

The All-Sky Automated Survey for SuperNovae (~~ASAS~~ SN or “Assassin”)

Benjamin J. Shappee^{1,2}
on behalf of the ASAS-SN team

¹Hubble Fellow, ²Carnegie-Princeton Fellow

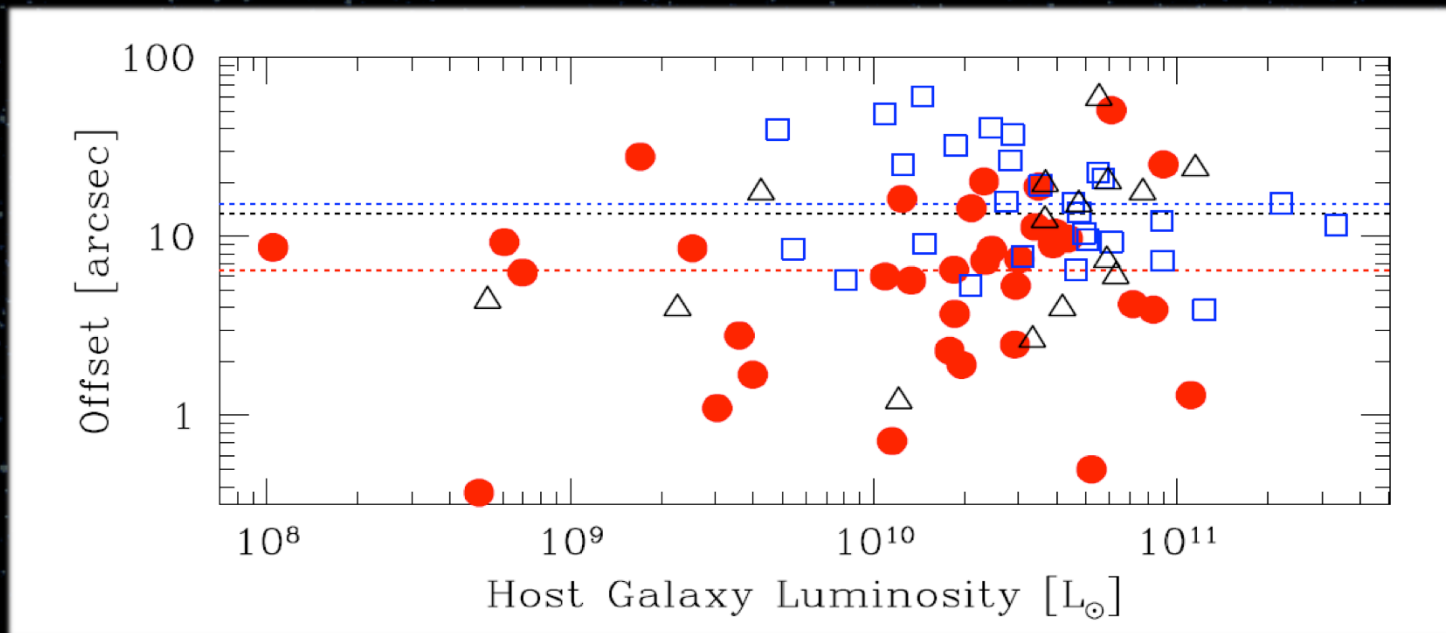


CSP Team meeting

July 30, 2015

ASAS SN Goals:

- Monitor of the entire sky every few nights in real-time
- V-band limiting magnitude ≈ 17
- Use commercially available Telephoto lenses and CCDs
- Find supernovae in a minimally biased search



ASAS SN Is a Global Partnership



B. Shappee

(Hubble Fellow; Carnegie-Princeton Fellow)

C. S. Kochanek, K. Z. Stanek,

T. W.-S. Holoien, J. Brown, A. B. Danilet,

G. Simonian, U. Basu,

J. F. Beacom, T. A. Thompson (Ohio State)

J. L. Prieto (Diego Portales; MAS)

D. Bersier (LJMU)

Subo Dong (KIAA-PKU)

P. R. Wozniak (LANL)

E. Falco (CfA)

J. Brimacombe
(Coral Towers Observatory)

D. Szczygiel, G. Pojmanski
(Warsaw University Observatory)

ASAS SN Is a Global Partnership



- Home base
- Scheduling and Analysis
- Aid in pipeline
- Funding
- Site support and Mounts
- Follow up resources



Sedgwick

McDonald

Haleakala

Teide

Cerro Tololo

Sutherland

Siding Spring

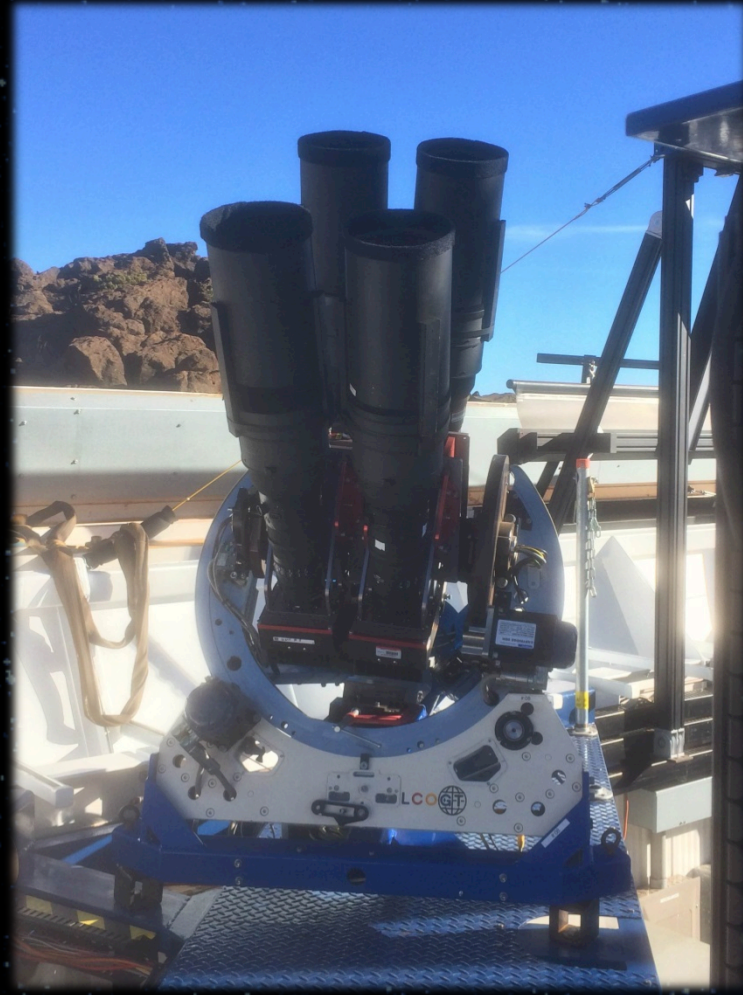
Faulkes Telescope North



Picture Courtesy of Mark Elphick

ASAS SN North “Brutus”

- 4 telescopes on a common mount
- 4 x 14cm lens
- 4 x FLI ProLine CCD cameras
- 4 x Fairchild Imaging 2k x 2k thinned CCD
- 4 x 4.47 x 4.47 degree field-of-view
- 7.8" pixel scale
- V-band filters
- limiting magnitude \approx 16.5-17.3
- 10,000 square degrees per night



Picture Courtesy of Mark Elphick

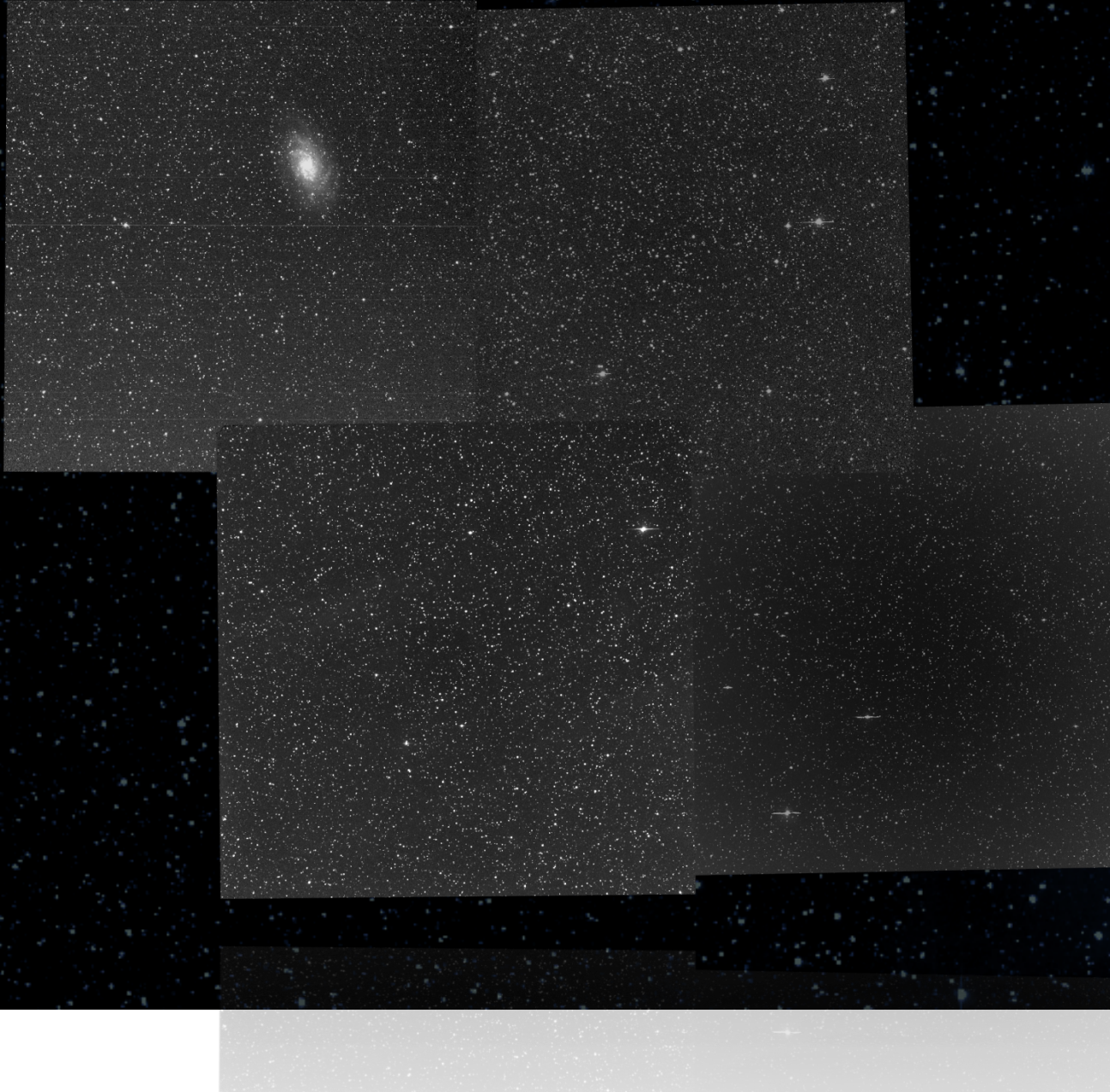
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Picture Courtesy of Mark Elphick

Brutus Data



4.5°

LCOGT Aqawan Enclosure at Cerro Tololo



Picture Courtesy of Wayne Rosing

ASAS-SN South “Cassius”

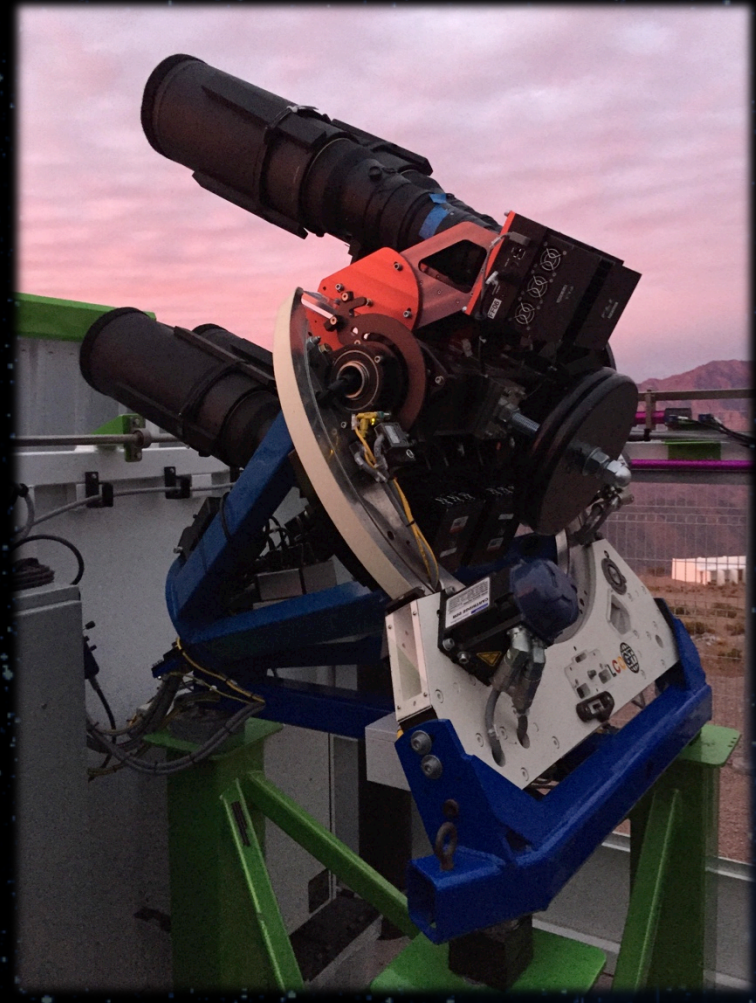
- First light on April 25, 2014
- Just expanded to 4 cameras in July
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Picture Courtesy of Jon De Vera

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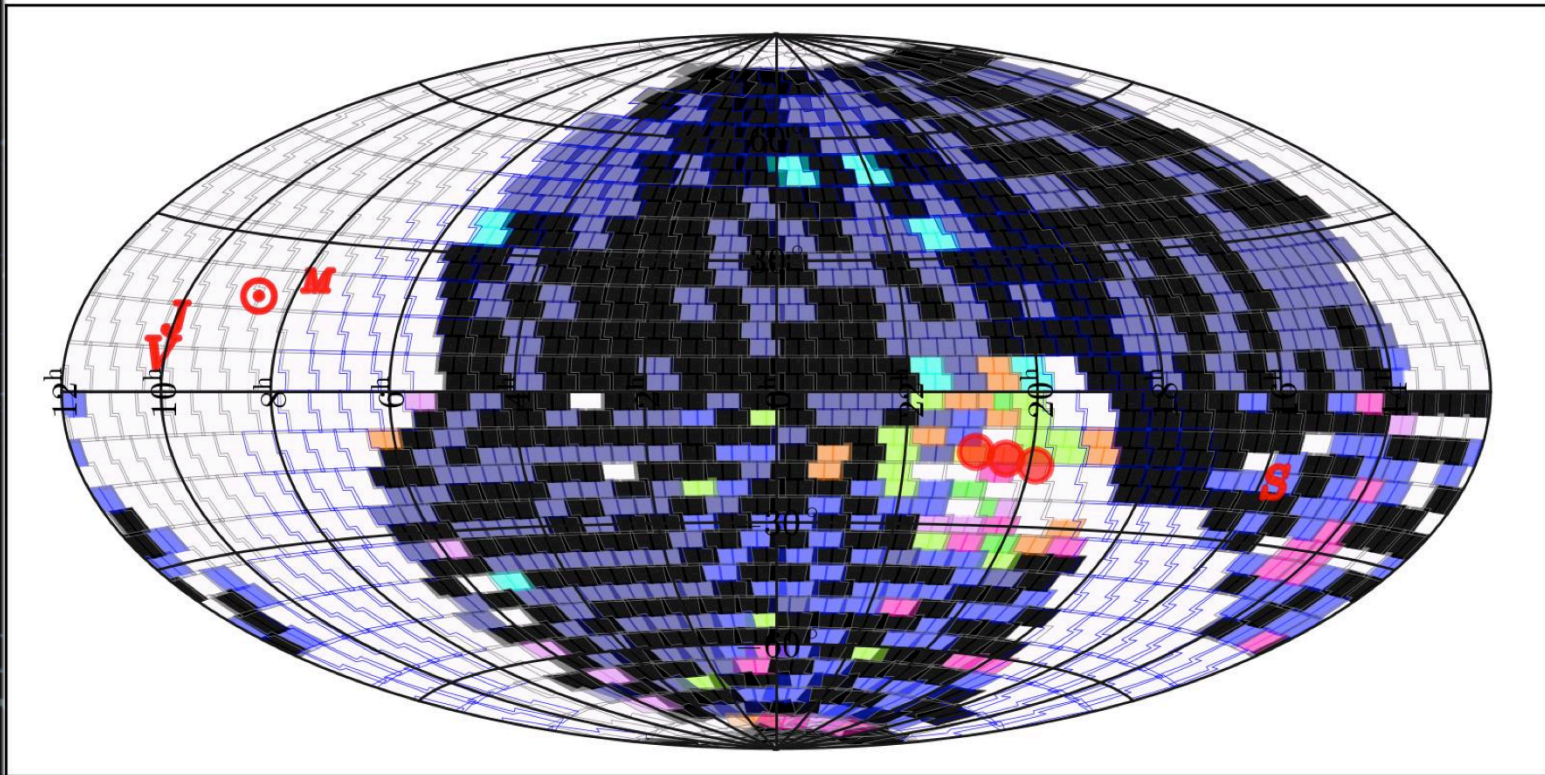
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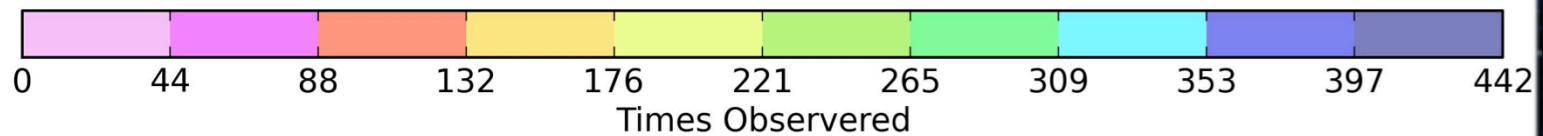
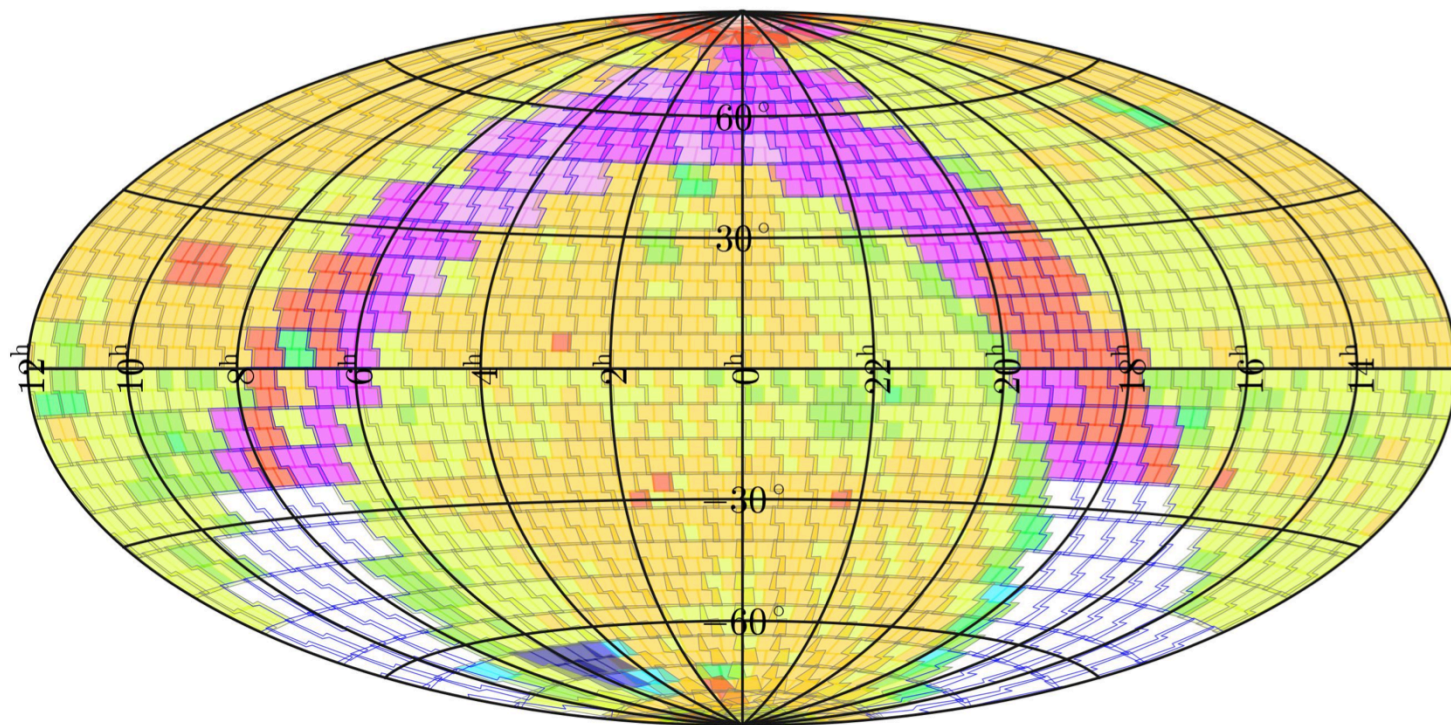
ASAS SN Cadence and Coverage

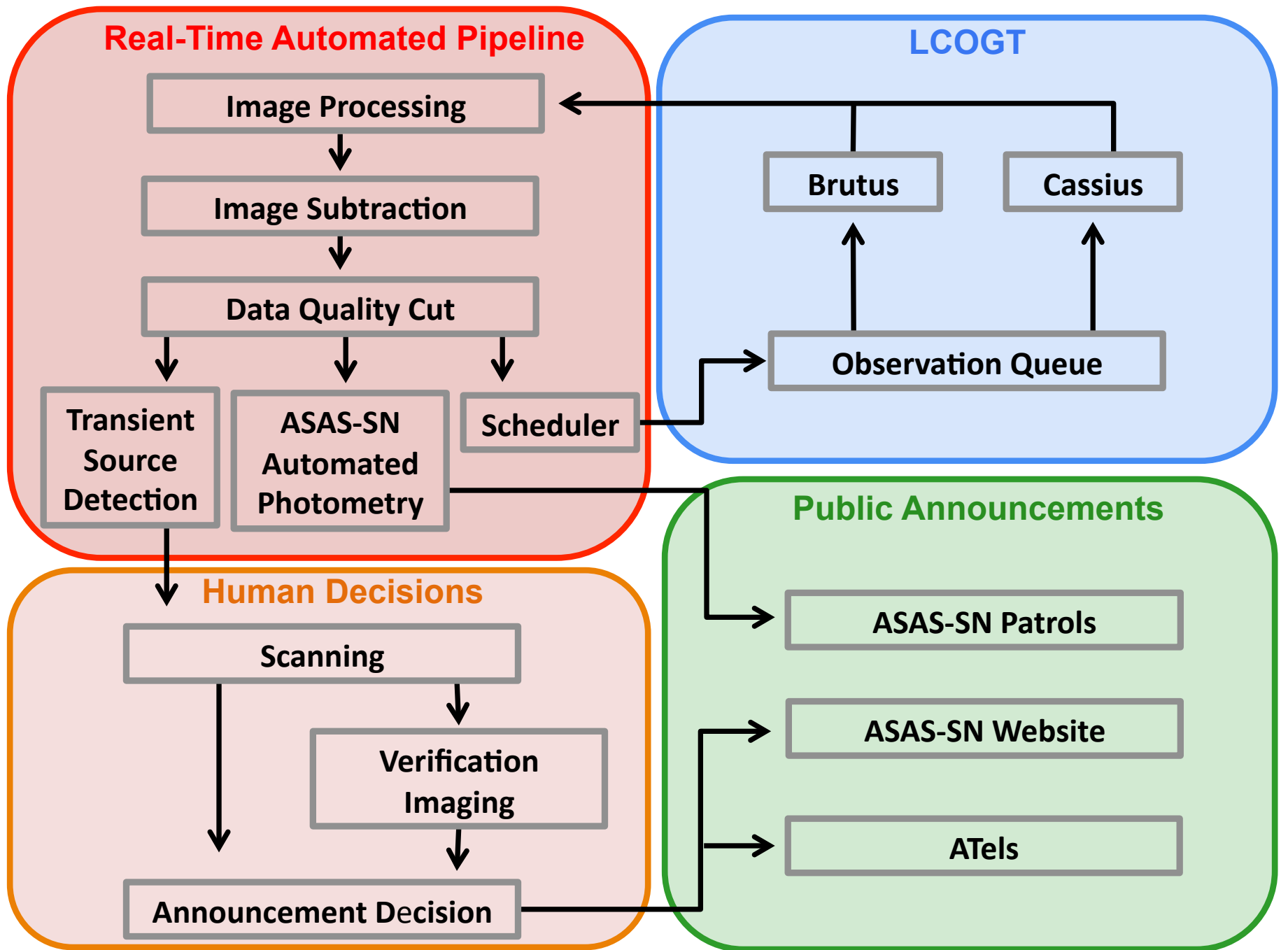
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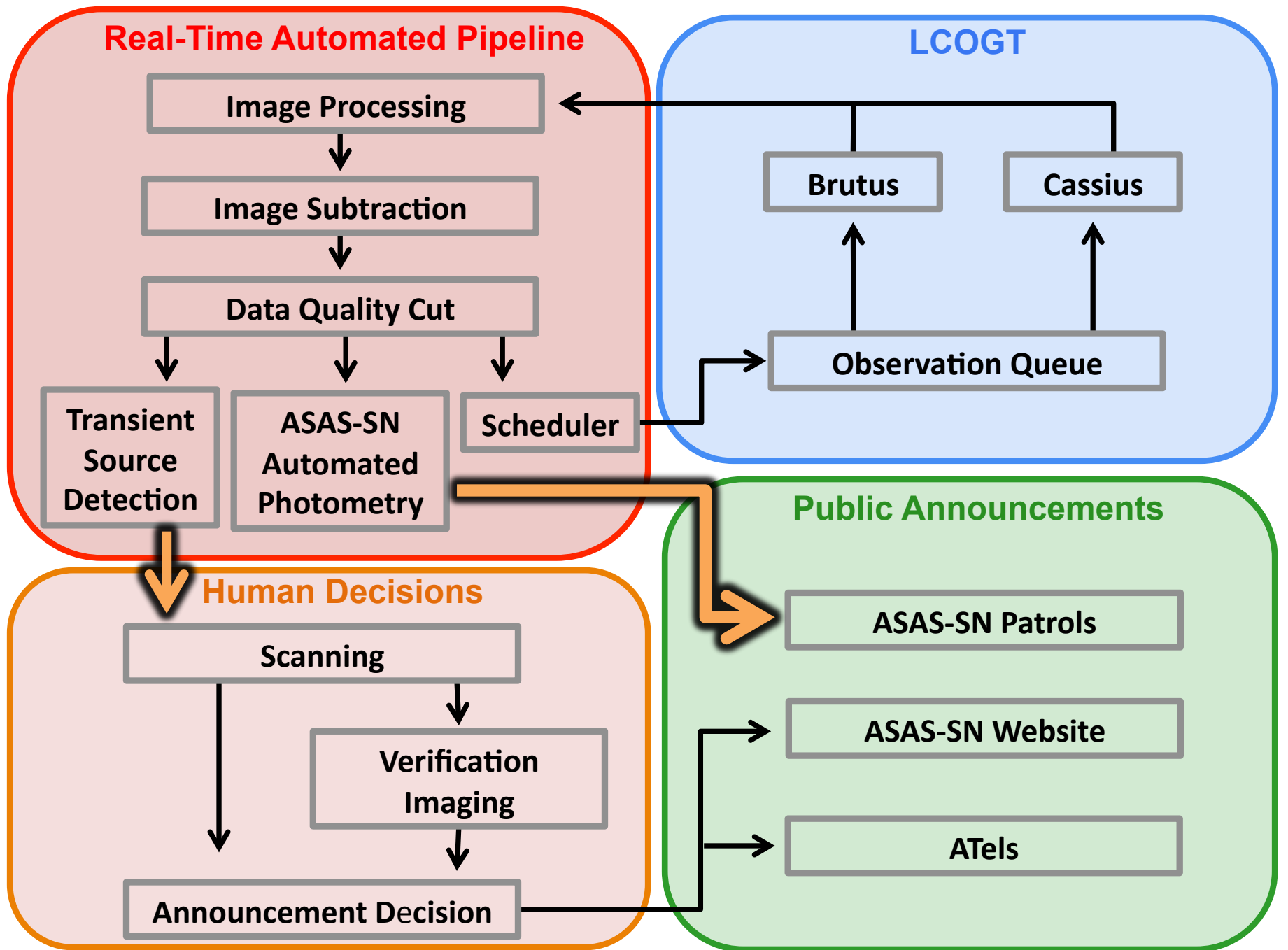


One Year of ASAS SN

Thu Jul 30 14:04:00 2015

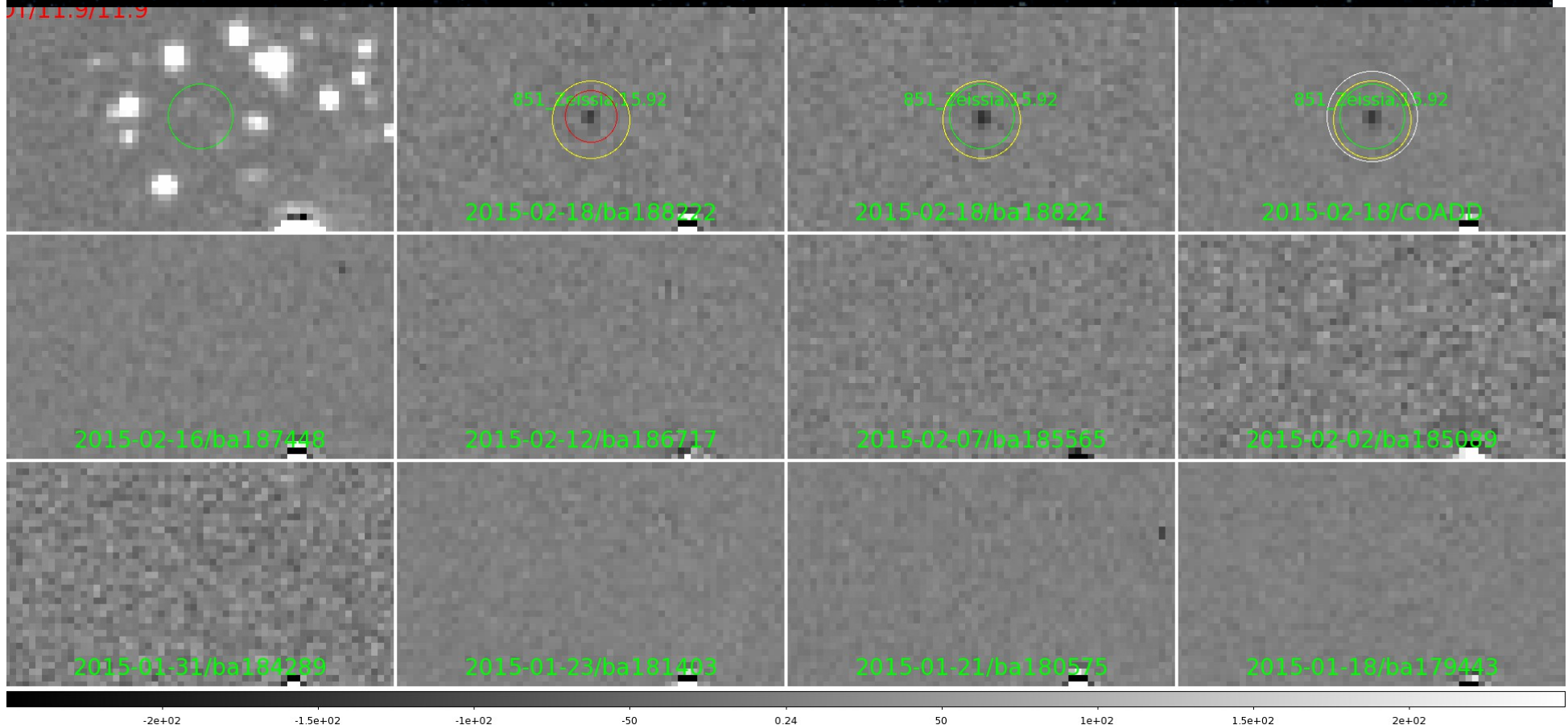






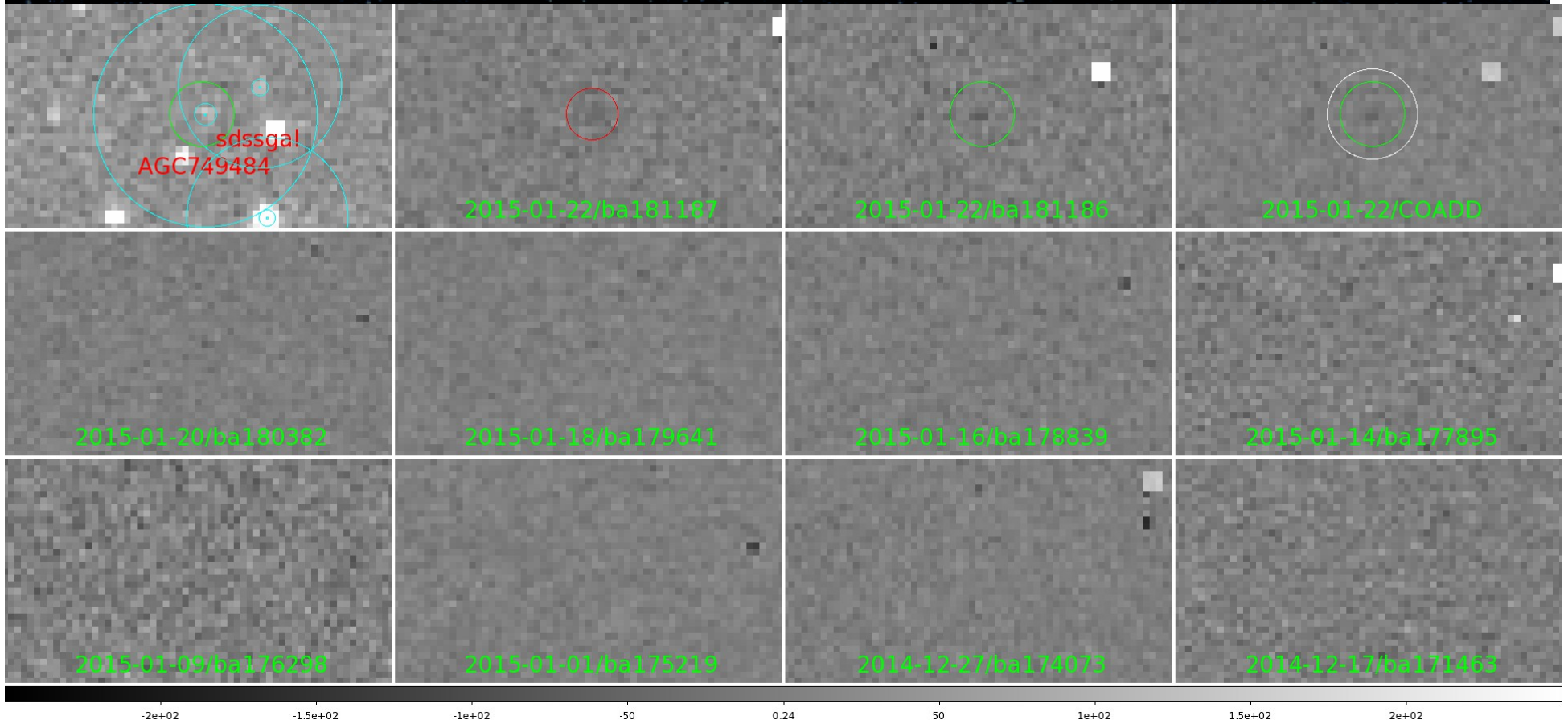
Transient Detection Pipeline

- New sources are identified on the subtracted images by SExtractor
- Detections are dominated by false positives
- Many cuts are made (flux, S/N, point-like, dithered correlations, random forest classifier)
- Candidates are then scanned by eye where further cuts can be adjusted
- Transients discovered and announced typically in **hours**
- We are implementing stacking over multiple night's images



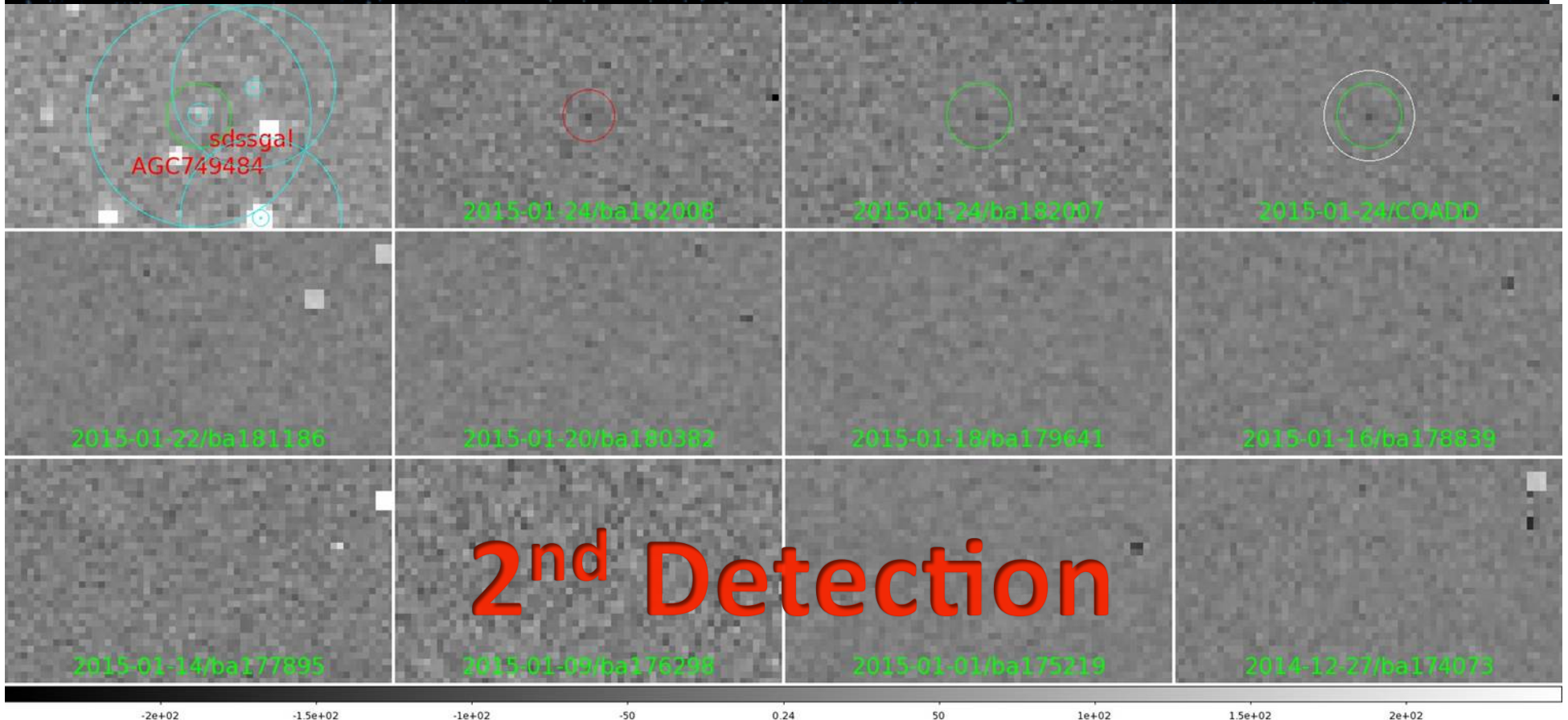
ASASSN-15bo

- ATEL #6989
 - Fernandez et al. (inc. Shappee) 2015
- $V \approx 17.1$ at 1st detection
- $V \approx 16.6$ at 2nd detection
- No redshift to the host galaxy in NED
- $z = 0.032$ from SN spectrum



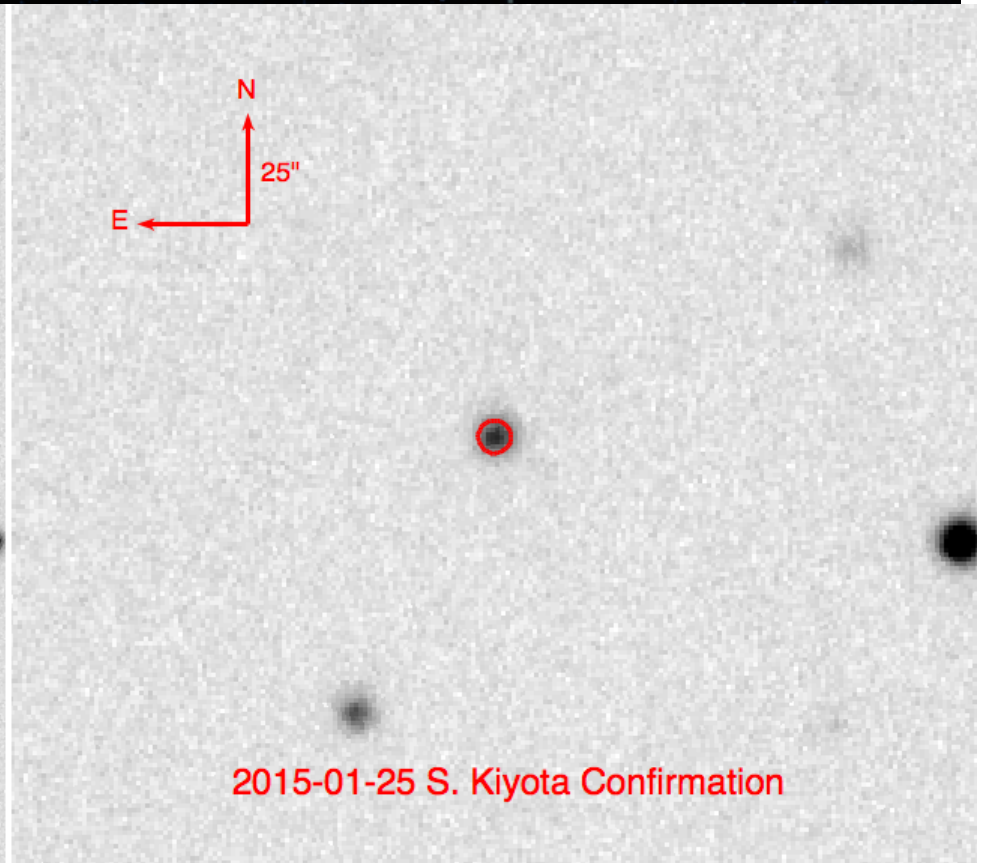
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ASASSN-15bo

ASAS-SN Discovery of A Probable Supernova in SDSS J144455.21+243443.9

ATel #6989; *J. M. Fernandez (Observatory Inmaculada del Molino), J. Brimacombe (Coral Towers Observatory), R. A. Koff (Antelope Hills Observatory), S. Kiyota (Variable Star Observers League in Japan), T. W.-S. Holoien, K. Z. Stanek, C. S. Kochanek, A. B. Danilet, G. Simonian, U. Basu, N. Goss, J. F. Beacom (Ohio State), B. J. Shappee (Hubble Fellow, Carnegie Observatories), J. L. Prieto (Diego Portales; MAS), D. Bersier (LJMU), Subo Dong (KIAA-PKU), P. R. Wozniak (LANL), D. Szczygiel, G. Pojmanski (Warsaw University Observatory), E. Conseil (Association Francaise des Observateurs d'Etoiles Variables), B. Nicholls (Mt. Vernon Obs., New Zealand)*

on 25 Jan 2015; 18:29 UT

Distributed as an Instant Email Notice Supernovae

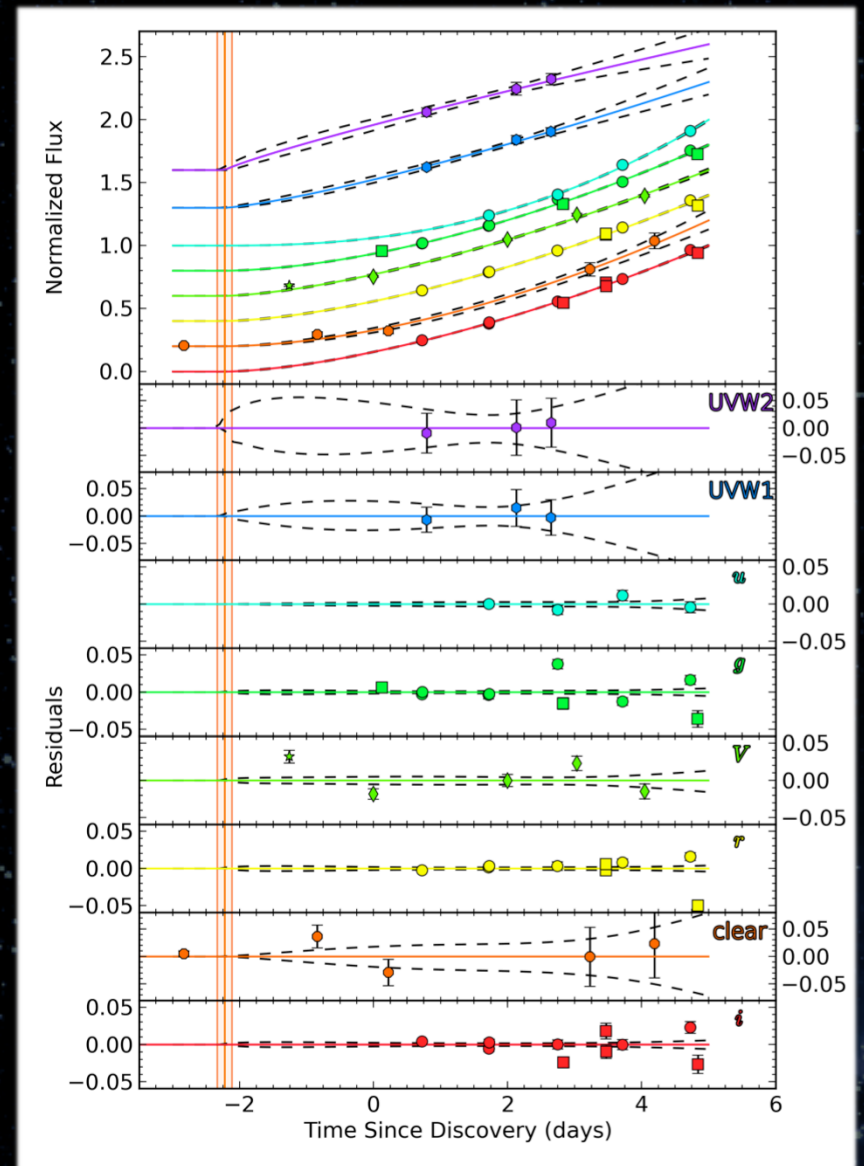
Credential Certification: Thomas Holoien (tholoien@astronomy.ohio-state.edu)

Archival SDSS g-band

2015-01-25 S. Kiyota Confirmation

ASAS SN Discoveries

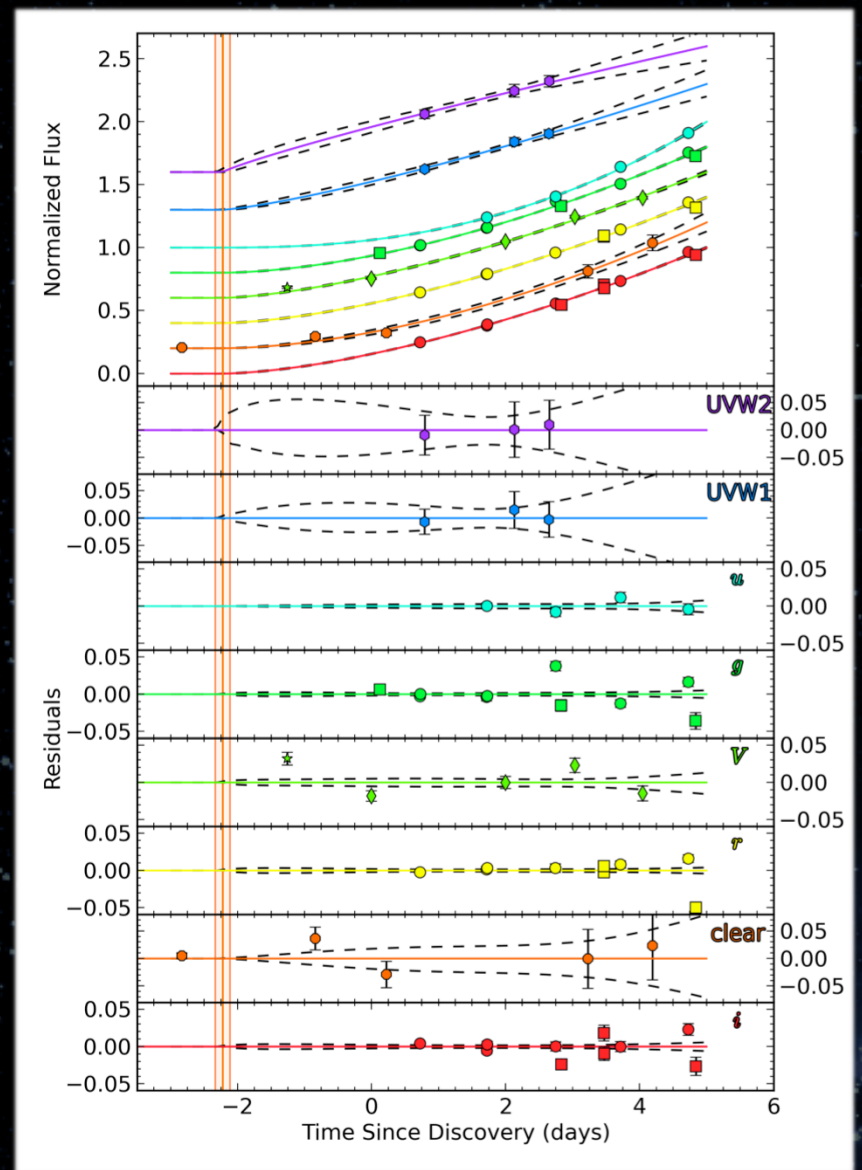
- 12 publications with 5+ more in preparation
- 250+ ATELS over first 2+ years of the real-time survey
- 196 Supernovae (148 Type Ia, 37 Type II, 7 Type Ib/Ic, 1 SLSN-I, 3 Untyped)
- 475+ new cataclysmic variable stars
- ASASSN-14lp discovered 2 days after explosion (Shappee et al. 2015)
- The most luminous SN ever discovered (Dong, Shappee et al. 2015)
- Low-mass Young Stellar Object (YSO) in a strong ($\Delta V \approx 4$ mag) outburst (Holoien et al. 2014a)
- 41 M-dwarf flares with $\Delta V \geq 4$
 - including two of the largest ever detected (Schmidt et al. 2014, Simonian et al. 2014)
- Many AGN/Blazar flares
 - Including a “Changing look” AGN (Shappee et al. 2014)
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Shappee et al. 2015

ASAS SN Discoveries

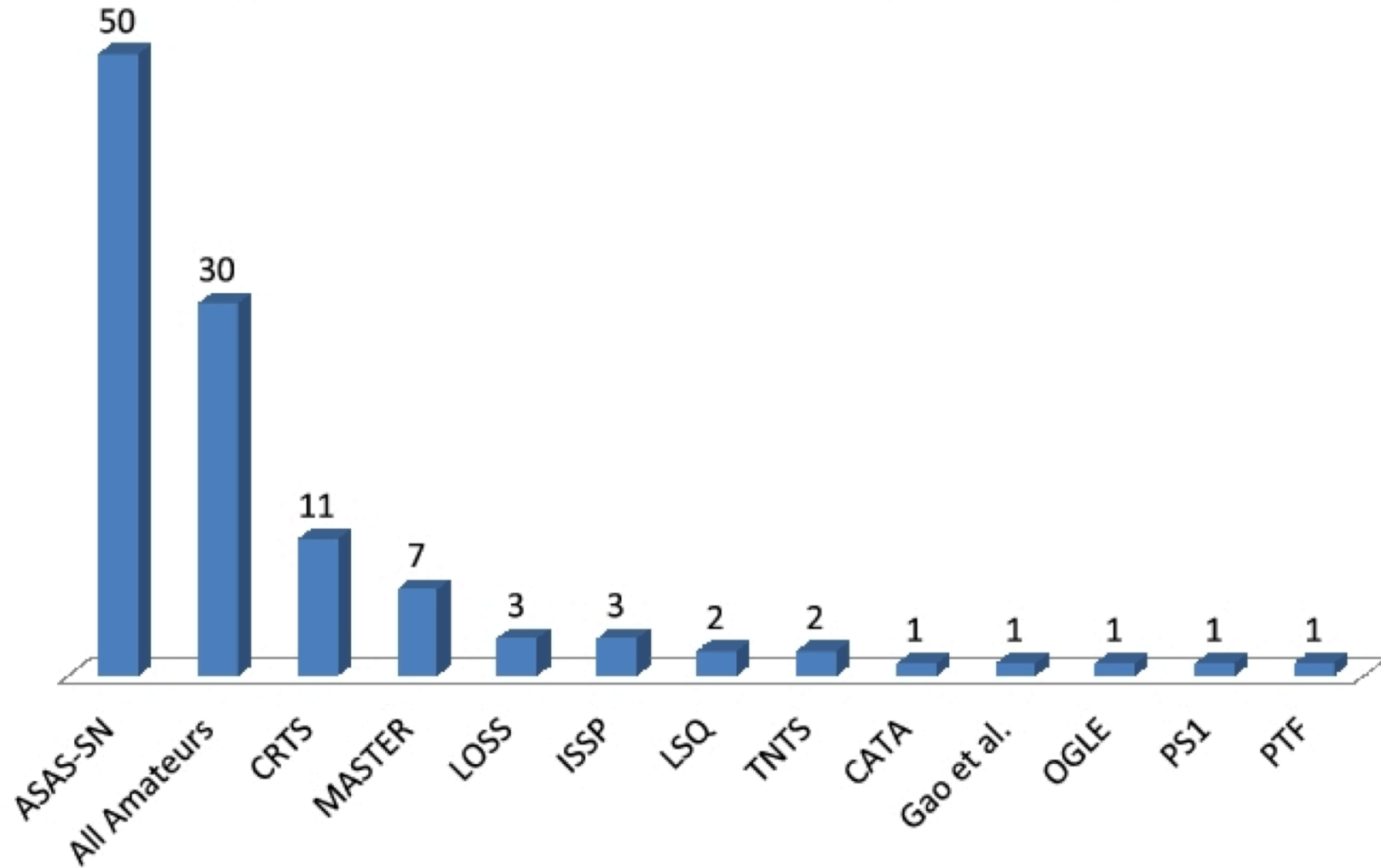
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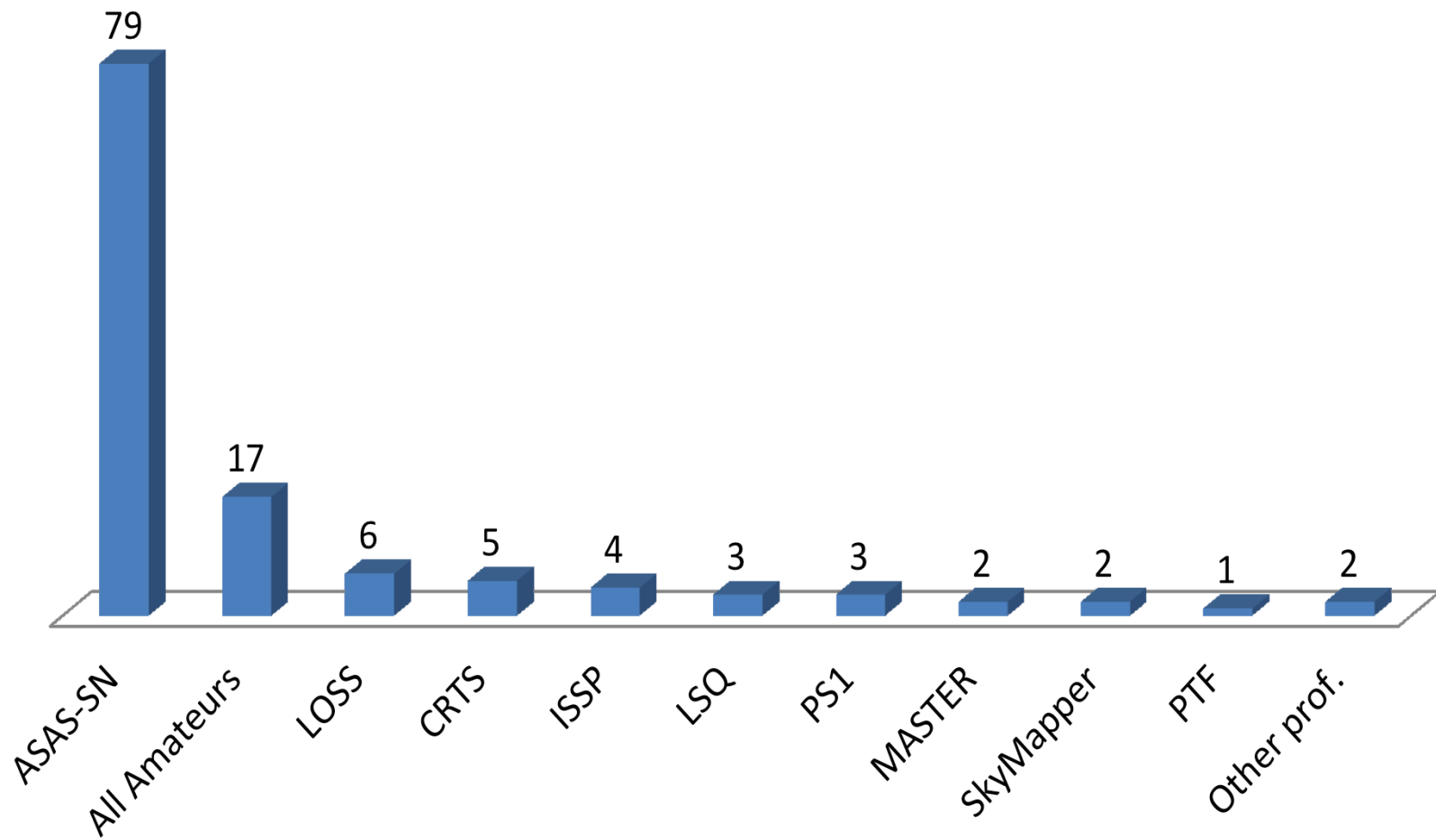
Nearby SNe

Bright (<17 Mag) SNe Discoveries May 1 - Nov. 1, 2014

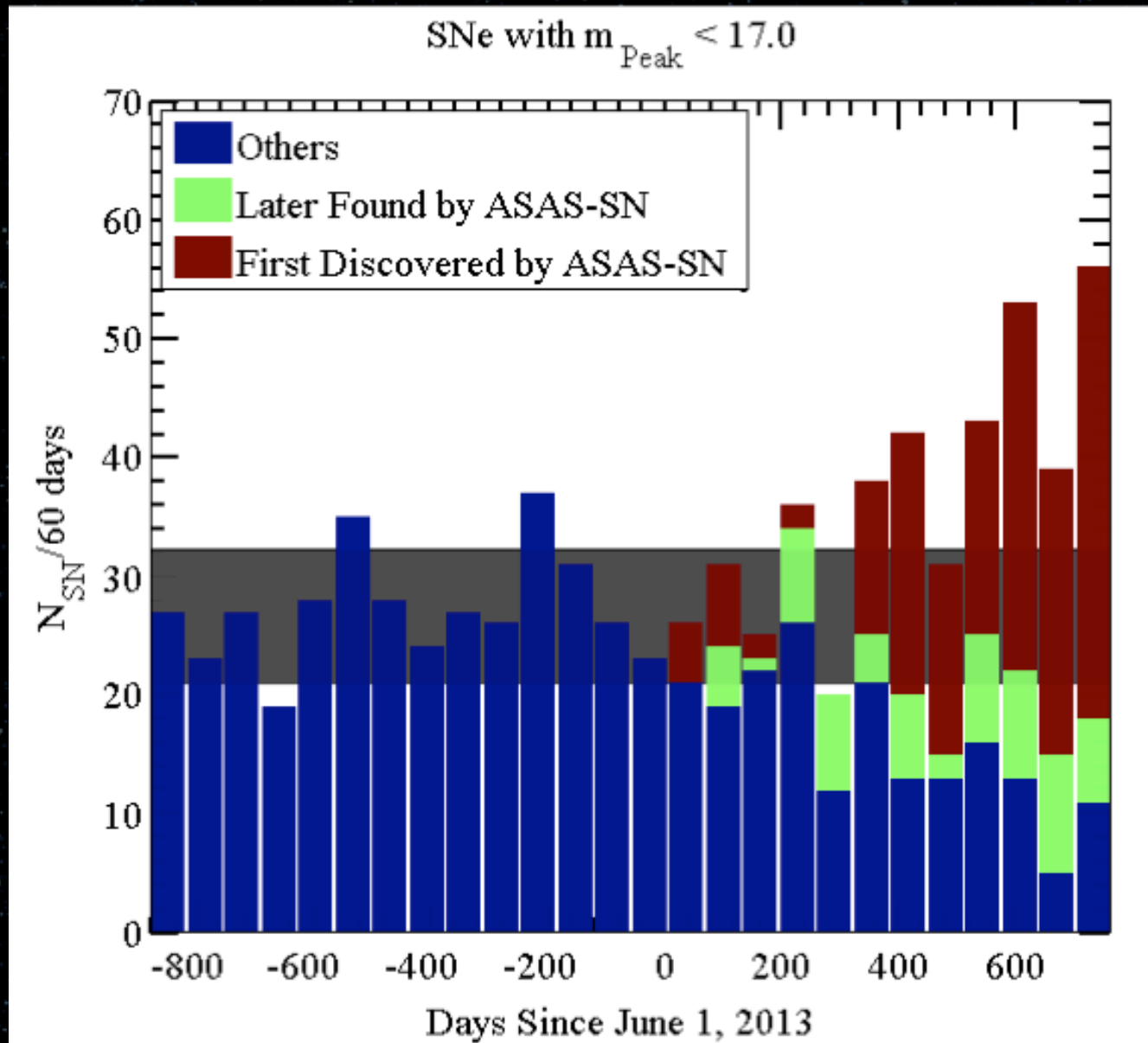


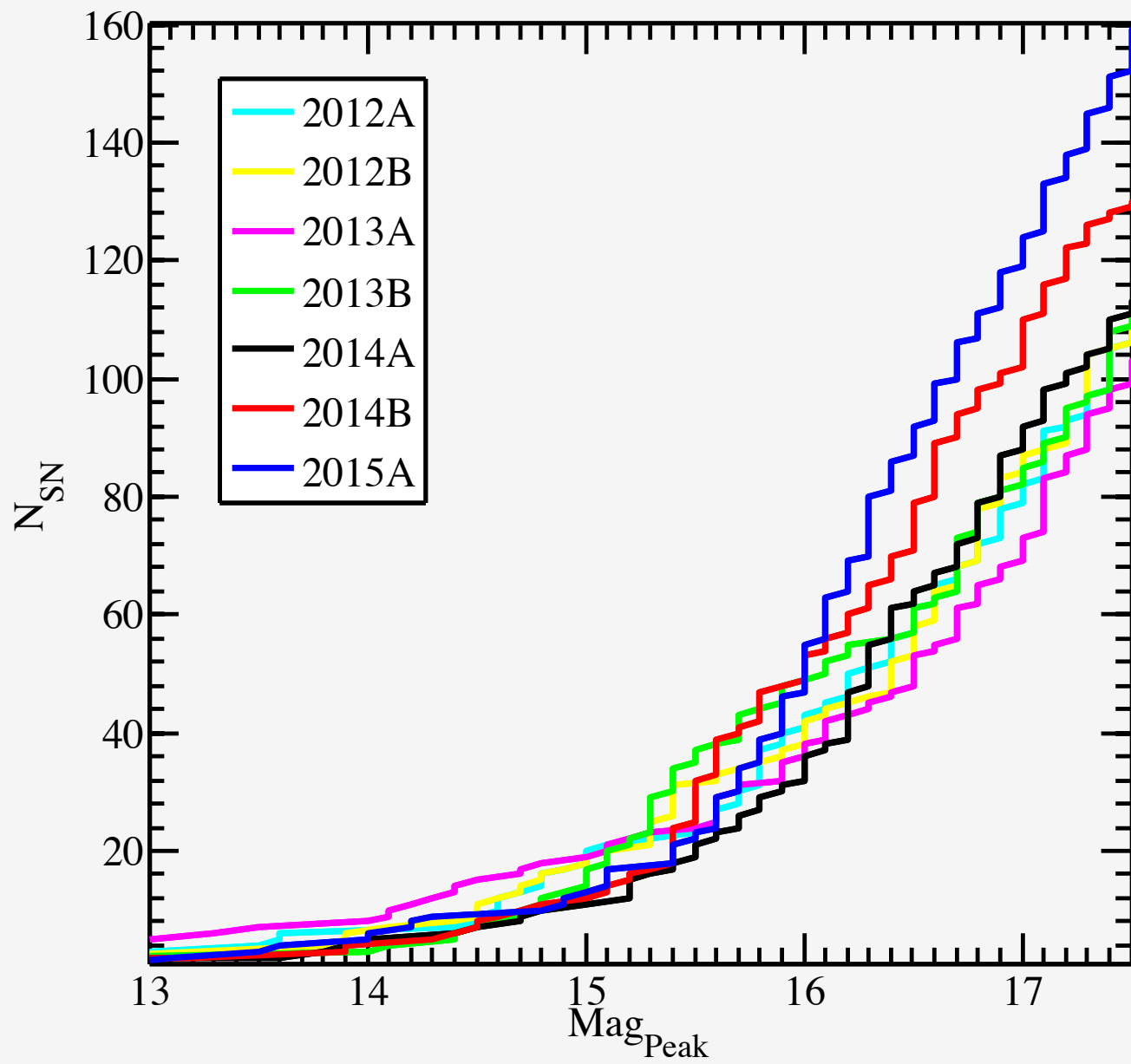
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Bright (<17 Mag) SNe Discoveries
Jan. 1- June 30, 2015: 124 Total



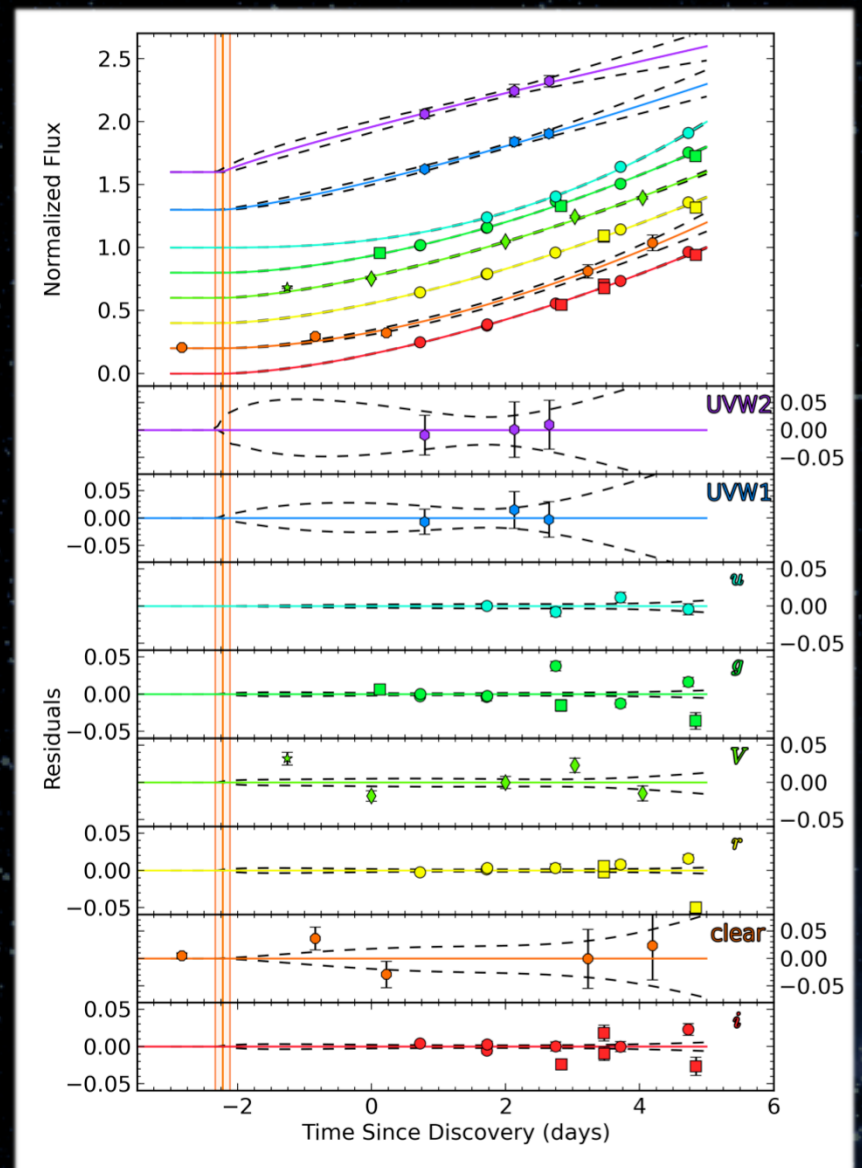
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ASAS SN Discoveries

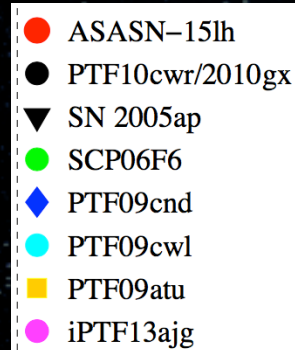
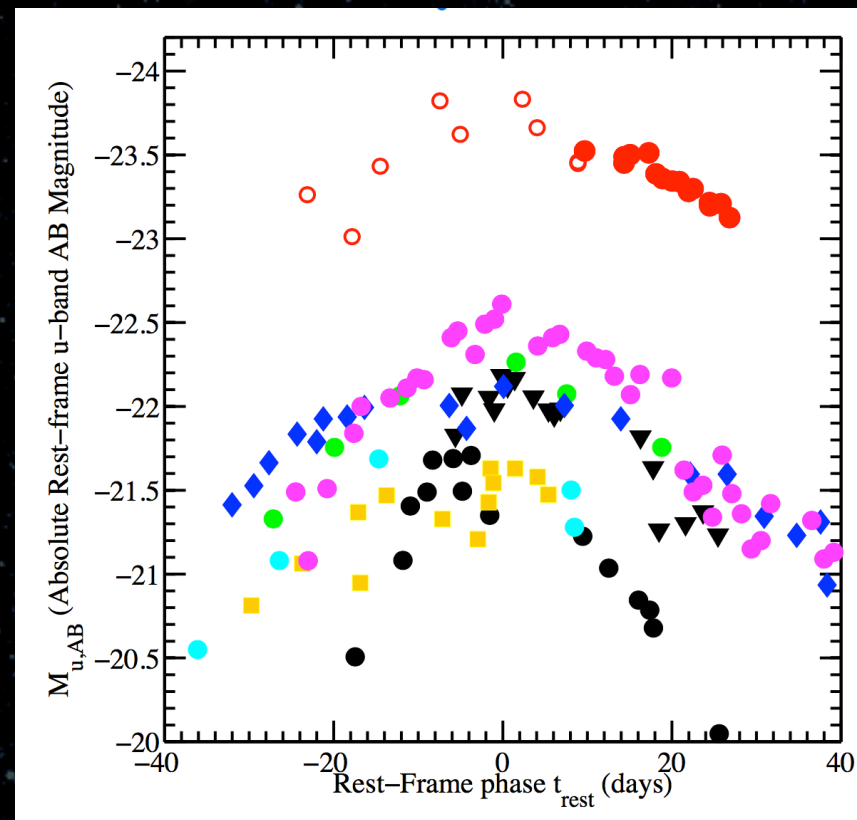
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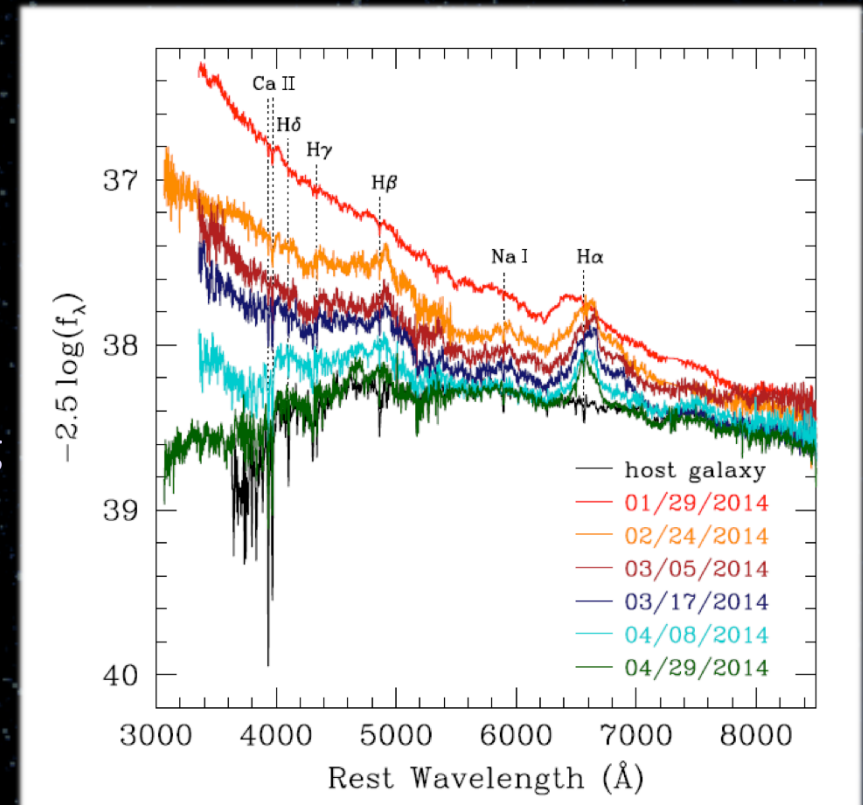
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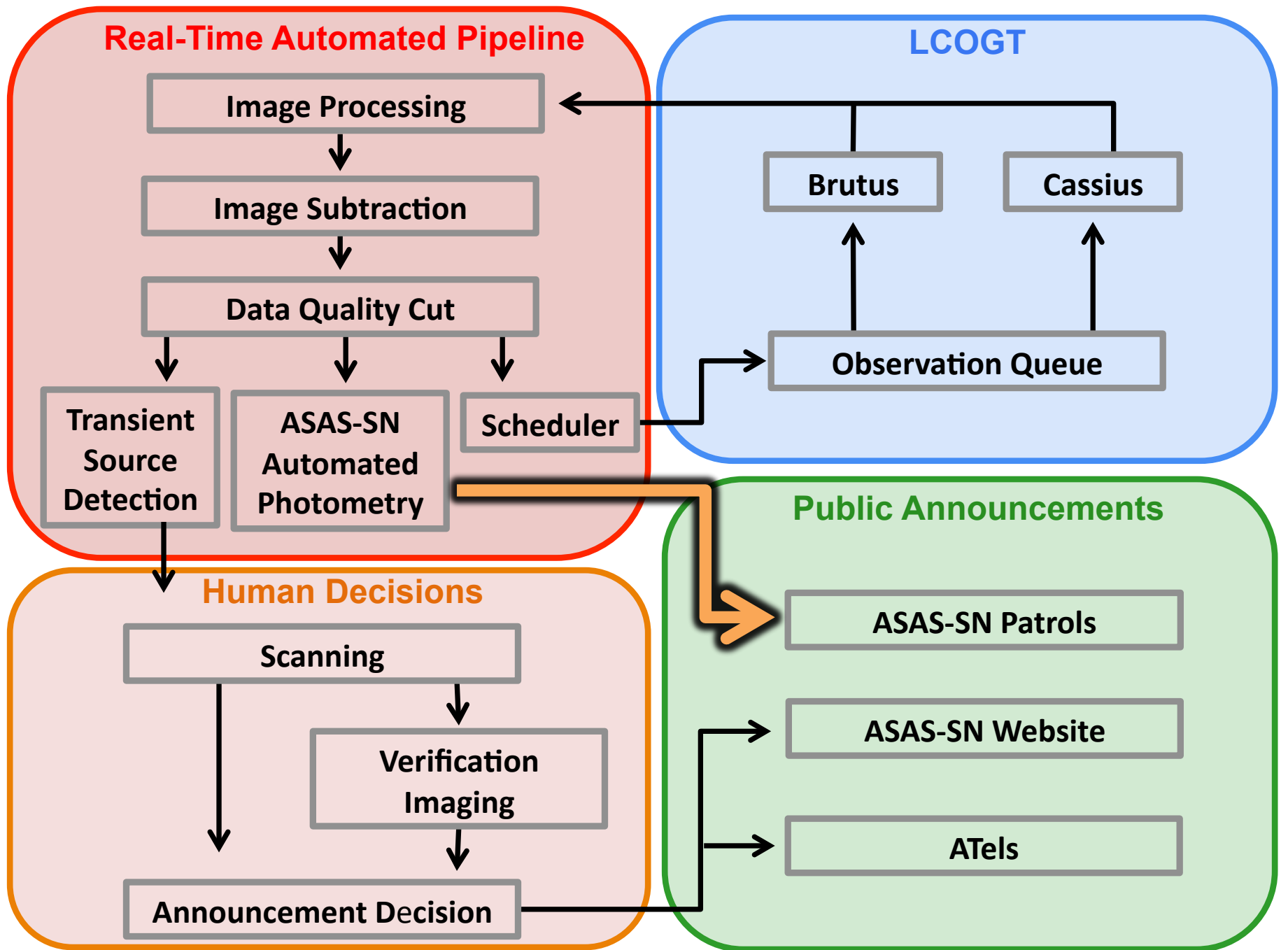
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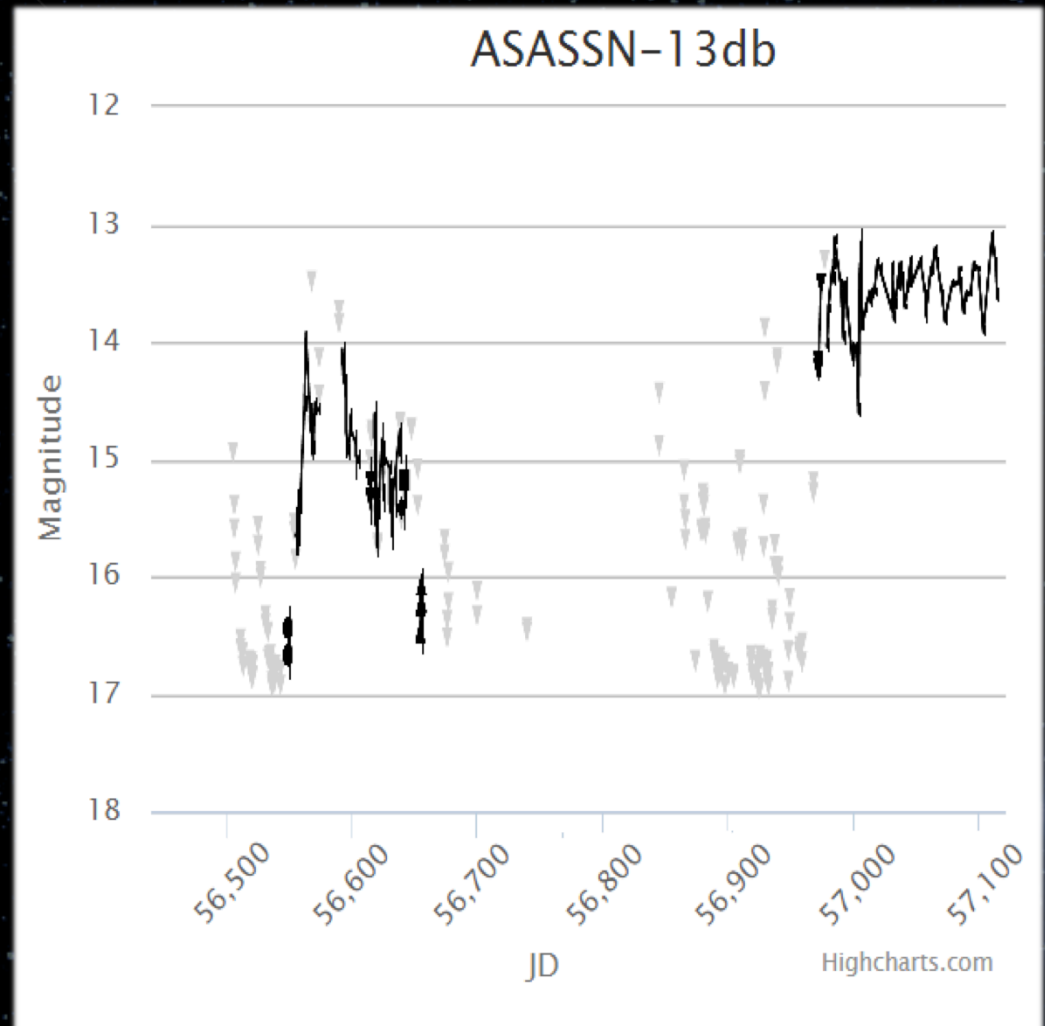


Holoien et al. (inc. Shappee) 2014b



ASAS SN Patrols

- Monitoring known sources for interesting behavior
 - ASAS-SN data releases that are:
 - Organized
 - Focused
 - Useful
 - Fast Cadence (2-3 days)
 - Base-line of years
 - Real-time
 - First Patrols:
 - CV
 - M dwarfs
 - Quasar
 - Blazars
 - AGN
 - SNe
 - Suggestions?
- Please let us know!



ASAS-SN CV Patrol Website
<http://cv.asassn.astronomy.ohio-state.edu/>

ASAS-SN: Looking Forward

- Expanded ASAS-SN South, “Cassius”
 - Last two weeks
 - Improve cadence, sky coverage, and **gaps in data**
 - 20,000 square degrees a night
- Start the south Galactic Plane in 2 months
- Further Expansion (with funding)
 - With 4 sites and 16 cameras
 - **entire sky every night!**
- Variable Stars
 - Led by Andres Jordan Universidad Católica
- All Public Data in a USEFUL WAY
 - Long term goal
 - What will **YOU** do with **ASAS-SN**?



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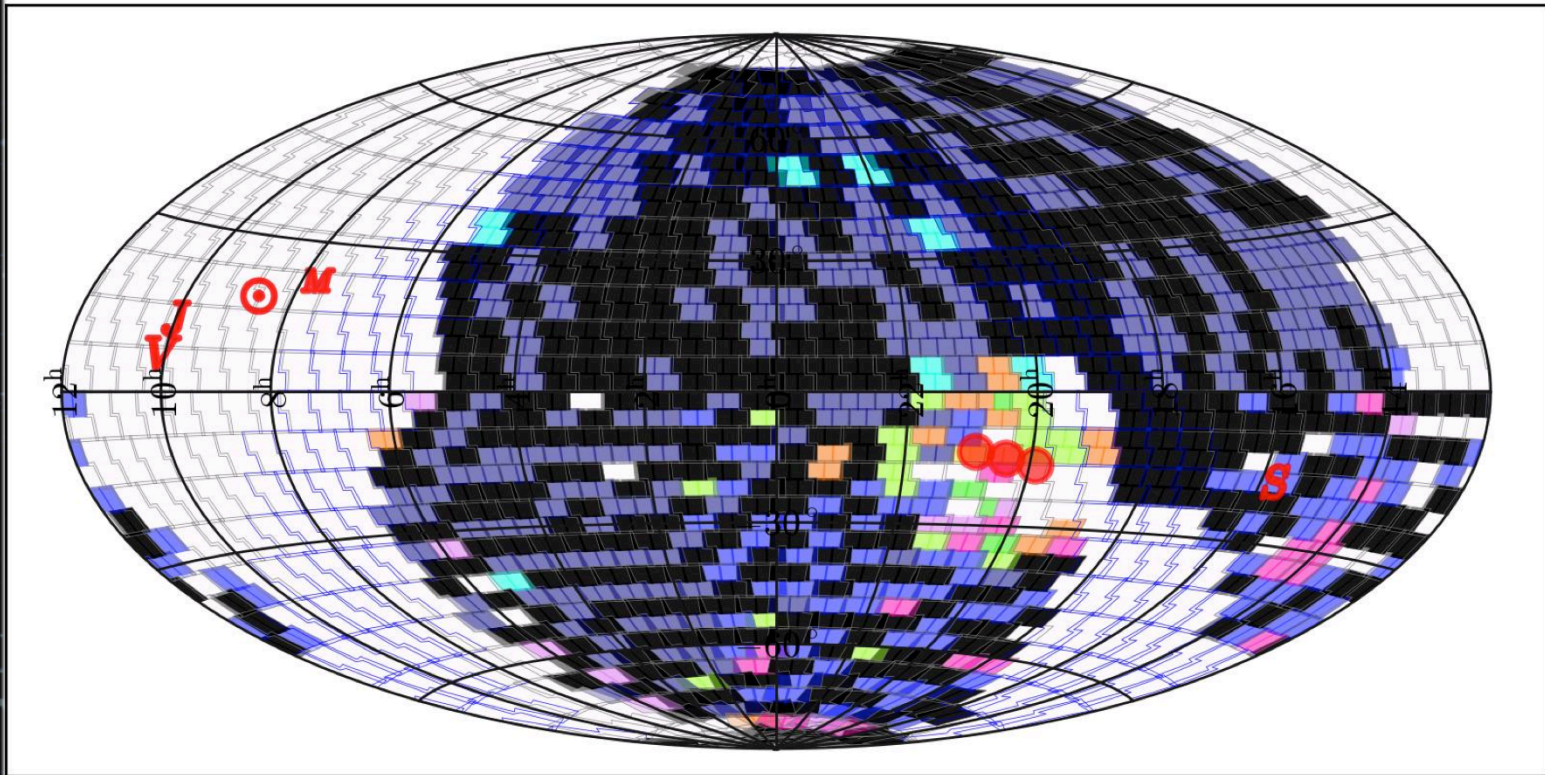
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Siding Spring

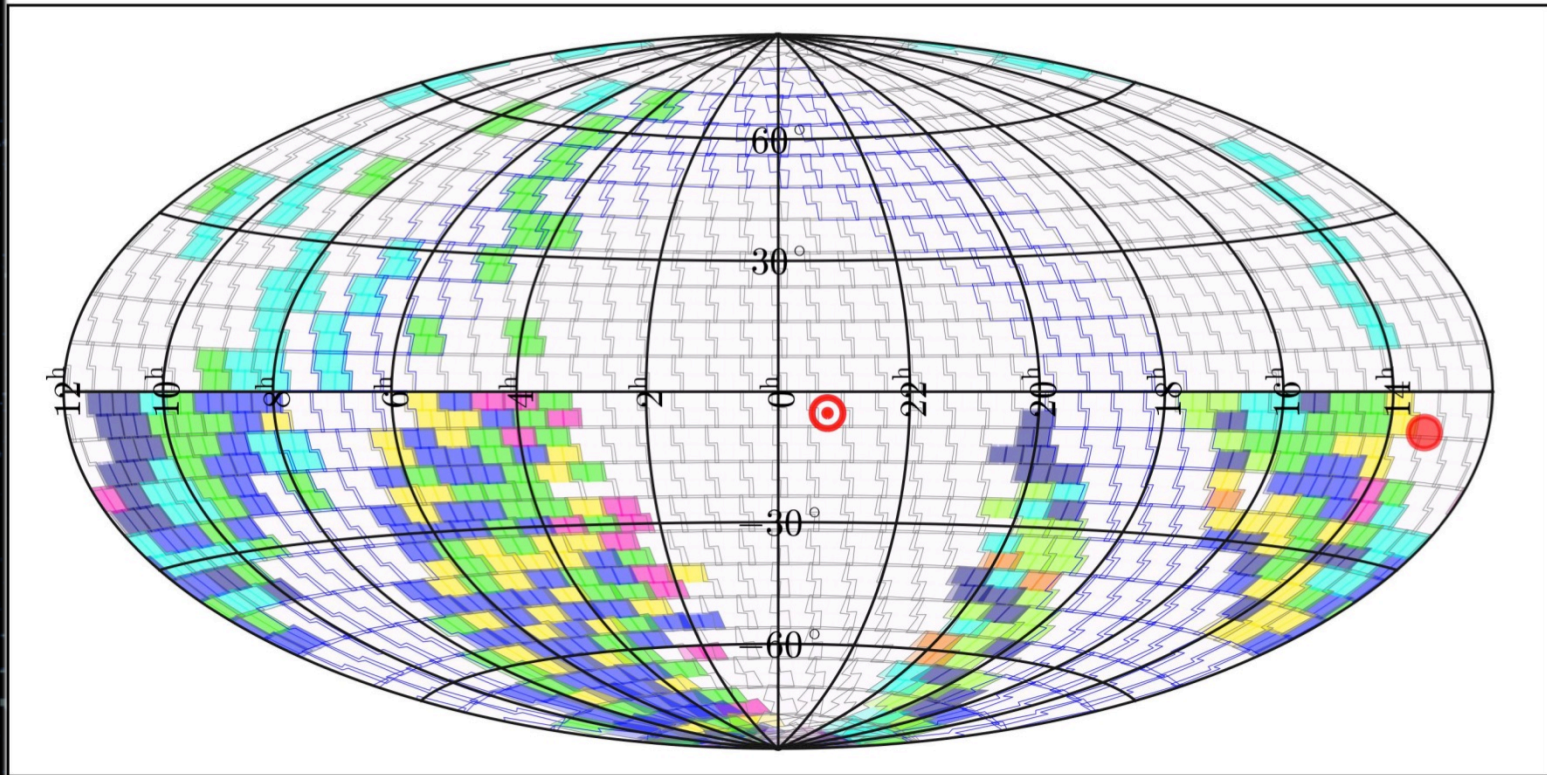
ASAS SN Cadence and Coverage

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ASAS SN Cadence and Coverage

Sun Mar 8 15:15:02 2015



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ASAS-SN + CSP: Looking Forward

- ASAS-SN is the first to discover about 12 bright SNe per month.
- $\approx 2/3$ of these are visible from LCO
- ASAS-SN attempts to classify spectroscopically any source which might be a SN
- ASAS-SN photometrically follow up any SN $z < 0.034$ not being followed by CSP
- I would like to implement fully- or semi-automatic triggering of sources which are in nearby galaxies

