SNAPS: The Solar System Notification Alert Processing System

David E. Trilling
(Northern Arizona University)

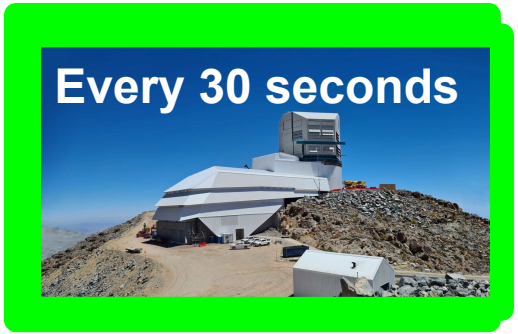
Mike Gowanlock, **Daniel Kramer**, Revanth Reddy Munugala, **Maria Chernyavskaya**, **Erin Clark**, **Connor Metcalfe**, **Graceson Mule**, **Gunnar Johnson**, **Savannah Chappus,** plus **students** from **NAU's Visual Design Lab**

What is SNAPS?

SNAPS is a **downstream broker** that is dedicated to Solar System science. Our goals are the following:

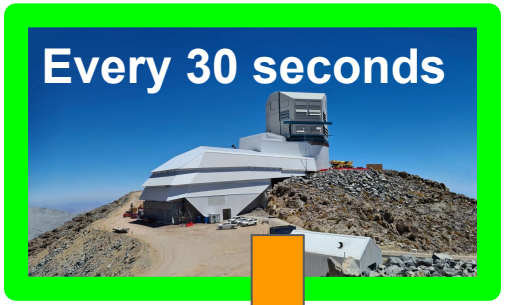
(1) Ingest alert data for moving objects (ZTF, LSST)
(2) Derive various properties (colors, lightcurves, etc.)
(3) Identify individual and population outliers
(4) Serve this data to the community (web page, outgoing alert stream, API)
(5) Do science related to small bodies

Brief review of the LSST data flow



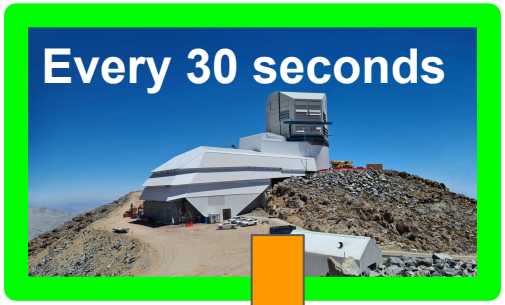
Brief review of the LSST data flow

Brief review of the LSST data flow



Transient detection

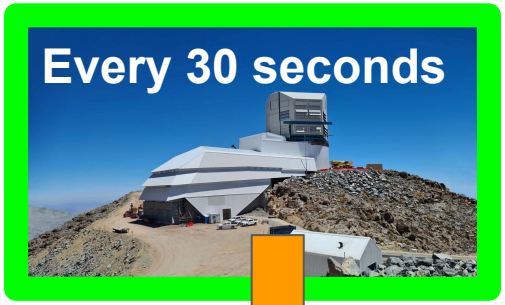
Brief review of the LSST data flow



Transient detection

Known SSO?

Brief review of the LSST data flow



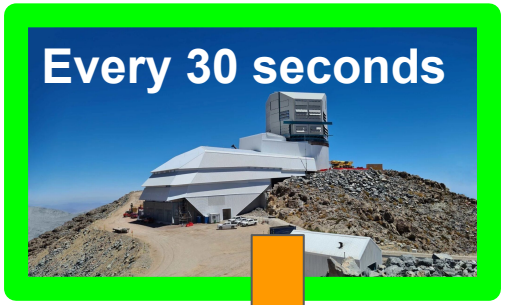
Transient detection

Known SSO?

No

Yes

Brief review of the LSST data flow



Transient detection

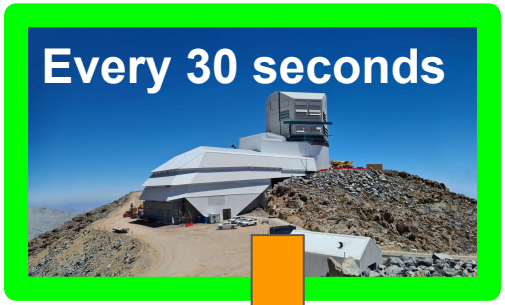
Known SSO?

No

Yes

Brokers (incl. ANTARES)

Brief review of the LSST data flow



Transient detection

Known SSO?

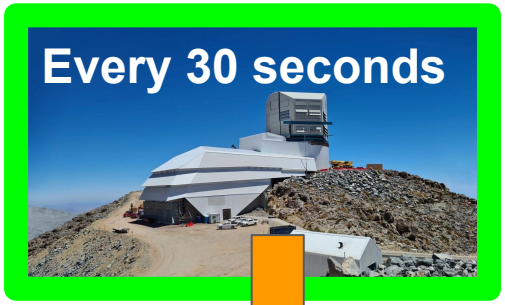
No

Yes

Brokers (incl. ANTARES)

MPC

Brief review of the LSST data flow



Transient detection

Known SSO?

No

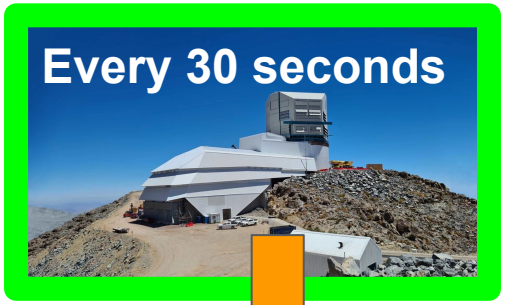
Yes

Brokers (incl. ANTARES)

SNAPS

MPC

Brief review of the LSST data flow



Transient detection

Known SSO?

No

Yes

Brokers (incl. ANTARES)

Could still be an SSO!

SNAPS

MPC

What makes SNAPS unique

We are the only Solar System dedicated broker

Moving objects present special “challenges”

We collect and serve moving object data; derive moving object properties; enable moving object science

What SNAPS does and does not

What SNAPS does:

–Ingest observations of known moving objects

–Derive properties

–Value-added catalog

–Identify outliers

What SNAPS does **not**:

–Discover new SS objects

–Non-SS objects

SNAPS science

Trilling+ 2023: Architecture and SNAPShot1

Kramer+ 2023: Aliasing in period solutions

Gowanlock+ 2024: Population outliers

Gowanlock+ 2025: Combining ZTF and TESS data

Chernyavskaya+ (forthcoming): Super fast rotating asteroids

Clark+ (forthcoming): Active asteroids

Trilling+ (forthcoming): web page+API (arXiv, submitted), SNAPShot2

Many others related to both astronomy and computer science

Current statistics

	Total number of observations ingested	Number of unique asteroids present	Number of unique asteroids present with >50 observations
ZTF	40.5M	902,104	222,297
LSST	480,790	3,357	1294 (114)

Current functionality

New public-facing URL and web page:

snaps.nau.edu

Current functionality

snaps.nau.edu

Login (rate-limited if not logged in; save recents and faves)

How to search for a ZTF object

How to search for an LSST object

What are the outputs from a search: plots, data downloads, postage stamps

Favorites, recent queries, random button

LSST caveat: alerts with bad helio/geo values are excluded

ZTF comets: working on geometry parameters (no LSST comets yet)

Current functionality

snaps.nau.edu

Examples

ZTF/SS1: 12345

ZTF/All: 12345

ZTF/Provisional: 2015 TA105

LSST: 16472 / 1990 OE5 / J900OE5

Coming soon

snaps.nau.edu

API

LSST SSSC community filters

- activity/photometry, activity/PSF, individual outliers (photometry/color)

Future features

Outgoing alert stream (individual and population outliers)

snaps.nau.edu

Conclusions

SNAPS web page open for business: snaps.nau.edu

Documentation available: arXiv/2604.27420

Additional features coming

It will never be perfect, but we've come a long way

Feedback welcome

Enjoy and happy sciencing!

snaps.nau.edu

Acknowledgements: NSF, NASA, ABOR, NAU OVPR, TRIF