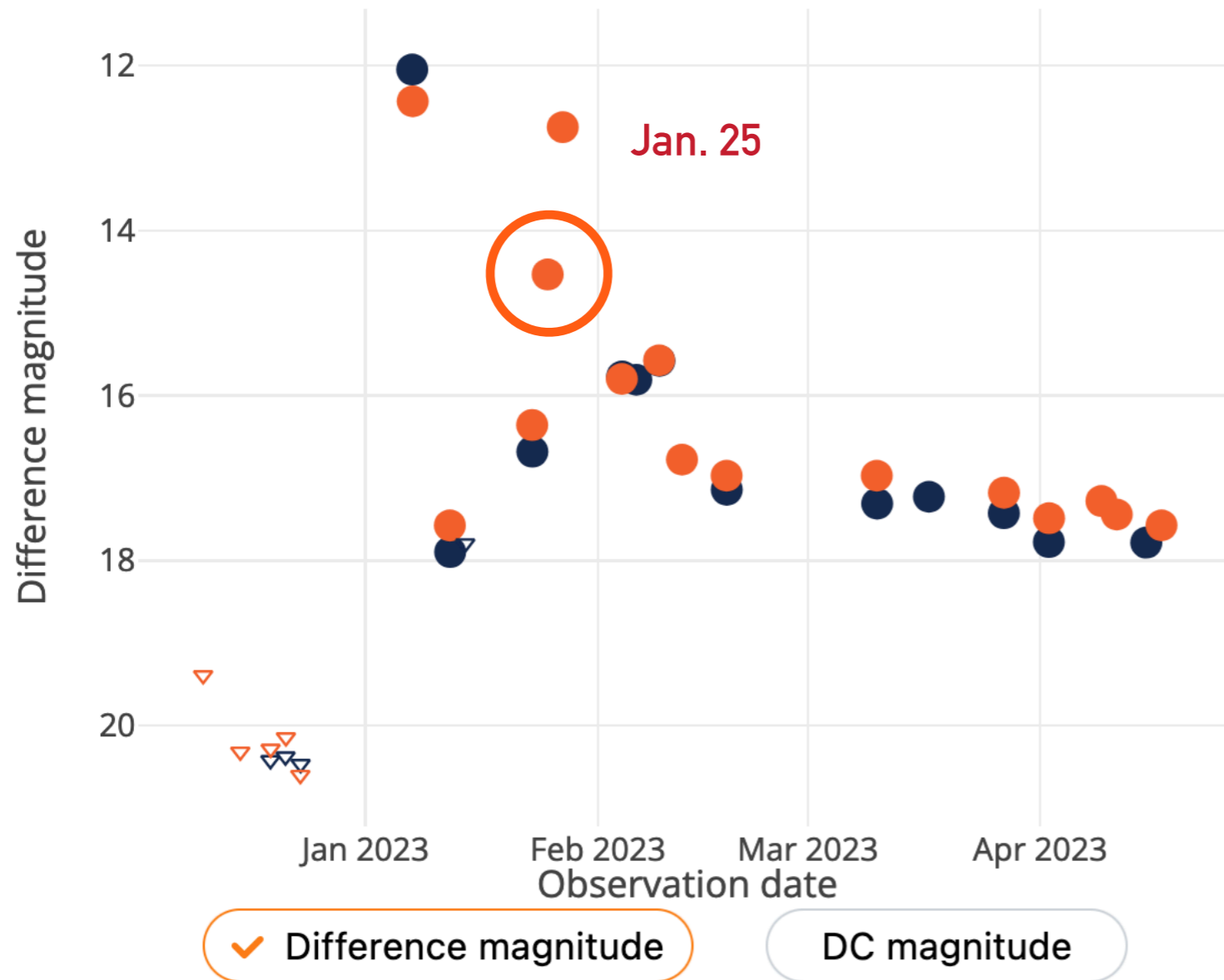


- ▶ 22 features (Malanchev et al., 2021  **SNAD**)
- ▶ Isolation forest applied to the LC features in both bands
- ▶ Resulting anomaly scores is averaged
- ▶ Domain expert analysis to discover and to debug

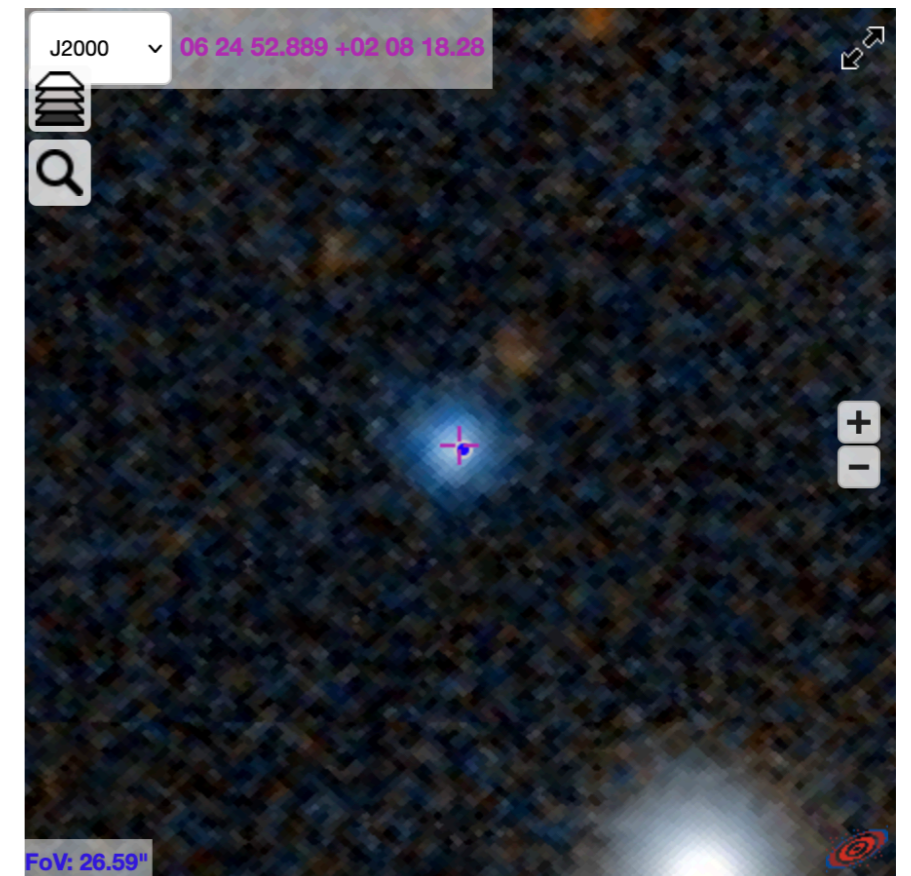
FIRST NIGHT – FIRST ANOMALY

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

● g band ● r band

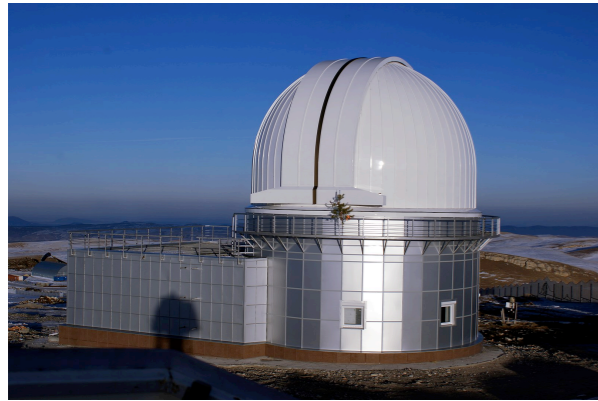


- ▶ ASASSN-23ac/PNV
J06245297+0208207
- ▶ Simbad: WD candidate



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

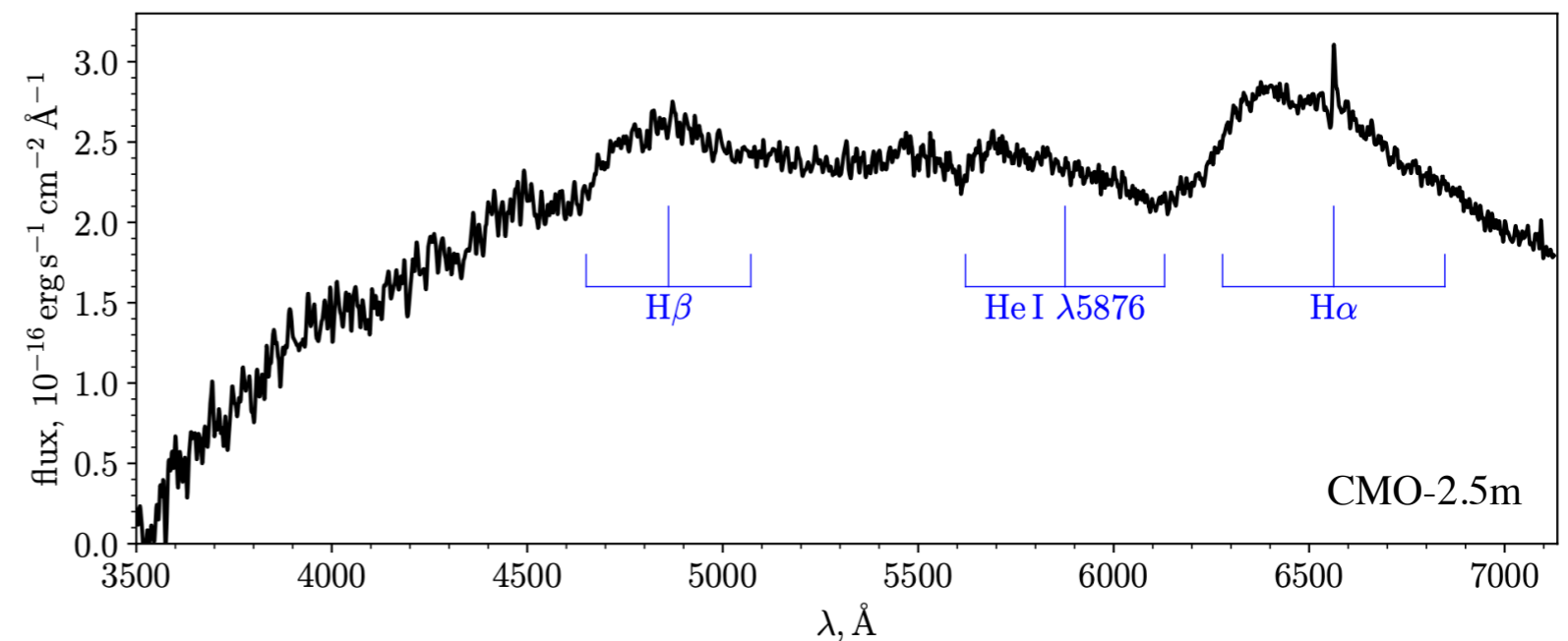
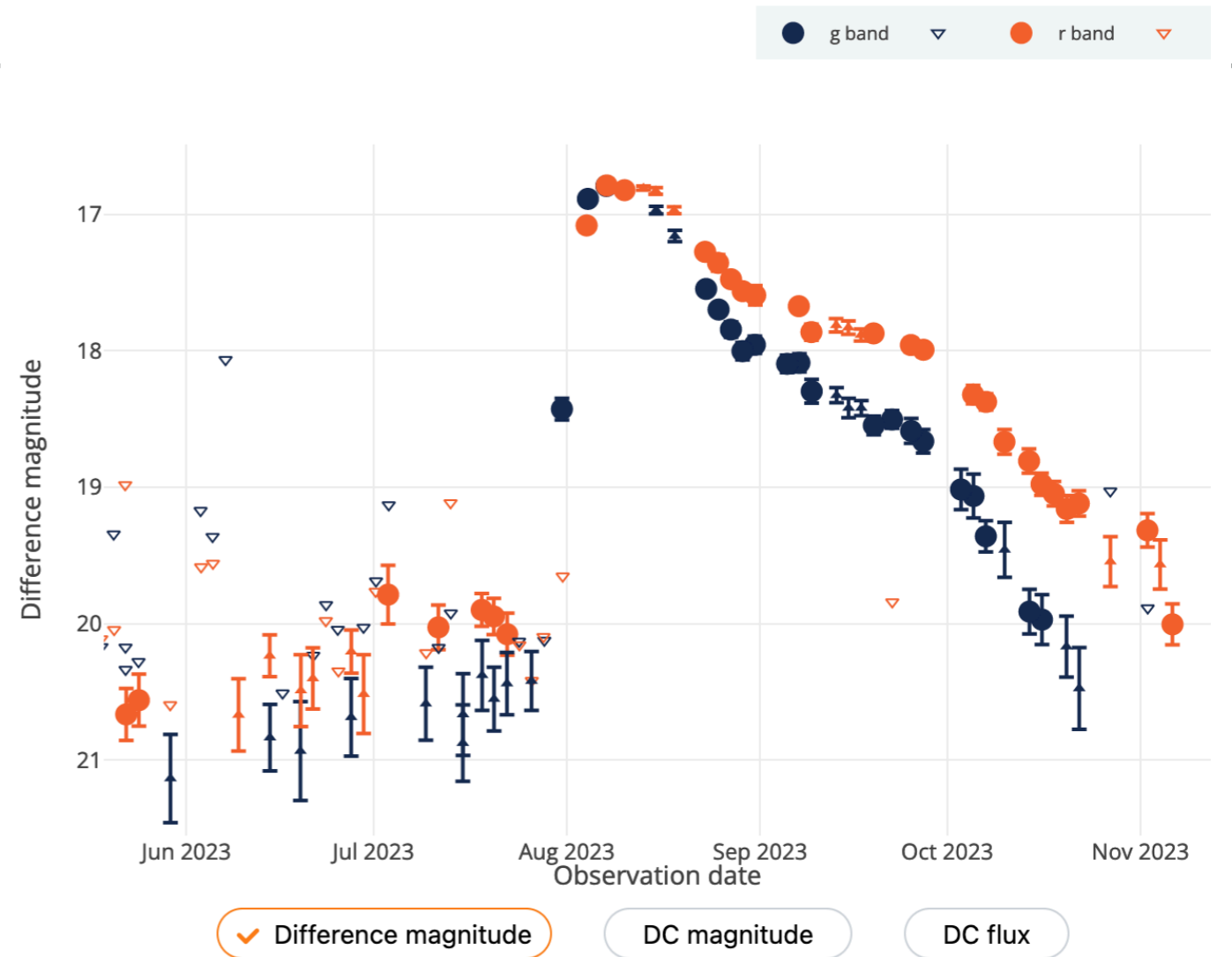


0.25M FRAM-ORM

RARE SUPERNOVA

<https://fink-portal.org/ZTF23aalftv>

- ▶ Featureless spectra
- ▶ Low-surface-brightness galaxy
- ▶ Redshift undefined
- ▶ Pre-cursor activity



Credit: A. Dodin, A. Belinskii

CATAclysmic VARIABLES



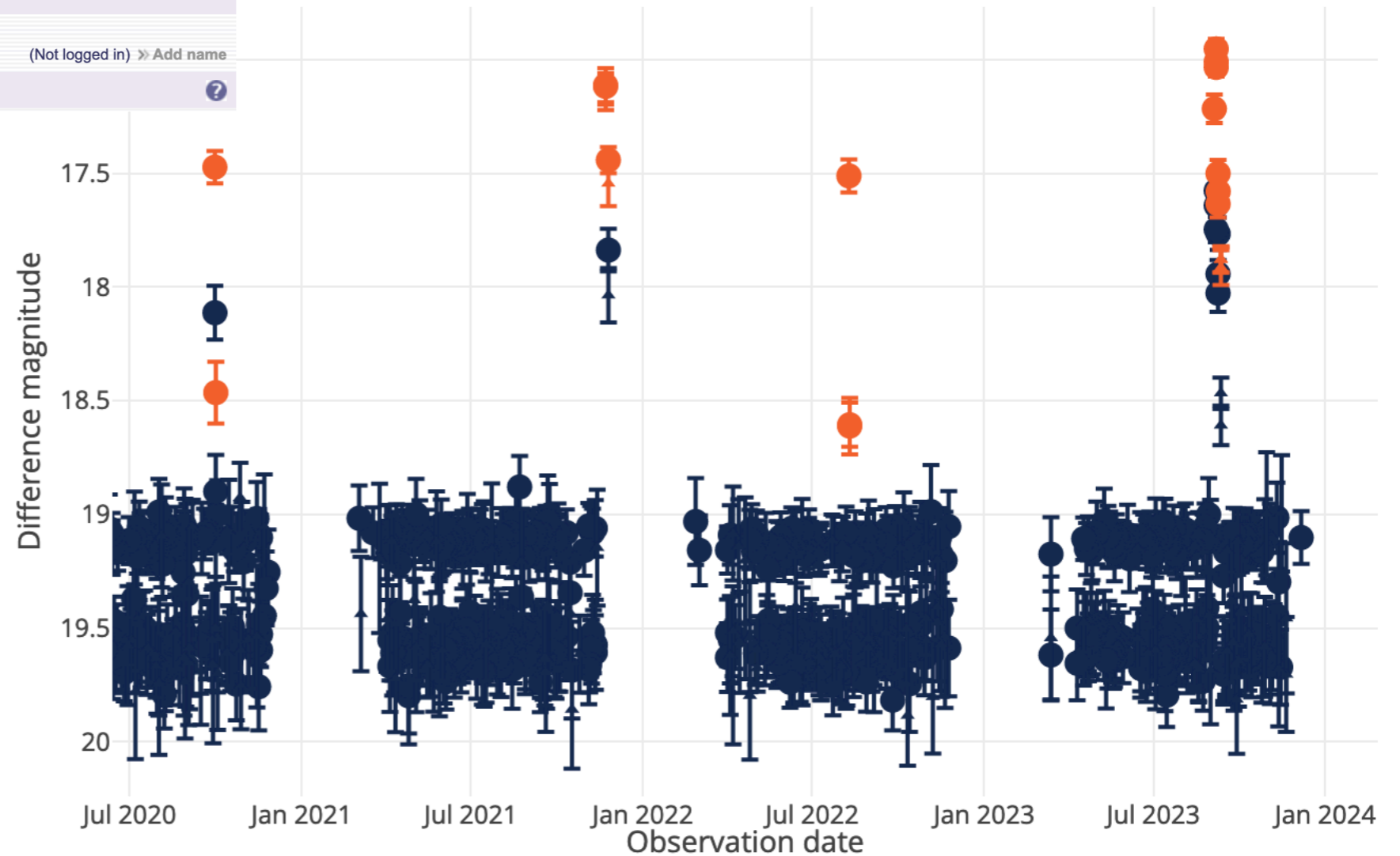
Latest Details

Log in to retrieve additional aliases from SIMBAD.

Name	ZTF18aayoyvo
AAVSO UID	000-BPS-433 (No observations)
Constellation	Cygnus » Sequence
J2000.0	20 34 40.21 +50 48 00.8 (308.66754 +50.80022) » Search nearby
B1950.0	20 33 10.42 +50 37 37.1
Galactic coord.	88.017 +6.227
Other names (Internal only)	Fink J203440.21+504800.8 (Not logged in) » Add name
Variability type	UG

<https://fink-portal.org/FinkJ194741.57+223702.3>

● g band ▾ ● r band ▾

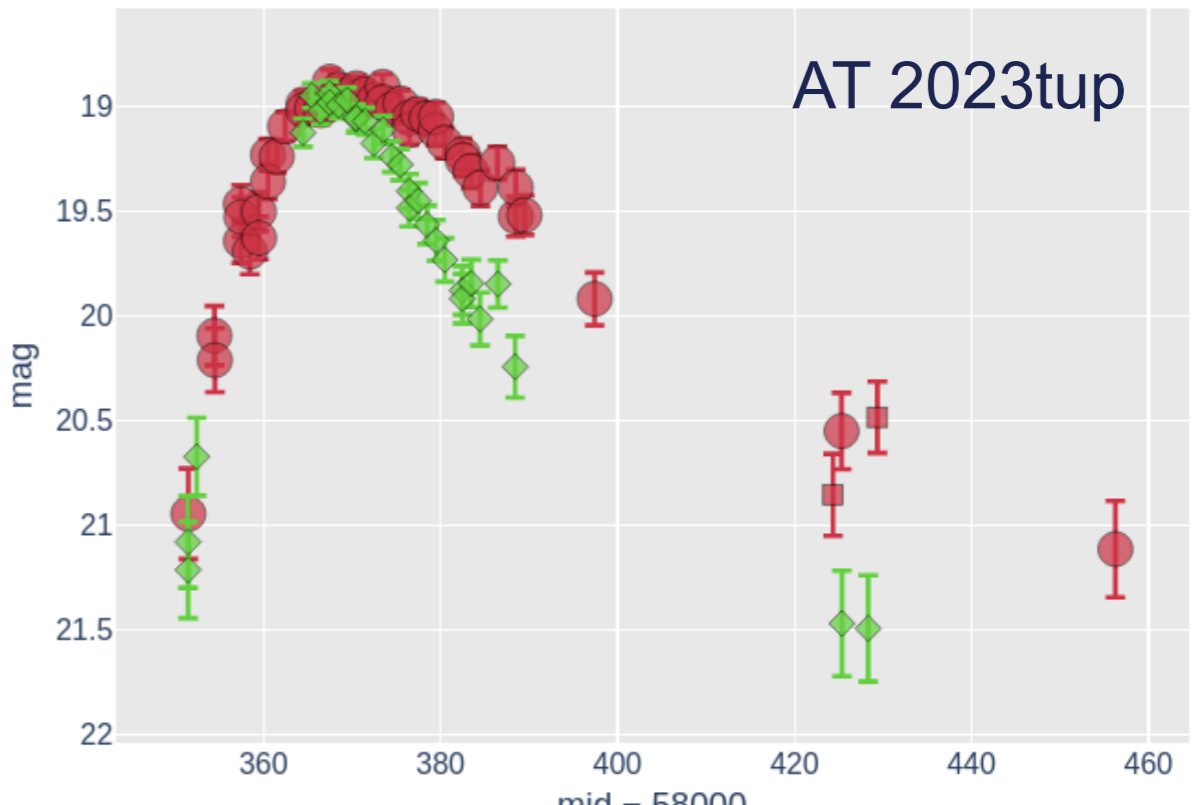
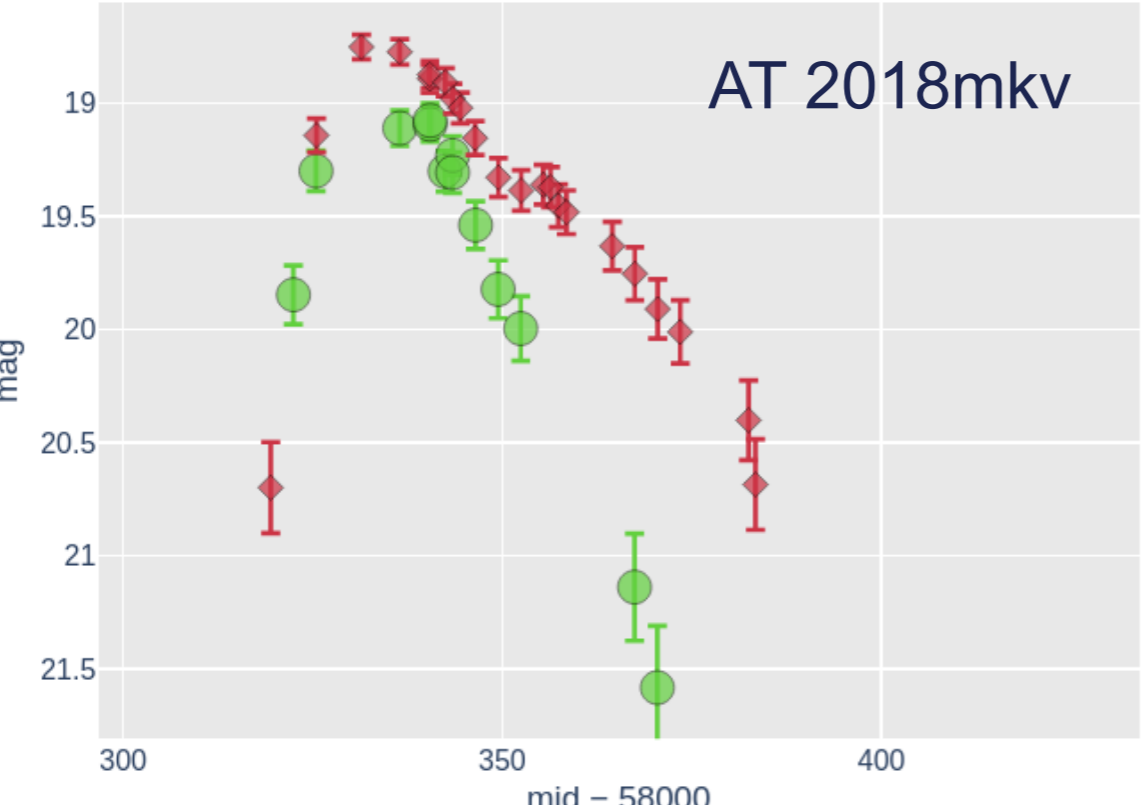
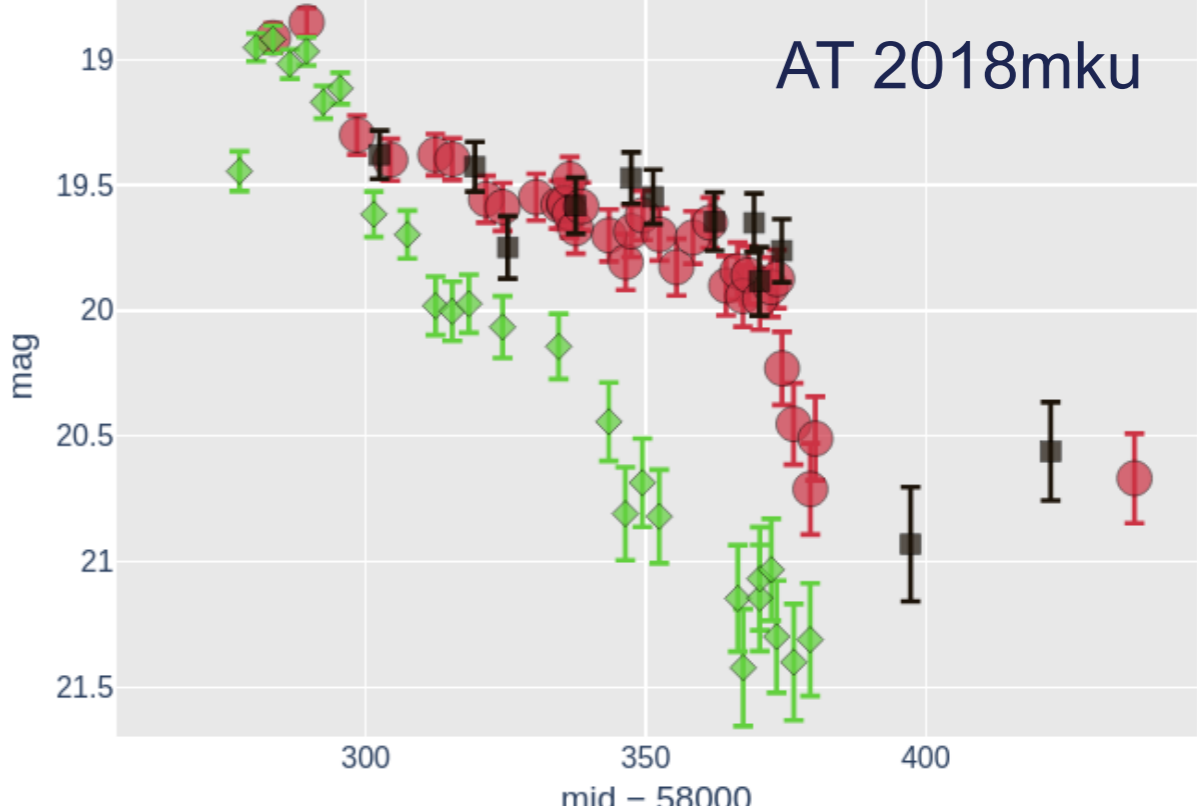
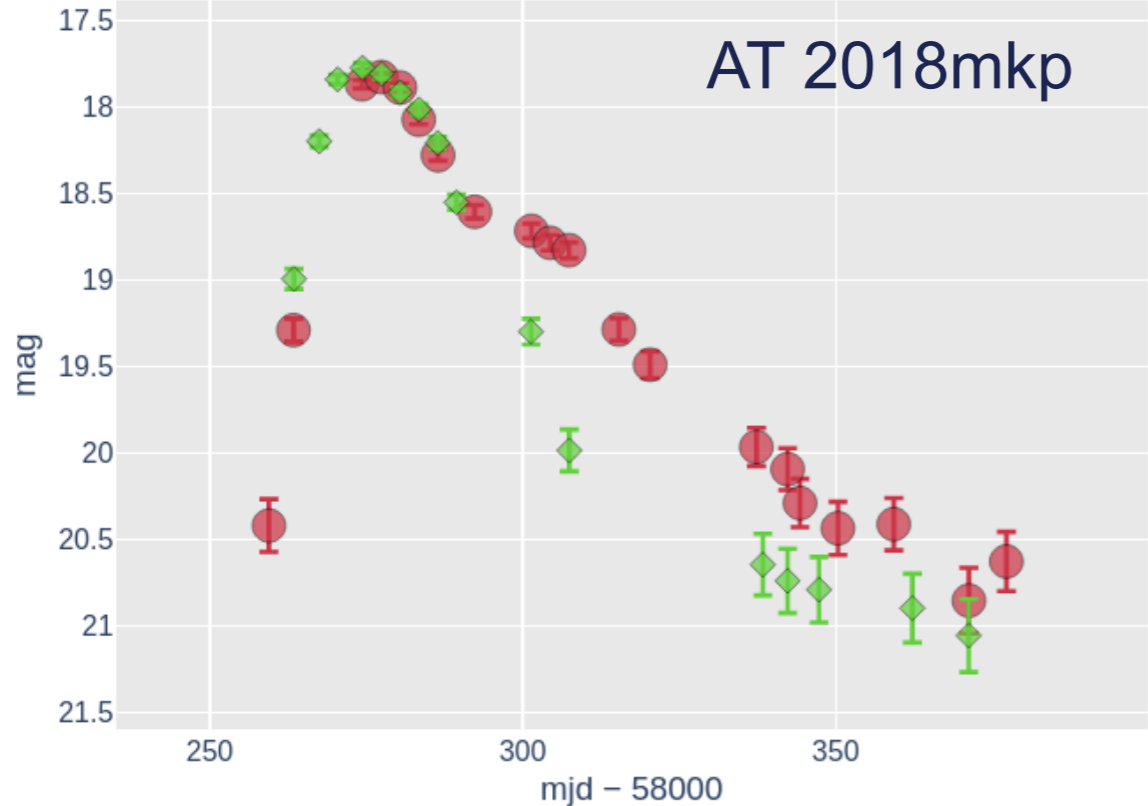


✓ Difference magnitude

DC magnitude

DC flux

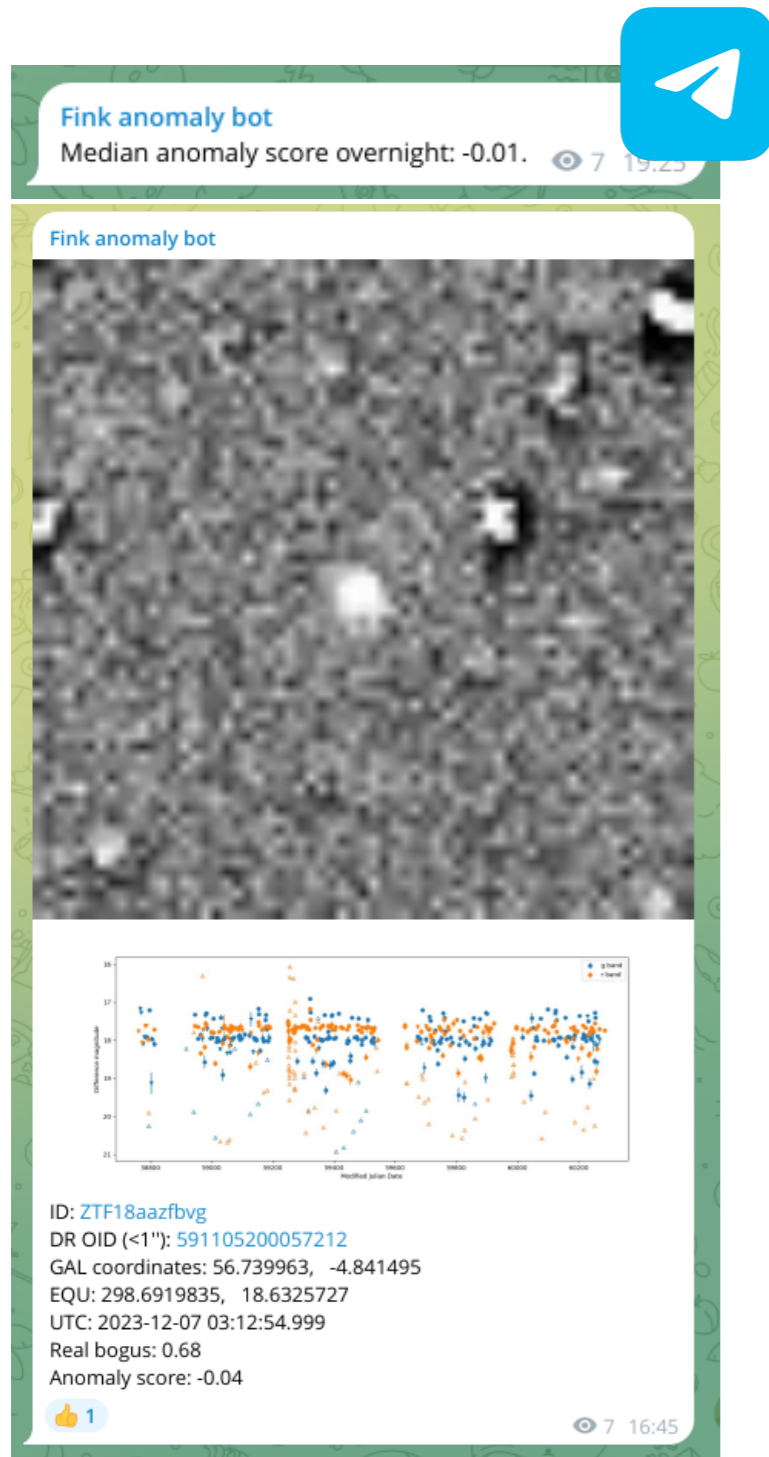
SUPERNOVAE



LCs are generated with SNAD ZTF Viewer

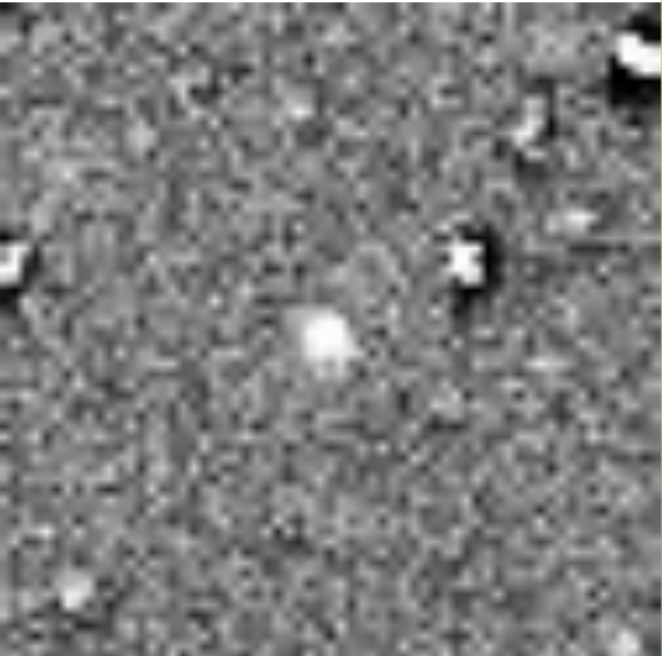
SLACK AND TELEGRAM BOTS

- ▶ TOP-10 anomalies each night

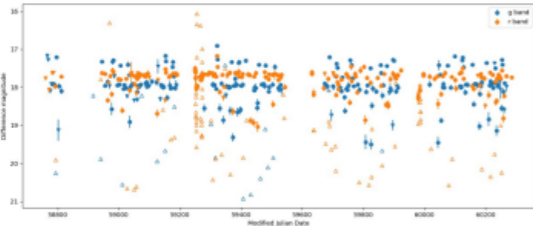


Fink anomaly bot
Median anomaly score overnight: -0.01. 7 19:25

Fink anomaly bot



ID: ZTF18aazfbvg
DR OID (<1"): 591105200057212
GAL coordinates: 56.739963, -4.841495
EQU: 298.6919835, 18.6325727
UTC: 2023-12-07 03:12:54.999
Real bogus: 0.68
Anomaly score: -0.04



1 7 16:45



Thread # fink_alert



Powerful app APP 20 hours ago

ID: ZTF23aaijdl

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

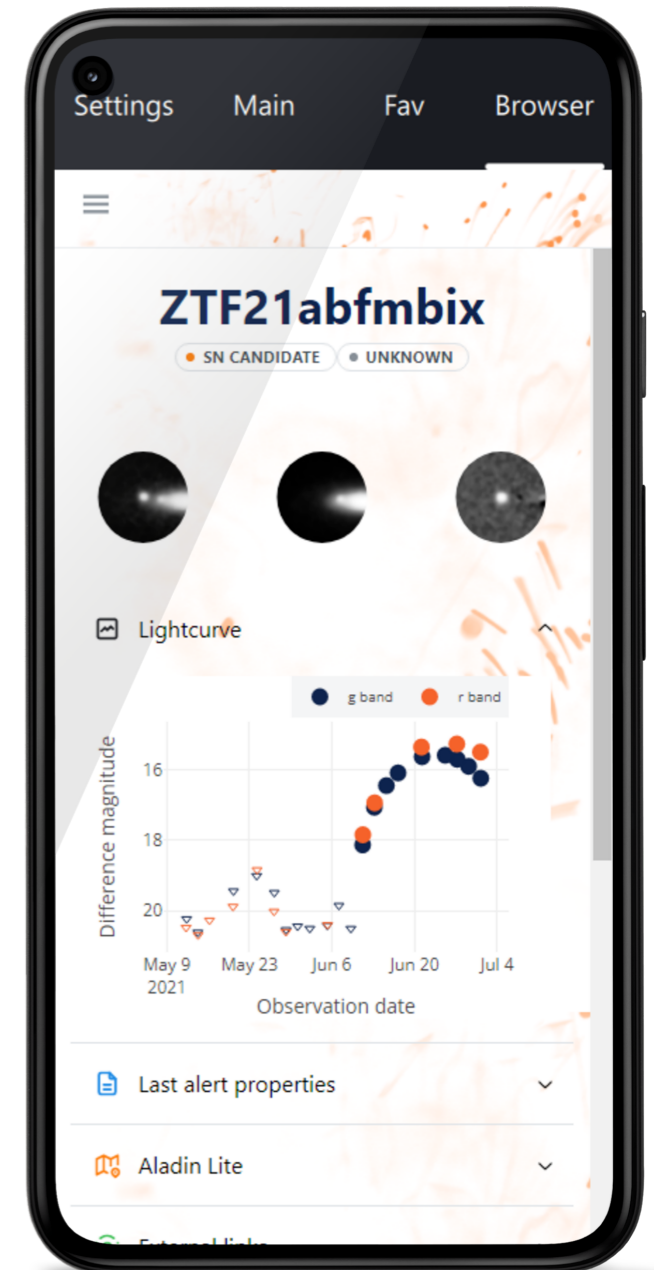
check it later – could be a rising supernova (edited)

B I

Reply...

Also send to # fink_alert


+ Aa



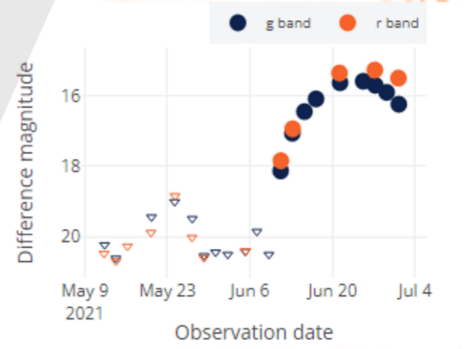
Settings Main Fav Browser

ZTF21abfmbix

SN CANDIDATE UNKNOWN



Lightcurve



g band r band

16
18
20
22

May 9 2021 May 23 Jun 6 Jun 20 Jul 4

Observation date

Last alert properties

Aladin Lite

Credit: Timofey Pshenichniy

ACTIVE ANOMALY DISCOVERY IN FINK

NEW!

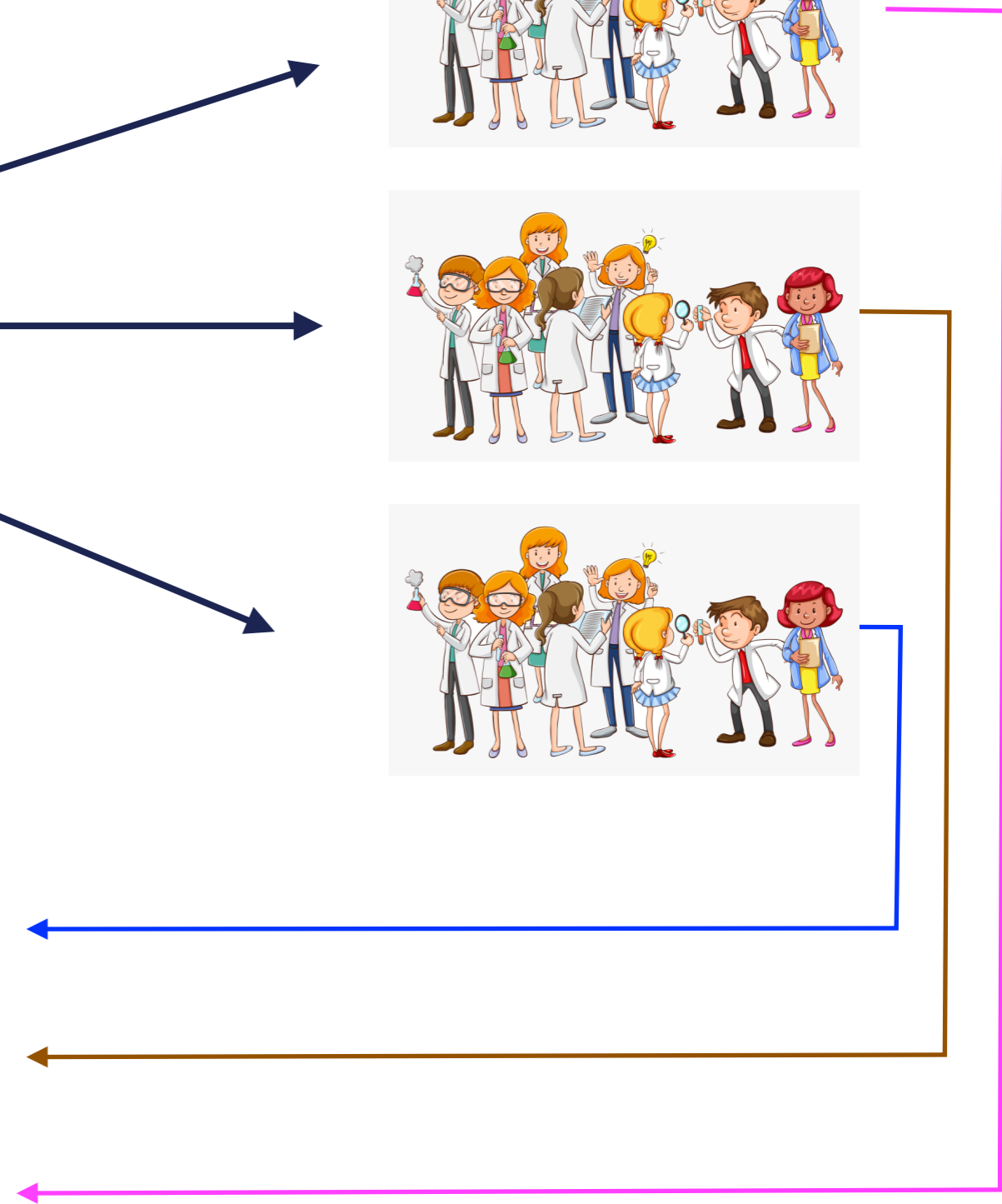
Active anomaly discovery in the alert stream
for **personalized** anomaly detection models



ANOMALY MODEL-1

ANOMALY MODEL-2

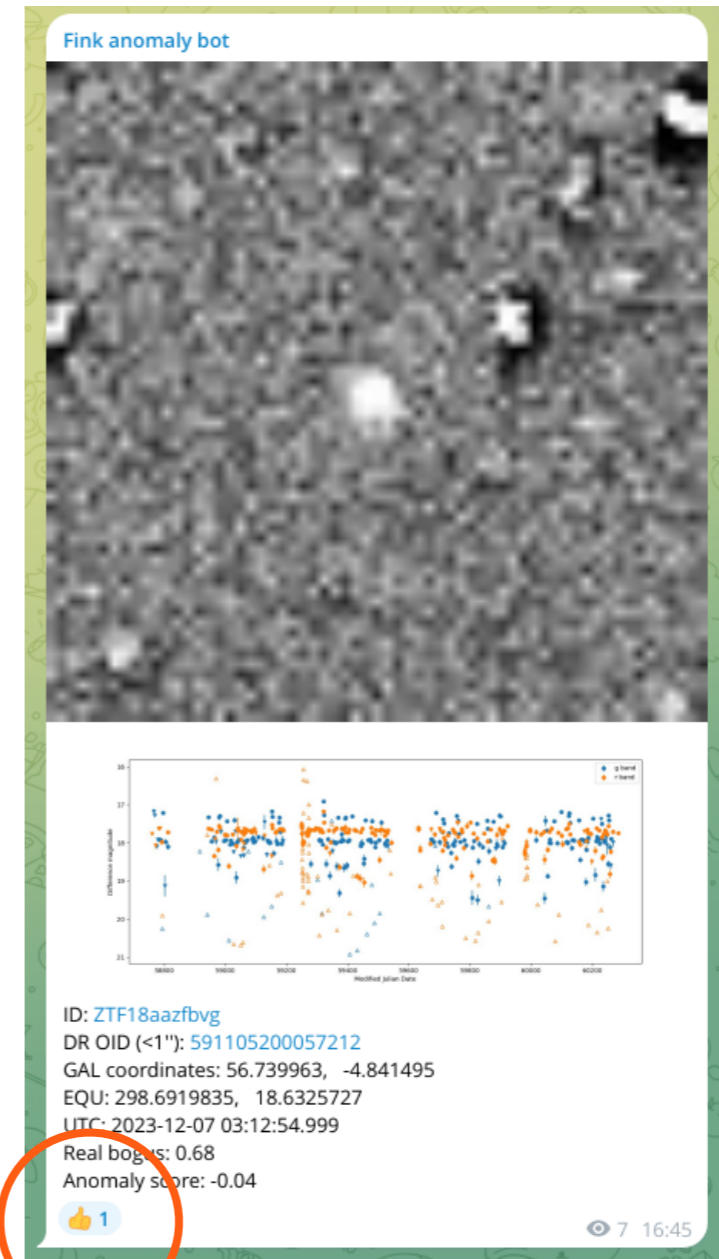
ANOMALY MODEL-3



ACTIVE ANOMALY DISCOVERY IN FINK

- ▶ User input through reactions
- ▶ Database maintenance
- ▶ User authentication
- ▶ Version control

Initial tests are promising!



SUMMARY

- ▶ Fink anomaly detection module is working and producing results
- ▶ Giving meaning to anomalies requires context
- ▶ A lot of infrastructure is necessary to allow coherent incorporation of expert's opinion
- ▶ Fink has been actively engaging community follow-up for exciting anomalies:
 - ▶ AT2023awt: 9.2m SALT (South Africa), 0.6m and 2.5m KGO (Russia), 0.25m FRAM-ORM (Spain)
 - ▶ SN 2023mtp: 2.5m KGO (Russia)
- ▶ In the era of Rubin, serendipitous discoveries will not happen



Stay tuned and join the channels!