Welcome!

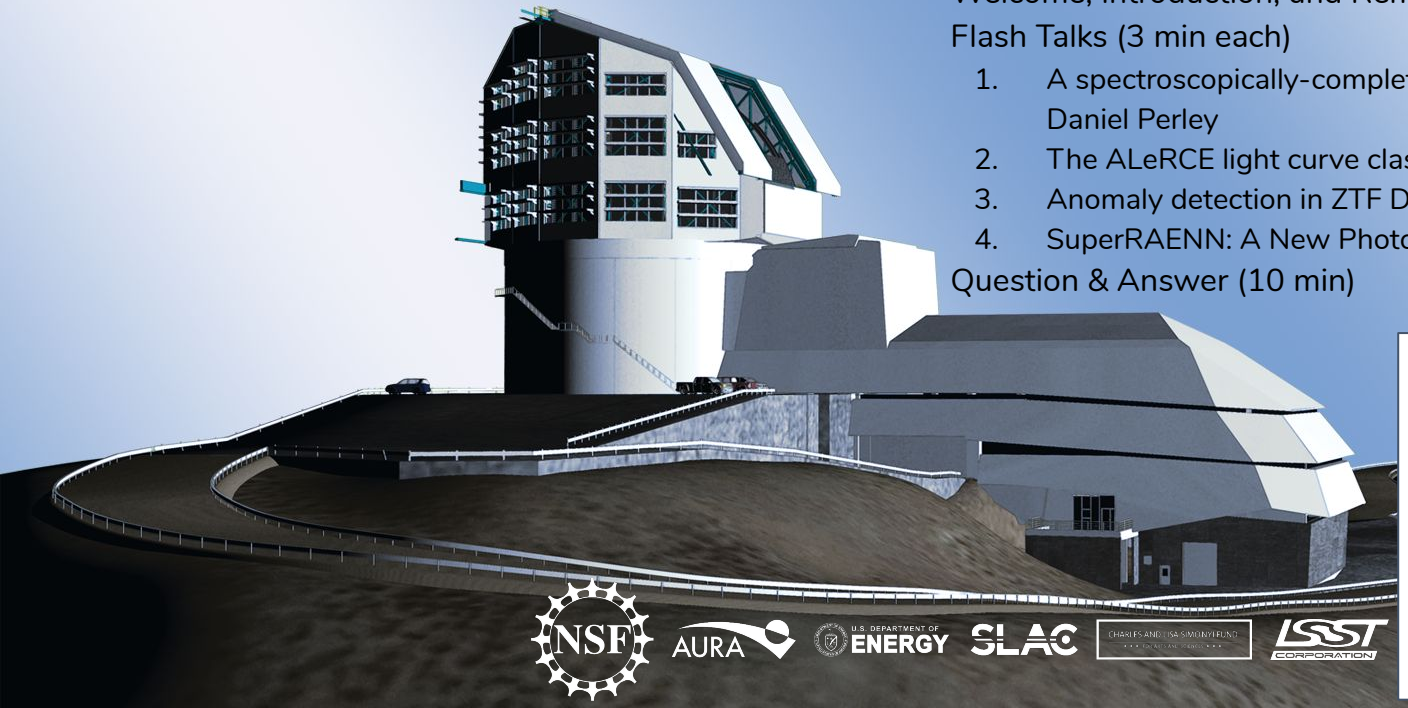
RRB H. Transient Classification

Tue Aug 11, 10:30am-11:30am

Chairs: Emille Ishida and Márcio Catelan

Slack: #day2-tue-slot2h-rrb-transient-classification

Rubin Observatory



Agenda (30 min)

Welcome, Introduction, and Reminders (5 min)

Flash Talks (3 min each)

1. A spectroscopically-complete sample of bright ZTF transients, Daniel Perley
2. The ALeRCE light curve classifier, Paula Sánchez Sáez
3. Anomaly detection in ZTF DR3, Konstantin Malanchev
4. SuperRAENN: A New Photometric Classifier, Ashley Villar

Question & Answer (10 min)

Attendees: Please mute!

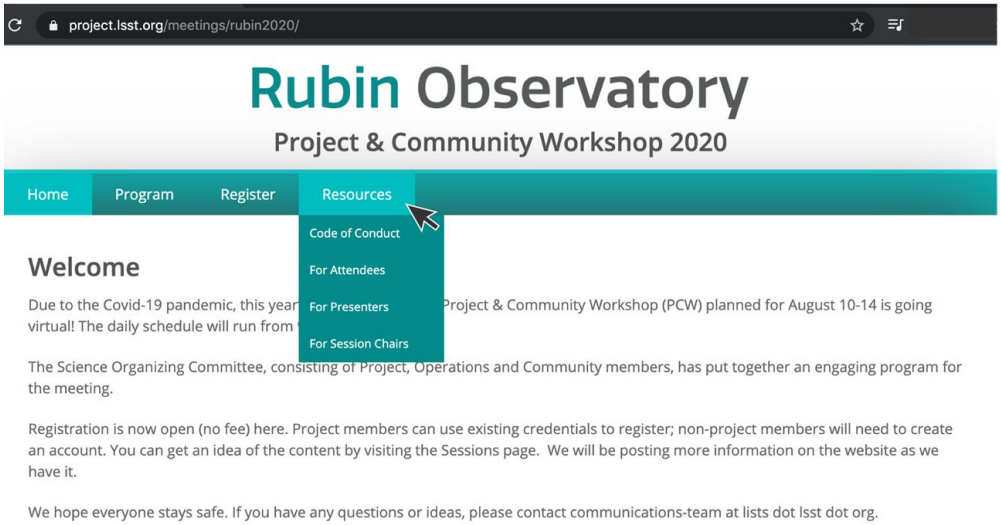
For the Q&A, ask questions via the Zoom chat or the Slack channel, and wait for the chair to invite you to unmute.

We apologize if there is not enough time for all questions; please continue discussions via Slack!

Friendly Reminders

Rubin Observatory

You agreed to abide by the Code of Conduct at registration - it can be found here on the website



Rubin adheres to the principles of Kindness, Trust, Respect, Diversity and Inclusion in order to provide a learning environment that produces rigor and excellence.

Any discriminatory behavior against colleagues on any basis, such as gender, gender identity, race, ethnic background, national origin, religion, political affiliation, age, marital status, sexual orientation, disabilities or any other reason will not be tolerated.

If I witness any form of bullying, harassment or aggression I will follow the reporting instructions in the Code of Conduct.

Friendly Reminders

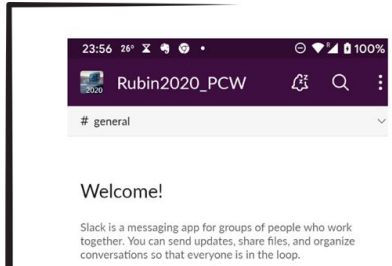
Rubin Observatory

All talks at this workshop will be recorded.

If you do not wish to be recorded, you are welcome to keep your camera off.

Videos are posted the next working day.

Each session will be posted on YouTube and embedded on the session's page.



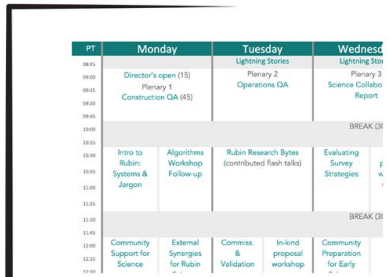
Ask questions through the Slack channel or the Zoom chat.

Give Slack questions a thumbs-up.

Questions with more thumbs up may get priority if time runs short.

Show your appreciation.

Feel free to applaud at any time but especially at the end - Slack has a clap emoji.



You can access the presentation material on the session page.

A spectroscopically-complete sample of bright ZTF transients (Daniel Perley, LJMU)

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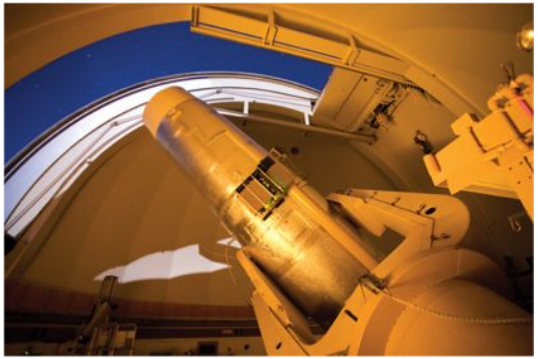
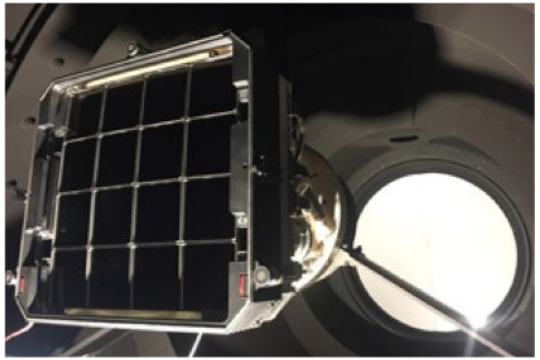
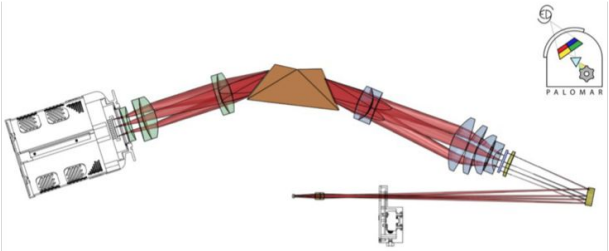
The Zwicky Transient Facility:

- 1.2m telescope
- 47 deg^2 camera
- m_{lim} ~ 20.5
- Dedicated follow-up spectrograph (SEDM)







ZTF Northern Sky Survey:

- ~18000 deg^2 in g/r filters, at 3d cadence
- Difference alerts (avro) sent to public brokers

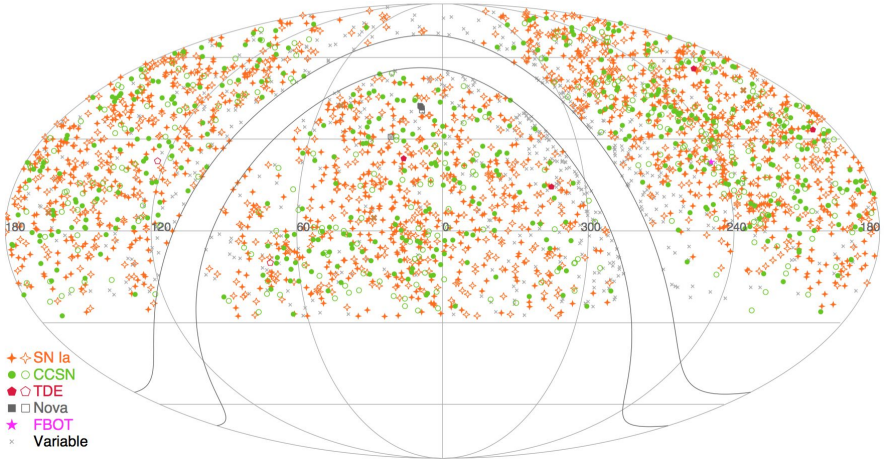
A spectroscopically-complete sample of bright ZTF transients (Daniel Perley, LJMU)

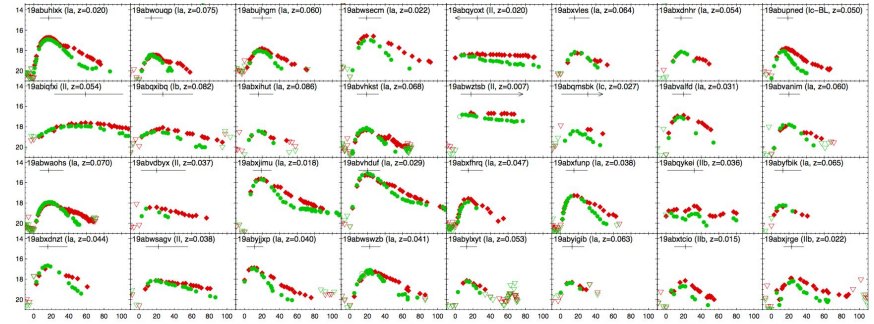
Rubin Observatory

The ZTF **bright transient survey**:

- Catalog all transients with m<19.0
- Classify all transients with m<18.5
- June 2018 - present
- As of yesterday:
  - 3275 SNe (2360 Ia, 915 CC)
    14 TDE, 11 "gap", 10 novae
    93% complete at m<18.5*
- Light curves and full alert histories also available via brokers; classification spectra via TNS

*for "quality" subset (~half of sample)





#rubin2020

A spectroscopically-complete sample of bright ZTF transients (Daniel Perley, LJMU)

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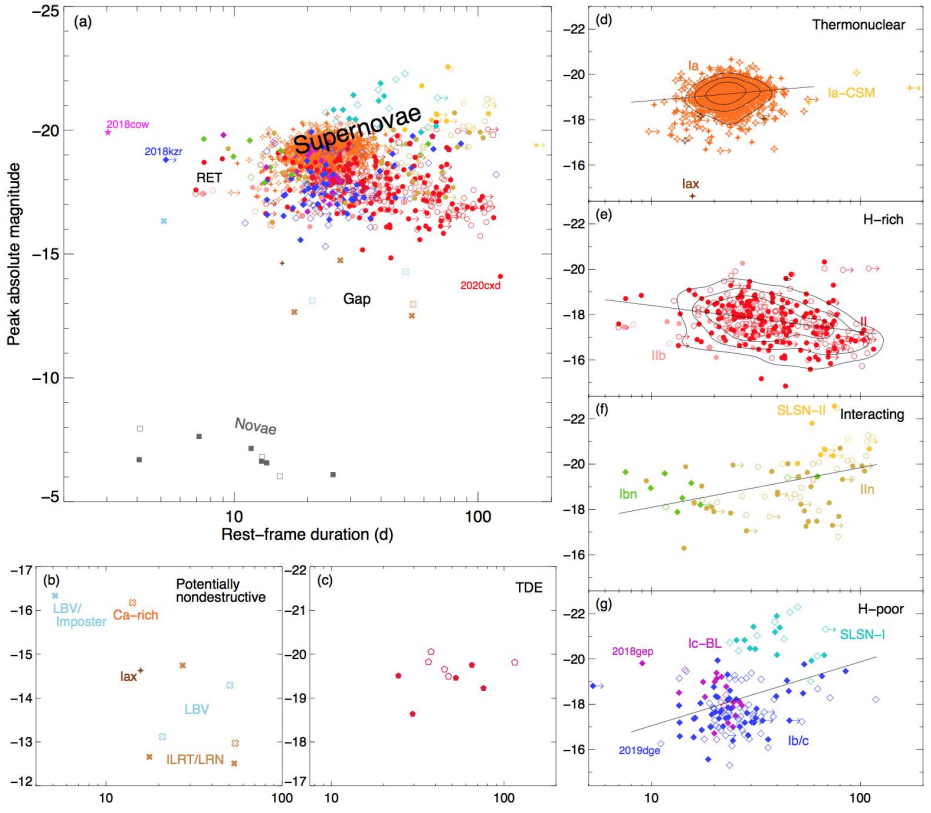
High-quality light curves:
easy to calculate luminosities, timescales, etc.

The interactive catalog is online and updated in real time:

https://www.astro.caltech.edu/ztf/bts/bts.php

https://www.astro.caltech.edu/ztf/bts/explorer.php

BTS Paper I: Fremling et al., ApJ 895:32
(Add'l papers coming soon)



#rubin2020

Paula Sánchez Sáez

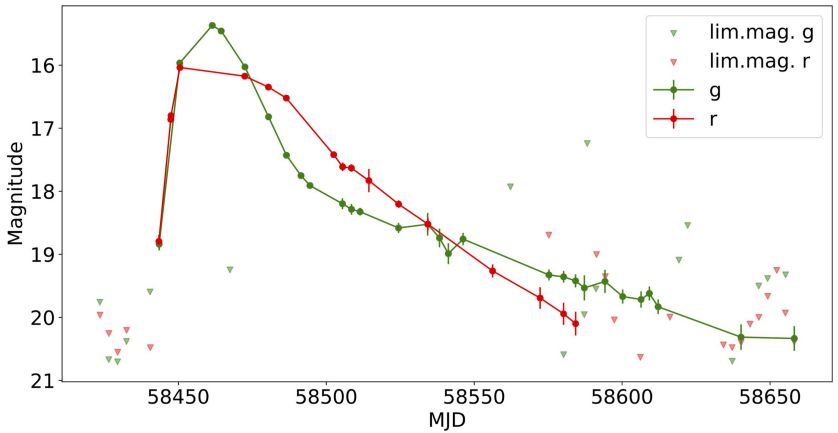
The ALeRCE Light curve classifier

Balanced Hierarchical Random Forest
(for objects with 6 or more alerts in a given ZTF band)

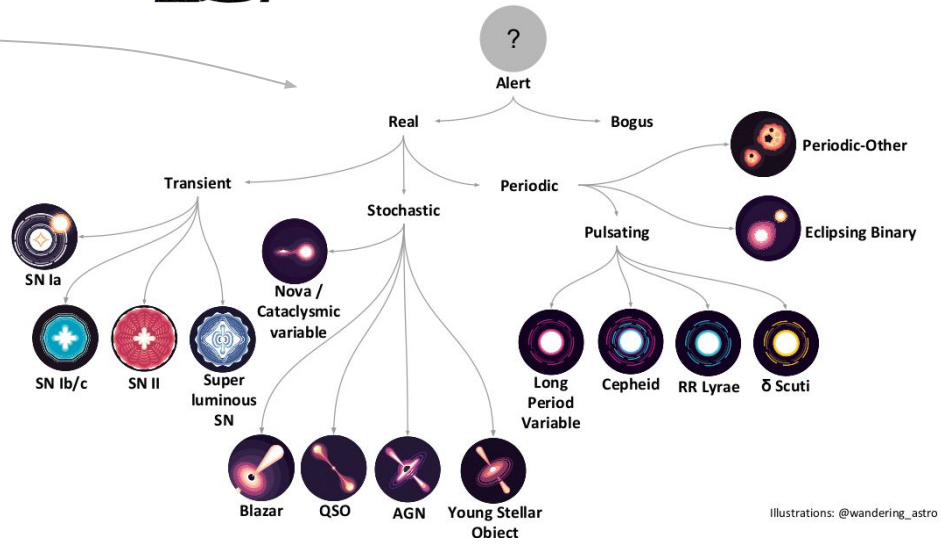
Sánchez-Sáez et al. 2020, submitted to AJ

Stamp classifier

Light curve classifier

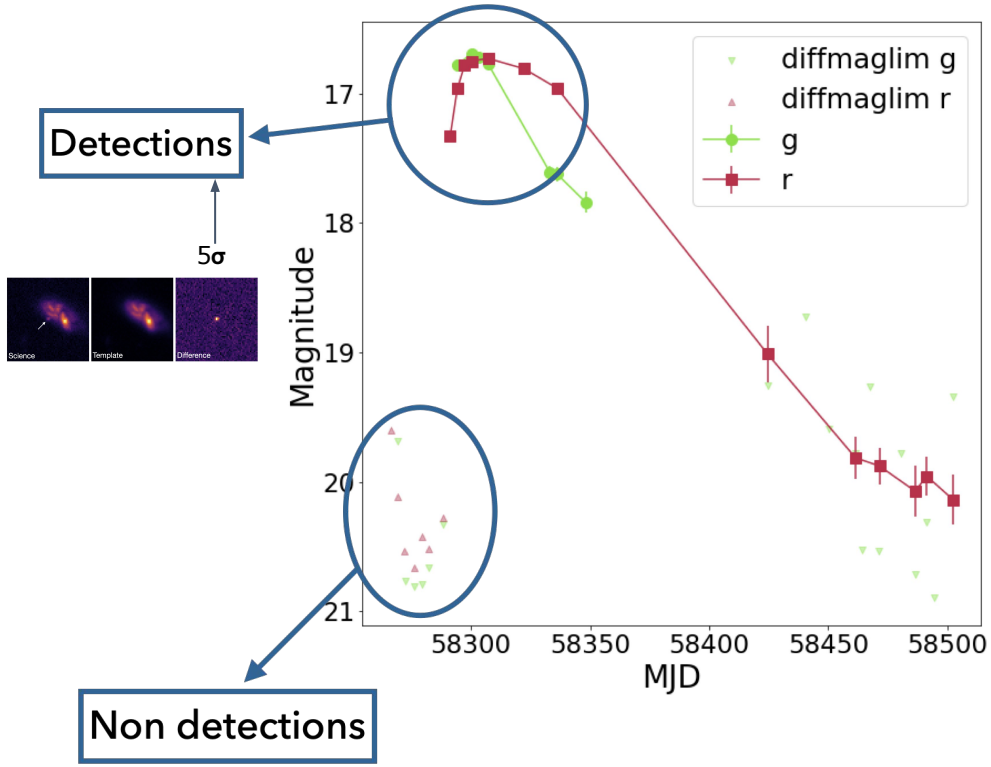


ZTF → LSST



Paula Sánchez Sáez

The ALeRCE Light curve classifier



Sánchez-Sáez et al. 2020, submitted to AJ

152 features in total:

- **Detection features: g and r ZTF band variability features (124)**
  - Supernova parametric model (SPM; adapted from Villar et al. 2019b)
  - Multiband period (adapted from Mondrik et al. 2015)
  - Irregular autoregressive model (IAR; Eyheramendy et al. 2018)
  - Mexican Hat Power Spectrum (MHPS; adapted from Arévalo et al. 2012)
- **Non detection features: from g and r ZTF band magnitude limits (18)**
- **Other: WISE colors, morphology, etc. (10)**

ZTF → LSST

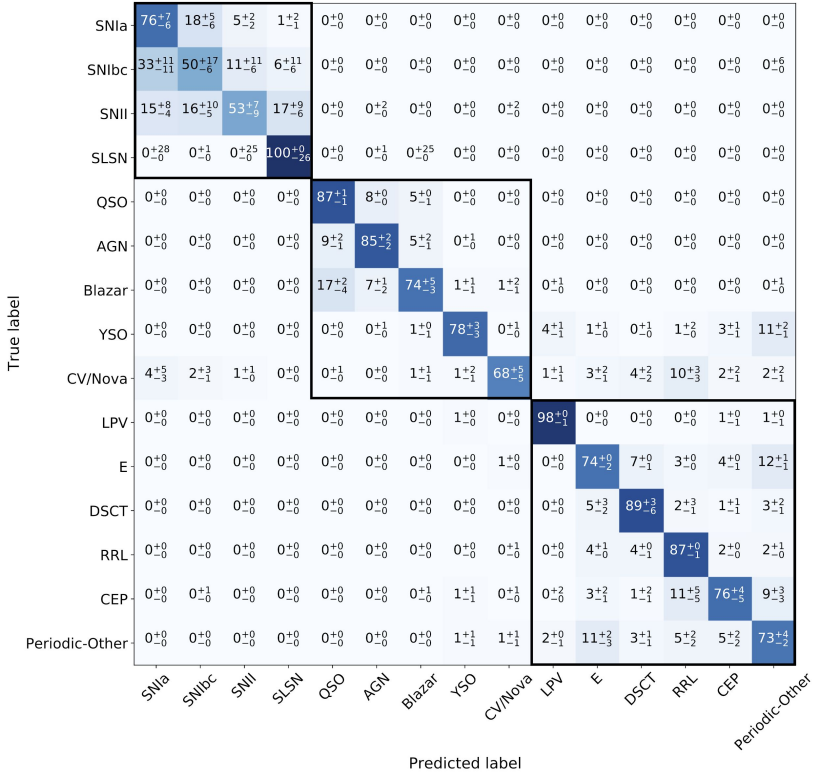
Paula Sánchez Sáez

The ALeRCE Light curve classifier

ALeRCE
Automatic Learning for the Rapid Classification of Events

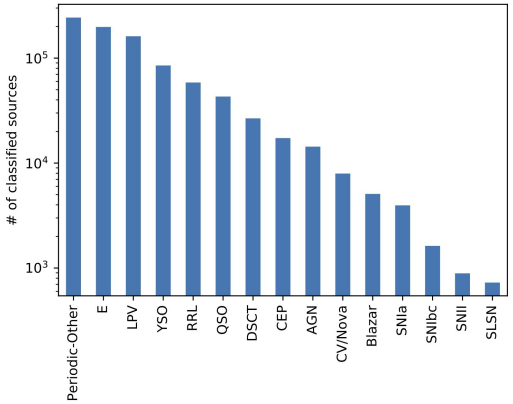
Rubin Observatory

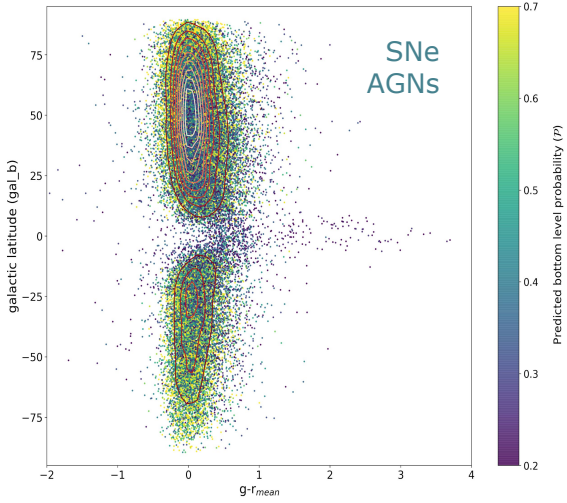
Confusion matrix



ZTF → LSST

Results for the ZTF unlabeled set





Sánchez-Sáez et al. 2020, submitted to AJ

Anomaly detection in ZTF DR3

Rubin Observatory

Konstantin Malanchev[MSU, UIUC]
on the behalf of the SNAD (https://snad.space) team:
Patrick Aleo, Emille Ishida, Matwey Kornilov, Vladimir Korolev, KM, Florian Mondon, Maria Pruzhinskaya, Sreevarsha Sreejith, Alina Volnova

Data

Three ZTF DR3 fields: one in the Galaxy plane, one outside it, one contains M31

2.25 million light curves with hundreds of observations in *zr* passband

Method

Anomaly detection algorithms yields 277 candidates which were manually examined

Results

New SNe, AGNs, YSOs, etc candidates; Pop II Ceph candidate; and a lot of artifacts

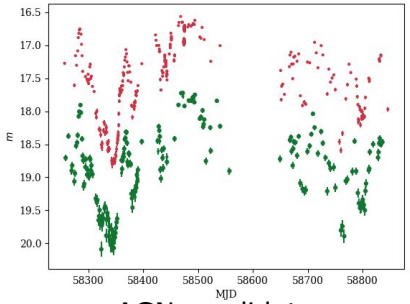
Conclusion

Anomaly detection provides some interesting objects without any prior information

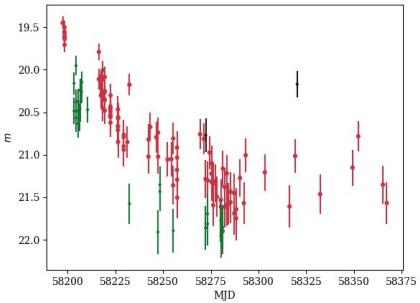
Preliminary results are published in RNAAS (Aleo et al. 2020)

The work is supported by the RFBR grant 20-02-00779

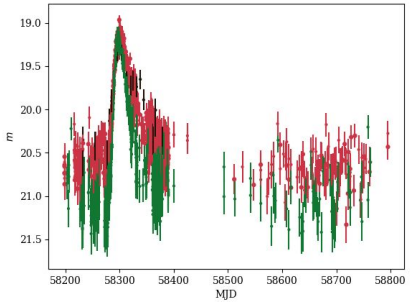
Examples: transients



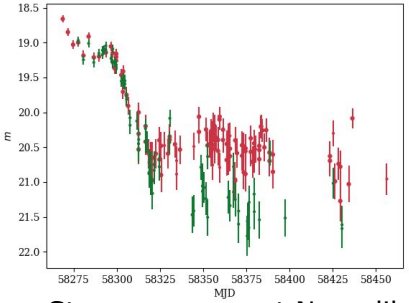
AGN candidate



QSO/SN/SLSN/AGN



SN Ia candidate



Strange recurrent Nova-like

Anomaly detection in ZTF DR3

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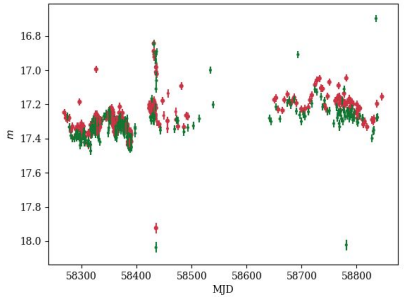
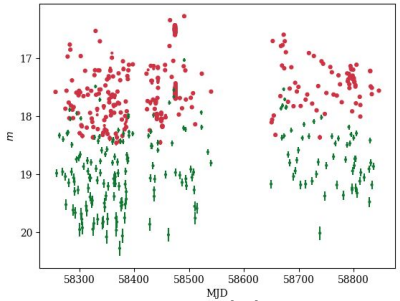
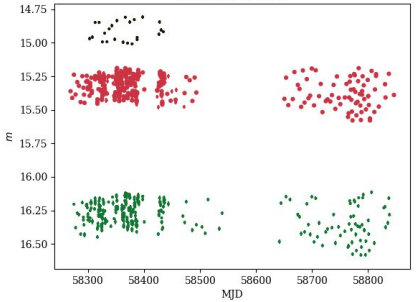
Examples: stellar objects



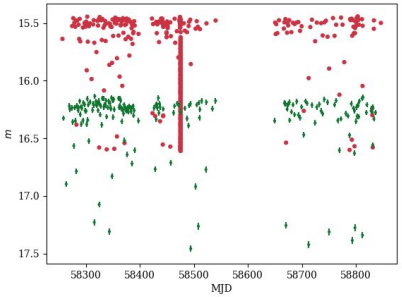
LBV candidate



YSO candidate



Pop II Ceph candidate



Algol-like

Anomaly detection in ZTF DR3

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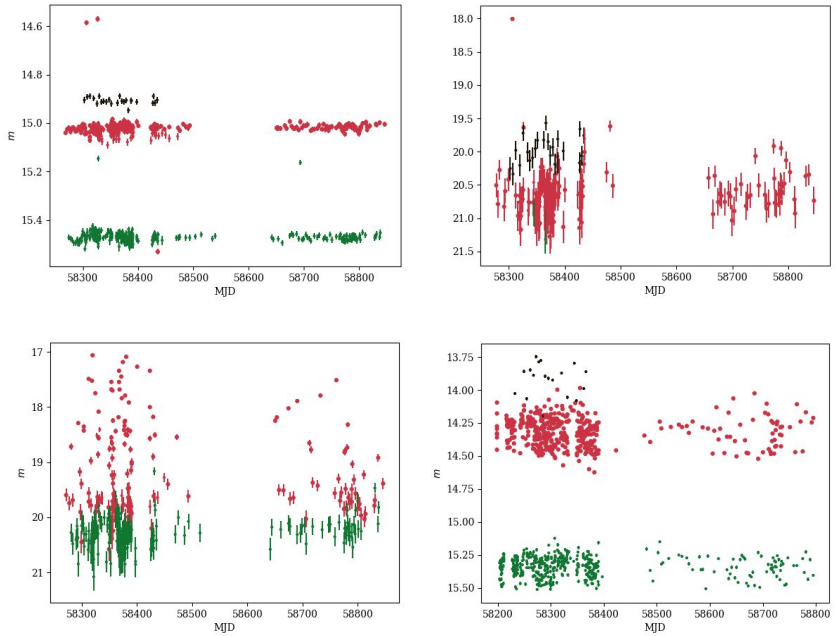
Examples: unclassified objects

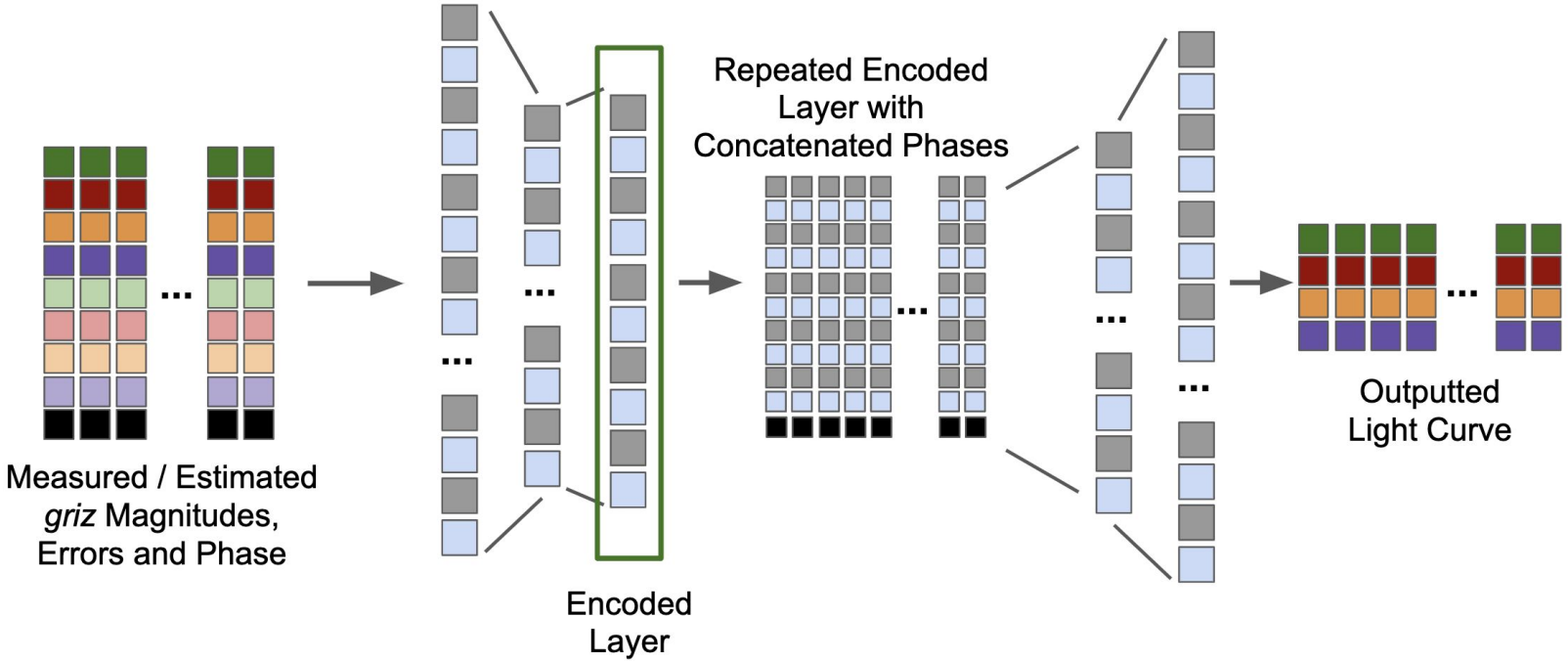


- Villar et al. (2020) and Hosseinzadeh et al. (2020) will present a sample of Pan-STARRS1 Medium Deep Survey SN-like transients and host spectra

- 5,243 SNe-like transients in PS1 MDS (Jones+2017)
- **2,885** events have reliable host redshift measurements
- **557 SNe** are spectroscopically classified with host redshift measurements

V. Ashley Villar

SuperRAENN: A new, semi-supervised classifier



SuperRAENN uses a novel recurrent autoencoder NN to extract light curve features, and is open source (https://pypi.org/project/superraenn/)

SuperRAENN is currently being adapted to work with live ZTF data streams...stay tuned!

Thanks!