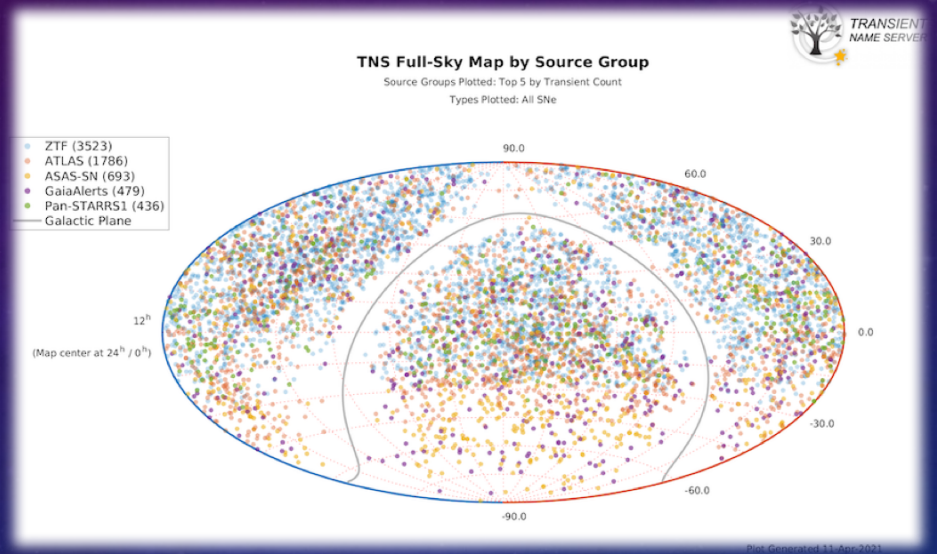
The Transient Name Server

[Overview for the LSSTC brokers workshop]

Apr 2021

Ofer Yaron

- "Name server"
- Fully searchable
- Citable (ADS indexed)



The Official IAU transient reporting mechanism

Reports

- "Manual" [forms] (including amateurs)
- Automatic [bots] (most surveys)
- Brokers

Alerts on

Transients (AT)

Classifications (SN...)

FRBs

(GW events, GRBs...)

AstroNotes

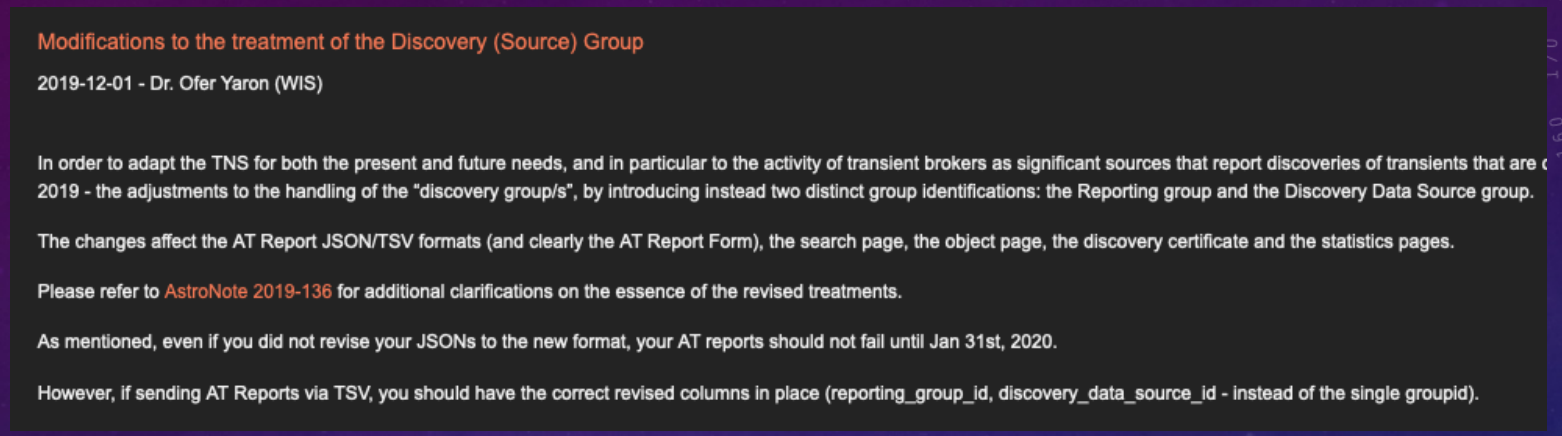
The team: Avishay Gal-Yam (PI, chair of IAU SN WG),

Avner Sass, Eran Ofek, Nikola Knezevic

Weizmann Institute for Science

www.wis-tns.org

The TNS is dynamic – constantly adjusted to meet the changing needs



Modifications to the treatment of the Discovery (Source) Group

2019-12-01 - Dr. Ofer Yaron (WIS)

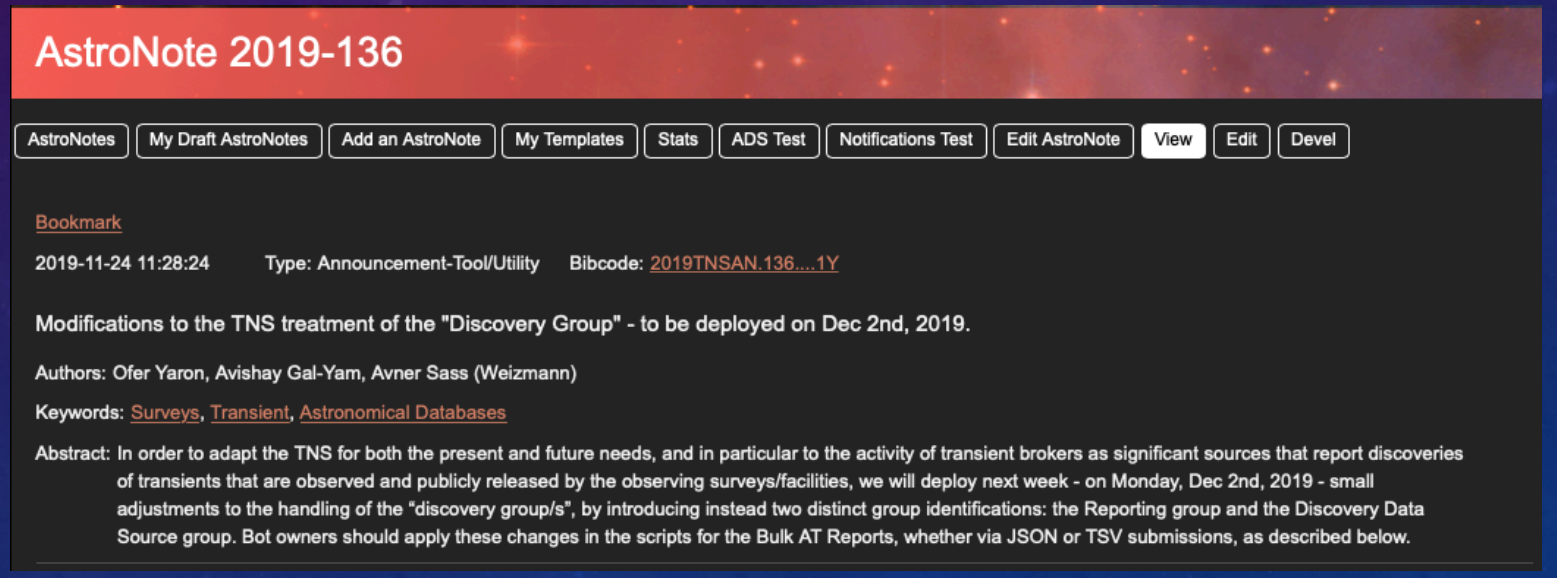
In order to adapt the TNS for both the present and future needs, and in particular to the activity of transient brokers as significant sources that report discoveries of transients that are
2019 - the adjustments to the handling of the "discovery group/s", by introducing instead two distinct group identifications: the Reporting group and the Discovery Data Source group.

The changes affect the AT Report JSON/TSV formats (and clearly the AT Report Form), the search page, the object page, the discovery certificate and the statistics pages.

Please refer to AstroNote 2019-136 for additional clarifications on the essence of the revised treatments.

As mentioned, even if you did not revise your JSONs to the new format, your AT reports should not fail until Jan 31st, 2020.

However, if sending AT Reports via TSV, you should have the correct revised columns in place (reporting_group_id, discovery_data_source_id - instead of the single groupid).



AstroNote 2019-136

AstroNotes | My Draft AstroNotes | Add an AstroNote | My Templates | Stats | ADS Test | Notifications Test | Edit AstroNote | View | Edit | Devel

Bookmark

2019-11-24 11:28:24 Type: Announcement-Tool/Utility Bibcode: 2019TNSAN.136....1Y

Modifications to the TNS treatment of the "Discovery Group" - to be deployed on Dec 2nd, 2019.

Authors: Ofer Yaron, Avishay Gal-Yam, Avner Sass (Weizmann)

Keywords: Surveys, Transient, Astronomical Databases

Abstract: In order to adapt the TNS for both the present and future needs, and in particular to the activity of transient brokers as significant sources that report discoveries of transients that are observed and publicly released by the observing surveys/facilities, we will deploy next week - on Monday, Dec 2nd, 2019 - small adjustments to the handling of the "discovery group/s", by introducing instead two distinct group identifications: the Reporting group and the Discovery Data Source group. Bot owners should apply these changes in the scripts for the Bulk AT Reports, whether via JSON or TSV submissions, as described below.

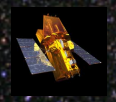
The Transient Name Server - overview

- In operation since Jan 1st 2016. The official IAU mechanism for reporting new astronomical (extra galactic) transients and specifically for official name designation. (Set up by the IAU in order to provide a modern, automatic mechanism to archive and distribute alerts about transients, replacing the manual defunct CBAT system.)
- [As of Apr 2021] holds >70k reported transient candidates ("ATs"), ~7k (10%) classified SNe (including a full catalog of all pre-2016 SNe); >1k registered users, >100 groups.
- The basic TNS object is an Astronomical Transient (AT) with a unique identifier of the form AT YYYYx (x=A..Z, aa..zz, aaa..zzz,…). The prefix "AT" can be later changed to indicate a classification (e.g., "SN") but the unique identifier is always kept.
- Most reports are submitted automatically by "bots" of the major surveys & brokers (PS1, ZTF, Gaia, ATLAS…), but it is also possible to submit reports interactively using forms. Discovery reports are called *AT-reps* whereas classification reports (supported by a spectrum, for the "normal" transients) are called *Class-reps*.
- The system naturally handles multiple reports on the same event (e.g., discoveries of the same object by different surveys) and keeps a (fully searchable) record of "internal names" that are associated with each AT-rep.
- The system supports a service for short astronomical announcements (AstroNotes) which is a superior version of the ATEL system (e.g., searchable; hyperlinked to specific objects).
- All reports and AstroNotes are indexed by the ADS and are citable.

The Transient Name Server - overview

- Currently all alerts/notifications from the TNS (discoveries/classifications/AstroNotes) are distributed via emails to the registered users, according to their defined preferences. (Additional staging/alerting mechanisms (e.g. Kafka streams) may be added.)
- Some data can be reported as proprietary for a certain period of time; e.g. securing a name designation without official release of the details yet, or not exposing a classification spectrum.
- Groups, Bots and memberships are all self-managed (by the users/group-owners), thus enabling flexible handling of access permissions, controlling the discovery credits etc.
- The system has recently been migrated to the AWS cloud, increasing its H/A capacity, and is designed to ingest the LSST streams and to be online ~99.999% of the time.
- Recently the FRB community joined the TNS.
  - An additional subsystem was developed for handling the specific requirements of FRBs – including a separate naming engine (FRB YYYYMMDDx), a separate report form (for the specific FRB properties), and enabling specification of area localizations (*"area transients"*).
  - The system was tailored to meet the wishes of the FRB community.

UV/visible/IR surveys



Real-time transient Alerts since 2016

Radio surveys

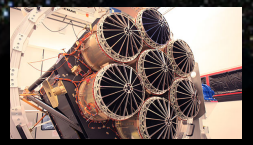
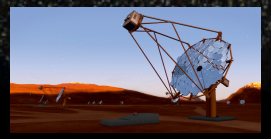
Joined 2020

Discussion initiated

Gravitational Wave Detectors

Potential

High energy surveys (X/γ)

TRANSIENT NAME SERVER

All data

WISeREP

Robotic follow-up facilities

Major follow-up collaborations

Pessto ESO

LCO Las Cumbres Observatory

NASA data system

astrophysics data system

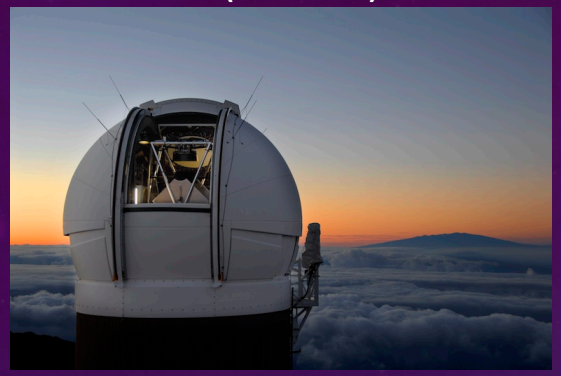
Data queries

Data contributions

Global Astrophysics Community

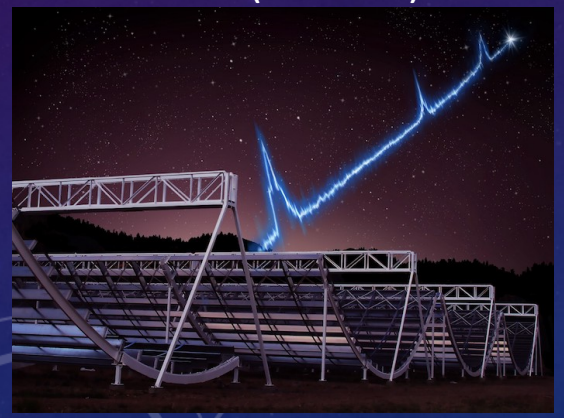
Some of the major surveys reporting to the TNS

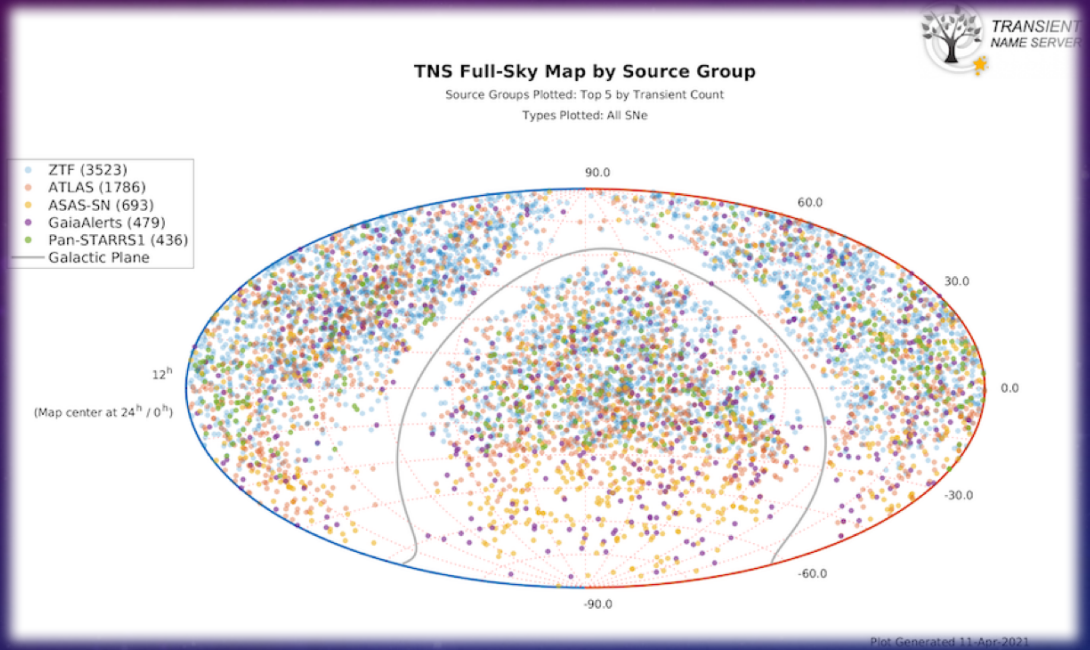
Pan-Starrs (Hawaii)



ZTF, iPTF (Palomar, CA)

CHIME-FRB (Canada)

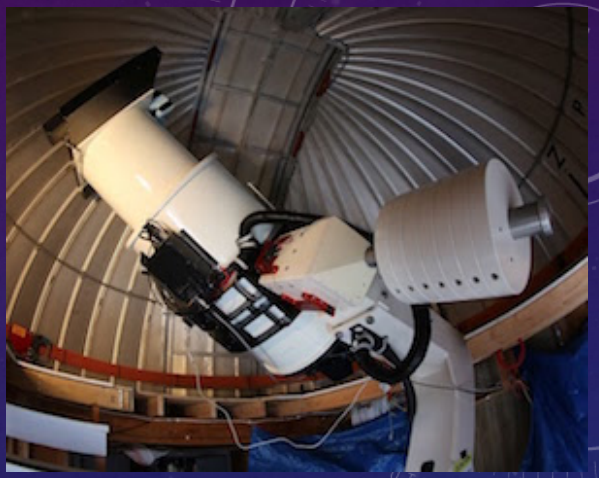




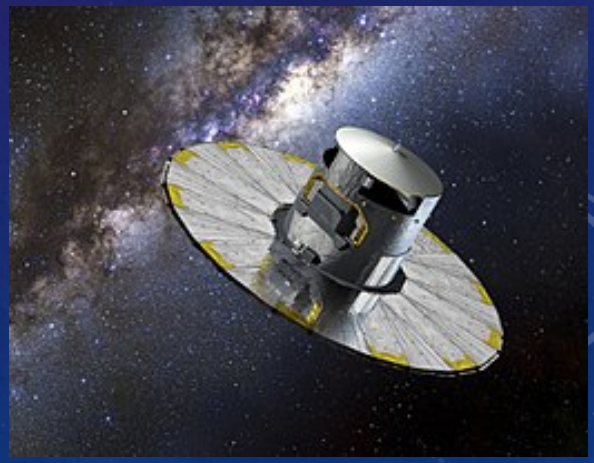
Soon…

- LIGO-Virgo-KAGRA
- GRBs

ATLAS (Hawaii)



Gaia (Space)



www.wis-tns.org/stats-maps

TNS Statistics (as of 2021-04-14)

ALL transients reported since Jan 1, 2016	71691	
PUBLIC transients reported since Jan 1, 2016	71186	
PUBLIC transients for the top 5 reporting groups	Pan-STARRS1	22021
	GaiaAlerts	12257
	ZTF	11395
	ATLAS	8541
	ALeRCE	8066
PUBLIC transients for the top 5 data source groups	Pan-STARRS1	23209
	ZTF	20933
	GaiaAlerts	12257
	ATLAS	8541
	iPTF	1635
PUBLIC classified SNe reported since Jan 1, 2016	7664	
PUBLIC classified SNe for the top 5 reporting groups	ZTF	2365
	ATLAS	1803
	ALeRCE	1075
	ASAS-SN	698
	GaiaAlerts	480
PUBLIC classified SNe for the top 5 data source groups	ZTF	3569
	ATLAS	1803
	ASAS-SN	698
	GaiaAlerts	480
	Pan-STARRS1	439
ALL spectra reported to the TNS	9310	
PUBLIC spectra reported to the TNS	8612	
PUBLIC classifications for the top 5 contributing groups	ZTF	3691
	ePESSTO	723
	ePESSTO+	684
	SCAT	388
	PESSTO	277

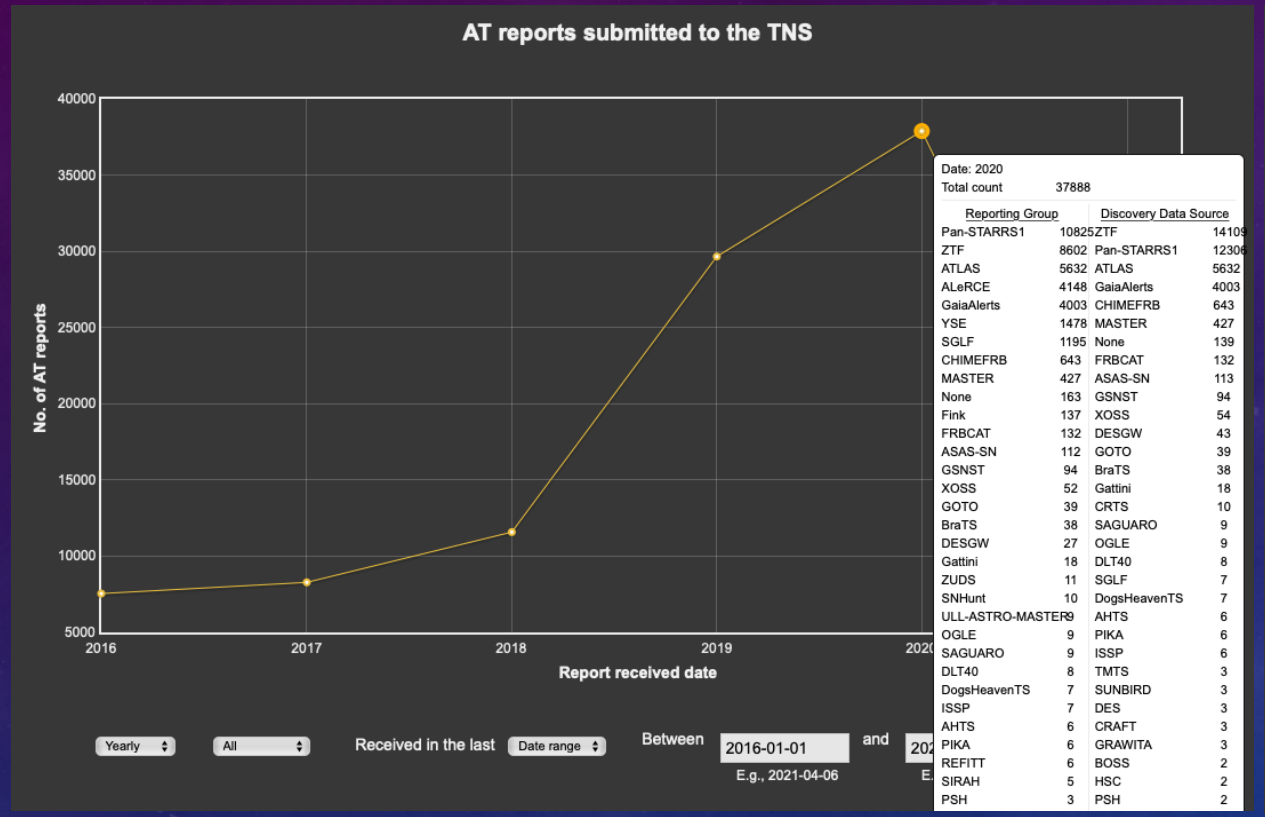
PUBLIC classified SNe by type

SN Ia	5045
SN II	1135
SN IIn	221
SN Ia-91T-like	199
SN Ic	178
SN IIP	165
SN Ib	122
SN IIb	104
SLSN-I	86
SN Ic-BL	72
SN Ia-91bg-like	60
SN Ia-pec	48
SLSN-II	40
SN Ib/c	38
SN I	31
SN	26
SN Ibn	26
SN Iax[02cx-like]	23
SN Ia-CSM	10
SN Ib-Ca-rich	9
SN Ib-pec	8
SN II-pec	7
SN Icn	3
SN IIn-pec	3
SN IIL	3
SN Ic-pec	2

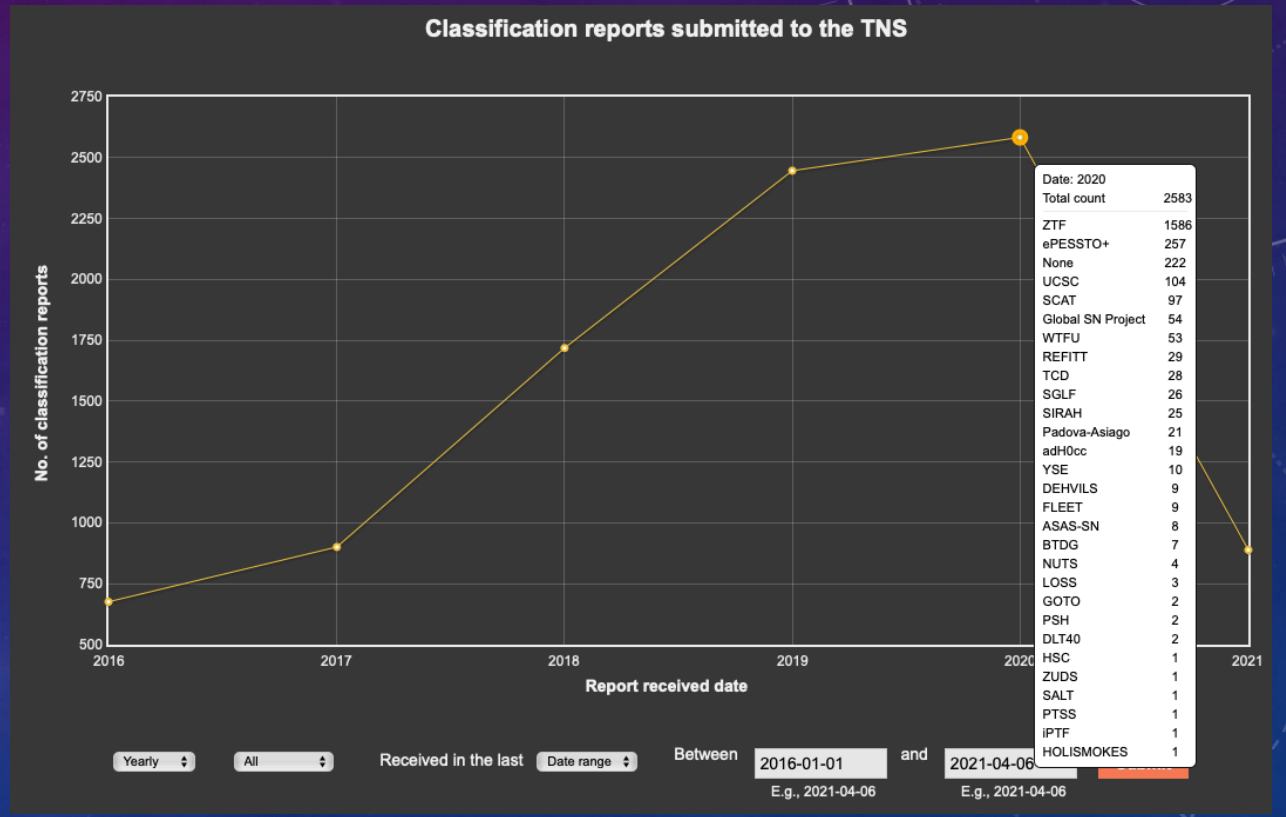
www.wis-tns.org/stats-maps

TNS Reports Yearly Timeline (2021-04-06)

Discovery reports



Classification reports



Brokers activity

An example of AT reports for ZTF/PS discoveries reported by various groups (as of 2021-04-12)

All AT Reports

name	count(*)
ZTF	23430
ALeRCE	8218
SGLF	1374
Fink	365
AMPEL	171
ZUDS	11
REFITT	10
ULL-ASTRO-MASTER	9
None	4
SIRAH	4
ePESSTO+	1
HOLISMOKES	1
IMSNG	1

ATs classified as SNe

name	count(*)
ZTF	8305
ALeRCE	1133
Fink	239
SGLF	116
AMPEL	28
REFITT	7
SIRAH	4
ULL-ASTRO-MASTER	2
None	1
HOLISMOKES	1

All AT Reports

name	count(*)
Pan-STARRS1	31891
YSE	1735
None	3

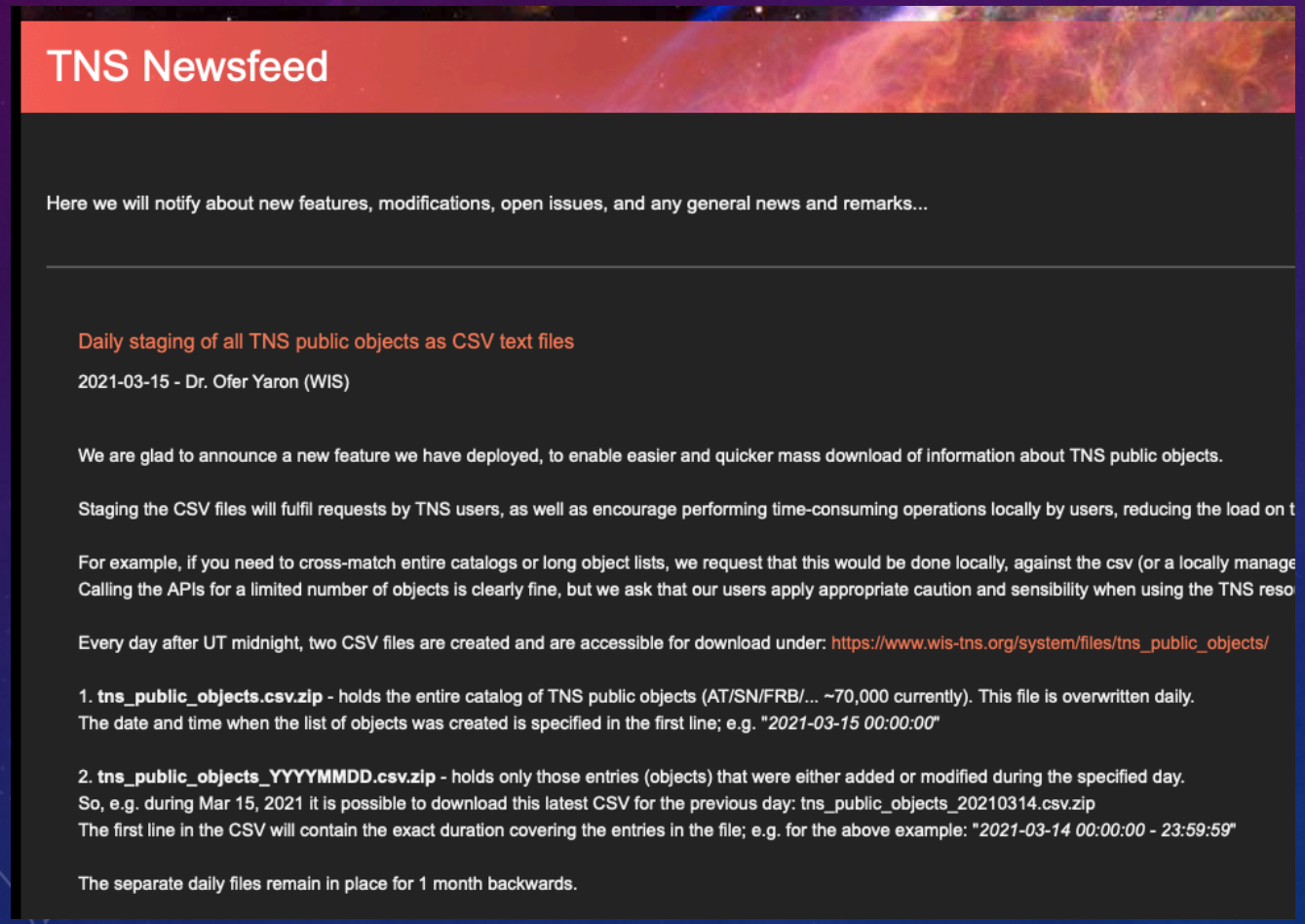
ATs classified as SNe

name	count(*)
Pan-STARRS1	3993
YSE	248

www.wis-tns.org/content/tns-getting-started
www.wis-tns.org/content/tns-newsfeed

TNS NewsFeed + Help Page

- Important updates/revisions are presented on the NewsFeed
- Use the help page, where also sample codes and examples are provided…



TNS Newsfeed

Here we will notify about new features, modifications, open issues, and any general news and remarks...

Daily staging of all TNS public objects as CSV text files

2021-03-15 - Dr. Ofer Yaron (WIS)

We are glad to announce a new feature we have deployed, to enable easier and quicker mass download of information about TNS public objects.

Staging the CSV files will fulfil requests by TNS users, as well as encourage performing time-consuming operations locally by users, reducing the load on t

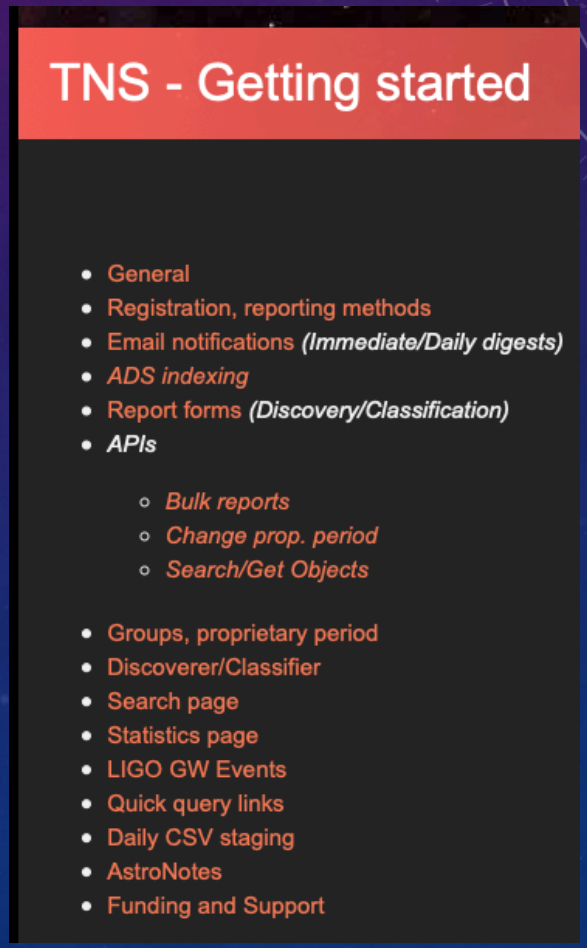
For example, if you need to cross-match entire catalogs or long object lists, we request that this would be done locally, against the csv (or a locally manage
Calling the APIs for a limited number of objects is clearly fine, but we ask that our users apply appropriate caution and sensibility when using the TNS reso

Every day after UT midnight, two CSV files are created and are accessible for download under: https://www.wis-tns.org/system/files/tns_public_objects/

1. **tns_public_objects.csv.zip** - holds the entire catalog of TNS public objects (AT/SN/FRB/... ~70,000 currently). This file is overwritten daily.
The date and time when the list of objects was created is specified in the first line; e.g. "*2021-03-15 00:00:00*"

2. **tns_public_objects_YYYYMMDD.csv.zip** - holds only those entries (objects) that were either added or modified during the specified day.
So, e.g. during Mar 15, 2021 it is possible to download this latest CSV for the previous day: tns_public_objects_20210314.csv.zip
The first line in the CSV will contain the exact duration covering the entries in the file; e.g. for the above example: "*2021-03-14 00:00:00 - 23:59:59*"

The separate daily files remain in place for 1 month backwards.



TNS - Getting started

- General
- Registration, reporting methods
- Email notifications *(Immediate/Daily digests)*
- *ADS indexing*
- Report forms *(Discovery/Classification)*
- *APIs*
  - *Bulk reports*
  - *Change prop. period*
  - *Search/Get Objects*
- Groups, proprietary period
- Discoverer/Classifier
- Search page
- Statistics page
- LIGO GW Events
- Quick query links
- Daily CSV staging
- AstroNotes
- Funding and Support

APIs, Bulk downloads

- A Sandbox environment exists for experimentation with the APIs (both for submission and retrieval of info)

  All API development must be performed against the sandbox!!!

  https://sandbox.wis-tns.org
  https://sandbox.wis-tns.org/api

- APIs are in place for:
  - the submission of Discovery (AT) and Classification reports.
  - Searching of objects (by coords, names – IAU/internal)
  - Retrieving object details

- CSV/TSV downloads are available from the Search page (also in a scriptable way)

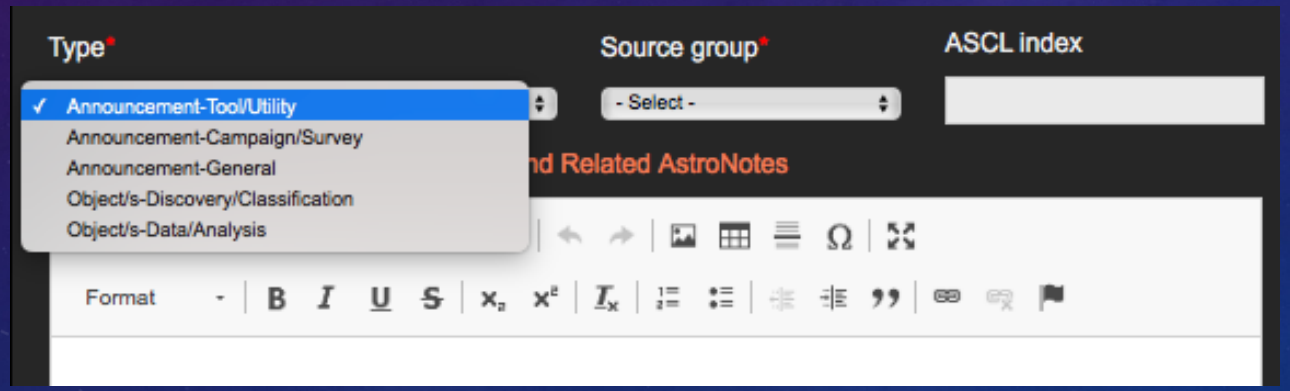
e.g. https://www.wis-tns.org/search?&&classified_sne=1&date_start%5Bdate%5D=2021-01-01&format=csv&num_page=100&page=0 ←[0..N]

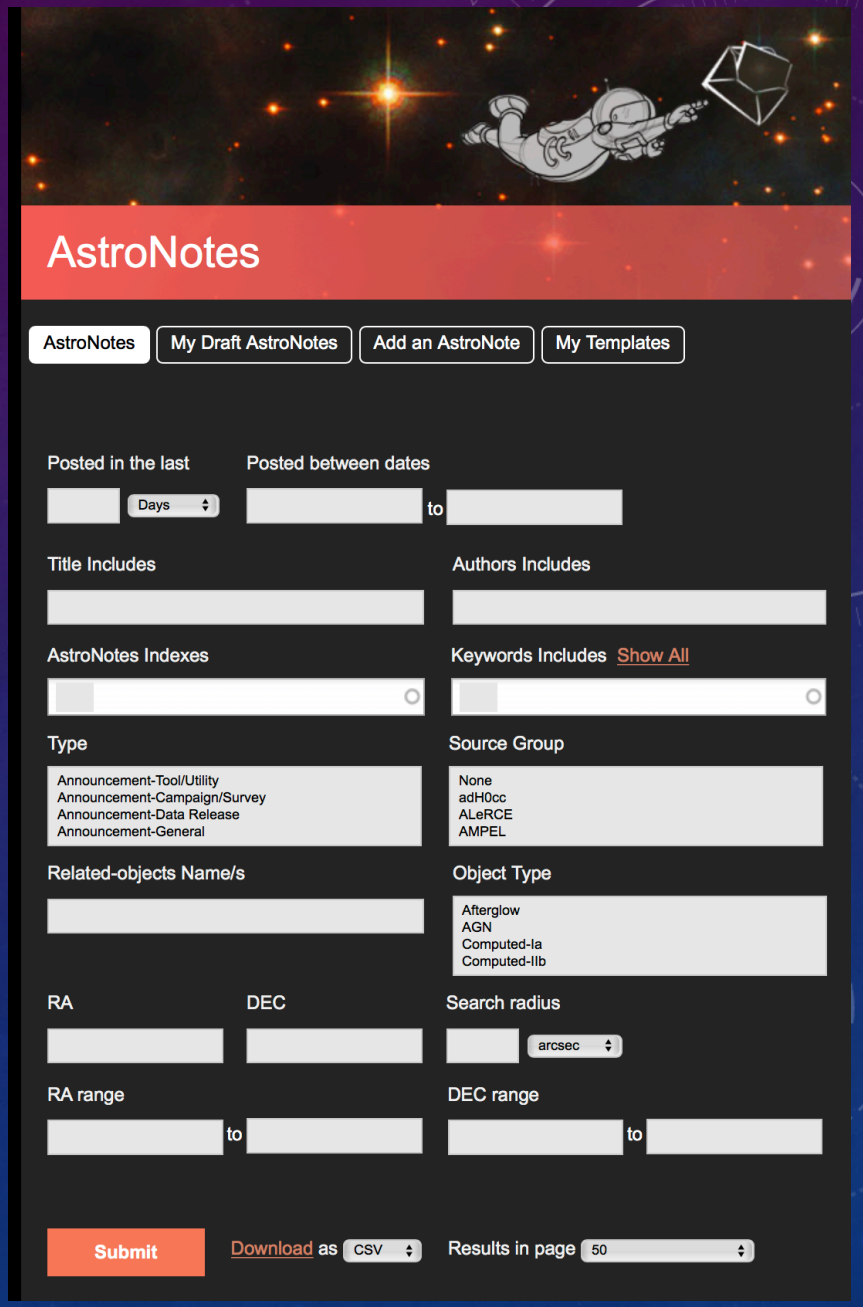
- A CSV of all public objects (as well as daily "delta" lists) are available for download, in order to allow for easy local managing of the TNS data and to perform "heavy" operations locally (such as cross-matching entire catalogs or long object lists)

https://www.wis-tns.org/system/files/tns_public_objects/tns_public_objects.csv.zip
Or using curl (with api_key) for a daily csv:
curl -X POST -d 'api_key=YOUR-API-KEY' https://www.wis-tns.org/system/files/tns_public_objects/tns_public_objects_20210404.csv.zip > tns_public_objects_20210314.csv.zip

AstroNotes!!!

- A sub-system within the TNS (so no need to register to an additional service for creating and receiving these notifications).
- Enabling the distribution of notifications in a very flexible (yet accurate) way, directly coupled to the related objects, searchable and citable.
- Can create either an object-related (discovery, classification, analysis) or an “announcement” notification, without any restrictions, limitations or penalties…





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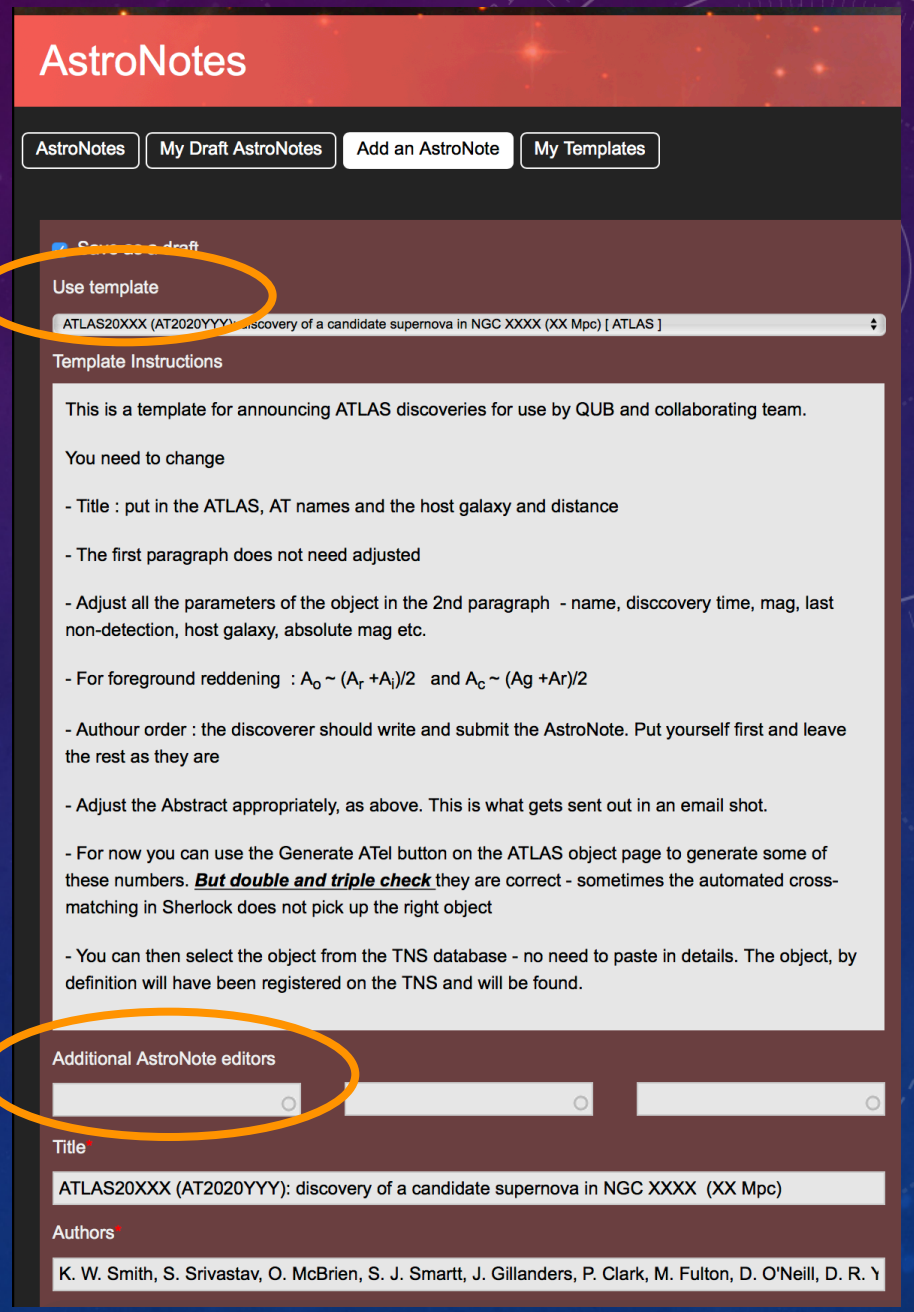
- Easy sharing of Drafts with the colleagues; allowing definition of several editors to continue editing the draft until submission.



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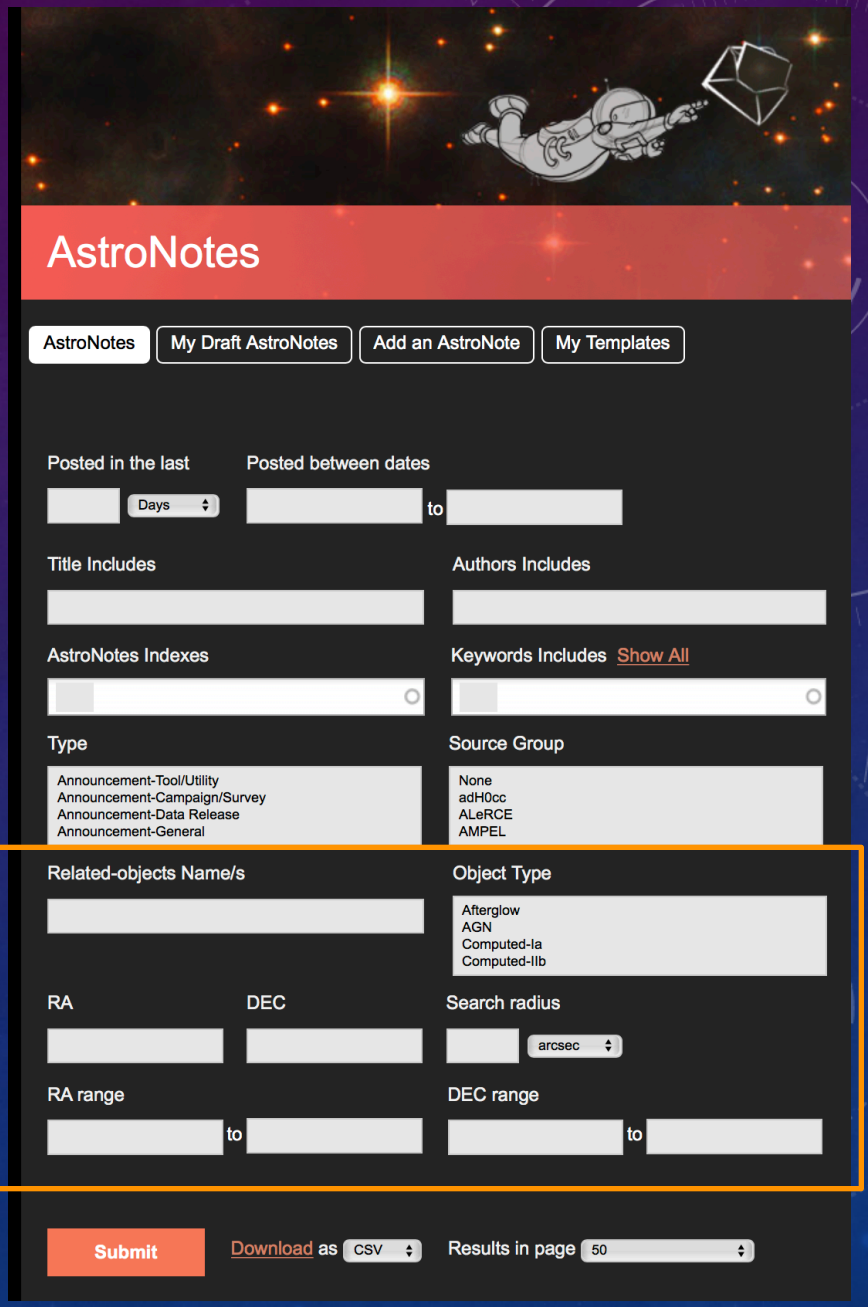
- Many Search options, including by object names, types and coords.



AstroNotes!!!

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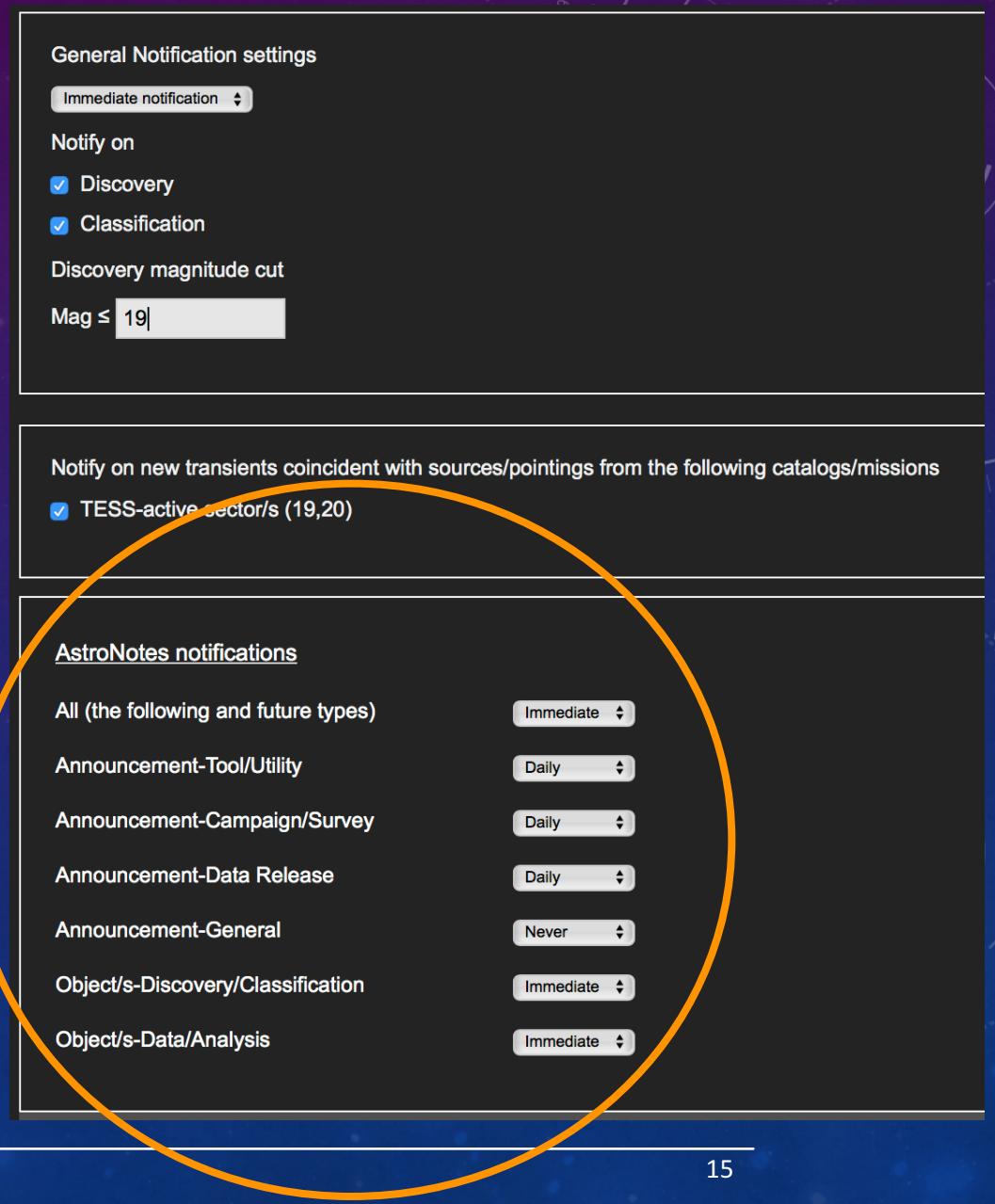
- Easy managing and use of Templates, for quicker writing of a new AstroNote.
- Easy sharing of Drafts with the colleagues; allowing definition of several editors to continue editing the draft until submission.
- Many Search options, including by object names, types and coords.
- Possible to define on your My Account page which notifications types to receive, and in which manner.

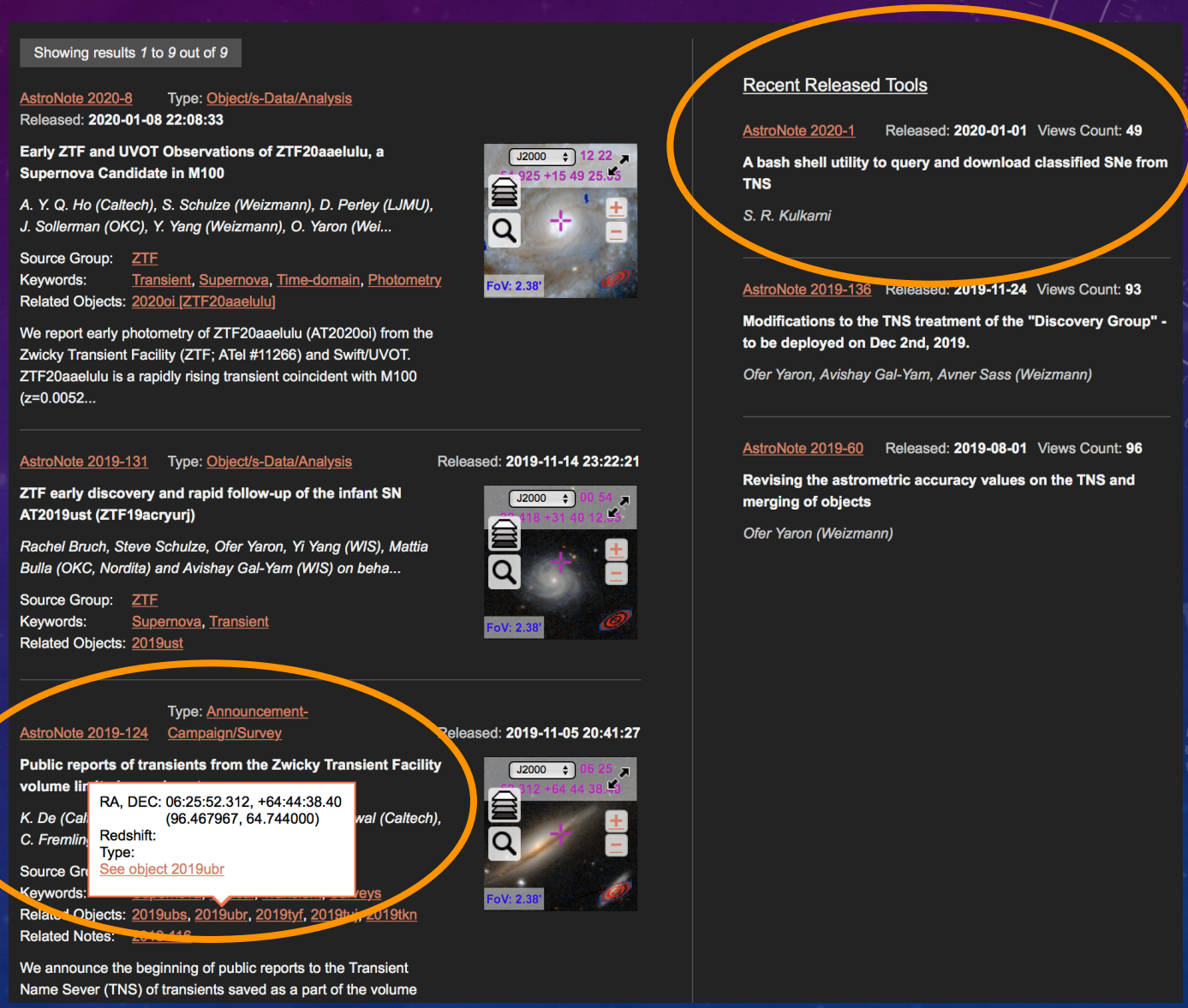


AstroNotes!!!

A query for ZTF AstroNotes:

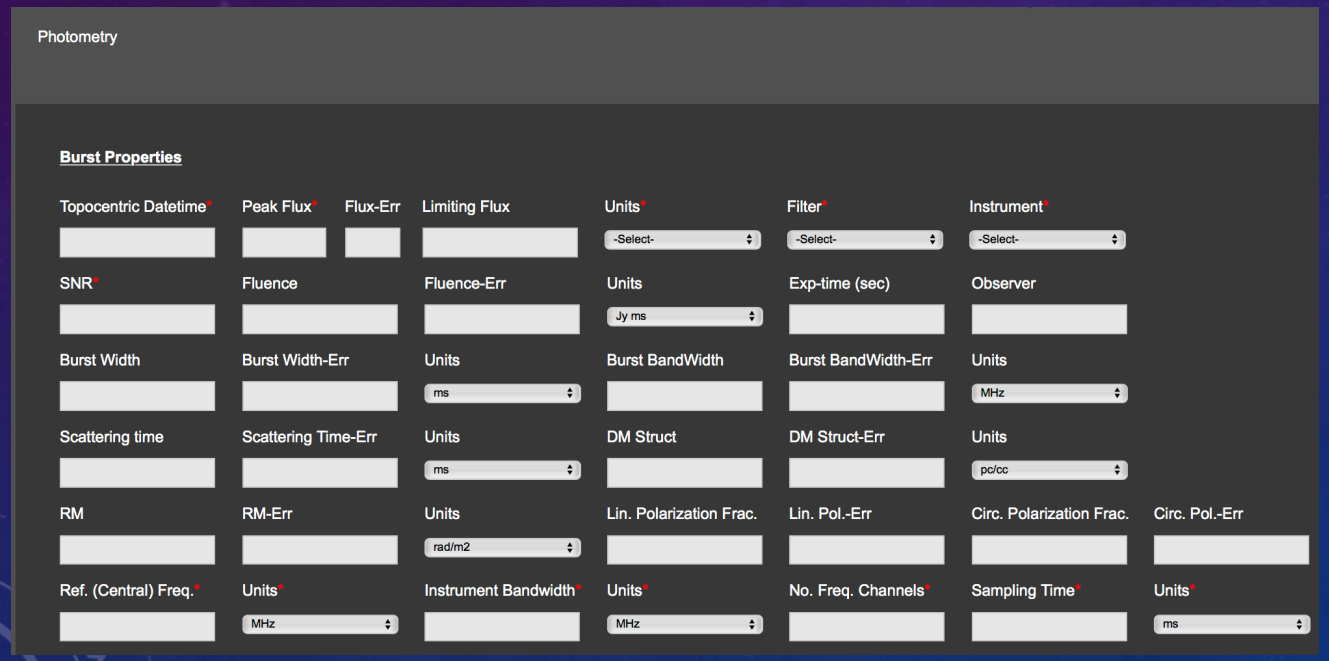
- Major surveys and groups of the Transients community have already moved to using solely AstroNotes – ATLAS, Pan-Starrs, PESSTO, ZTF…

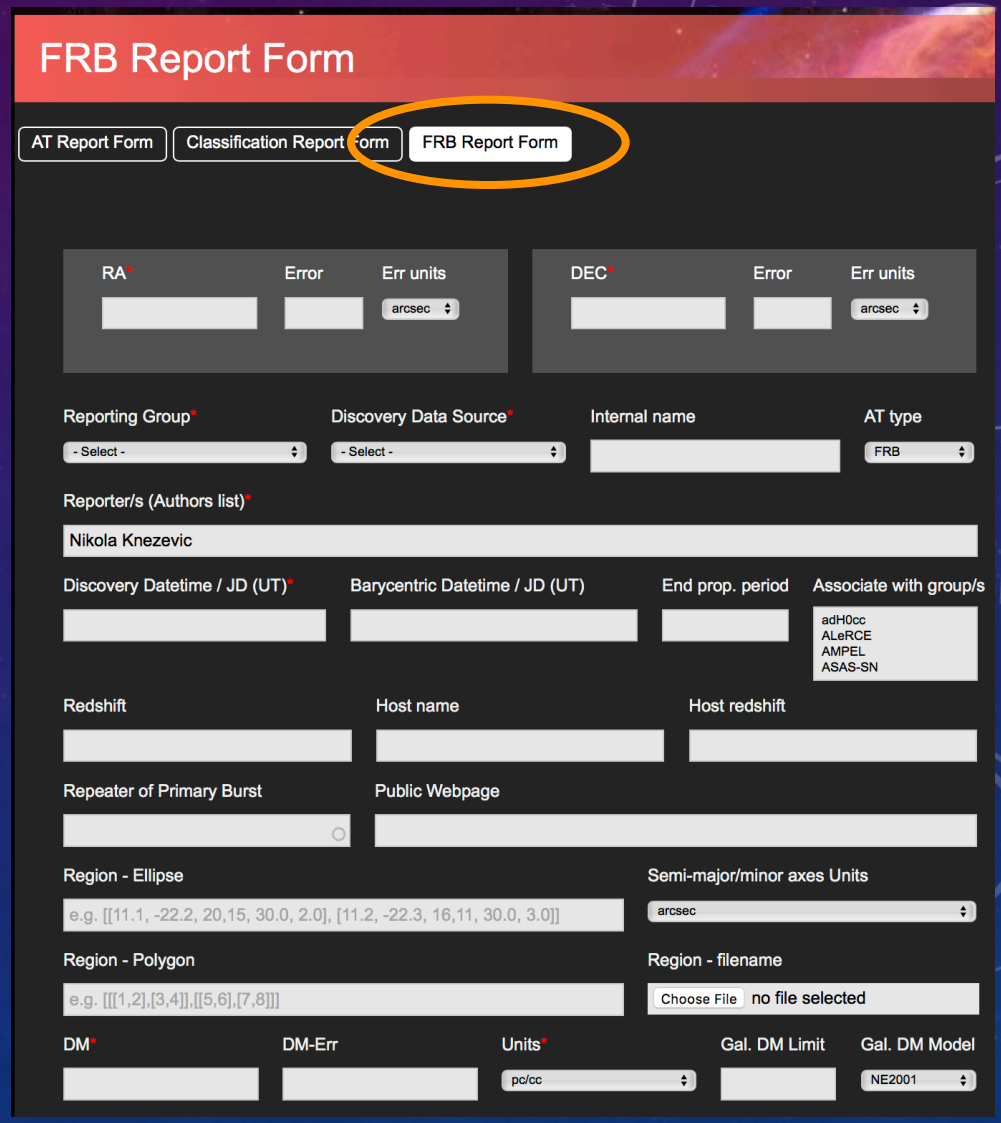
Clicking on an object name overlays its basic details, with a link directly to the object page



Area Transients - The new guys in town (since 2020-03)… FRBs

- Main coordination with CHIME and representatives of the FRB community
- A separate engine for designation of names: (FRB)YYYYMMDDabc, coexisting next to the AT/SN names
- FRB-Catalog fully ingested to the TNS





Fast Radio Bursts

FRB Advanced Search

Repeater: Repeater | Repeater of | FRB with measured redshift

DM Range: to | RM Range: to

SNR Range: to | Flux Range: to

Show main query | Explain main query

Submit | Download as CSV | Download as TSV | Results in page 50

Columns to display

Showing results 1 to 2 out of 2

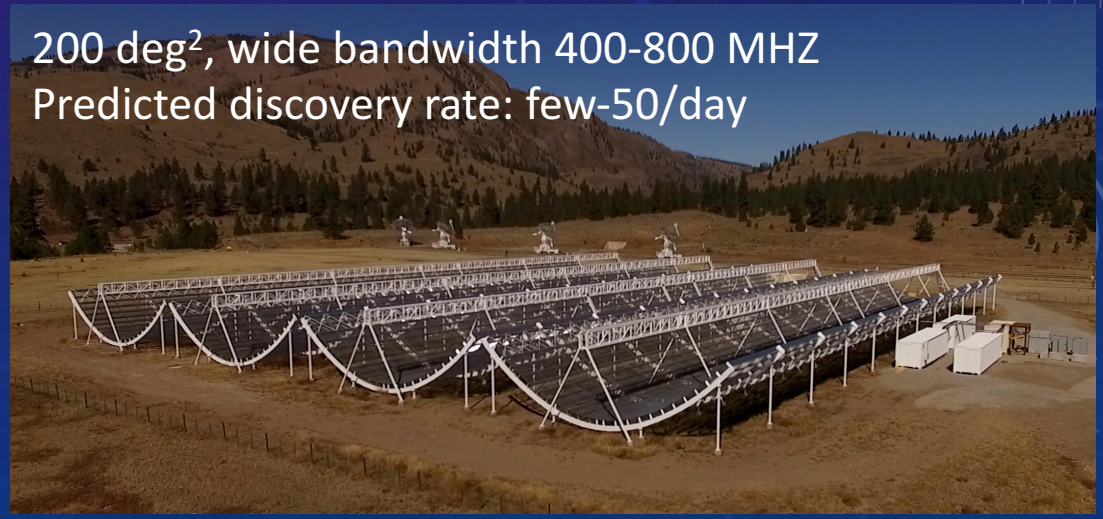
ID	Name	Reps	Class	RA	DEC	Obj. Type	Repeater of Primary Burst	DM (Err)	Galactic DM Limit	Barycentric Datetime
51465	FRB 20191202A	1		02:15:60.000	+33:00:00.00	FRB	FRB 20191202A	680 (68) pc/cc	24 (NE2001)	
51466	FRB 20190807A	1		00:08:00.000	+02:00:00.00	FRB	FRB 20191202A	430 (43) pc/cc	23 (YMW16)	

- Repeaters are distinct objects on the TNS, allowing flexible associations of multiple bursts with the Primary Burst.

CHIME/FRB Discovery of Eight New Repeating Fast Radio Burst Sources

The CHIME/FRB Collaboration, B. C. Andersen,[1,2] K. Bandura,[3,4] M. Bhardwaj,[1,2] P. Boubel,[1,2] M. M. Boyce,[5] P. J. Boyle,[1,2] C. Brar,[1,2] T. Cassanelli,[6,7] P. Chawla,[1,2]

The discovery of the first repeating FRB source, FRB 121102, at a dispersion measure DM $\simeq$ 560 pc cm^{-3} (Spitler et al. 2014, 2016), eliminated cataclysmic models as the only means for producing FRB emission. The repetitive nature of FRB 121102 enabled sub-arcsecond localization of the source via radio interferometry and subsequent optical identification of the low-metallicity host galaxy



Clarifications / to summarize

- The TNS manages discovery & classification information (data), NOT extended LCs, spectral sequences etc…
  For this, data repositories such as WISeREP are relevant.

- Initiated mainly for SN candidates, the TNS also handles other extra-galactic transients, including novae (CVs), AGN flares, TDEs, Kilonovae… BUT NOT variable stars, asteroids or other such galactic/local variable/moving sources.

PLEASE DO NOT submit varstars/moving objects but only secure extra-galactic transient candidates!!!

- "Area Transients" are also officially joining the TNS: FRBs, and soon also GRBs, GW events.
  (In future more sophisticated cross-matching and association capabilities should be implemented – both on the TNS, and hopefully also by the additional utilities being developed.)

- Classifications must be supported by a spectrum (not relevant for the area transients), and currently the TNS only switches the prefixes from AT to SN. (TDEs, Kilonovae… remain AT until an official decision will be made.)

- API sample codes are available for download on the help page.

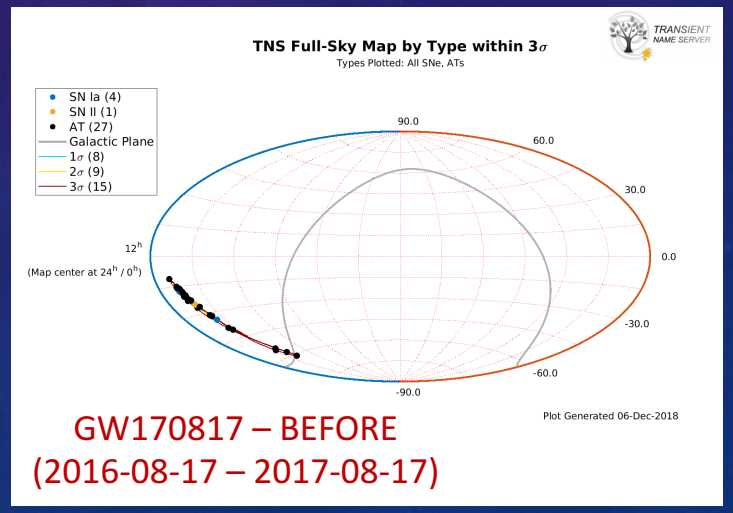
- For any questions/feedback/suggestions related to the use of the TNS, its APIs, AstroNotes, please do not hesitate to contact us: www.wis-tns.org/content/contact-us (or me in person)

Current LIGO pages on the TNS – a clarification

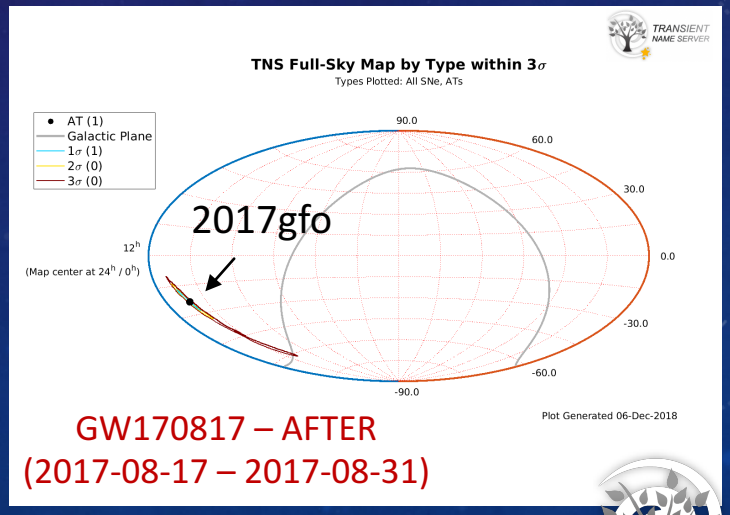
- During O1-O3 observing runs, we ingested to the TNS the reported LIGO events and based on the localization maps (HEALPix) provided to the community maps and tables of the known transients (ATs) on the TNS discovered within half a year BEFORE the GW event and the discovered transients within the localizations during the 2 weeks AFTER the event.
- The plan is to continue doing so for the future LVK runs. Any ideas and recommendations are clearly welcome.

LIGO GW

Event Date	Event Name	GraceDB	Instruments	Classification	Distance [Mpc] (Err)
2020-03-16 21:57:56	S200316bj	To GraceDB event page	H1, L1, V1	Mass-Gap: (99.57%) Terrestrial: (0.43%)	1177.983 (283.01)
2020-03-11 11:58:53	S200311bg	To GraceDB event page	H1, L1, V1	BBH: (100%) Terrestrial: (0%)	1114.588 (174.59)
2020-03-02 01:58:11	S200302c	To GraceDB event page	H1, V1	BBH: (88.96%) Terrestrial: (11.04%)	1820.133 (536.10)
2020-02-25 06:04:21	S200225q	To GraceDB event page	H1, L1	BBH: (95.77%) Terrestrial: (4.23%)	994.913 (187.86)
2020-02-24 22:22:34	S200224ca	To GraceDB event page	H1, L1, V1	BBH: (100%) Terrestrial: (0%)	1574.996 (322.37)
2020-02-19 09:44:15	S200219ac	To GraceDB event page	H1, L1, V1	BBH: (96.4%) Terrestrial: (3.6%)	3533.071 (1031.11)
2020-02-13 04:10:40	S200213t	To GraceDB event page	H1, L1, V1	Terrestrial: (37.05%)	200.919 (80.01)
2020-02-08 13:01:17	S200208q	To GraceDB event page	H1, L1, V1	BBH: (99.34%) Terrestrial: (0.66%)	2142.007 (459.01)
2020-01-29 06:54:58	S200129m	To GraceDB event page	H1, L1, V1	BBH: (100%) Terrestrial: (0%)	754.616 (193.72)
2020-01-28 02:20:11	S200128d	To GraceDB event page	H1, L1	BBH: (96.9%) Terrestrial: (3.1%)	3701.586 (1264.51)



GW170817 – BEFORE
(2016-08-17 – 2017-08-17)



GW170817 – AFTER
(2017-08-17 – 2017-08-31)