

10 Years of **ASAS SN**

Michael Tucker

CCAPP Fellow



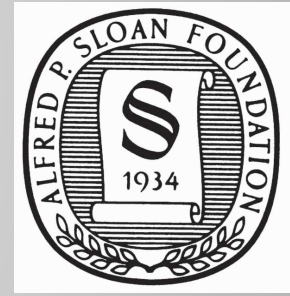
11.000



THE OHIO STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

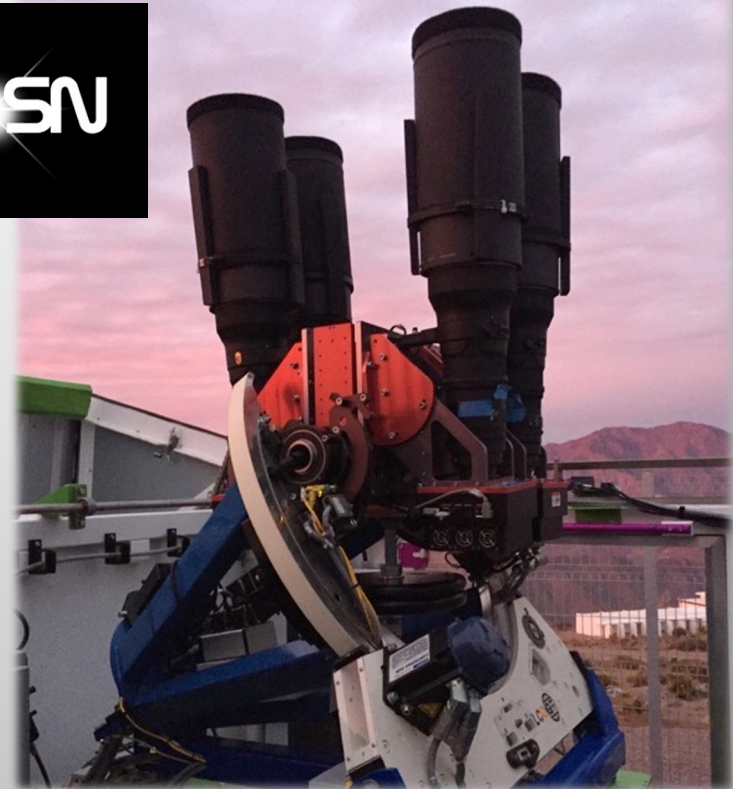
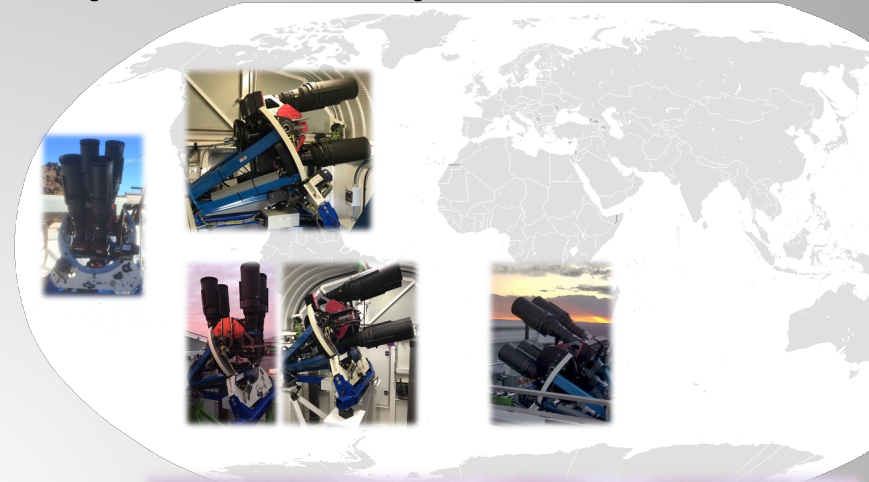


- **C. Kochanek, K. Z. Stanek**, T. Thompson, D. Rowan, S. Bose, M. Rizzo Smith, K. Neumann, J. Neustadt, M. Tucker, J. Beacom (**OSU**)
- **B. Shappee**, J. Hinkle, A. Payne (**Hawaii**)
- T. Jayasinghe (**Berkeley**)
- **T. Holoi** (**Carnegie Observatories**)
- J. Prieto (**Diego Portales; MAS**)
- L. Chomiuk, J. Strader, E. Aydi (**Michigan State**)
- Subo Dong (**KIAA-PKU**)
- X. Dai (**University of Oklahoma**)
- O. Pejcha (**Charles University**)
- K. Auchetti (**Melbourne**)
- A. Franckowiak (**DESY**)
- J. Tayar (**Florida**)
- E. Levesque (**Washington**)
- J. Brimacombe (**Coral Towers Observatory**)



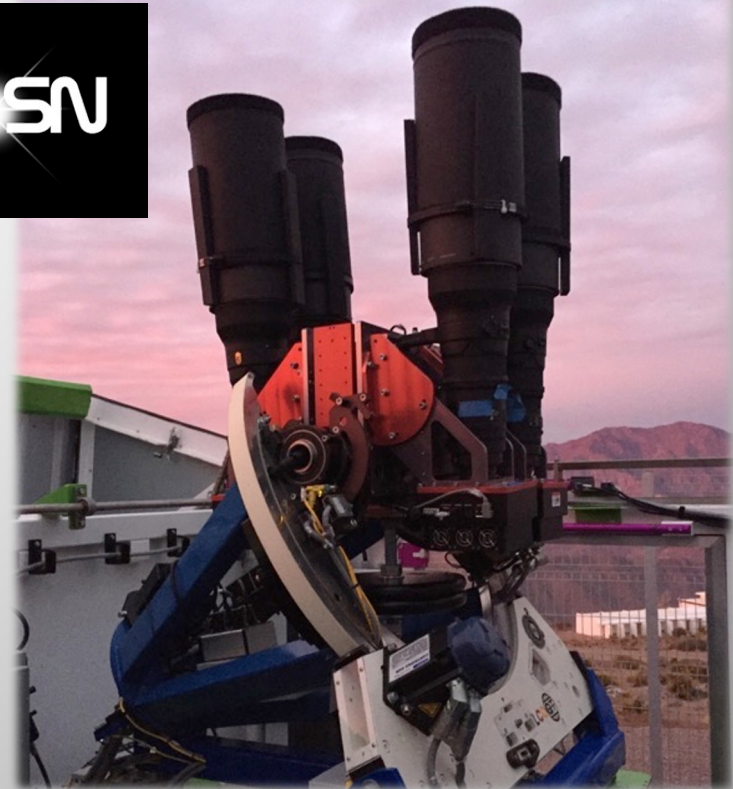
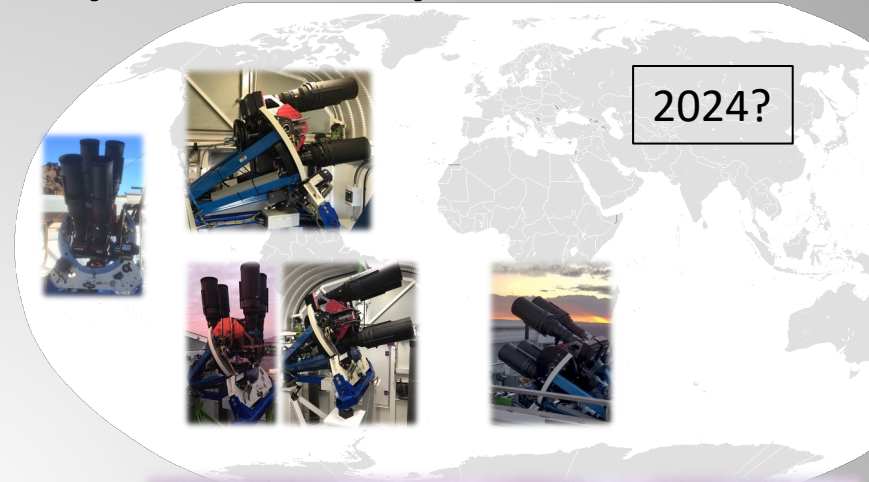
All-Sky Automated Survey for Supernovae

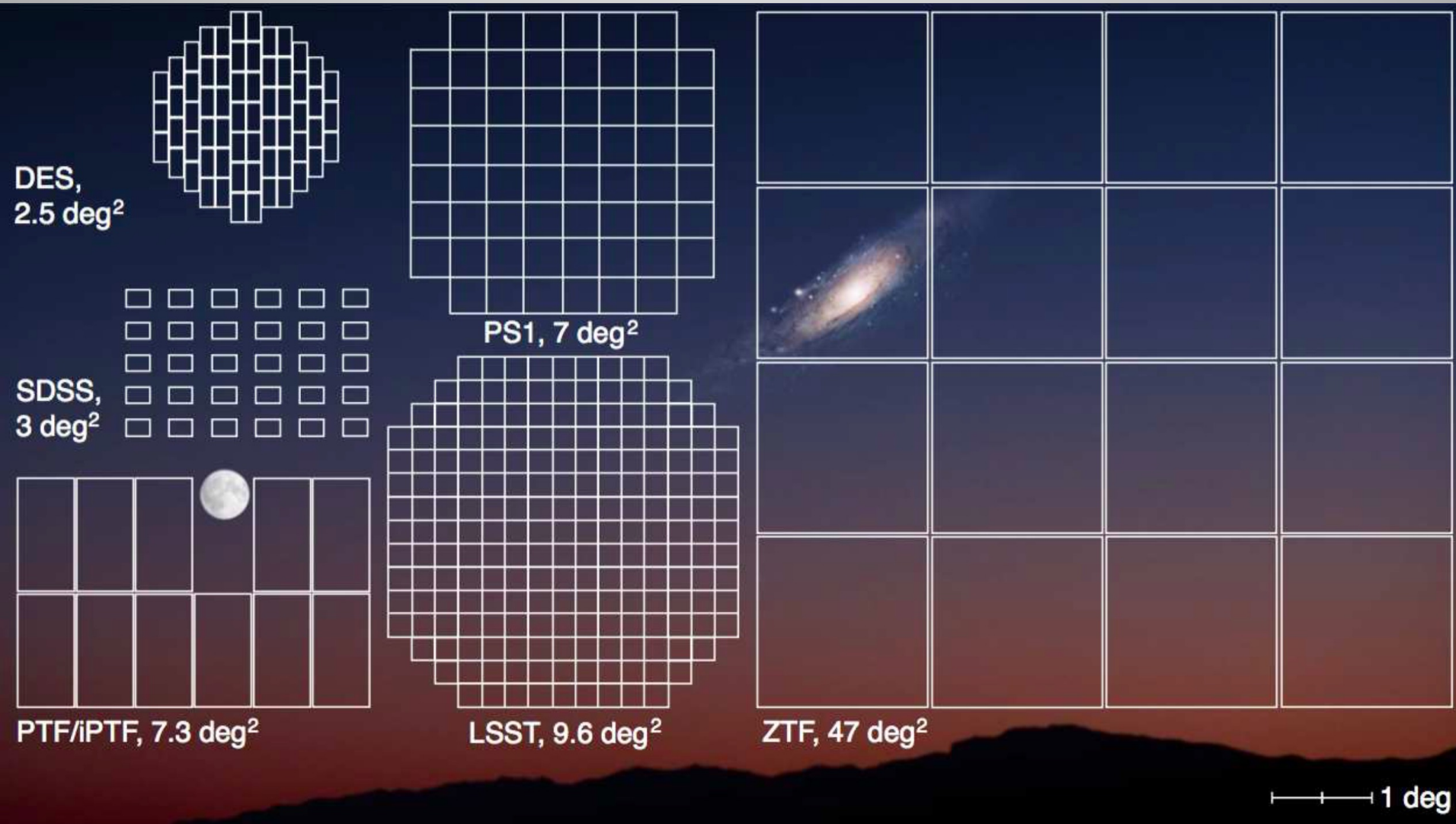
- 4 telescopes per mount
- 5 mounts
 - 20 total cameras
- 14cm lens, 2k × 2k thinned CCDs
- 4.47 × 4.47 degree field-of-view
 - 20 deg² per camera
 - 400 deg² total
- 7.8" pixel scale
- *g*-band filters
- Limiting magnitude ≈ 18.5
- ≈6500 images per night
- 40,000 square degrees per night

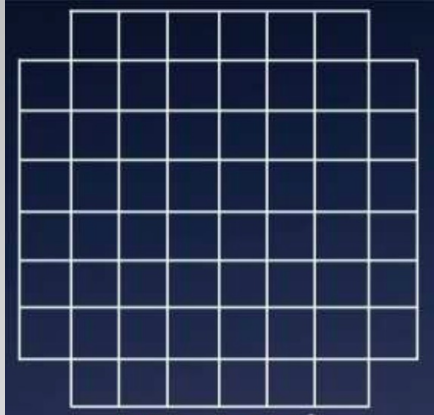


All-Sky Automated Survey for Supernovae

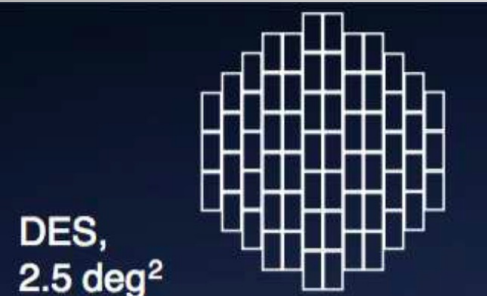
- 4 telescopes per mount
- 5 mounts
 - 20 total cameras
- 14cm lens, 2k × 2k thinned CCDs
- 4.47 × 4.47 degree field-of-view
 - 20 deg² per camera
 - 400 deg² total
- 7.8" pixel scale
- *g*-band filters
- Limiting magnitude ≈ 18.5
- ≈6500 images per night
- 40,000 square degrees per night



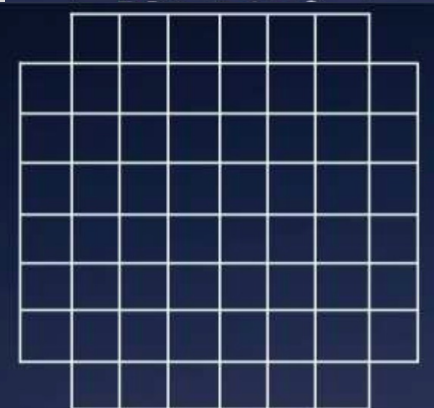




2



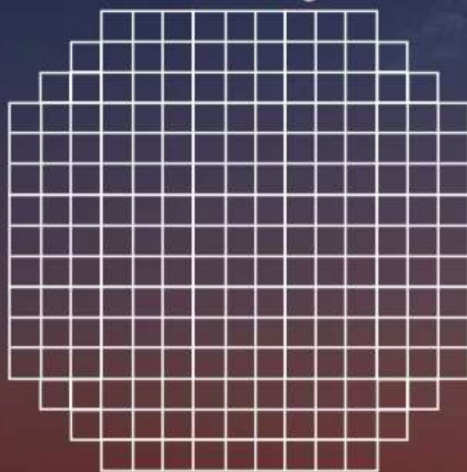
DES,
2.5 deg²



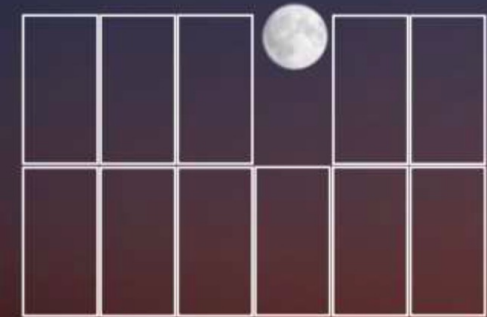
PS1, 7 deg²



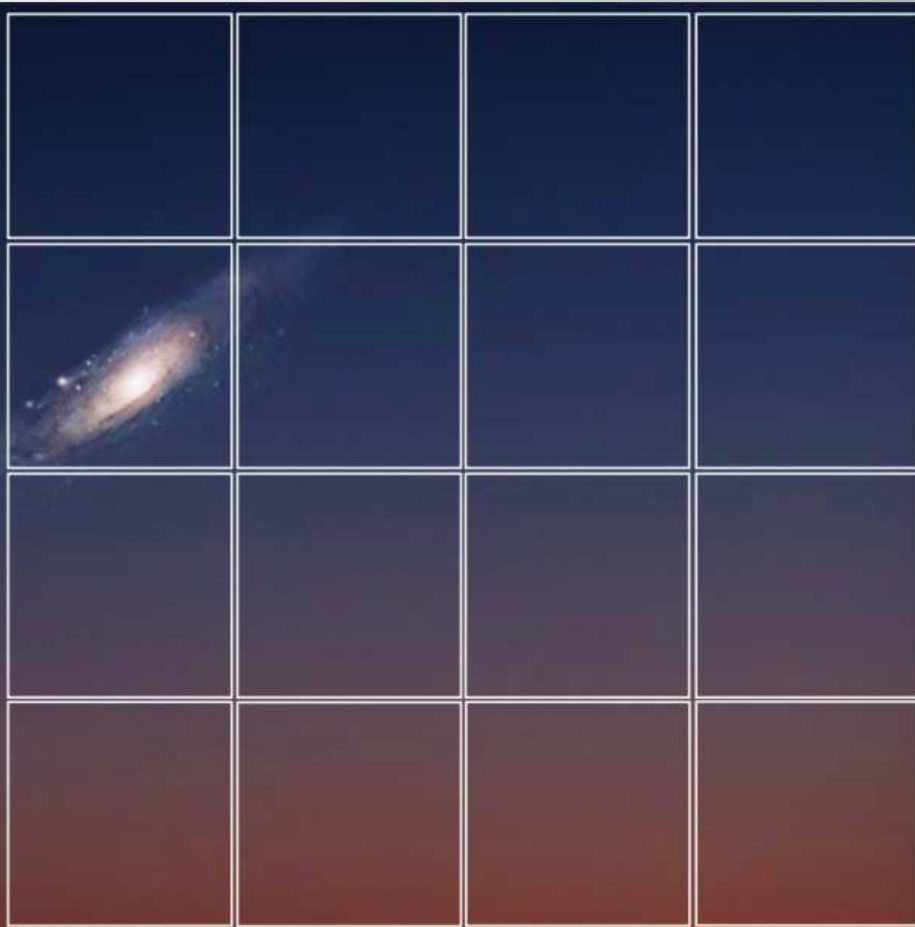
SDSS,
3 deg²



LSST, 9.6 deg²

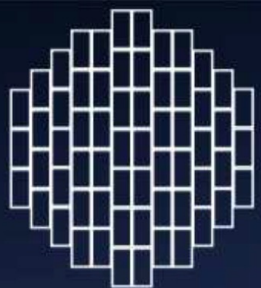
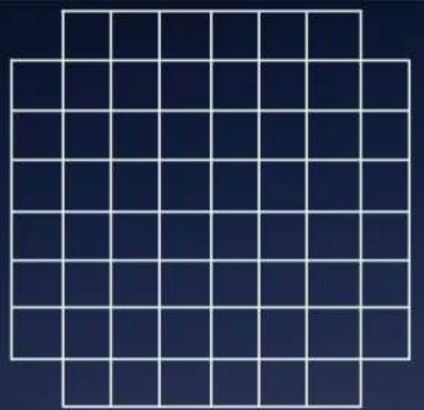


PTF/iPTF, 7.3 deg²



ZTF, 47 deg²

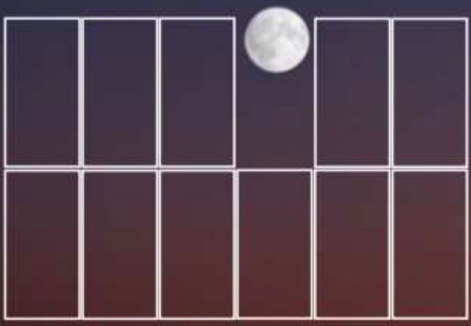
ASAS SN



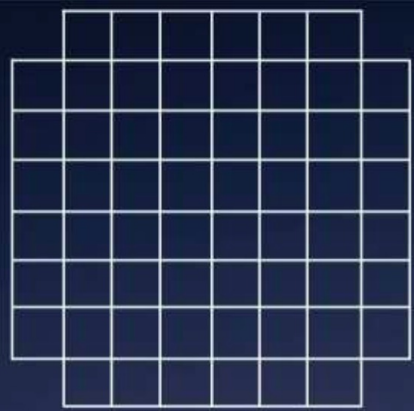
DES, 2.5 deg²



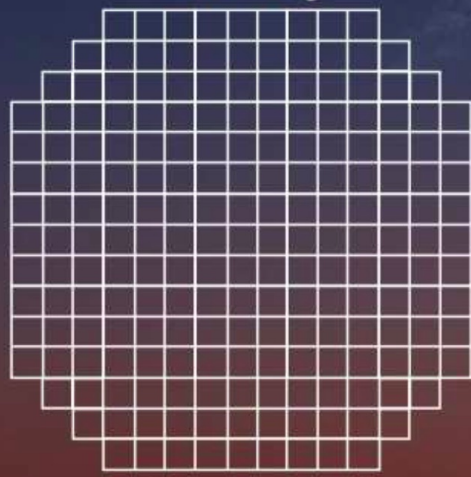
SDSS, 3 deg²



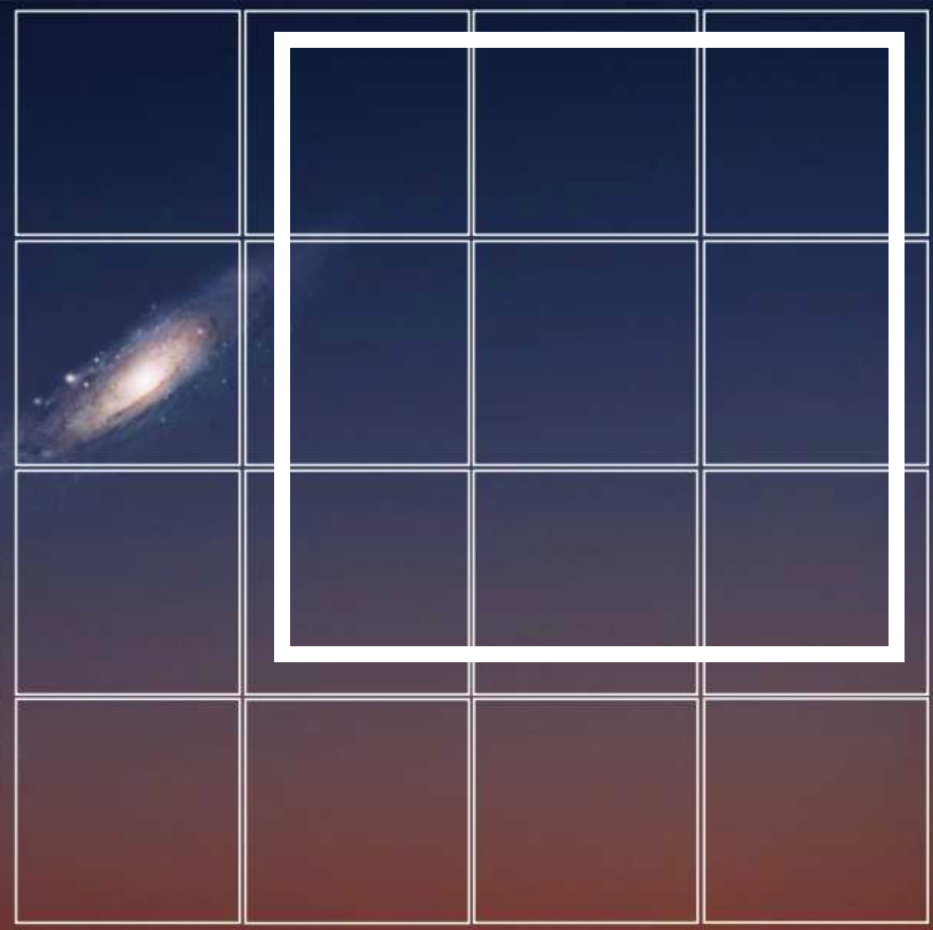
PTF/iPTF, 7.3 deg²



PS1, 7 deg²



LSST, 9.6 deg²



ZTF, 47 deg²

ASAS SN

DES,
2.5 deg²

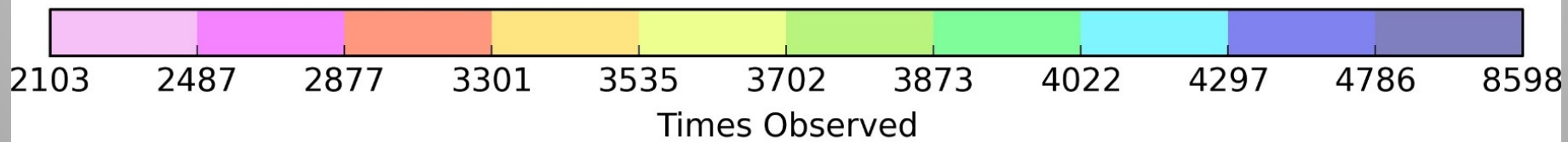
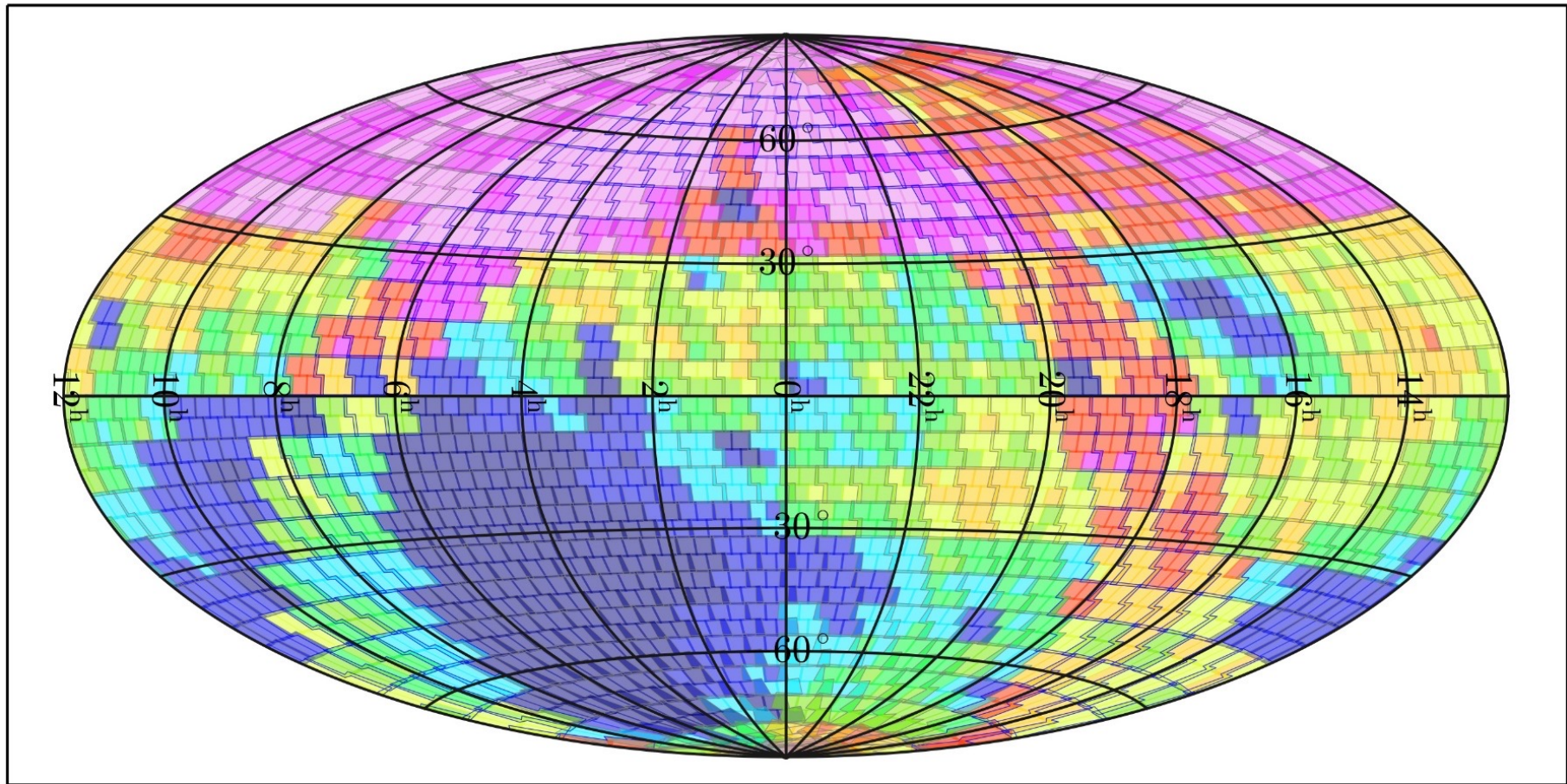
LSST, 7 deg²

PTF/iPTF, 7.3 deg²

LSST, 9.6 deg²

ZTF, 47 deg²

1 deg



A Decade of All-Sky Science

Variable Stars

Jayasinghe+2019, 2020,
Auge+2020, Bredall+2020,
O'Grady+2020,
Rowan+2021, Way+2022,
Rowan+2022, Christy+2023

Supernovae

Vallely+2018, Bose+2018,
Shappee+2019, Bose+2019,
Brown+2019, Chen+2019,
Meza+2019, Vallely+2019,
Bose+2021, Neumann+2023

Multi-messenger

IceCube Collaboration+
2017, 2018, Mishra+2021, de
Jaeger+2022, de
Jaeger+2023

Novae/CV/LMXBs

Kato+2017, Tucker+2018,
Ayidi+2019, Kawash+2021,
Kawash+2022

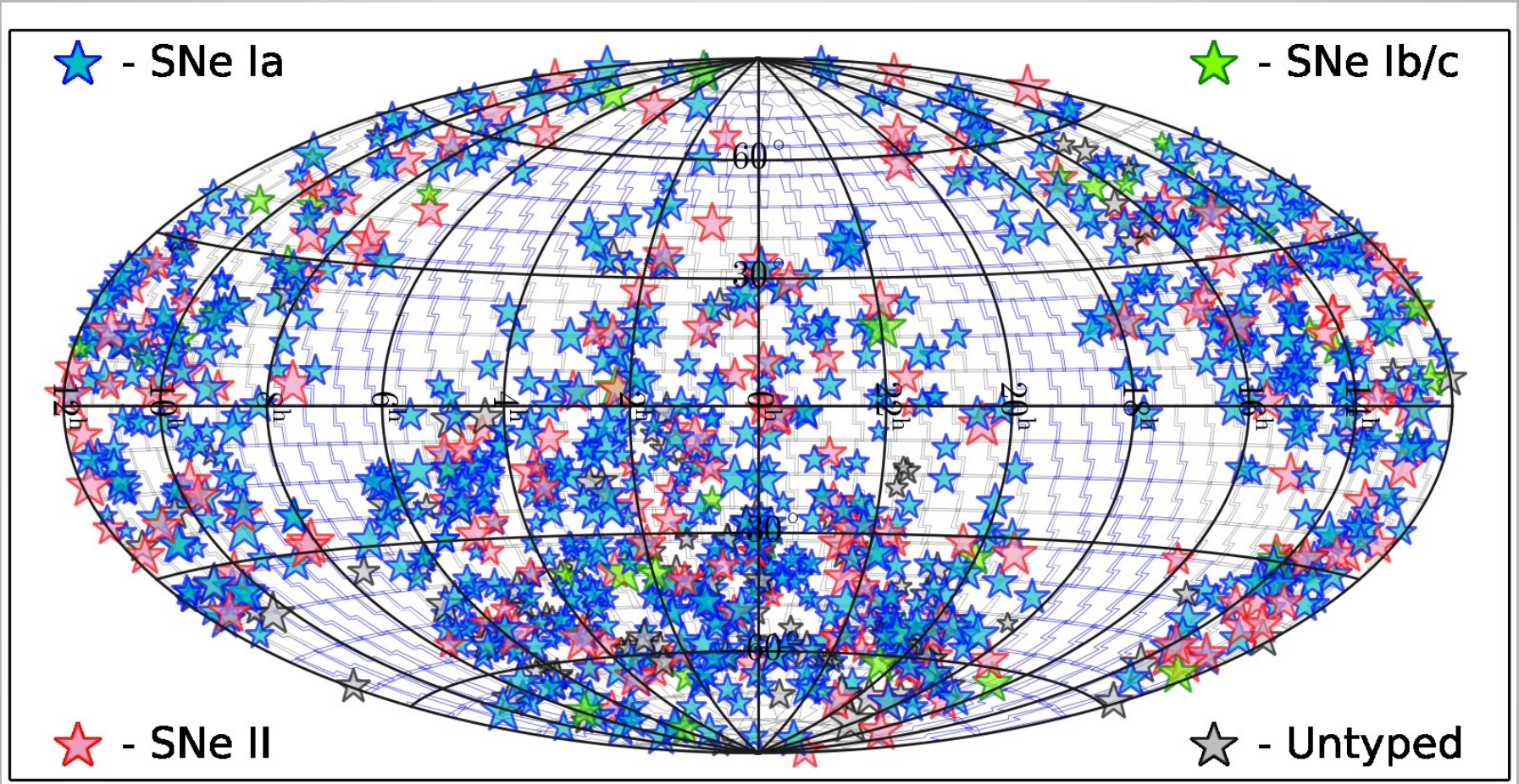
AGN/TDEs

Holoien+2016, Holoien+2020,
Neustadt+2020, Hinkle+2021,
Payne+2021, Hinkle+2022,
Yuk+2022, Holoien+2022,
Neustadt+2023

Comets/Asteroids

Prieto+ 2017, Brinkmann+
2021, Hanus+2021

Bright Transients





Public Data

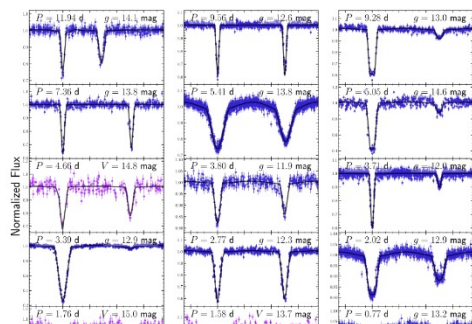
ASAS-SN Binary Stars Databases



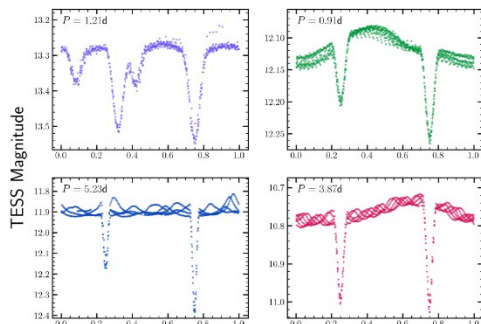
Using in Publications

When using ASAS-SN light curves in publications cite: Shappee et al. (2014) and either: (i) The Value-Added Catalog of ASAS-SN Eclipsing Binaries Rowan et al. (2022) , (ii) The Value-Added Catalog of ASAS-SN Eclipsing Binaries II Rowan et al. (2022) , or (iii) The Value-Added Catalog of ASAS-SN Eclipsing Binaries III Rowan et al. (2022)

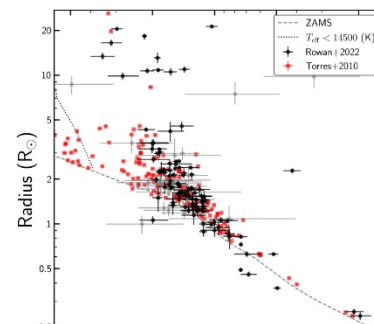
Detached Eclipsing Binaries



Extra-Physics Binaries



Fundamental Stellar Parameters



SkyPatrol V1

Any RA/Dec
Limited to single-object queries
Computationally expensive/slow

<https://asas-sn.osu.edu/>

Sky Patrol All-Sky Automated Survey for Supernovae



Making ASAS-SN light curves public is primarily funded by grants GBMF5490 and GBMF10501



ALFRED P. SLOAN FOUNDATION

ASAS-SN is funded in part by the Alfred P. Sloan Foundation under grant G202114192



Find Right Ascension and Declination by Star Name

Resolve Name

Compute Coordinate Lightcurve

* J2000.0 Right Ascension

12:00:00.00 or 12 00 00.00 or 180.00000

* J2000.0 Declination

03:00:00.0 or 03 00 00.0 or 45.00000

* Number of days to go back

20

* Photometry Method: (see update below for details)

Aperture Photometry

Shappee et al. (2014),
Kochanek et al. (2017)

SkyPatrol V2

<http://asas-sn.ifa.hawaii.edu/skypatrol/>

ASAS-SN Sky Patrol Photometry Database



Using in Publications

When using ASAS-SN Sky Patrol V2.0 data in publications cite: [Hart et al. \(2023\)](#) and [Shappee et al. \(2014\)](#).

Database Updated: 6/1/2023
Total Light Curves Available: 103,874,668

Search Sources ▲

Cone Search	Random Light Curves	ADQL	Cross Match Search
-------------	---------------------	------	--------------------

Right Ascension	Declination	Radius
<input type="text" value="Degrees of hh:mm:ss.ss"/>	<input type="text" value="Degrees or hh:mm:ss.ss"/>	<input type="text"/>
Radius Unit	Catalogue	
<input type="text" value="degrees"/>	<input type="text" value="master_list"/>	

SkyPatrol V2

Source Catalog	Type	<i>n</i> sources
ASAS-SN Stellar Source Table	Stellar	98,602,587
Fermi LAT 10-Year Point Sources	Gamma Ray	5,788
Chandra Sources v2.0	X-Ray	317,224
Swift Master Catalog	Optical/UV/X-Ray/Gamma Ray	254,936
AllWISE AGN Catalog	Mid-IR/AGN	1,354,775
Million Optical/Radio/X-Ray Associations Catalog (MORX)	Optical/Radio/X-Ray	3,262,883
Million Quasars Catalog (MILLIQUAS)	QSO	1,979,676
Bright M-Dwarf All Sky Catalog	Stellar	8,927
AAVSO International Variable Star Index	Stellar	1,437,528
Galaxy List for the Advanced Detector Era (GLADE)	Galaxy	3,263,611

Stellar Source Table: Objects from SDSS, 2MASS, Refcat, Gaia DR2, WISE, TESS

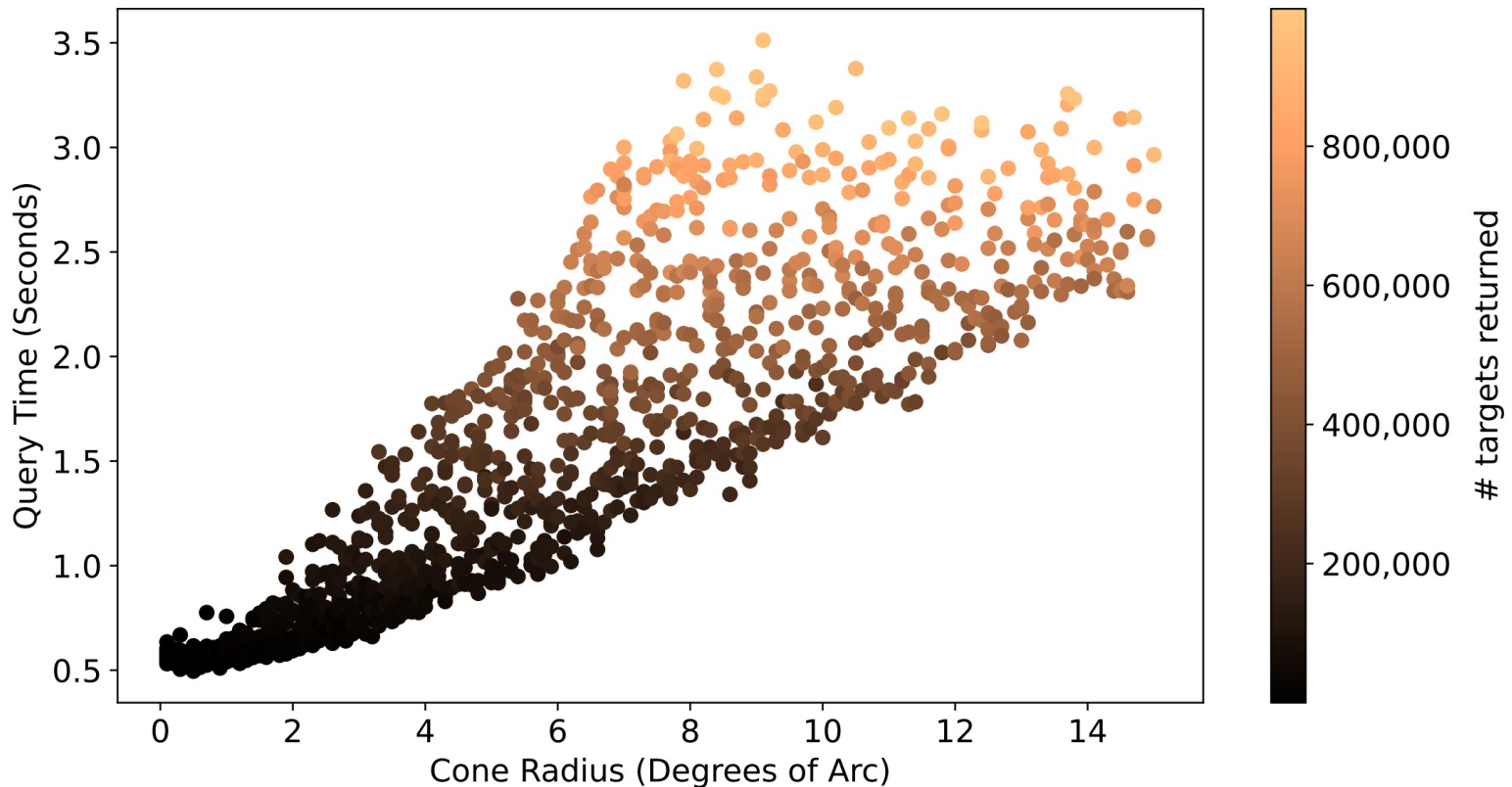
“Real-time” photometry:
database is updated within an ~hour

SkyPatrol V2

```
>>> from pyasasn.client import SkyPatrolClient
>>> client = SkyPatrolClient()
>>> client.cone_search(ra_deg=277.0,
                      dec_deg=-12.1,
                      radius=5.0,
                      units='arcmin',
                      catalog='aavsovsx')
```

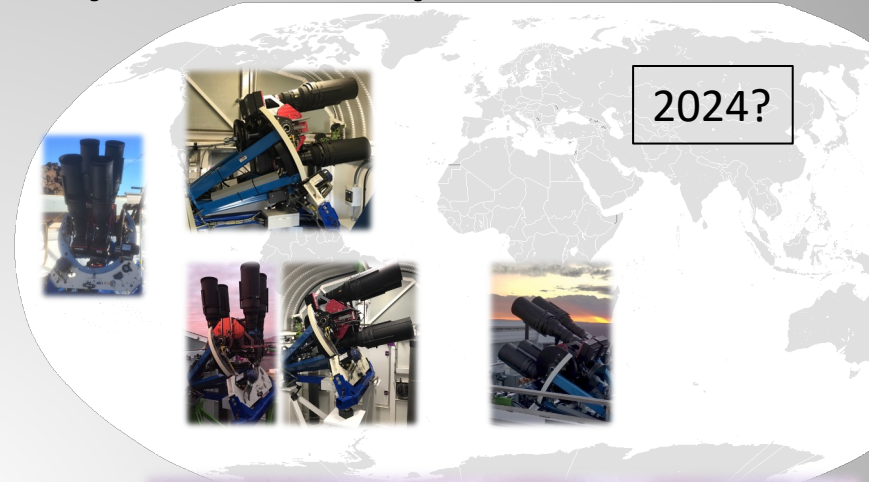
asas_sn_id	ra_deg	dec_deg	name
292059085873	276.84665	-12.01138	GDS_J1827232
326417718321	277.36058	-12.37650	ASASSN-V J18
395137087890	280.42779	-10.01075	NSVS 1675161
...

[6594 rows x 4 columns]



All-Sky Automated Survey for Supernovae

- 14cm lenses
- 4.47×4.47 degree field-of-view
- 7.8" pixel scale
- *g*-band filters
- Limiting magnitude ≈ 18.5
- 40,000 square degrees per night



SkyPatrol V1: Single object queries

<https://asas-sn.osu.edu/>

SkyPatrol V2: precomputed light curve server

<http://asas-sn.ifa.hawaii.edu/skypatrol/>

