



ALeRCE

Automatic Learning for the
Rapid Classification of Events



G. Cabrera-Vives; F. Förster; F. E. Bauer; A. Bayo; M. Catelan; P. A. Estévez; S. Eyheramendy; P. Huijse; G. Pignata; P. Sánchez-Sáez; A. Muñoz-Arancibia; L. Hernández-García; I. Reyes; A. Álvarez; C. Mansilla; E. Pizarro; E. Muñoz; H. Larragaña; K. Medina; B. Gamboa; A. Mourao; J. Borissova; A. Clocchiatti; F. Elorrieta; R. Kurtev; P. Lira; J. Vergara; M. Contreras; R. Dastidar; J. Pineda; J. Silva; D. De Cicco; C. Donoso-Oliva; M. J. Graham; A. Mahabal; W. Palma; M. Pérez-Carrasco; A. Papageorgiou; P. Protopapas; E. Vera; A. Jordán; R. Roa; A. Rodríguez

CMM
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Modeling



DO
DATA OBSERVATORY





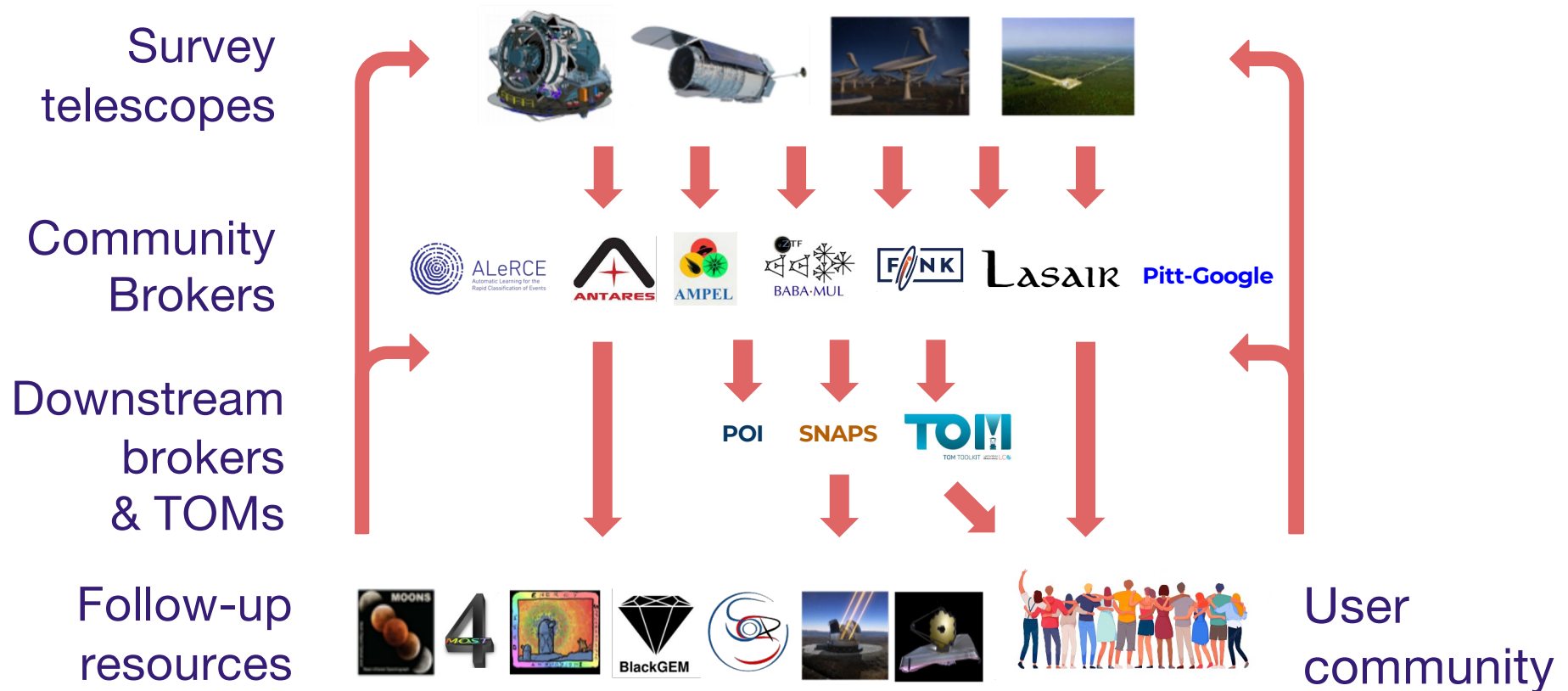
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Brokers

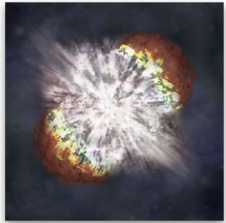


The Future Time Domain Ecosystem





Scientific questions



Transients

Progenitors of stellar explosions (outermost layers) & explosion physics (ejecta structure).

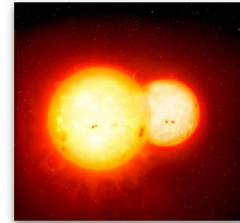
How does the Universe expand?



Active Galactic Nuclei

Changing state AGNs, reverberation mapping, detection of intermediate mass black holes, tidal disruption events.

What is the nature of accretion in supermassive black holes?



Variable stars

Microlensing events, changing mode stellar pulsators, rapid reaction to eclipsing events, eruptive events.

How is matter distributed in our galaxy?



Solar System

Near earth objects, size distribution, collisional or rotational disintegration.

How was the solar system formed?



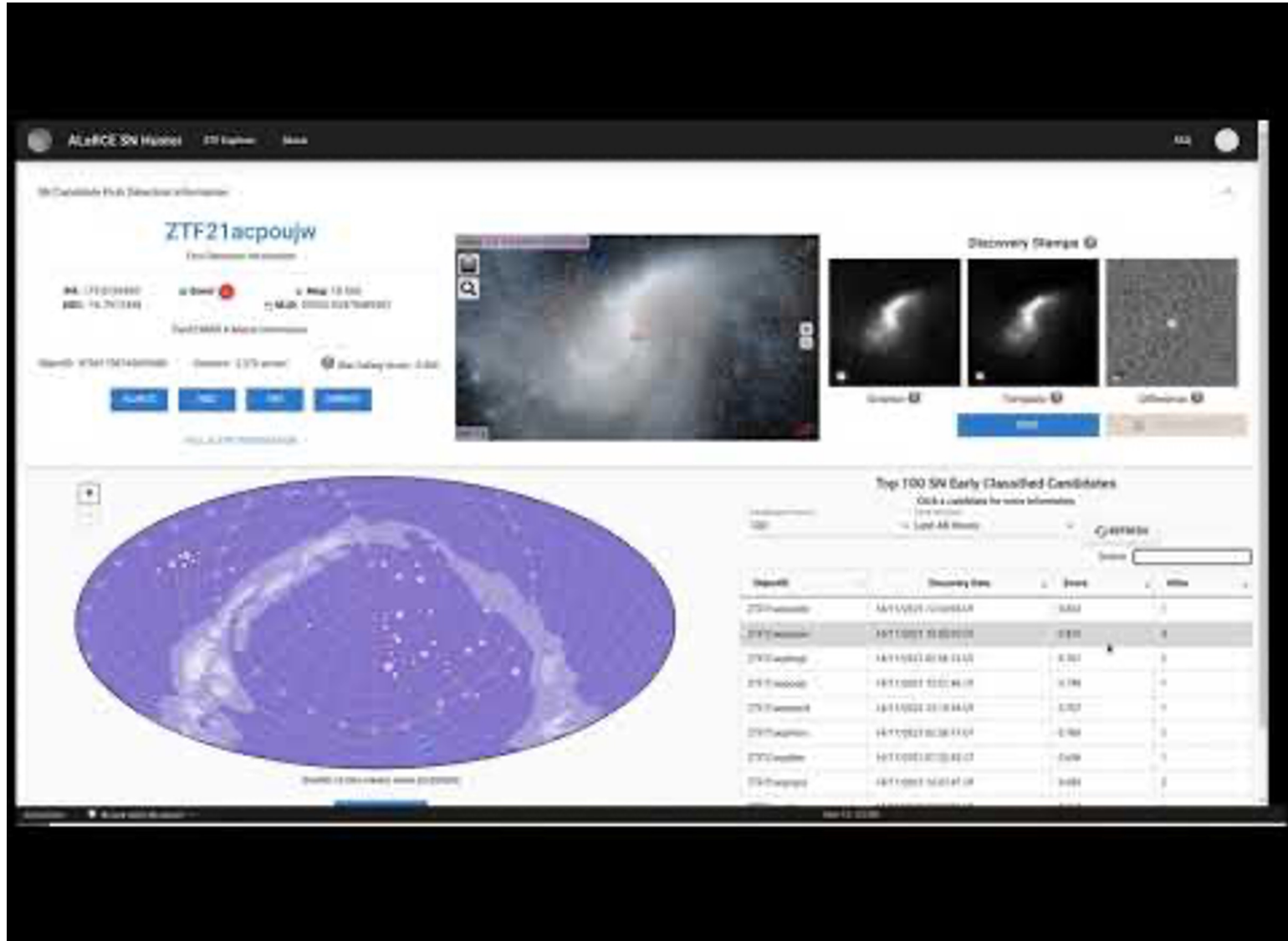
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Tools



<https://snhunter.alerce.online>

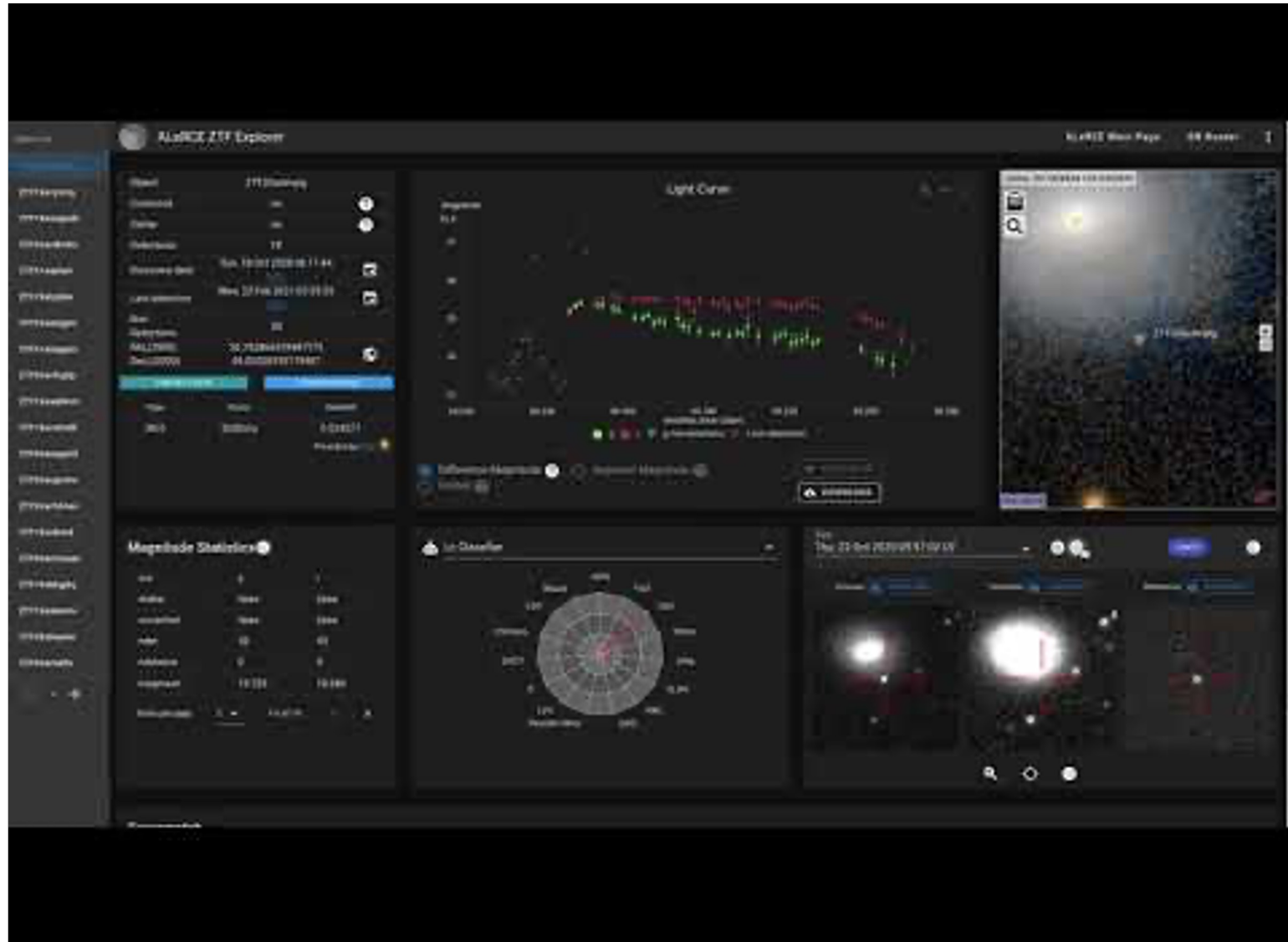




ALeRCE Explorer

Inspect classes
& classifiers

<https://alerce.online/>

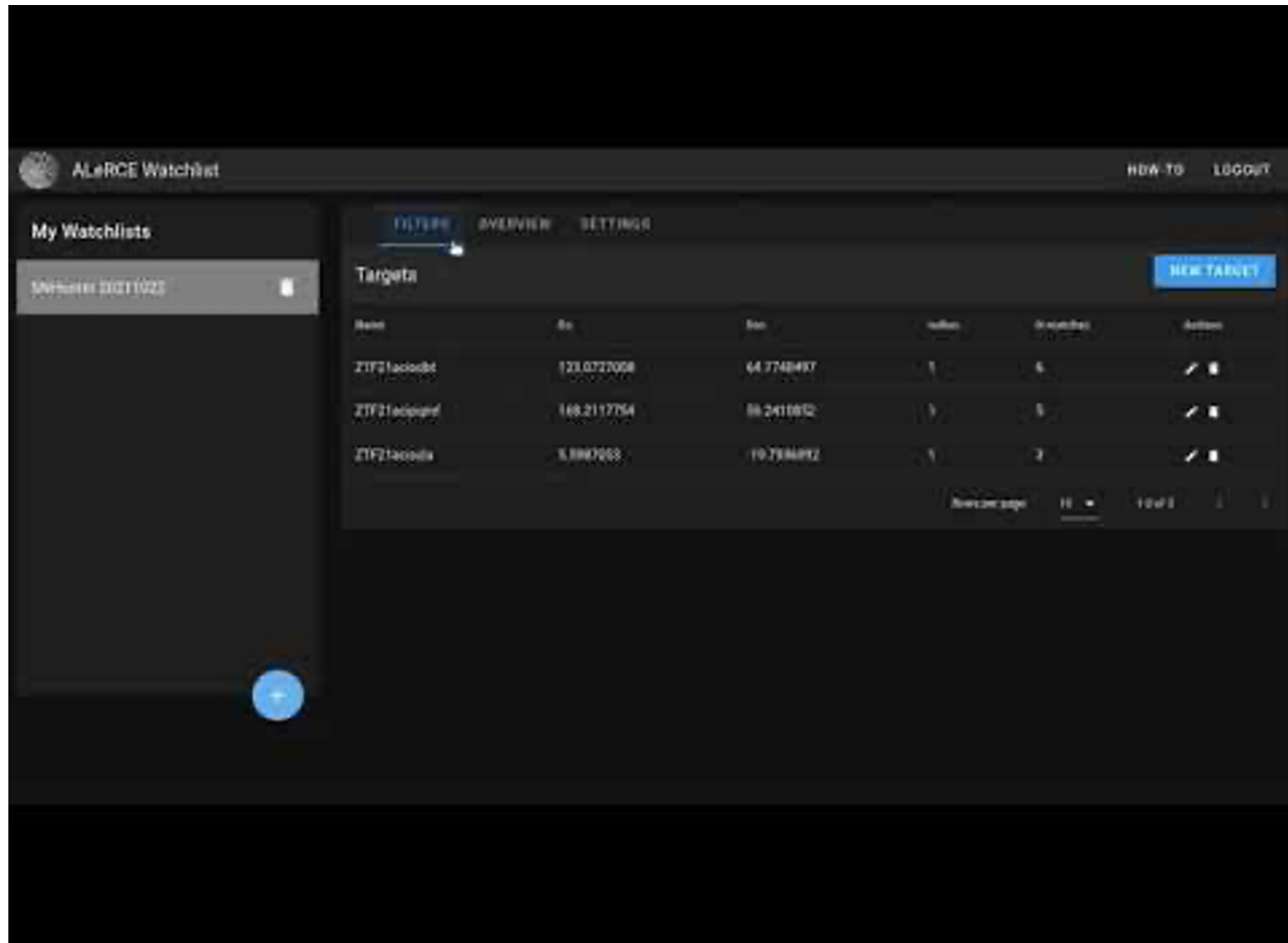




ALeRCE Watchlist

Get object
notifications

<https://watchlist.alerce.online>





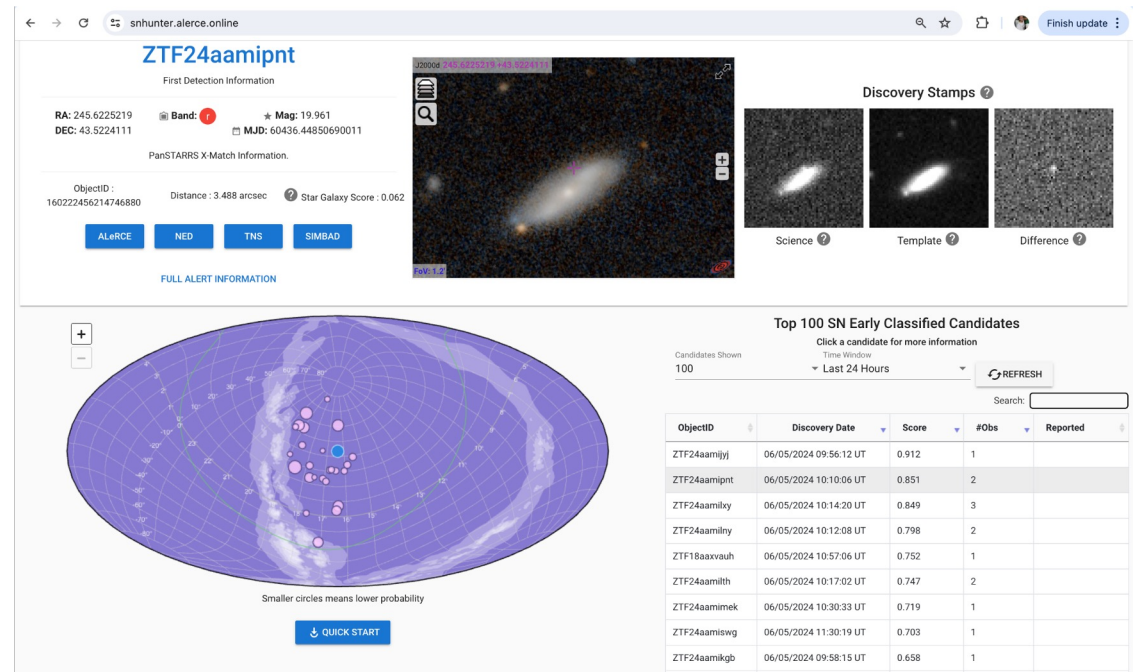
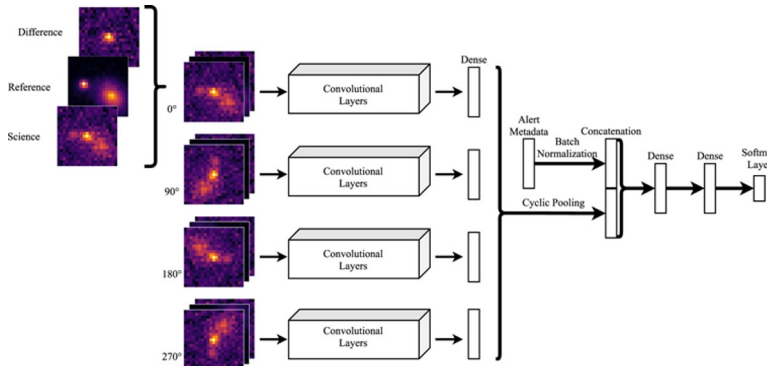
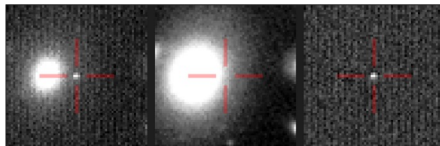
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Models



Stamp based classifier: SN Hunter

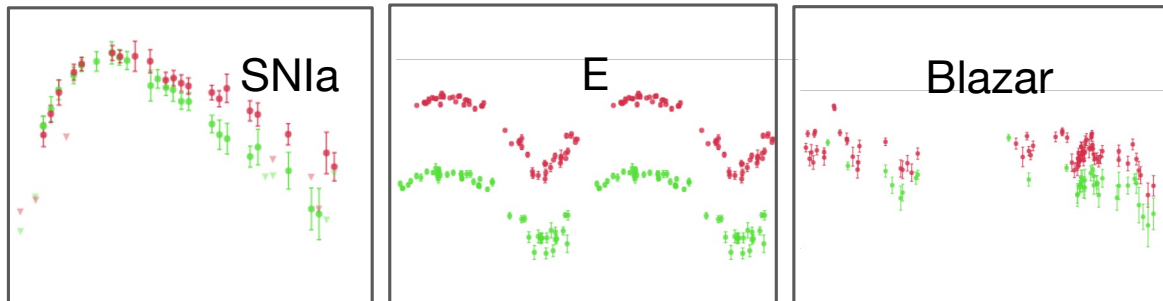


Carrasco-Davis, Reyes+2021
DOI 10.3847/1538-3881/ac0ef1



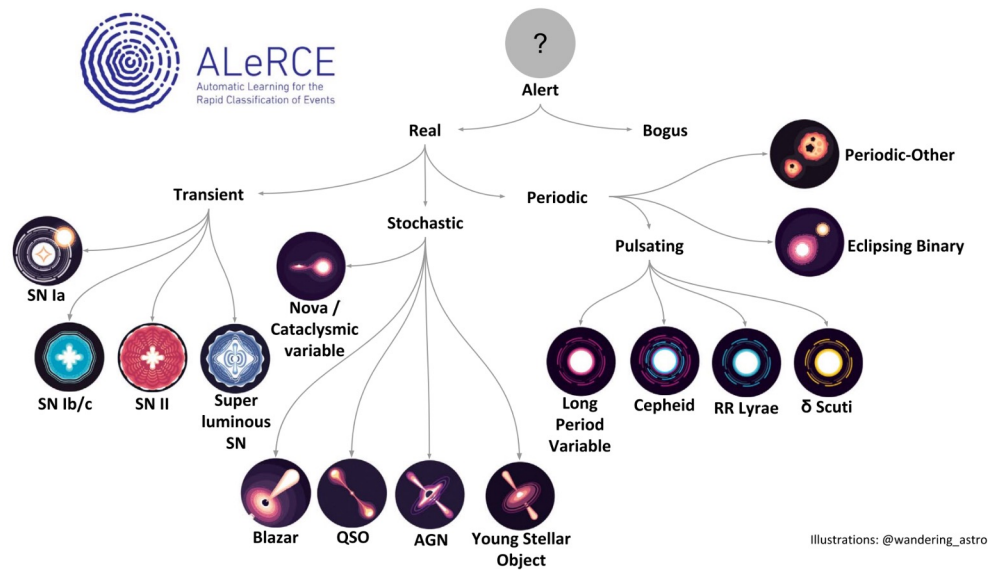
Light curve classifiers

- Calculate ~185 features (over 400 for Rubin)
- Balanced Hierarchical Random Forest



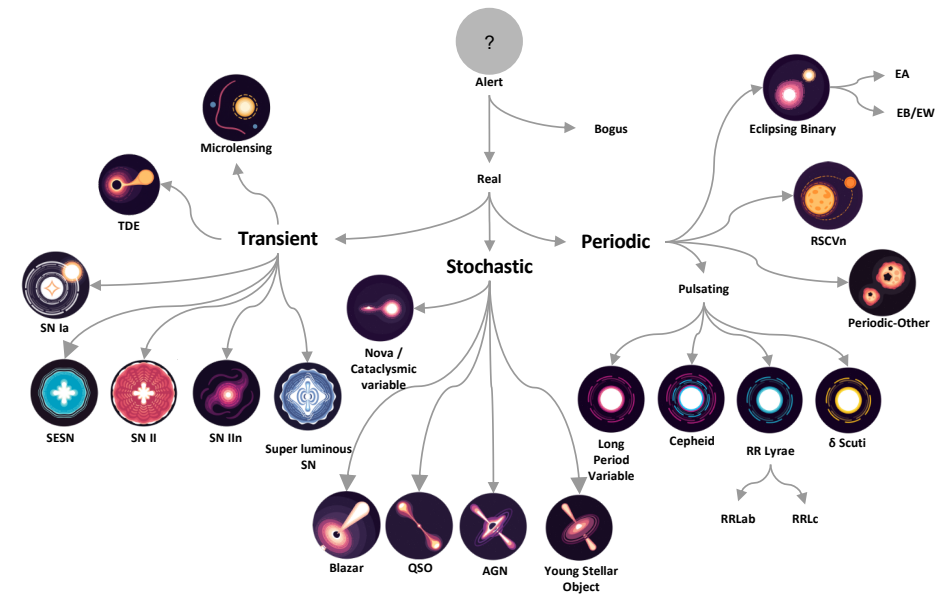
Light curve classifier 1

Sánchez-Sáez+2021 AJ



Light curve classifier 2

Started: 29/05/2025



ALeRCE ZTF Explorer

Search Filters

General Filters

Object ID

Classifier

Lc Classifier

Lc Classifier Top

Lc Classifier BHRF Forced Phot

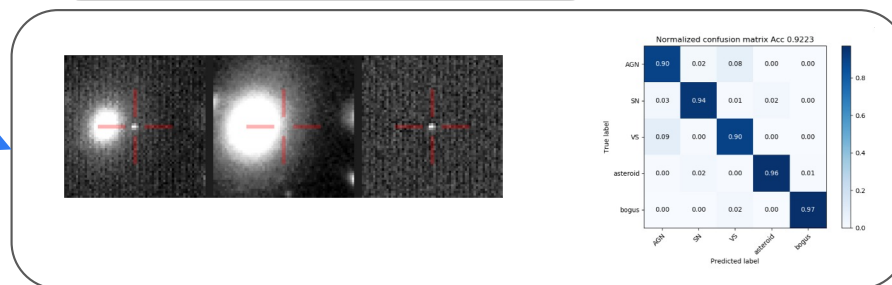
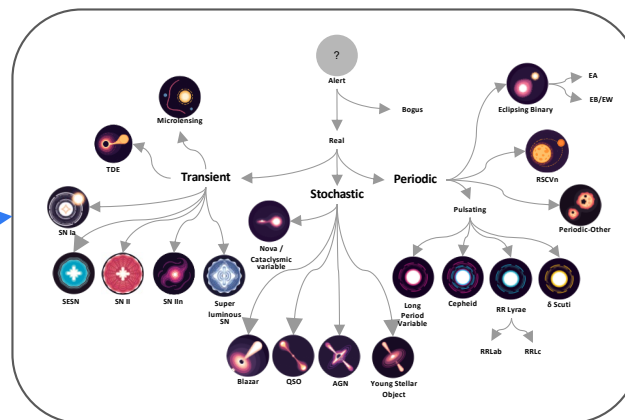
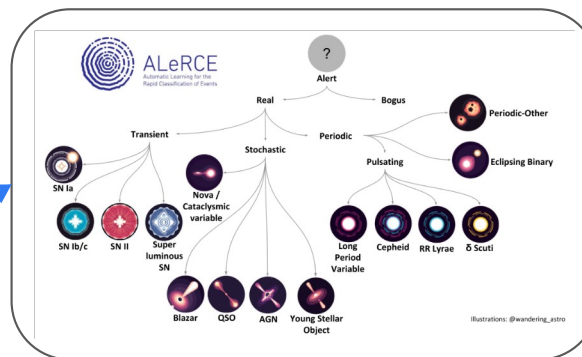
Stamp Classifier

LC Classifier ATAT Forced Phot Data

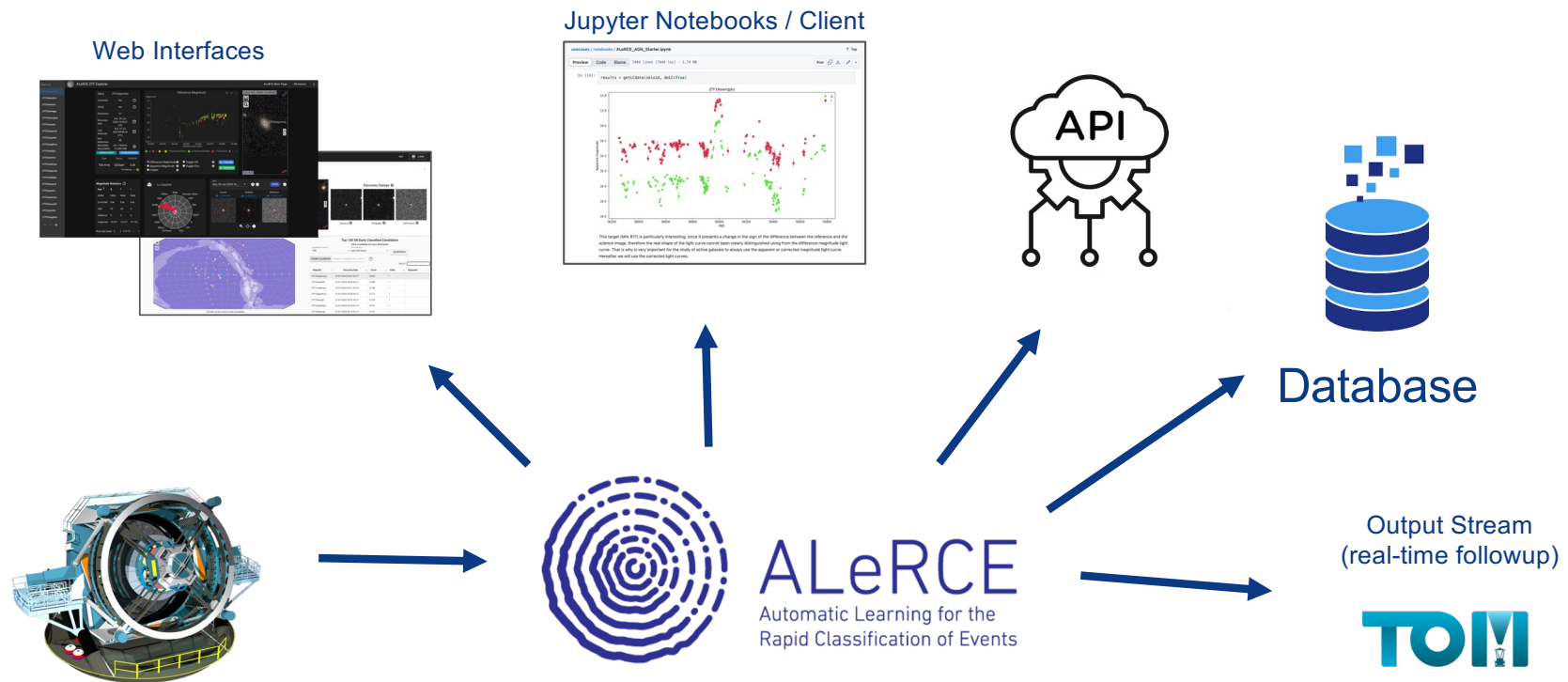
Stamp Classifier 2025 Beta

SEARCH

CLEAR



User Interfaces





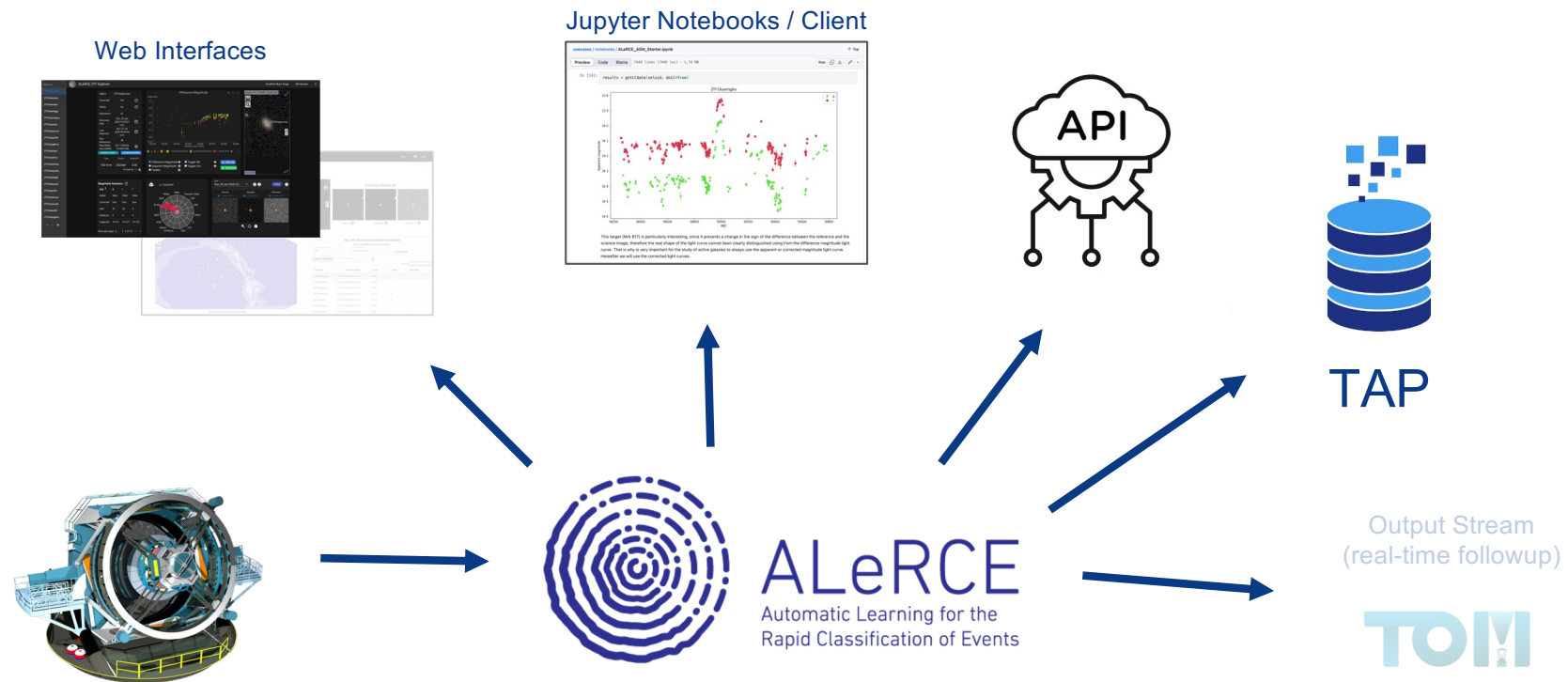
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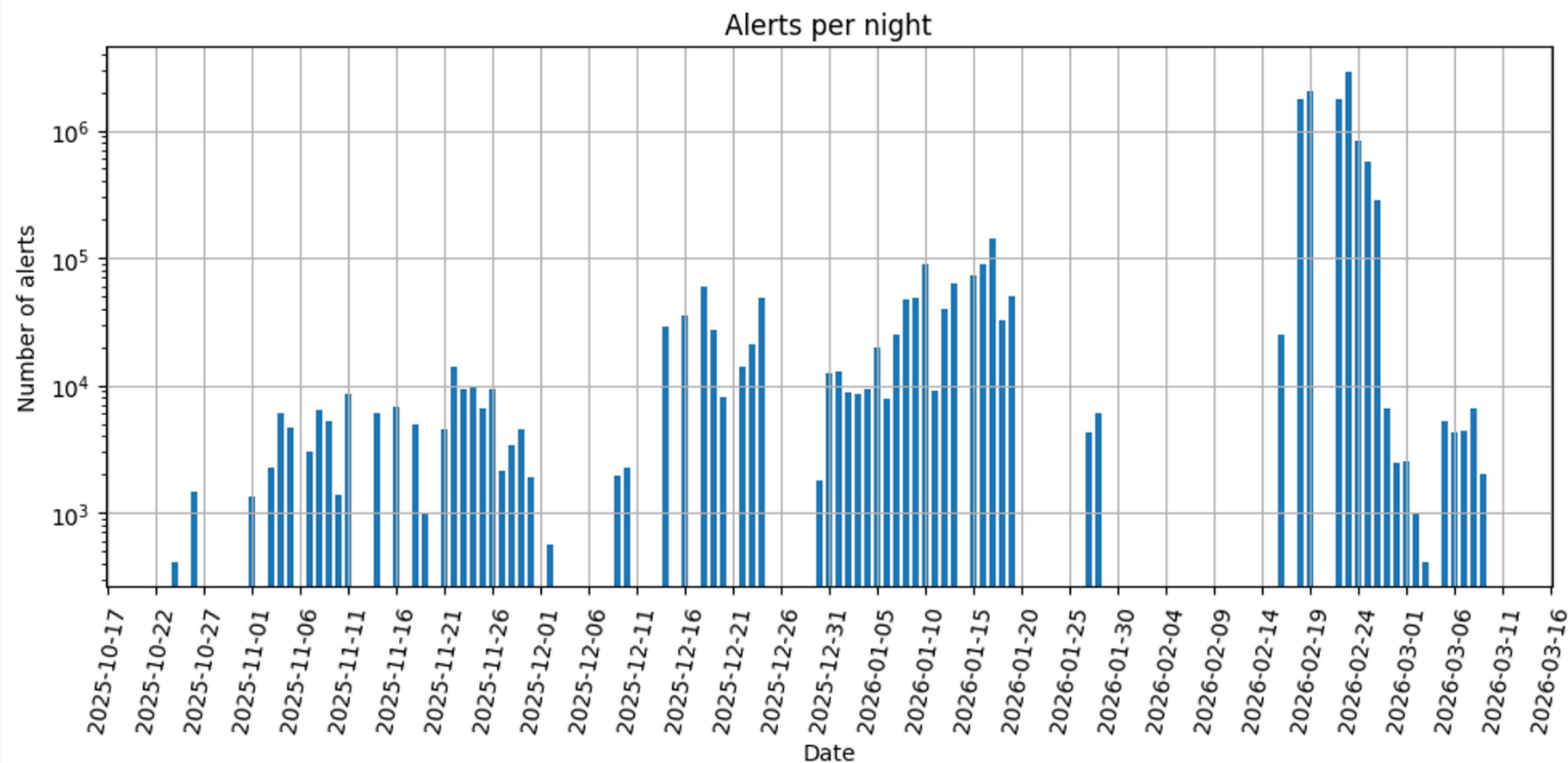
RUBIN IS HERE!!!

<https://science.alerce.online/alerce-lsst/>

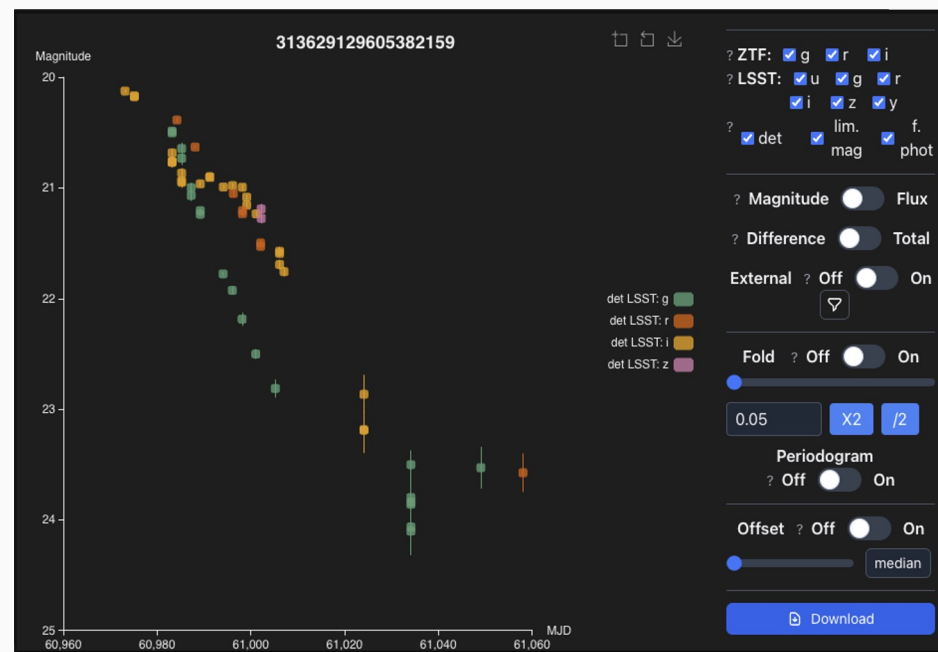
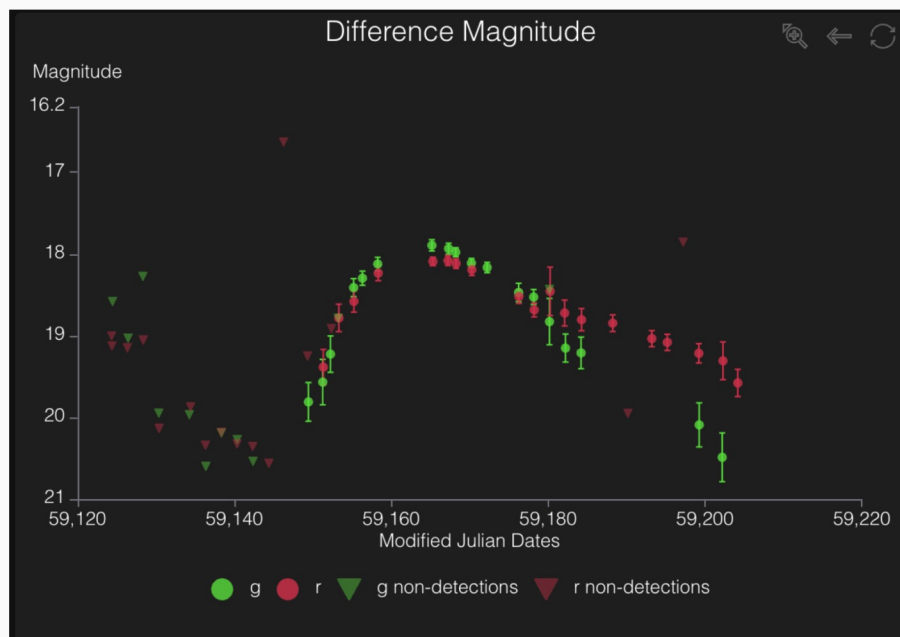
User Interfaces



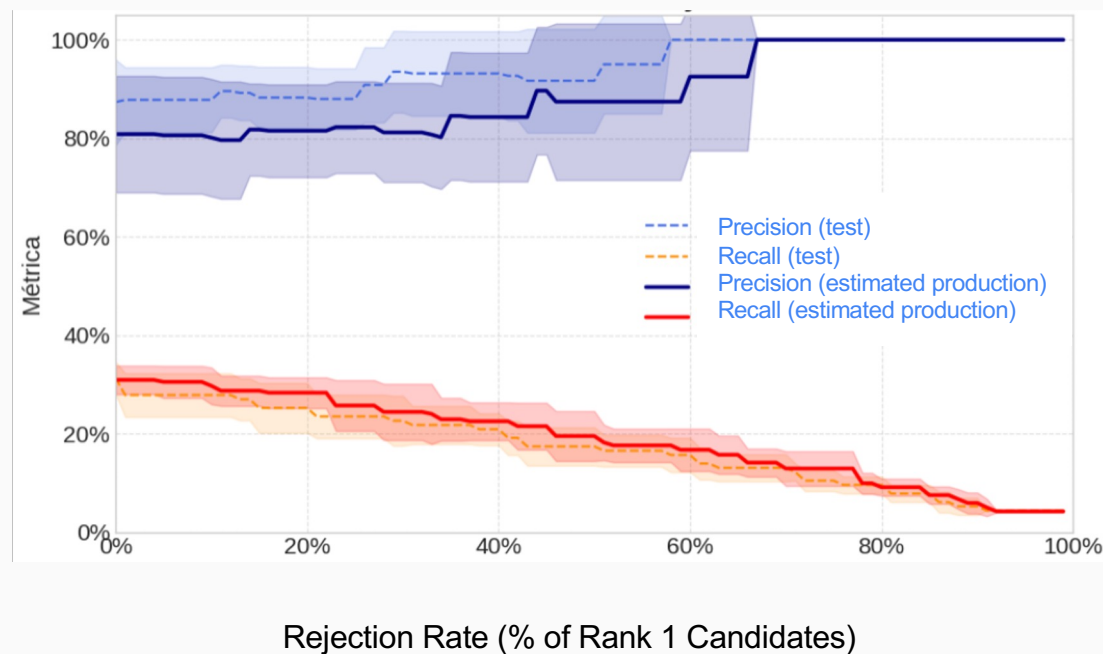
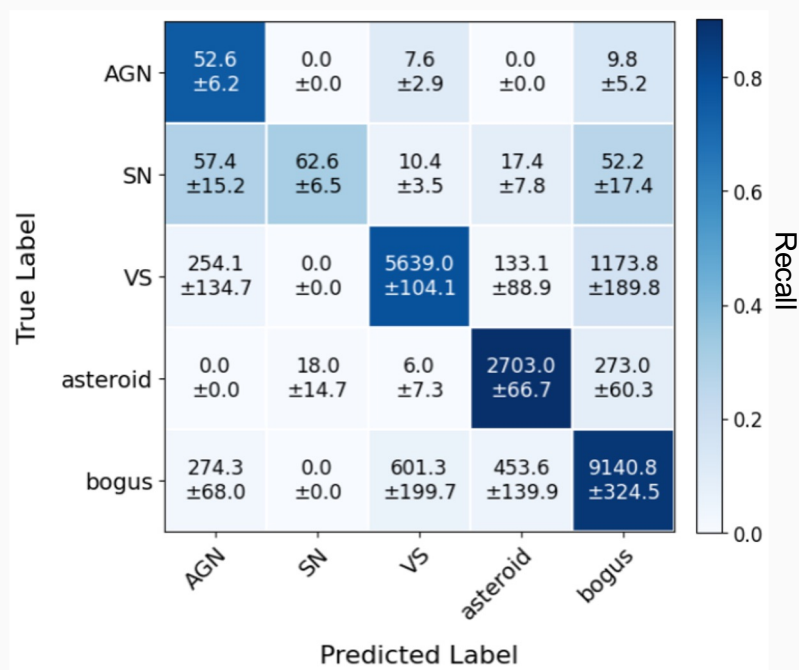
Rubin Alerts



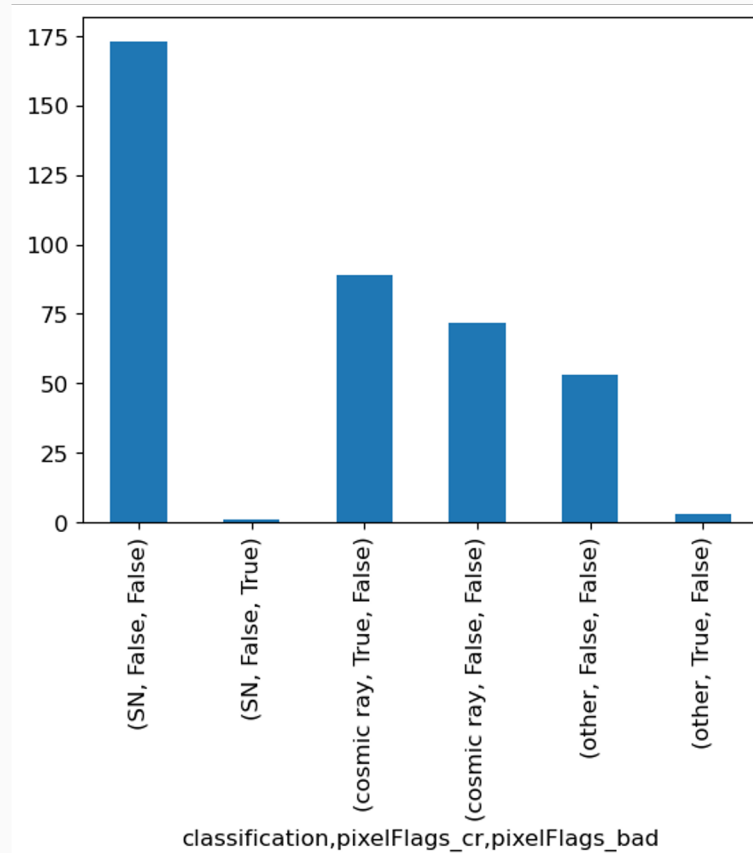
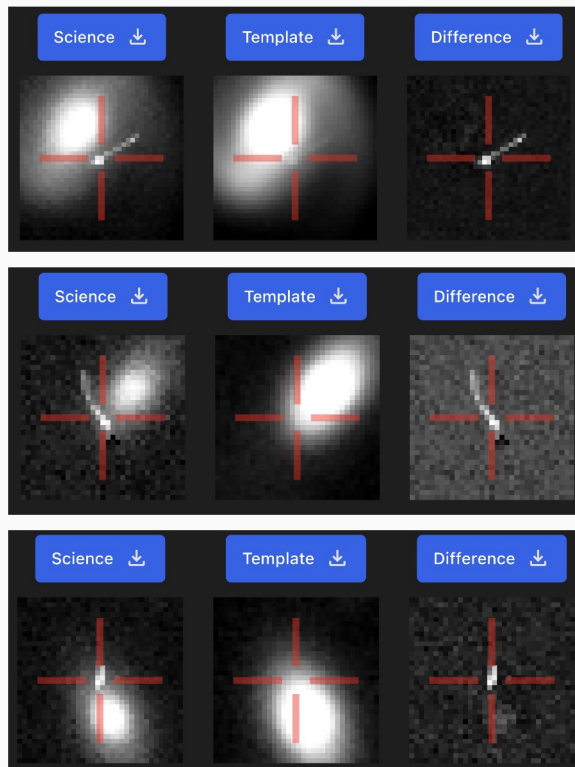
Rubin vs ZTF



Stamp classifier previous to public release



Stamp classifier after public release



ALeRCE public real-time products from stream data (as of today)



Service	ZTF	LSST
Explorer	https://alerce.online/	https://lsst.alerce.online/
SN Hunter	https://snhunter.alerce.online/	Not yet
Watchlist	https://watchlist.alerce.online/	Not yet
Python client	https://alerce.readthedocs.io/en/latest/	https://alerce.readthedocs.io/en/latest/
API	https://api.alerce.online/ztf/v1	See info here
Direct DB connection (SQL queries)	Yes	No
TAP access (ADQL queries)	Not yet	https://tap.alerce.online/
Stream	Upon request	Upon request
Use case jupyter notebooks	https://github.com/alercebroker/usecases/tree/master/notebooks/ZTF	https://github.com/alercebroker/usecases/tree/master/notebooks/LSST

- ALeRCE provides a complete service ecosystem for Rubin.
- Explorer, TAP, APIs, and Python client are fully operational.
- The alert stream is continuously evolving.
- Upstream changes impact downstream systems.
- Models must be continuously retrained and validated using the stream.
- Close communication between surveys and brokers is essential.
- Early coordination is key for Roman readiness.
- The ecosystem must co-evolve with the data.



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