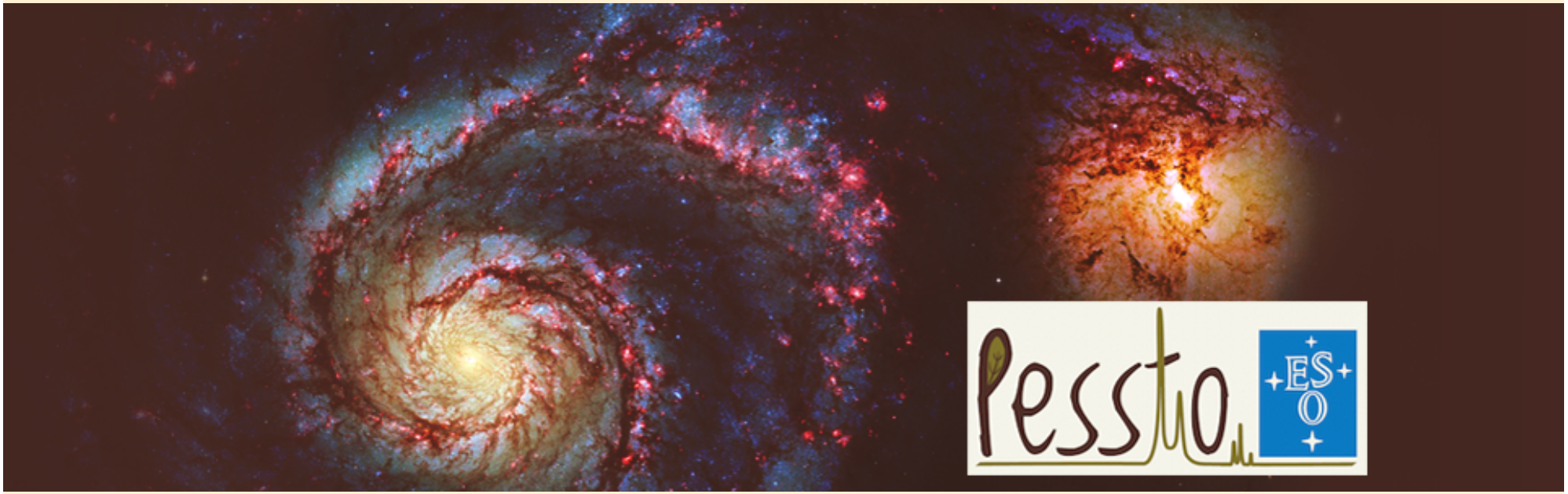
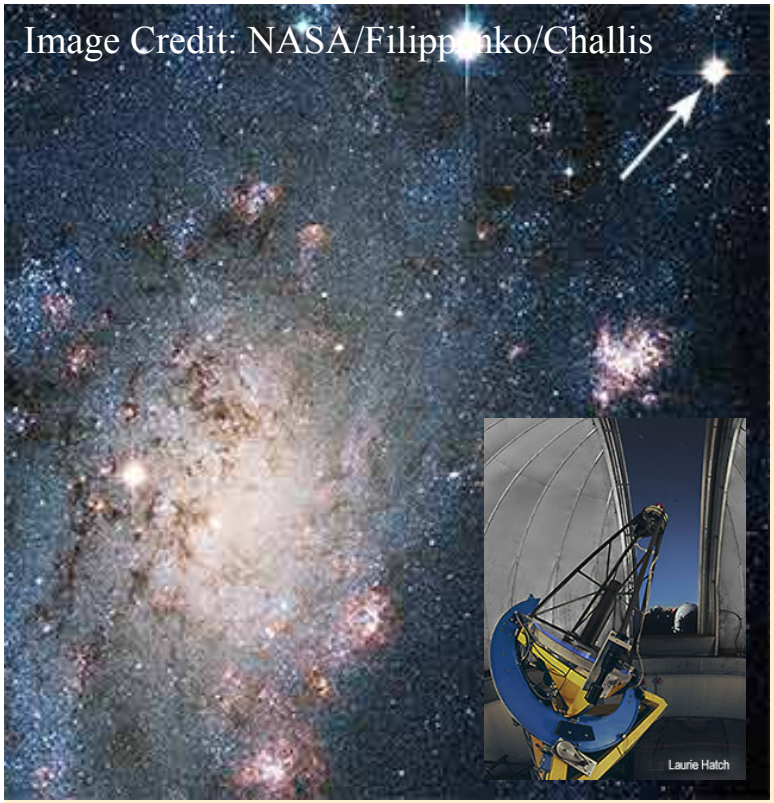


Public ESO Spectroscopic Survey of Transient Objects

www.pessto.org

Stephen Smartt
PI and Survey Director
Queen's University Belfast

PESSTO Meeting II : Garching, Feb 7th-8th 2012



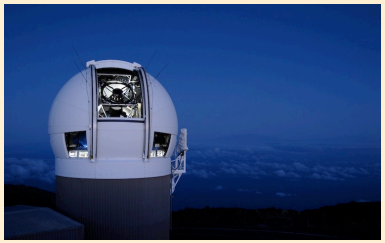
Until Recently :
Nearby SNe discovered by amateur astronomers , and two professional search teams:
North : LOSS (Filippenko & Li)
South : CHASE (Pignata et al.)

Stefano Benetti's ESO Large Programme : "Supernovae and Nucleosynthesis" ; 20 papers published or submitted since 2010

Wide-field synoptic surveys : game changer

10 square degree cameras + 1-2m telescopes

PTF – low-z SNe ("factory" follow-up built in)



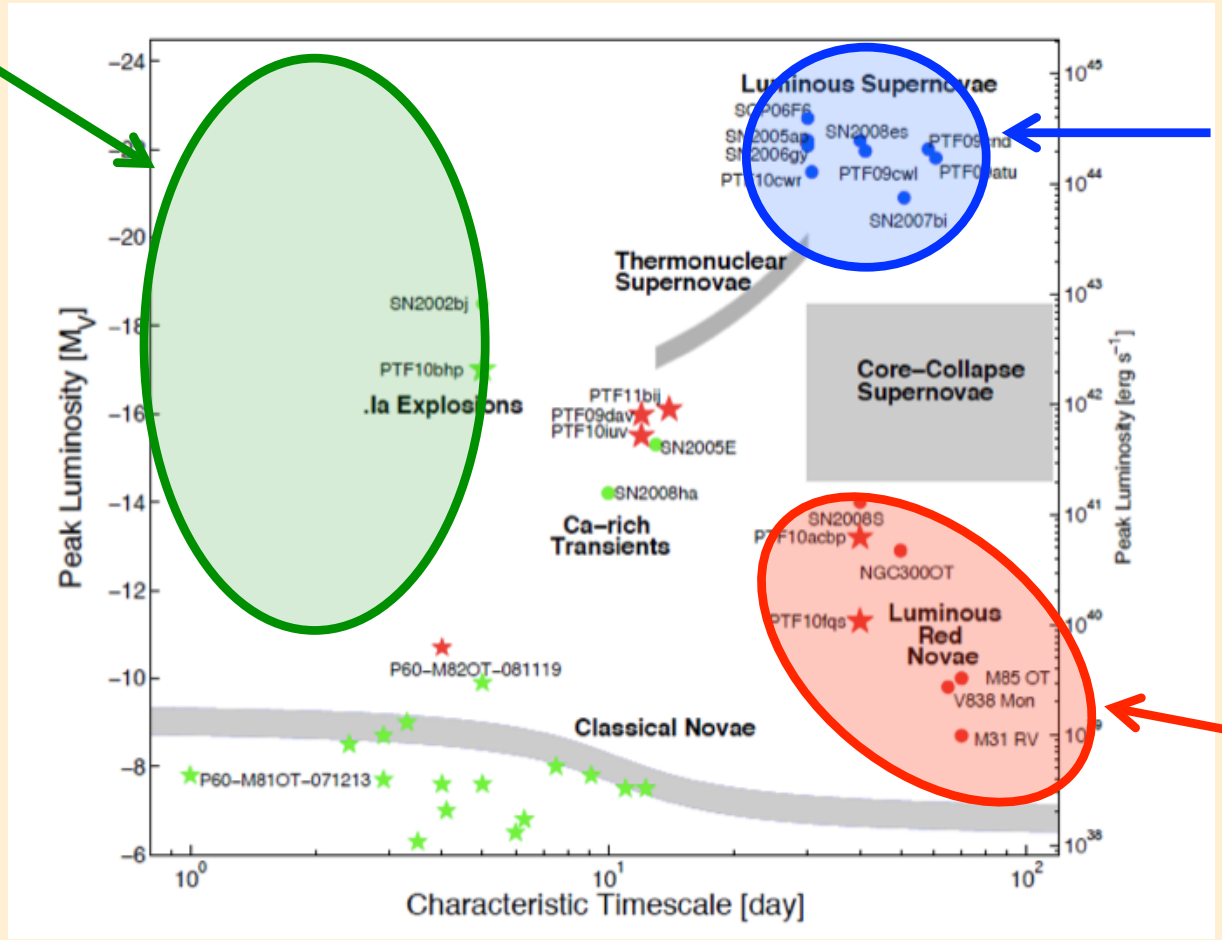
PS1 – high-z SNe (dedicated 4-8m follow-up)

+ Pesstro ESO

La Silla QUEST+ SkyMapper (see Charlie Baltay's talk)

PESSTO Science

the unknown



the bright

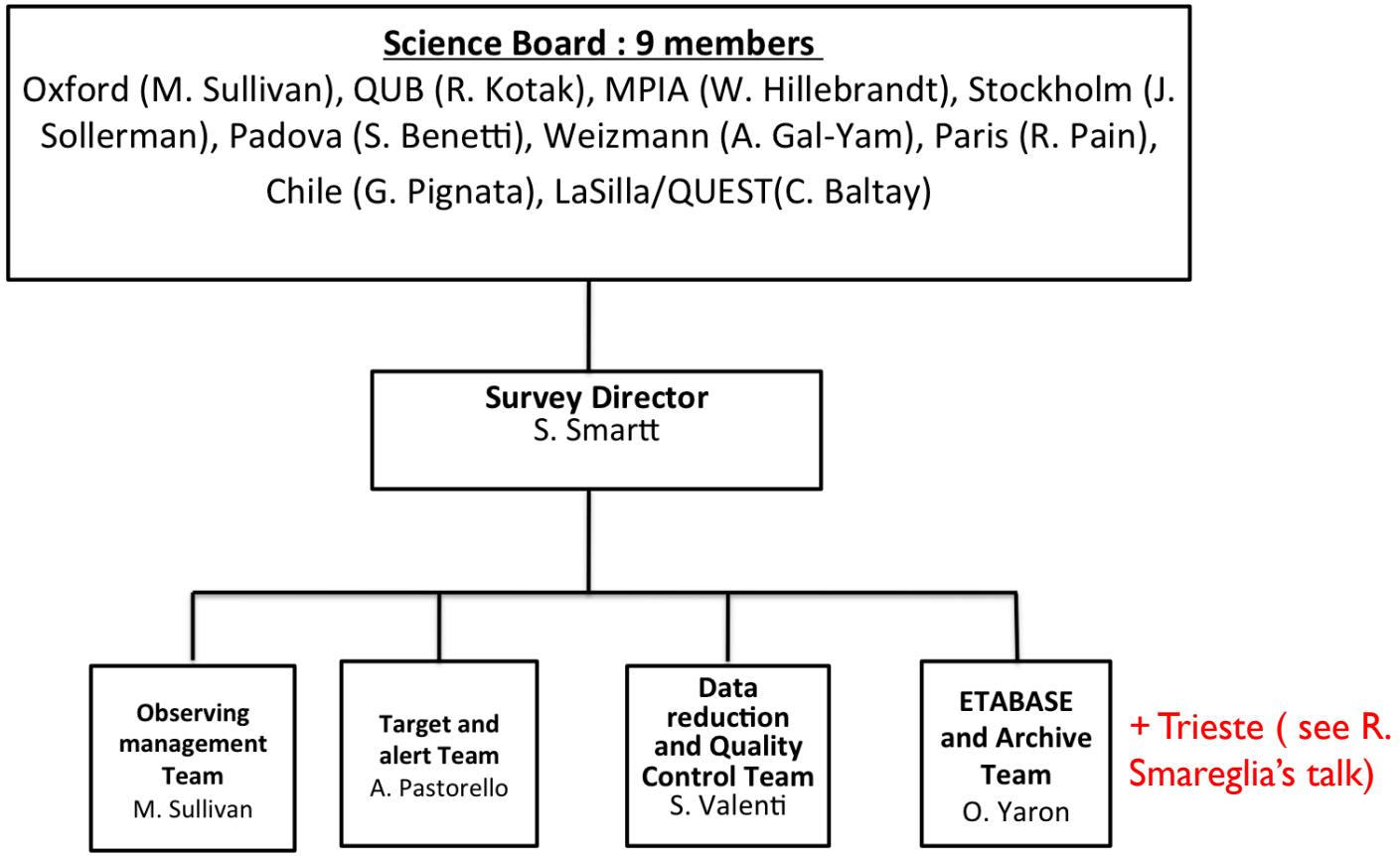
the faint

What are the limits of physical explosions and transients ?

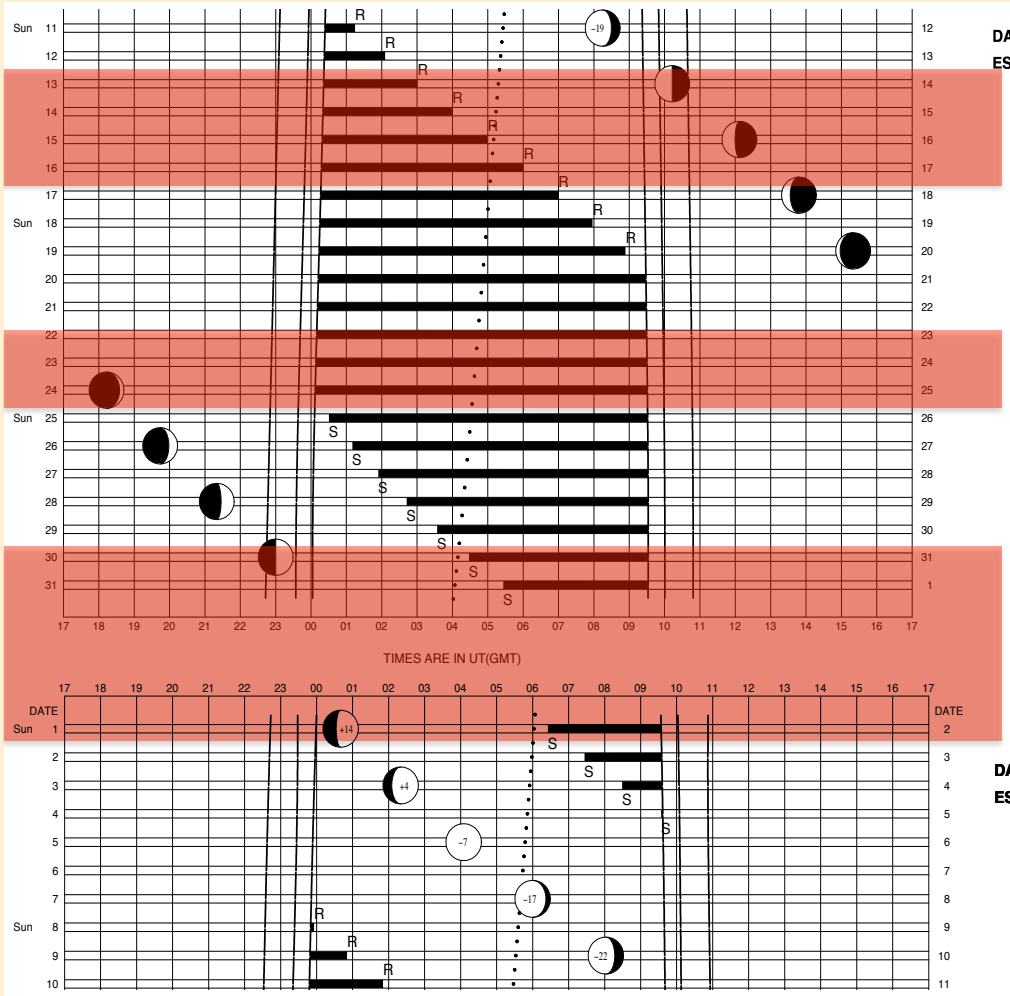
Image credit : Shri Kulkarni, Mansi Kasliwal, CalTech

PESSTO in a Nutshell

- 90n per year : 9 months, 10n per month
- 4 yrs (2012-2015), with 1yr more pending formal NTT review
- EFOSC2 + SOFI : breakdown flexible
- Will classify 2000 SNe – all spectra reduced, classified and released within 24hrs
- Will follow approx 150 with full spectroscopic and photometric time series coverage


Science Board : 9 members
Oxford (M. Sullivan), QUB (R. Kotak), MPIA (W. Hillebrandt), Stockholm (J. Sollerman), Padova (S. Benetti), Weizmann (A. Gal-Yam), Paris (R. Pain), Chile (G. Pignata), LaSilla/QUEST(C. Baltay)
Survey Director
S. Smartt
Observing management Team
M. Sullivan
Target and alert Team
A. Pastorello
Data reduction and Quality Control Team
S. Valenti
ETABASE and Archive Team
O. Yaron
+ Trieste (see R. Smareglia's talk)
Operating team : Survey Director + each of the team leads

Typical lunation – 10n



DAYLIGHT AND MOONLIGHT DIAGRAM **MARCH 2012**
ESO - La Silla
LONGITUDE W 070° 44′
LATITUDE S 29° 15′

Run A1 – grey, last quarter moon. 4 nights

Run A2 – dark moon. 3 nights

Run A3– grey, first quarter moon. 3 nights

DAYLIGHT AND MOONLIGHT DIAGRAM **APRIL 2012**
ESO - La Silla
LONGITUDE W 070° 44′
LATITUDE S 29° 15′

At night, in the shaded region, the Moon is below the horizon; the Moon rises at R and sets at S.
At Moon upper transit, phases including declination near full phase are given.
The dotted line near midnight is LST = 12h. The outer curves are lines of sunset and sunrise.
The inner curves are lines of evening and morning nautical twilight.
The innermost curves are lines of evening and morning astronomical twilight.

Prepared by H.M. Nautical Almanac Office, U.K. Hydrographic Office

Optical Data Products

- EFOSC2 optical spectra
  - "C" (Classification setting) Gr13 : 3685-9315A, 1:00" slit produces 17.7 Å FWHM
  - "B" (Blue Setting) Gr11: 3380-7520A, 1:00" slit produces 13Å FWHM
  - "R" (Red Setting) Gr16 : 6015-10320A, 1:00" slit produces 13Å FWHM
  - Classification target range : $r < 19.5^m$ (*S/N in continuum > 20)*

Exp. Time	Mag	Continuum S/N (C)
1200s	19.5	18

1200s exposure means 1800s OB

NIR Data Products

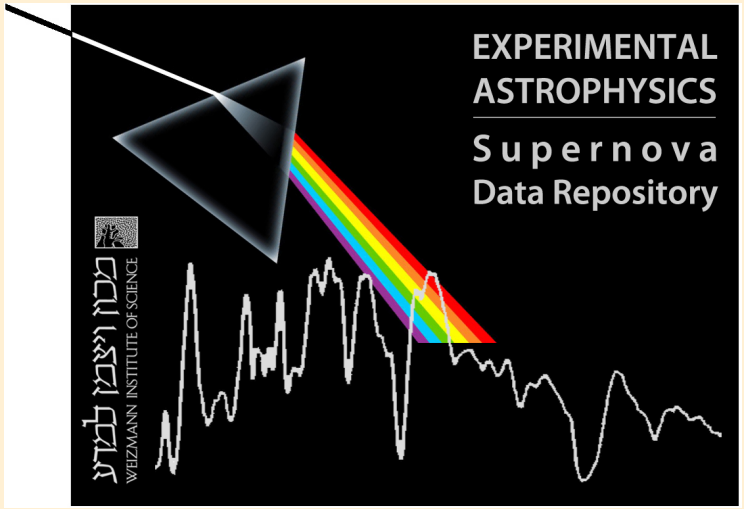
- SOFI imaging : *JHK* for selected targets
- SOFI spectra for selected targets :
  - Blue Grism : 0.93-1.67µm
  - Red Grism : 1.50-2.50µm
  - Target range : *14 < H* < 17 (50 > *S/N in continuum > 20)*

- NIR for approximately half the targets (maybe less), with half the half the frequency
- 18% of PESSTO for SOFI means 1.5N during a lunation
- Cadence of 15 days (± 5d)

10 optical spectra for ~150 transients, cadence of 1-10d
NIR for half, half the frequency

What's new and public ?

- Direct link and partnership with feeder surveys – aiming to find the extremes, quickly
- Commitment to release *classified* spectra within 24hrs of end of night
- Released rapidly and reliably through WISeREP



Leading global repository for public supernova spectra

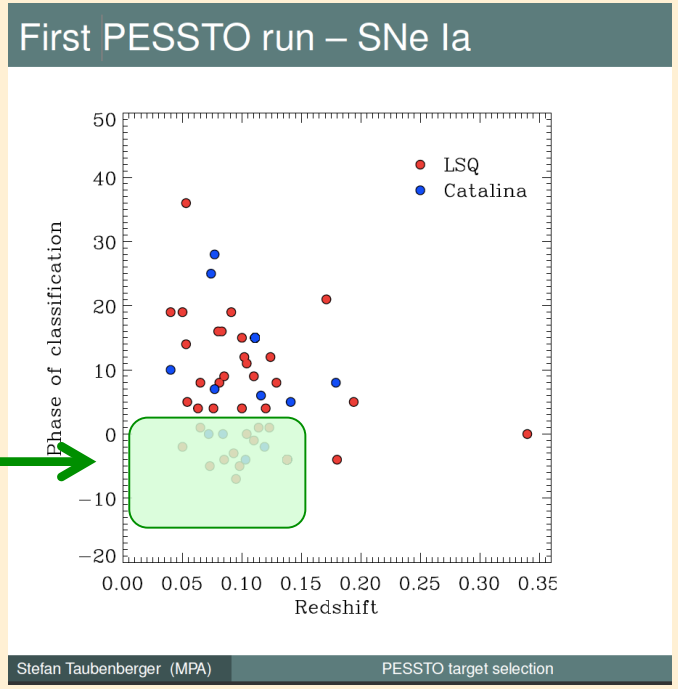
All raw data available immediately in ESO archive

+ Full reduced, and intermediate data products @IA2, Trieste

PESSTO pipeline

- Fully automated *python/pyraf* pipeline (S. Valenti (INAF, Padova) : Flux calibrated spectra in seconds when at NTT
- Full reduction of all optical, NIR spectra and imaging, ESO Phase 3 compatible, at end of month

PESSTO goal : discover, classify, target for follow-up.
Speed and classification accuracy key. Automated pipeline essential

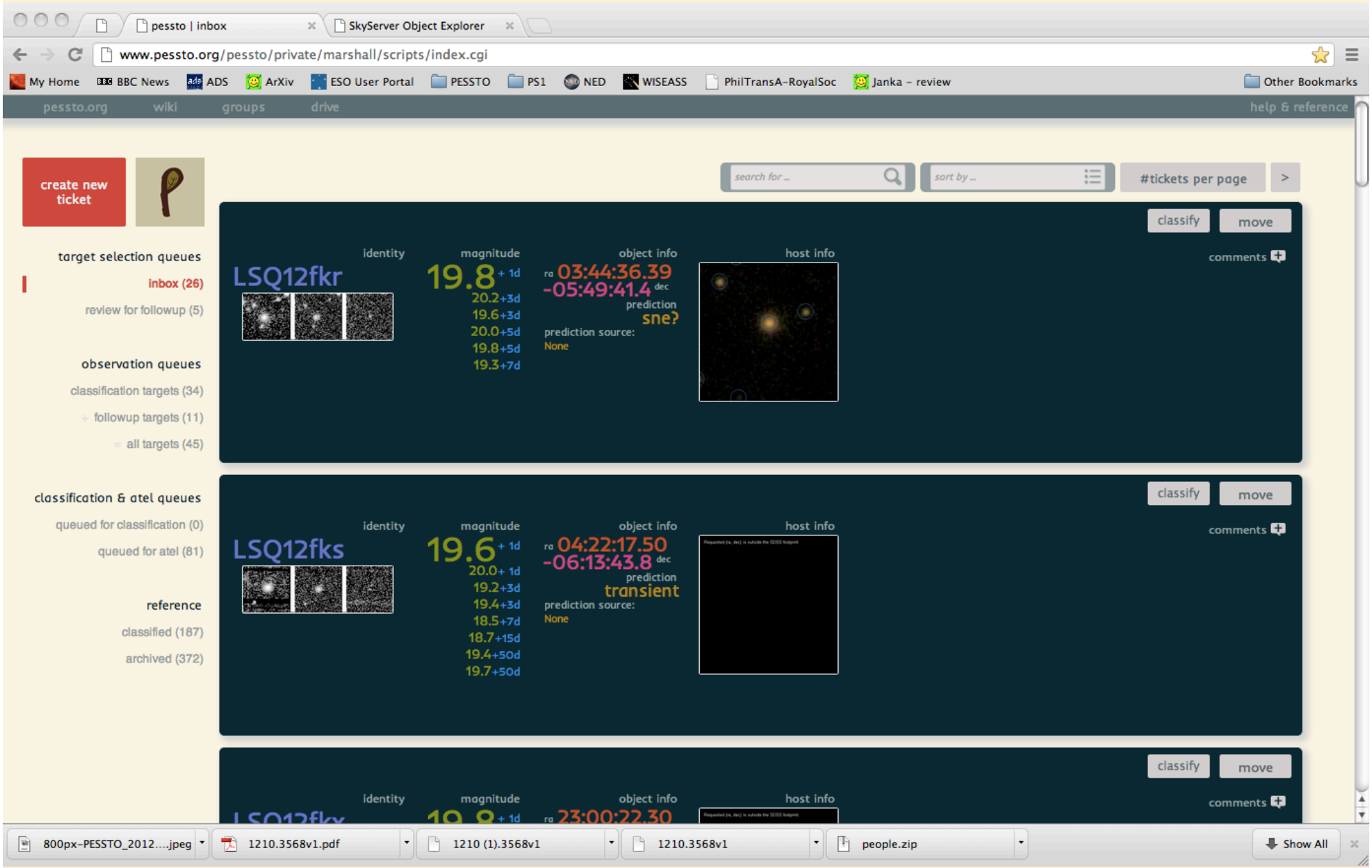


Status and Lessons learned

Key Software :

1. The PESSTO Marshall : live database, editable webpages, user interface, automatic pull of targets from surveys (see R. Smareglia's talk)
2. The PESSTO Pipeline : EFOSC2 , SOFI. PhIII compatible with "ESO External Data products standards"

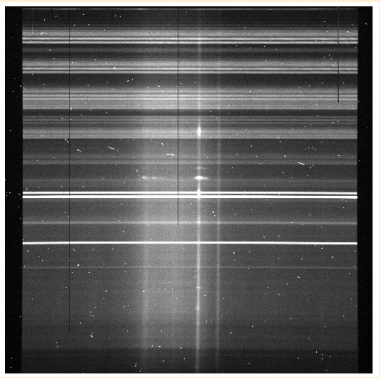
Stefano Valenti (Padova/INAF),
Dave Young (QUB)


pessto | inbox
SkyServer Object Explorer
www.pessto.org/pessto/private/marshall/scripts/index.cgi
My Home
BBC News
ADS
ArXiv
ESO User Portal
PESSTO
PS1
NED
WISEASS
PhilTransA-RoyalSoc
Janka - review
Other Bookmarks
pessto.org
wiki
groups
drive
help & reference
create new ticket
search for ...
sort by ...
#tickets per page
>
target selection queues
inbox (26)
review for followup (5)
observation queues
classification targets (34)
followup targets (11)
all targets (45)
classification & atel queues
queued for classification (0)
queued for atel (81)
reference
classified (187)
archived (372)
classify
move
comments
identity
magnitude
object info
host info
LSQ12fkr
19.8 + 1d
20.2+3d
19.6+3d
20.0+5d
19.8+5d
19.3+7d
ra 03:44:36.39
-05:49:41.4 dec
prediction
sne?
prediction source:
None
LSQ12fks
19.6 + 1d
20.0+ 1d
19.2+3d
19.4+3d
18.5+7d
18.7+15d
19.4+50d
19.7+50d
ra 04:22:17.50
-06:13:43.8 dec
prediction
transient
prediction source:
None
Requested (ra, dec) is outside the SDSS footprint
LSQ12fkx
19.8 + 1d
ra 23:00:22.30
800px-PESSTO_2012....jpeg
1210.3568v1.pdf
1210 (1).3568v1
1210.3568v1
people.zip
Show All

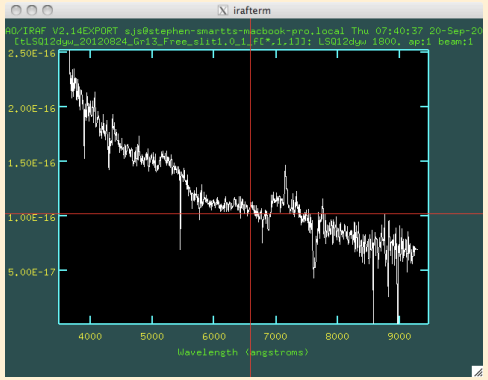
Lessons Learned

- Essential toolkit for observers and data reduction team : PESSTO Pipeline and SNID/Gelato

Observers:



➔



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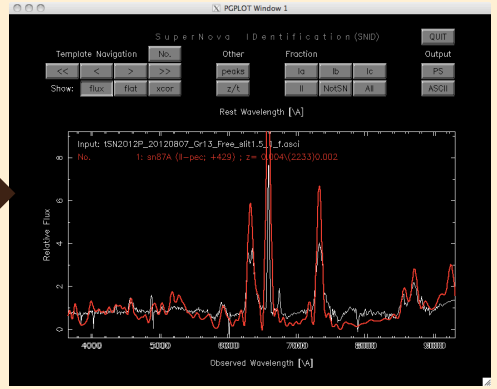
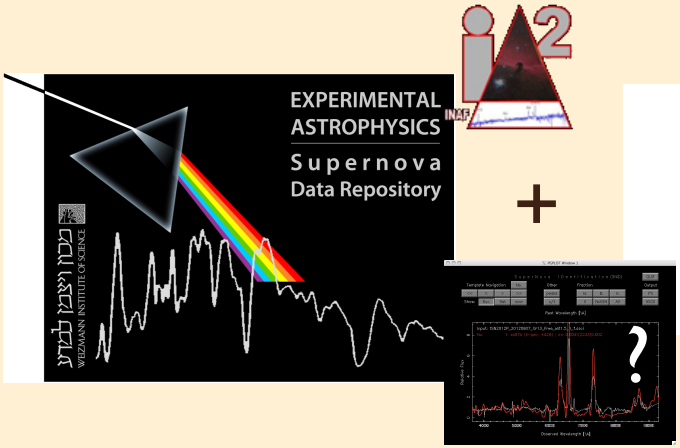


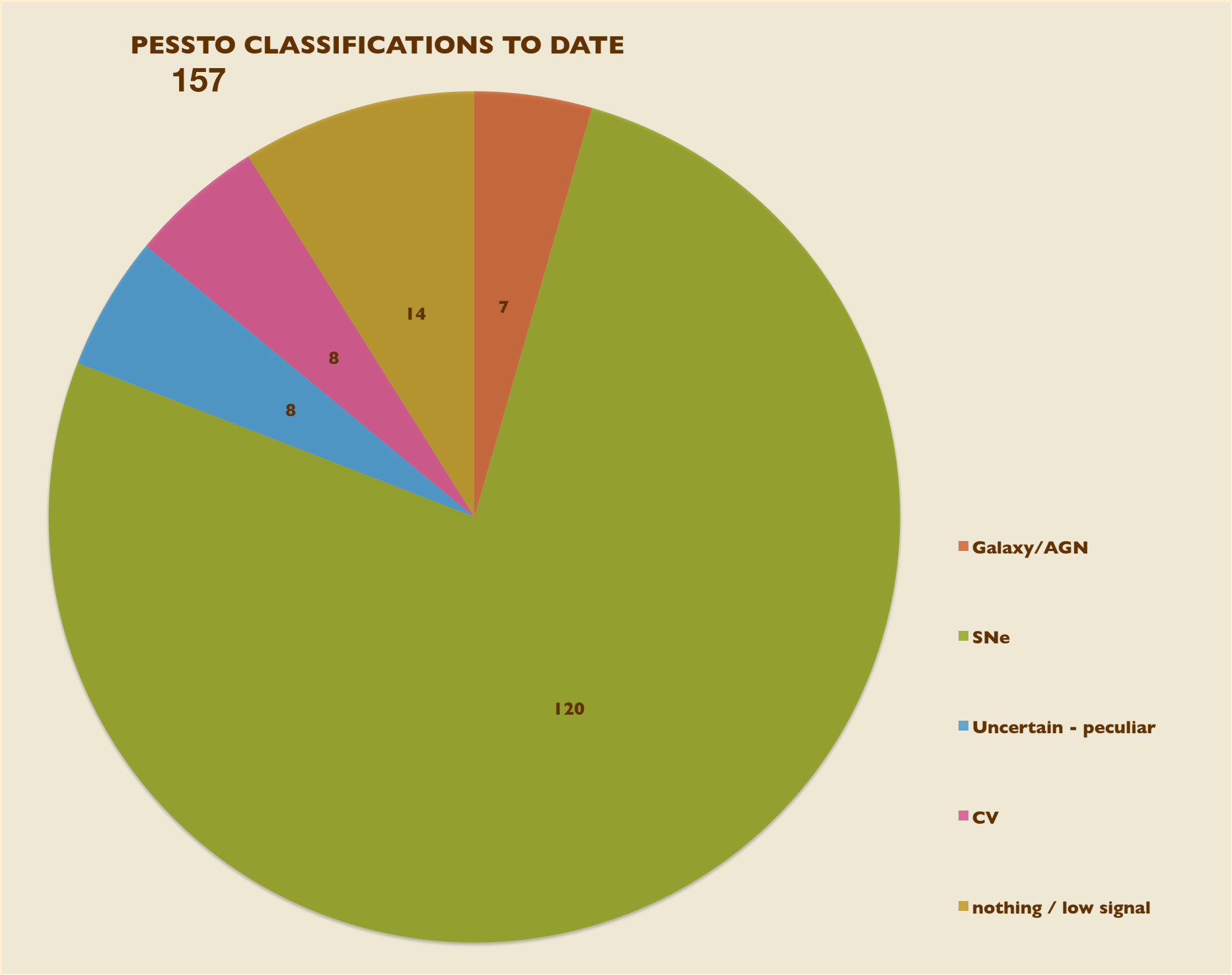
Data Team:

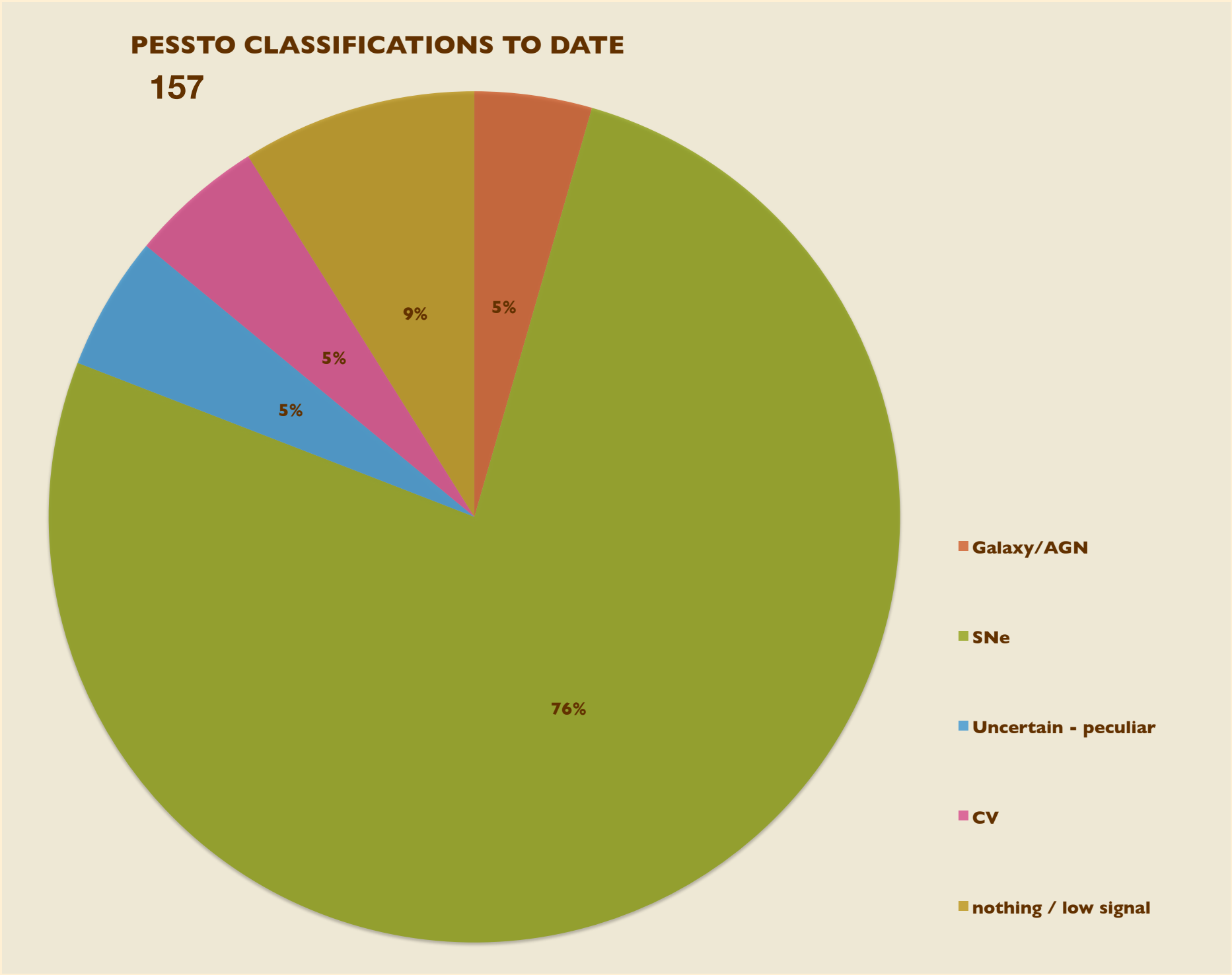


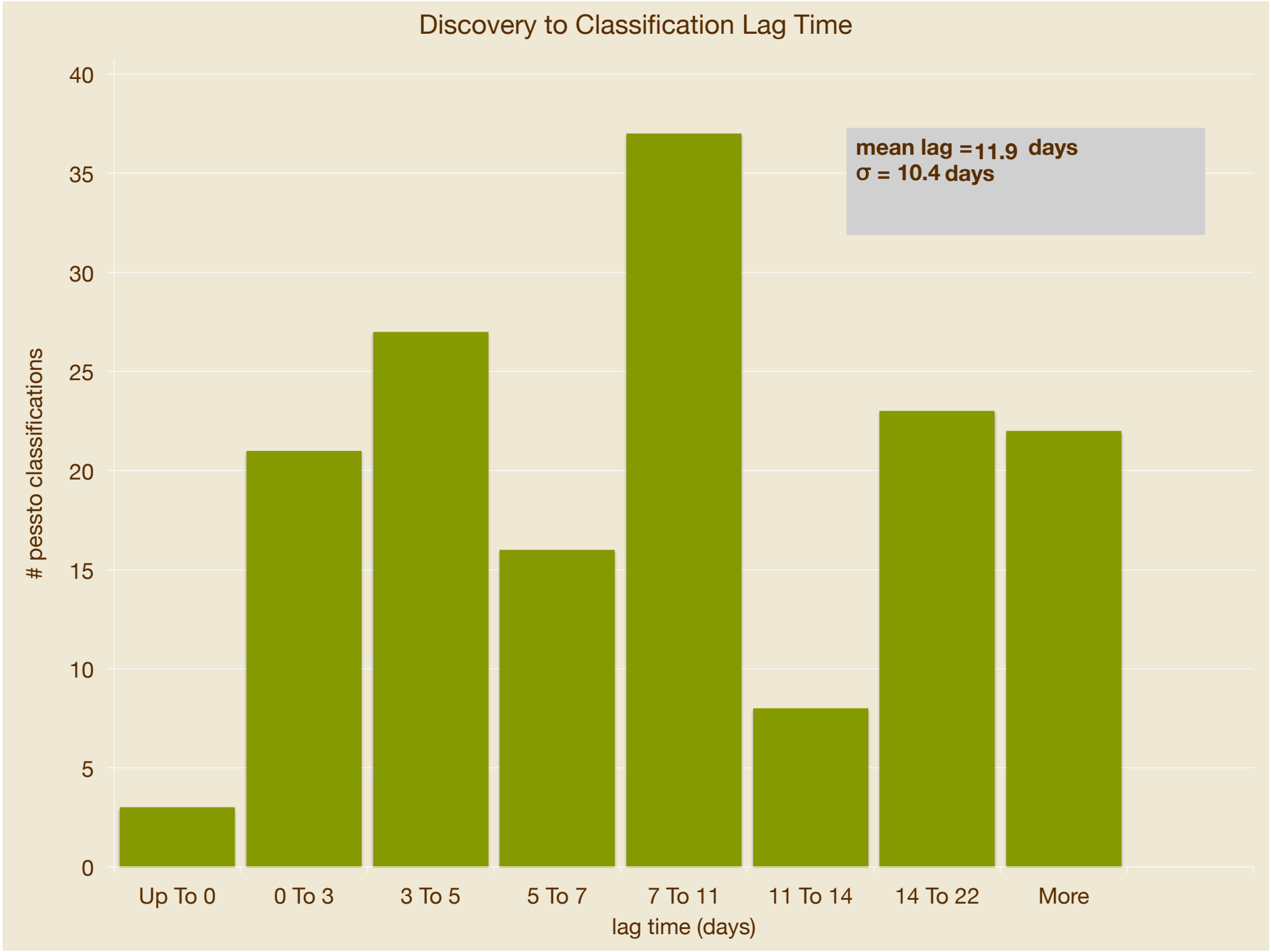
+

Lesson's Learned - OBs

- There is very little support on La Silla – we support ourselves (via PESSTO Handbook)
- Standard OBs are major help – define what the observers should do. Avoids mistakes in setup
- OBs (calibrations) must be tied to what the PESSTO pipeline needs
- No need to redesign calibrations, standards, setups. Just get the OBs


PESSTO CLASSIFICATIONS TO DATE
157
7
120
8
8
14
Galaxy/AGN
SNe
Uncertain - peculiar
CV
nothing / low signal


PESSTO CLASSIFICATIONS TO DATE
157
5%
76%
5%
5%
9%
Galaxy/AGN
SNe
Uncertain - peculiar
CV
nothing / low signal


Discovery to Classification Lag Time
mean lag = 11.9 days
σ = 10.4 days
pessto classifications
0
5
10
15
20
25
30
35
40
Up To 0
0 To 3
3 To 5
5 To 7
7 To 11
11 To 14
14 To 22
More
lag time (days)

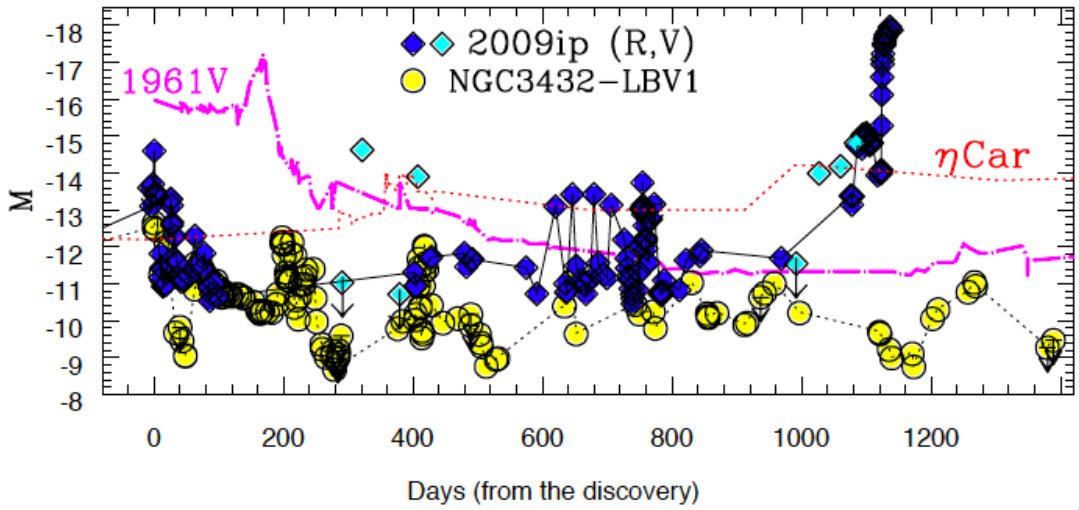
3 months PESSTO "Key Science Targets"

- SN2009ip : pulsational pair instability supernova?
- 3 unusual blue transients (2 type super-luminous supernovae; 1possible Tidal Disruption Event)
- SNHunt 121 : faint type Ic (paper drafted)
- LSQ12btw : Ibn (paper drafted)
- SN2012ca : unusual type IIn
- SN2012ec : type II with progenitor (paper drafted)
- SN2012dy : energetic IIb
- PTF12gzk = LSQ12dwl = PS1-12baa - peculiar Ic, very faint host
- Two unusual type Ia SNe : 91T-like, faint host galaxies (low Z?)

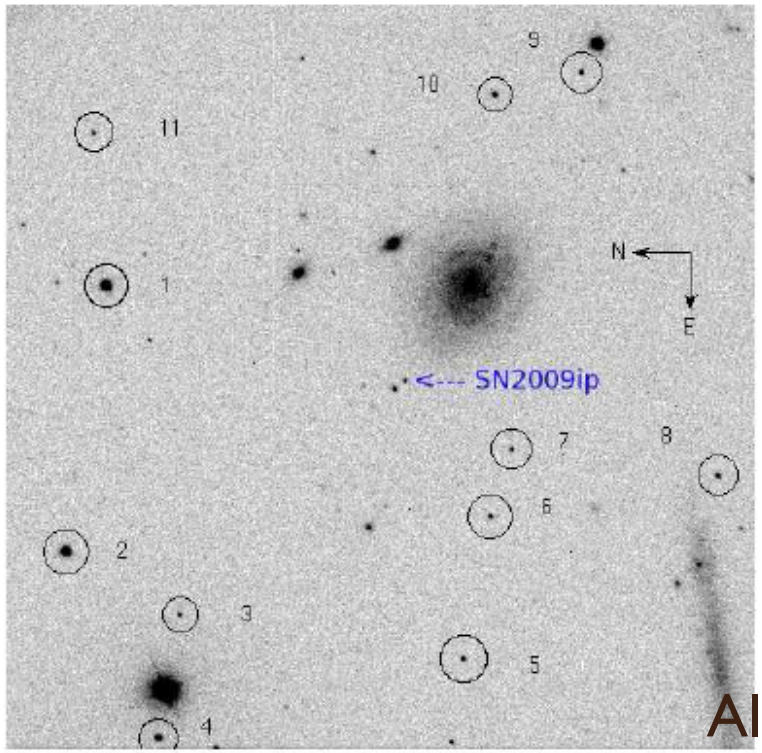
"12 Key Science Targets"

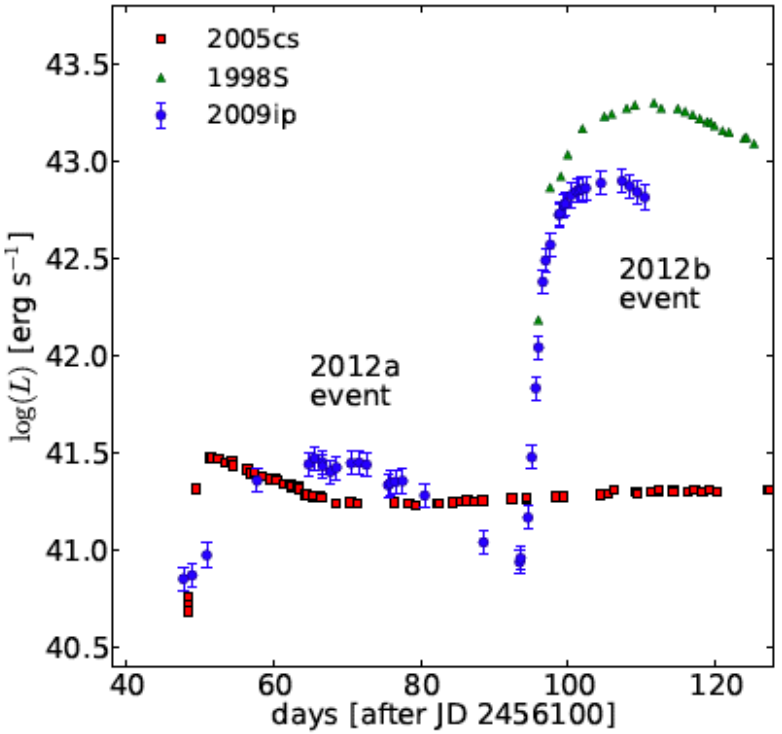
- 10 optical spectra for cadence of 1-10d
- NIR half, half the frequency

SN2009ip : pulsational pair instability SN ?



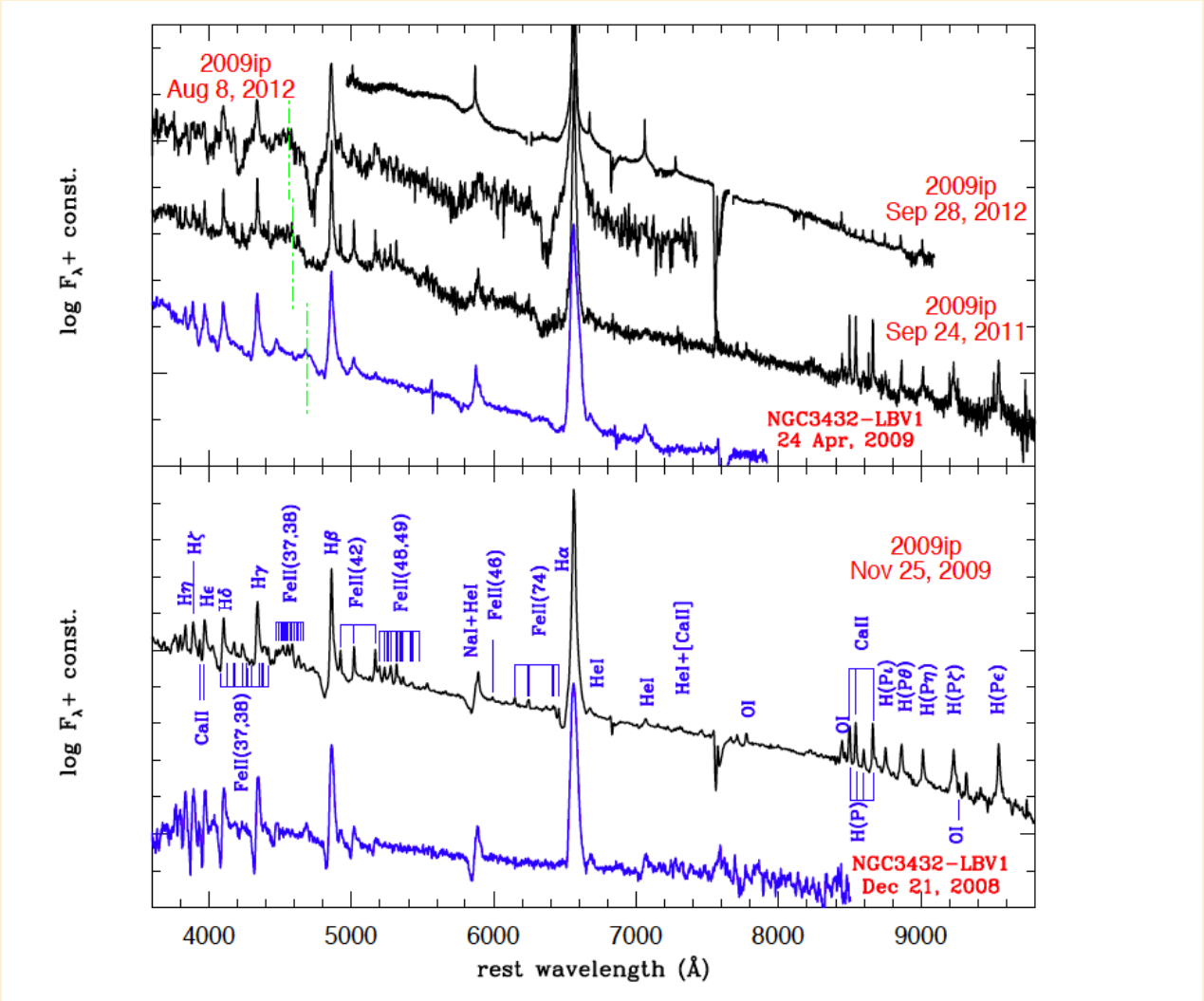
Pastorello et al., ApJ submitted
Benetti et al. ESO LP "Supernovae and Nucleosynthesis"





Also See Mauerhan et al. Prieto et al. ; submitted

2009ip : high velocity ejecta



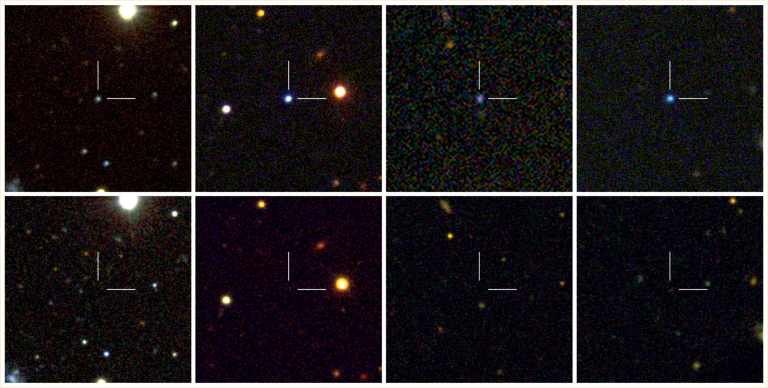
10,000 km/s
Detected in
2011 and 2012

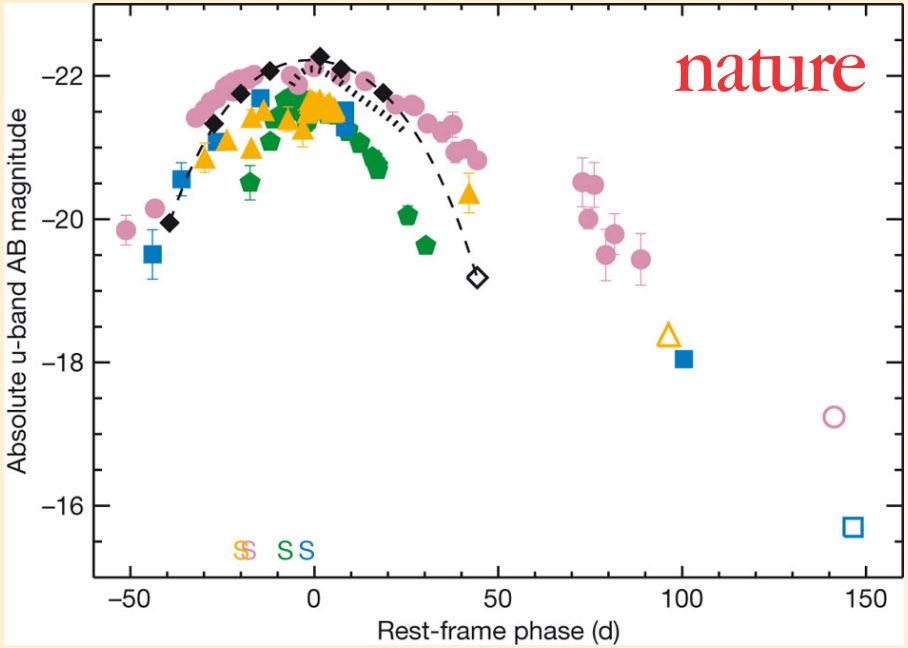
No surface
mechanism –
core related ?
Pulsational
PISN possible.

PESSTO Key Science Target : one of the best observed SNe in history ?
"Exploded" in Aug, 3 papers on arxiv, 19 ATels

Superluminous stellar explosions

Palomar Transient Factory

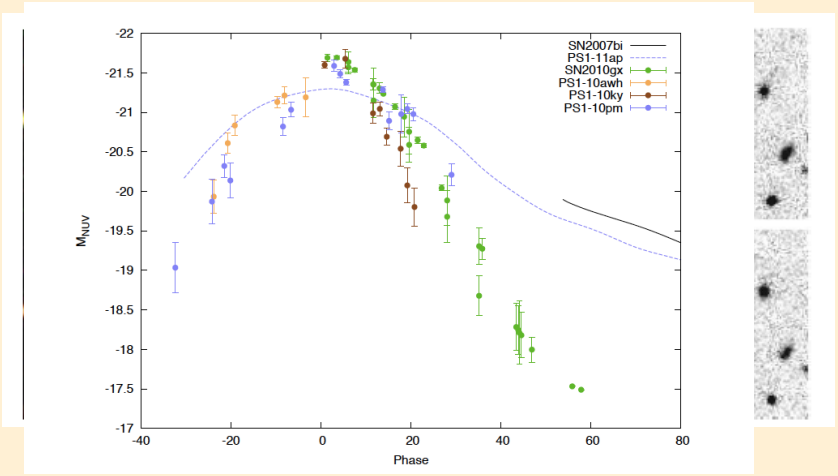




RM Quimby *et al*. *Nature* 2011

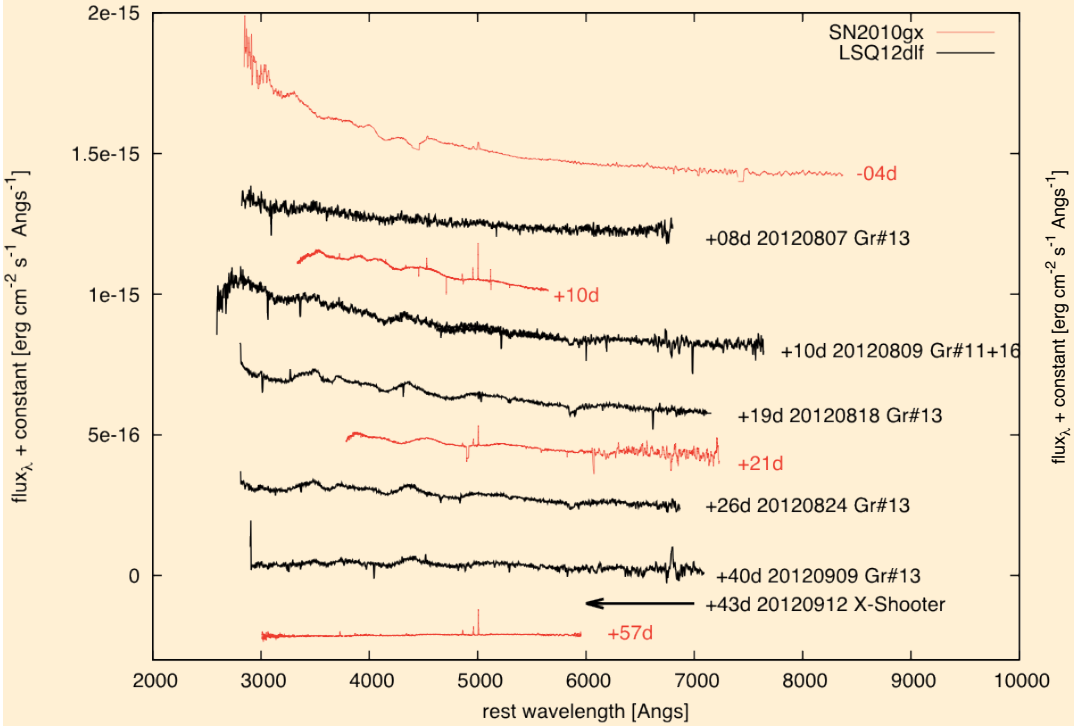
Pan-STARRs1 probing redshift ranges $z = 0.1 - 1.5$

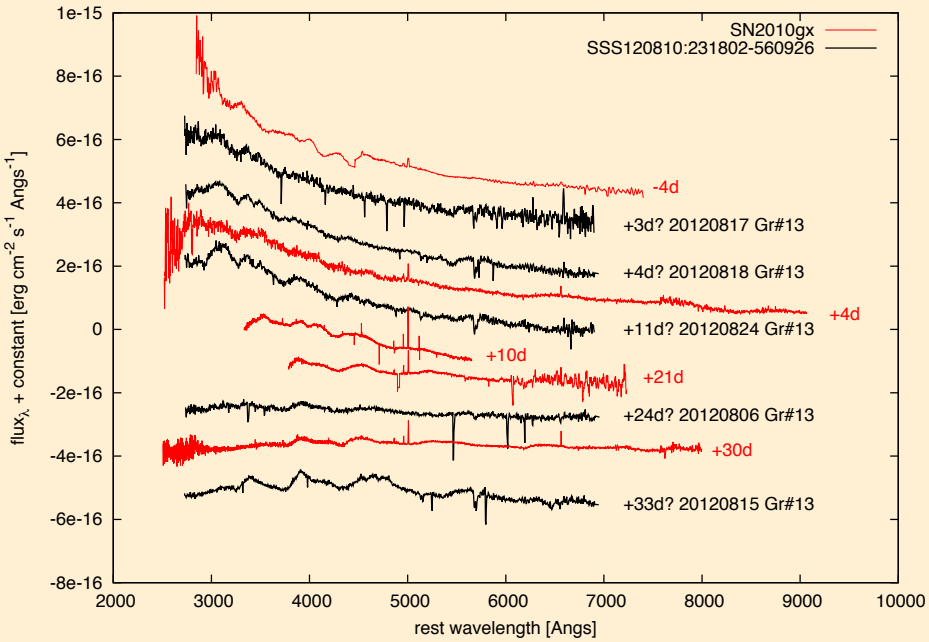
- Z = 0.1 – 0.3 in the 3Pi survey
- SN2010gx, PS1-11xk, PS1-12fo, + two other candidates
- Z= 0.5 – 1.5 in the MD fields



Chomiuk et al. 2011, Berger et al. 2012,Pastorello et al. 2010, McCrum et al, in prep, Inserra et al. in prep.

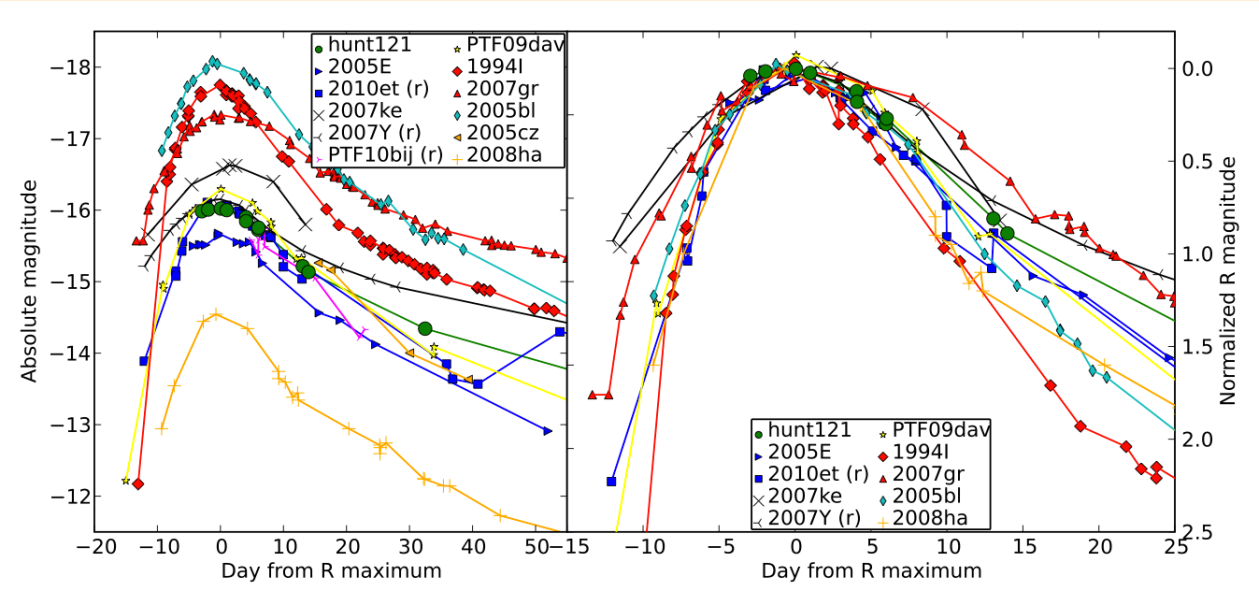
Two superluminous SNe in PESSTO

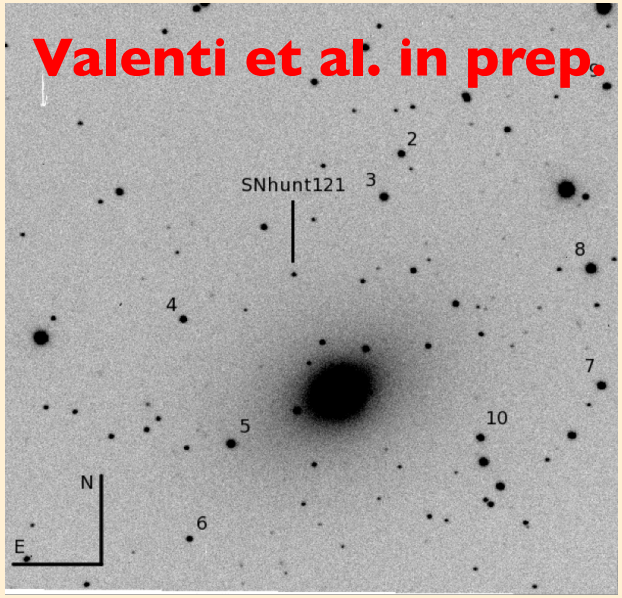




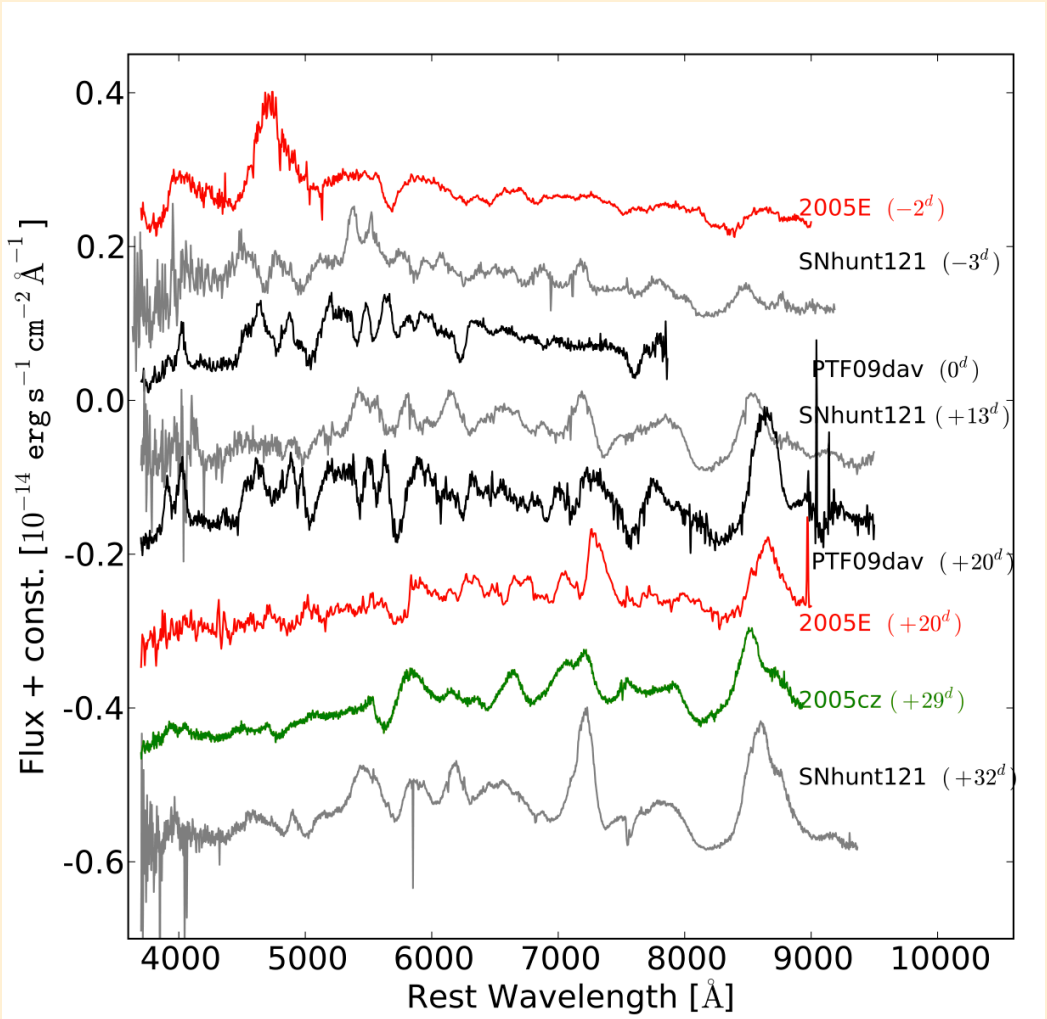
- SSS120810:231802-560926 and LSQ12dlf
- Blue featureless continnua : T_{BB} ~ 20k
- Evolve into type Ic SNe (like the GRB related Sne))
- z= 0.2, 0.25
- M_u ~ -22

SNHunt121 – thermonuclear or core-collapse ?

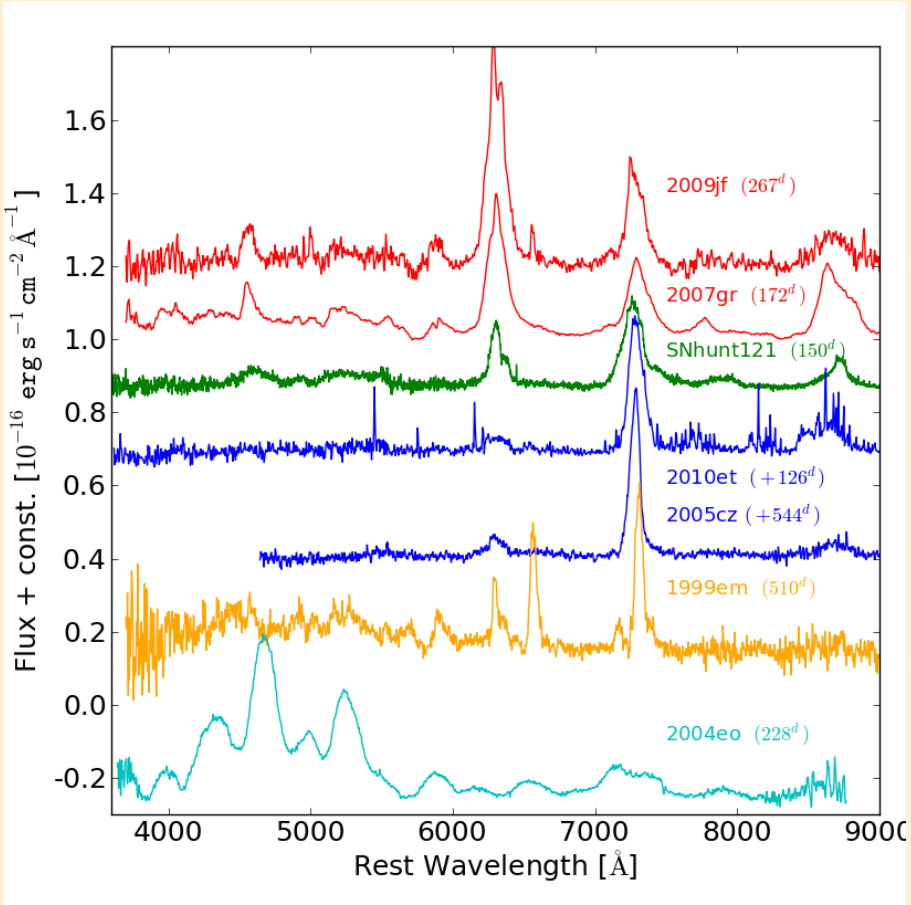




- Several SNe with disputed explosion channel : 2005E, 2005cz (Perets et al, 2010, Nat.; Kawabata et al. 2010, Nat.)
- SN2008ha : faint type I, core-collapse ? (Valenti et al. 2009, Nat.)



He surface detonation on a WD ?



Core-collapse, but faint, black-hole formation ?

PESSTO lifetime Projection – Key science targets

- 12 PESSTO Key science targets in 4 months
- 5 years = 45 months ≈ 135 “Key science targets”
  - Weather loss (~30%)
- Conclusion – we’re on track, within the noise
- Aim : discovery of 3-4 “Key Science Targets per month”

PESSTO Issues- internal

- Better linkage with LSQ (+SkyMapper) to get targets earlier – not completely happy with our turn around time
- Lightcurves - we want one, or two reliable sources
- PESSTO Marshall development - needs further work
- Data archiving : all products, delivery method for PhIII products to ESO
- A&A paper : describing the survey, data products, data release versions etc

PESSTO Issues - ESO

- Need the ESO Phase III definition – pipeline development cannot be completed
- NTT network to outside world is 30 kB/sec : no way round. Proves difficult for transient work
- Europe data teams need instant data access : ESO archive problem seems to have been solved
- Dissemination : forsee multiple sources of reduced data (WISEREP, VO@IA2 Trieste, ESO archive). See this as success if popular and widespread use
- Excel OB reports – what's the point in these ?