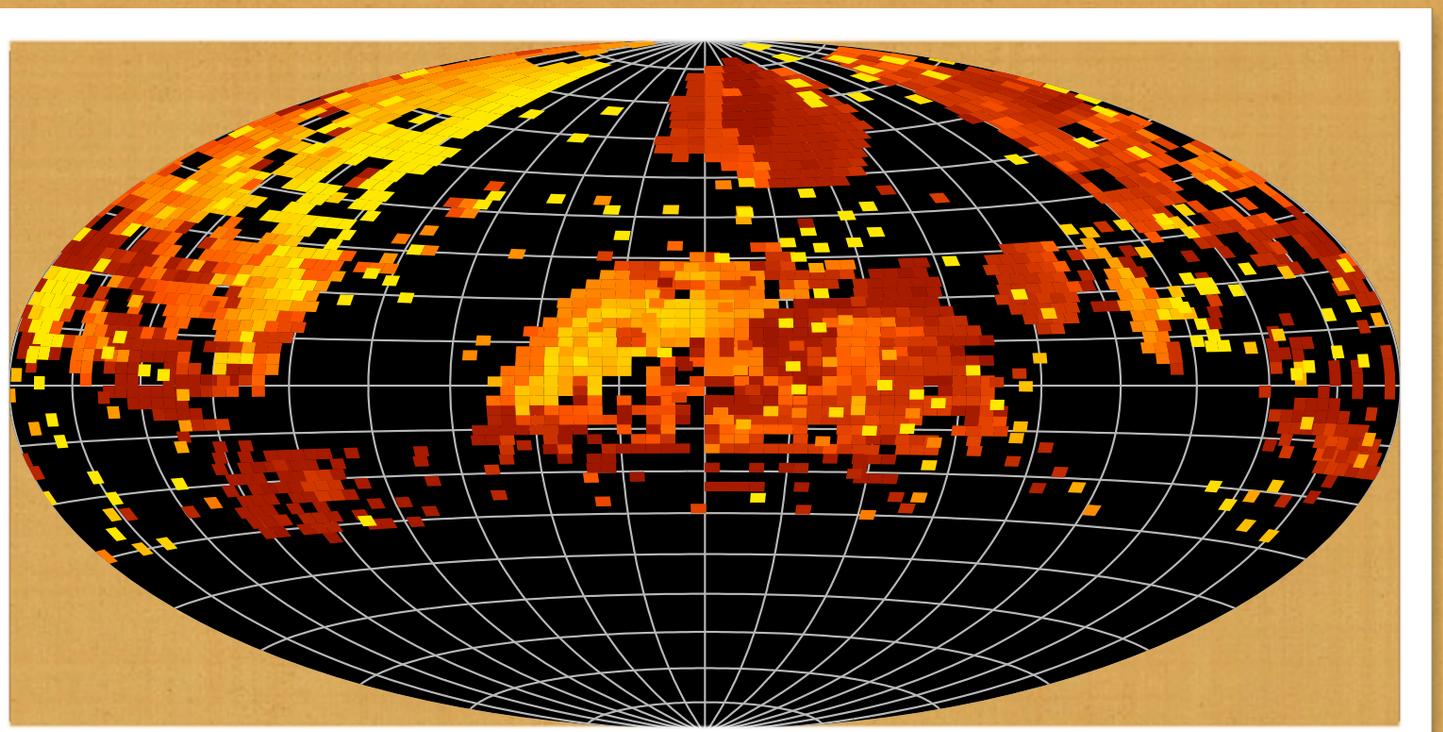
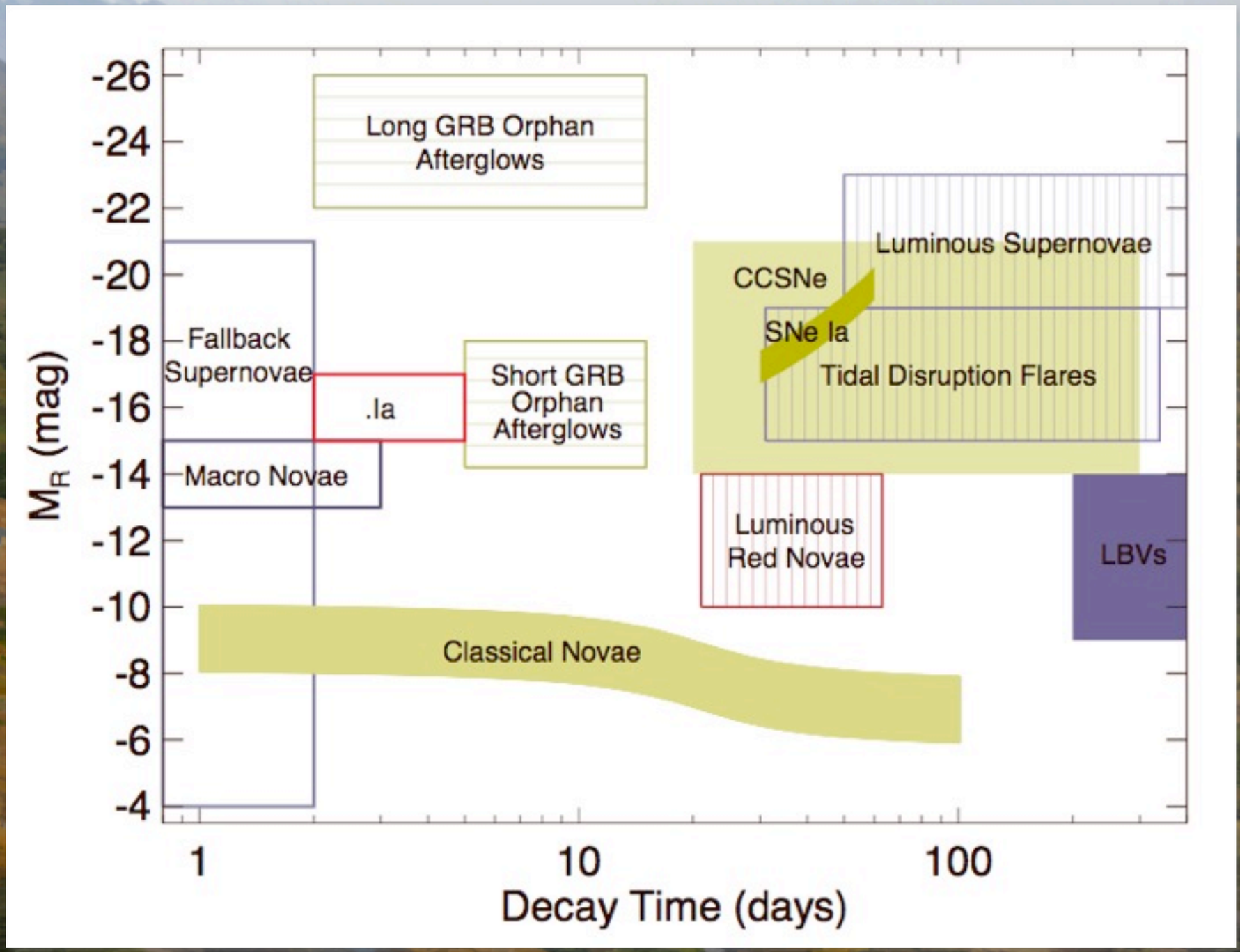
The Palomar Transient Factory



Robert Quimby & Shri Kulkarni
(Caltech)

Transient Phase Space



Rau et al. 2009

Robert Quimby

Palomar Transient Factory

Link together the wide field survey potential of the 48”, multi-band photometric screening with the 60”, and spectroscopic typing by the 200” telescopes

P48 (survey telescope)

P60 primary follow-up telescope

Explore known transients in new ways
Hunt for new transient classes

Robert Quimby

PTF: We Recycle

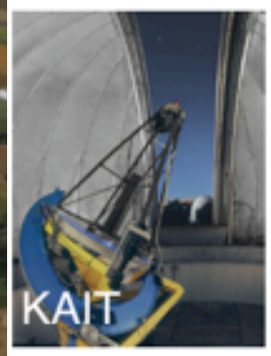
Oschin Schmidt Telescope

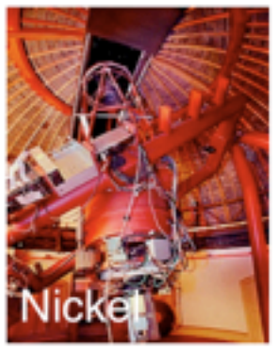
- First light in 1948
- 1.2m aperture Schmidt
- 36 square degree field of view
- POSS and DSS

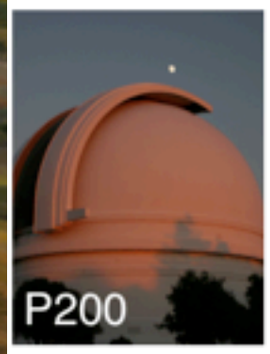
PTF Camera

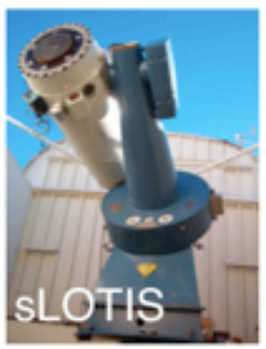
- Refurbished CFH12K camera
- 12 2x4k CCDs (1 inoperative)
- 1” pixels => 7.3 deg^2 active area
- ~100 Mpix (200 MB/exposure)

Investment in Follow-up









Date	Runs	
2010-11-30	P60+P60 Camera	WHT+ISIS
2010-12-01	P60+P60 Camera	
2010-12-02	P60+P60 Camera	
2010-12-03	P60+P60 Camera	
2010-12-04	P60+P60 Camera	Lick 3-m+KAST
2010-12-05	P60+P60 Camera	
2010-12-06	P60+P60 Camera	P200+DBSP
2010-12-07	P60+P60 Camera	
2010-12-08	P60+P60 Camera	NOT+ALFOSC
2010-12-09	P60+P60 Camera	
2010-12-10	P60+P60 Camera	
2010-12-11	P60+P60 Camera	
2010-12-12	P60+P60 Camera	P200+DBSP
2010-12-13	P60+P60 Camera	Lick 3-m+KAST
2010-12-14	P60+P60 Camera	
2010-12-15	P60+P60 Camera	
2010-12-16	P60+P60 Camera	
2010-12-17	P60+P60 Camera	
2010-12-18	P60+P60 Camera	
2010-12-19	P60+P60 Camera	
2010-12-20	P60+P60 Camera	
2010-12-21	P60+P60 Camera	
2010-12-22	P60+P60 Camera	
2010-12-23	P60+P60 Camera	
2010-12-24	P60+P60 Camera	
2010-12-25	P60+P60 Camera	
2010-12-26	P60+P60 Camera	
2010-12-27	P60+P60 Camera	
2010-12-28	P60+P60 Camera	Lick 3-m+KAST
2010-12-29	P60+P60 Camera	P200+DBSP Keck1+LRIS
2010-12-30	P60+P60 Camera	

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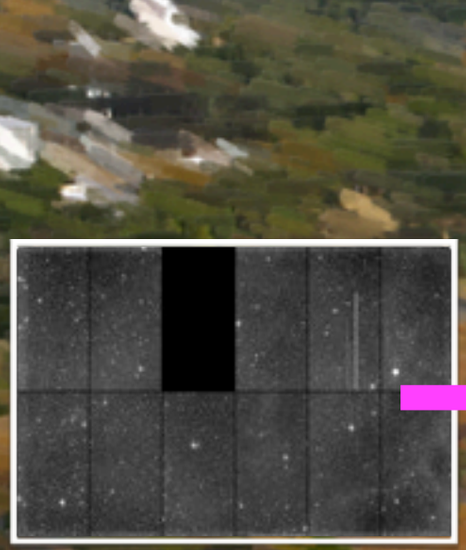
PTF Survey

Search Strategy

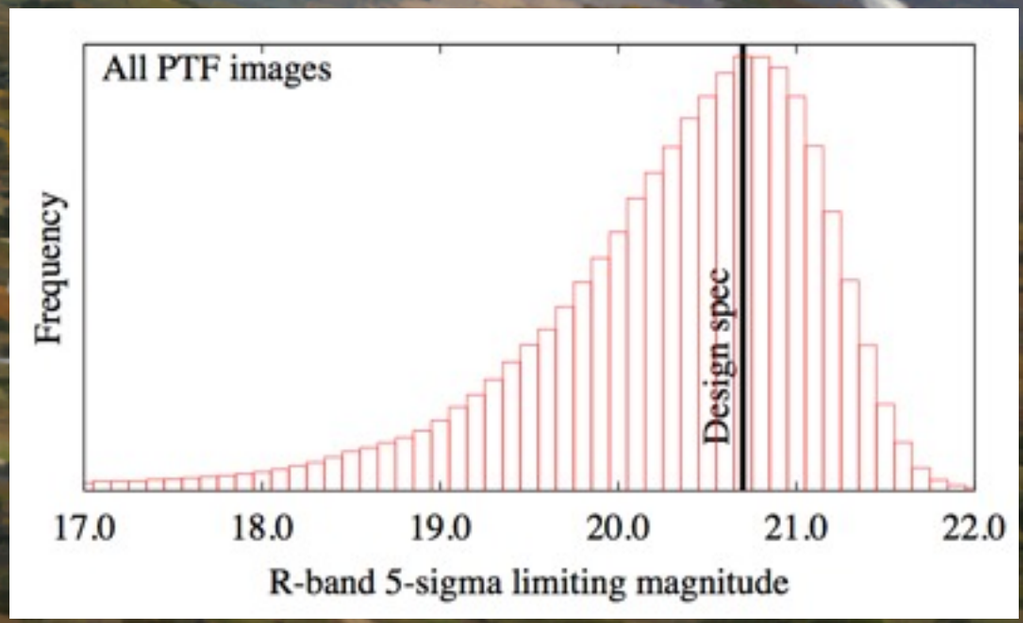


~1 hour

60s exposures
30s readout/slew

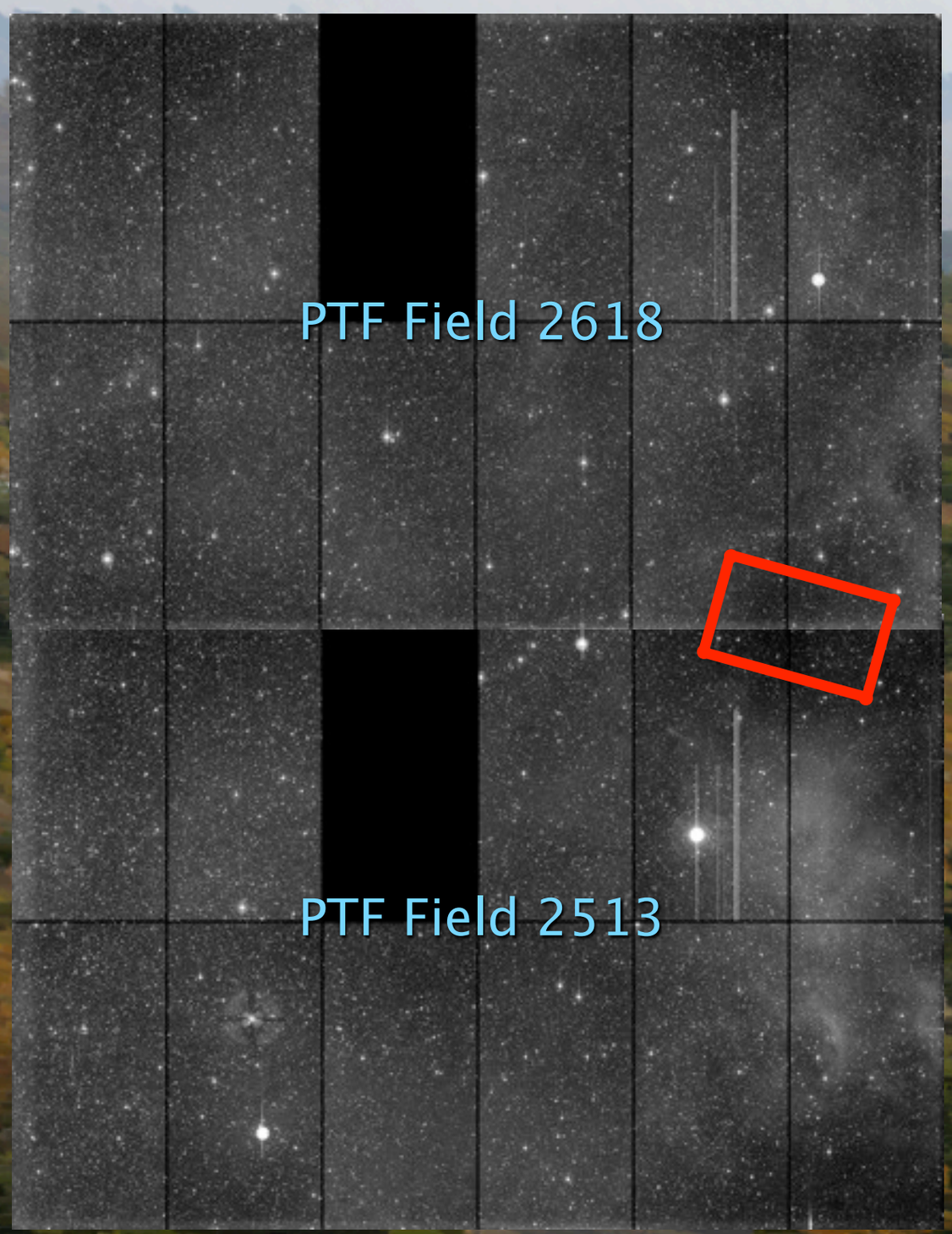
<1-5 days

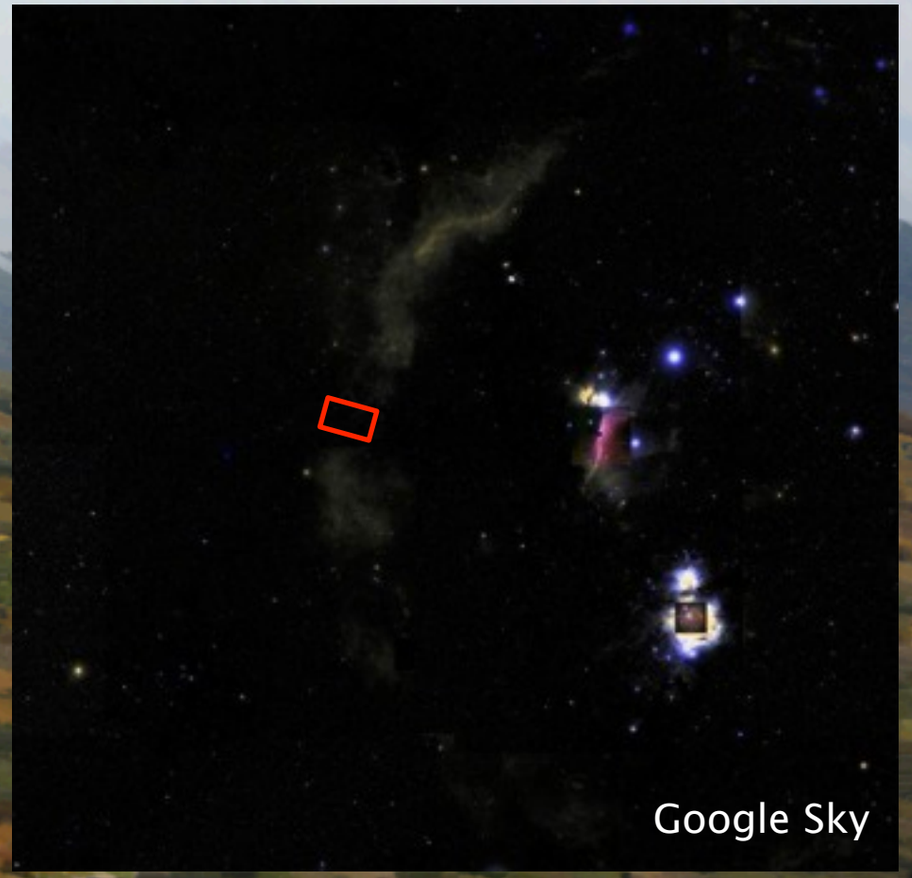
Limiting Magnitude



Typical 5σ limit of R<20.7 mag (averaged over all weather and moon phases)

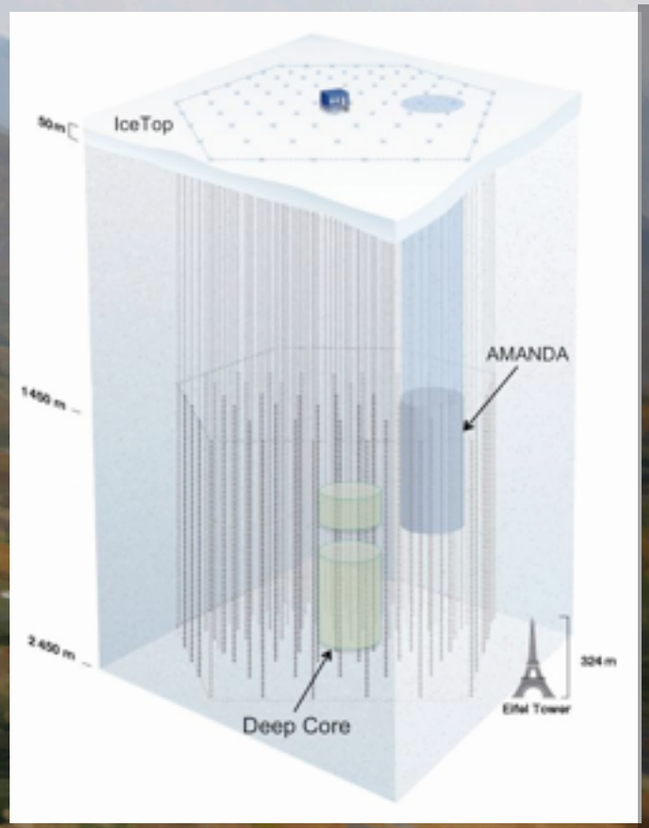
MAXI XRF101117A





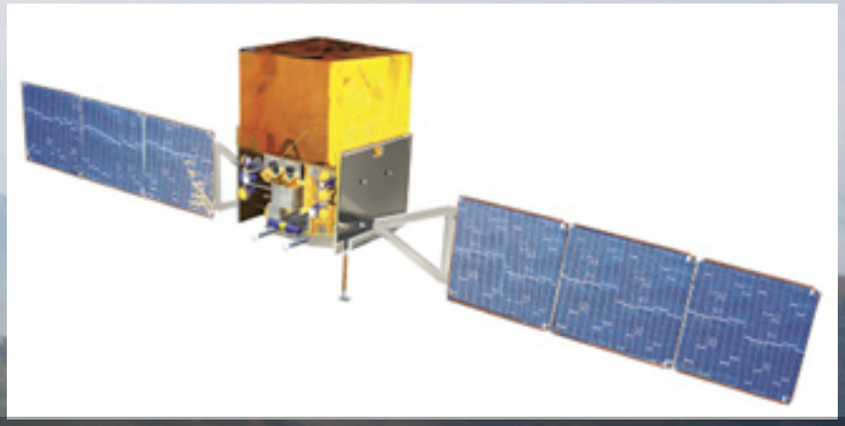
- 2010-11-17 07:32:59 -- MAXI detects short (32s) X-ray transient (Yamazaki et al. GCN 11410)
- 2010-11-18 06:09 -- PTF follow-up begins (earlier start possible)
- Comparison to USNO-B1.0 catalog reveals no new transient sources (Cenko & Ofek GCN 11418)

PTF as a Follow-Up Instrument



IceCube

- high energy neutrino telescope
- 3 events so far (~10/year)
- ~1.5 deg error circles
- PTF actively investigating recent alert



Fermi/GBM

- several triggers followed up by PTF already (expect ~20/year)
- statistical errors < ~3 deg (but systematics larger!)

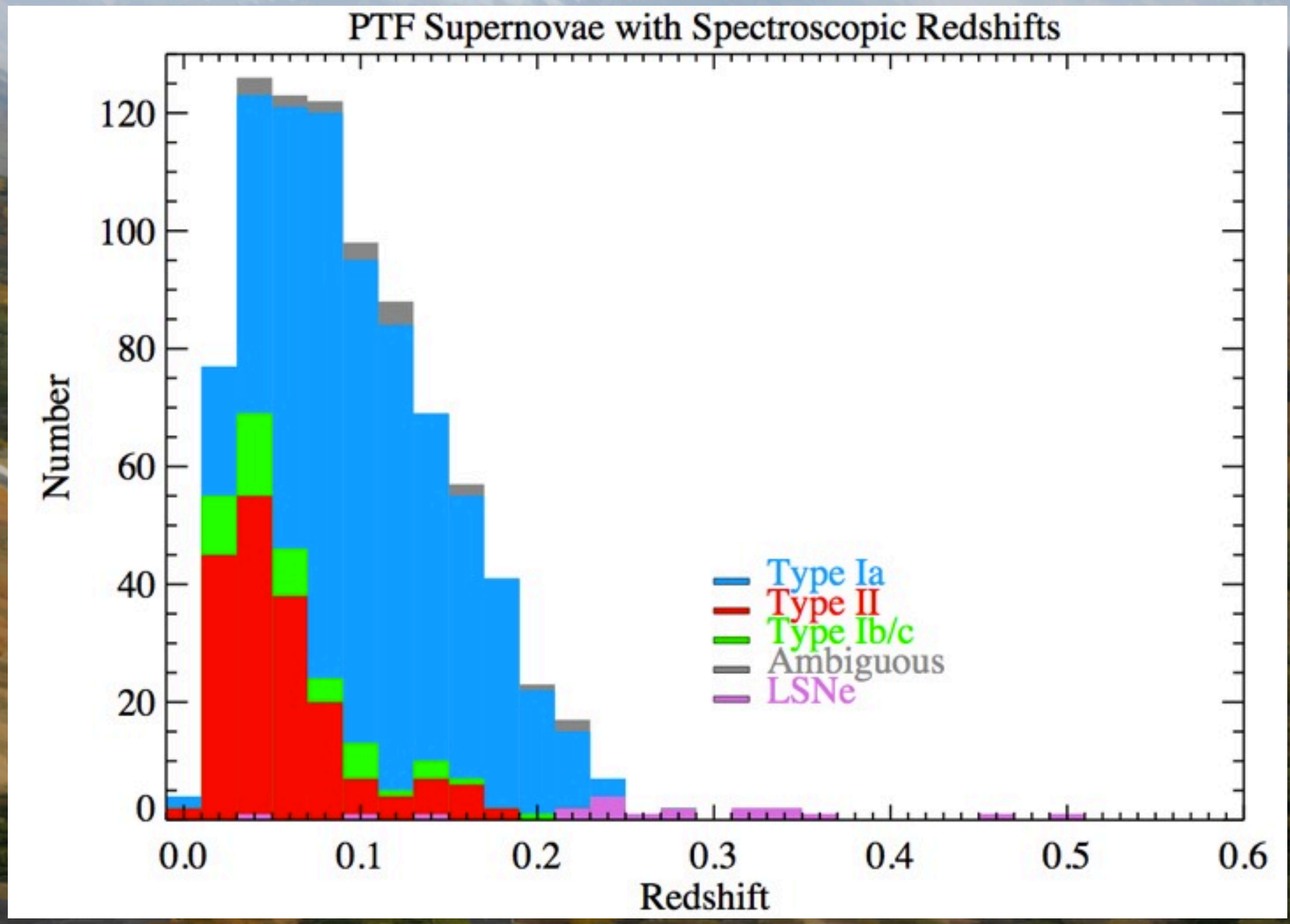
LIGO

- gravitational wave telescope
- PTF followed up one trigger covering about 10 fields
- Now offline for upgrade

Confirmed PTF Supernovae

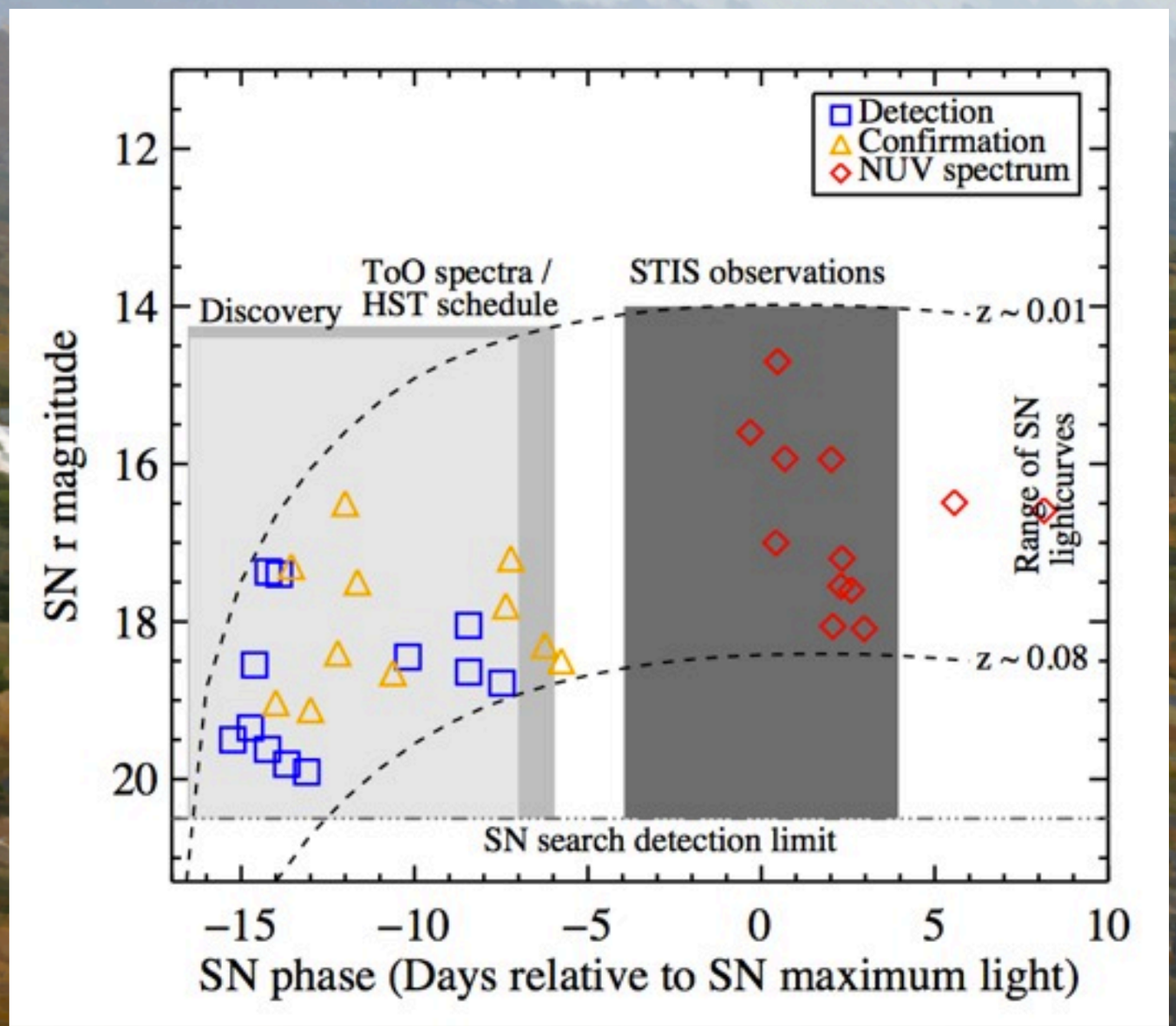
1000+ Spectroscopically Confirmed Objects

- 600 SN Ia
- 200 SN II
- 50 SN Ib/c

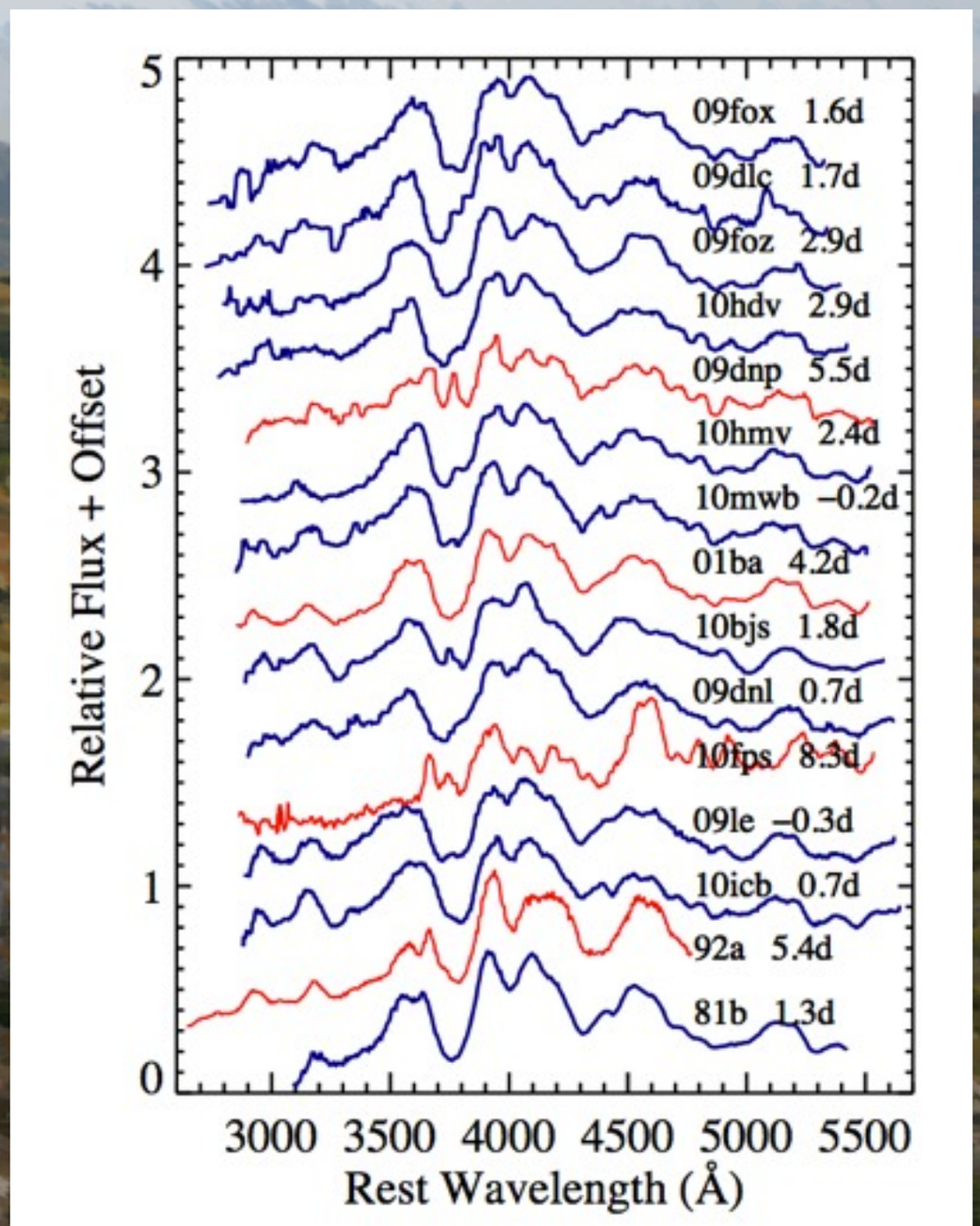


Robert Quimby

HST UV Spectroscopy of SN Ia

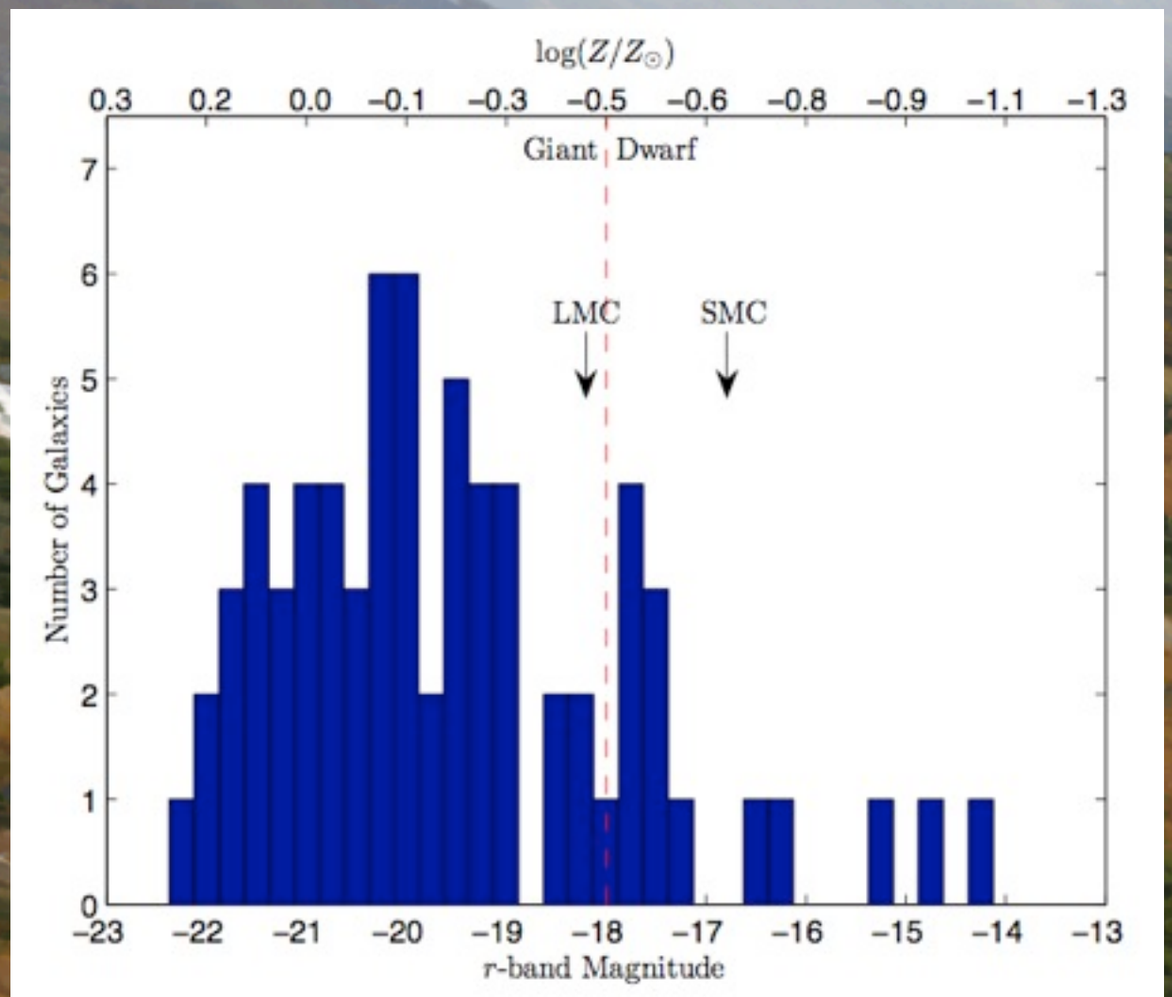


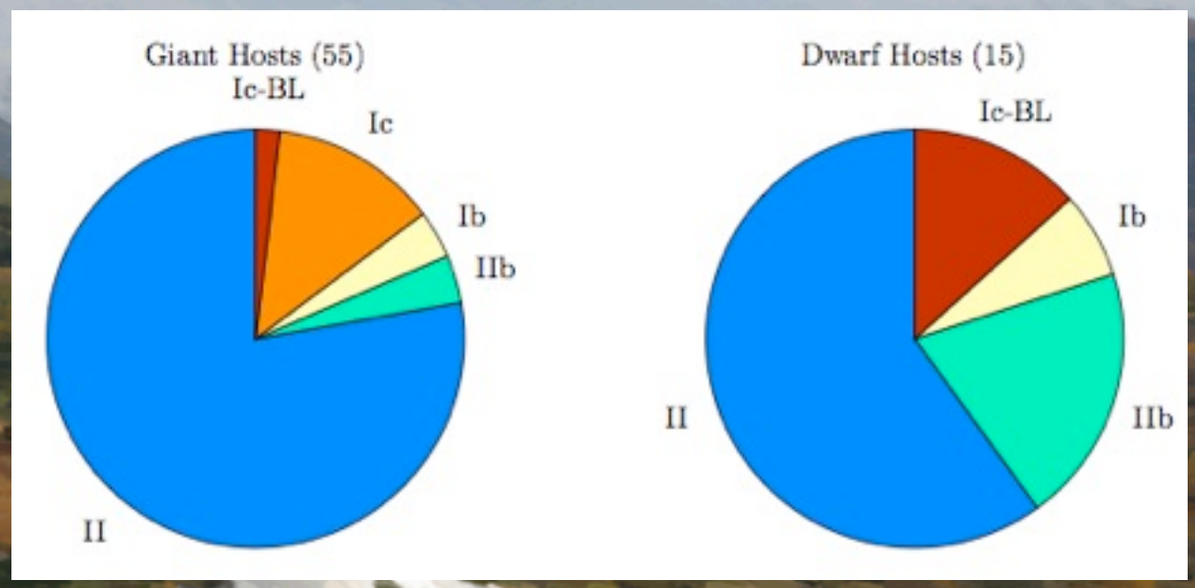
Cooke et al. 2010



Host Galaxies of PTF SNe

(Core-Collapse Supernovae)



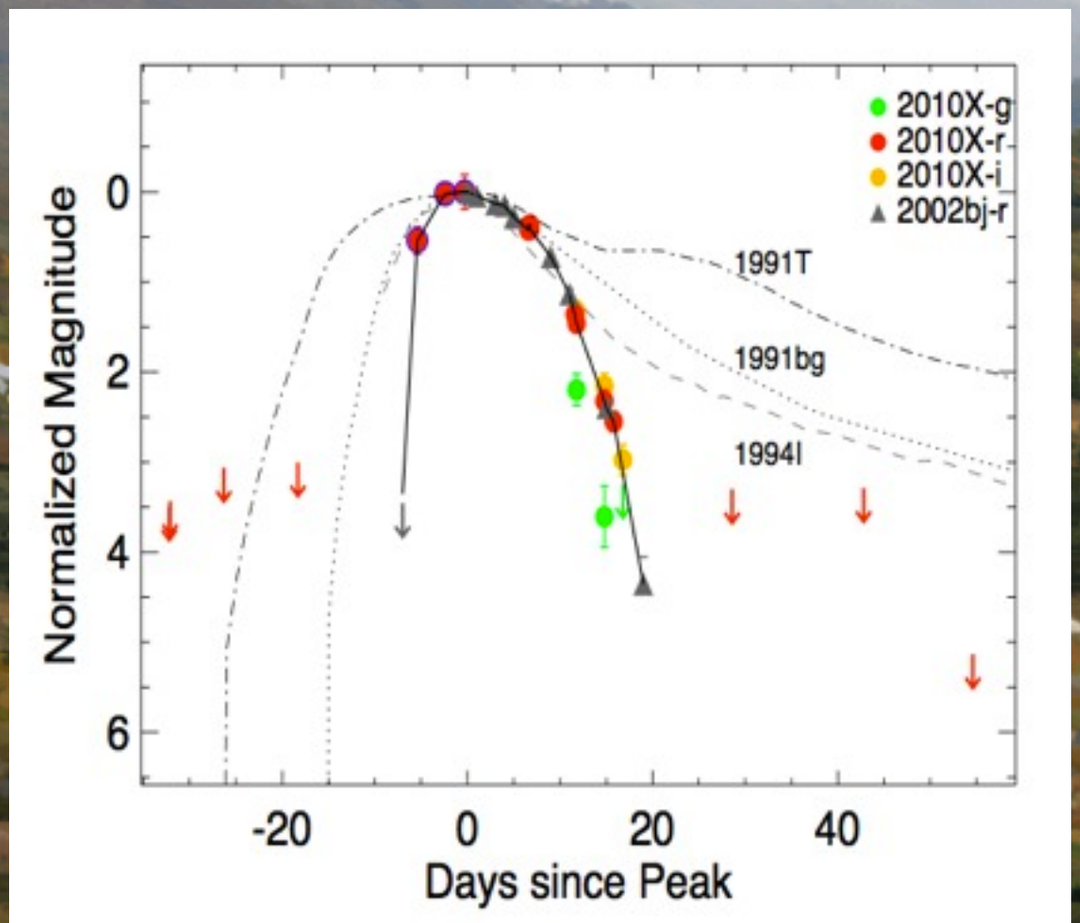


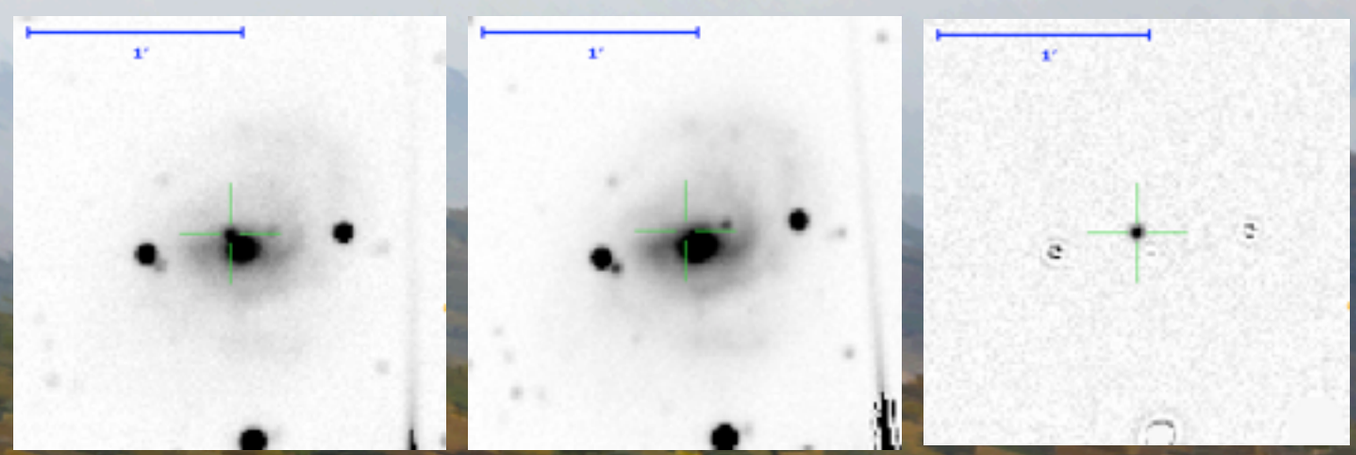
SN Type	Giant Host	Dwarf Host
II	42	9
IIb	2	3
Ib	2	1
Ic	7	0
Ic-BL	1	2
Galaxies	55	15

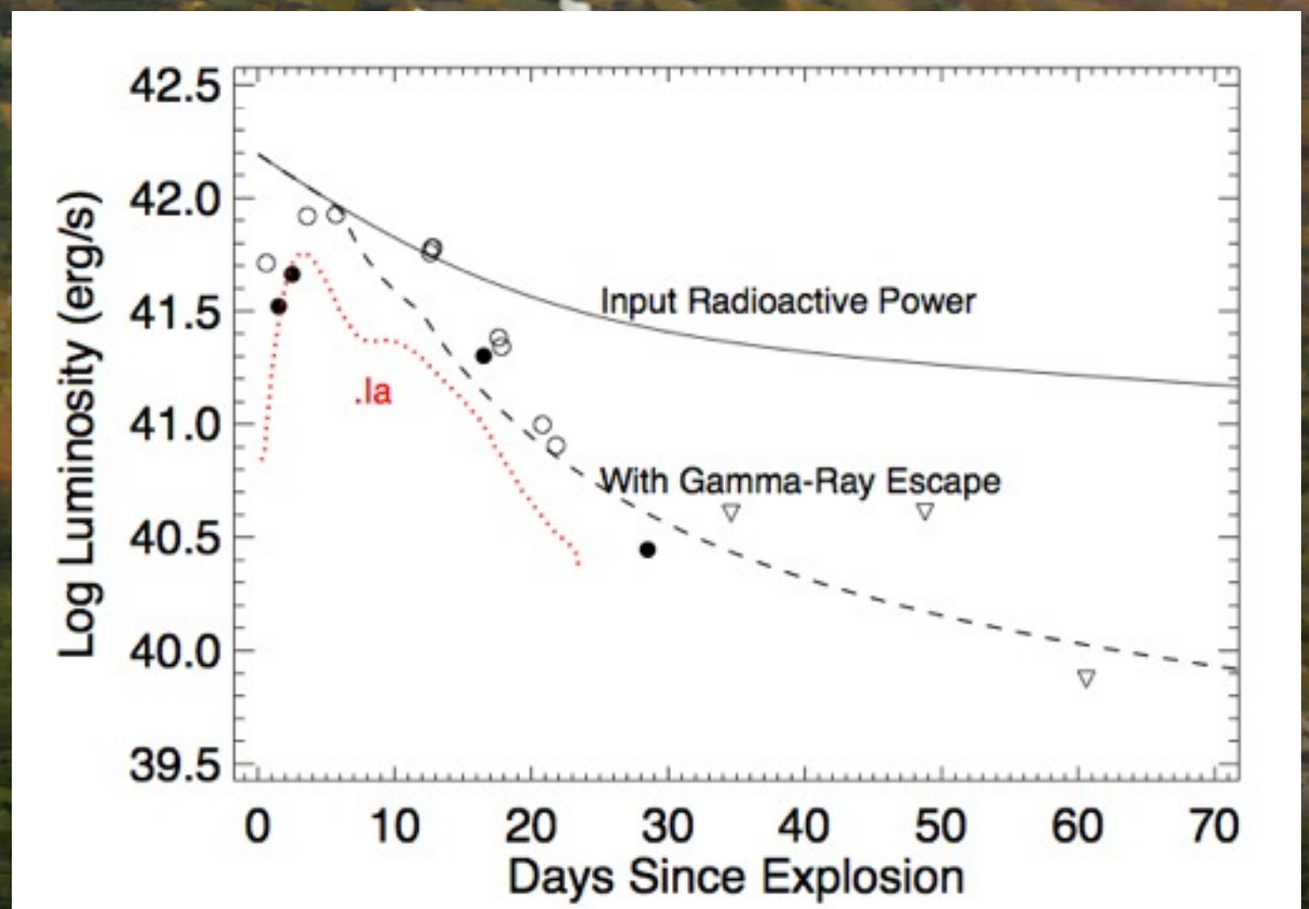
Arcavi et al. 2010

Faint and Fast: PTF10bhp

Possible .Ia?



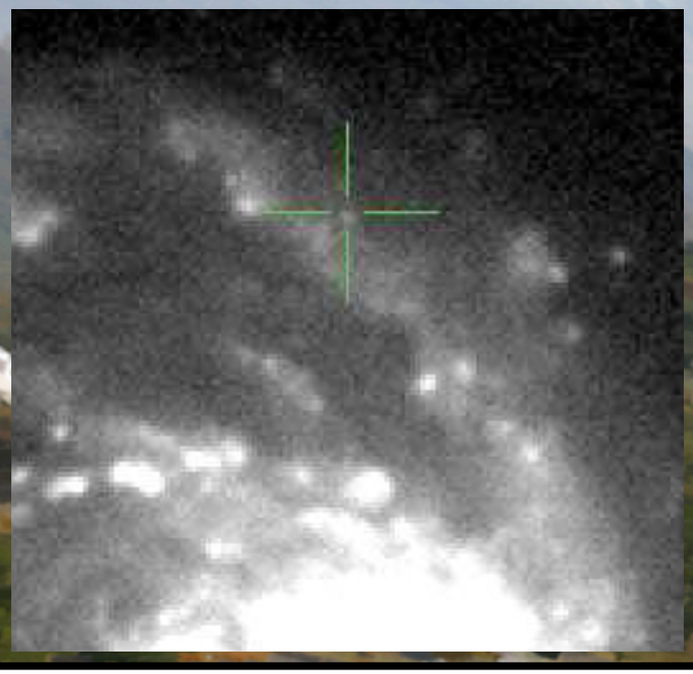


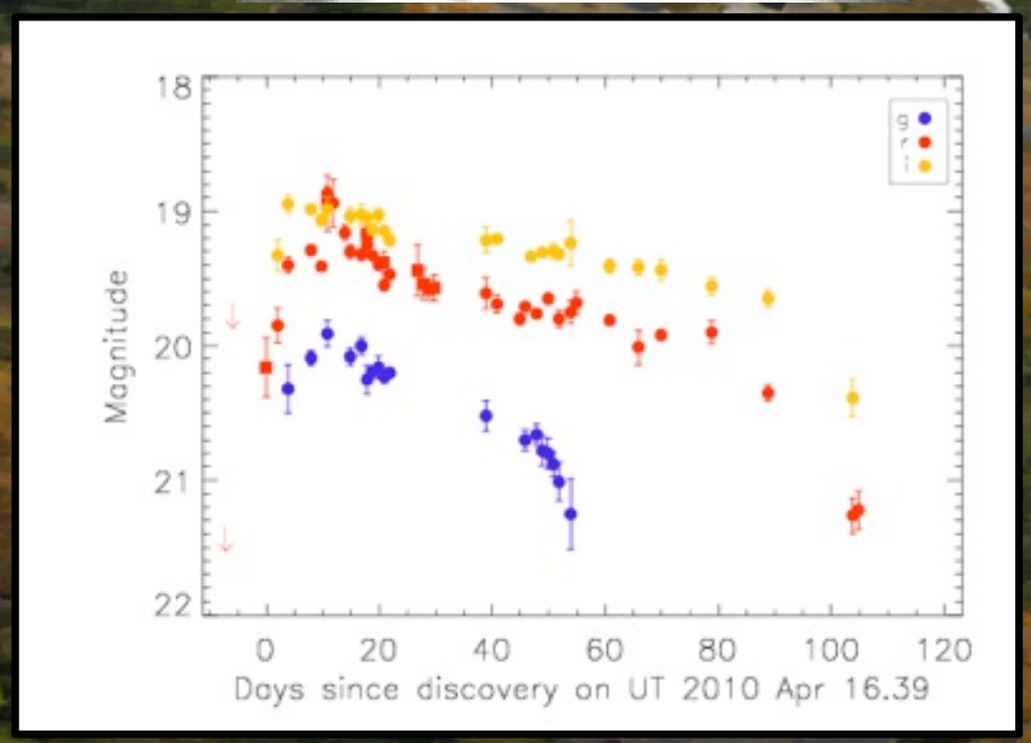


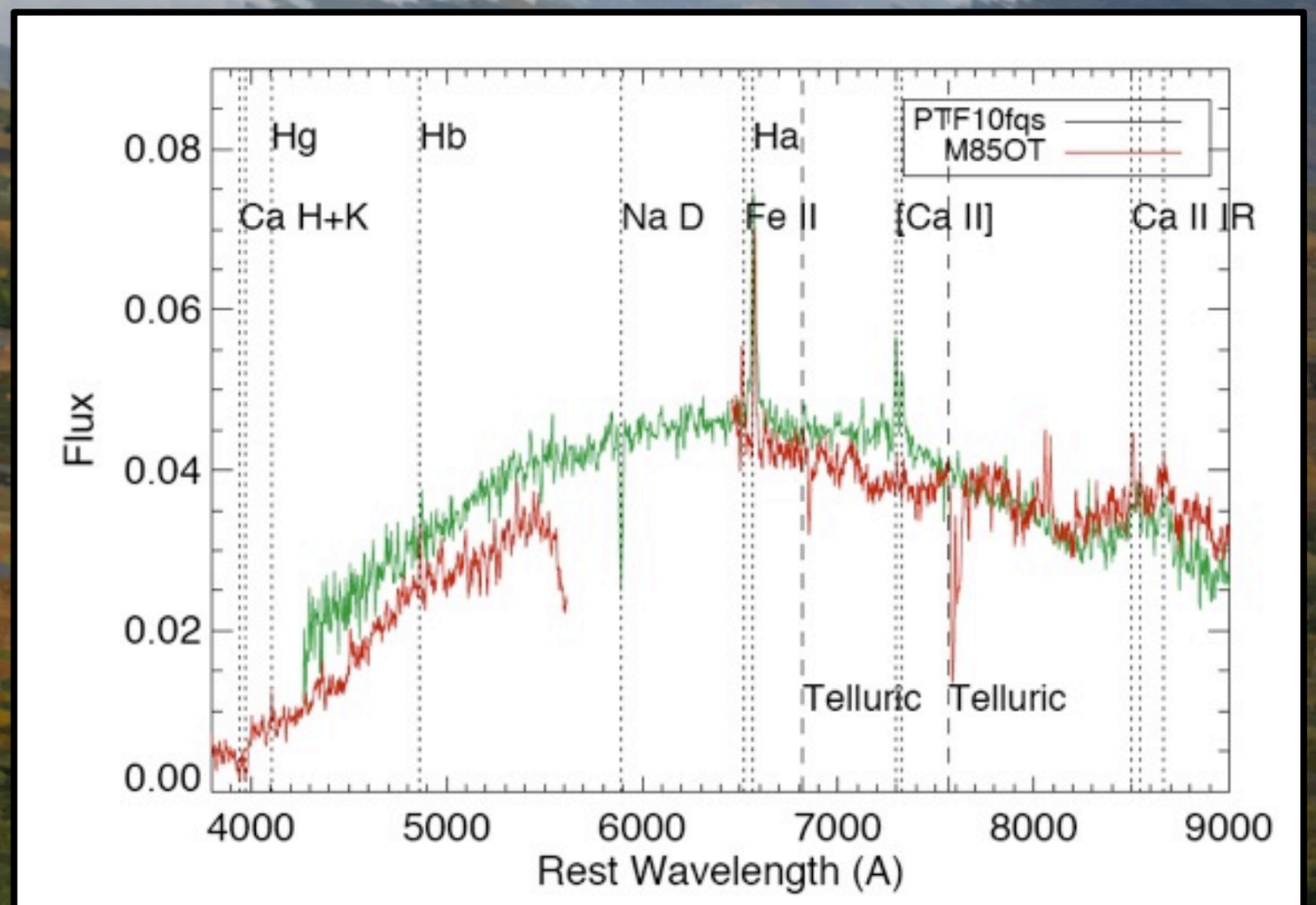
Kasliwal et al. 2010

Faint and Slow: PTF10fqs

Possible electron capture supernova?

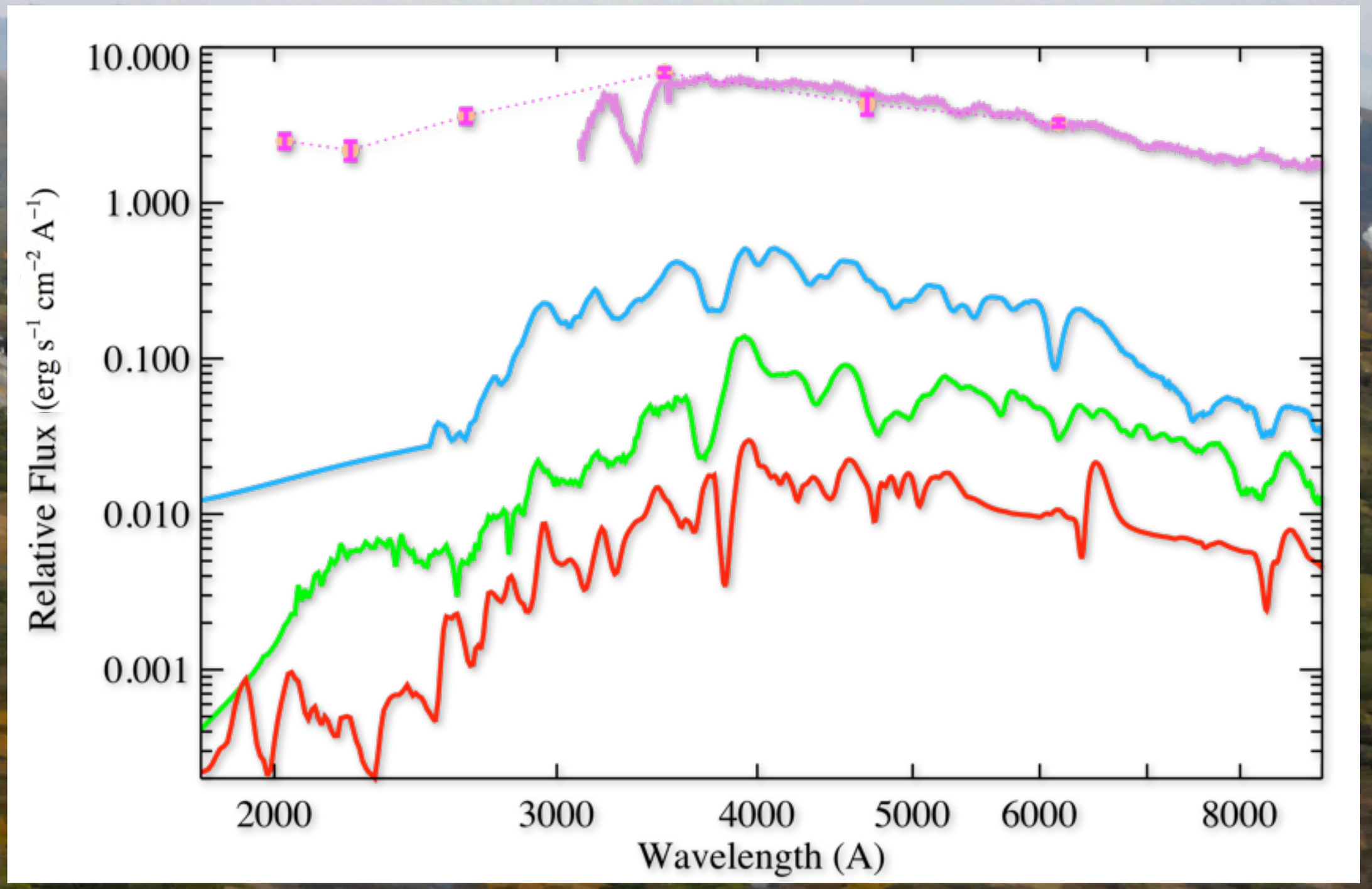






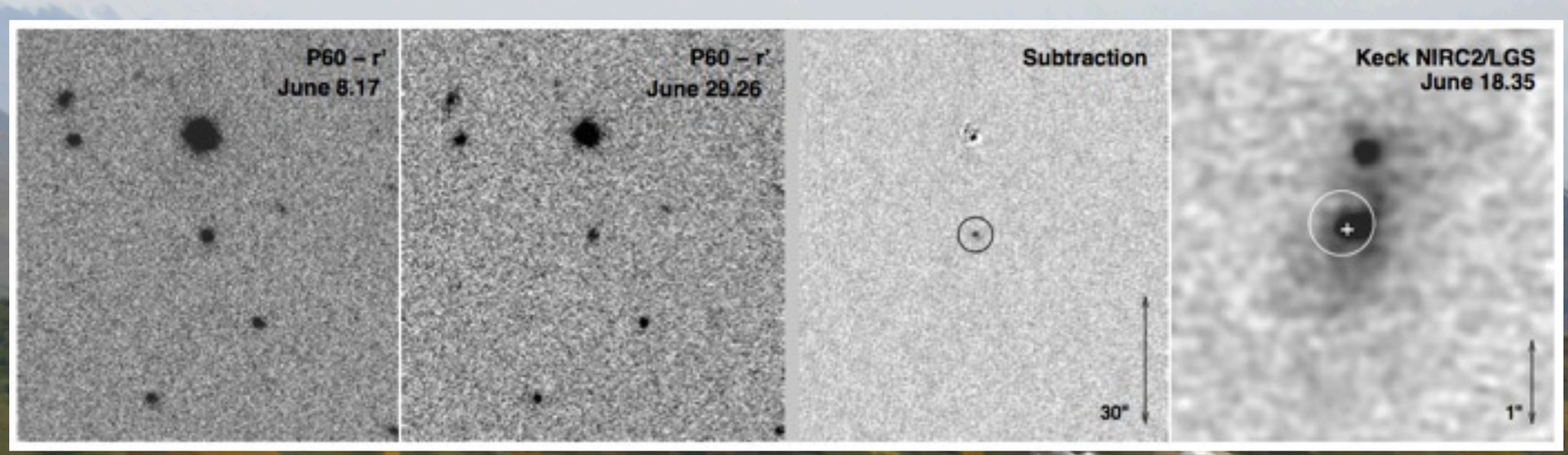
Kasliwal et al. 2010b

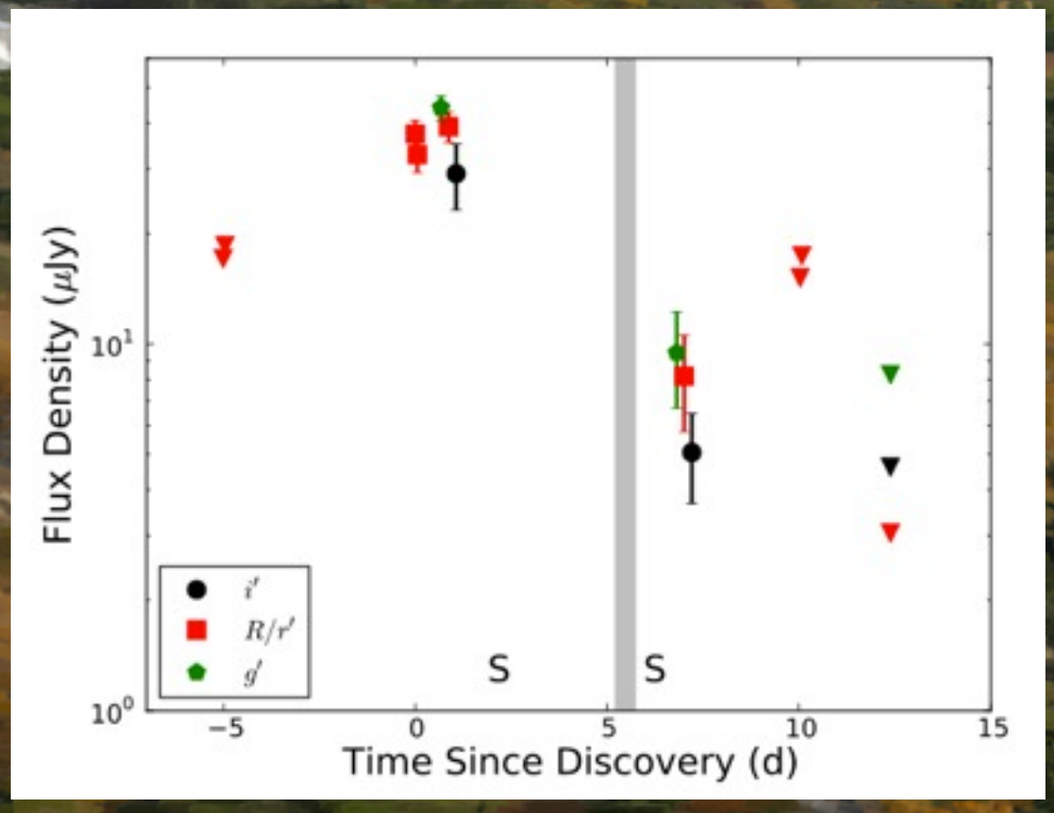
Luminous Supernova Spectra Compared to Normal SNe

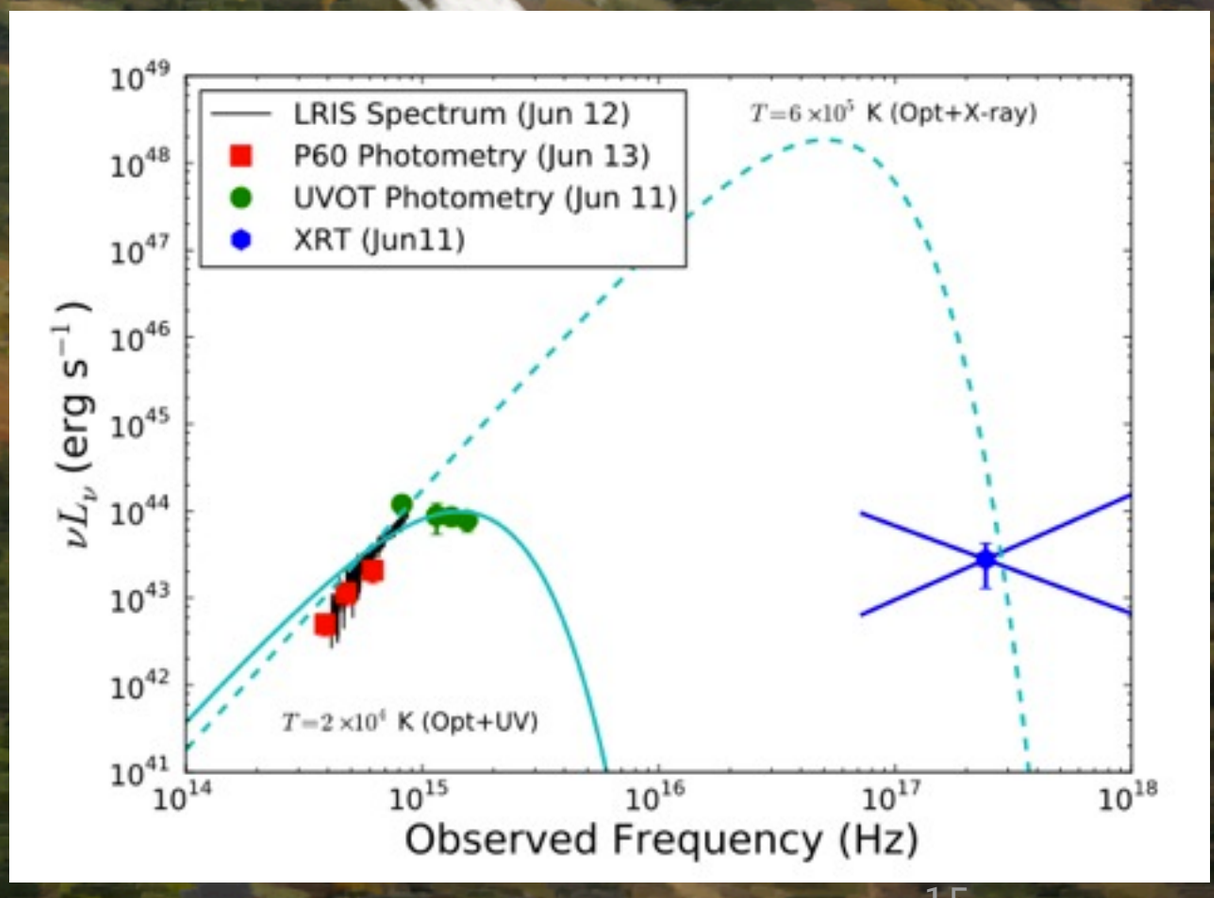


PTF10iya: Short Lived, Luminous Flare near a Galaxy Core

Tidal Disruption?



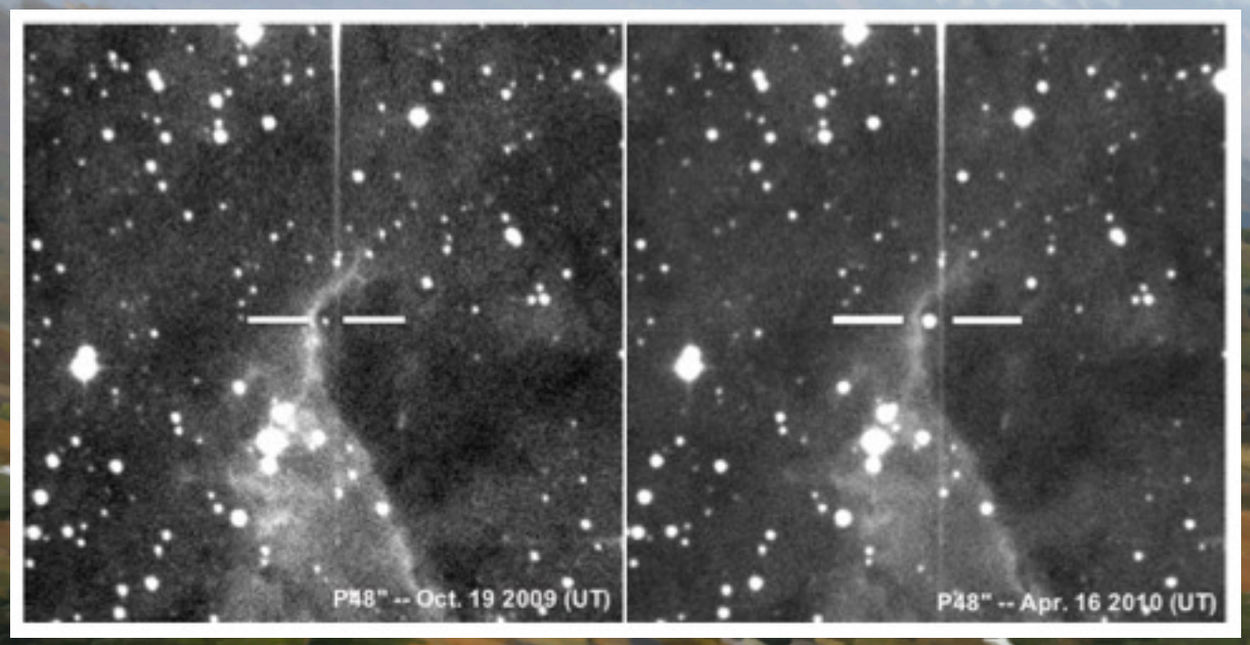


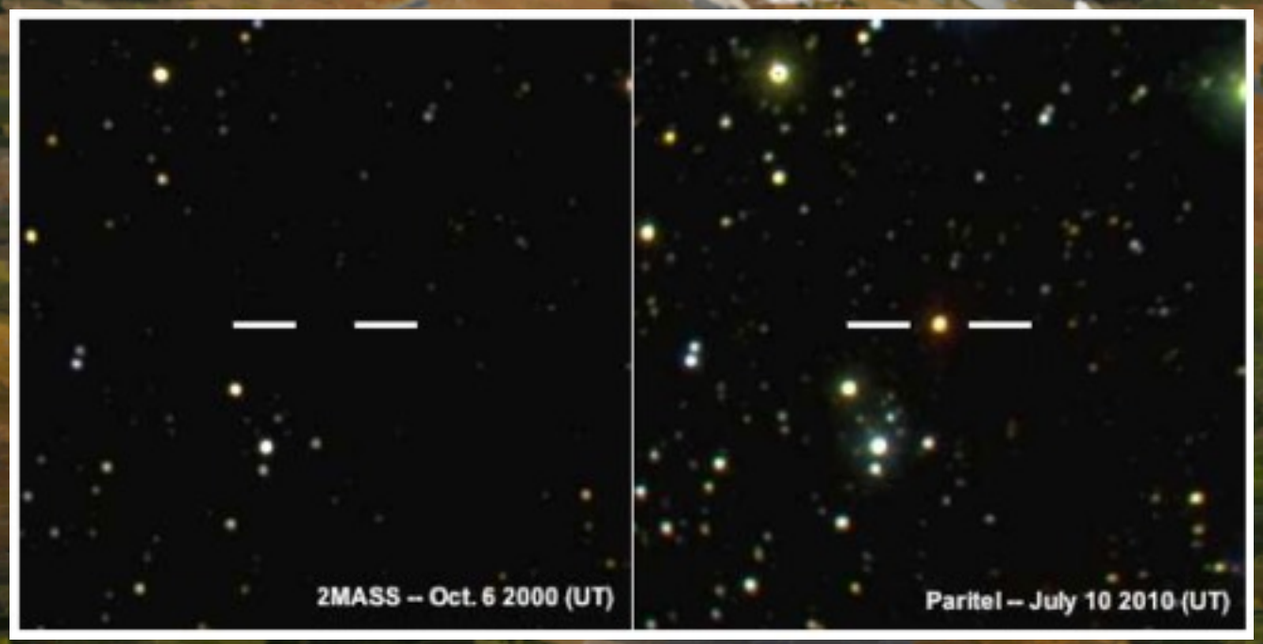


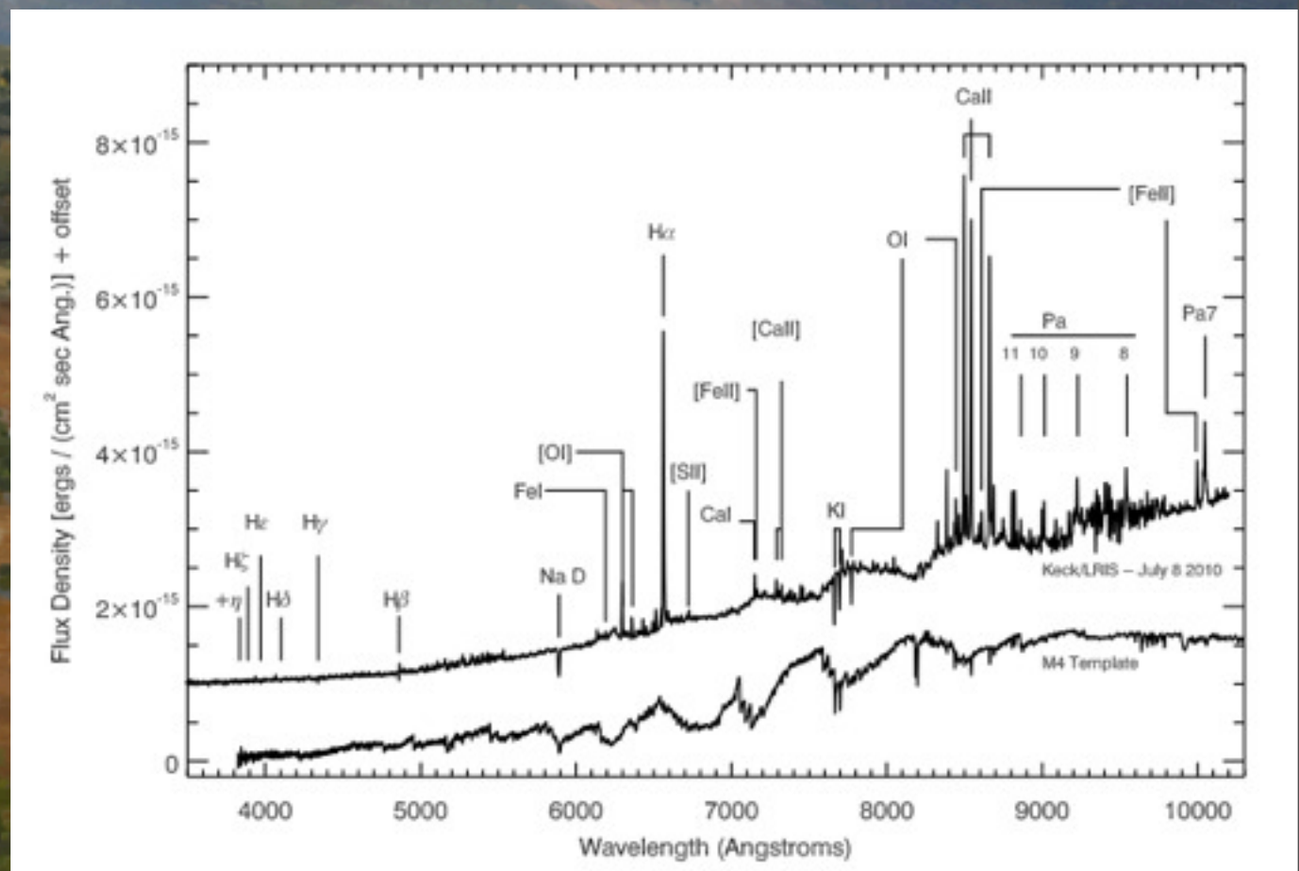
Cenko et al. 2010

Galactic Variable Stars:
PTF10nvg

Mass accretion onto a proto-star

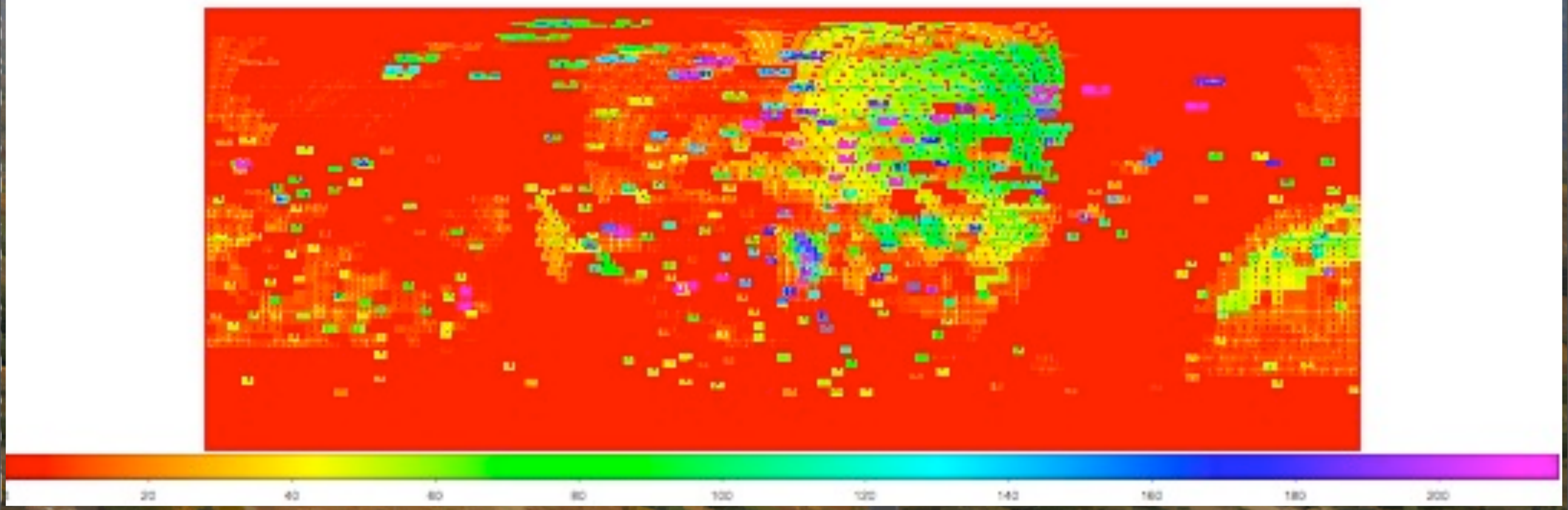






Covey et al. 2010

PTF Sky Coverage



- Stellar projects now ramping up

Would You Like to Know More?

http://www.astro.caltech.edu/ptf/

PTF Mini-Workshop

- Friday, December 3 (tomorrow)
- Location: IPMU (Kashiwa Campus)
- Time: 13:00 to 17:00