


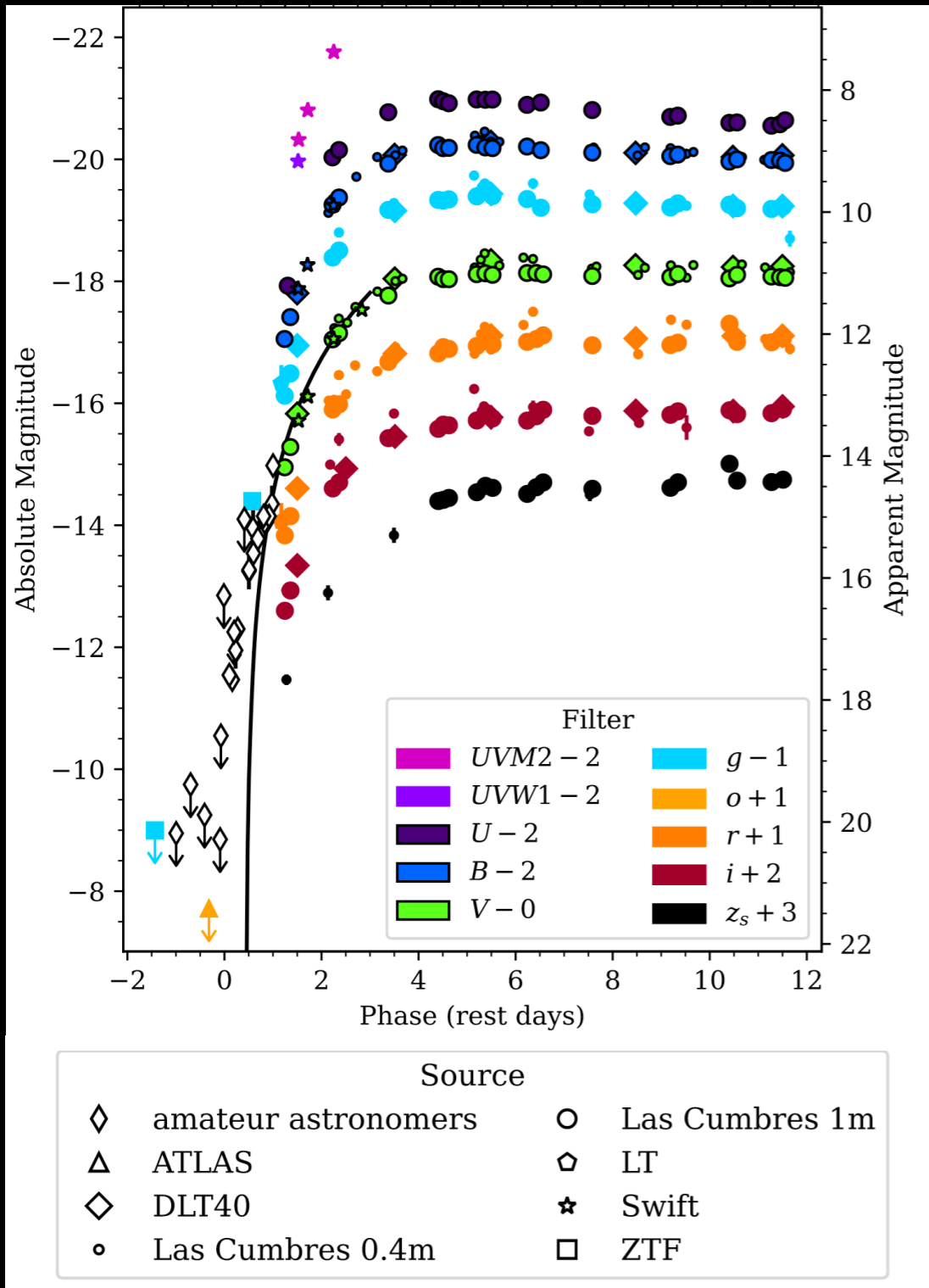
Identifying the Closest Supernova in the Legacy Survey of Space and Time

Azalee Bostroem
LSST-DA Catalyst Fellow
University of Arizona

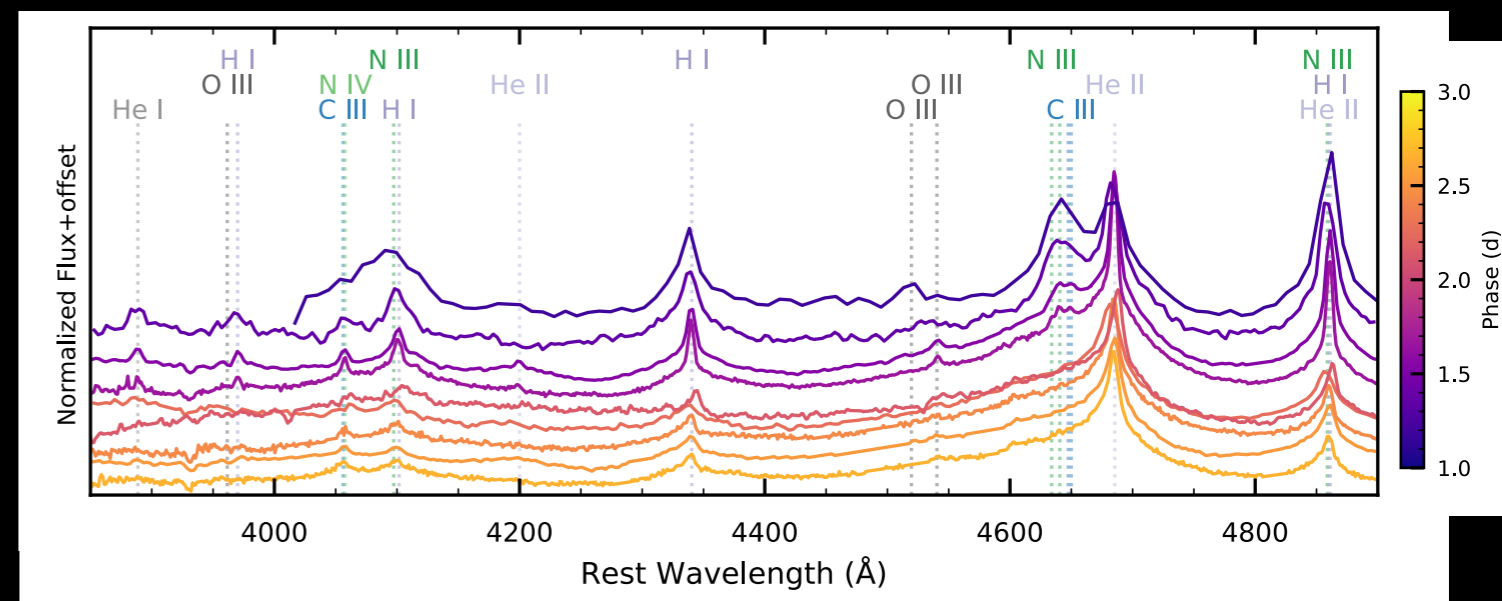
SN 2023ixf



SN 2023ixf: A once in a decade* supernovae



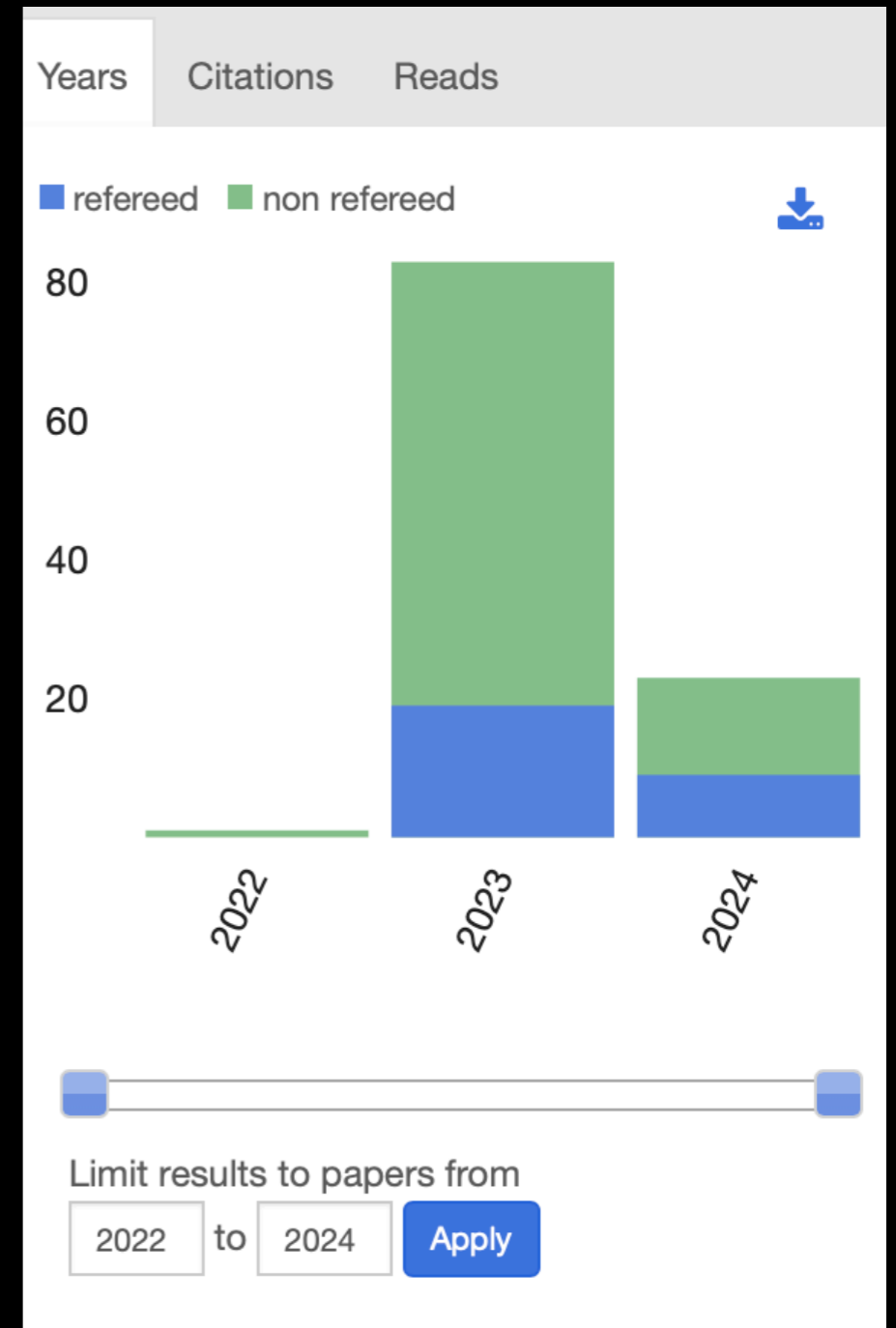
- Nearby Host: M101
- Discovered w/in 1 day of explosion
- Rapid Evolution (hours)



All Eyes on SN 2023ixf

- 28 refereed publications
- neutrinos, gamma rays, X rays, UV, optical, IR, radio
- 79 non-refereed

ADS



Successes

- Public announcement of discovery ~4hr after discovery
- Rapid Classification ~2 hr after discovery announced
- Community use of Transient Name Server

Transient Name Server

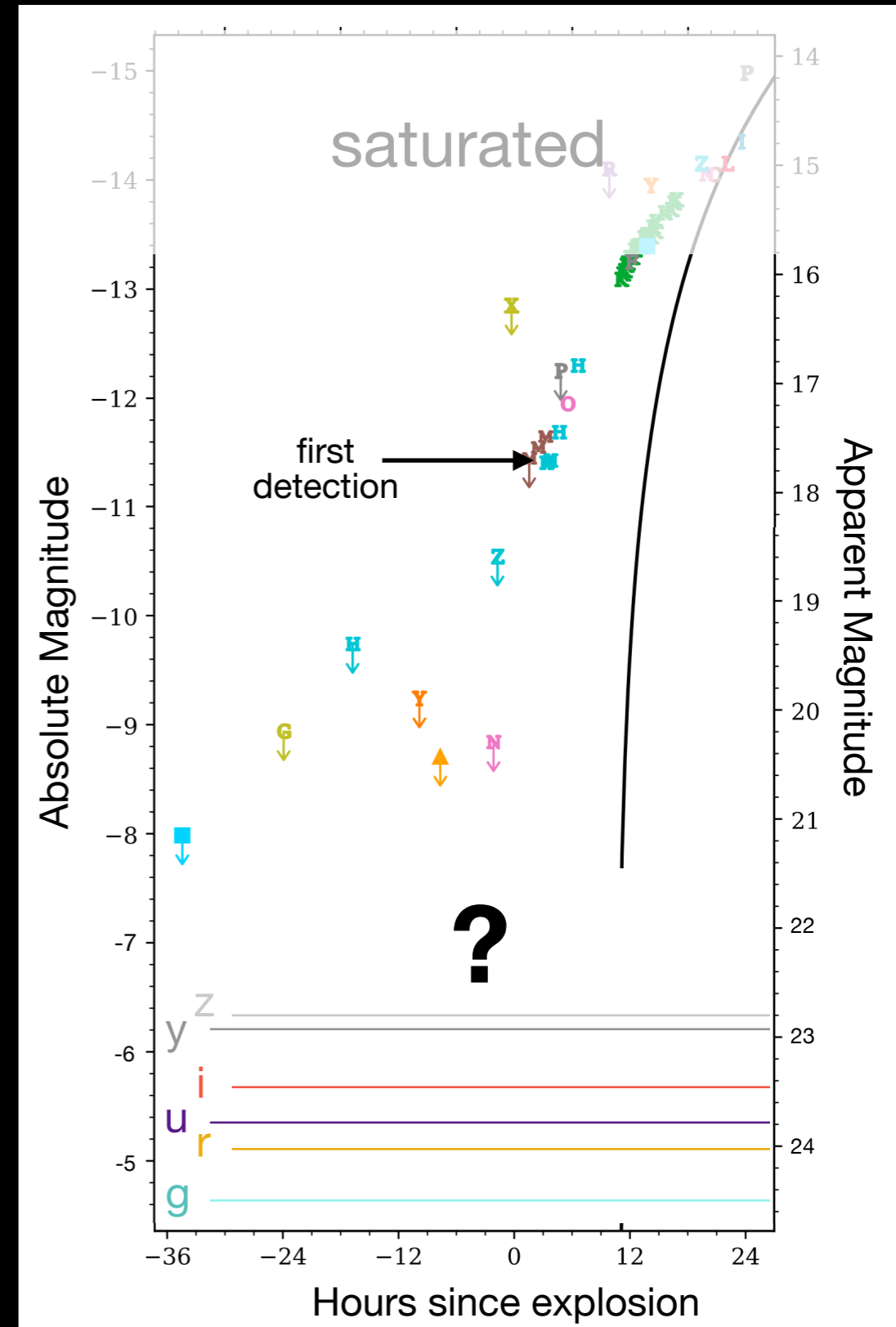
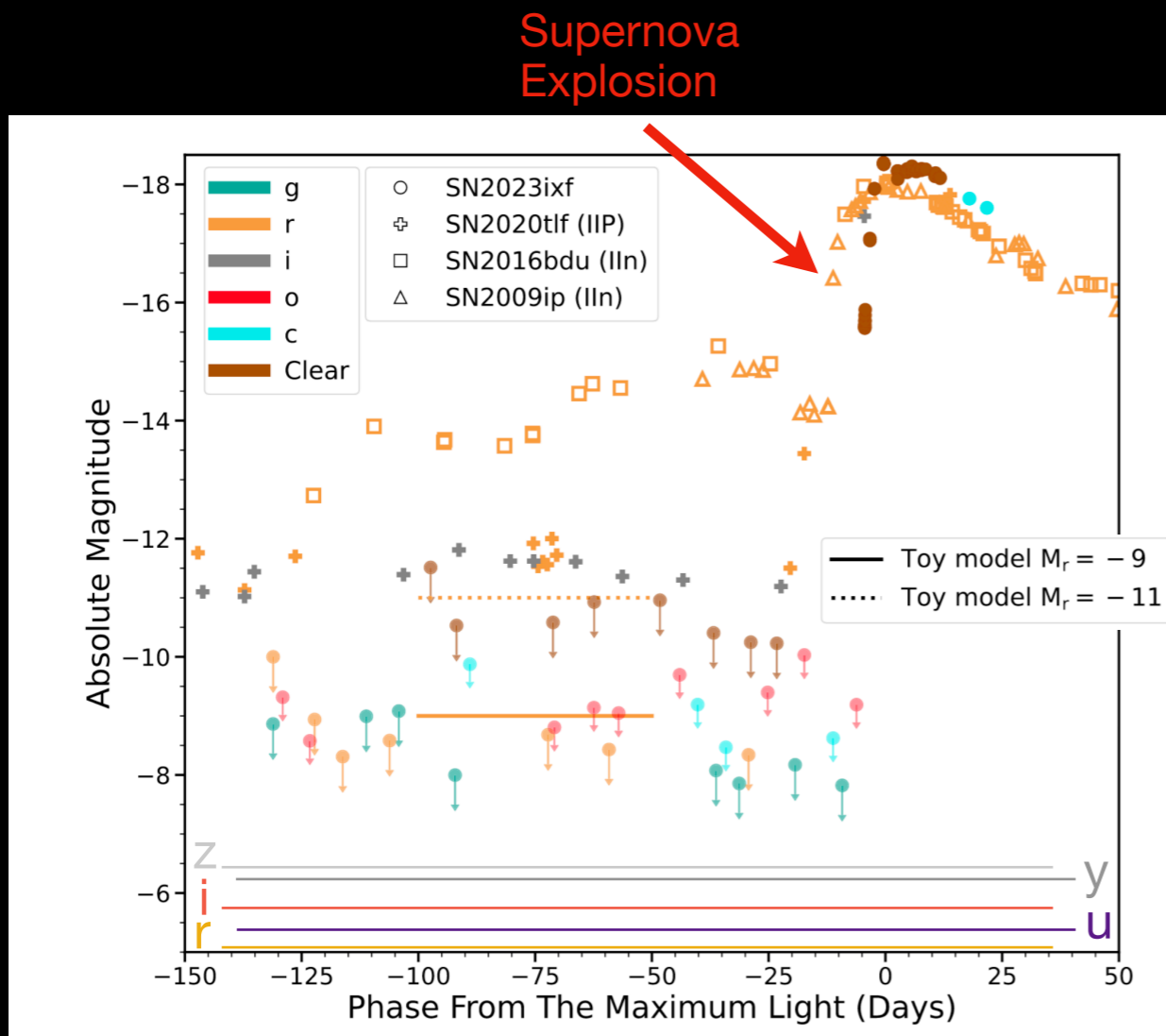
RA/DEC (2000)	Type	Redshift
14:03:38.562 +54:18:41.94 210.910674637 +54.3116510708	SN II	0.0008

[Discovery Report](#) [Classification Report](#)

Related AstroNotes: [2023-119](#), [2023-120](#), [2023-123](#), [2023-124](#), [2023-125](#), [2023-127](#), [2023-128](#), [2023-129](#), [2023-130](#), [2023-132](#), [2023-133](#), [2023-135](#), [2023-131](#), [DRAFT-1297](#), [2023-136](#), [2023-137](#), [2023-139](#), [2023-140](#), [2023-141](#), [2023-142](#), [2023-143](#), [2023-146](#), [2023-147](#), [2023-145](#), [2023-150](#), [2023-153](#), [2023-154](#), [2023-155](#), [2023-156](#), [2023-157](#), [2023-160](#), [2023-161](#), [2023-144](#), [2023-170](#), [2023-172](#), [2023-175](#), [2023-180](#), [2023-181](#), [2023-190](#), [2023-209](#), [2023-211](#), [2023-212](#), [2023-213](#)

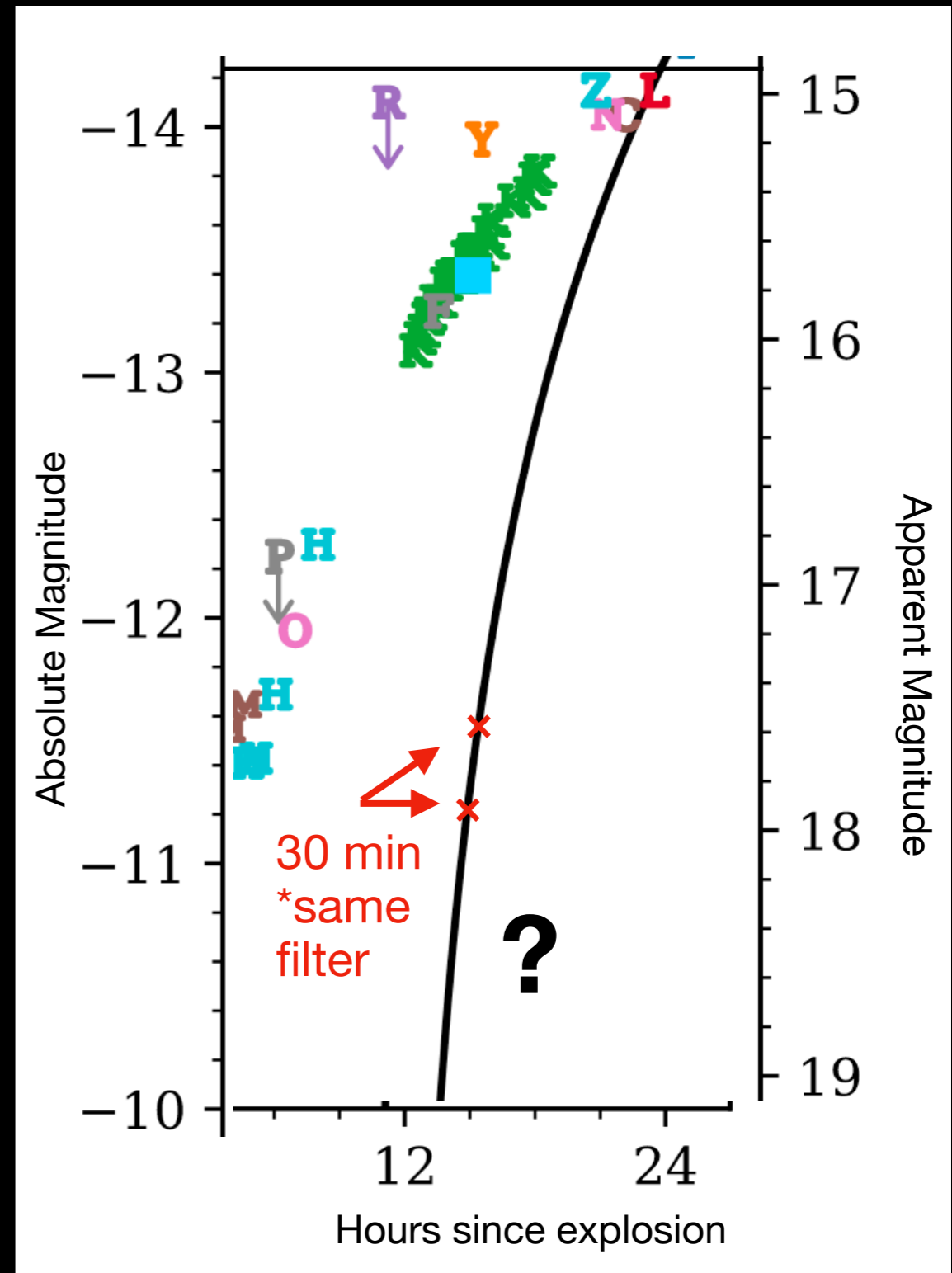
Rubin's Potential

- Precursor emission
- Community alert
- SN 2023ixf light curve to 31 Mpc



Basic Workflow

- Single visit (30s):
 - 1st image: transient detected
 - 2nd image: confirmation image?
- Alert (60s)
 - Any source change w.r.t. to template w/ $S/N > 5$
- Second image (30 min)
 - color
 - rising



Alert Packets

- Flux
- Extendedness
- Spurious
- Filter
- Coordinates



Brokers

- Host association
- Existing catalog cross-matching (host, known source)
- Classification
- Define own filters (e.g. color, rise)

Alerce



Ampel

ANTARES



Babamul

Fink



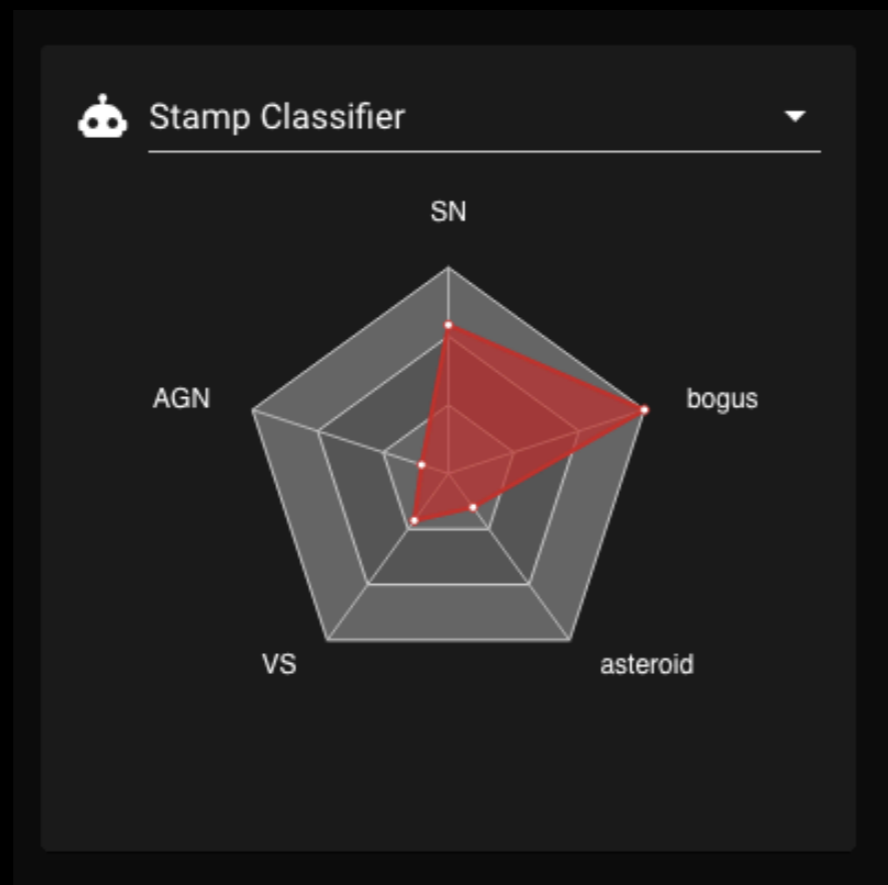
Lasair

Pitt-Google

 Pitt-Google Broker

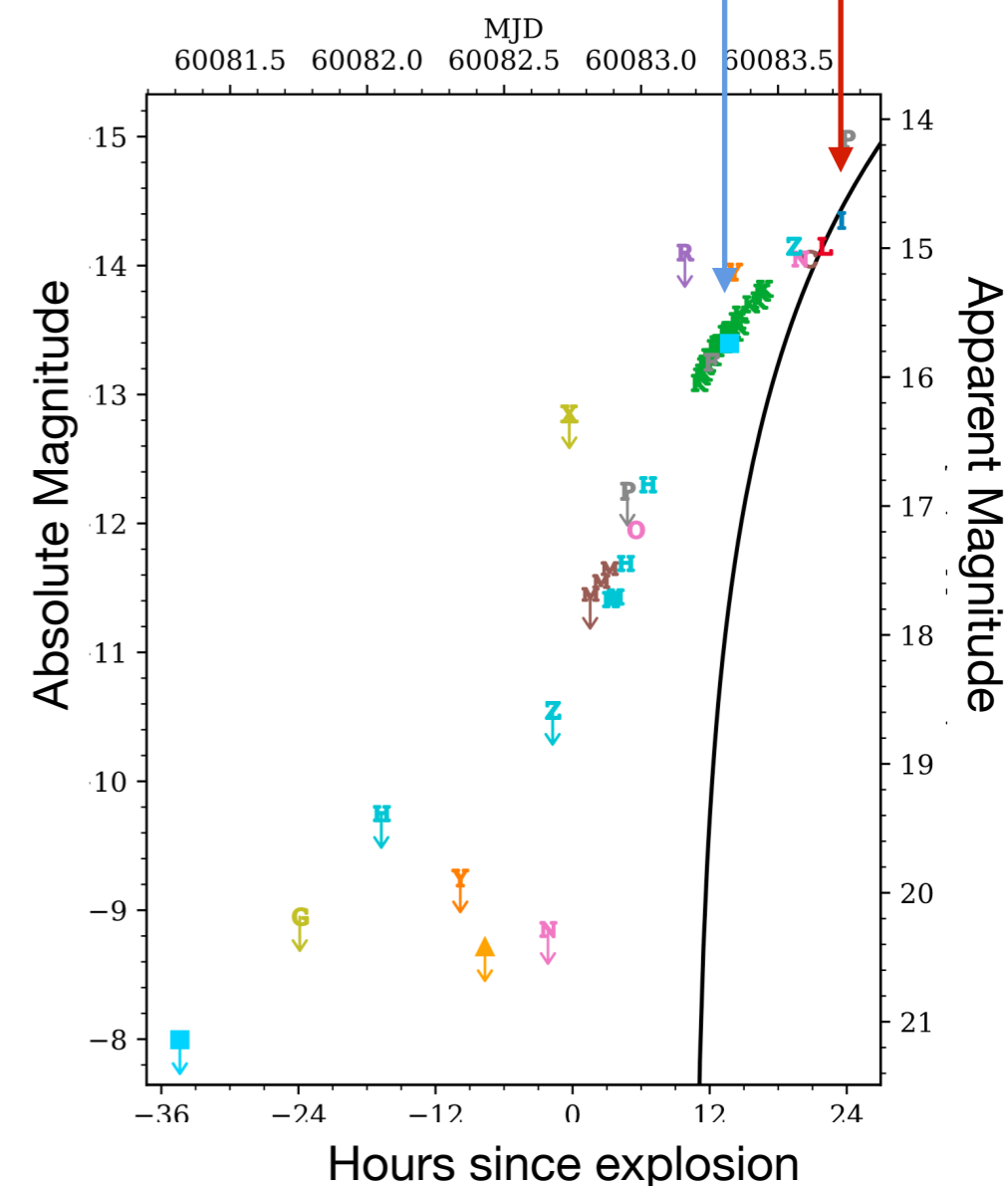
Challenge: what is real?

- Real/Bogus=0.998
- Wait for a second detection
- Stamp classifier on single image

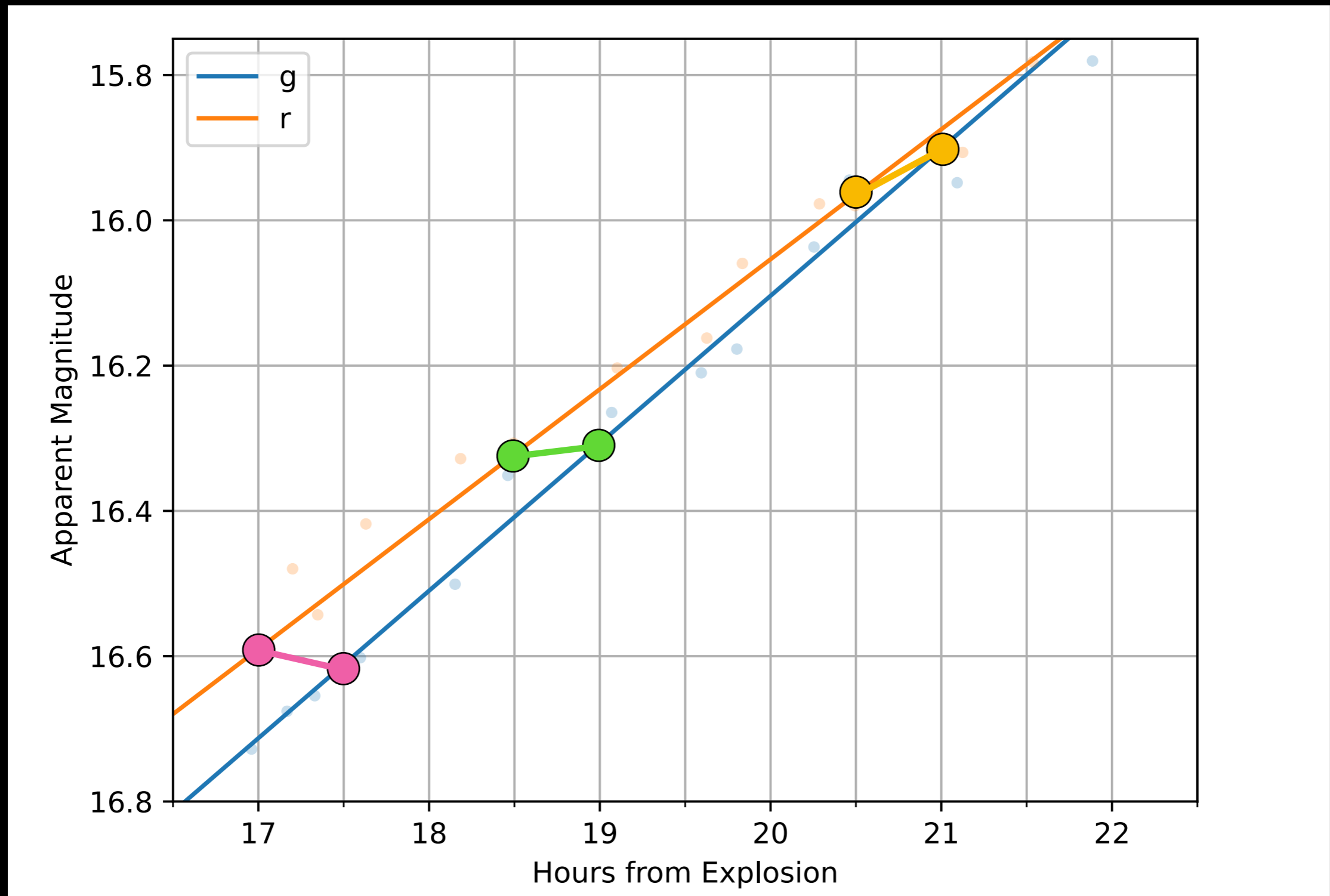


ZTF Detection

Discovery

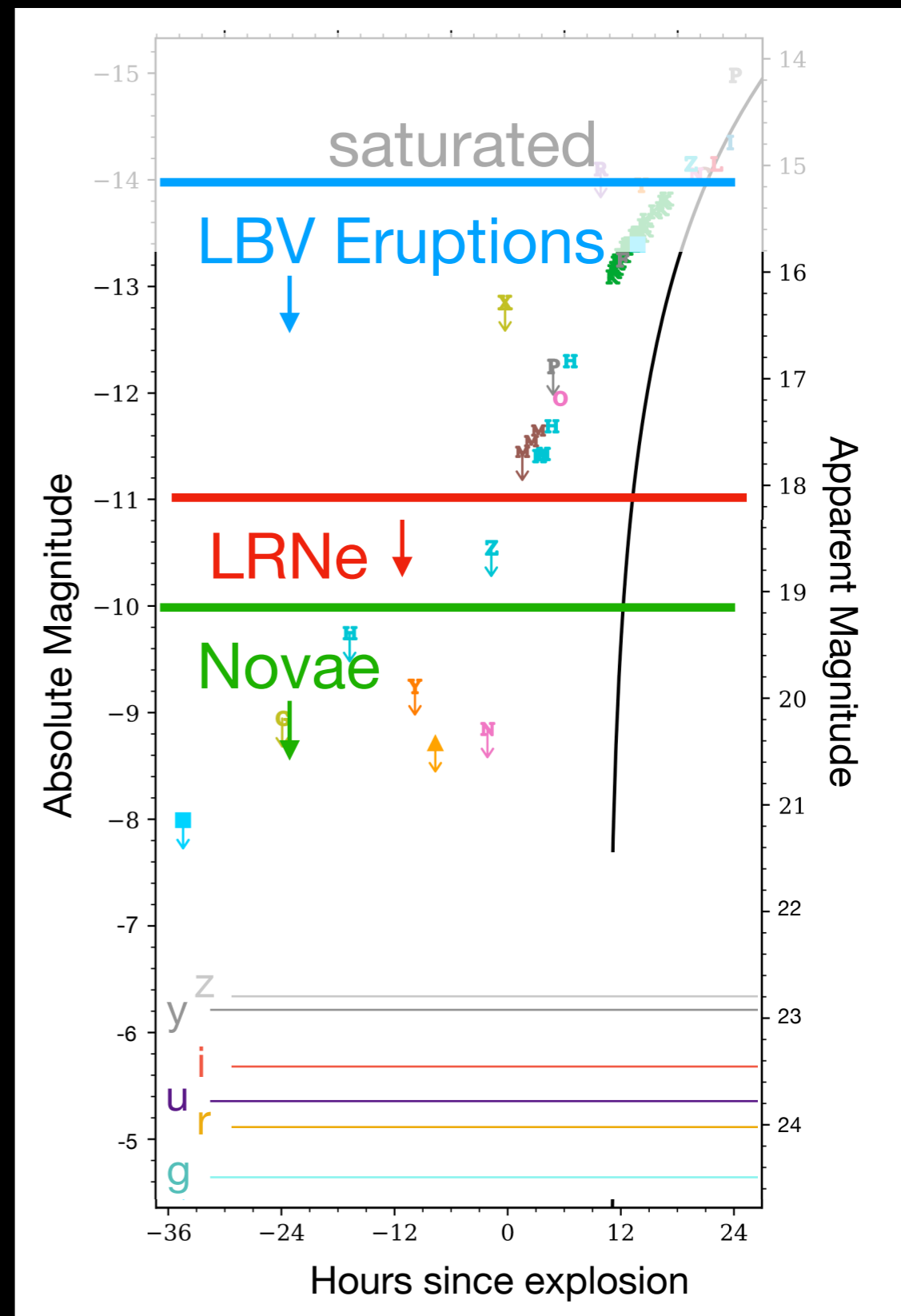


Challenge: What is a rise in different colors?



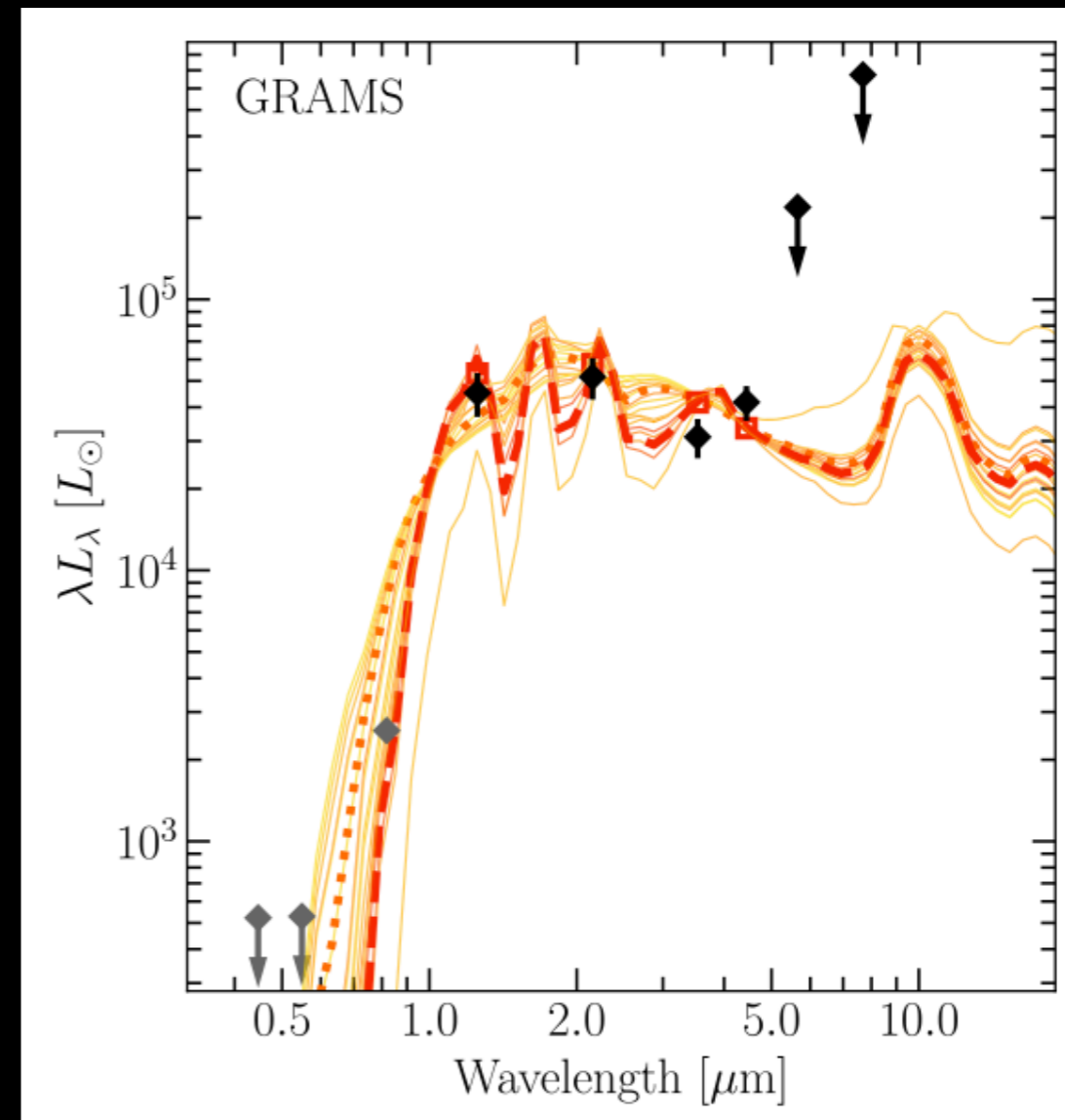
Challenge: is it a supernova?

- Need deep early data
- Rubin year 1?



Challenge: what is the progenitor?

- Catalogs from archival images of other telescopes
 - e.g. list of RSG, LBVs
 - HST, JWST, Roman
 - Funding challenge



Jencson+ 2023

Conclusions

- Early alert with Rubin is hard
 - Case for cadence tweak?
- Need to access to auxiliary information
- Brokers are critical
- Open challenges:
 - When do you call it a supernova?
 - Determining rise with different filters
 - Faint contaminants
 - Progenitor catalogs

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Resources

- SCOC req: <https://pstn-055.lsst.io/>
- Alerce stamp: <https://ui.adsabs.harvard.edu/abs/2021AJ....162..231C/abstract>
- LSST key numbers: <https://www.lsst.org/scientists/keynumbers>
- Alerts key numbers: <https://dmtn-102.lsst.io/>
- Data Products: <https://lse-163.lsst.io/>



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