New Unusual Transients in the Gap

and how to find them

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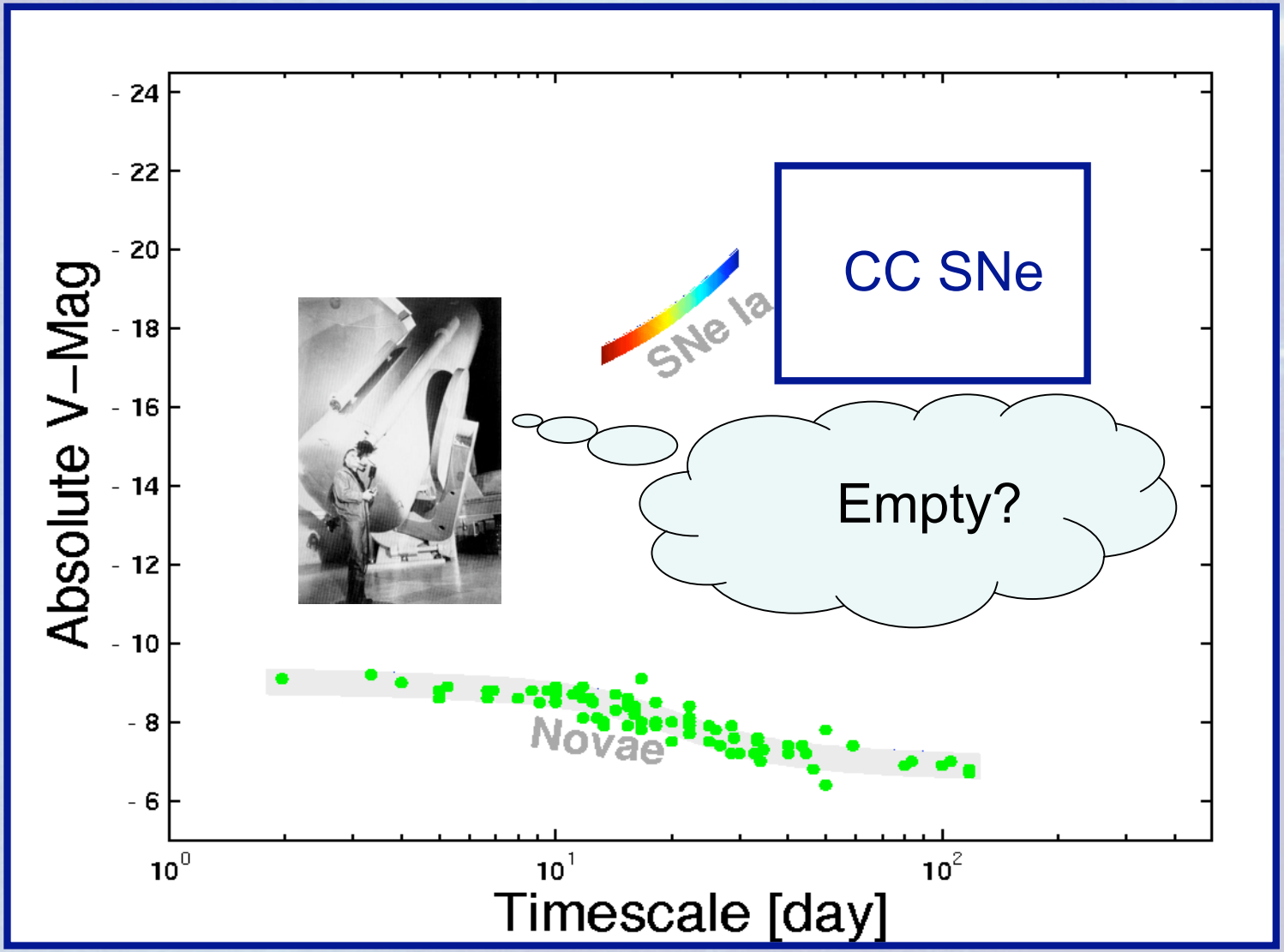
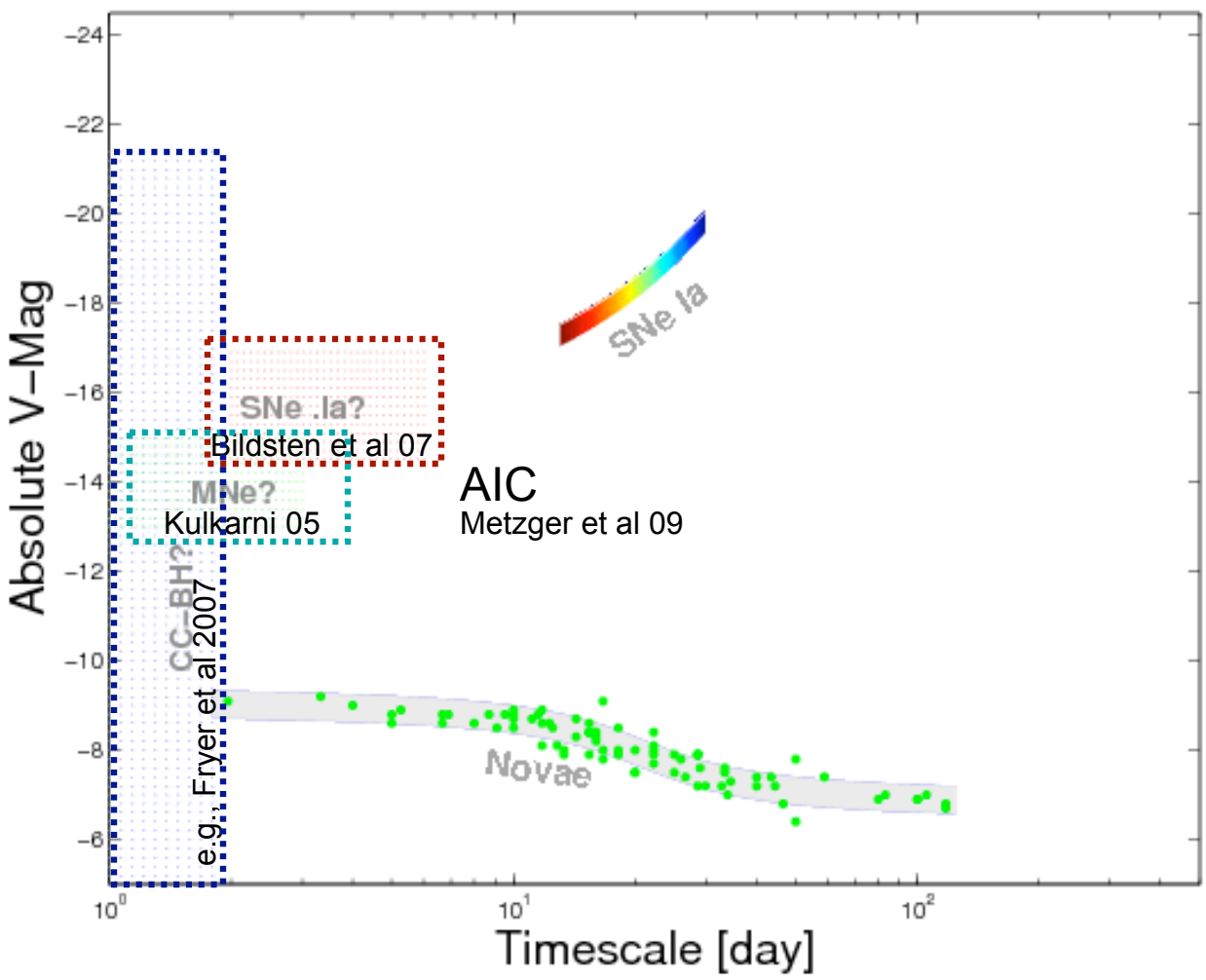
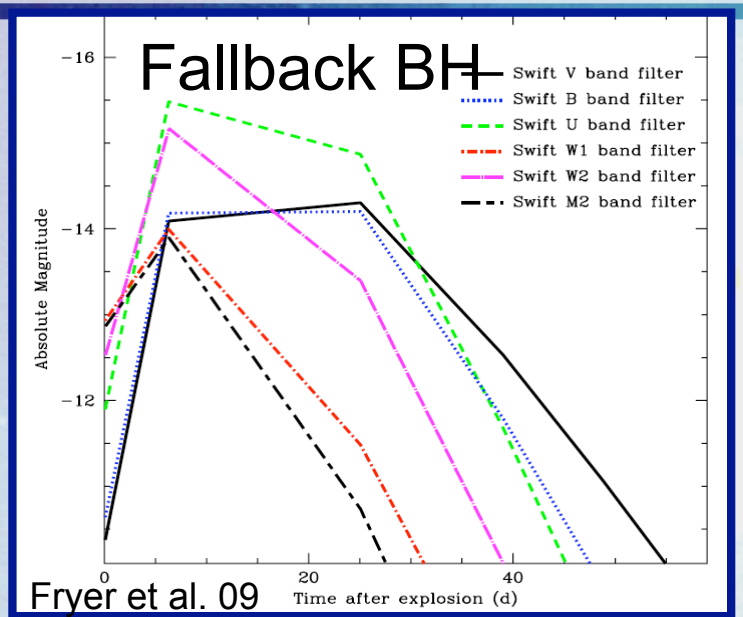
The Gap Between Novae and Supernovae

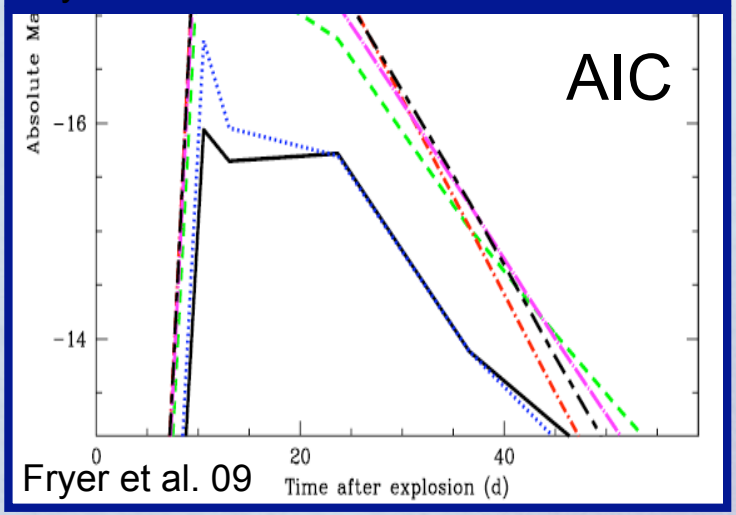


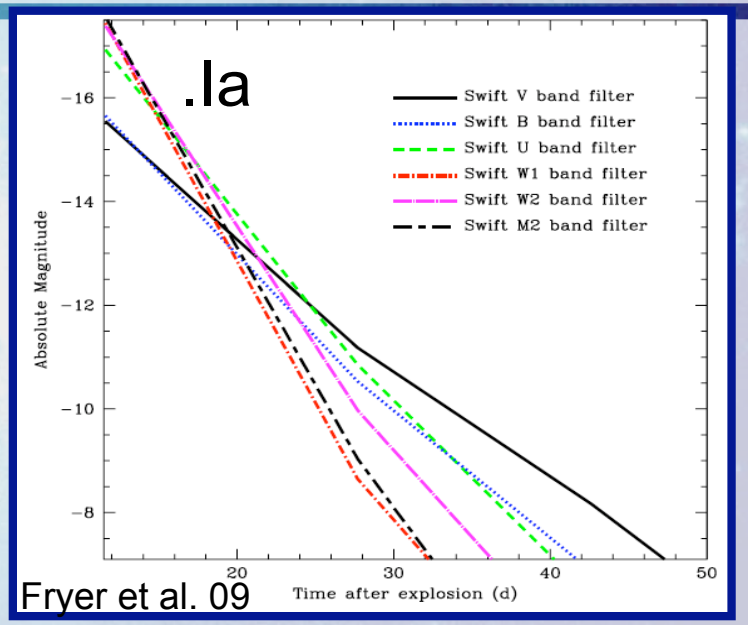
Theoretical Impetus

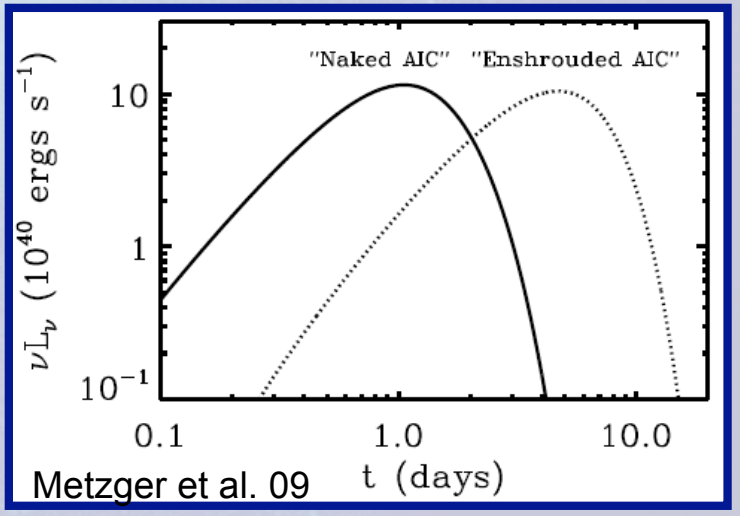


Predicted Light Curves

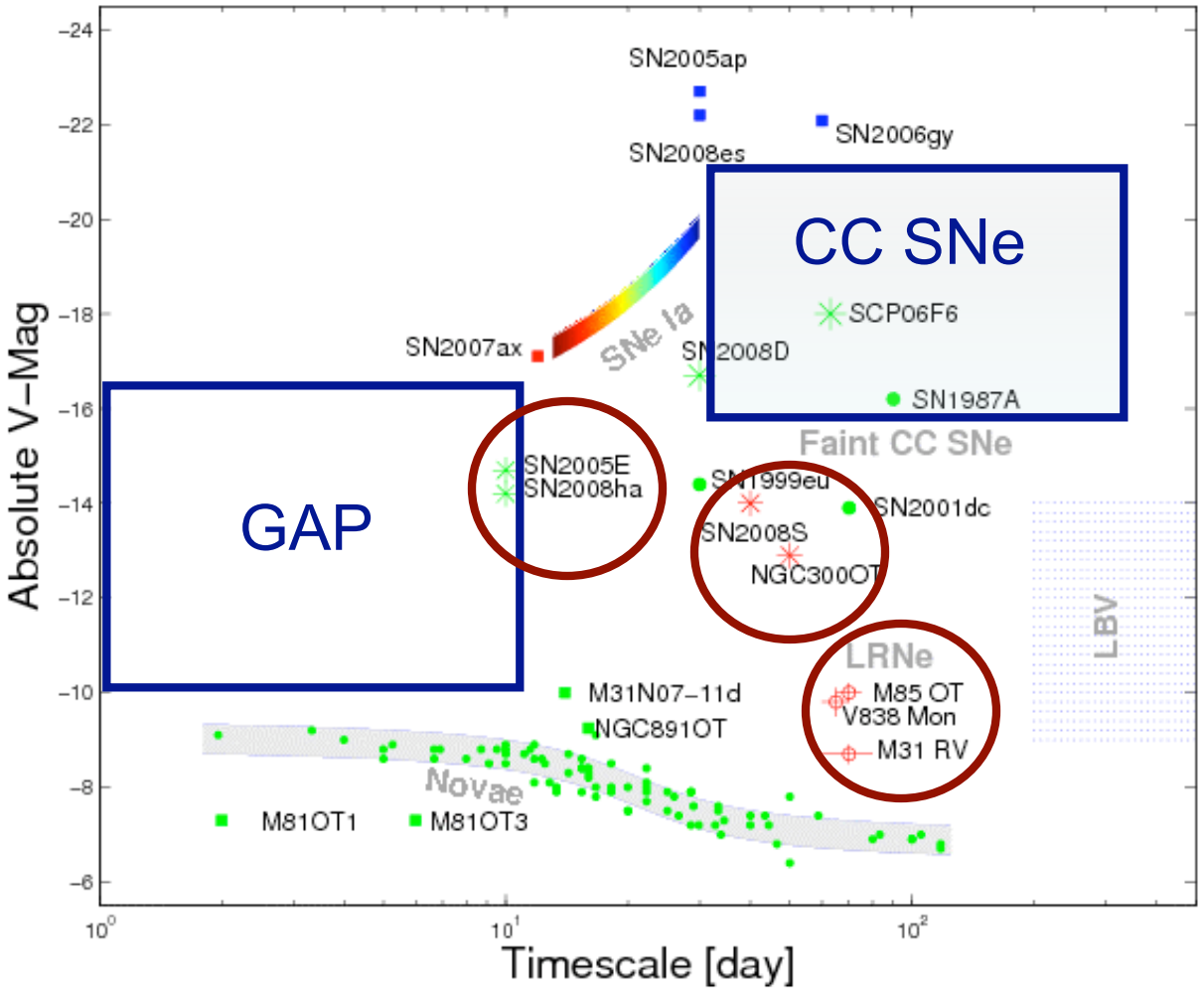




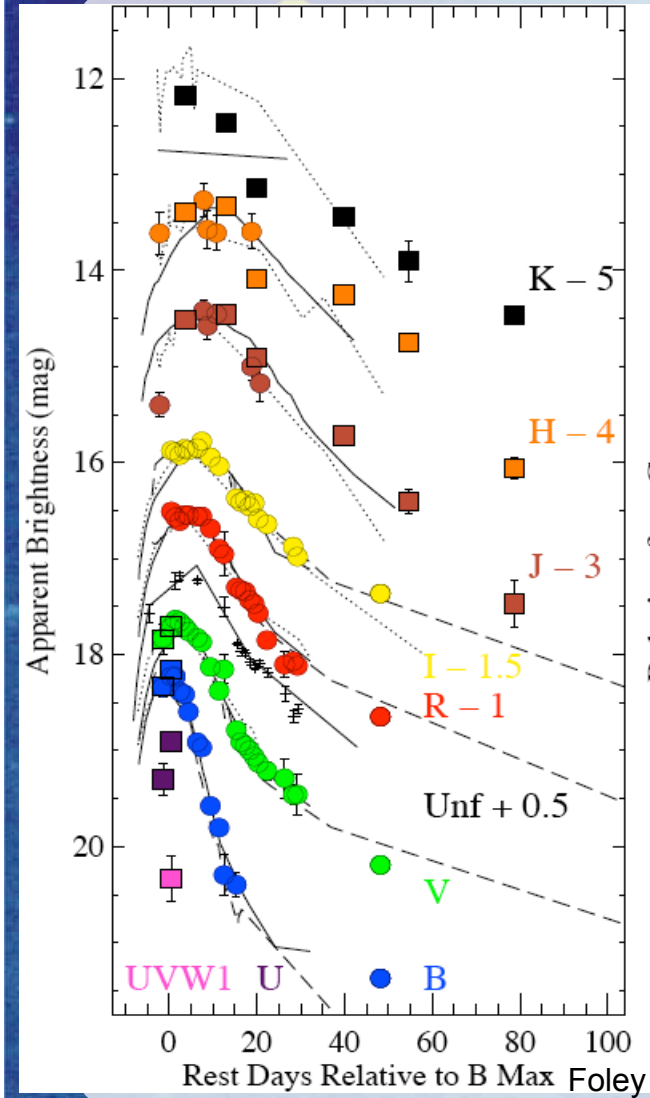




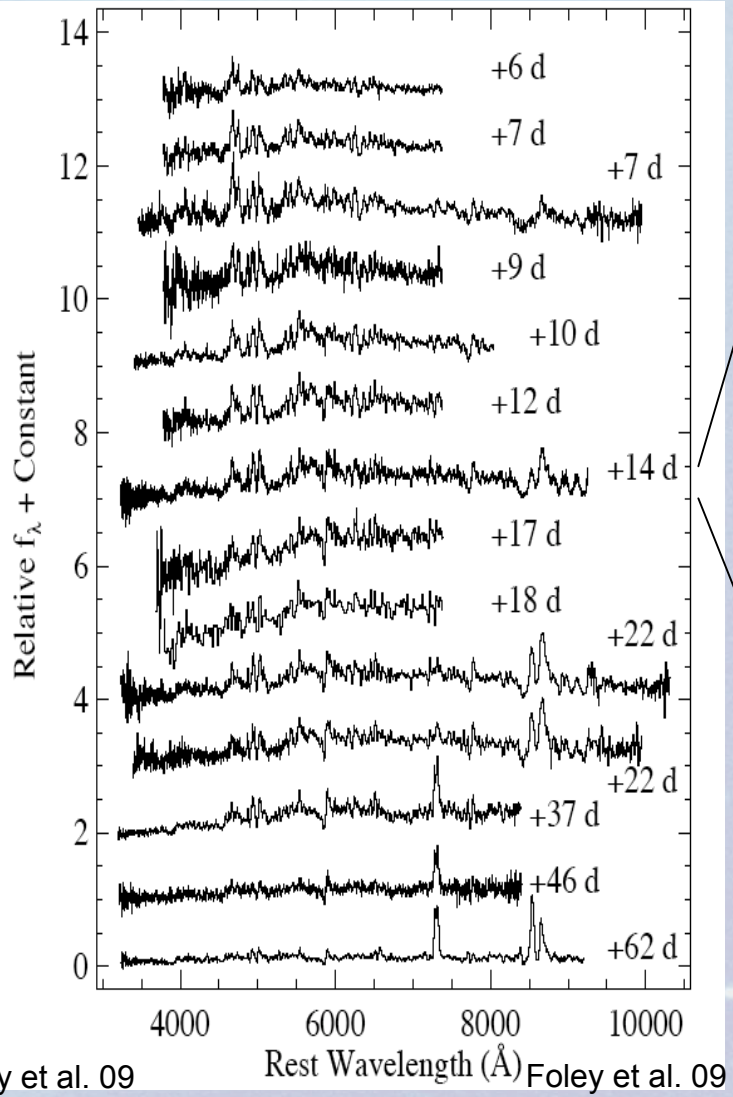
Intriguing Serendipitous Discoveries



Mystery I. 2008ha



Foley et al. 09



Foley et al. 09

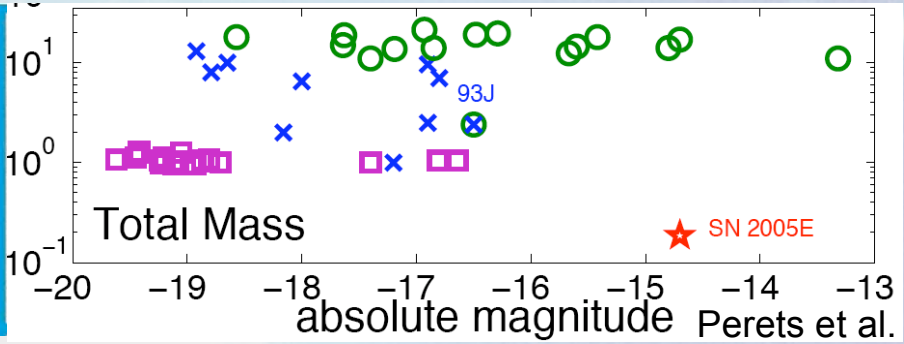
Massive Star?

- Extremely stripped
- Fallback BH

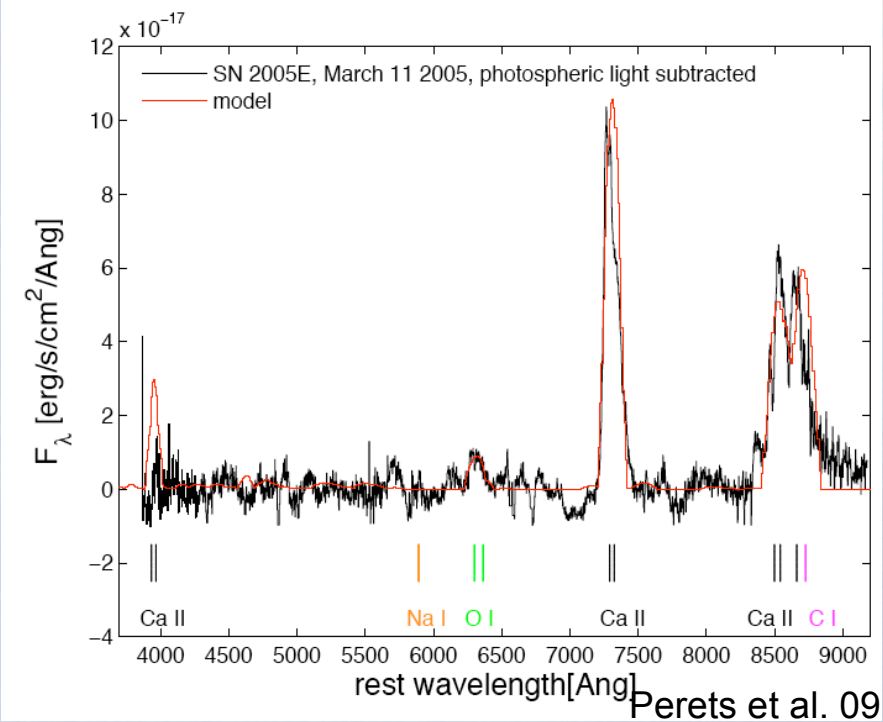
White Dwarf?

- AIC,e-capture
- Deflagration
- Inefficient .Ia

Mystery II. 2005E



Perets et al. 09



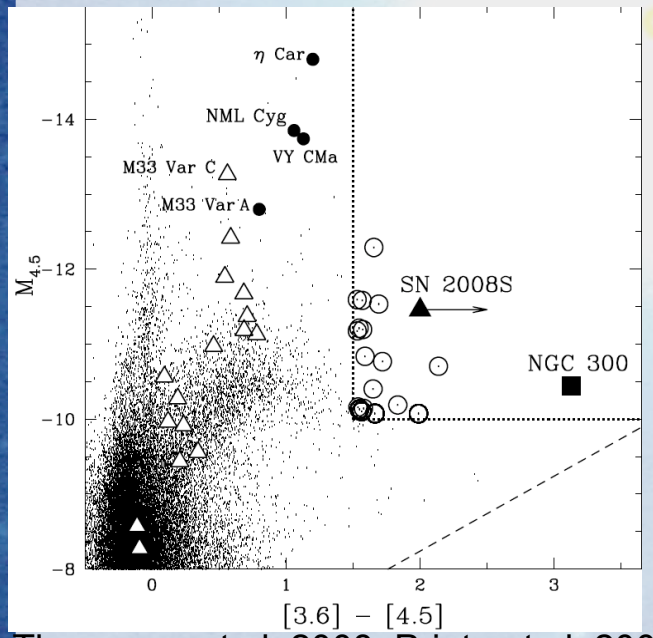
Perets et al. 09

- *Halo Location : Not a Massive Star*
- *Fast Photometric Evolution*
- *Faint Luminosity*
- *Too Little Ejecta*
- *AIC or SN .Ia*

Mystery III. 2008S/NGC300-OT

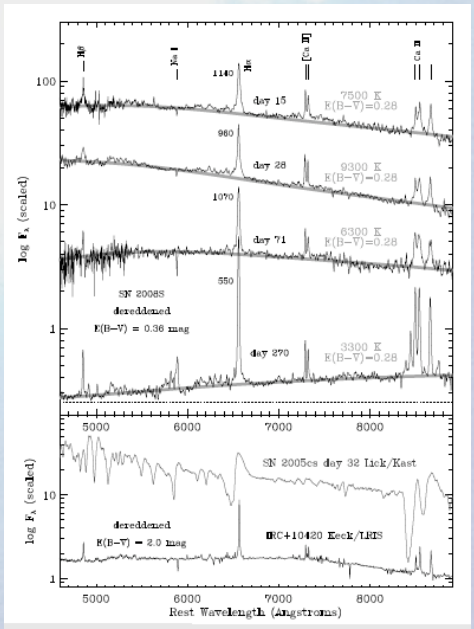
What type of star exploded !?

8-11 $M_\odot$ e- capture?



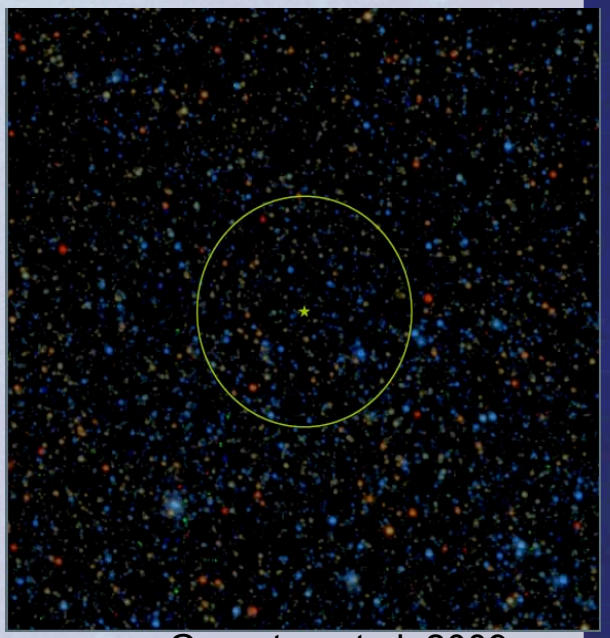
Thompson et al. 2008, Prieto et al. 2008

>20 $M_\odot$LBV



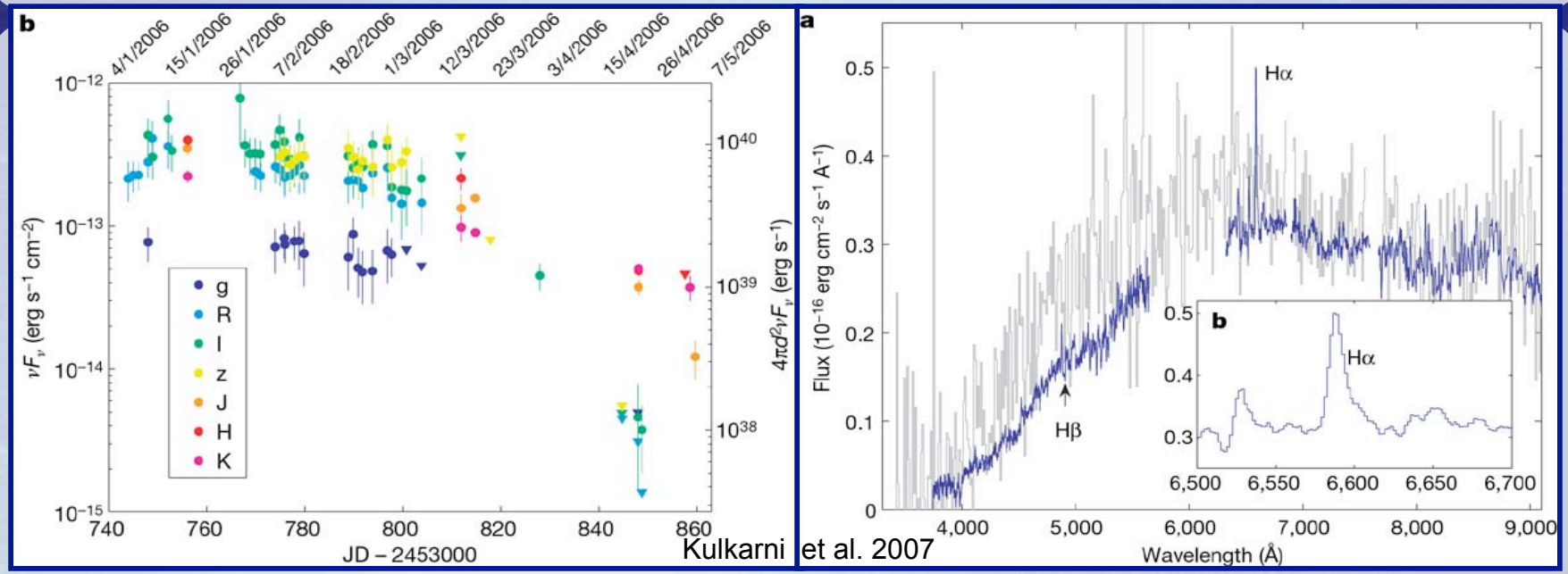
Smith et al. 2009

12-25 $M_\odot$ SN?



Gogarten et al. 2009

Mystery IV. M85OT/M31RV/V838Mon



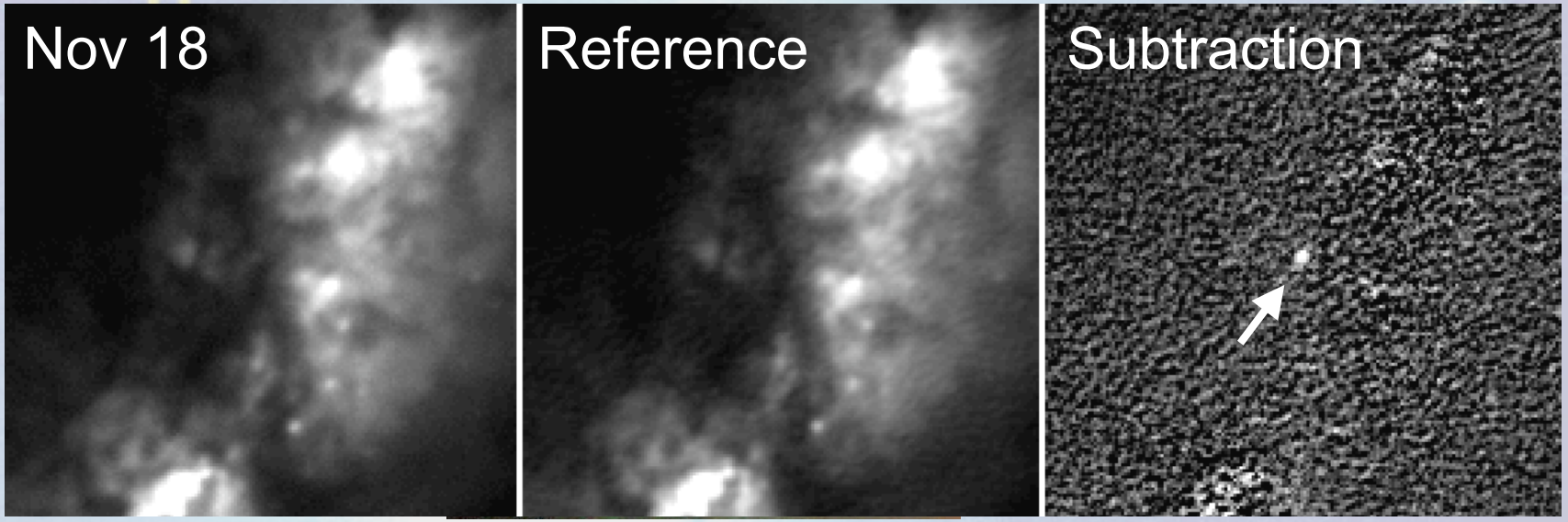
Kulkarni et al. 2007

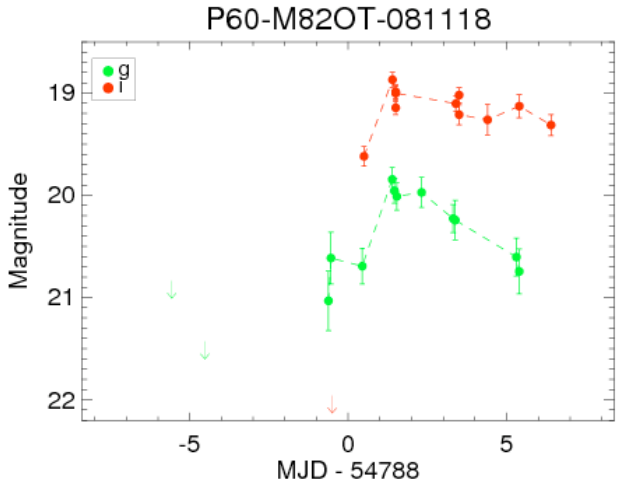
- M_R = -12! Extremely red (g-R = 2) and long plateau at 2 x 10^{40} ergs/s
- Late-time (180 days) excess in Spitzer mid-IR bands similar to V838Mon and M31RV ; Blackbody T_{eff} ~ 950K (Rau et al. 2006)
- FWHM Hα = 350 km/s, T_{eff} ~ 4700K
- Proposed Models:
  - Stellar Merger (Soker & Tylenda 2006, M_2/M_1 ~ 0.03..0.1, cool remnant)
  - Extreme Classical Nova (Shara, pers comm)
  - Extreme Type IIp supernova (Pastorello et al 2007)

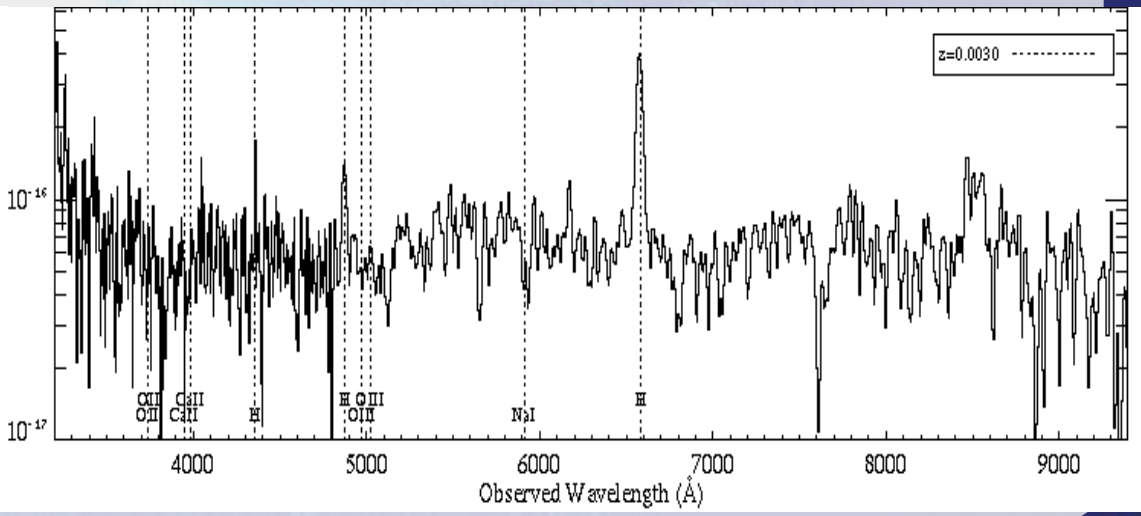
Systematic Search

- Design
  - *Fast* : Needs to be fast cadence
  - *Faint* : Needs to be deep
  - *Rare* : Needs to target nearby galaxies and galaxy clusters
- Execution
  - Needs real-time automated pipeline
  - Needs spectroscopic follow-up
  - Needs multi-wavelength follow-up

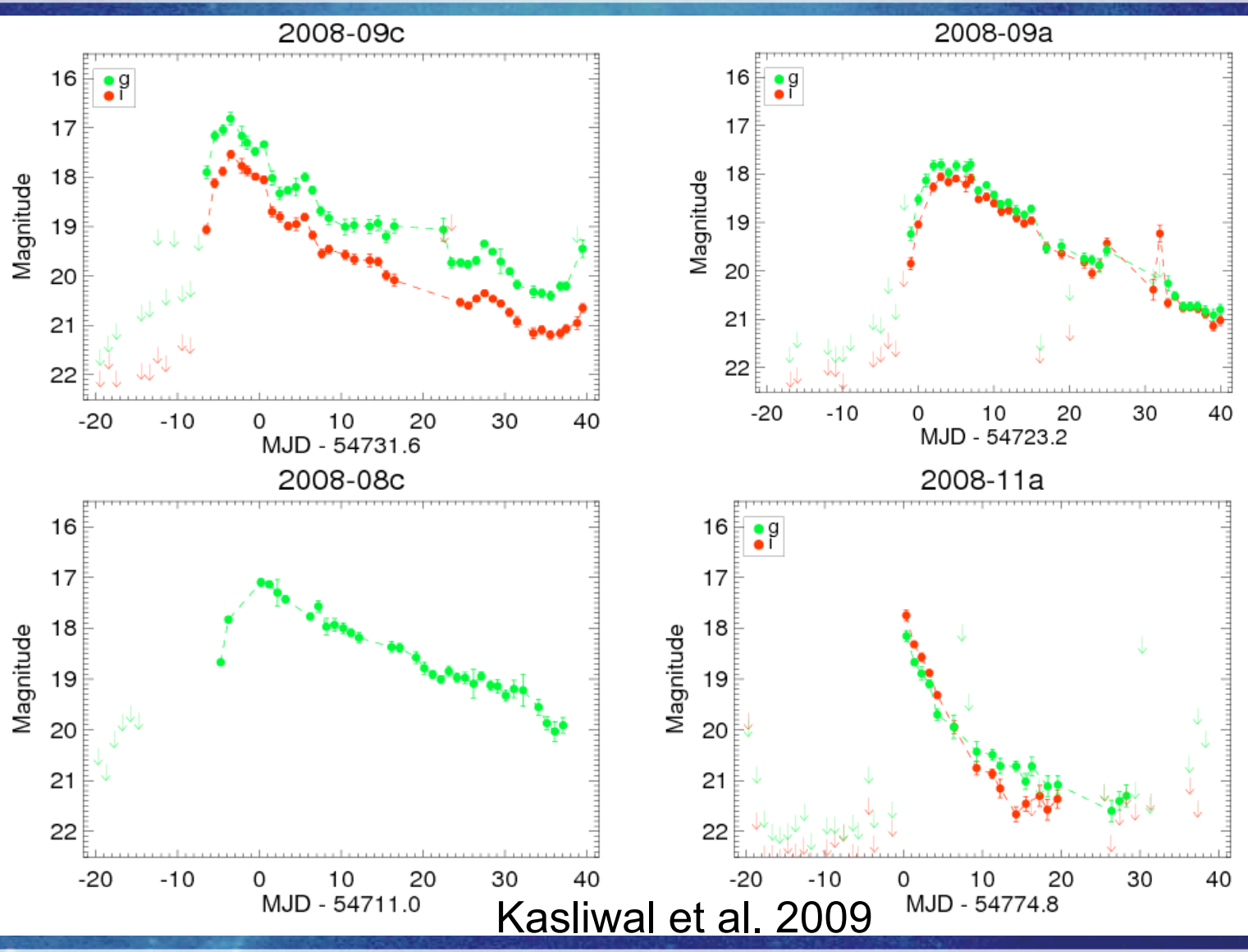
I. P60-FasTING



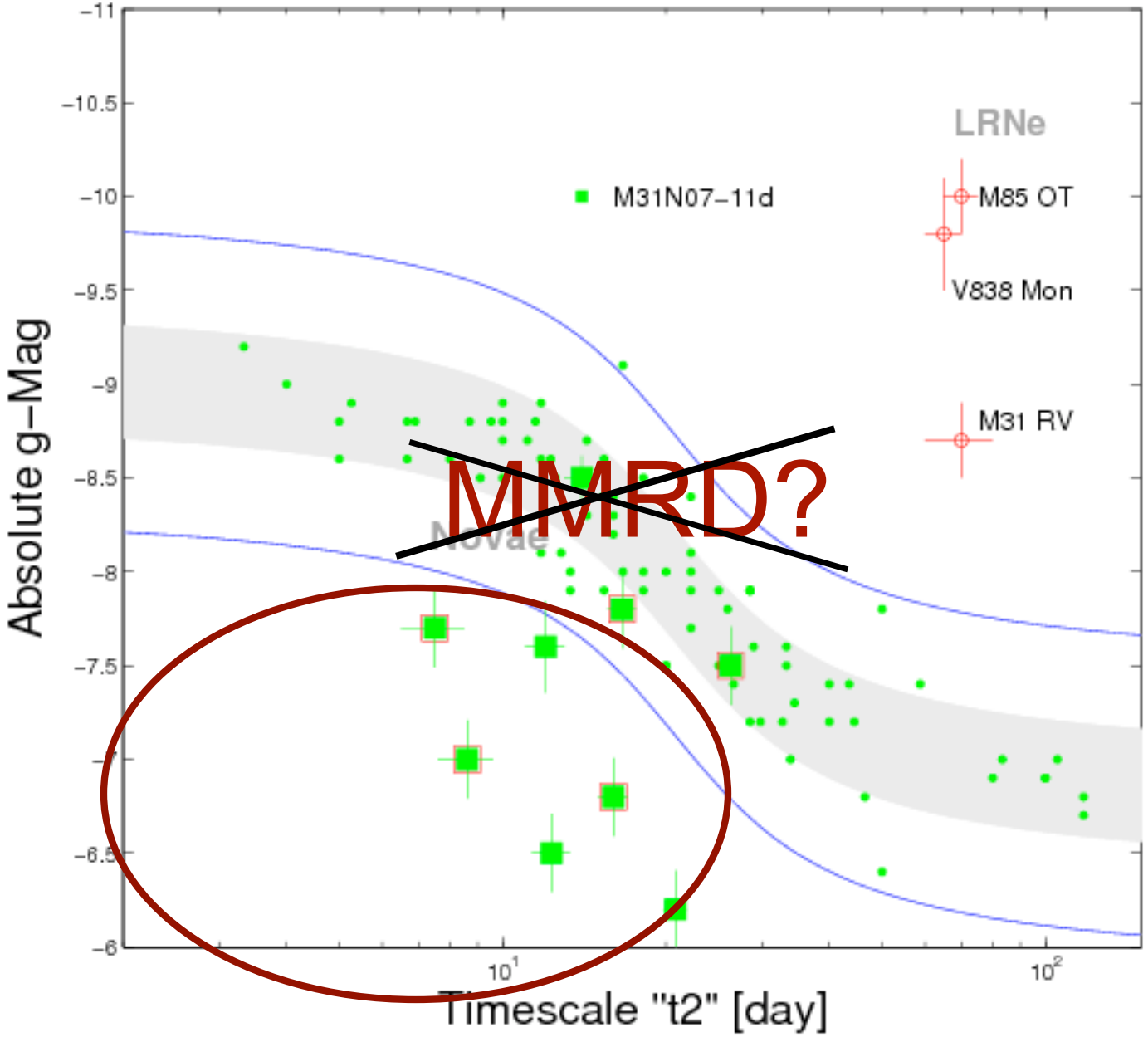




Faint and Fast Novae

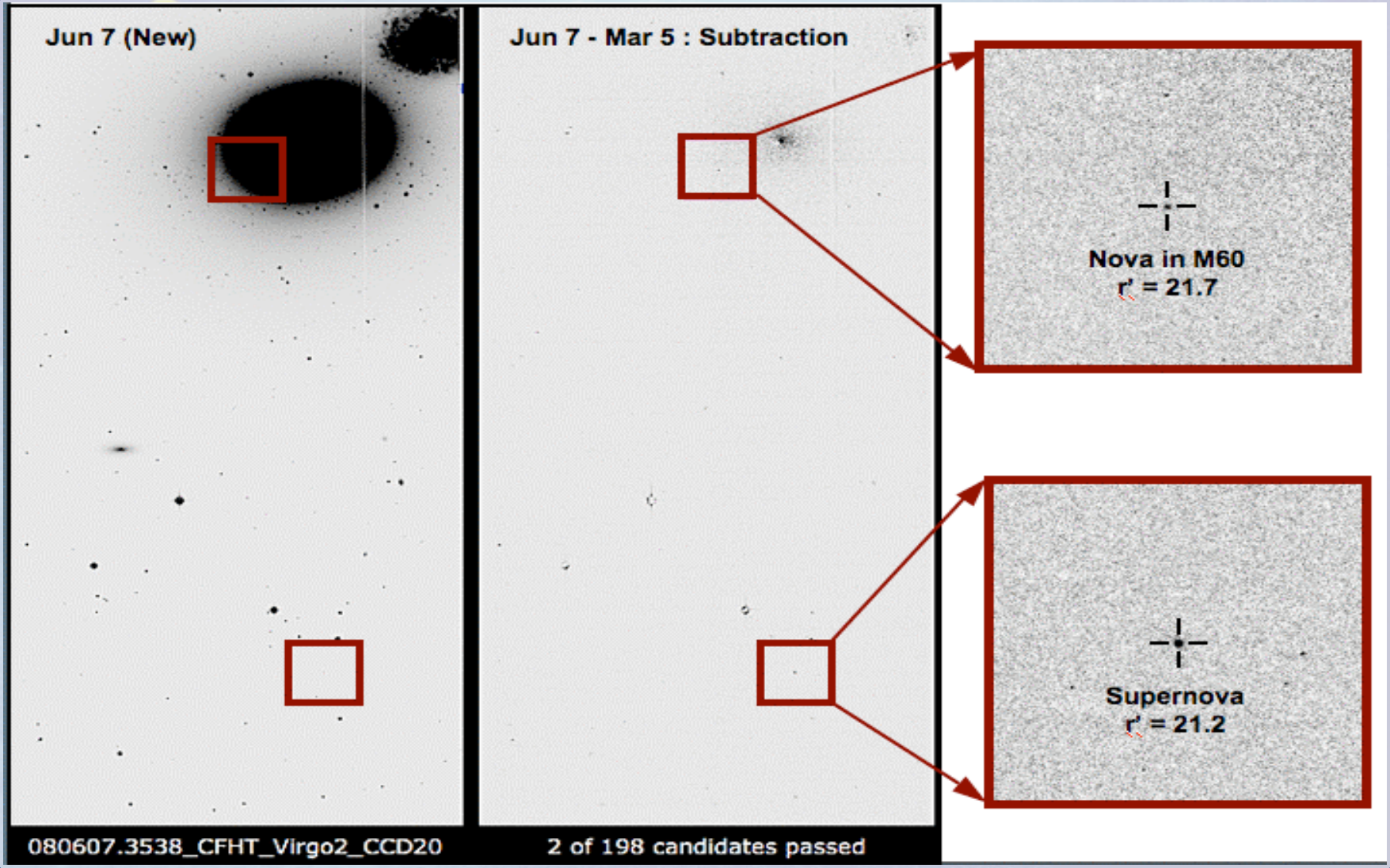


Kasliwal et al. 2009

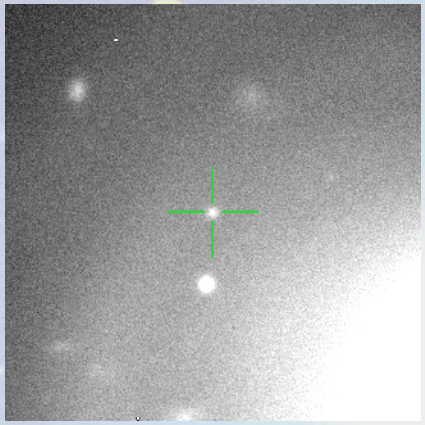


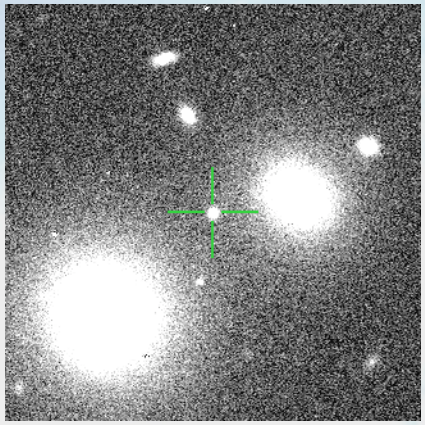
Kasliwal et al. 2009

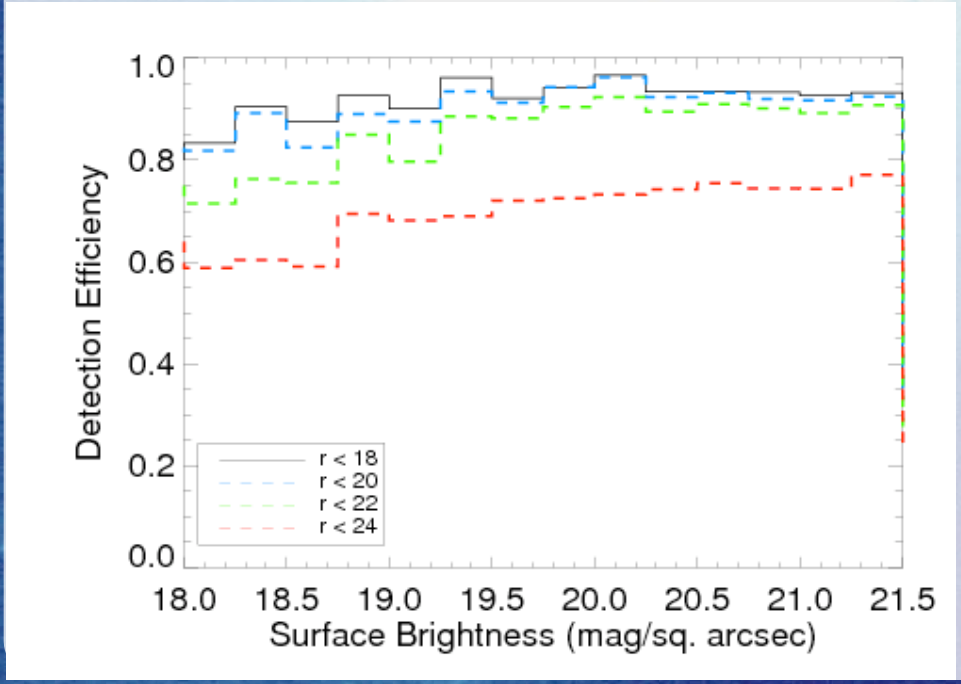
II. CFHT-COVET



CFHT-COVET

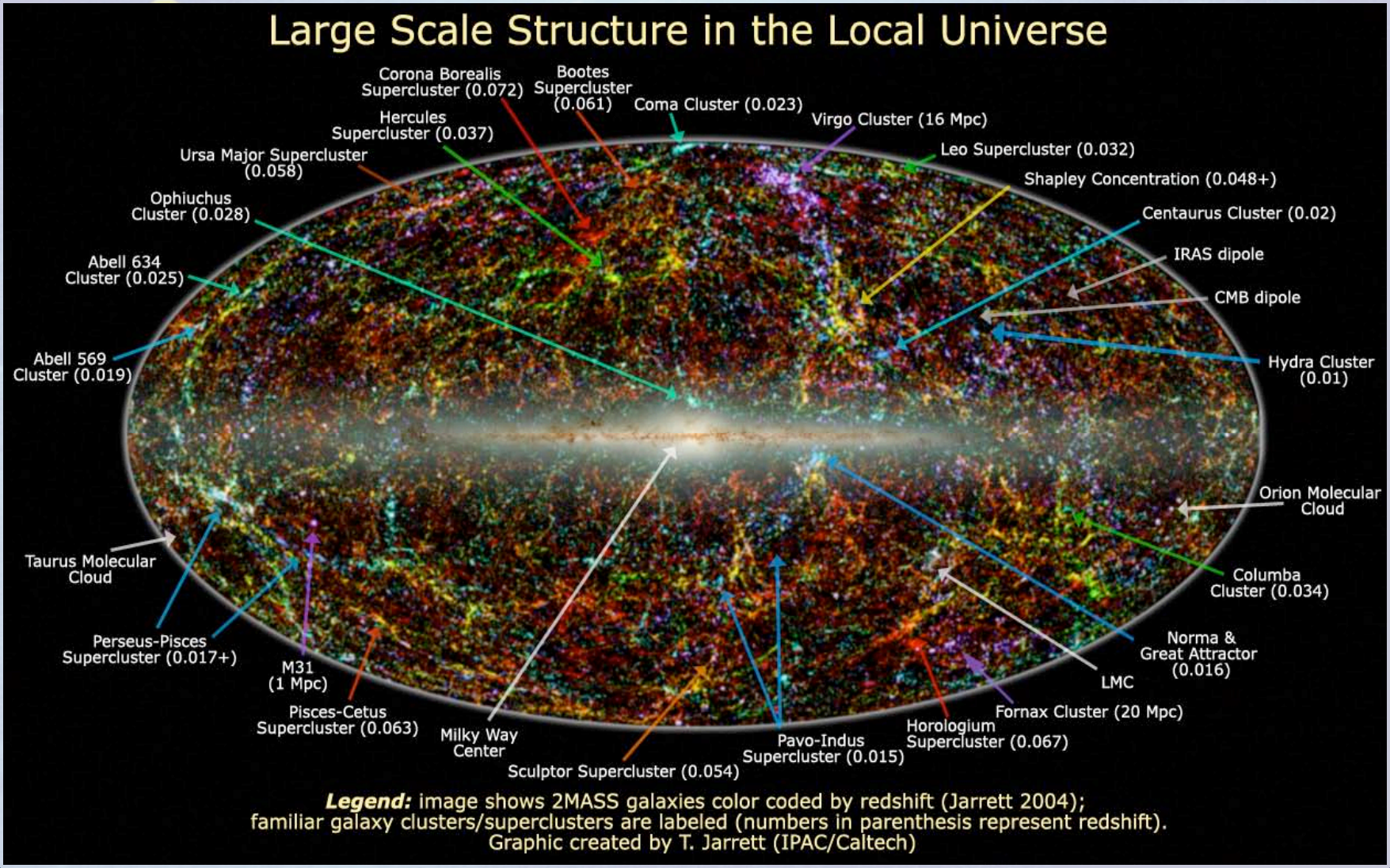






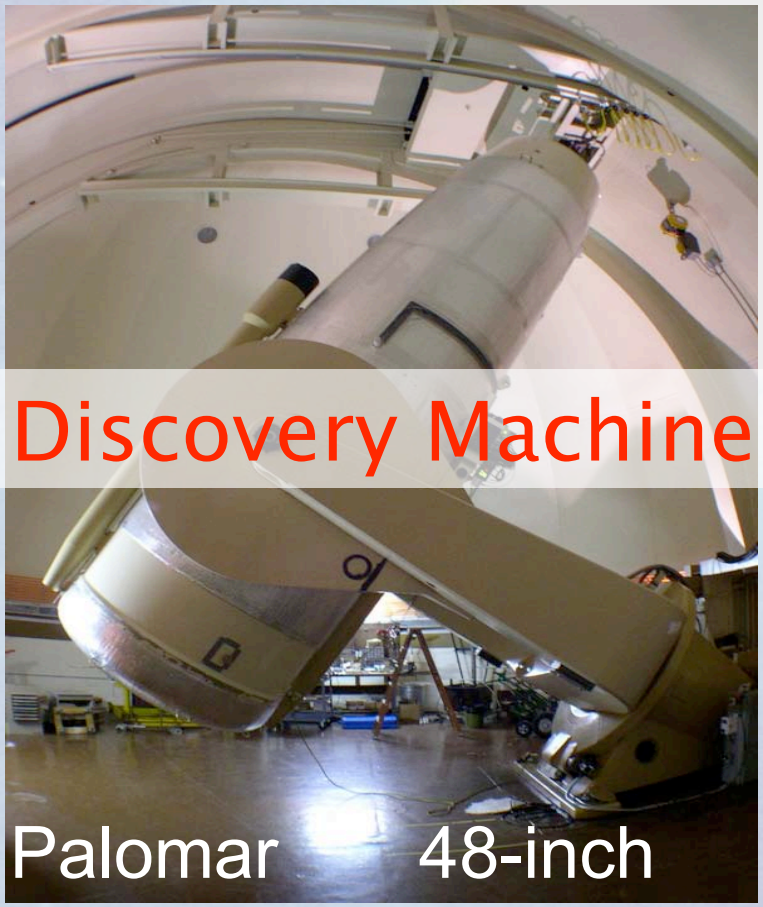
- 7 sq deg Virgo + 3 sq deg Coma, daily, 56 days
- 160 Transients :
  - 140 Background SN/AGN
  - 20 Virgo Novae
- Upper limit :
  - @ Mv < -9, Rate < 9.5 x 10^{10} Lsun-yr
  - @ Mv < -13, Rate < 4.4 x 10^{11} Lsun-yr

III. Palomar Transient Factory



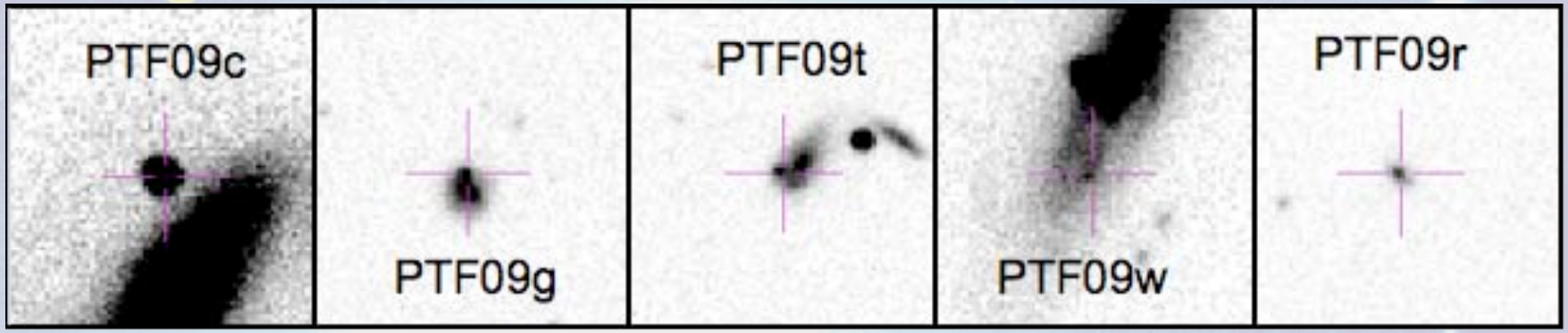
III. Palomar Transient Factory

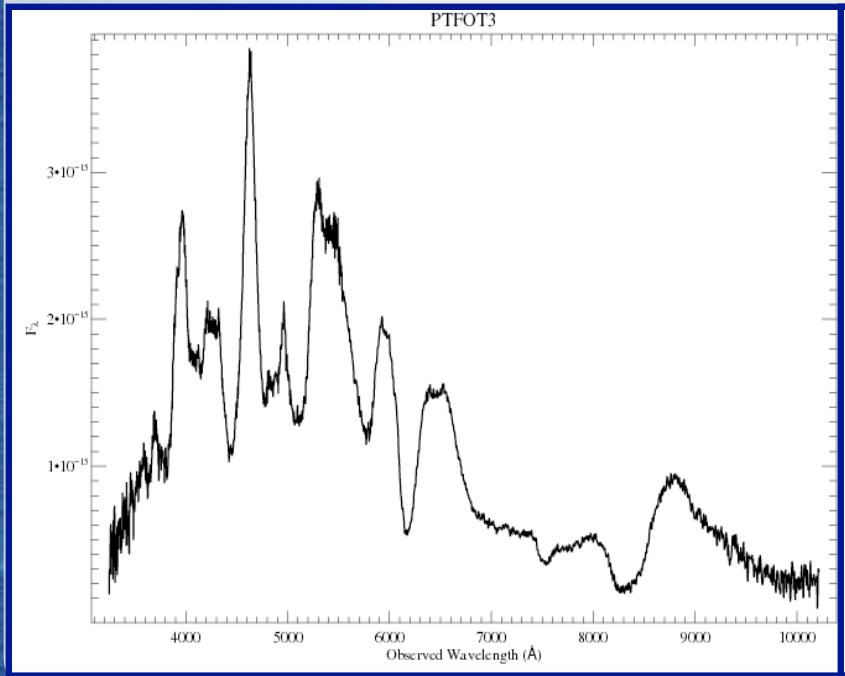
A wide-angle, high cadence survey dedicated to systematically chart the transient sky.

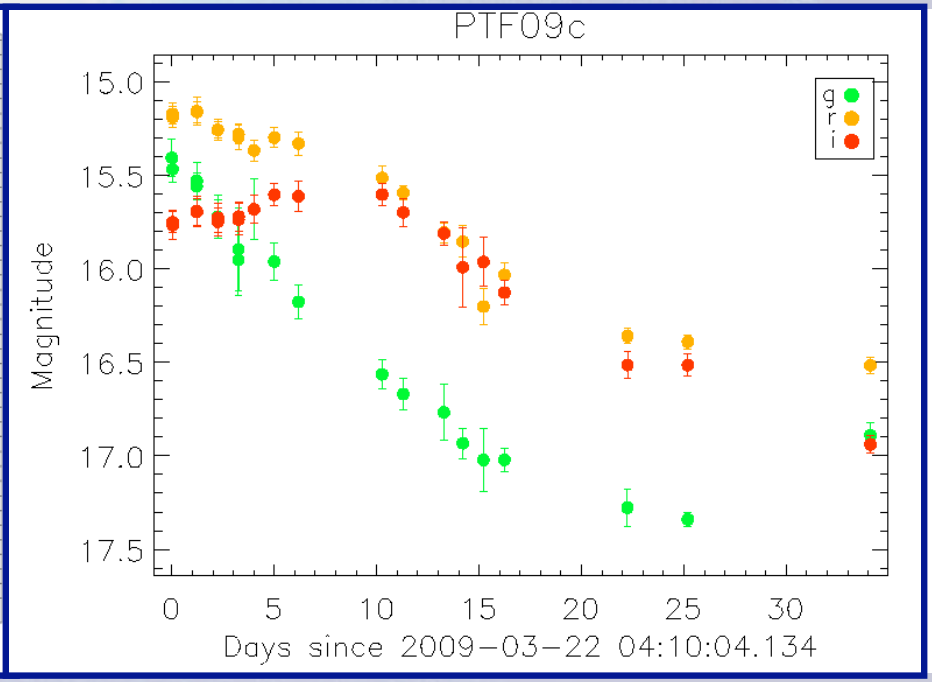


Discovery Machine + Classification Engine

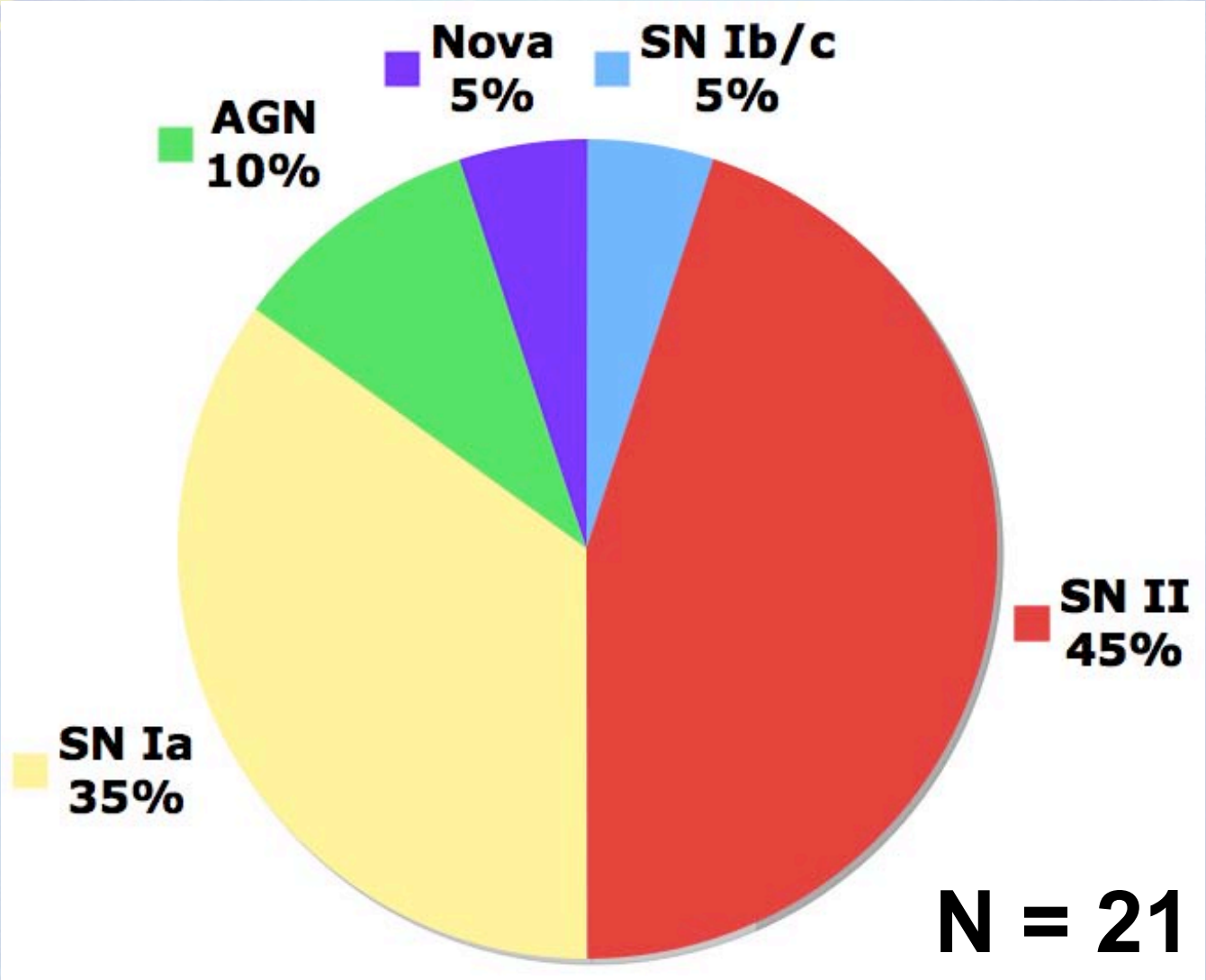
First Results



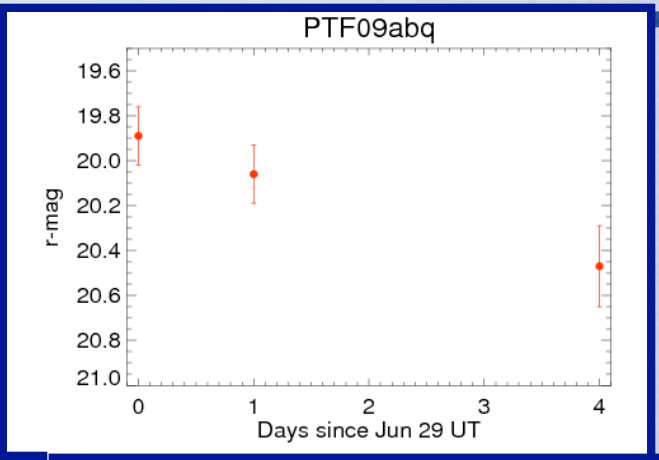


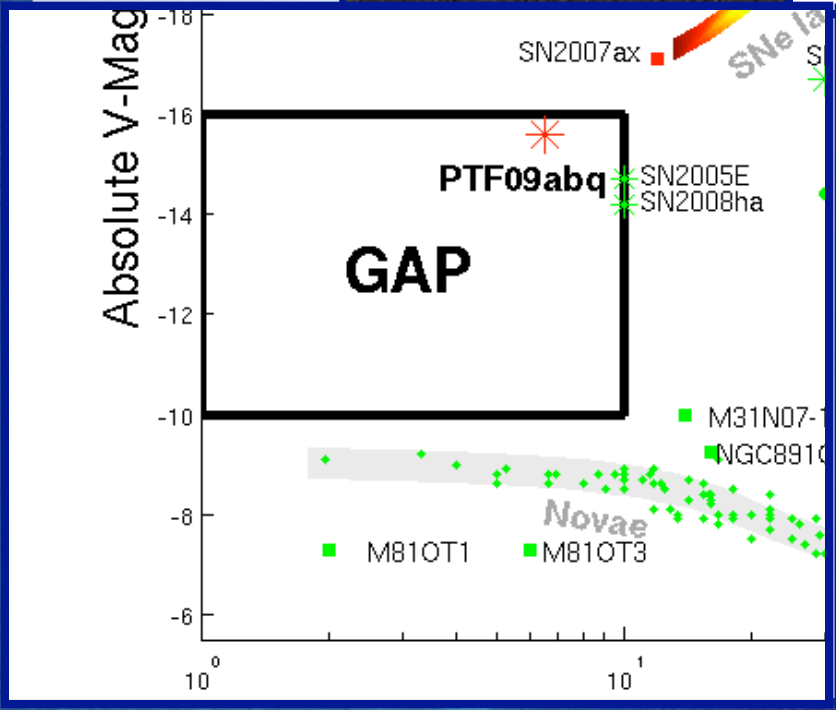


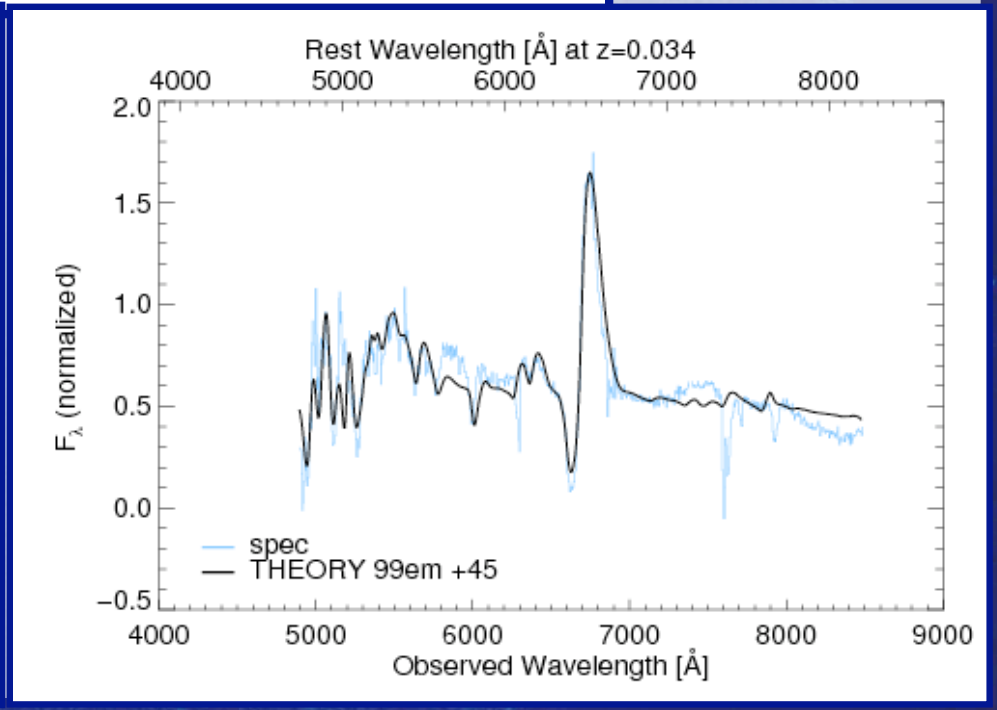
A complete inventory : d < 200 Mpc



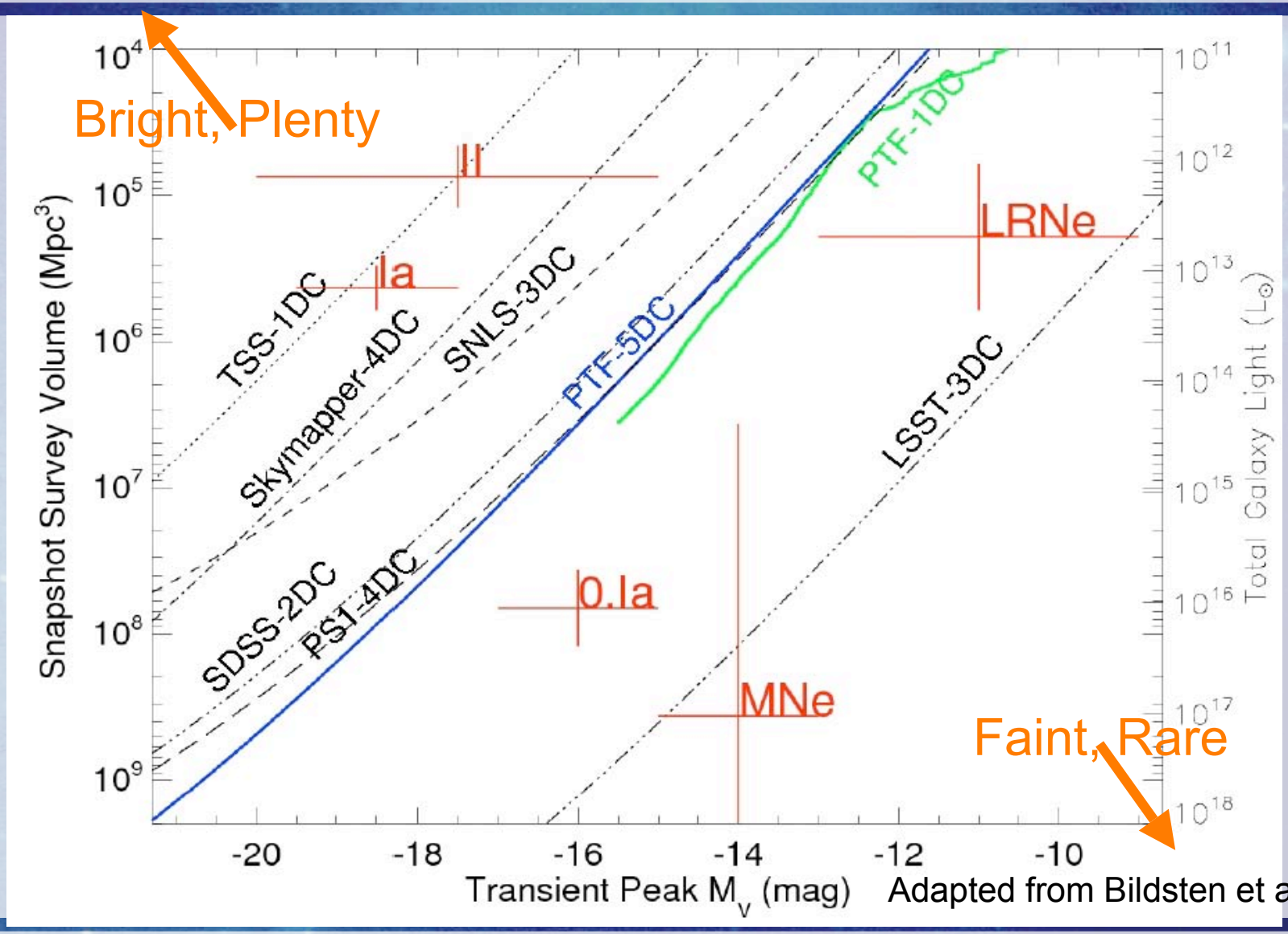
First Candidate : PTF09abq







How sensitive is PTF?



Adapted from Bildsten et al, in prep

Questions?