

# Mansi M. Kasliwal

ASSISTANT PROFESSOR OF ASTRONOMY  
CALIFORNIA INSTITUTE OF TECHNOLOGY

**GROWTH**



Global Relay of Observatories Watching Transients Happen



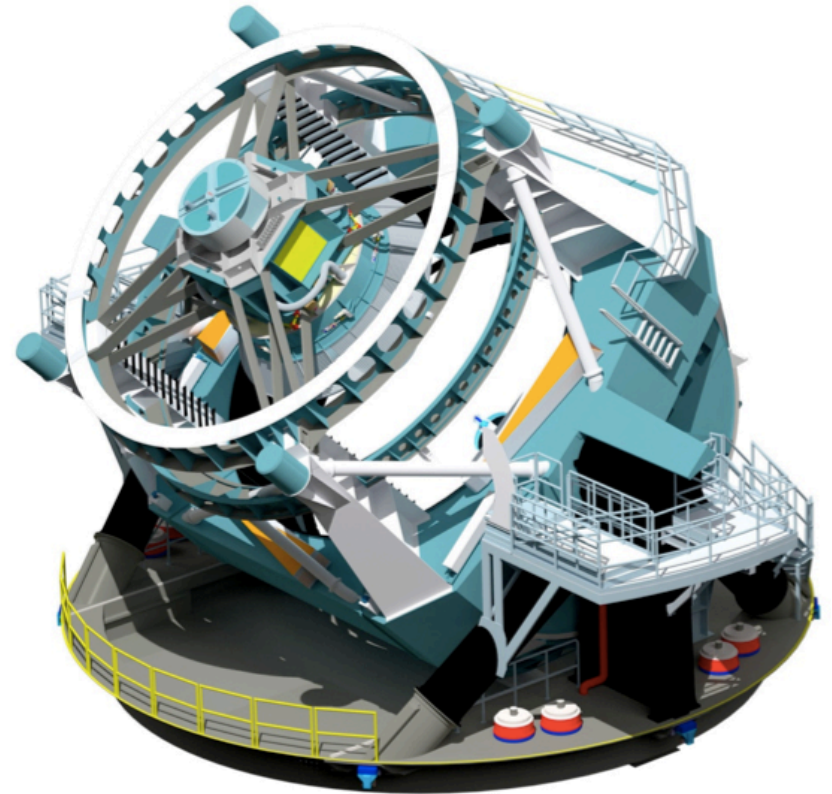
# Time-Domain Astronomy

**PTF:**  $4 \times 10^4$  events/night

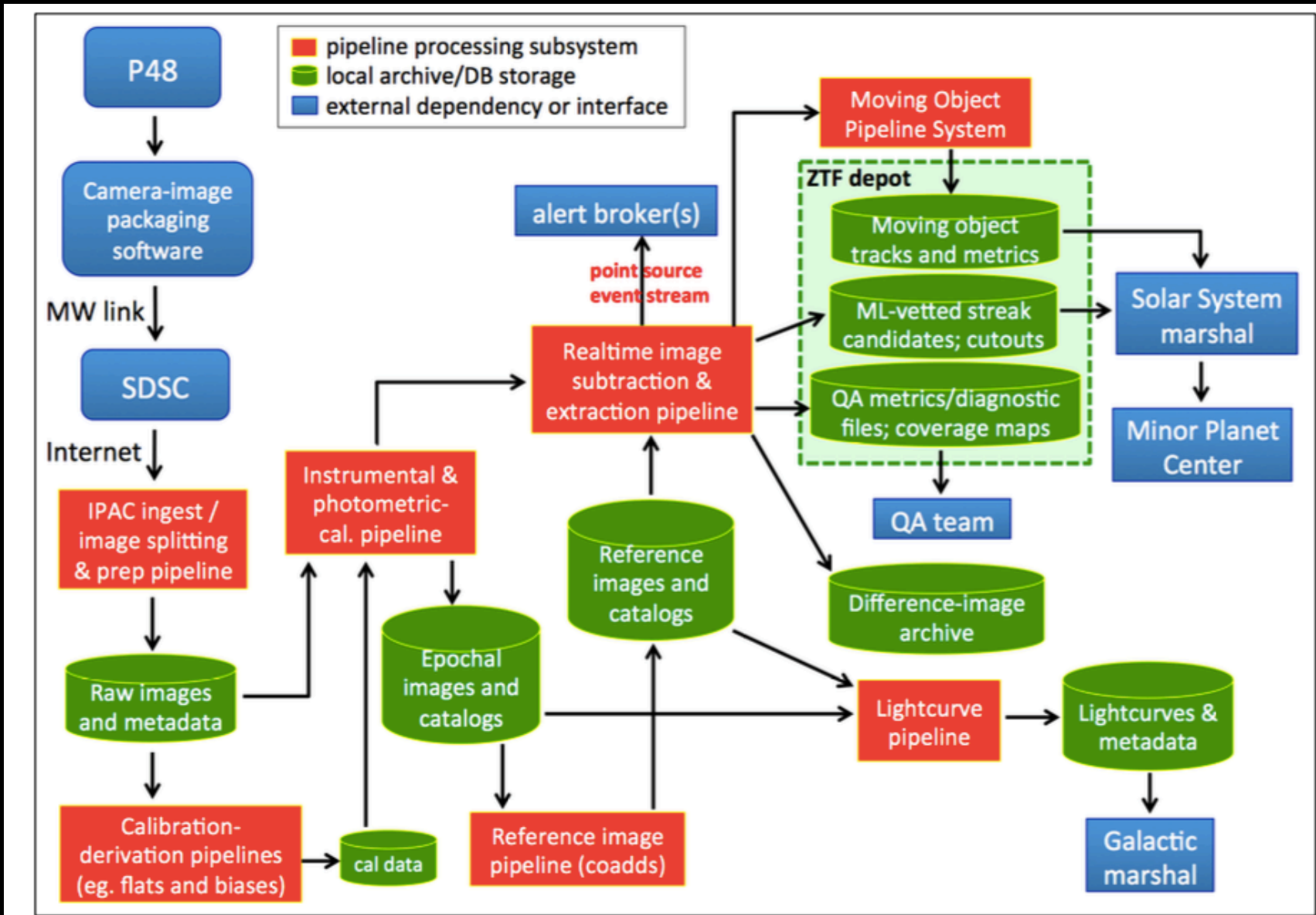
**ZTF:**  $3 \times 10^5$  events/night

**LSST:**  $2 \times 10^6$  events/night

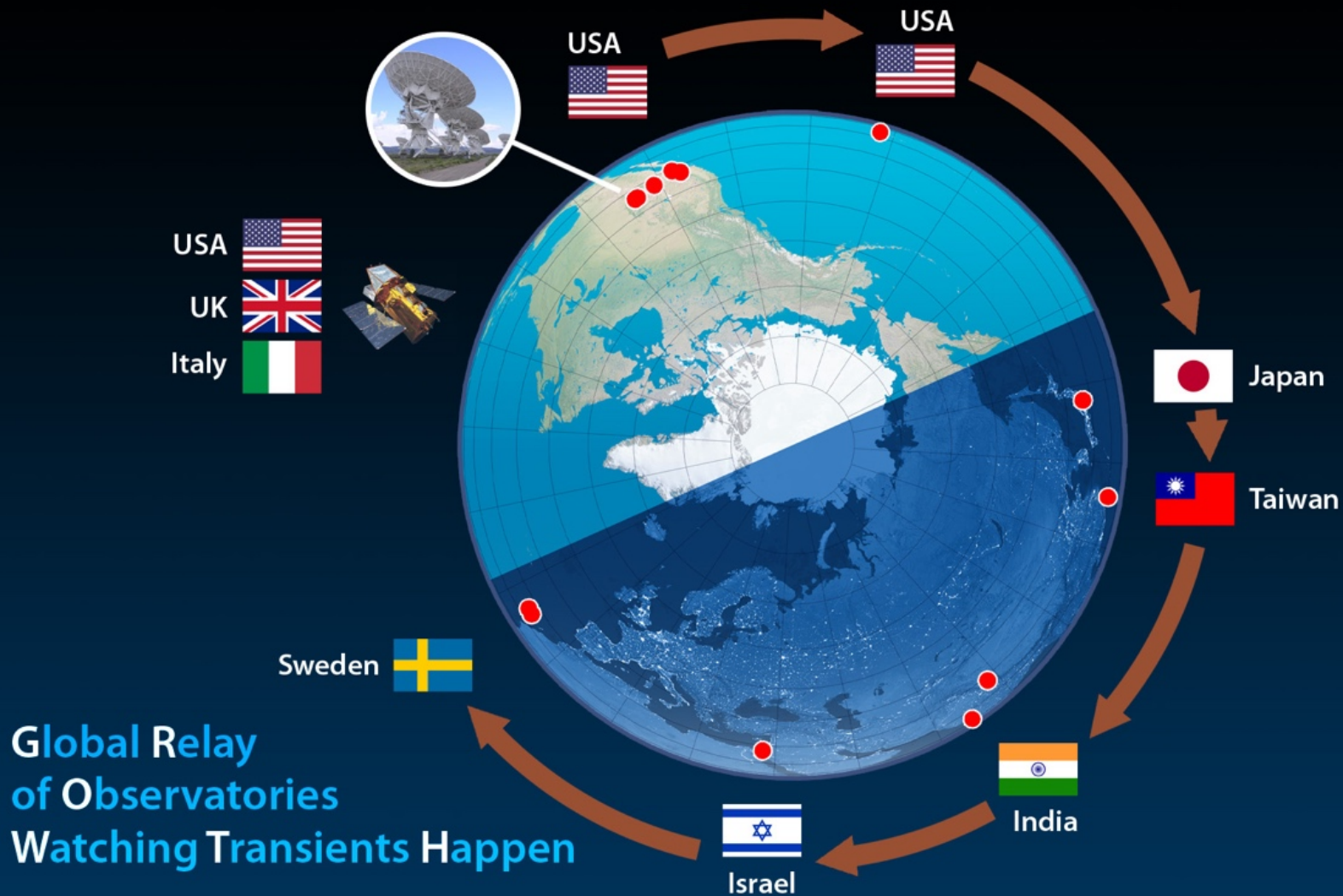
Technical	develop algorithms & software for detection & classification
Scientific	discover new transient & variable phenomena
Organizational	organize collaborations and followup strategies with real data



# Real-time IPAC pipeline



# Follow-Up is Key



**GROWTH**

Global Relay of Observatories Watching Transients Happen



# GROWTH Marshal Team

- Post-bac Chris Cannella, Caltech
- Graduate Student Tiara Hung, Maryland
- Postdoc Ulrich Feindt, Sweden
- Postdoc Christoffer Fremling, Caltech

Assistance from:

- Dmitry Duev (Server Host)
- Richard Walters (SEDM Interface)
- Heritage of PTF/iPTF marshal code

**Hiring: New Post-bac, Recommendations very welcome!**



# GROWTH Marshal Design Goals

A dynamic web portal that facilitates ZTF Science by:

- (a) A well-defined filter that defines the sample selection
- (b) An interactive graphical interface to vet candidates
- (c) Analysis tools (both manual and automated) to deep-drill on selected sources
- (d) Interface to organize and communicate with follow-up telescopes (both manual and automated)
- (e) Provide what you need at an observing run - visibility charts, finder charts, coffee
- (f) Ingest and visualize follow-up data (both manual and automated)
- (g) View Reports of properties of selected sample

# GROWTH Followup Marshal



view source



query database



view report



at an observing run



scan for candidates



add source



transfer source



schedules



general info



related sites

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Transient Advocate: n/a



**Melissa Graham** commented on [ZTF18aabwaec](#) and [ZTF18aabsygo](#): "spectrum obtained with APO+DIS on 2018-03-20 UT; redux underway"  
6 hours ago



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next runs

2018-03-20 APO+DIS

2018-03-21 APO+DIS

2018-03-22 APO+DIS

2018-03-22 P200+DBSP

2018-03-23 APO+DIS

2018-03-23 TNG+DOLORES



P60 schedule



most viewed  
this week



[ZTF18aabywzu \(CV\)](#)  
64 views



[ZTF18aabybkt \(SN II\)](#)  
50 views



[ZTF18aabrgzo](#)  
45 views



[ZTF18aabstmw \(SN Ia\)](#)  
30 views

Please fill out the form below to add a new source to the DB. (\* = REQUIRED)

Note that this will only create the source page. Photometry/spectroscopy needs to be uploaded subsequently.

\*Name

IAU Name

\*RA  (in decimal degrees)

\*DEC  (in decimal degrees)

Classification

New Thumbnail:  No file selected.

Reference Thumbnail:  No file selected.

Subtraction Thumbnail:  No file selected.

\* Program name  [click here to add a program](#)



# GROWTH Followup Marshal



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30 views

# Filtering: In Situ Beamline Triggers

[Edit Filters](#)

Limit IPAC query (boolean):

Ingested between  and

Number of Candidates <

Limit To Candidates From:

Time Stamp	New	Ref	Sub	SDSS		Autoannotations
03:45:04 (2018-02-25)					<p>ID: ZTF17aacbuuj  <b>PREVIOUSLY SAVED</b>            Mag_new: &gt;17.99 (5-sig UL)            Coordinate: 113.44269 26.32394            RB Score: 0.64333</p> <p><input type="button" value="Graham Nuclear Transients"/> Save  <input type="button" value="Graham Nuclear Transients"/> Remove</p>	 Graham Nuclear Transie <b>magnitude:</b> 17.988555 <b>rbscore:</b> 0.6433333158 <b>sgscore:</b> 1.0
03:45:04 (2018-02-25)					<p>ID: ZTF18aaaryqf  <b>NOT SAVED</b>            Mag_new: &gt;17.76 (5-sig UL)            Coordinate: 111.58194 23.62320            RB Score: 0.30000</p>	 ZTF Science Validation: <b>slope:</b> 0.0 <b>real:</b> True <b>positiveSubtraction:</b> 1 <b>magnr:</b> 21.0979995721 <b>brightStar:</b> False <b>magnitude:</b> 17.760728 <b>rbscore:</b> 0.3000000119 <b>sgscore:</b> 0.0 <b>mover:</b> False <b>distnr:</b> 8.45762825012
05:02:15 (2018-02-25)					<p>ID: ZTF18aabquwu  <b>NOT SAVED</b>            Mag_new: &gt;17.45 (5-sig UL)            Coordinate: 114.83417 16.10039            RB Score: 0.34000</p>	 ZTF Science Validation: <b>slope:</b> 5.6835337852 <b>real:</b> True <b>positiveSubtraction:</b> 1 <b>magnr:</b> 17.047000885 <b>brightStar:</b> False

# Diversity of Transient Filters

- Nuclear Transients
  - Young Supernovae
  - Fast Transients
  - Red Transients
  - Bright Transients
  - Slowly Rising Transients
  - SN Ia-like light curve from AMPEL?
  - Large Amplitude Variability in Young Stars?
  - CVs?
- etc.

# An Example Filter

## Initialize your variables

```
bright = False;  
noPointUnderneath = True;  
mover = True;
```

## Get values from AVRO packet

```
prevCandidates = observation["prv_candidates"];  
m_now = observation["candidate"]["magpsf"];  
t_now = observation["candidate"]["jd"];  
fid_now = observation["candidate"]["fid"];  
sgscore = observation["candidate"]["sgscore1"];  
rbscore = observation["candidate"]["rb"];  
magnr = observation["candidate"]["magnr"];  
distnr = observation["candidate"]["distnr"];  
scorr = observation["candidate"]["scorr"];
```

## Annotations

```
annotate "magnitude" m_now;  
annotate "sgscore" sgscore;  
annotate "slope" slope;
```

# An Example Filter

## Conditions

```
if (rbscore and rbscore > 0.2) { real = True;}

if (sgscore and sgscore > 0.76) { noPointUnderneath = False;}

if (magnr and magnr < 15.0 and distnr and distnr < 10) { brightStar = True; }

for candidate in prevCandidates{
    if (candidate["jd"] and candidate["magpsf"] and candidate["fid"] and
        candidate["isdifffpos"] and (candidate["isdifffpos"] == "t" or candidate["isdifffpos"]
        == "1")) { dt = t_now - candidate["jd"];

if (dt > 0.02 and candidate["magpsf"] < 99) { mover = False; }

if (dt != 0.0 and candidate["magpsf"] < 99){
    if (candidate["jd"] > t_slope and candidate["fid"] == fid_now) {
        t_slope = candidate["jd"];
        slope = (m_now - candidate["magpsf"]) / dt;    }    }    }}
}
```

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# Tuning a Filter

- Re-ingest i.e. Rewind was done on a regular basis during Science Validation to help people tune their filters
- If you let us know, we can do this on a daily basis at a pre-specified time once operations data starts flowing...

# GROWTH Followup Marshal



view source



query database



view report



at an observing run



scan for candidates



add source



transfer source



schedules



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Transient Advocate: n/a



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P60 schedule



most viewed  
this week



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50 views



[ZTF18aabrgzo](#)  
45 views



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30 views



# Event-specific Detail



# ZTF18abcwtr Ic

## SN

11:46:12.99  
+20:23:18.6  
176.554127  
+20.388509

View another



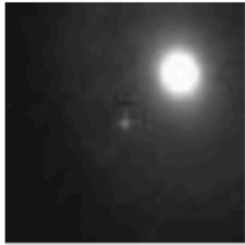
OVERVIEW

PHOTOMETRY

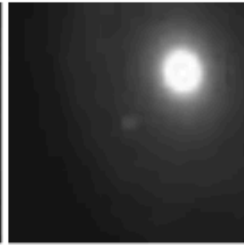
SPECTROSCOPY

OBSERVABILITY

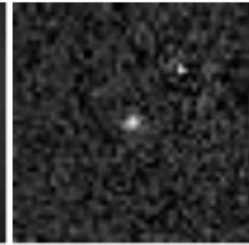
NEW



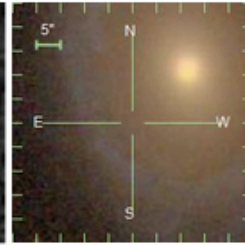
REF



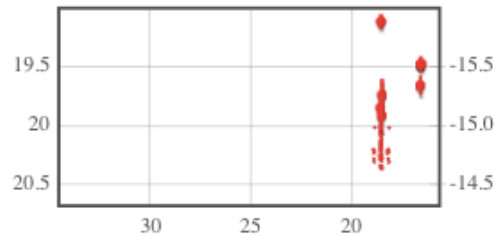
SUB



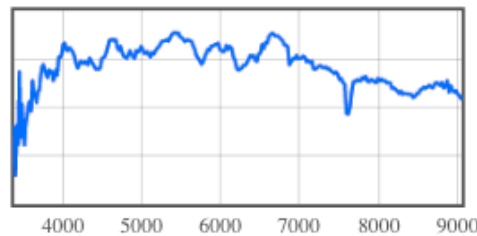
SDSS



PS1



$r = 19.5$  (16.6 d) | Upload New Photometry



$z = 0.023436$  | Upload New Spectroscopy  
DM (approximate) = 34.99

### AUTO ANNOTATIONS

2018 Feb 13 rllnann [saved\_for\_program]: 3  
Auto Annotation [Submission Form](#)

### COMMENTS

2018 Feb 15 ccannell [comment]: This is a test of the spectra upload with this header format.  
2018 Feb 14 ftadd [redshift]: 0.023436  
2018 Feb 14 fremling [classification]: SN Ic  
2018 Feb 14 ftadd [info]: The NOT+ALFOSC spectrum from 13Feb2018 reveals a SN, possibly Type Ic pre or around peak. The spectrum will be uploaded shortly.  
2018 Feb 13 rllnann [info]: Given that Palomar looks weathered out, we're triggering NOT ToO for a spectrum.  
2018 Feb 13 rllnann [info]: Likely supernova. Visible both in reference and "new" image; not on TNS. Host galaxy is redshift 0.023 so if photometry is correct, could be quite young.

Add a Comment:

Attach File:  No file selected.

### SEND AN ALERT

'ZTF Science Validation'

- Soft Alert (email)
- Hard Alert (email + SMS)

### ADDITIONAL INFO

-

### CURRENT FOLLOWUP REQUEST

Requester	Instrument	Start Date	End Date	Program	Priority	Status
rsw	SEDM	2018-02-24	2018-03-03	ZTF Science Validation	2	ACCEPTED



# ZTF18aabsygo

09:16:22.11  
+10:13:53.9  
139.092144 +10.231626

View another

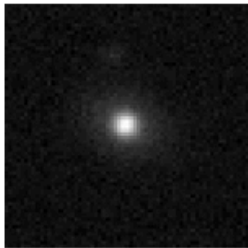
OVERVIEW

PHOTOMETRY

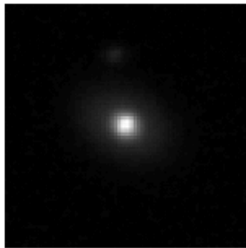
SPECTROSCOPY

OBSERVABILITY  

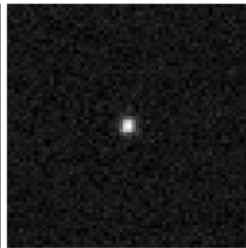
NEW



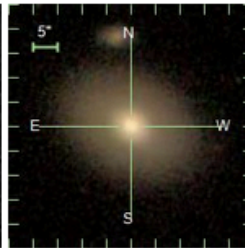
REF



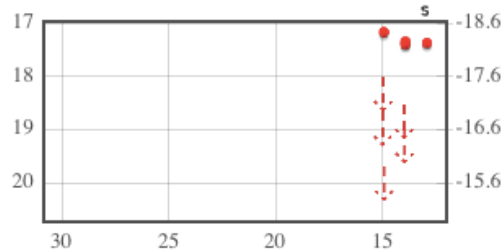
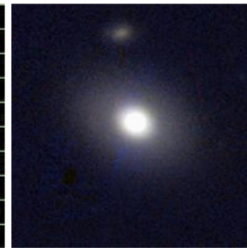
SUB



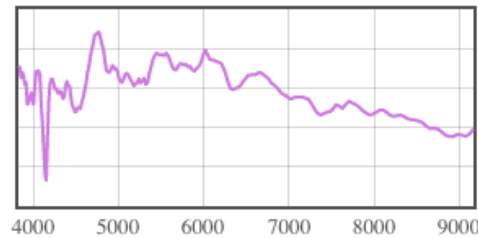
SDSS



PS1



$r = 17.4$  (12.9 d) | [Upload New Photometry](#)



$z = 0.0308$  | [Upload New Spectroscopy](#)  
DM (approximate) = 35.59

## AUTO ANNOTATIONS

- 2018 Mar 06 suvi [saved\_for\_progam]: 10
  - 2018 Mar 06 steveschulze [NED\_GALEX\_auto]: NUV: 20.41 +- 0.0487 mag, FUV: 22.922 +- 0.183 mag (CGCG 062-012, 0.414", [reference])
  - 2018 Mar 06 steveschulze [NED\_redshift\_auto]: 0.0308 +- 9e-06 (CGCG 062-012, 0.414", [reference])
  - 2018 Mar 06 steveschulze [SDSS\_specz\_auto]: 0.0308 +- 8.7e-06 (0.352", GALAXY, [reference])
  - 2018 Mar 06 steveschulze [SDSS\_photz\_auto]: 0.0318 +- 0.0076 (0.352", [reference])
  - 2018 Mar 06 steveschulze [saved\_for\_progam]: 3
- Auto Annotation [Submission Form](#)

## COMMENTS


- 2018 Mar 10 nblago [redshift]: 0.0308
- 2018 Mar 09 sjoert [info]: BPT='Seyfert' in Portsmouth catalog
- 2018 Mar 07 nblago [info]: Tentative match to SN Ia as well. [view attachment]
- 2018 Mar 07 nblago [info]: SNID fit to a SN Ic possible. Although the redshift does not quite match. [view attachment]

Add a Comment:

Attach File:  No file selected.

info 

## SEND AN ALERT

'ZTF Science Validation' 

Soft Alert (email)

## ADDITIONAL INFO

- |      |      |      |        |        |         |       |         |      |           |            |
|------|------|------|--------|--------|---------|-------|---------|------|-----------|------------|
| NED  | TNS  | SNEx | SIMBAD | VizieR | HEASARC | DECam | SkyView | PyMP | MPChecker | Extinction |
| CFHT | IPAC | DSS  | WISE   | Subaru | VLT     | FIRST | CRTS    | -    | ADS       |            |

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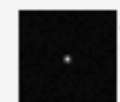
2018-03-23 TNG+DOLORES



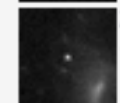
P60 schedule



most viewed  
this week



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50 views



[ZTF18aabrgzo](#)  
45 views



[ZTF18aabstmw \(SN Ia\)](#)  
30 views



# Tools Observing Planner

Assigned to Scheduled Run: 2018-03-20 APO+DIS

(priority 0 or higher)

More query options ▼

There are 33 targets assigned to this run ([jump to starlist](#)):

Name Type	RA Dec	REF	SUB	Light Curve	Assignment Details Comments
<a href="#">ZTF18aawwug</a> None	07:52:26.95 +16:29:38.5				2018-03-19 mlgraham P5 Classification ✓
<a href="#">ZTF18aabvpg</a> SN Ia (z=0.037)	08:08:35.99 +20:03:47.1				2018-03-19 mlgraham P2 Followup   declining SNIa; might be too faint for APO ✓ nblago [redshift]: 0.037 nblago [classification]: SN Ia DonNeill [info]: SNID match to SNIa 2000dg at +5 days ...
<a href="#">ZTF18aabufhw</a> None (z=0.04282)	08:37:11.44 +23:11:53.0				2018-03-19 mlgraham P4 Followup ✓ steveschulze [redshift]: 0.04282 steveschulze [comment]: SDSS redshift nblago [info]: blue continuum with strong galaxy emission lines.

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**Steve Schulze** commented on [ZTF18aabywzu](#): "AKA CSS 090516:103739+124250. Listed as CV in the AAVSO International Variable Star Index VSX. Also listed as dwarf nova (see Vizer database)."  
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**Steve Schulze** uploaded Swift photometry to [ZTF18aabybkt](#)  
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2018-03-20 APO+DIS

2018-03-21 APO+DIS

2018-03-22 APO+DIS

2018-03-22 P200+DBSP

2018-03-23 APO+DIS

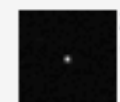
2018-03-23 TNG+DOLORES



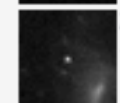
P60 schedule



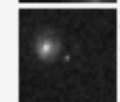
most viewed  
this week



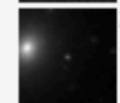
[ZTF18aabywzu \(CV\)](#)  
64 views



[ZTF18aabybkt \(SN II\)](#)  
50 views



[ZTF18aabrgzo](#)  
45 views



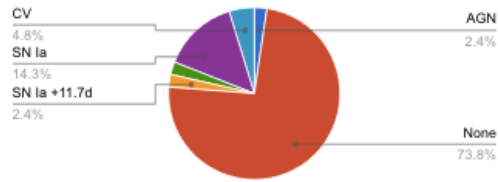
[ZTF18aabstmw \(SN Ia\)](#)  
30 views

# Science Program Reports

Currently Displaying For ZTF Science Validation

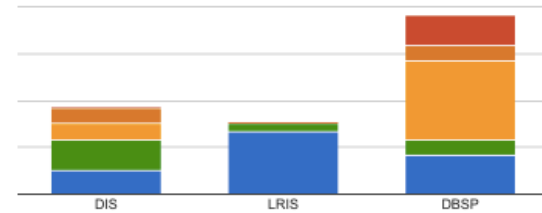
## Subtypes:

AGN: 1  
 None: 31  
 SN Ia +11.7d: 1  
 SN Ic: 1  
 SN Ia: 6  
 CV: 2



## Active Assignments:

DIS: 11  
 LRIS: 9  
 DBSP: 23



P48 Image	Name* (age)	Type	z	RA Dec	Mag (days ago)	Light Curve	Spectra	Assignments	P	Autoannotations
	<a href="#">ZTF18aabqgnb</a> (16.6 d)	None		11:52:45.48 +37:51:15.3	r = 18.2 (9.5 d)		no spectra found	2018-02-18 DBSP 2018-02-17 DIS	4.0 4.0	<a href="#">[saved_for_progam]: 3</a>
	<a href="#">ZTF18aabpqus</a> (59.4 d)	None		11:56:08.34 +40:40:47.8	r = 19.5 (14.5 d)		no spectra found			<a href="#">[saved_for_progam]: 3</a>
	<a href="#">ZTF18aabowsg</a> (16.6 d)	None		10:51:57.86 +08:52:07.2	r = 19.1 (14.6 d)		no spectra found			<a href="#">[saved_for_progam]: 3</a>
	<a href="#">ZTF18aablldc</a> (15.8 d)	None		06:05:29.36 +45:20:45.5	r = 19.2 (14.8 d)		no spectra found	2018-02-12 DBSP 2018-02-13 LRIS	3.0	<a href="#">[saved_for_progam]: 3</a>
	<a href="#">ZTF18aabewq</a> (18.5 d)	None		13:32:53.76 +24:07:12.4	r = 17.9 (16.5 d)		no spectra found			<a href="#">[saved_for_progam]: 3</a>

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Transient Advocate: n/a



**Melissa Graham** commented on [ZTF18aabwaao](#) and [ZTF18aabsygo](#): "spectrum obtained with APO+DIS on 2018-03-20 UT; redux underway"  
*6 hours ago*



**Melissa Graham** commented on [ZTF18aaayernw](#) and [ZTF18aaewugy](#): "spectrum obtained APO+DIS 2018-03-20 UT; redux underway"  
*7 hours ago*



**Richard Walters** uploaded a P60 (SEDM) spectrum to [ZTF18aabywzu](#) and 2 other targets from 2018-03-16  
*3 days ago*



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2018-03-21 APO+DIS

2018-03-22 APO+DIS

2018-03-22 P200+DBSP

2018-03-23 APO+DIS

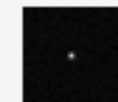
2018-03-23 TNG+DOLORES



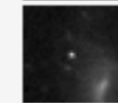
P60 schedule



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64 views



[ZTF18aabybkt \(SN II\)](#)  
50 views



[ZTF18aabrgzo](#)  
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[ZTF18aabstmw \(SN Ia\)](#)  
30 views

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Transient Advocate: n/a



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2018-03-23 APO+DIS

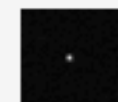
2018-03-23 TNG+DOLORES



P60 schedule



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[ZTF18aabybkt \(SN II\)](#)  
50 views



[ZTF18aabrgzo](#)  
45 views



[ZTF18aabstmw \(SN Ia\)](#)  
30 views



# Calendar

Welcome Mansi!

March 2018

today < >

Assign Scanning Schedule

Add a Follow Up Run

My calendars

- Follow Up Schedule
- Nuclear Transients
- ZTF Science Validation

Sun	Mon	Tue	Wed	Thu	Fri	Sat
25	26	27	28	1	2	3
			NOT + ALFO!			
4	5	6	7	8	9	10
		APO + DIS	APO + DIS NOT + ALFO! P200 + DBSF Suvi Gezari	NOT + ALFO! Tiara Hung	Charlotte Wai	Sara Frederic
11	12	13	14	15	16	17
	NOT + ALFO!	NOT + ALFO!		Keck1 + LRIS		
18	19	20	21	22	23	24
APO + DIS	Keck1 + LRIS	APO + DIS	P200 + DBSF		TNG + DOLO	
25	26	27	28	29	30	31
1	2	3	4	5	6	7

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2018-03-21 APO+DIS

2018-03-22 APO+DIS

2018-03-22 P200+DBSP

2018-03-23 APO+DIS

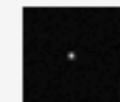
2018-03-23 TNG+DOLORES



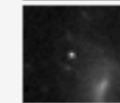
P60 schedule



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# Directory

Select a Program

ZTF Science Validation

Show 10 entries

Search:

First	Last	Institution	Email
Adam	Miller	Northwestern University	amiller@northwestern.edu
Andy	Connolly	University of Washington	ajc@astro.washington.edu
Angie	Van Sistine	UWM	vansisti@uwm.edu
Angie	VanSistine	UWM	vansisti@uwm.edu
Anna	Ho	Caltech	ah@astro.caltech.edu
Ariel	Goobar	The Oskar Klien Centre, Stockholm University	Ariel@fysik.su.se
Avishay	Gal-Yam	Weizmann Institute of Science	avishay.gal-yam@weizmann.ac.il
Brad	Cenko	NASA GSFC	brad.cenko@nasa.gov
Charlotte	Ward	University of Maryland	charlotteward@astro.umd.edu
Chris	Cannella	Caltech	ccannell@caltech.edu

Showing 1 to 10 of 54 entries

Previous

1

2

3

4

5

6

Next

name	nickname	diameter	lat	lon
<a href="#">Akeno MITSuME</a>	Akeno	0.5	35.7866	138.4806
<a href="#">Apache Point 3.5m</a>	APO	3.5	32.78	-105.82
<a href="#">ARIES 1.3m Devasthal Fast Optical Telescope</a>	DFOT	1.3	29.4	79.46
<a href="#">Calar Alto 1.2m</a>	CAHA 1.2m	1.23	37.22361	-2.5461
<a href="#">China Near Earth Object Survey Telescope</a>	CNEOST	1.5	32.066667	118.816667
<a href="#">CTIO 1.3m</a>	CTIO-1.3m	1.3	-30.169661	-70.806525
<a href="#">CTIO Victor M. Blanco 4-meter Telescope</a>	CTIO-4m	4.0	-30.169661	-70.806525
<a href="#">Discovery Channel Telescope</a>	DCT	4.3	34.744305	-111.422515
<a href="#">du Pont 2.5m</a>	DUP	2.5	-29.0033	-70.7017
<a href="#">Ekar 1.82m</a>	Ekar	1.82	11.548	45.8486
<a href="#">Extremely Fake Telescope</a>	EFT	None	None	None
<a href="#">Faulkes Telescope North</a>	FTN	2.0	20.7075	-156.256111
<a href="#">Faulkes Telescope South</a>	FTS	2.0	-31.273333	149.071111
<a href="#">Gemini North</a>	Gemini N	8.1	19.8	-155.5
<a href="#">Gemini South</a>	GS	8.0	-30.24075	-70.736693
<a href="#">Gran Telescopio Canarias 10.4 m</a>	GTC	10.4	28.756611	342.107972
<a href="#">Himalyan Chandra Telescope</a>	HCT	2.0	32.779444	78.964167
<a href="#">Hobby-Eberly Telescope</a>	HET	11.0	30.67139	-104.02139

# Marshal FAQ Page on Twiki



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You are here: [TWiki](#) > [GROWTH Web](#) > MarshalFAQs

r3 - 15 Mar 2018 - 19:25:40 - MansiKasliwal

## General Questions

### How do I sign up to the GROWTH marshal?

Everyone who wants to use the GROWTH Marshal can sign up on the following page

<https://zwickv.tf/wg6>

Marshal accounts need to be approved by the marshal administrator.

### What is the marshal homepage?

Please bookmark this URL for access to the homepage of the GROWTH marshal

<https://zwickv.tf/gru>

Note that to access this page you need to have your account approved by the marshal administrators. New accounts are reviewed and processed on a daily basis.

Email: [contact\\_growth AT astro.caltech.edu](mailto:contact_growth@astro.caltech.edu)



Thank you