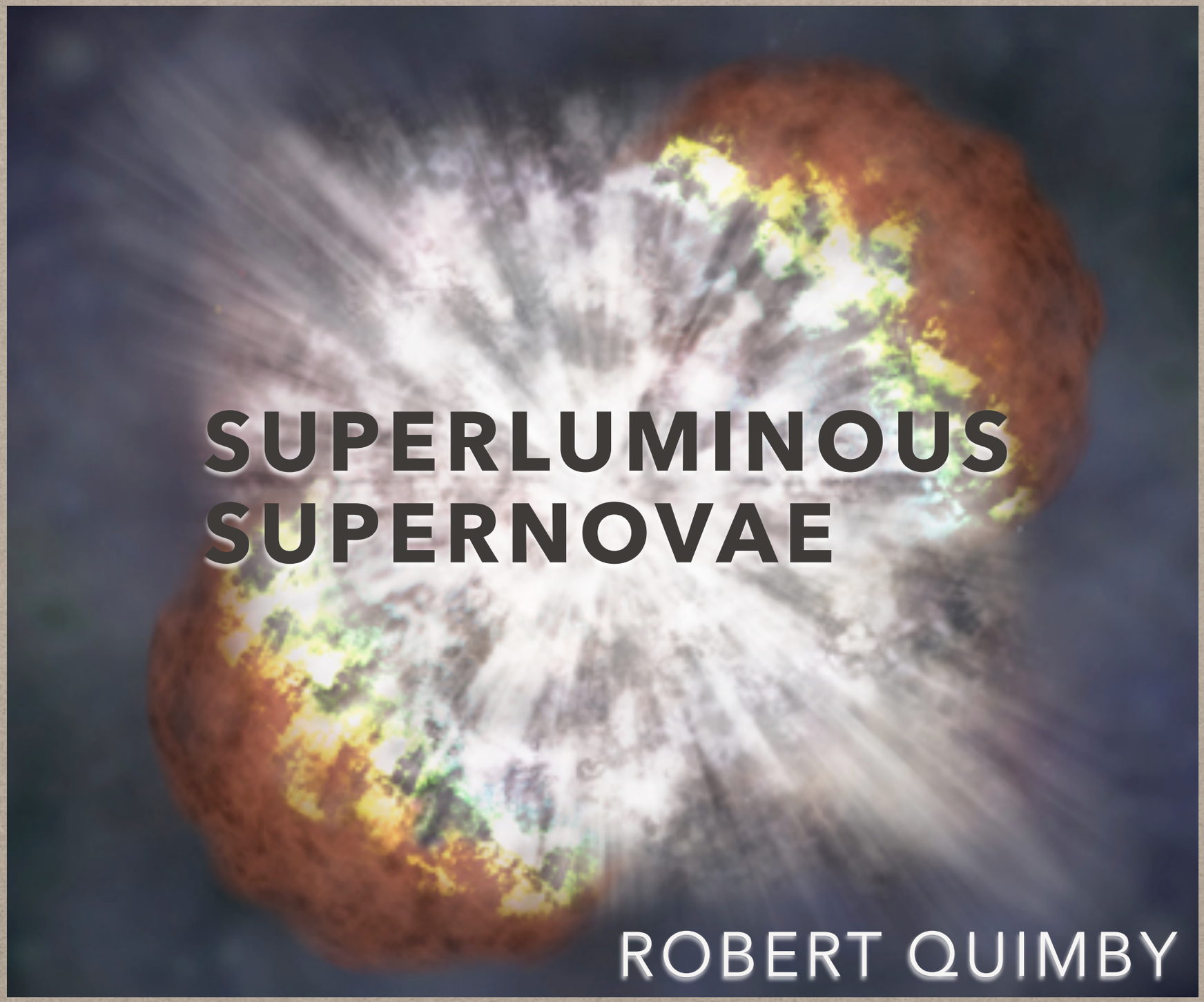
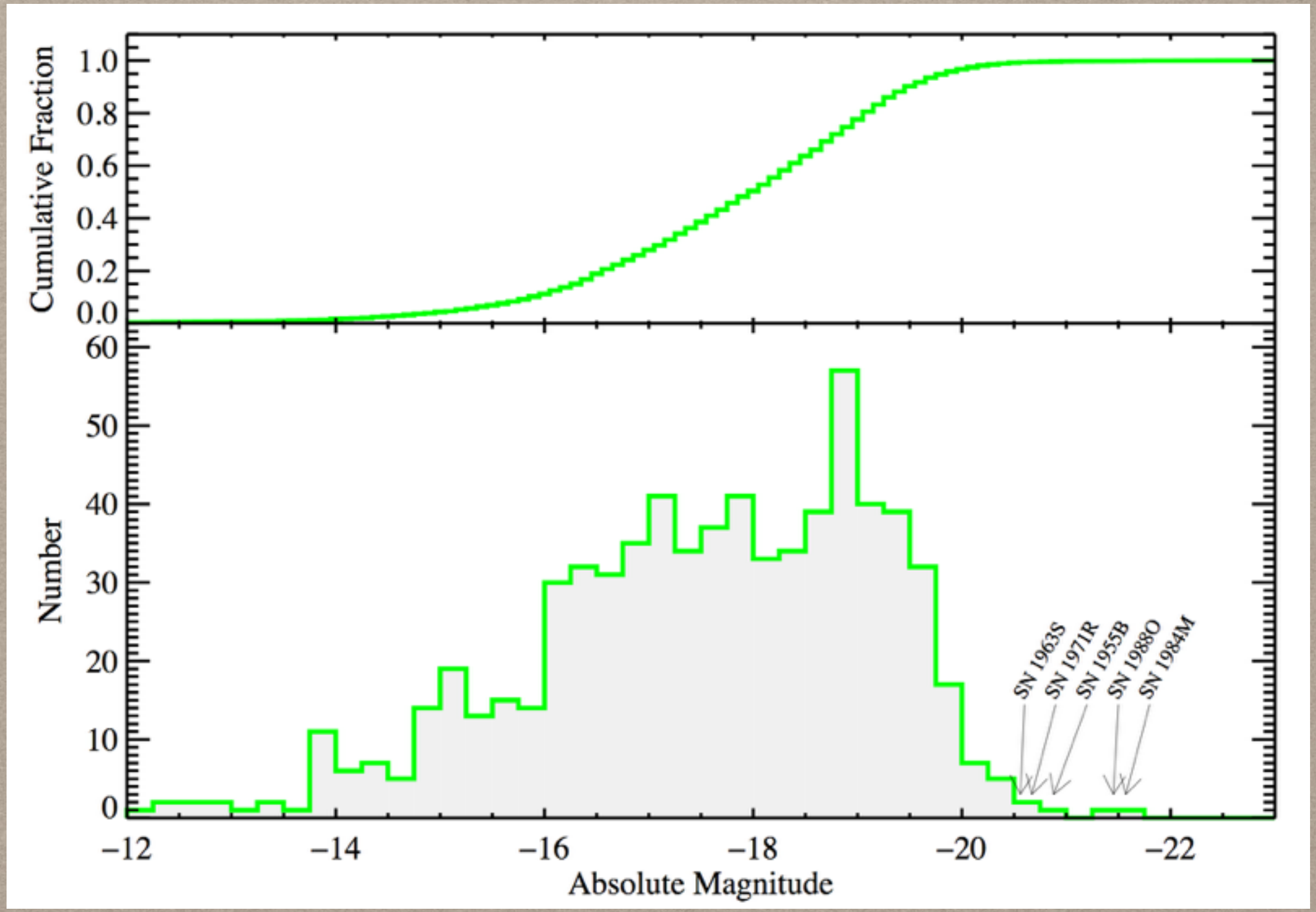


KAVLI IPMU

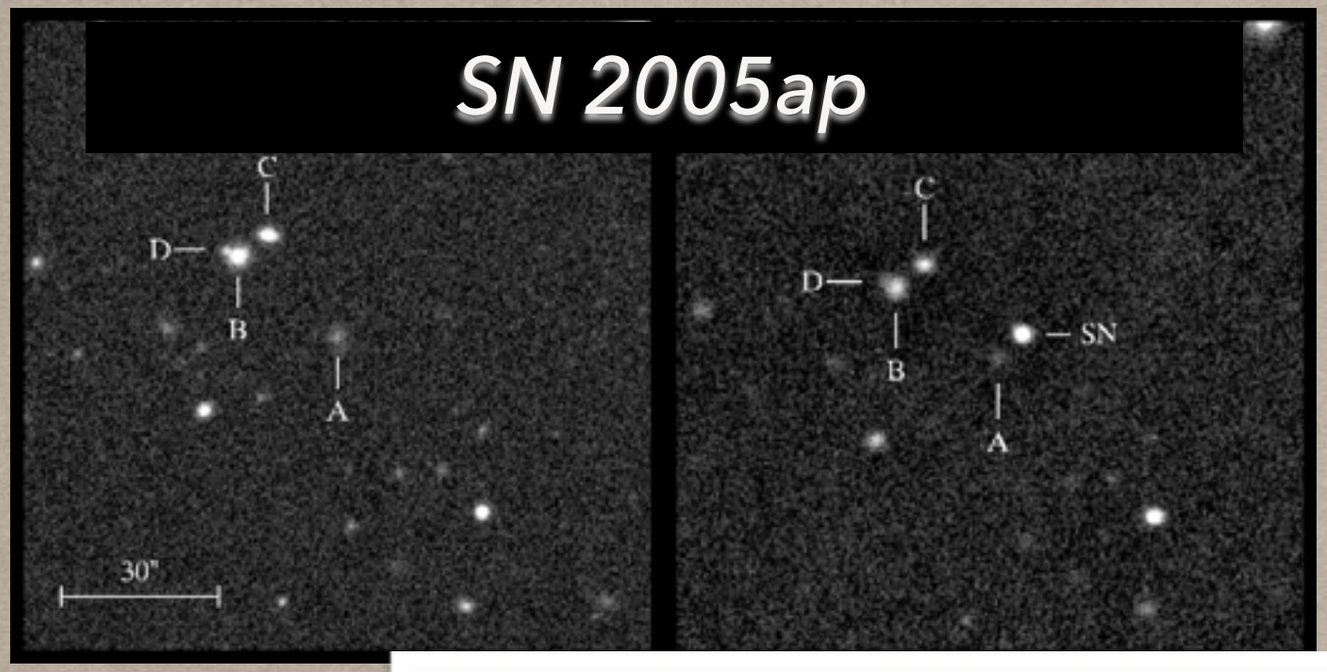
SAN DIEGO STATE UNIVERSITY

SN PEAK LUMINOSITIES (HISTORICAL)

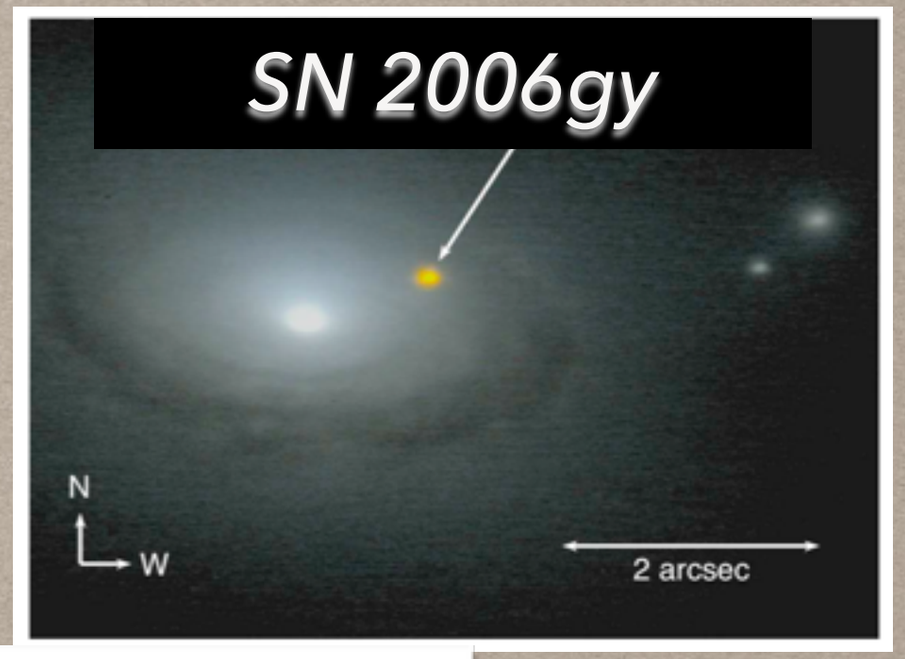


source: Asiago Catalog

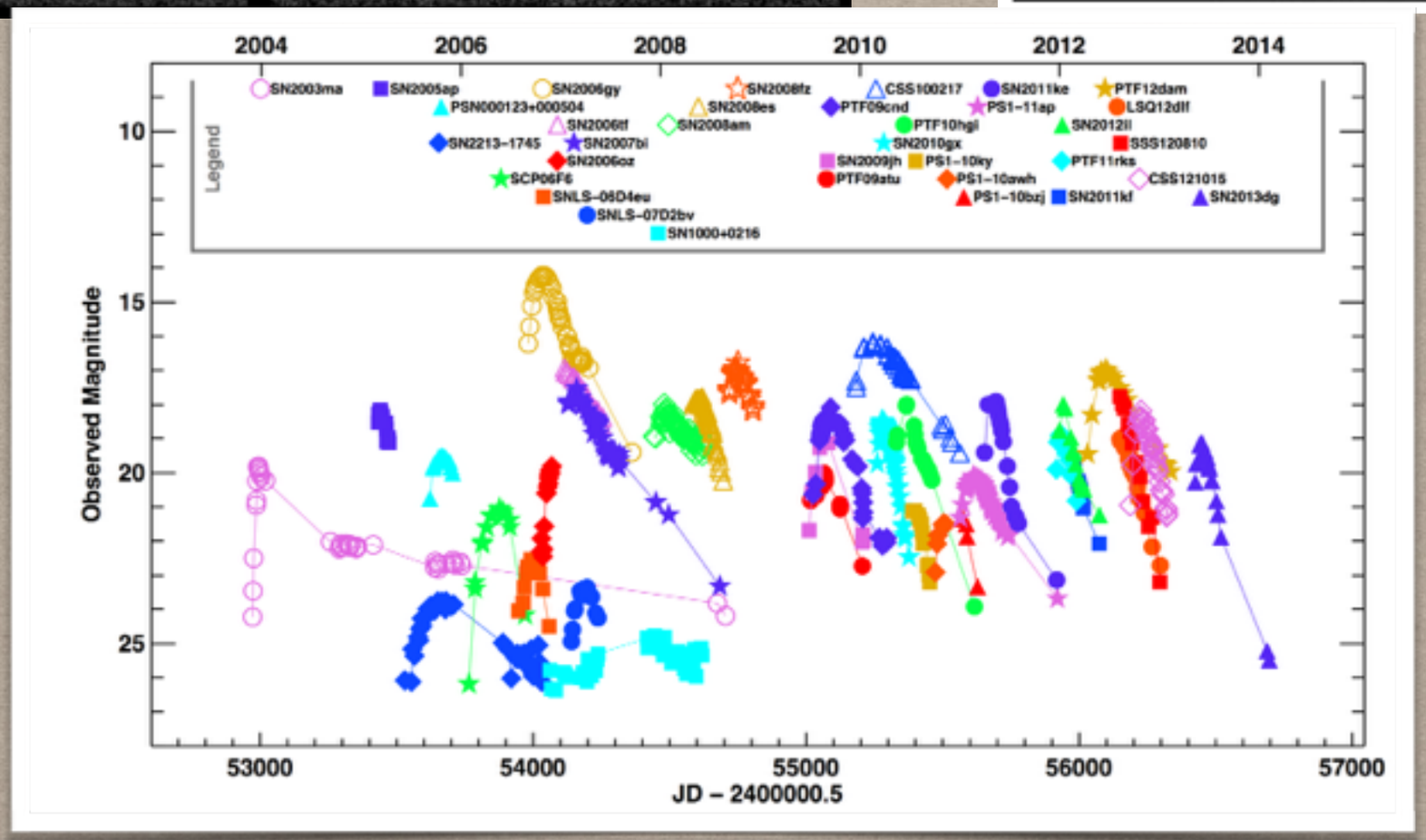
MODERN SEARCHES FIND M<-20 SN



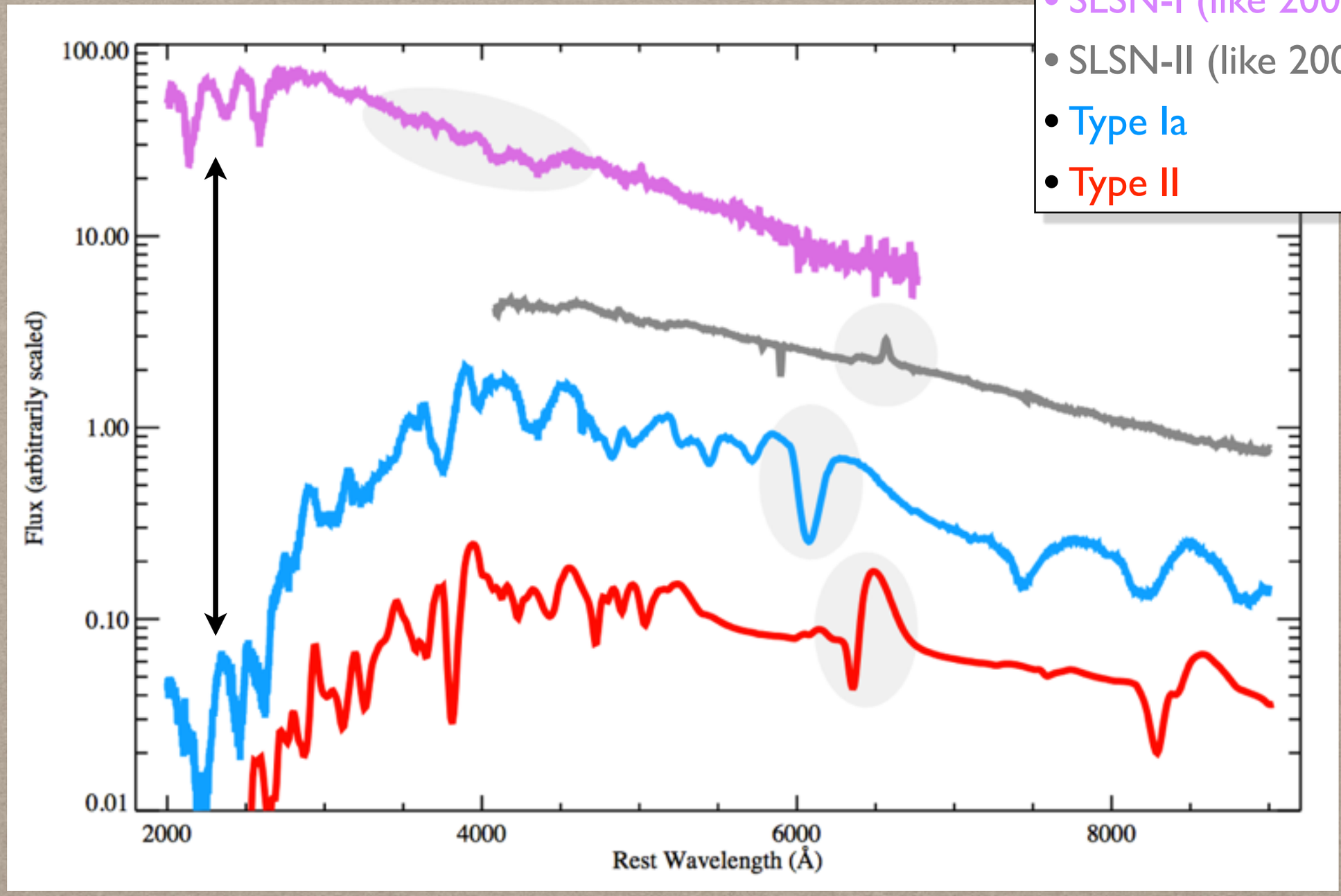
RQ et al. 2007



Smith et al. 2008



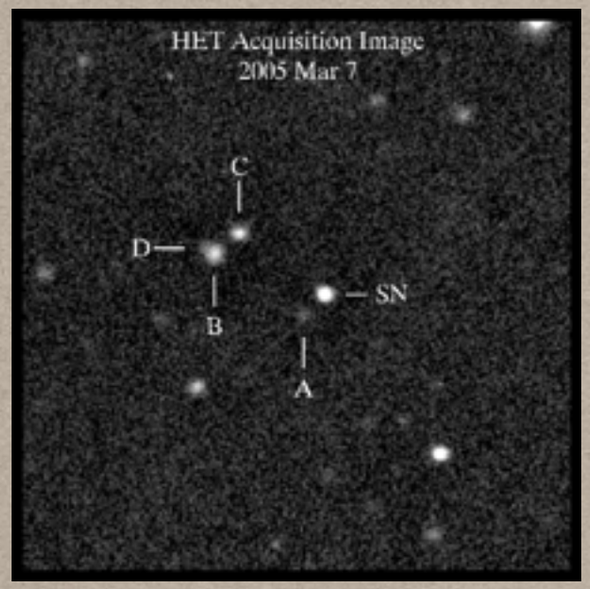
SLSN SPECTRA



- SLSN-I (like 2005ap)
- SLSN-II (like 2006gy)
- Type Ia
- Type II

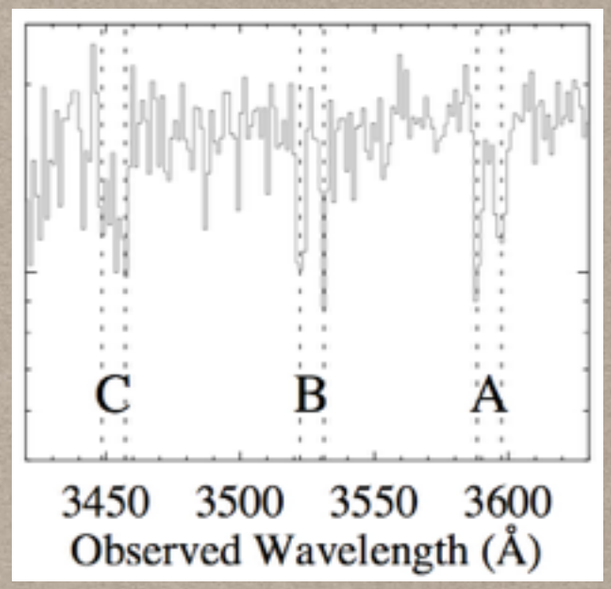
Hundreds of times brighter than SNIa in the UV!

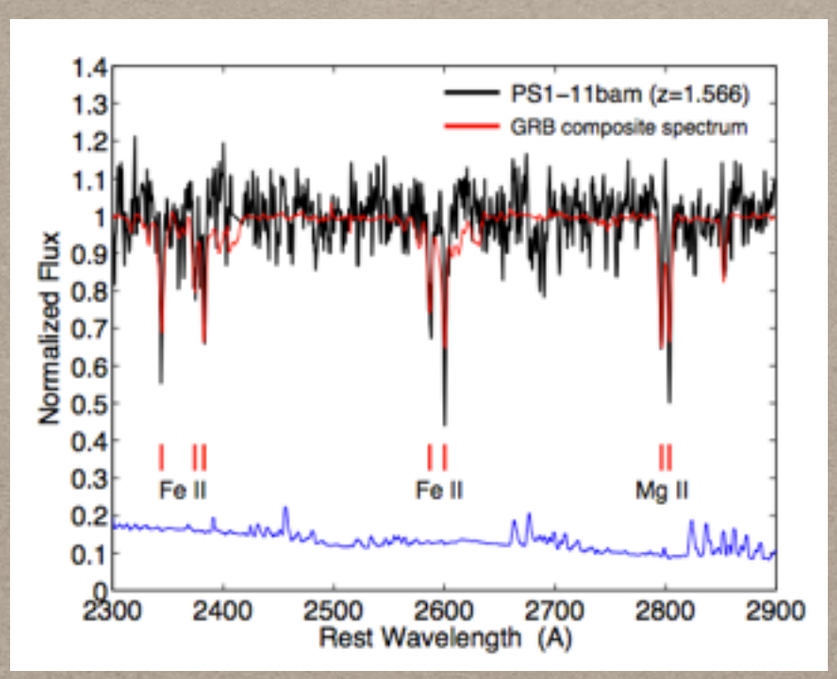
SLSN COULD BE USEFUL BACKLIGHTS!



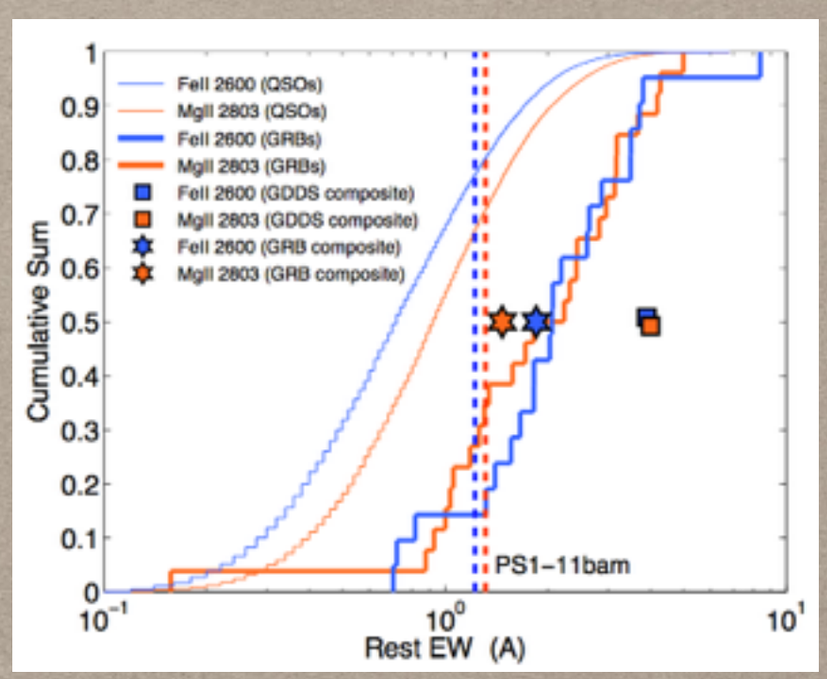
SN 2005ap
z=0.283

RQ et al. 2007



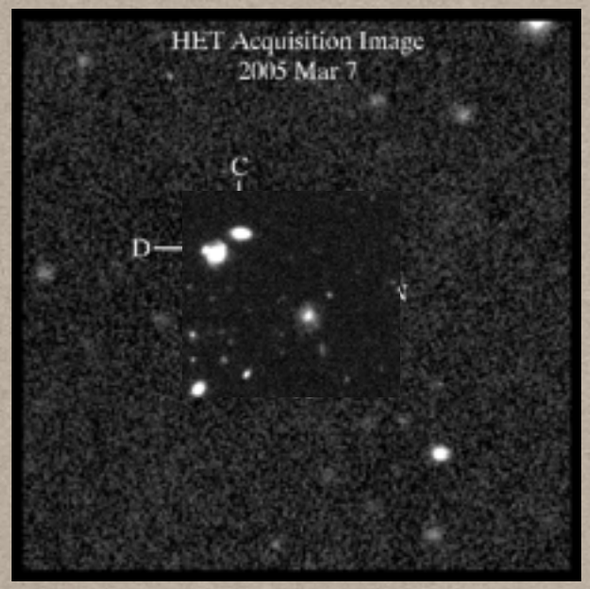


PS1-11bam
z=1.566



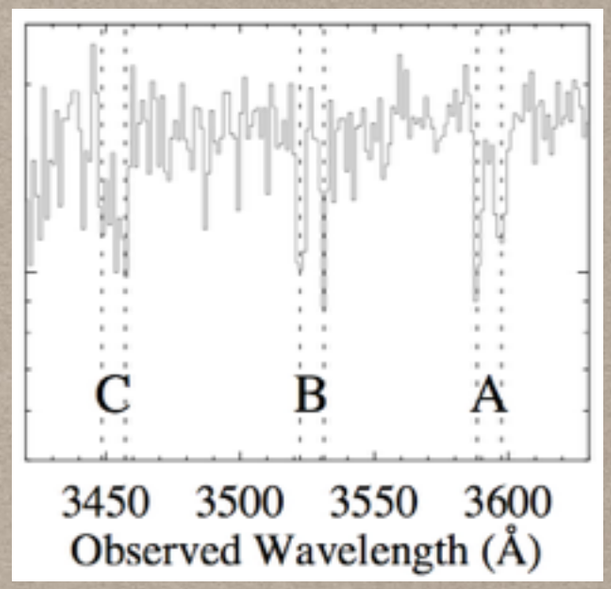
Berger et al. (2012)

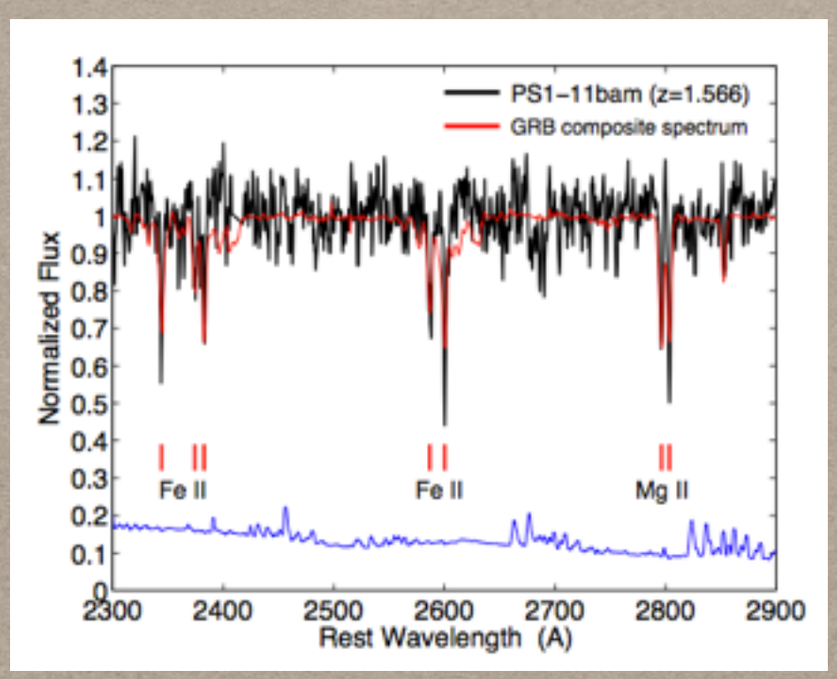
SLSN COULD BE USEFUL BACKLIGHTS!



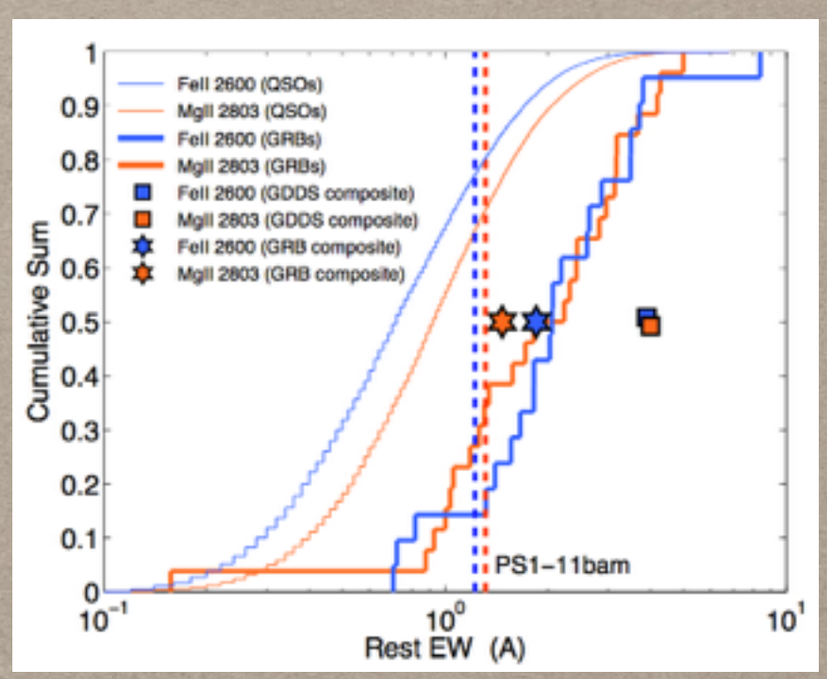
SN 2005ap
z=0.283

RQ et al. 2007





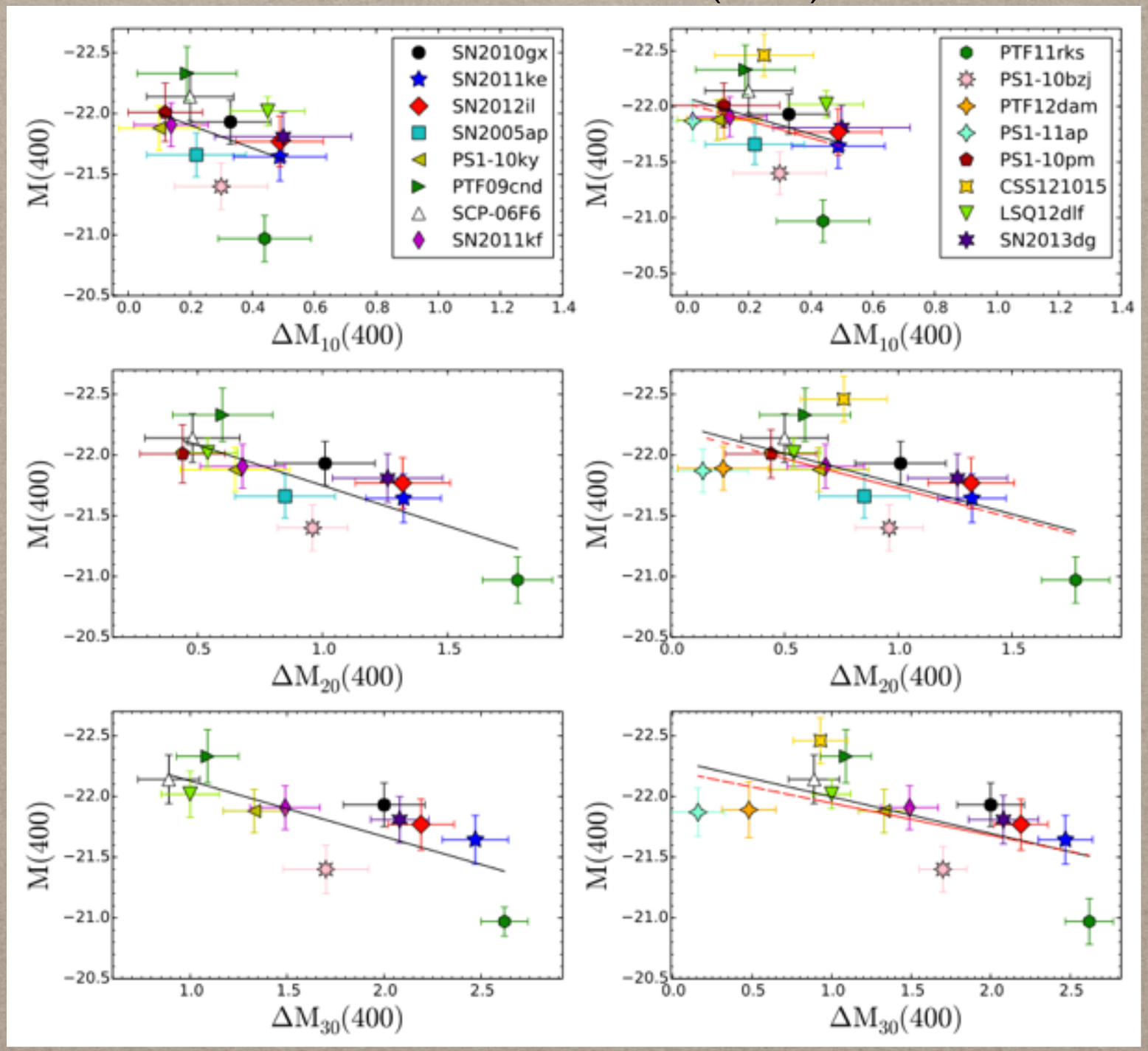
PS1-11bam
z=1.566



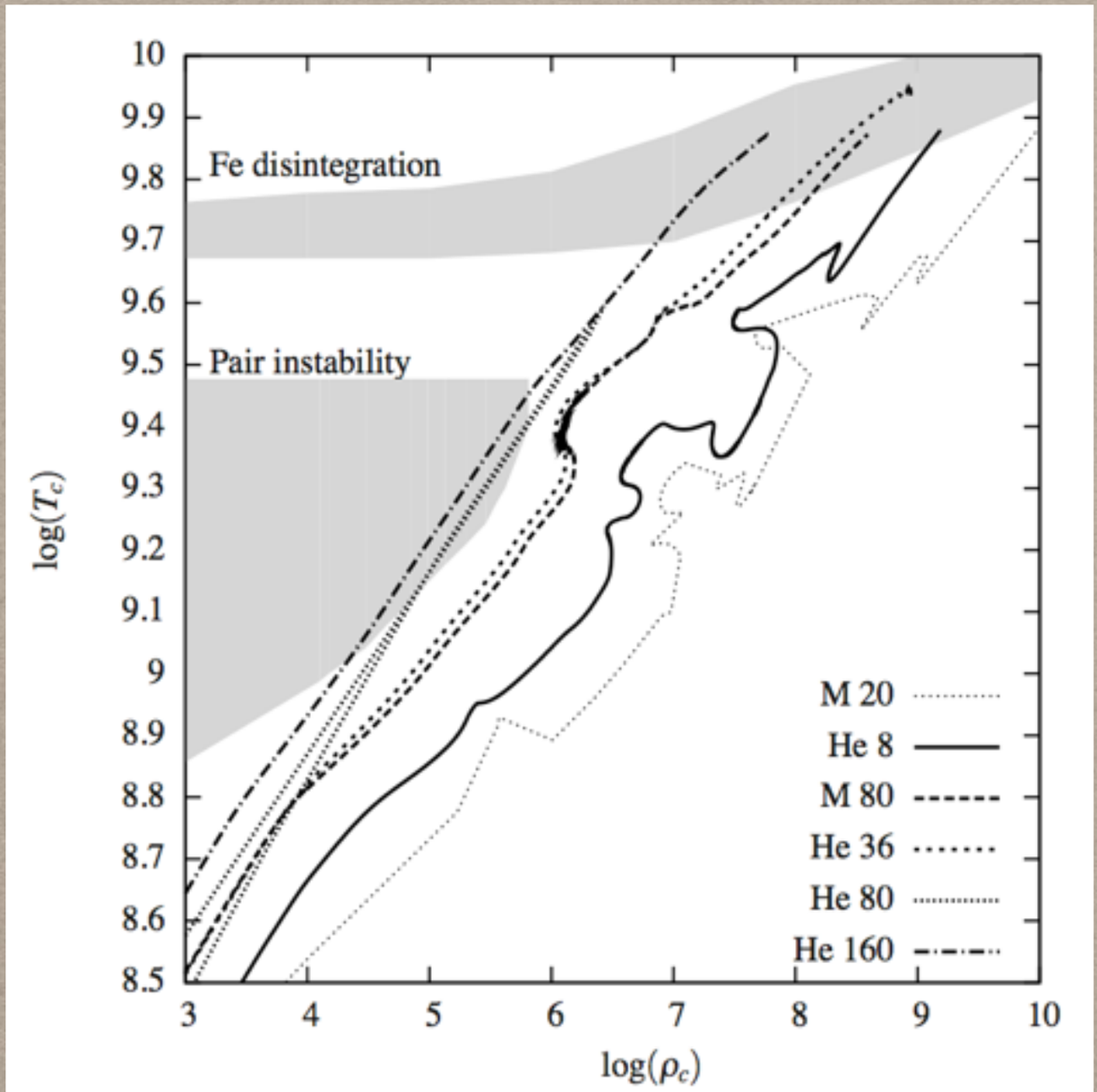
Berger et al. (2012)

SLSN AS STANDARDIZABLE CANDLES?

Inserra & Smartt (2014)



ARE SLSN: 1) PAIR-INSTABILITY SN?

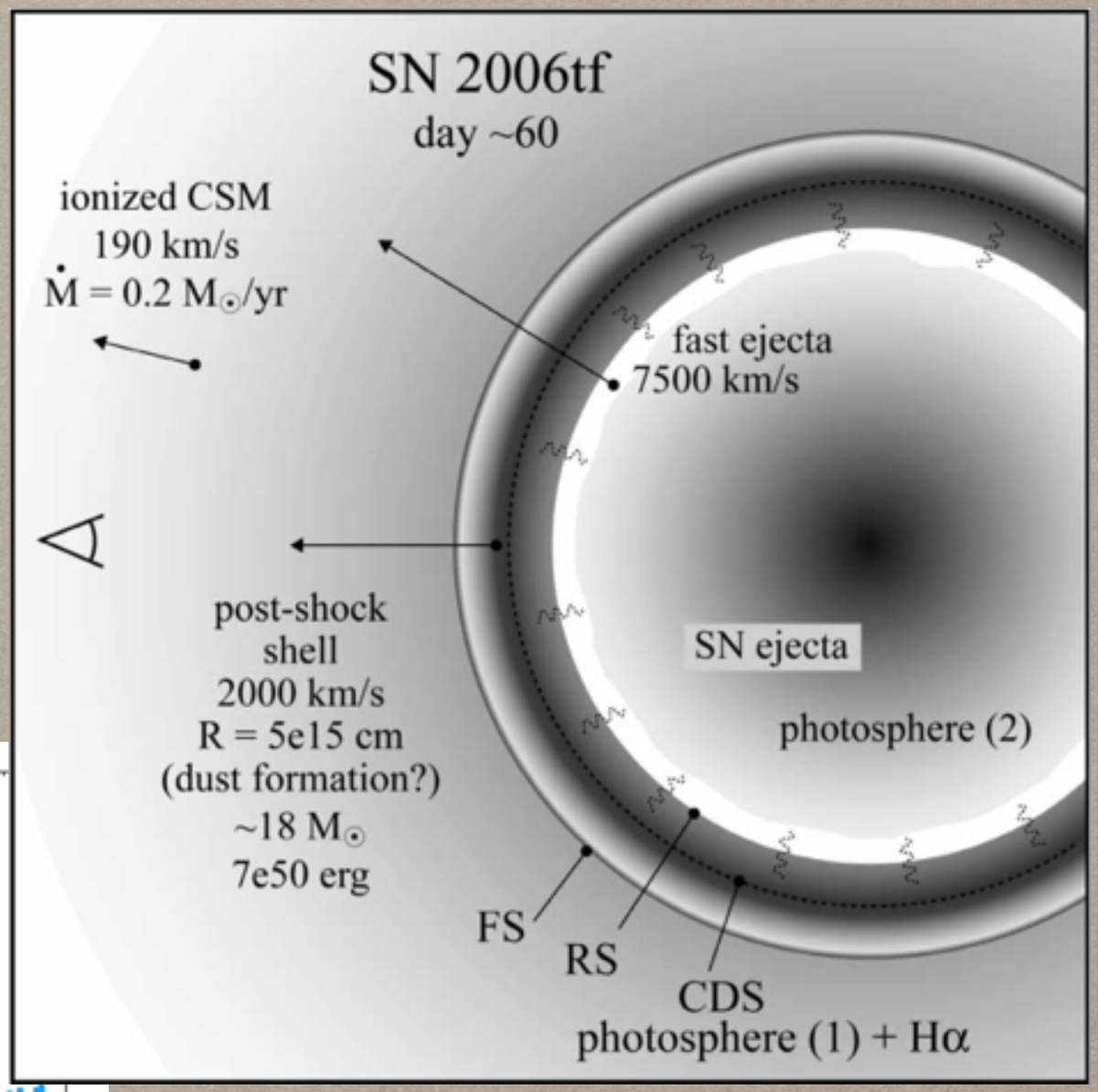


Waldman 2008

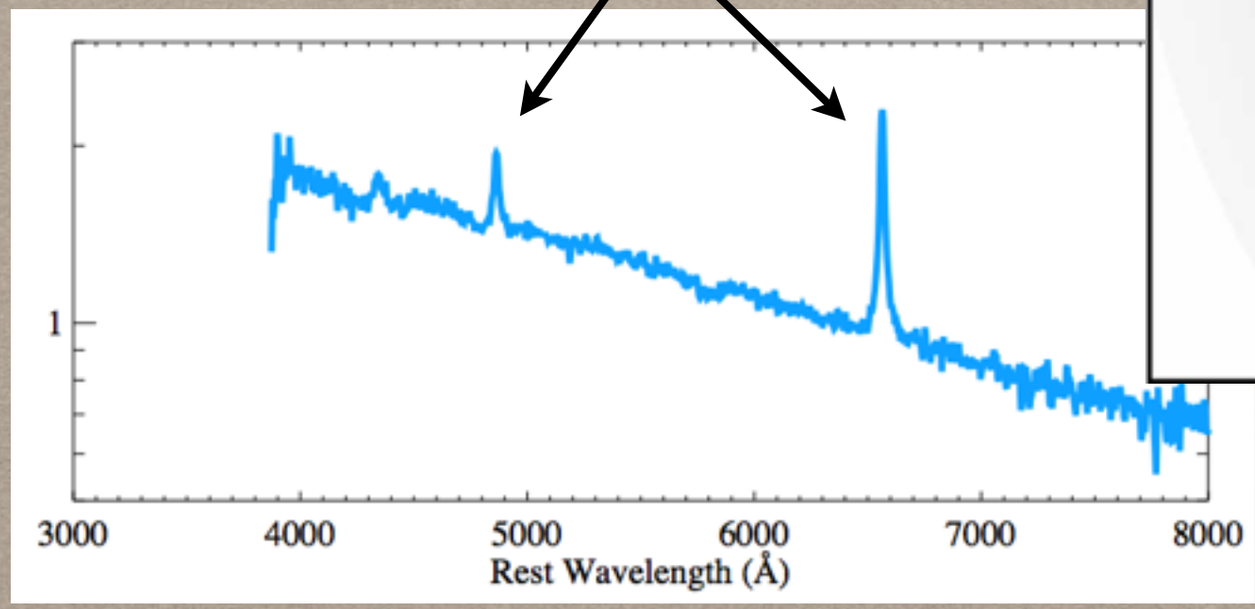
- First Proposed it the 1960's (Rakavy et al. 1967; Barkat et al. 1967)
- Massive stars are supported by radiation pressure
- At high temperatures, photons are created with E > e+e-
- Losses to pair production soften the EOS, and lead to instability
- Expected fate of the first (low metal, high mass) stars

ARE SLSN: 2) POWERED BY INTERACTIONS?

Smith et al. 2008

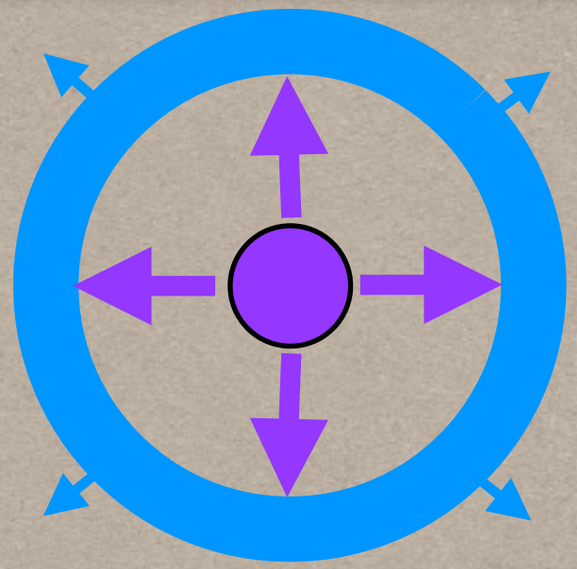


Narrow emission lines indicate ejecta/wind interaction

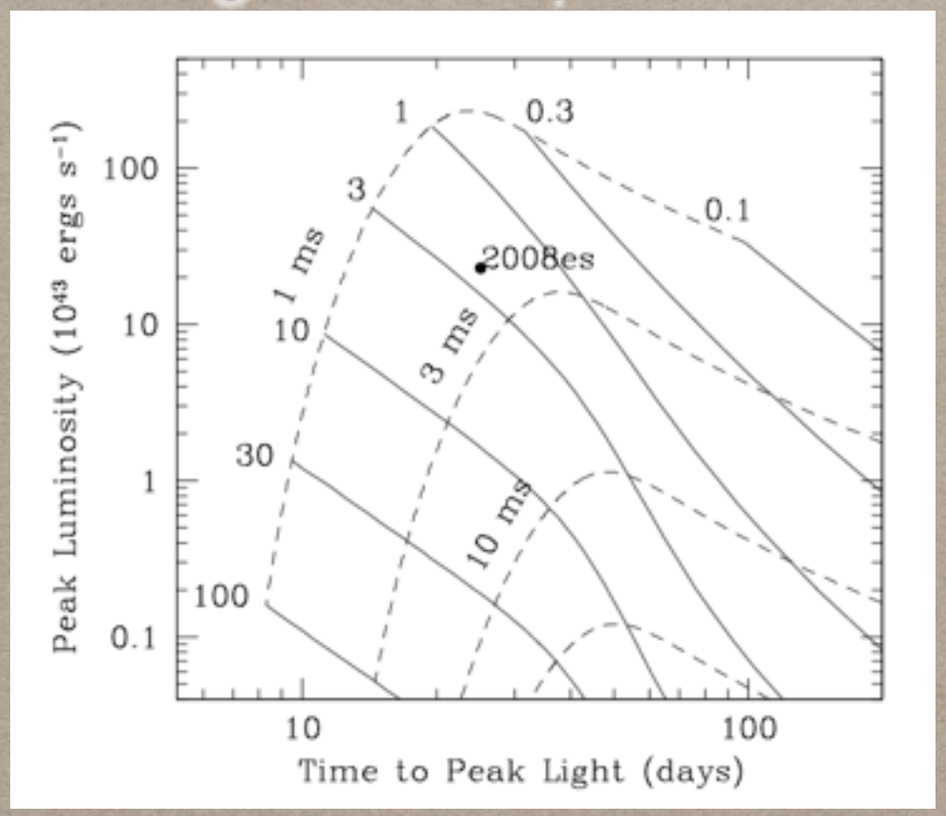


see also Smith & McCray 2007, Chevalier & Irwin 2011, Moriya et al. 2013

ARE SLSN: 3) CENTRAL ENGINE POWERED?

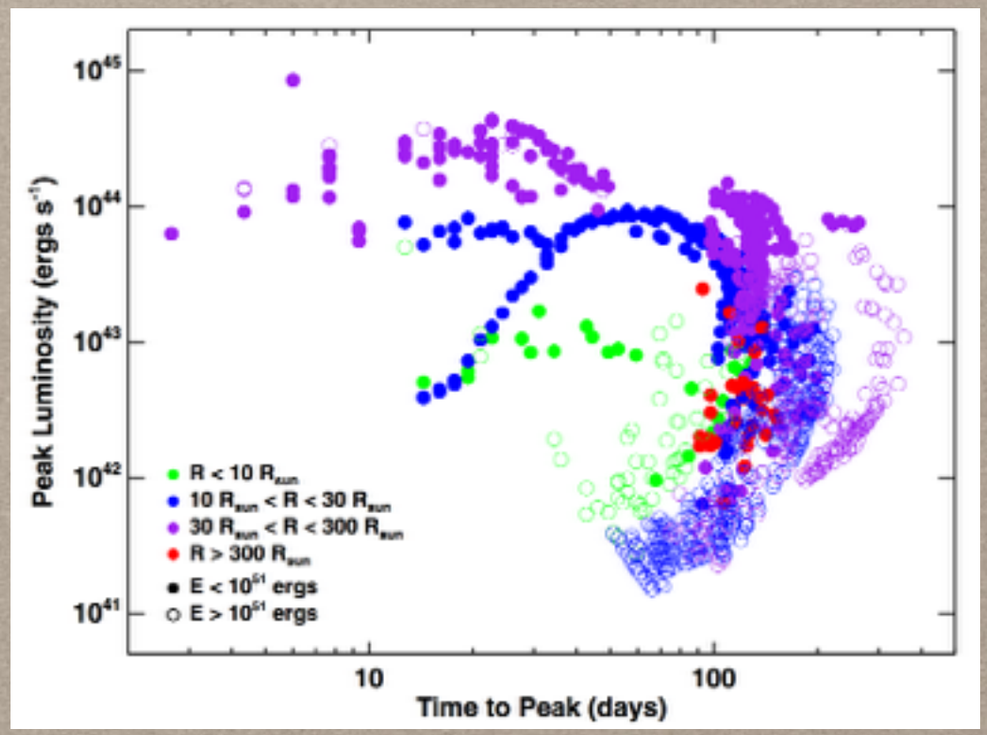


"Magnetar" Spindown



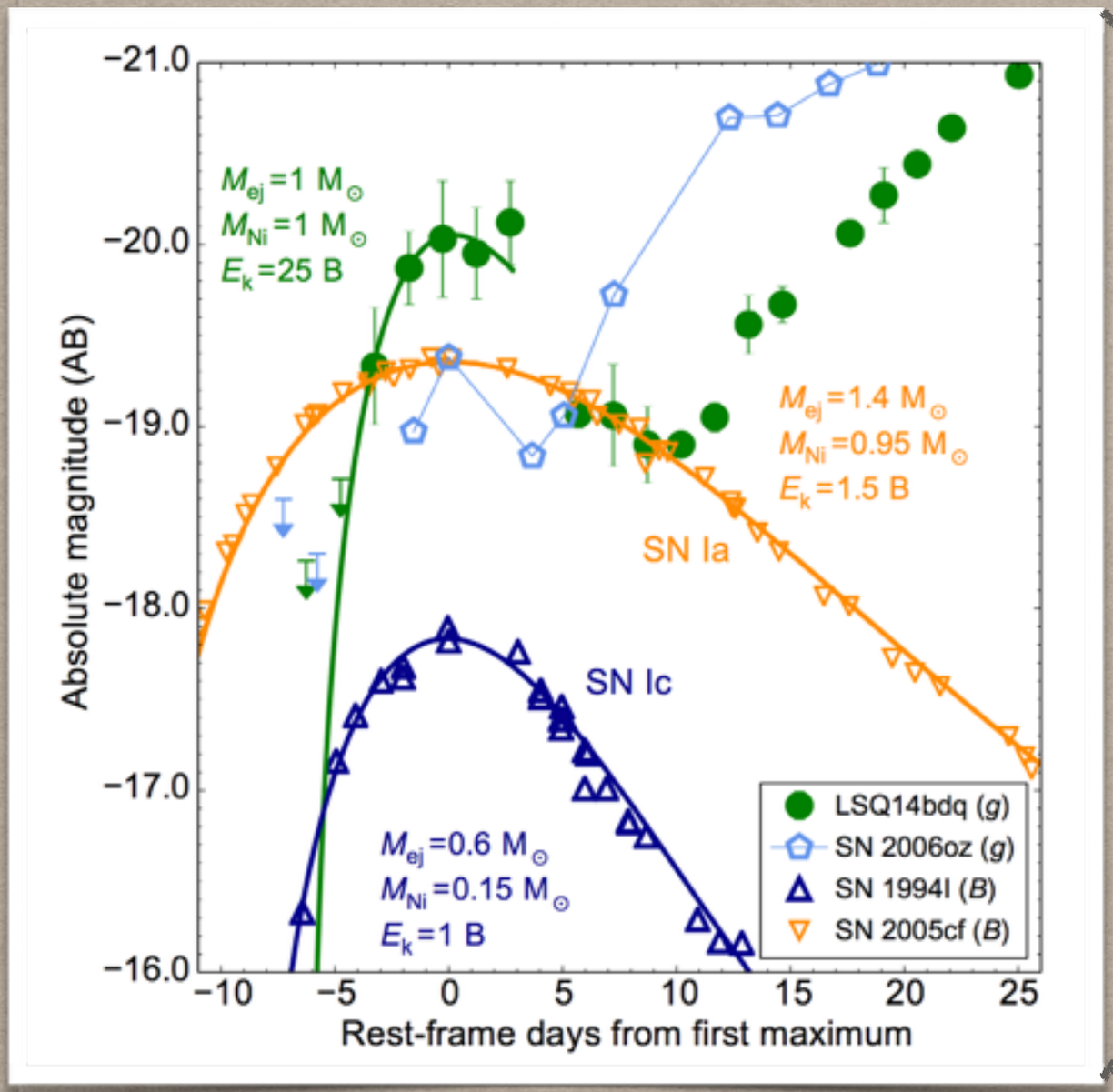
Kasen & Bildsten 2010
see also Woosley 2010

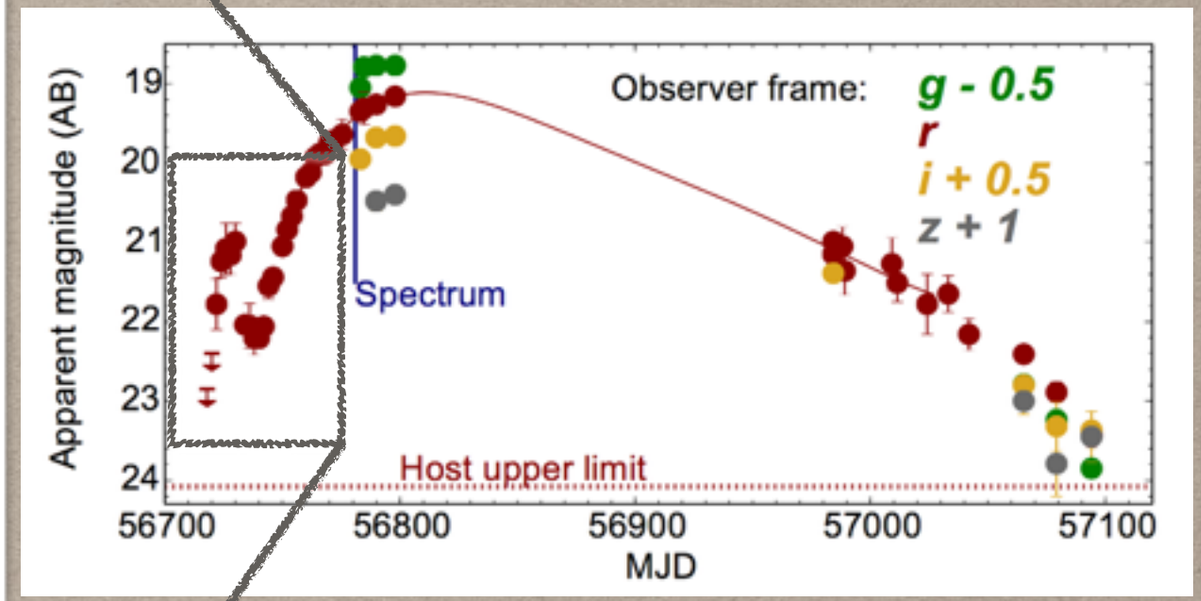
Fallback Accreation



Dexter & Kasen 2014

DOUBLE PEAKED SLSN-I

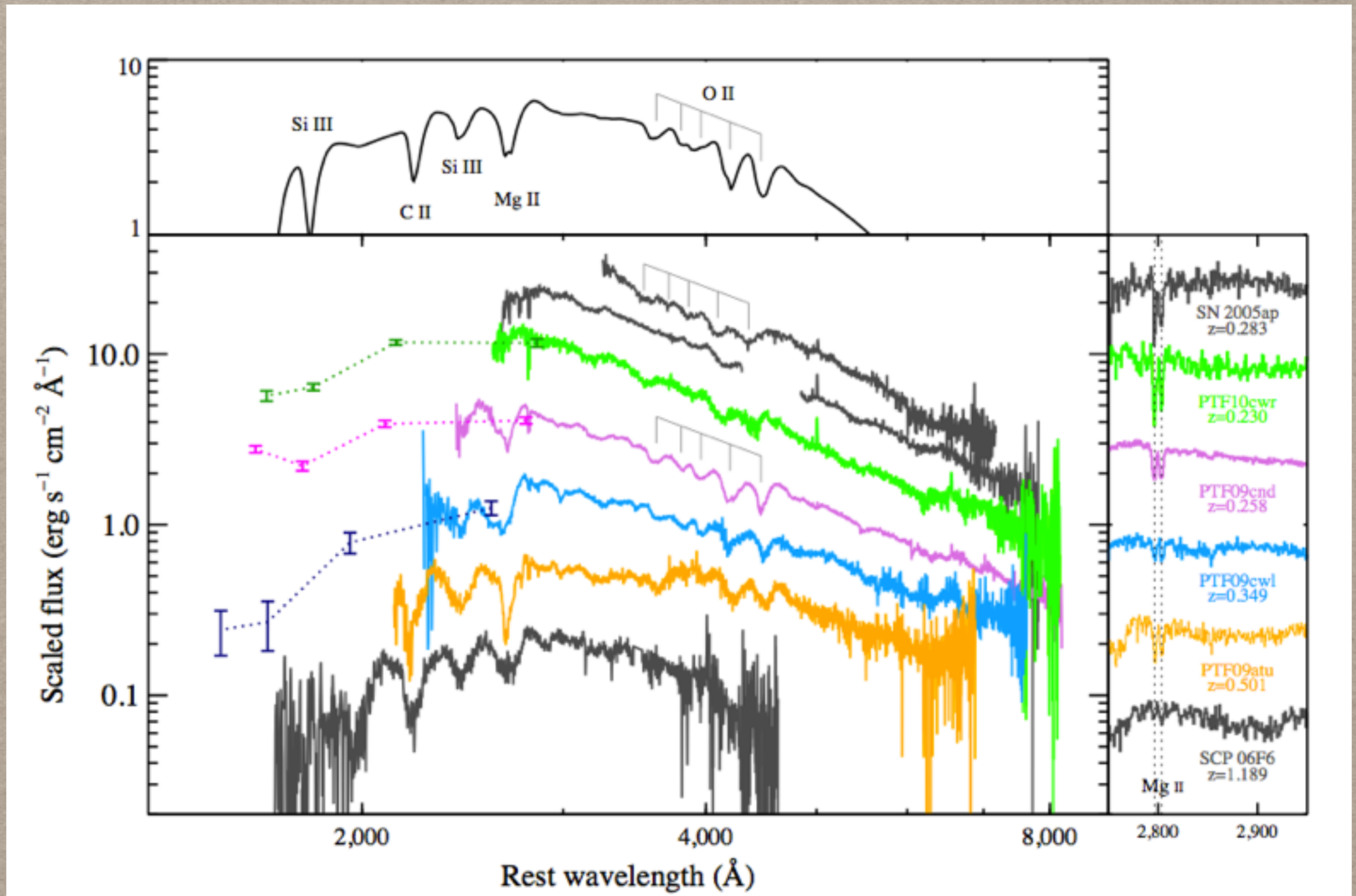




Nicholl et al. (arXiv:1505.01078)

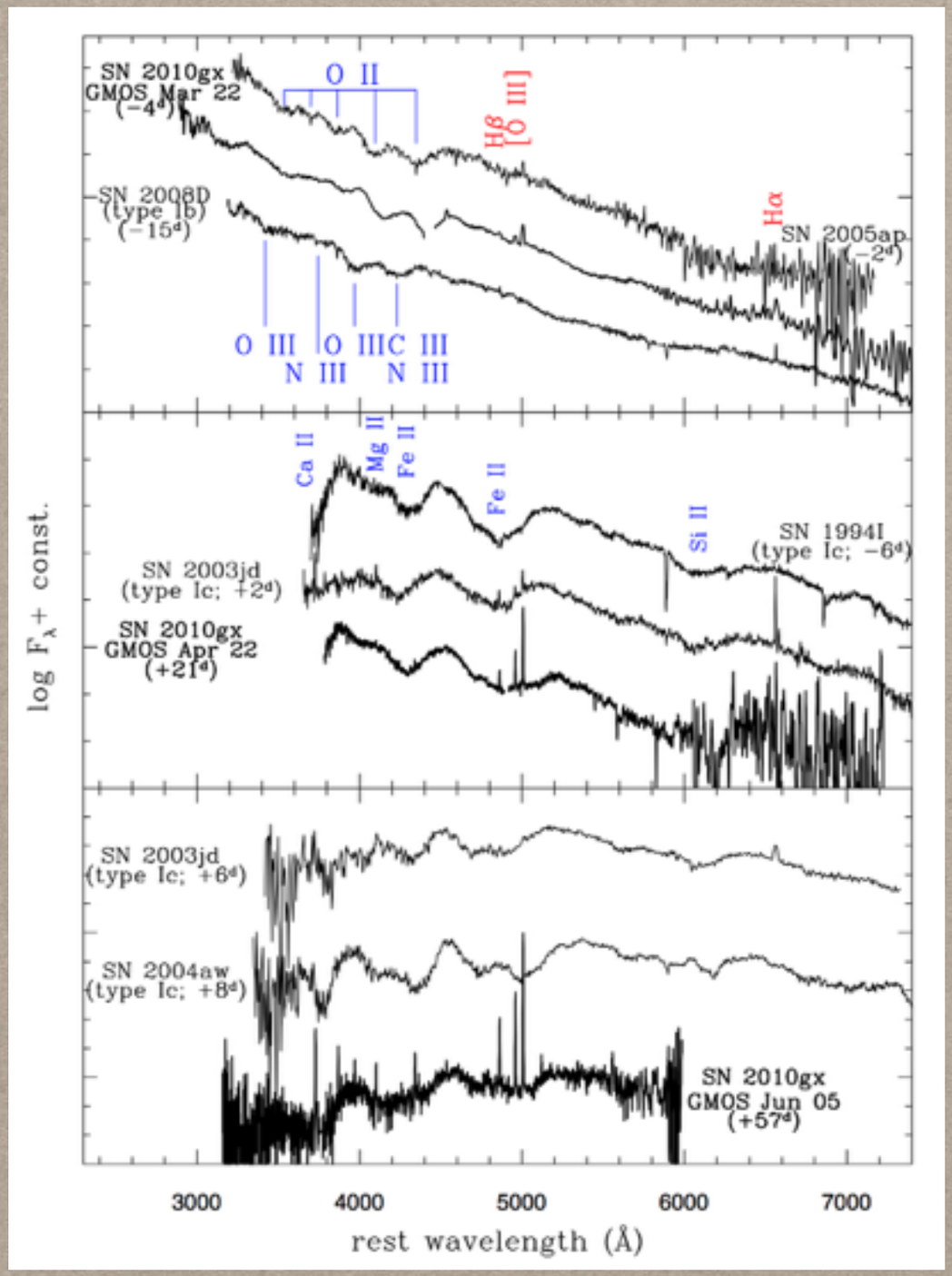
See also Leloudas et al. 2012

(EARLY) SLSN-I SPECTRA

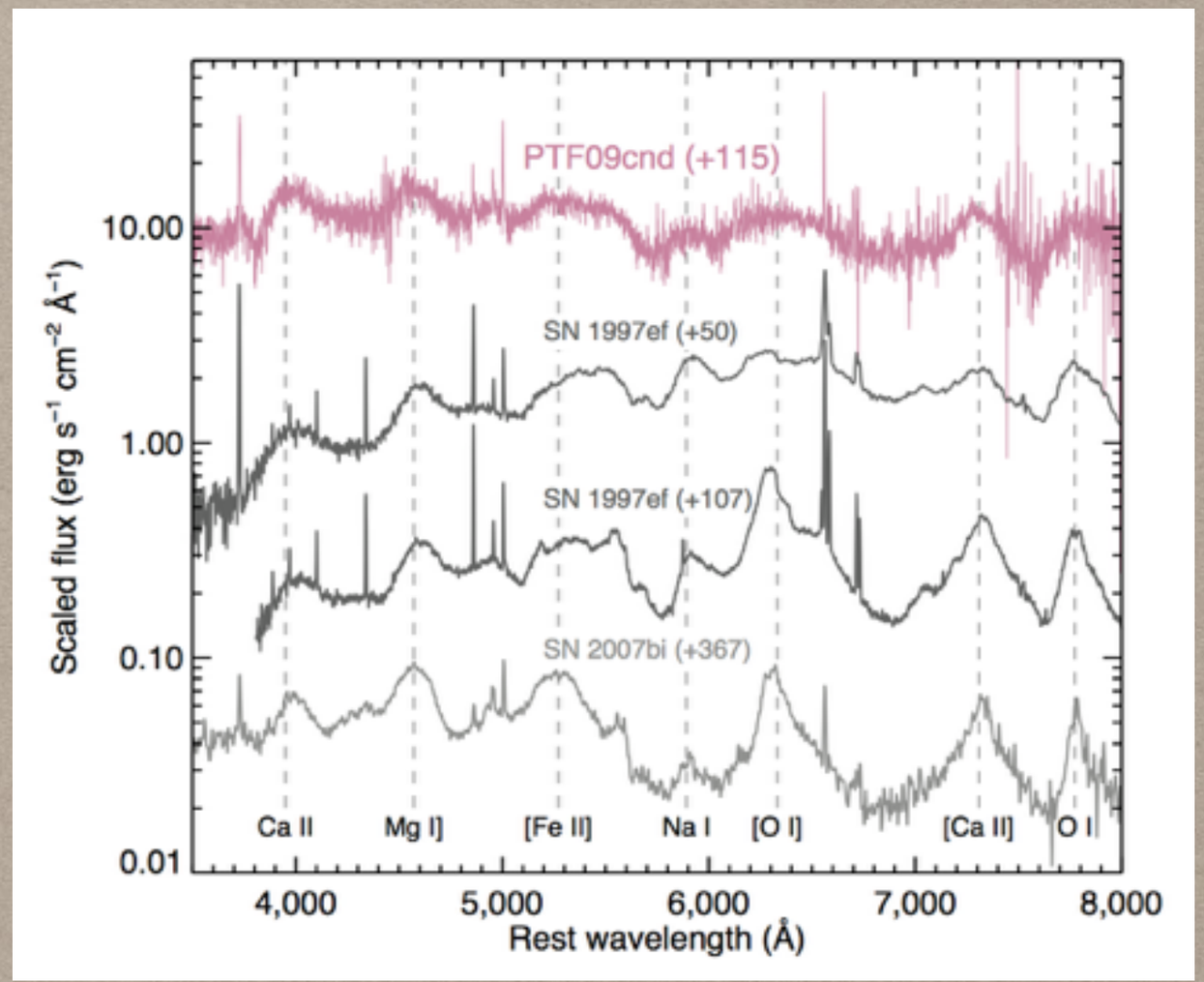


RQ et al. 2011

(LATE) SLSN-I SPECTRA

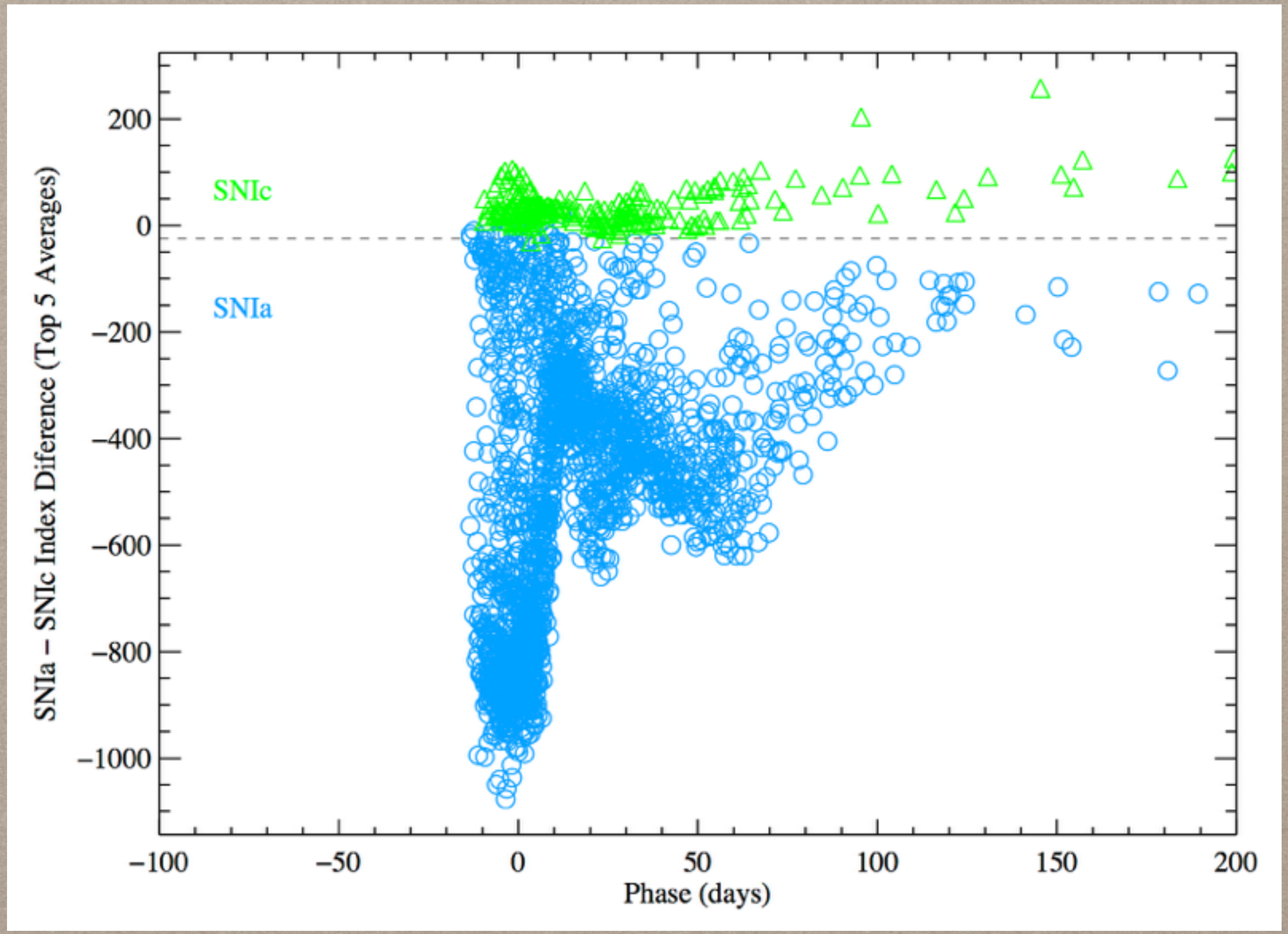


Pastorello et al. 2010

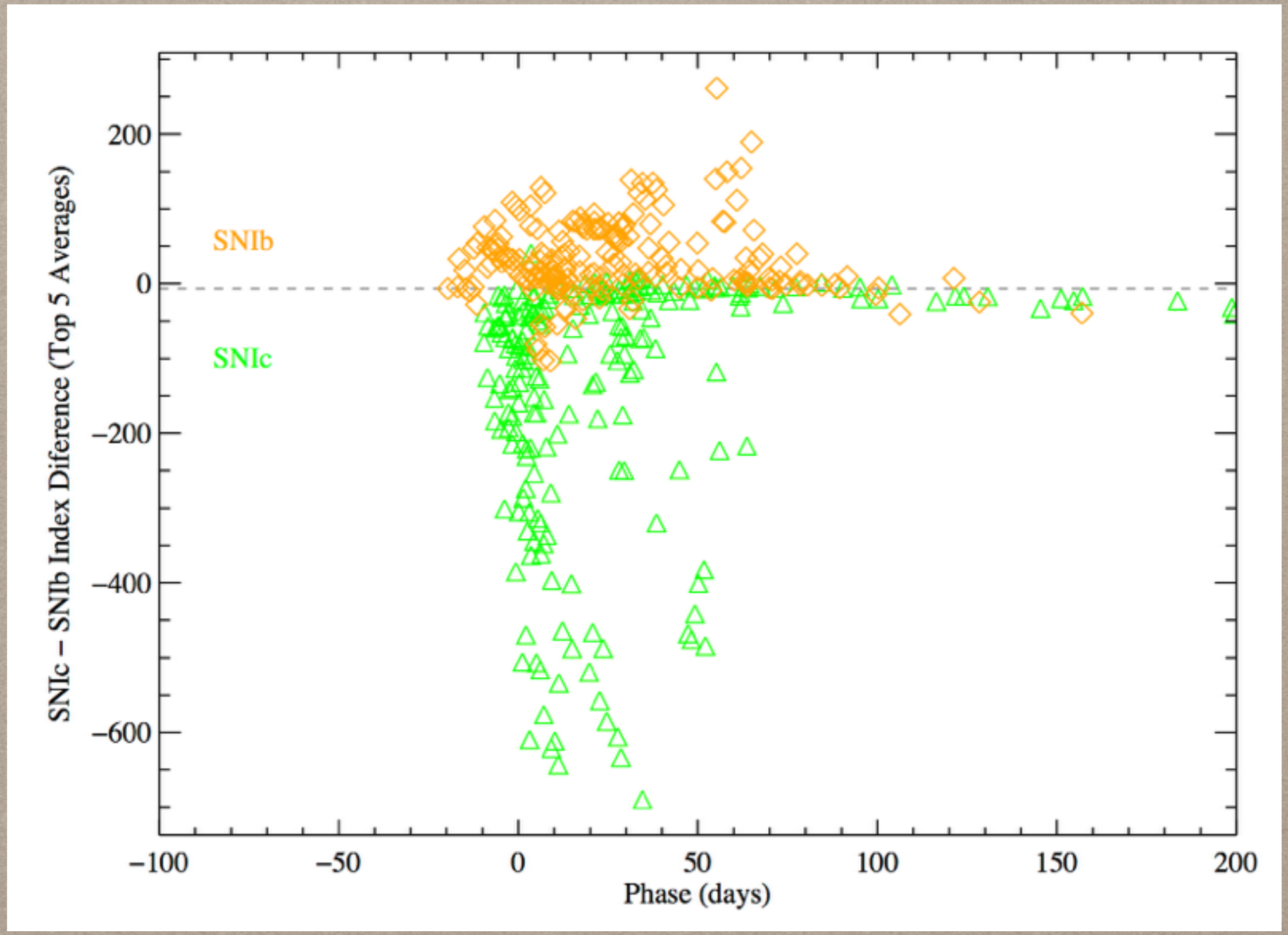


RQ et al. 2011

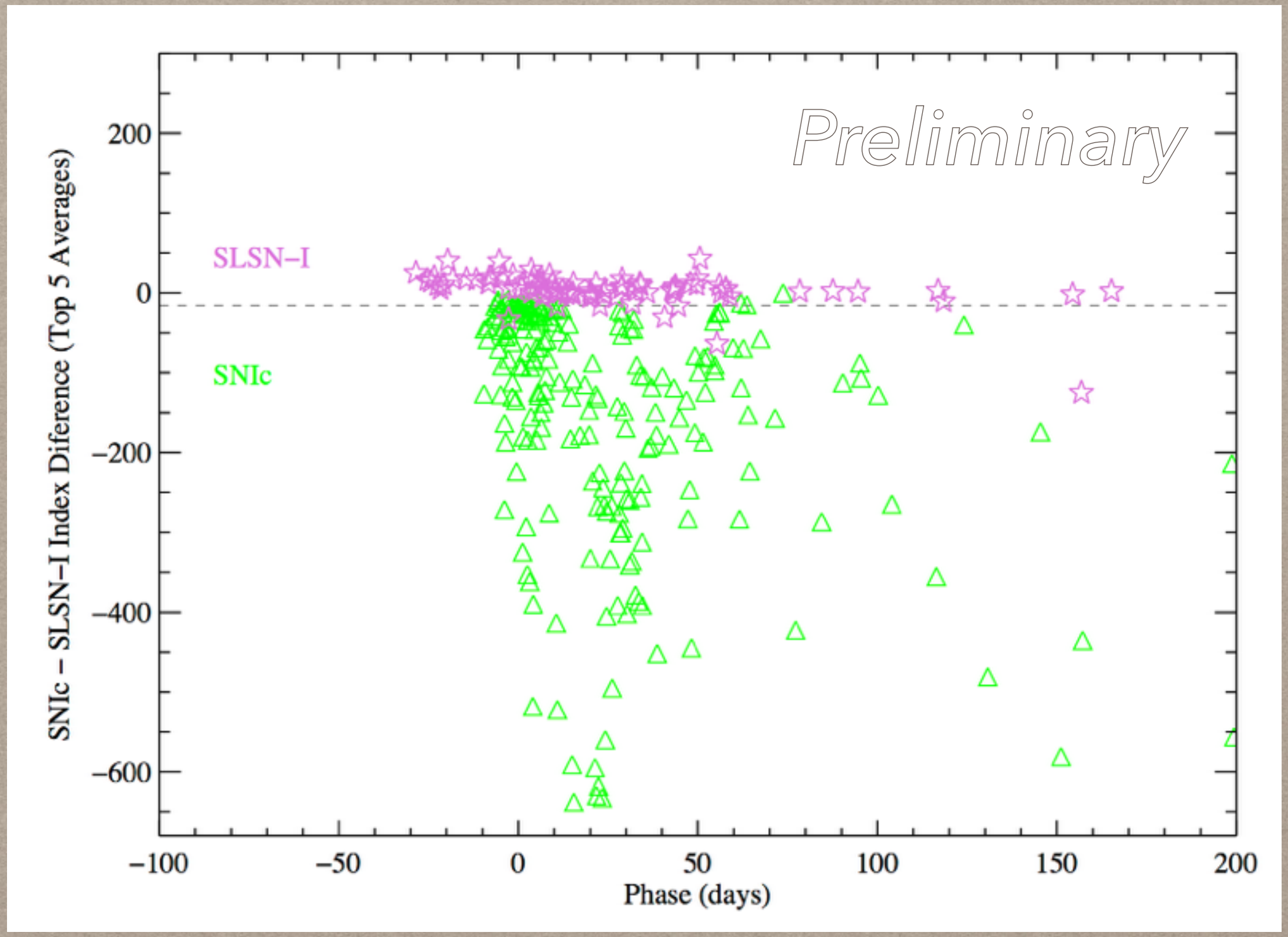
ARE SLSN-I AND SNIC SPECTRA THE SAME?



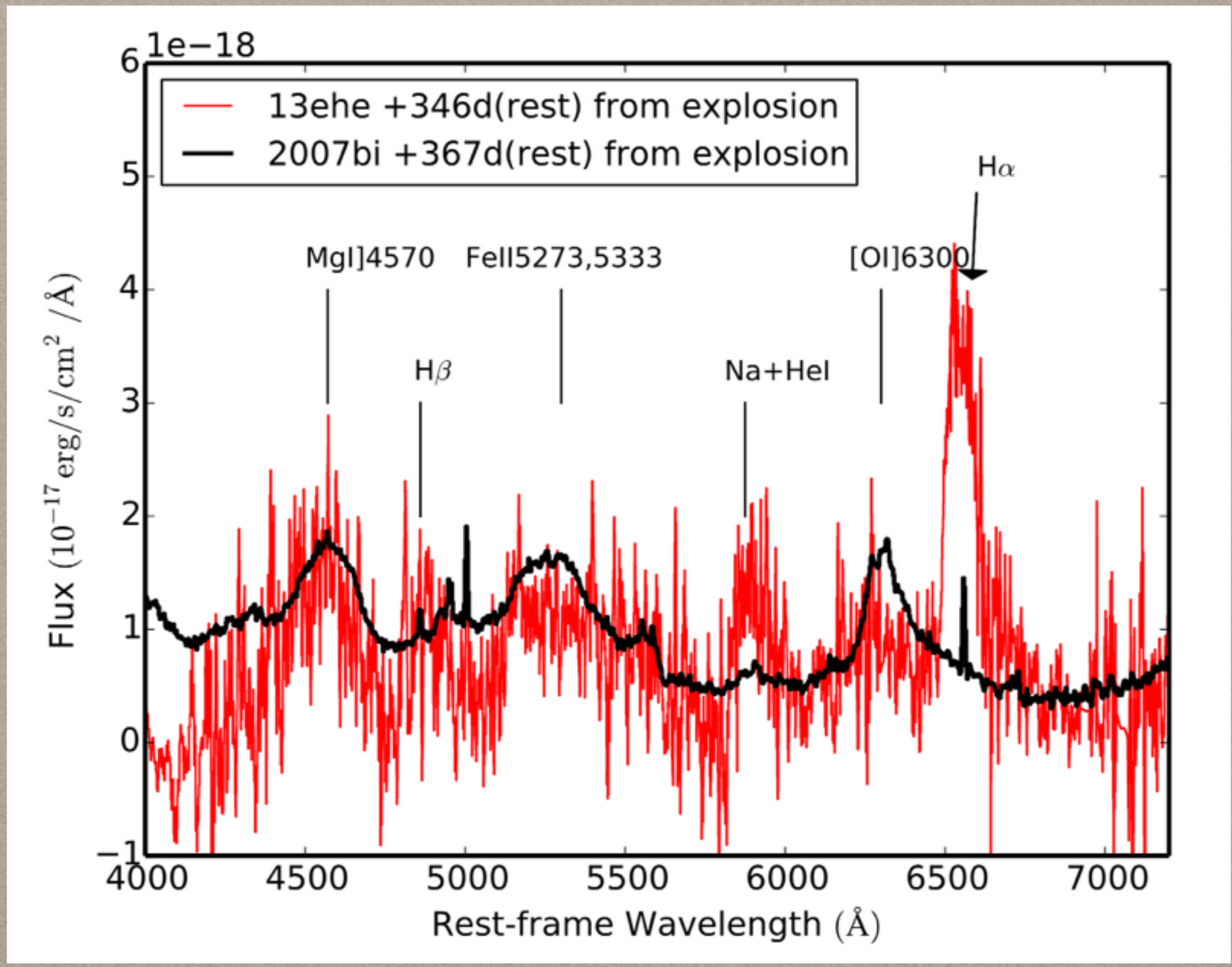
ARE SLSN-I AND SNIC SPECTRA THE SAME?



ARE SLSN-I AND SNIC SPECTRA THE SAME?



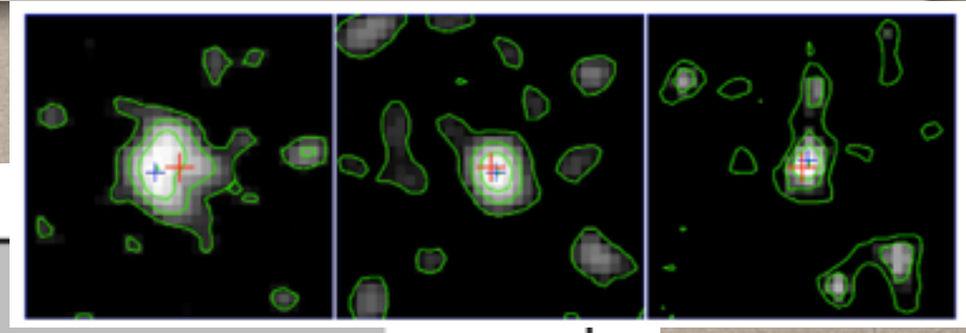
H-POOR, BUT NOT H-FREE

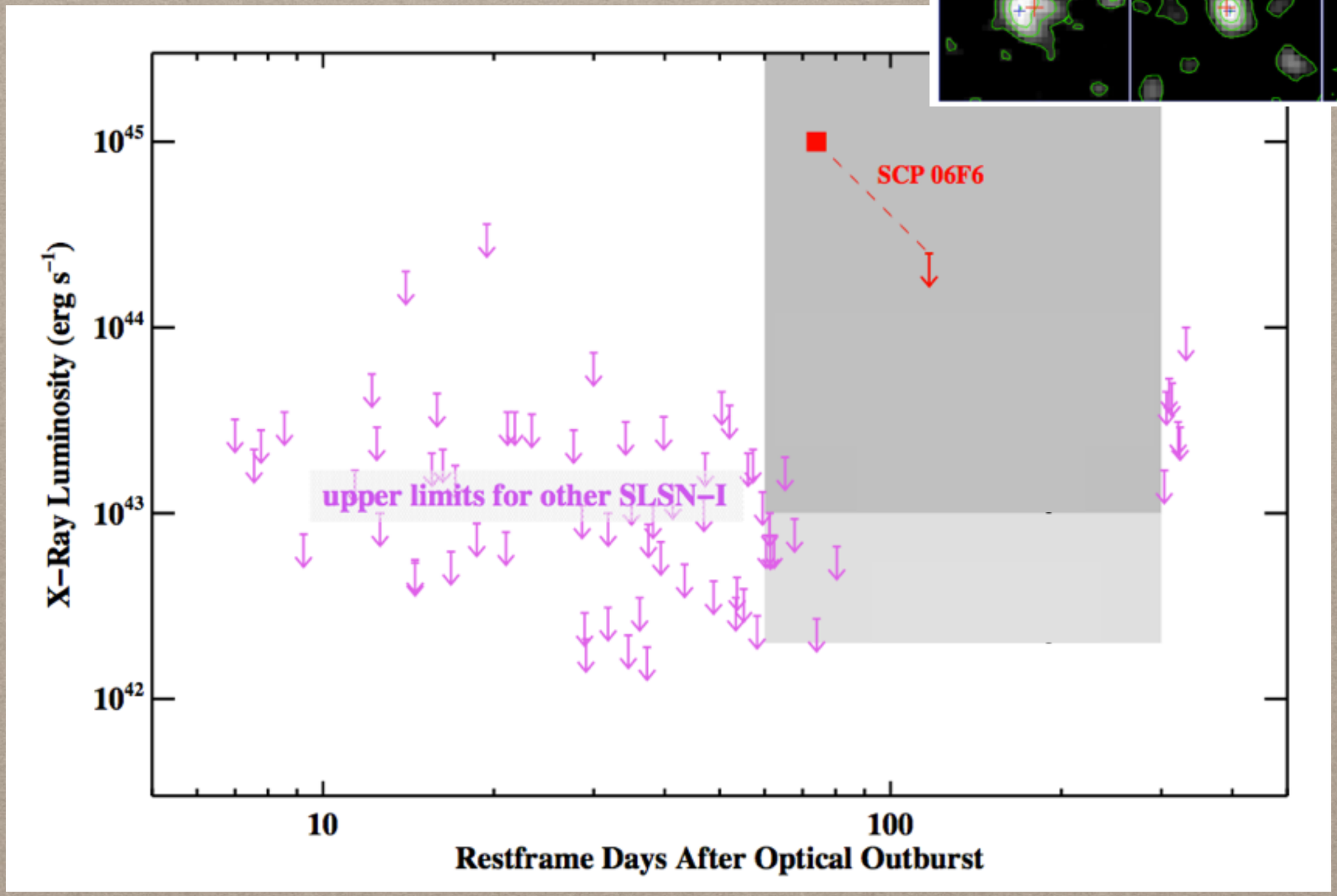


Yan et al. (in prep)

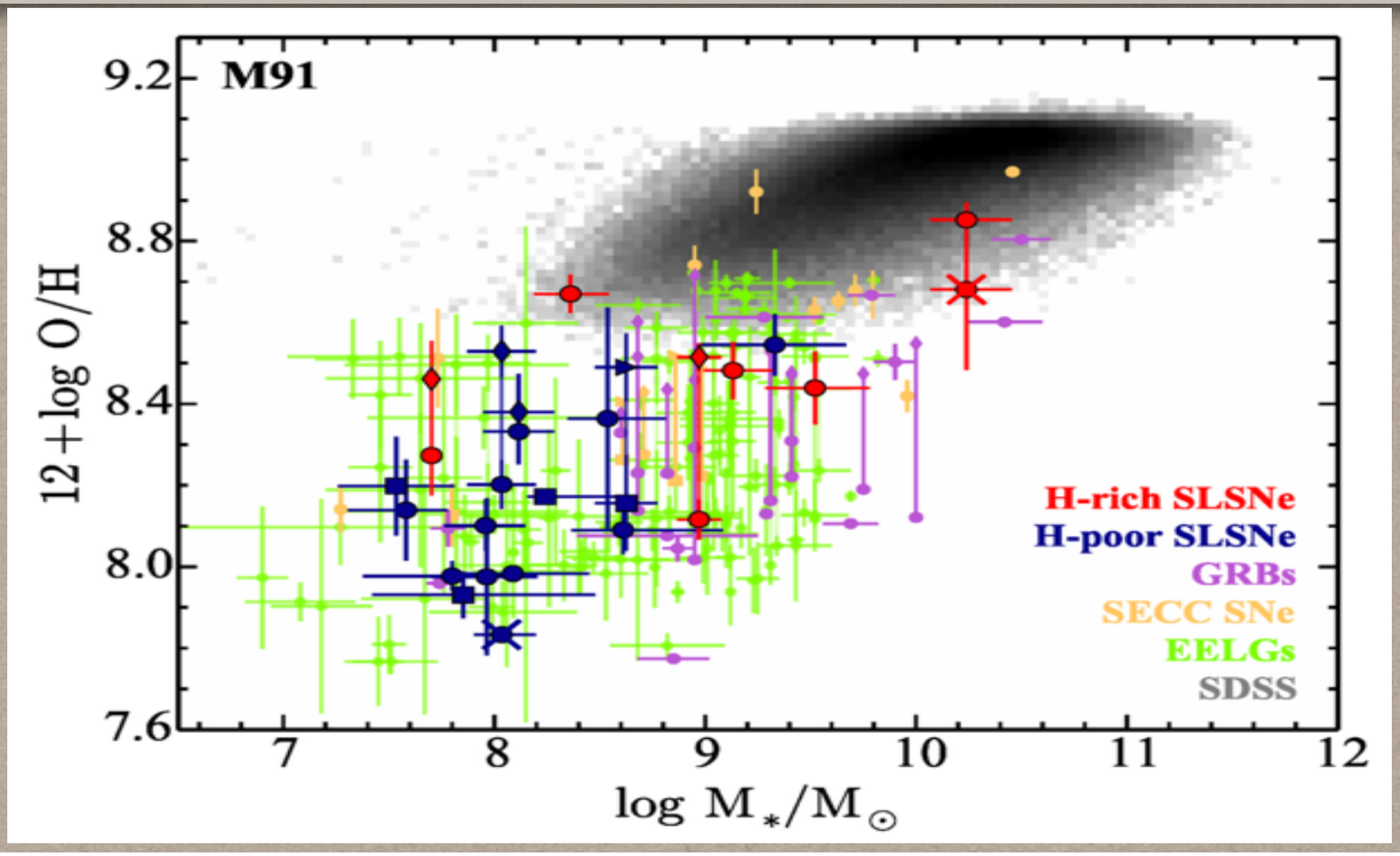
X-RAY FLARES?

see Levan et al. 2013, Metzger et al. 2014

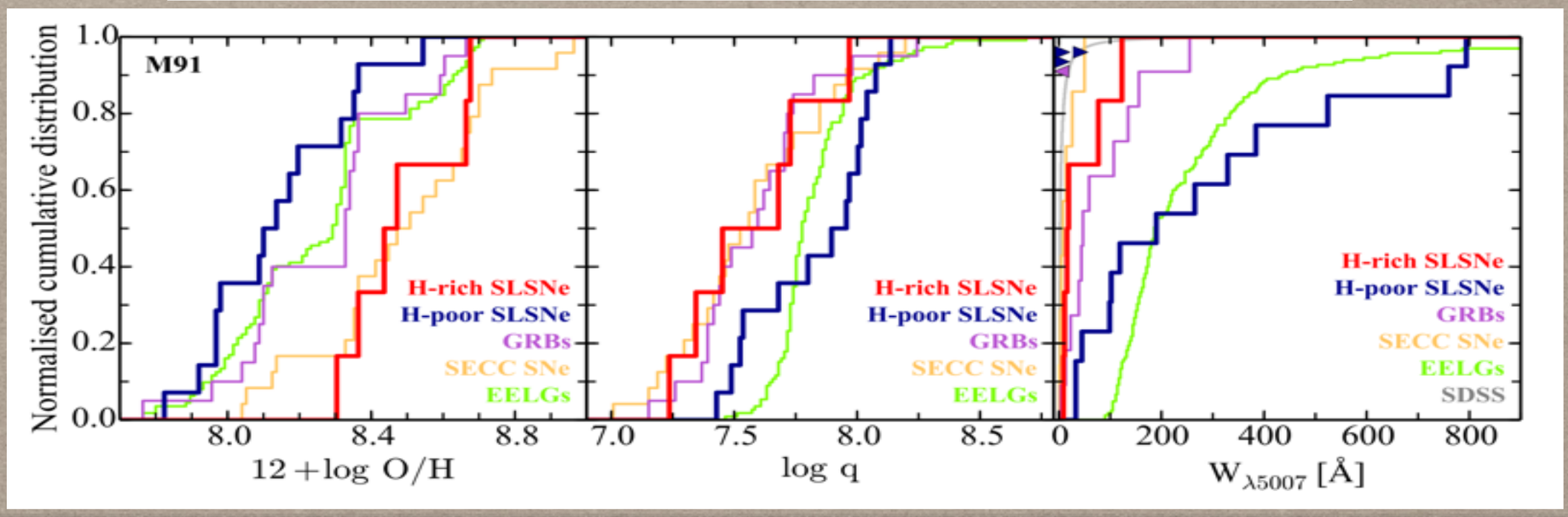




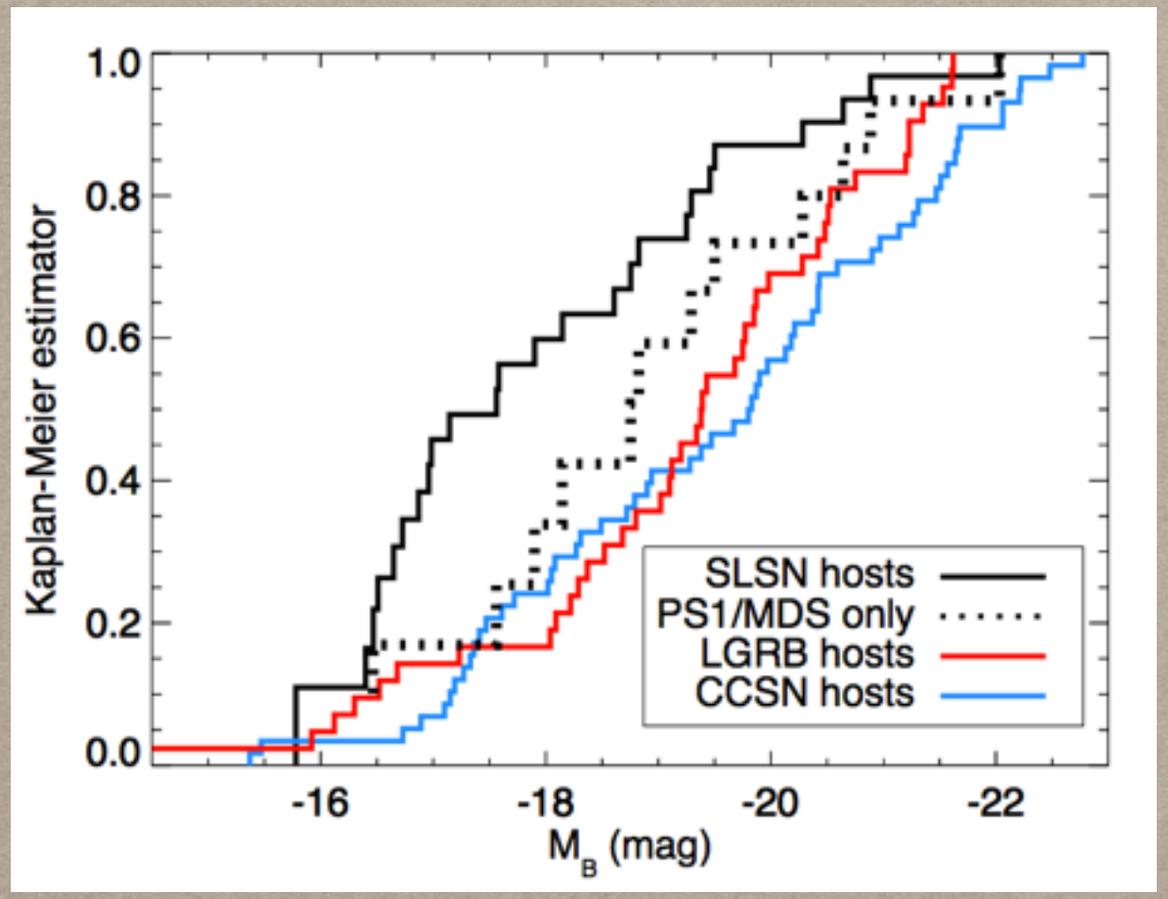
SLSN HOST GALAXIES



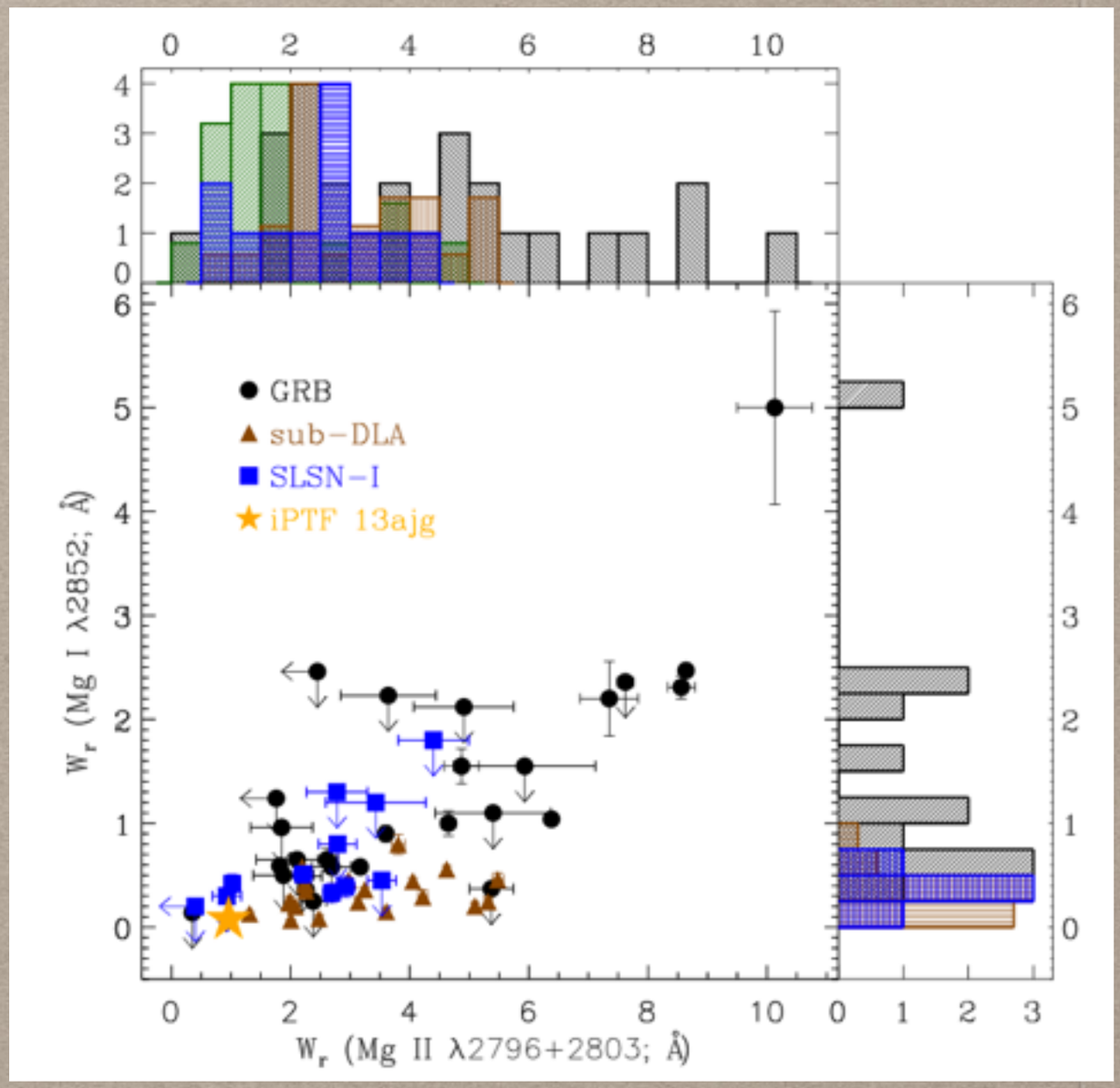
Leloudas et al. 2015



SLSN VS. GRB HOSTS

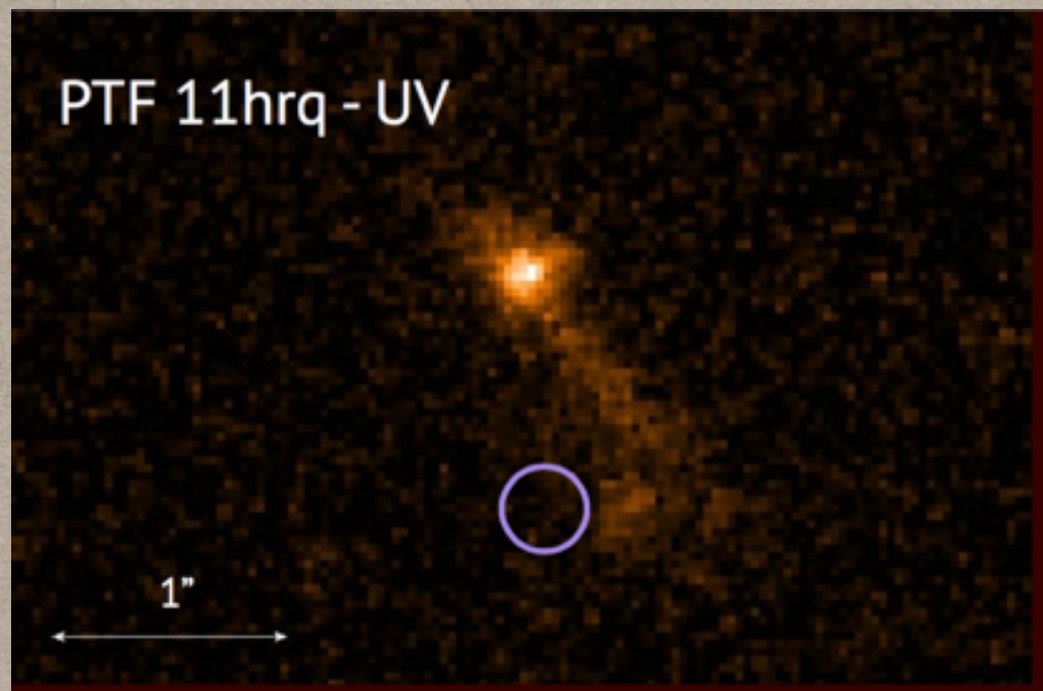


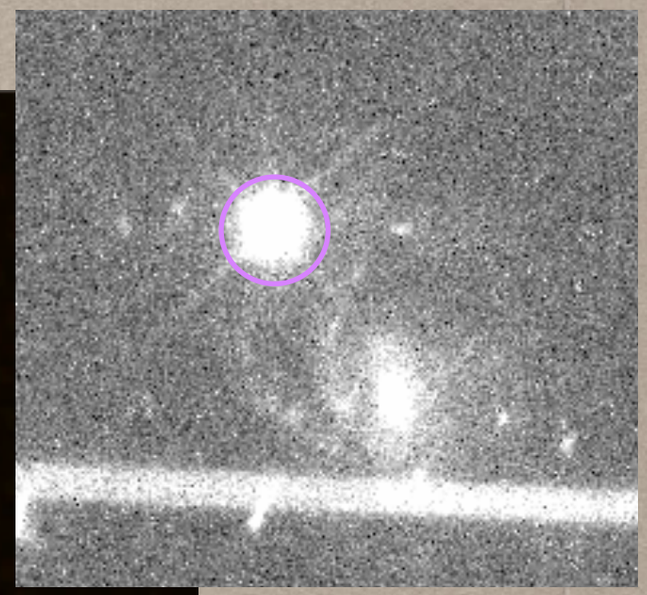
Lunnan et al. 2014

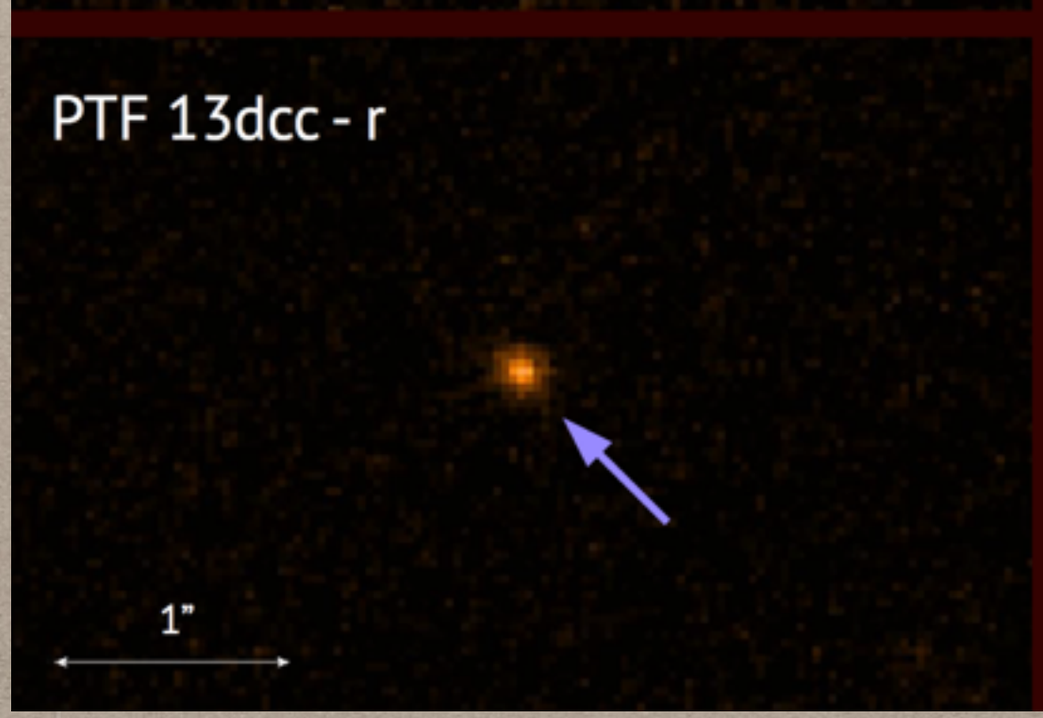


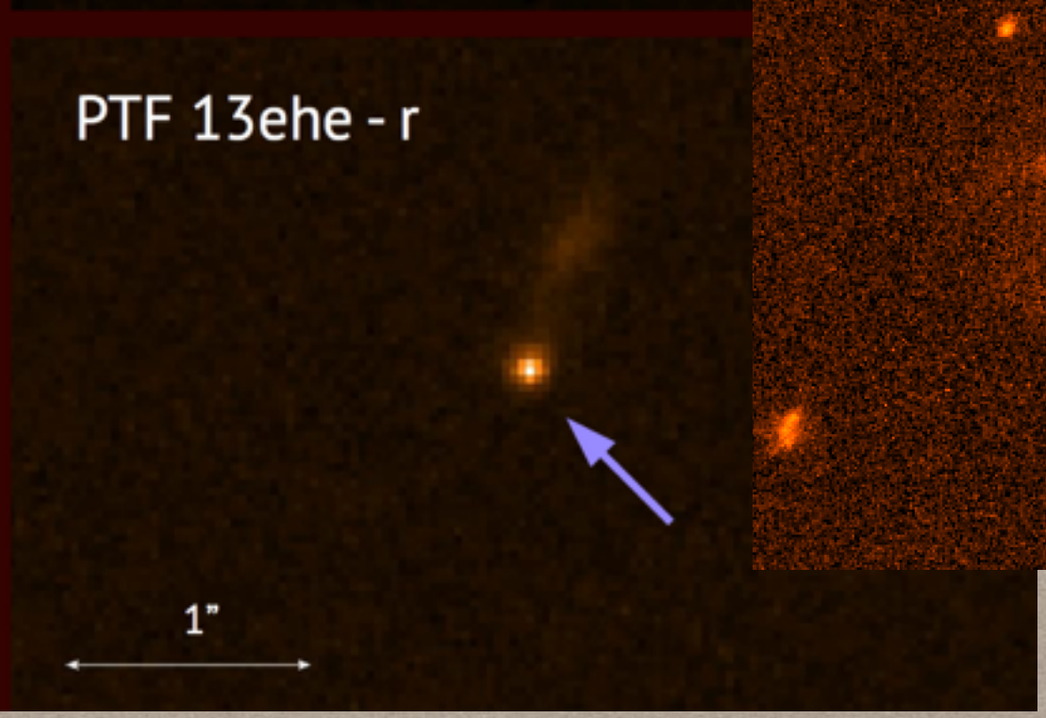
Vreeswijk et al. 2014

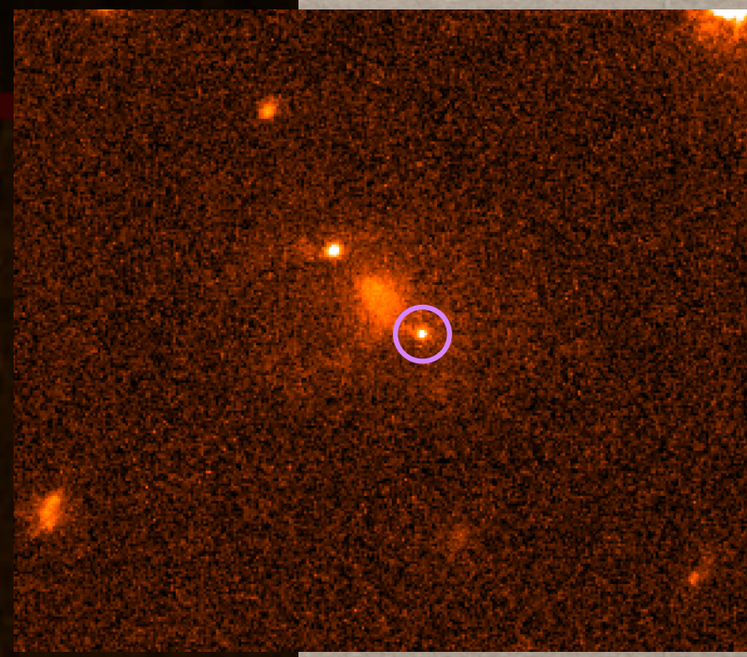
LOCATION, LOCATION, LOCATION









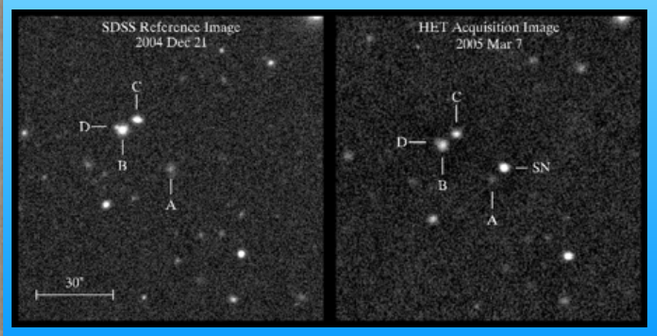


De Cia (in Prep)

SLSN RATES

RQ et al. 2013

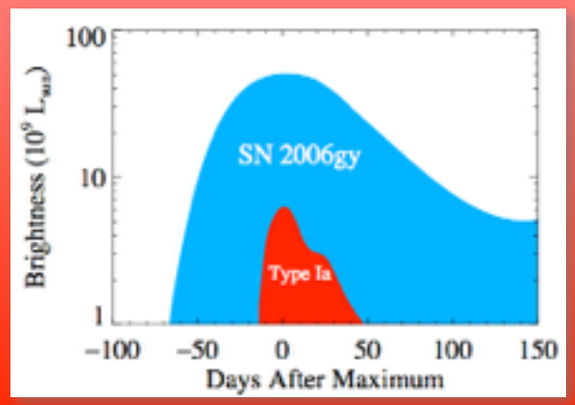
(BASED ON ROTSE-IIIB SAMPLE)



SLSN-I

32^{+77}_{-26} events/Gpc^3/yr

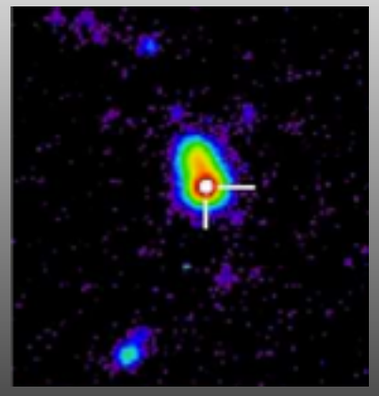
(z~0.17)



SLSN-II

151^{+151}_{-82} events/Gpc^3/yr

(z~0.15)



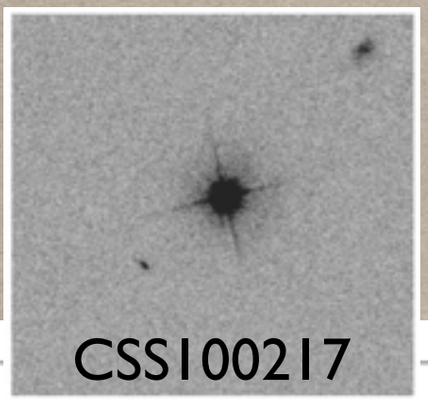
All SLSN-like events

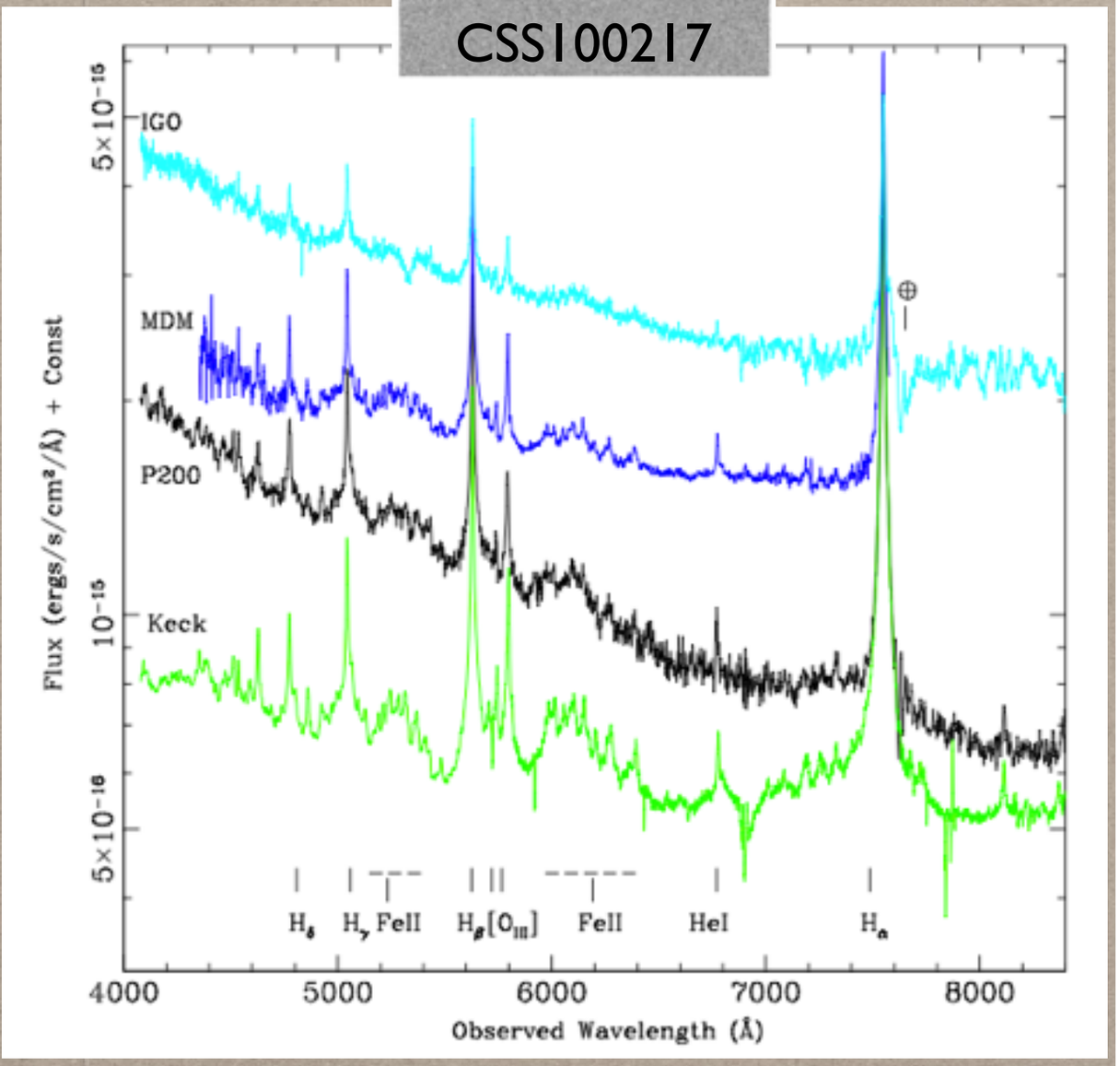
199^{+137}_{-86} events/Gpc^3/yr

(z~0.16)

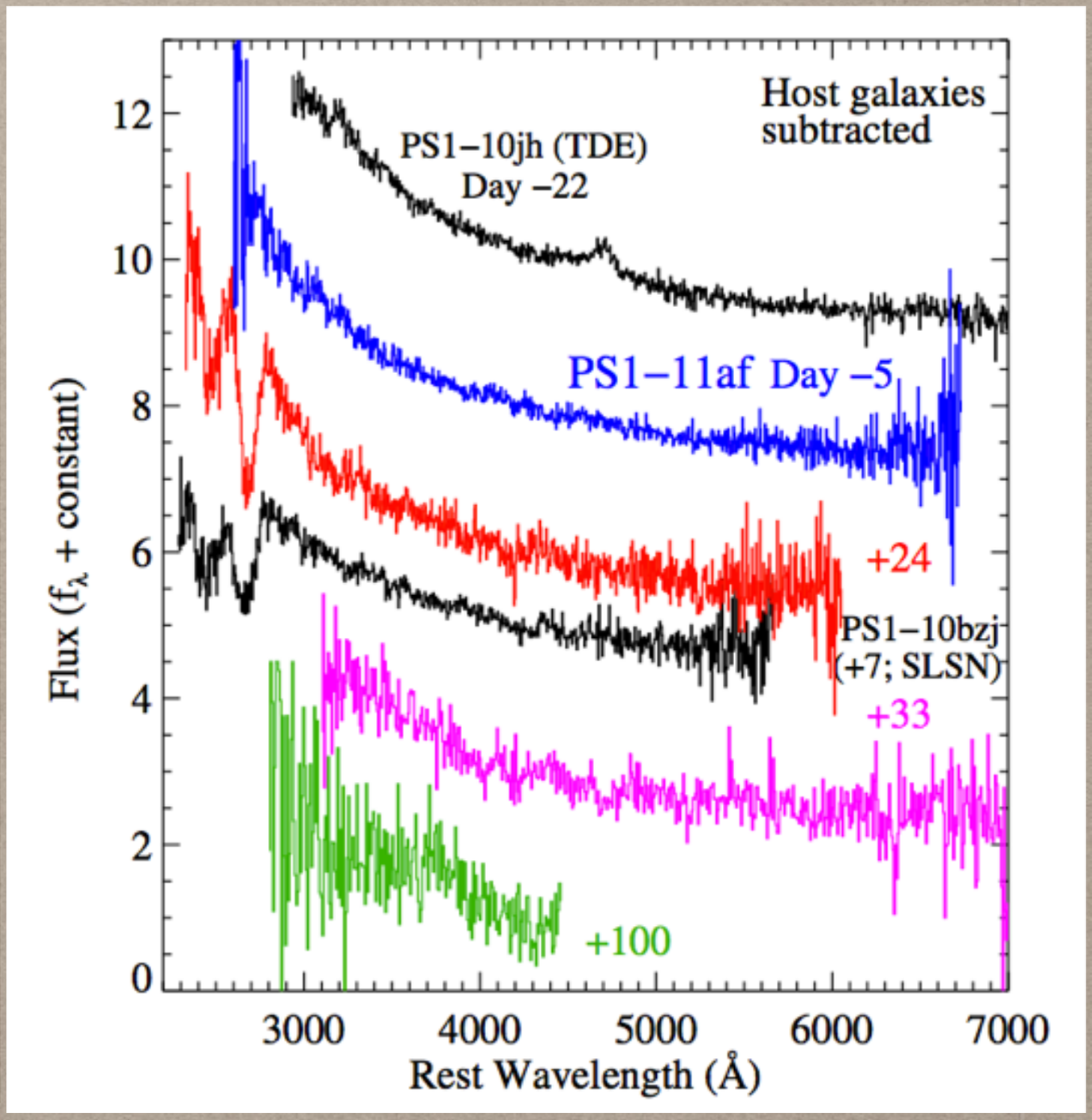
Compare to CCSN: ~10^5 events/Gpc^3/yr and SNIa: ~3×10^4 events/Gpc^3/yr

SLSN IMPOSTERS(?)



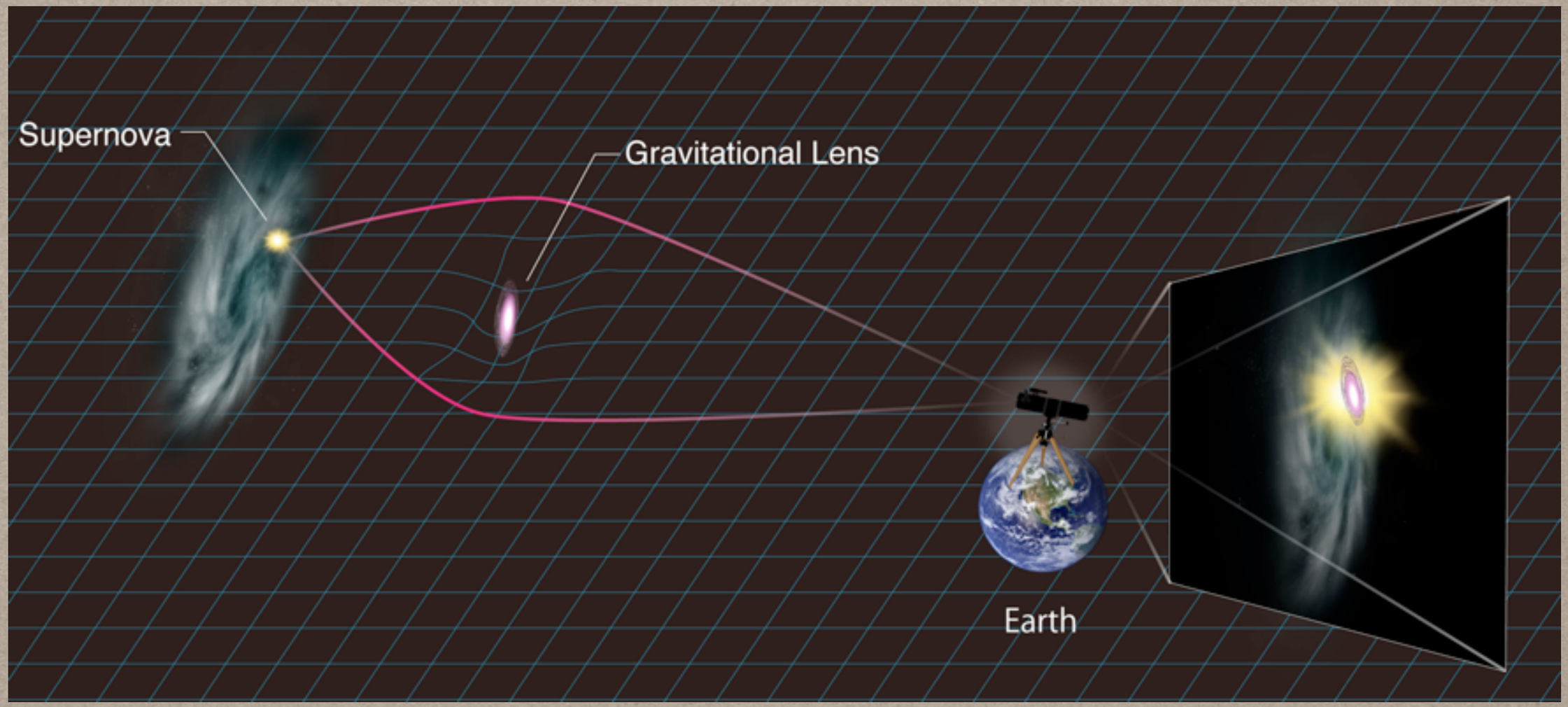


Drake et al. 2011



Chornock et al. 2014

STRONGLY LENSED SN



Normal supernovae seen through strong gravitational lenses may appear "superluminous"

e.g. PS1-10afx; Chornock et al. 2013; RQ et al. 2013, 2014