The Transient Sky seen by the Zwicky Transient Facility

Mickael RIGAULT
ZTF | Go Fast (30s exp.), Scan Large (full visible sky)

We have about $10^5$ event/night; 10% of LSST
A 1.5m Schmidt Telescope

2m mirror

Declination axis

1.2m lens
A 1.5m Schmidt Telescope

- New tube baffles
- Bonn Shutter
- Camera Support Structure
- Front-End Baffle & Trim Plate
- Archon Controllers (x5) Outside Beam Footprint
- Filter Exchange Robot (KUKA)
- Filter Storage Closet Through Access Port in Tube
- Electronics Rack
The Camera

**Key Information**

- **47 square degree field**  
  
  (on 2 grids; 1 main + extra)

- **16 E2V 6k x 6k CCDs**  
  
  (2 different coatings)

- **1 Pixel ~ 1 arcsec**  
  
  (typical seeing ~2 arcsec)

- **30s exposure + 15s slew**

- **~20.5 mag (5σ) per exposure**  
  
  (slightly better in R)

**3 Filters**

- g, r, I
A Filter

Roger Smith, Technical lead
**Public Survey “MSIP”**

- 2 Filters (g, r)
- 6400 sqdeg every 3 days (in both bands!)
- Alerts public right away (all transients discovered within MSIP)

**Kafka stream hosted by UW**
(The LSST team and technology !)

+ Galactic plane (August mainly)

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**ZTF = 3750 square degrees/hour**

**Chart:**
- Caltech 20%
- Partner 40%
- Public (MSIP) 40%
Public Survey “MSIP”

2 Filters (g, r)

6400 sqdeg every 3 days (in both bands!)

Alerts public right away (all transients discovered within MSIP)

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+ Galactic plane (August mainly)

Starting TODAY (4th of June)
MSIP Survey

Starting TODAY (4th of June)
Partner | Caltech | Public

PUBLIC SURVEY “MSIP”
2 Filters (g, r) every 3 days
On 6400 sqdeg + MW

PARTNERSHIP & CALTECH
High cadence fields (g,r)
(4x the same field every night)

Third Filter mapping MSIP
(4 days cadence; For Cosmology mainly)

Galactic Plane + M31
(Mainly August)

ZTF = 3750 square degrees/hour

Caltech 20 %
Partner 40 %
Public (MSIP) 40 %
The Science | The Transient Sky
The Science | The Transient Sky

The diagram shows a scatter plot with the axes labeled as follows:
- Y-axis: Peak Luminosity (M_V)
- X-axis: Characteristic Timescale (day)

Marked regions include:
- ZTF
- Relativistic Explosions
- Luminous Supernovae
- Thermonuclear Supernovae
- Core-Collapse Supernovae
- Car-rich Transients
- Intermediate Luminosity Red Transients
- Luminous Red Novae
- Classical Novae
- P60-M82OT-071213
- V1309 Sco

Points and labels correspond to various astronomical events and phenomena.
Science Working Groups

Solar System Bodies

Galactic and M31 Science

ElectroMagnetic counters part of GW and Neutrinos

Physics of Supernova and Relativistic Explosions

AGN and Tidal Disruption Events

Type Ia Supernova & Cosmology
Multi Messenger Follow Up

10% of the time dedicated | Possibility to extend the exposure time up to 10min (mag 22)

Localization of GW170817 was smaller than ZTF FoV

Abbot et al. (2017), PRL 119, 161101
Type Ia Supernova Cosmology with ZTF

Our Goal — A Fully typed SNeIa Sample of all SNeIa nature provides up to z~0.1

We should get ~800 SNeIa per year with

At least 5 points per filter (g,r,i)  
(the limitation is the i-band)

At least 1 point prior -7 days to max  
(We catch them really early)

At least 1 point after +40 days to max  
(we should see the second bump for all of them)
Type the Transient Sky!

Survey Volume, 1 hr. cadence (Mpc$^3$, $M_V = -19$)
ZTF | Camera & Spectros

ZTF Camera (P48)

SEDmachine (IFU P60)

Long slit (P60)

See the Broker talk
ZTF | observing the transient sky

Key Features

- 47 square degree field
- 3 filters (g, r, I)
- \(~20.5\) mag (5\(\sigma\)) per exposure
- 3700 sq-deg / hour
  \((MSIP = 12\ 000\ sq-deg /\text{night})\)
- MSIP: g & r 3 day cadences

Starting TODAY (4th of June)
(check ATel / TNS)