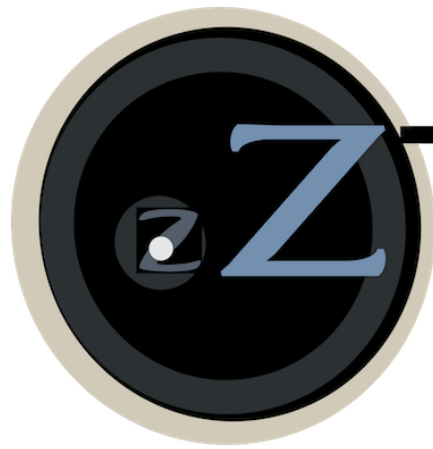# The ZTF Alert Stream
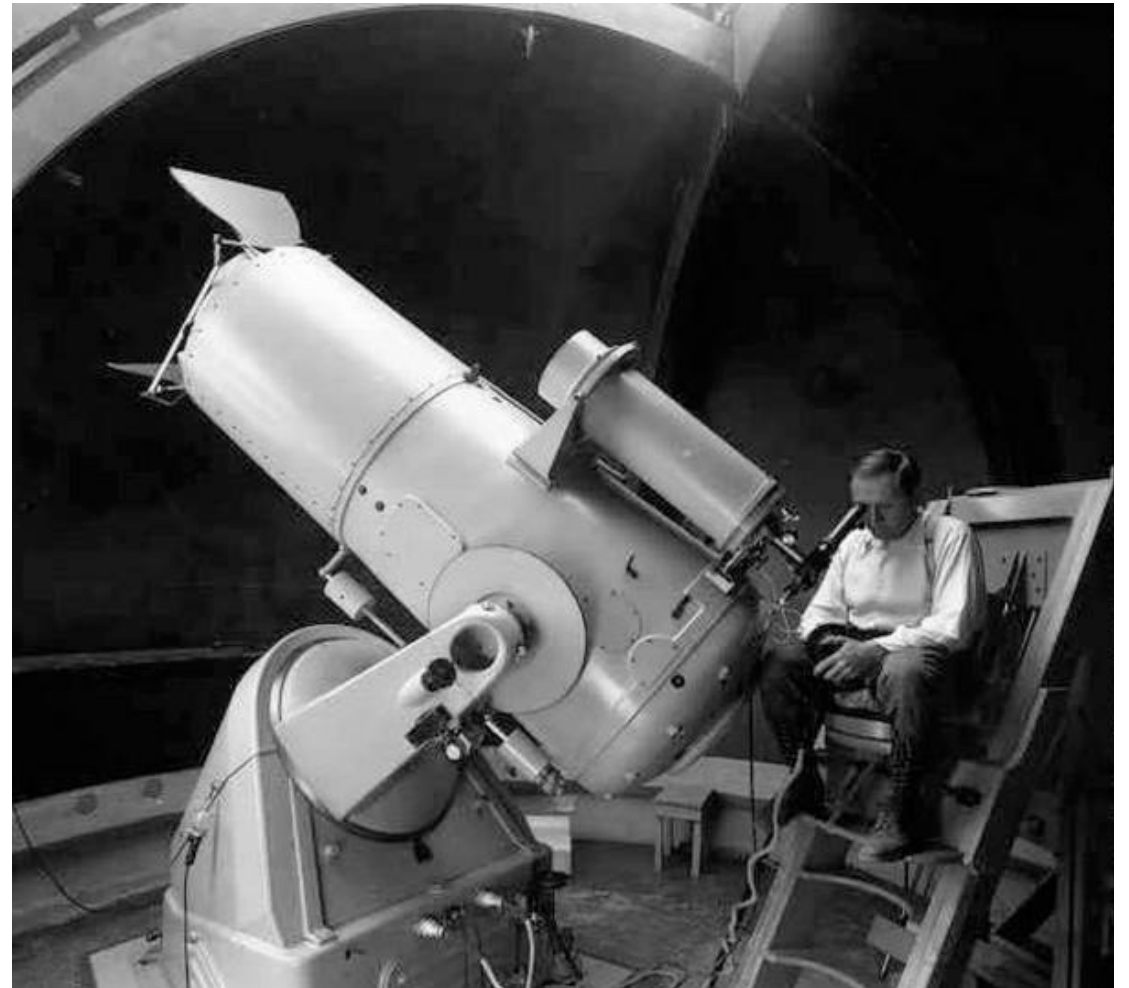
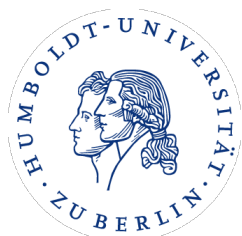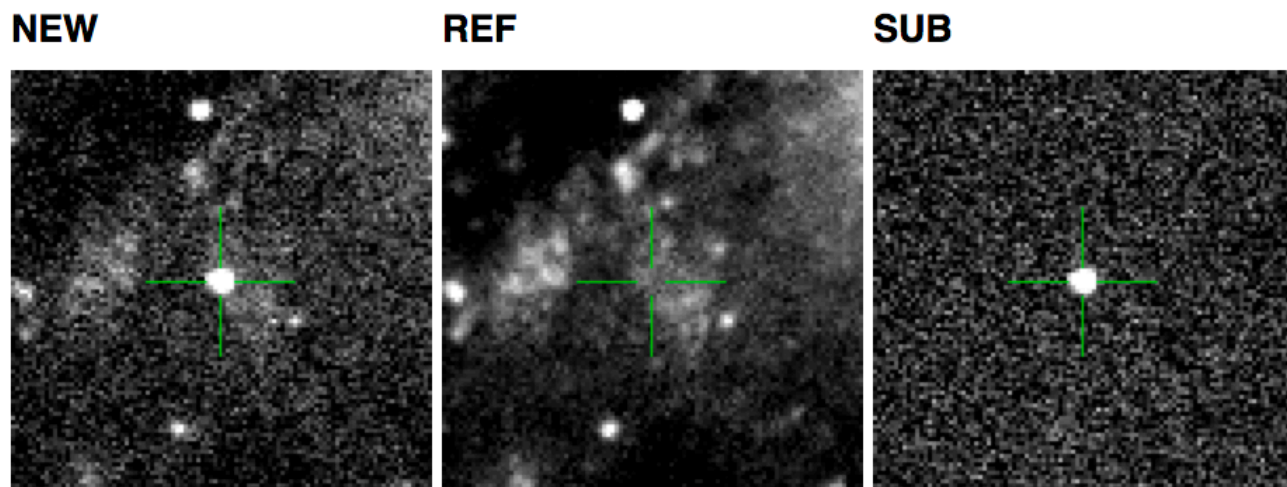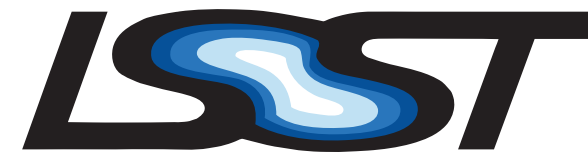**Eric Bellm**

Survey Scientist
University of Washington

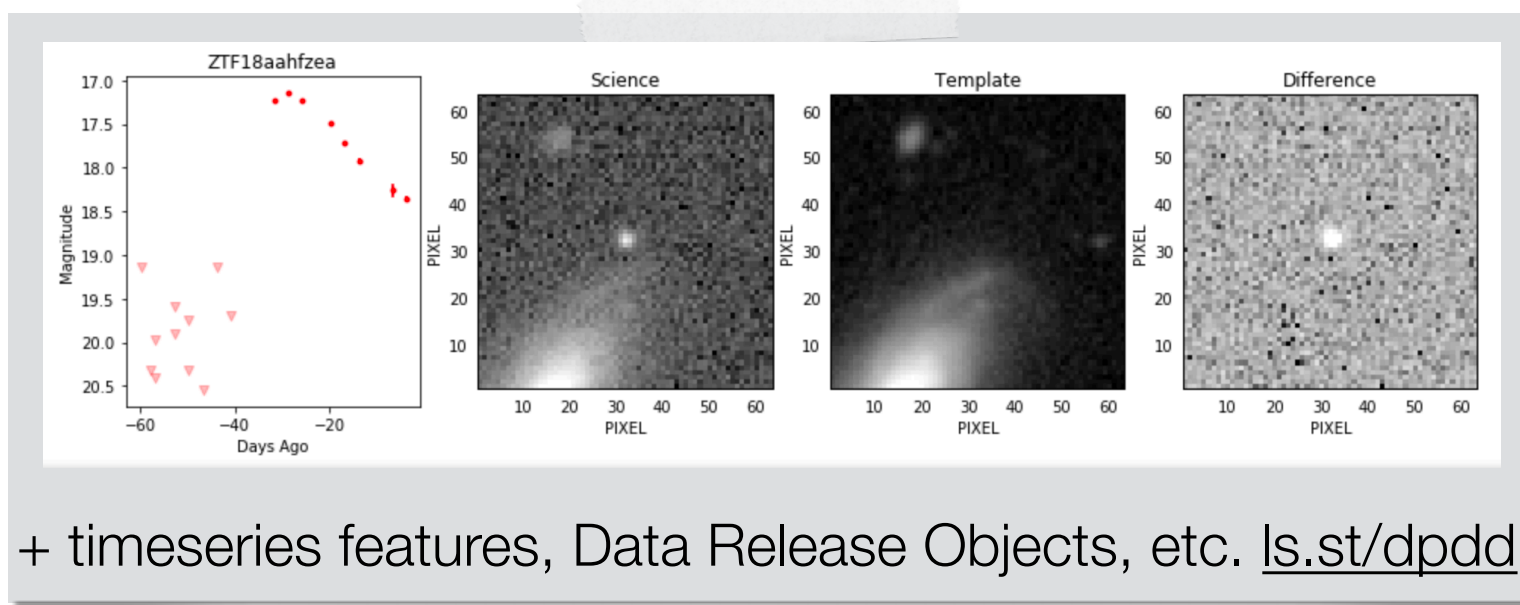# LSST adopted a plan for a comprehensive alert stream.

Find changing sources with image subtraction…

create alert packets rich with contextual information to enable rapid decisions…

+ timeseries features, Data Release Objects, etc. ls.st/dpdd

and distribute *all* of them in near-real time to community brokers & the LSST Alert Filtering Service.

Real-time, low-latency, naturally distributed

ZTF is serving as an LSST alert stream precursor.
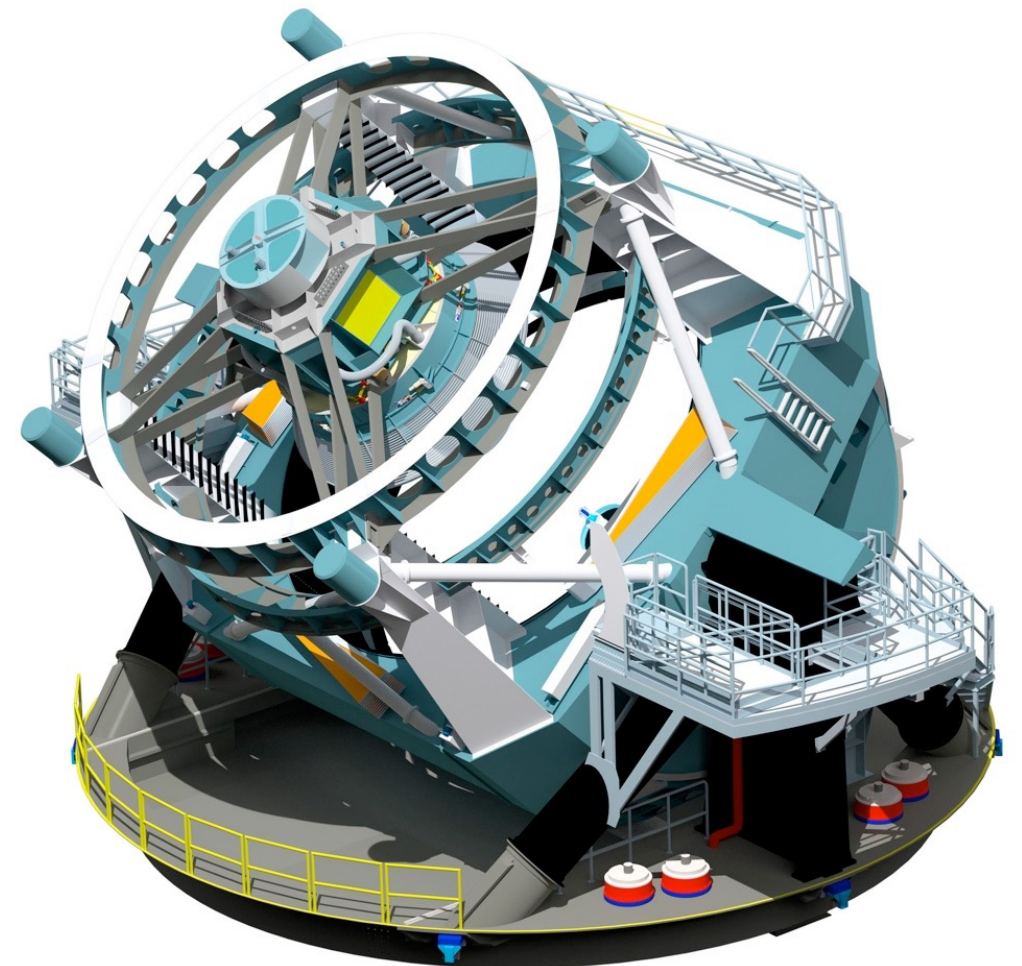

ZTF

A **1.2m telescope** with a **47 deg²** field of view, providing more than **250 exposures per year** in gri to **20.5 mag** and **1 million nightly alerts** since June 2018.

LSST

A **8.4m telescope** with a **9.6 deg²** field of view, providing more than **80 exposures per year** in ugrizy to **24.5 mag** and **10 million nightly alerts** starting **2022**.

ZTF adopted the LSST alert stream concept & tools.

alert serialization

ZwickyTransientFacility / ztf-avro-alert   https://zwicky.tf/dm5

<> Code   ⊙ Issues **0**   Pull requests **0**   Projects **0**   Wiki   I

✳ Avro schema for ZTF alerts   https://zwickytransientfacility.githu...

Add topics

alert distribution

ZwickyTransientFacility / alert_stream
forked from lsst-dm/alert_stream

<> Code   ⊙ Issues **0**   Pull requests **0**   Projects **0**   Wiki   I

🏄 A realtime alert stream based on Apache Kafka.   https://zwickytransientfacility

Maria Patterson, ECB, et al. 2019
PASP **131** 018001

ZTF and LSST alerts are very similar...

Based on image differencing

Alerts sent for every source detected at 5 sigma in the image difference

    Alerts include transients, variable stars, AGN, asteroids...

**Similar data format and serialization (although LSST formats will continue to evolve)**

    includes image cutouts, history of detections (including upper limits), real-bogus score, nearby static sky objects...

**Same transport layer (Apache Kafka)**

…but have some significant differences.

|	ZTF	LSST
History	30 days	1 year
Cutouts	Science, template, difference	Template, difference
Crossmatches	Gaia, PanSTARRS	LSST DRP
Precomputed timeseries features	None	6x32 periodic & 6x20 nonperiodic features (TBD)
Solar System Object features	Crossmatch only	Orbital parameters, etc.
Forced photometry measurements	None	Included if they exist
Variable star photometry	Reconstruct from difference & template fluxes	Provided as forced PSF fit to unsubtracted visit image

ZTF's public surveys provide a systematic view of the dynamic Northern Hemisphere sky.
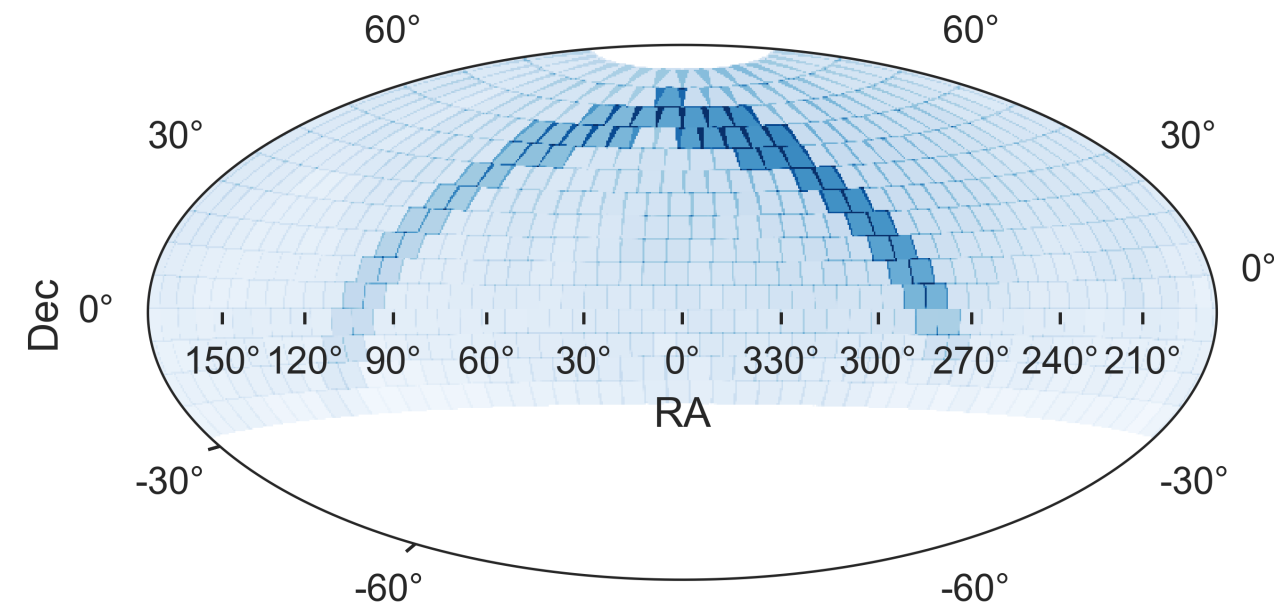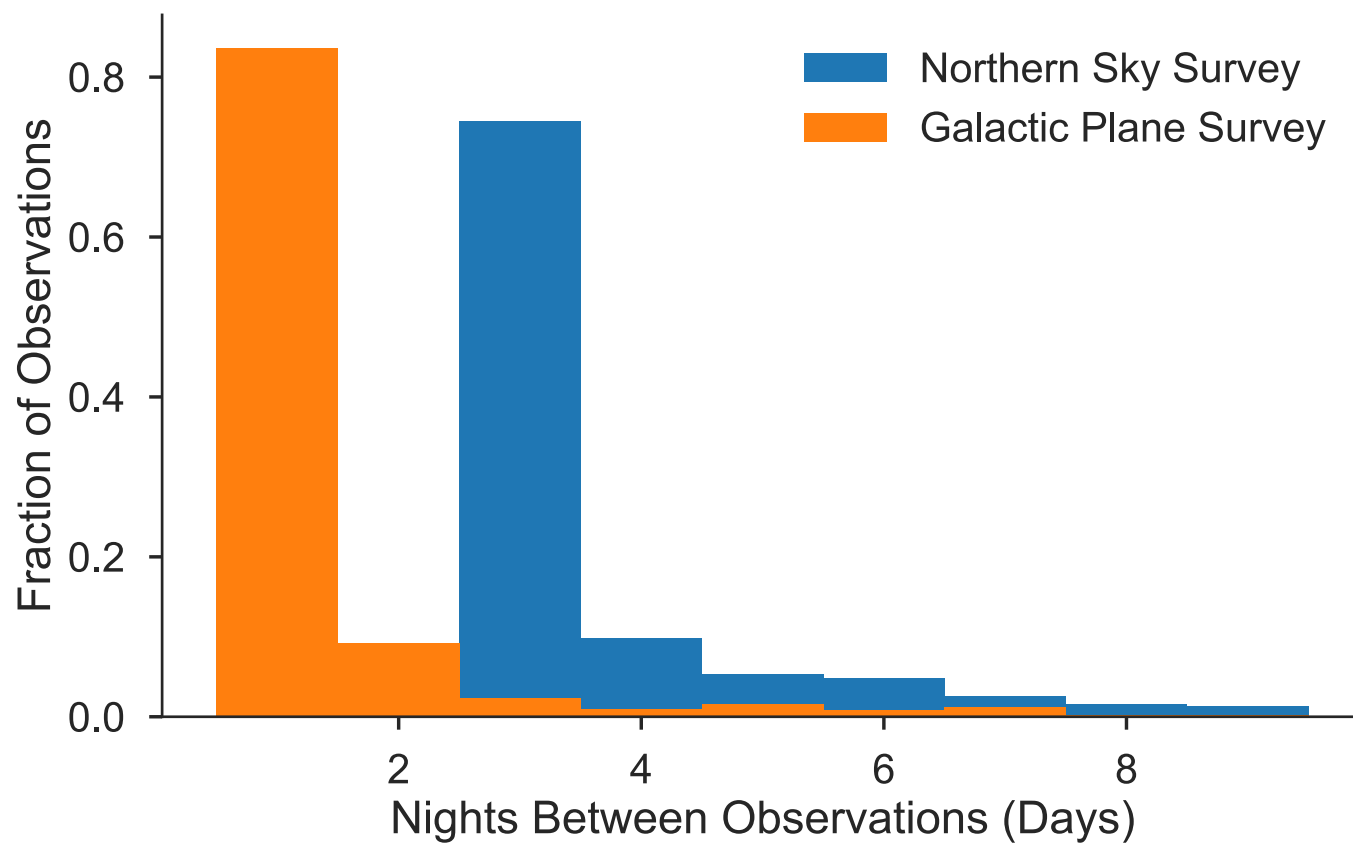

g-band
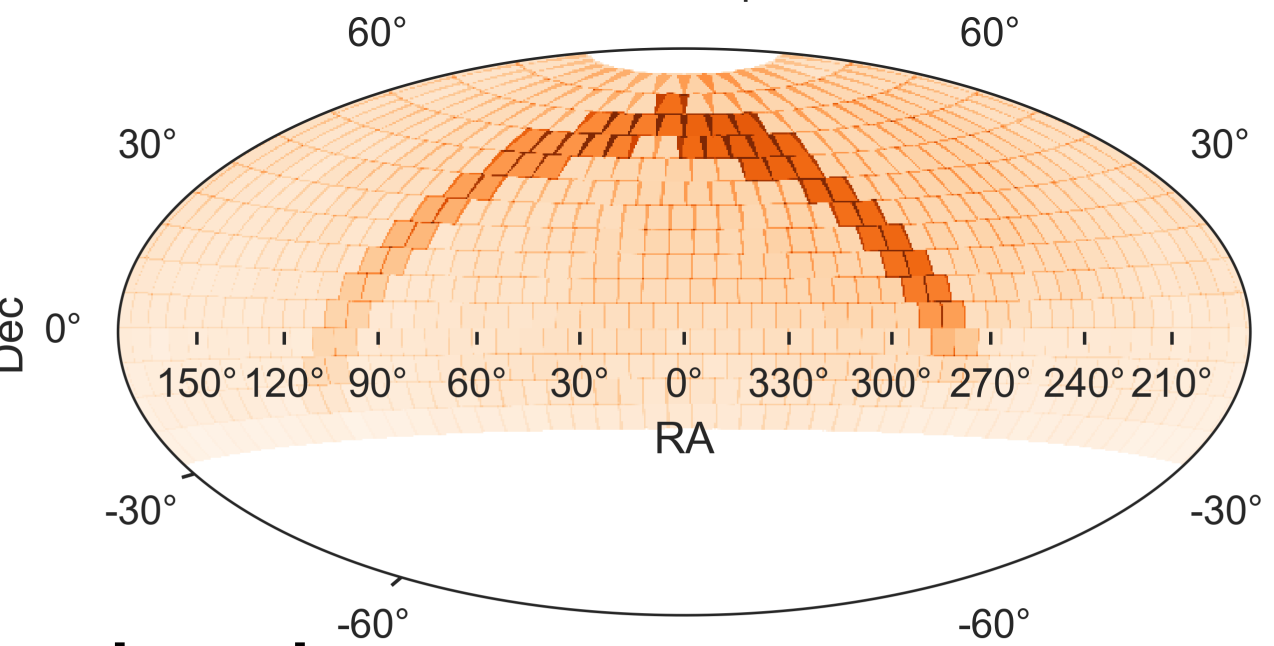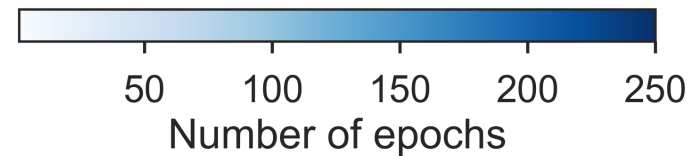
r-band
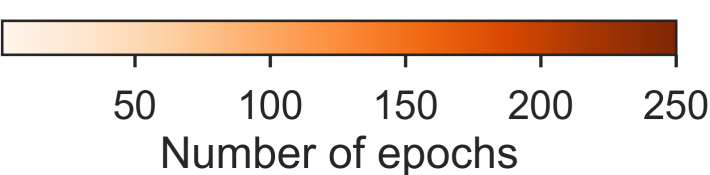
Northern Sky Survey
3-day cadence, g+r, $|b| > 7°$, $\delta > -30°$

Galactic Plane Survey
1-day cadence, g+r, $|b| < 7°$, $\delta > -30°$

Bellm et al. 2019b, PASP

Since June 2018 ZTF has been sending real-time alerts from the public surveys to community brokers.

https://antares.noao.edu/

https://lasair.roe.ac.uk/

http://alerce.science/

https://mars.lco.global/

There is also nightly static archive of the bulk alerts:
**https://ztf.uw.edu/alerts/public/**

New brokers and teams are welcome to connect!
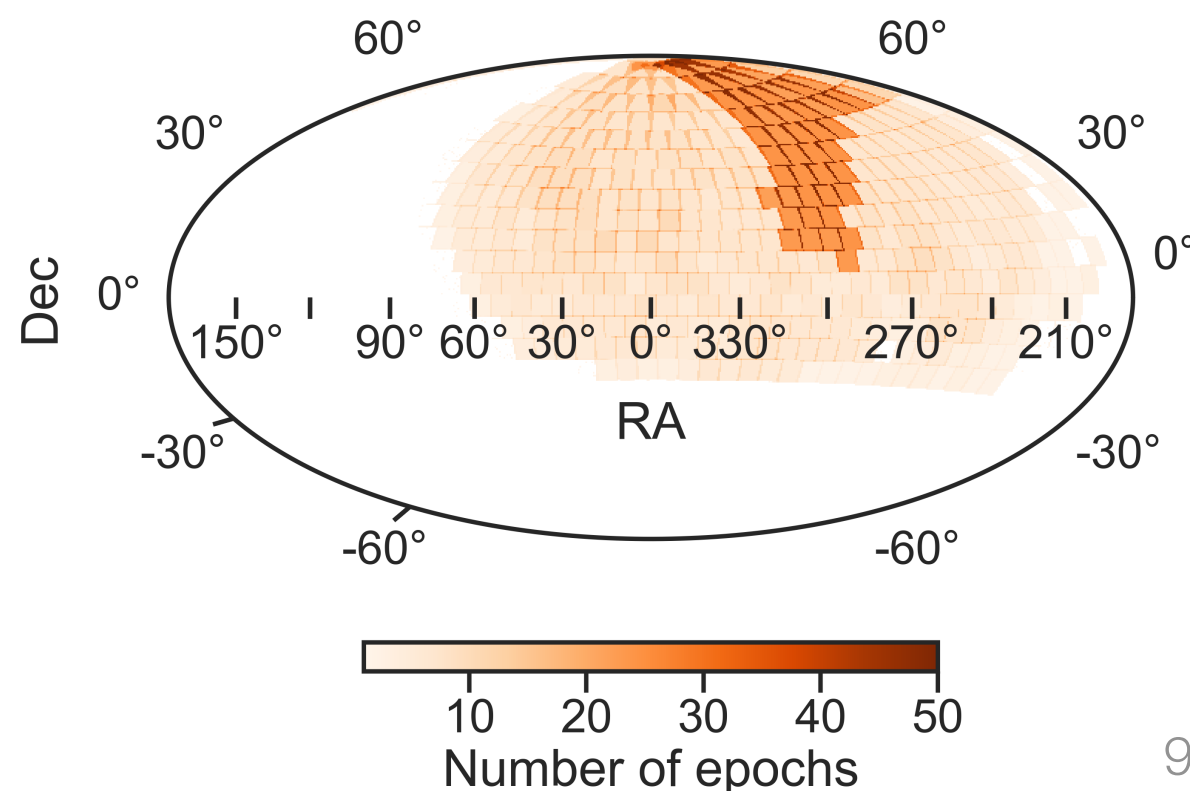
In July 2018 the public surveys were revised.

Nightly (g+r) survey of the Galactic Plane replaced by nightly (g+r) observations of the current TESS sector.

TESS alerts identifiable by alert column 'program_pi' == 'TESS'.

3-day cadence Northern Sky Survey notionally unchanged, but sky coverage will adjust seasonally.
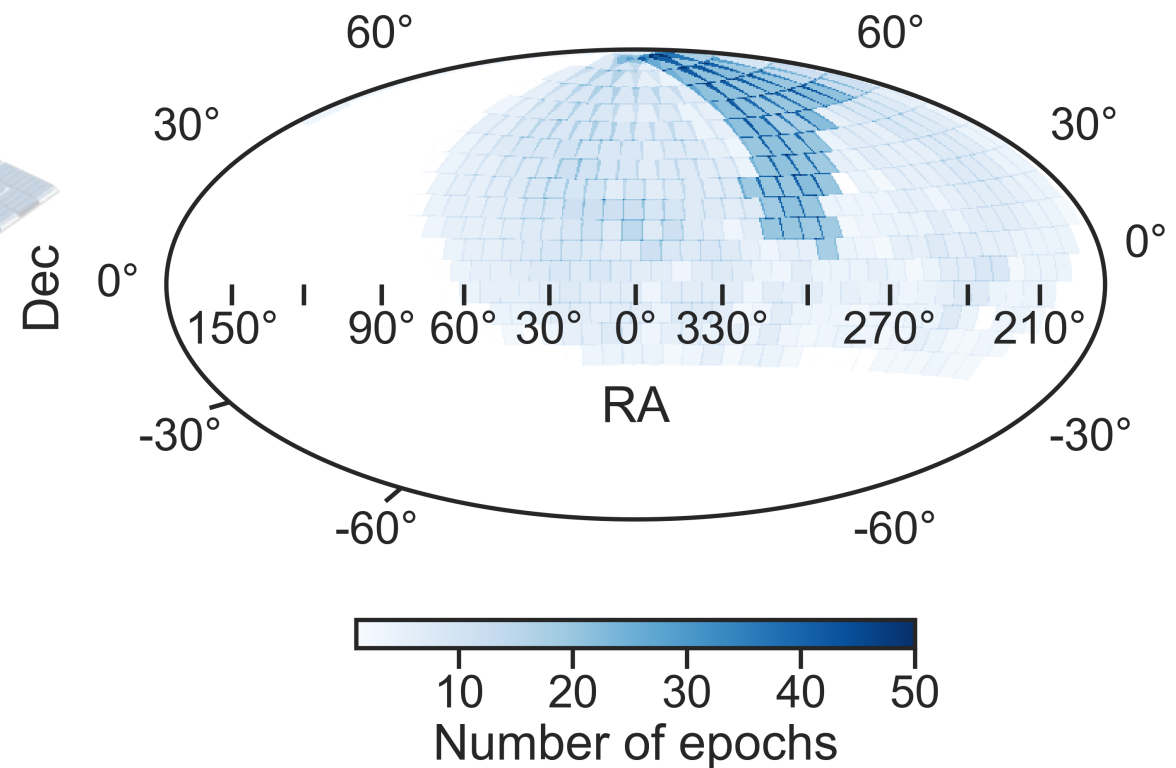
Public survey coverage since 18 July

MSIP funding has provided access to PTF, iPTF, & ZTF data.

2015-2016: PTF & iPTF public data releases

2017: ZTF first light & commissioning

2018: ZTF survey starts

       March 20: formal surveys begin

       June 1: public alert stream begins

2019: Survey continues

       May: ZTF Data Release 1

       July: public surveys revised to shadow TESS

       December: ZTF Data Release 2

2020: End of MSIP-funded survey; final data releases

2021-23: ZTF Phase II?

       potentially supported by 2019 MSIP, new/expanded partnership

The ZTF alert stream is operating effectively, generating science, and seeding a new ecosystem of community brokers for the LSST era.

We'd welcome new teams interested in connecting to the alert stream, and support and new partners to continue public alerts in ZTF Phase II.