

Optical & NIR Observations of Nearby Supernovae with OISTER

Masayuki Yamanaka (Kyoto Univ.)

Today's Topics

1. Domestic collaboration of the transient in Japan
2. Preliminary results of individual objects,
normal Type Ia 2011by,
transitional Type IIb 2011dh
peculiar Type Ia SN 2012Z (I mainly talk)
(and more ... if I can)

OISTER: *Optical and Infrared Synergetic Telescopes for Education and Research*

- The OISTER collaboration have been started since Apr. 2011 for the simultaneous time-resolved observations of intra- and inter- night variability of transients in optical and NIR wavelengths.
- Eight institutes participate this collaboration !
(Informally, 13 institutes)
- Totally, we can use 19 telescopes, whose diameter ranged 0.4 and 2.0m.

Objects observed by OISTER

Object Type	Numbers	Object Type	Numbers
Supernova	7	Close binary	1
Blazar	1	AGN	1
GRB	0	X ray binary	2
Novae	1	Dwarf novae	1

Around 100 persons contribute OISTER.

SNe people in OISTER, (who performed follow-up observations of nearby SNe in early-phase)



Koji Kawabata (Hiroshima Univ.)
Supervisor



(Kyoto U.)
PD



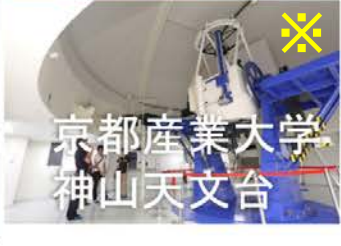
(Hiroshima U.)



(Hiroshima U.)

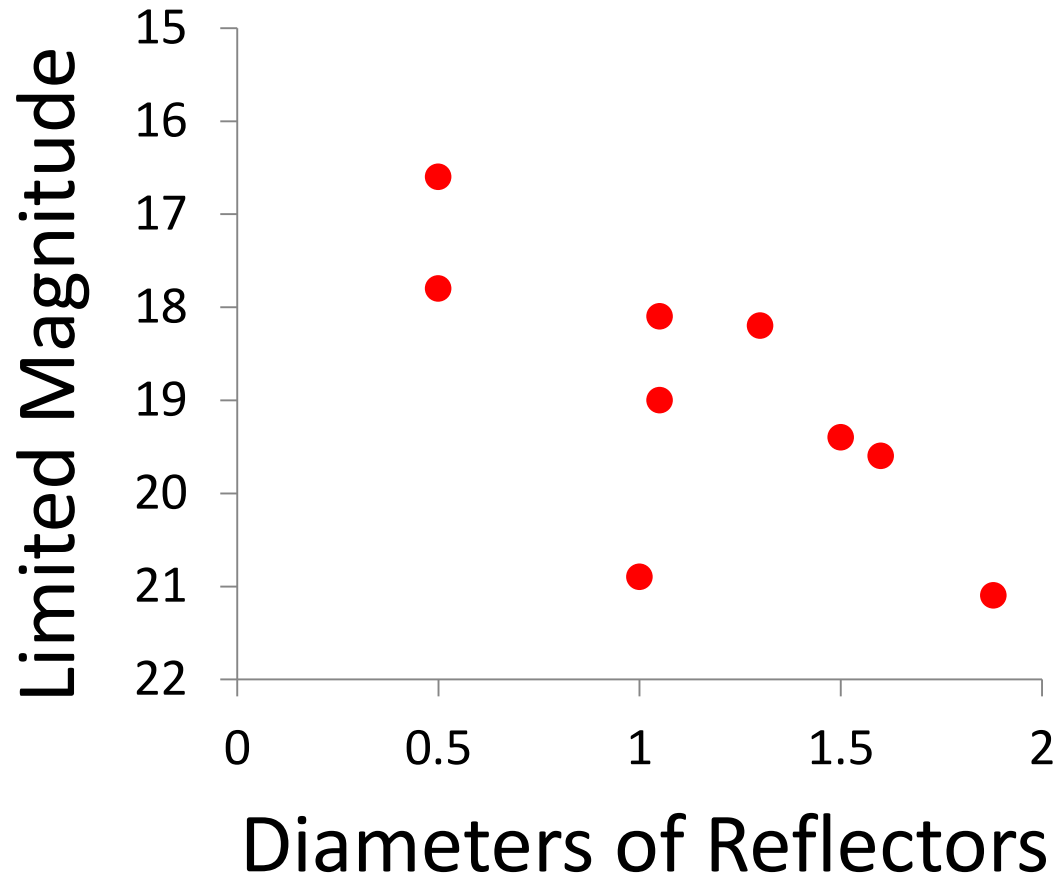
students

Observatories & Telescopes



✖ Informal
☆ formal

How faint we can observe in OISTER ?



Strategy

- When bright ($>16-17$ mag) SNe (or PSNe) appear in the nearby (<100 Mpc), we triggered the ToO observations in OISTER (through ML).
- We can get the nightly multi-color (U, B, g' , V, Rc, Ic, z' , J, H, Ks) bands photometric data and low-resolution ($R \sim 400-600$) spectroscopic data.

SN 2011by
(Normal Type Ia SN)

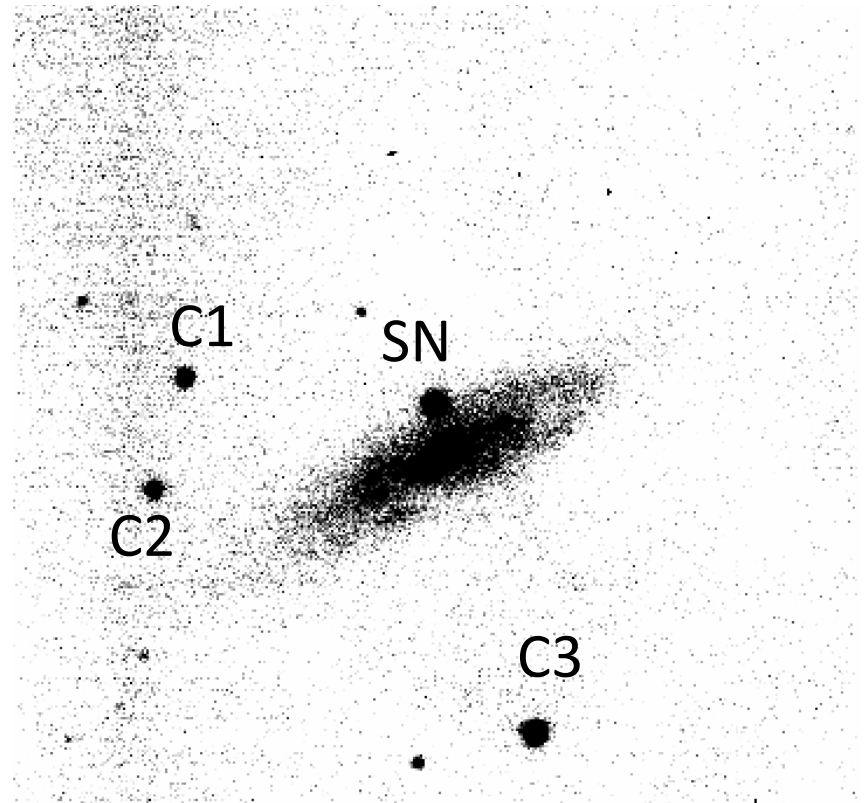
SN 2011by

R.A. = 11h55m45s.56,
Decl. = +55° 19'33".8

host NGC 3972
distance ~ 20Mpc

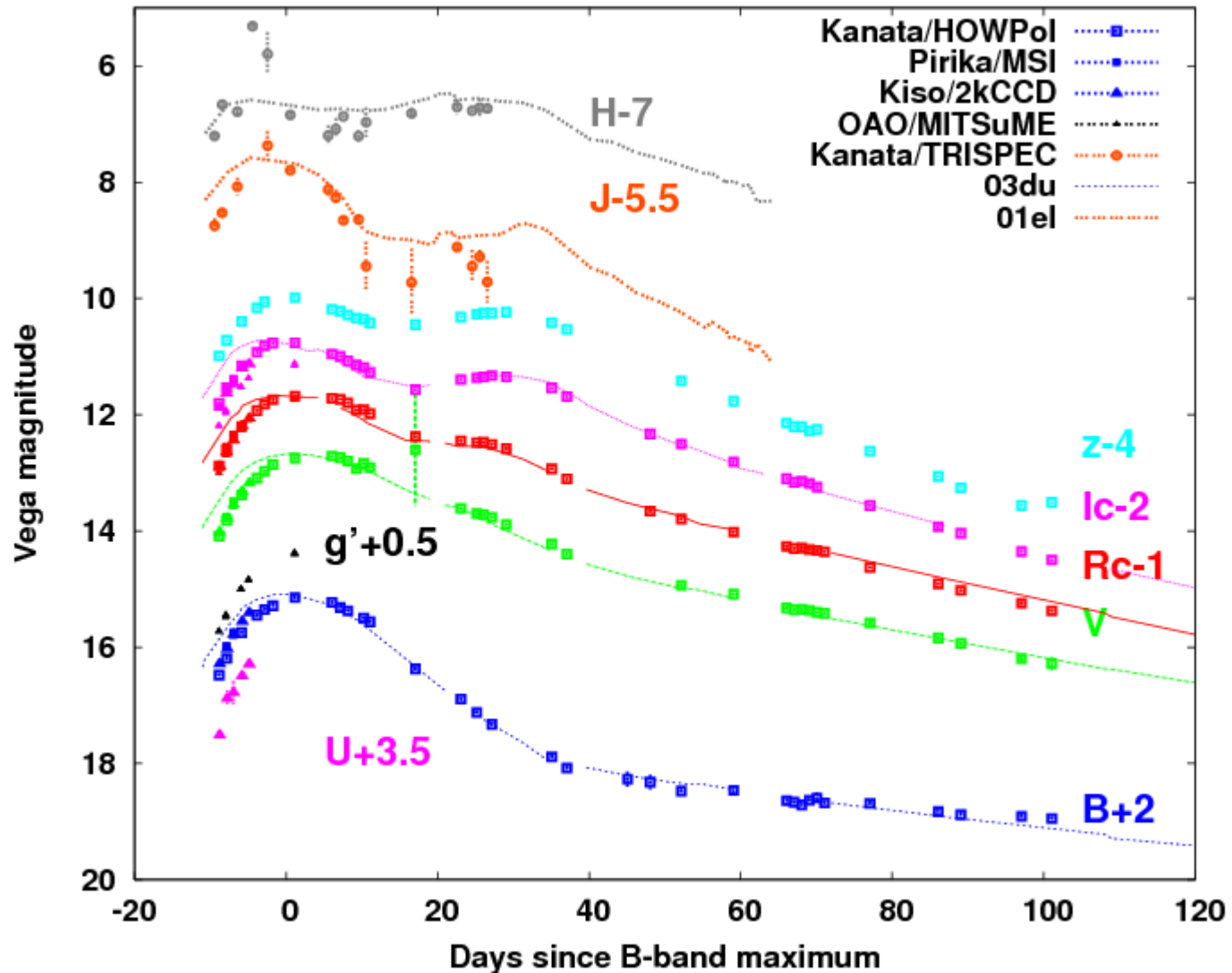
Motivation

Normal SN Ia in a
very nearby galaxy

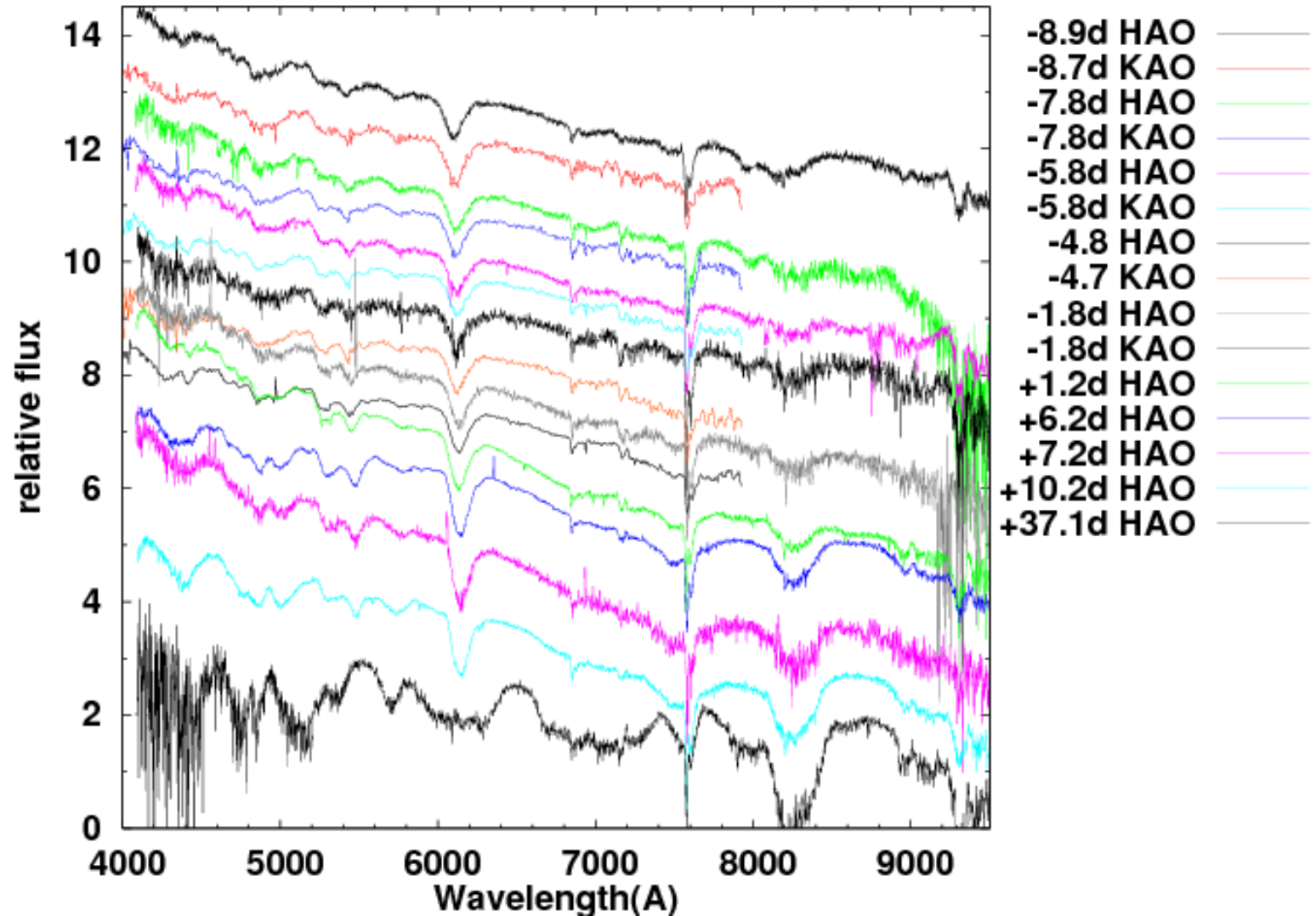


6' x 6'

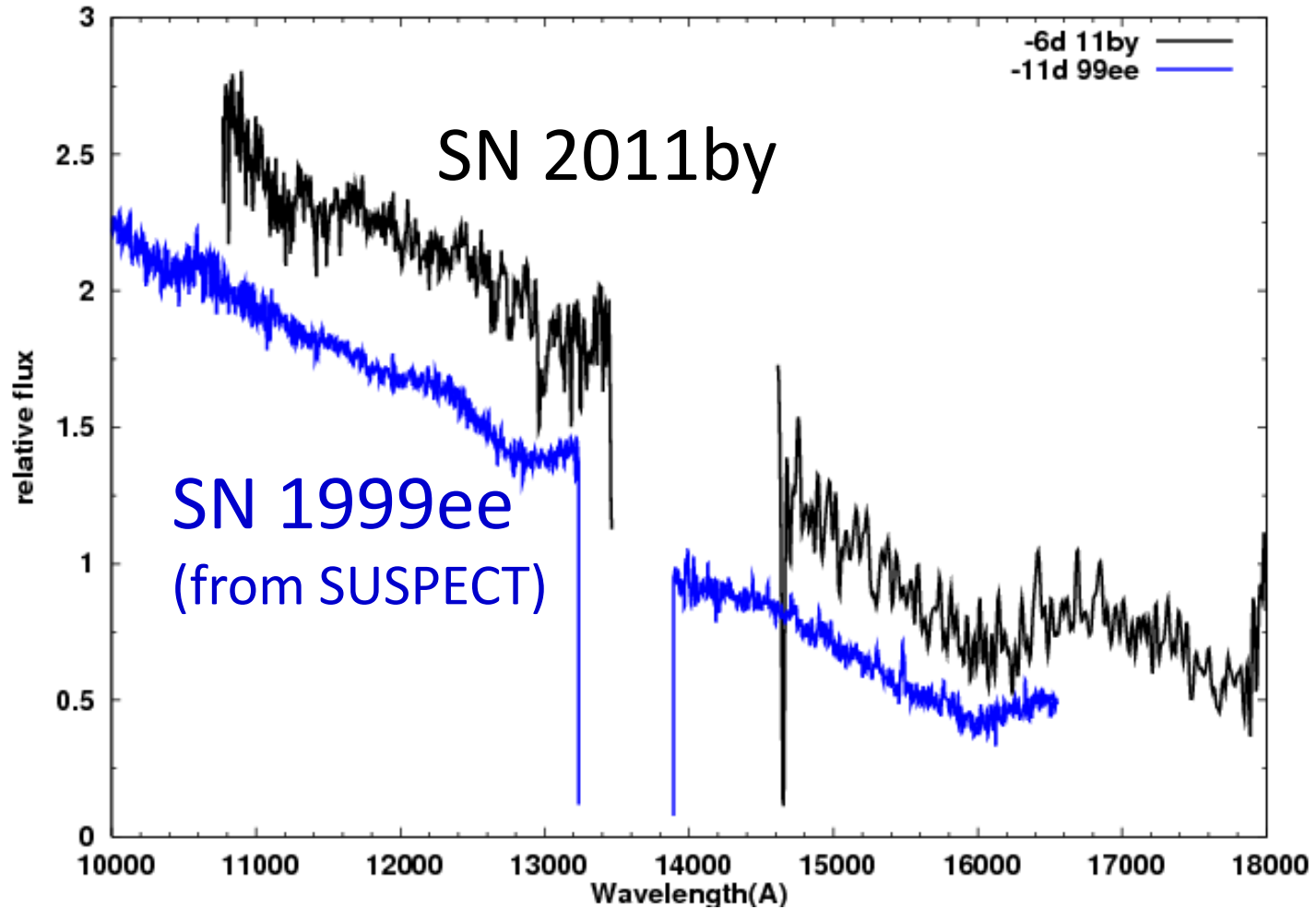
Light Curves



Spectral Evolution



Near-infrared Spectrum @ -10d



SN 2011dh
(Transient Type IIb)

SN 2011dh in M51

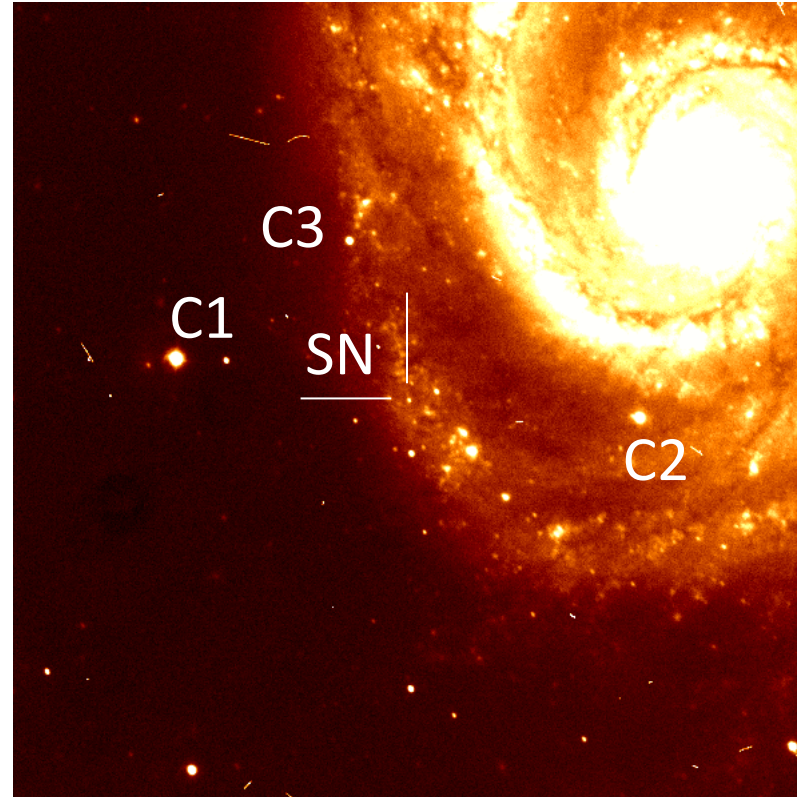
R.A. = 13h30m05s.124,
Decl. = +47° 10'11".301

host M51

distance ~ 9.4 Mpc

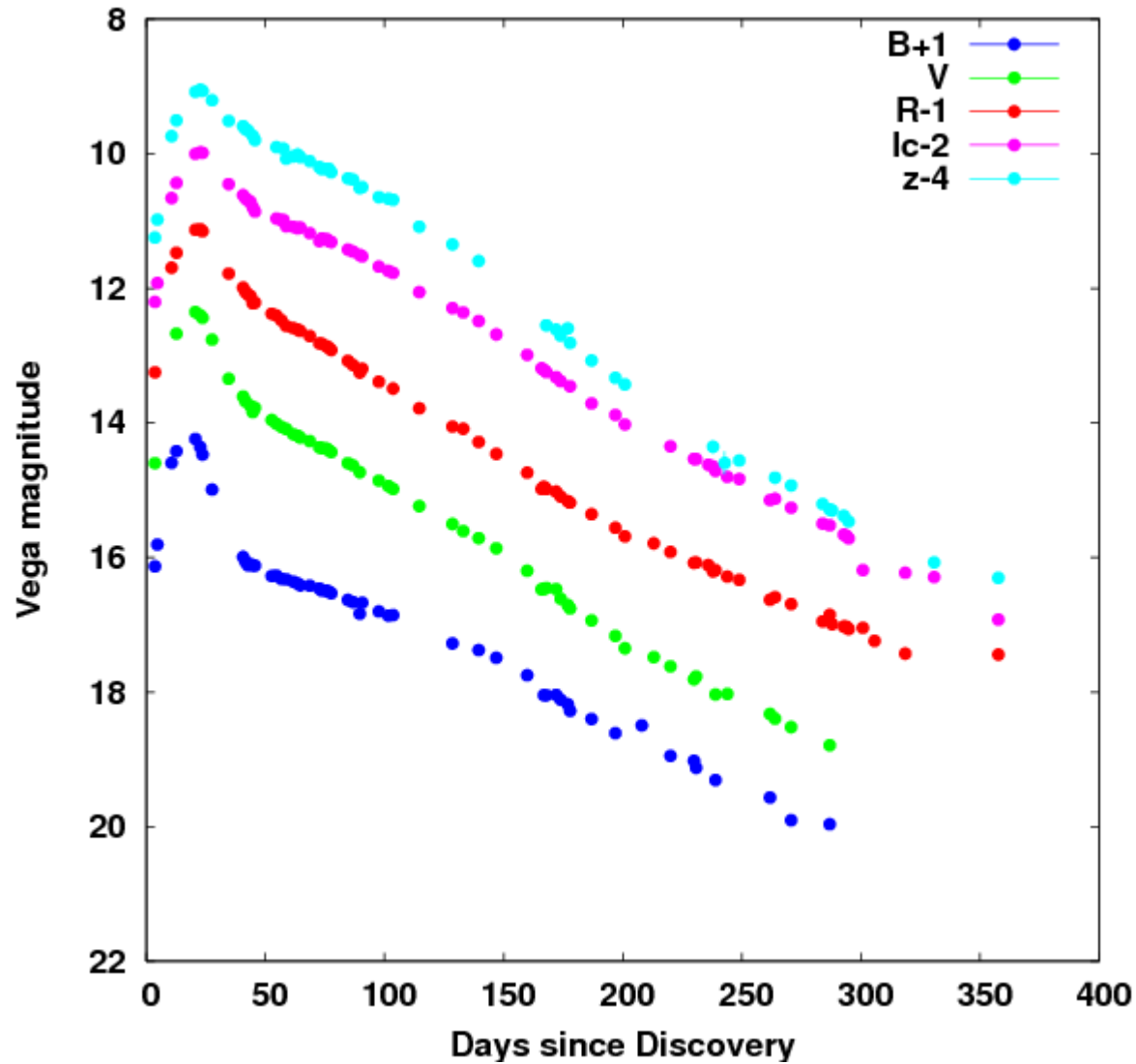
Motivation

Type IIb in very nearby galaxy
We can get a good sample of a
SN Type IIb.

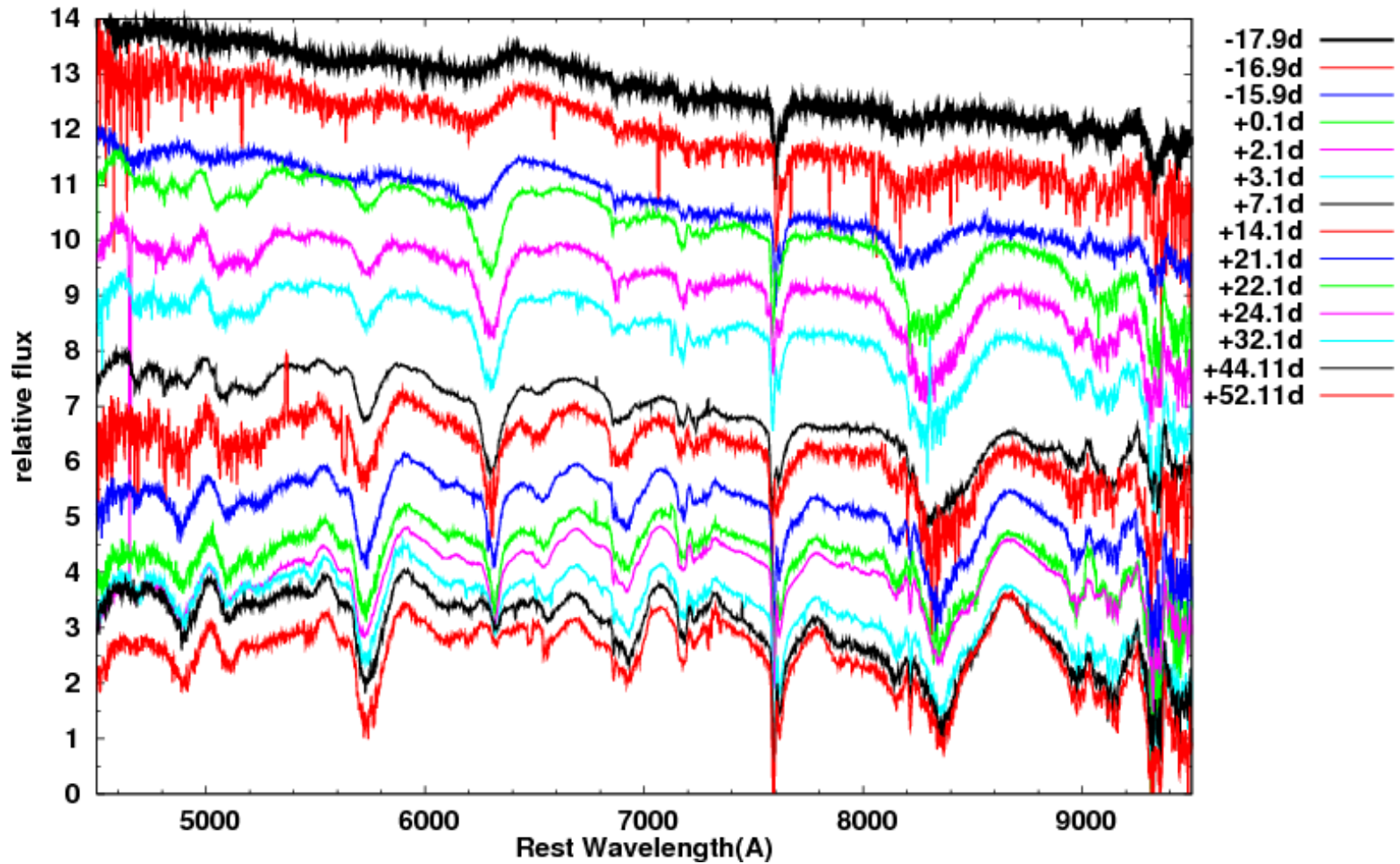


6' x 6'

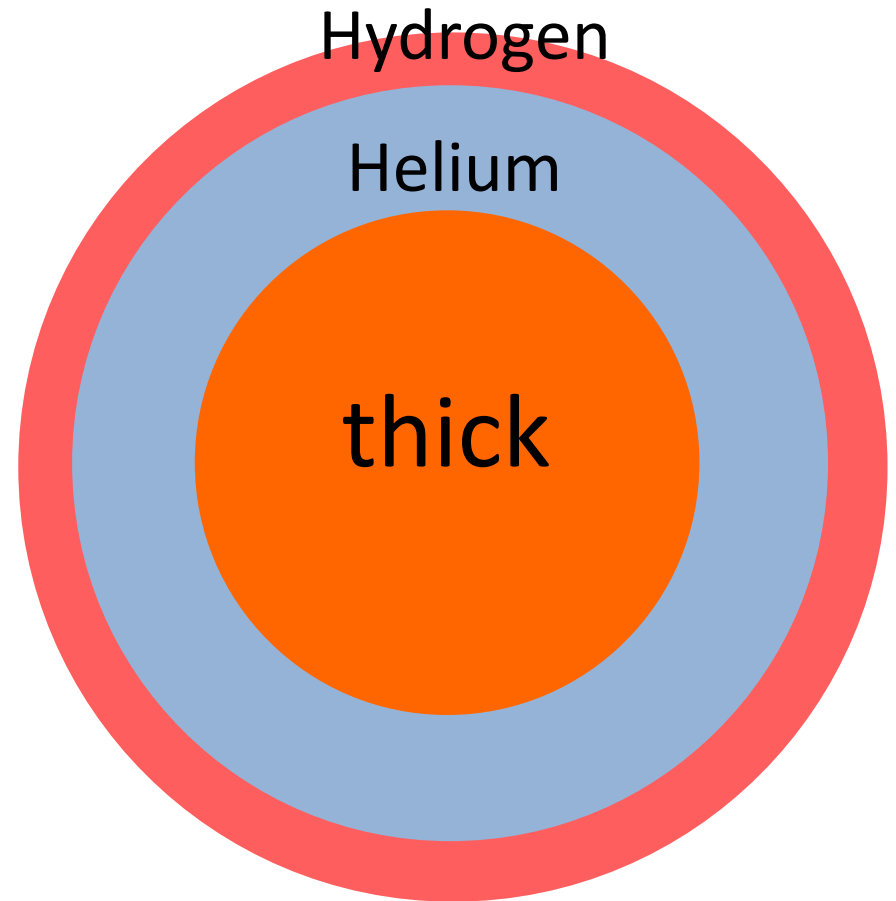
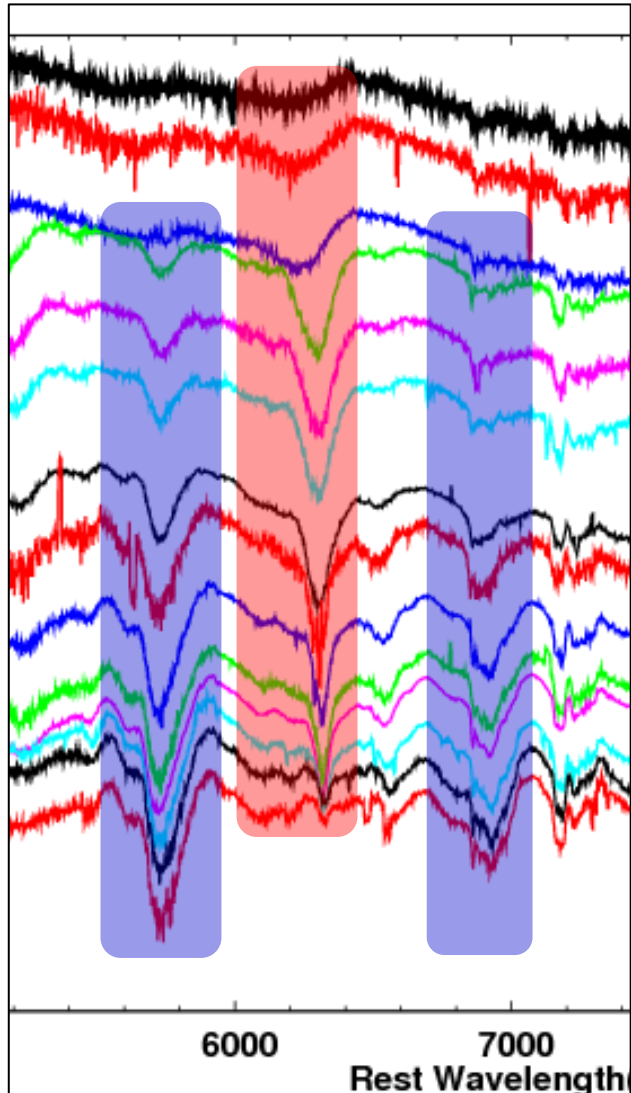
Light Curves



Spectral Evolutions



Hydrogen/Helium transition



SN 2008ax : ○ Steep density profile?
SN 1993J : ×

SN 2012Z

(Peculiar Type Ia SN 02cx-like candidate!)

SN 2012Z in NGC 1309

(Peculiar Type Ia SN ; 02cx-like event)

Coordinates (ATEL 3900)

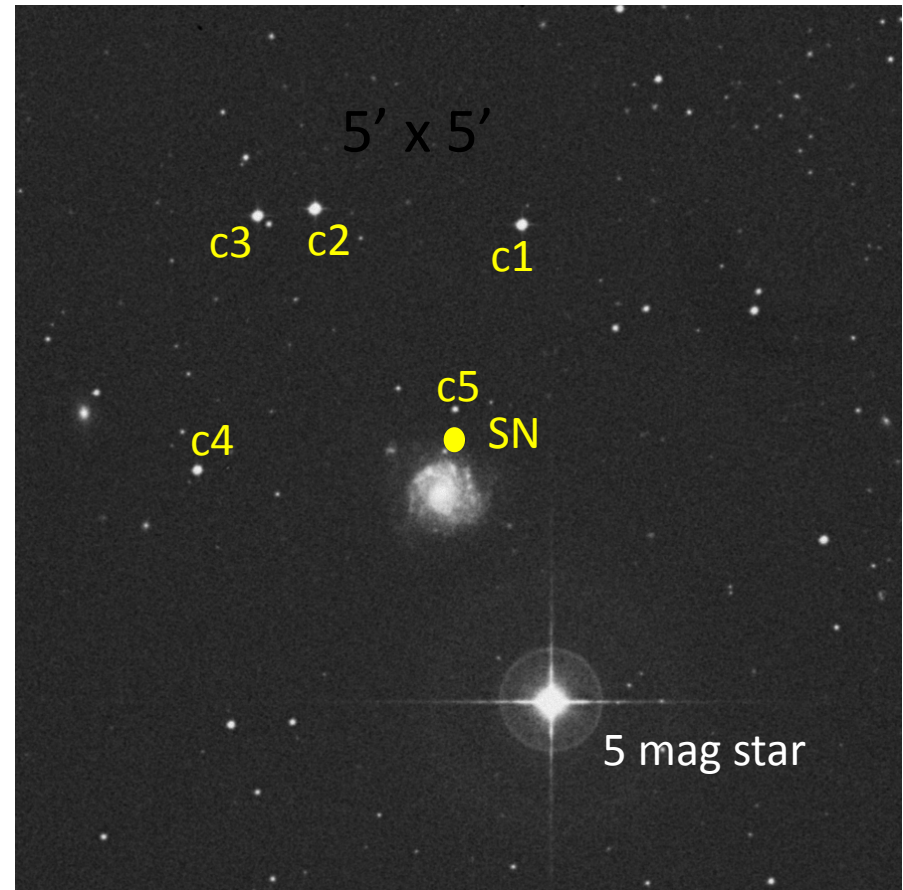
R.A. 03:22:05.35,

Decl. -15:23:15.6

Discovered by LOSS at $V \sim 18.0$ mag at a nearby galaxy NGC 1309 (20 Mpc) on Jan 29 (ATEL 3900)

The spectrum of 12Z is similar to that of 05hk at a week before max (ATEL 3901)

Swift/UVOT observations on Feb. 2 also reported as 15.5 mag at V-band. The luminosity evolved in the rising phase. -> Exploded at a few days before discovery !



FOV 15' x 15' (Red in DSS)

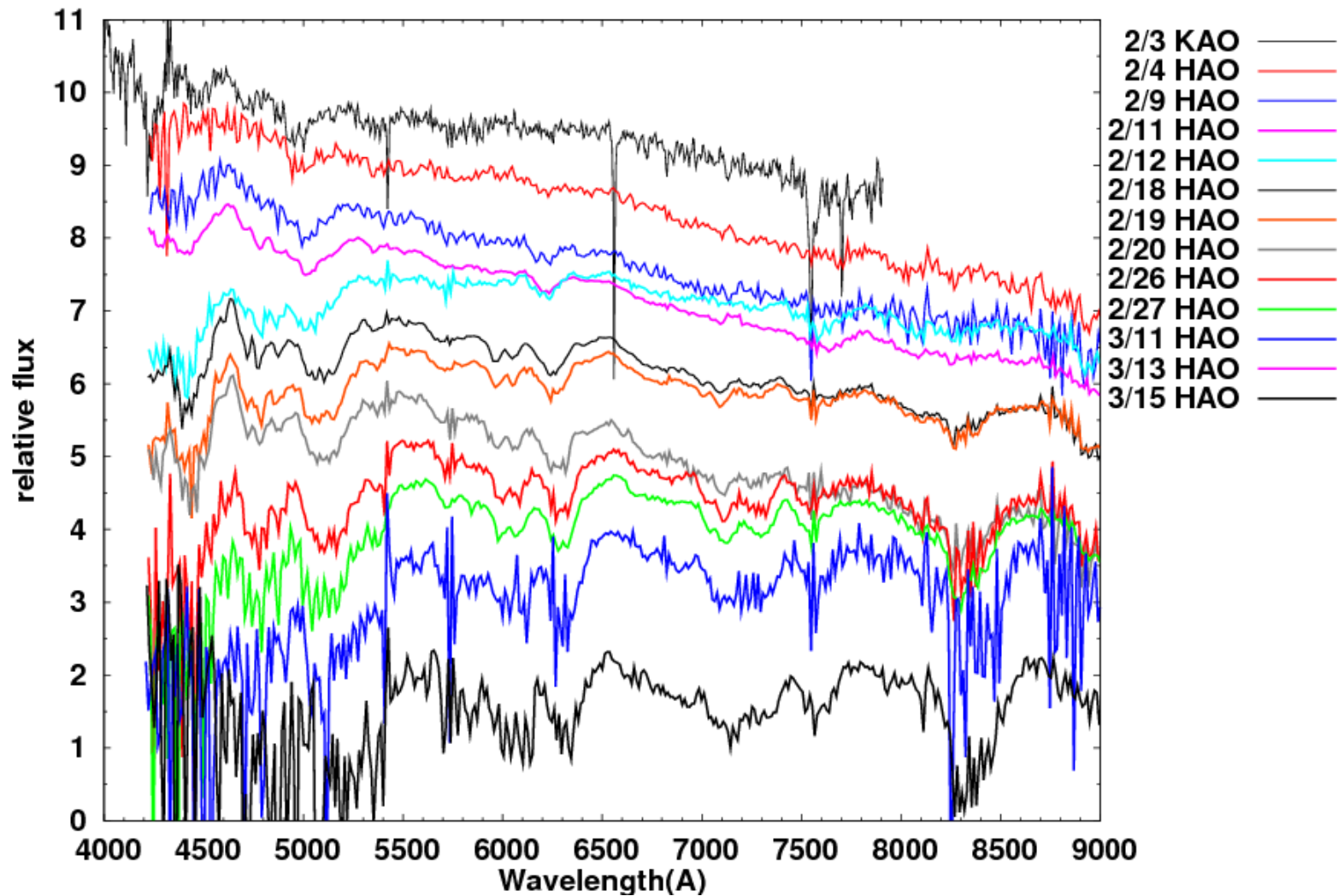
The observations of SN 2012Z

Observatories and their observation status:

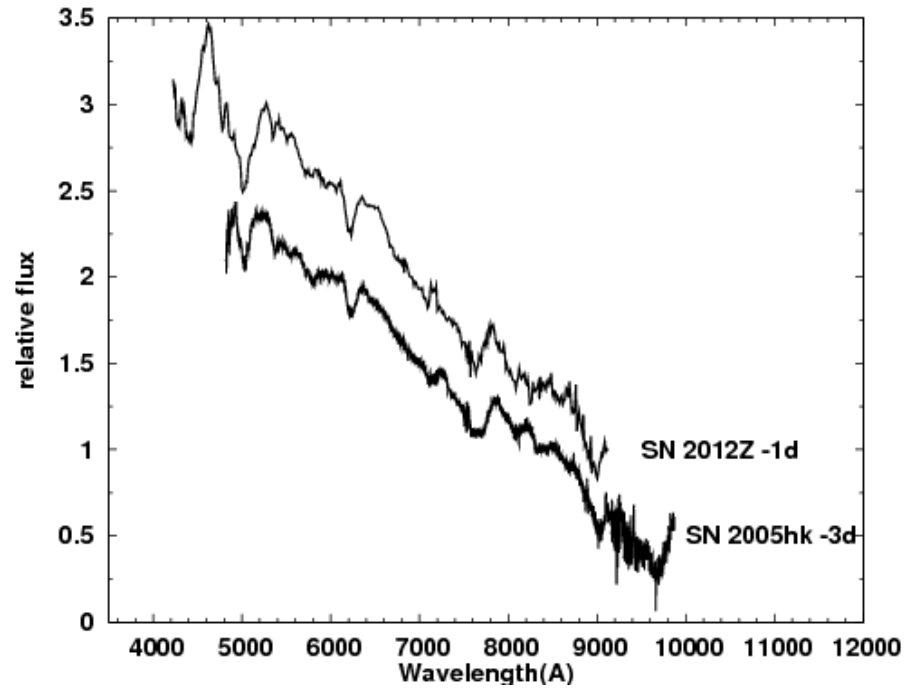
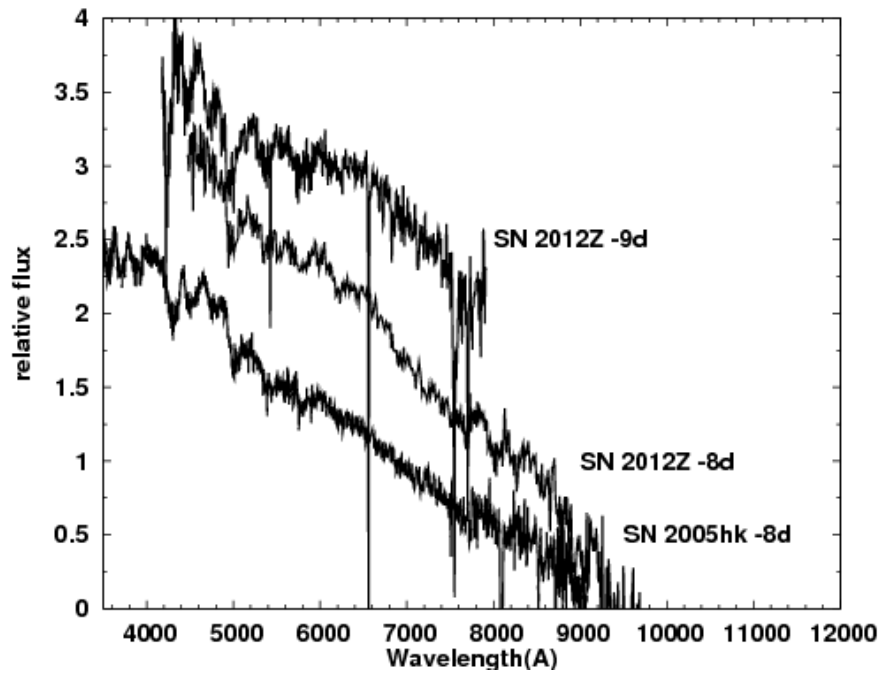
- 国立天文台 (National Astronomical Observatory of Japan) - Formal (★)
- 東京大学 木曾観測所 (University of Tokyo, Muro Obs) - Informal (✖)
- 西はりま天文台 (Seiwa-harima Astronomical Observatory) - Formal (★)
- コッタミア天文台 エジプト (Kottamia Astronomical Observatory, Egypt) - Informal (✖)
- 北海道大学(名寄) (Hokkaido University, Namiyo) - Informal (✖)
- 東京工業大学(北社) (Tokyo Institute of Technology, Kita-sha) - Informal (✖)
- ぐんま天文台 (Gunma Astronomical Observatory) - Formal (★)
- 京都産業大学 神山天文台 (Kyushu Sangyo University, Kamiyama Astronomical Observatory) - Informal (✖)
- 鹿児島大学(入来) (Kagoshima University, Irigai) - Informal (✖)
- 国立天文台 石垣天文台 (National Astronomical Observatory of Japan, Ishigaki Astronomical Observatory) - Informal (✖)
- 名古屋大学 (南アフリカ) (Nagoya University, South Africa) - Informal (✖)
- 東京大学 (チリ) (University of Tokyo, Chile) - Informal (✖)
- 美星スペースガードセンター (Misaki Space Guard Center) - Formal (★)
- 〇AO/MITSuME (Observatory for Astronomical Observations of MITSUBISHI) - Informal (✖)
- 〇AO/WFC (Observatory for Astronomical Observations of WAFU) - Informal (✖)
- 京都大40cm (Kyoto University 40cm) - Informal (✖)
- 埼玉大 55cm (Saitama University 55cm) - Formal (★)
- 美星天文台 1.0m (Misaki Astronomical Observatory 1.0m) - Informal (✖)
- 大教大51cm (Daigaku Daigaku 51cm) - Informal (✖)

✖ informal
★ formal

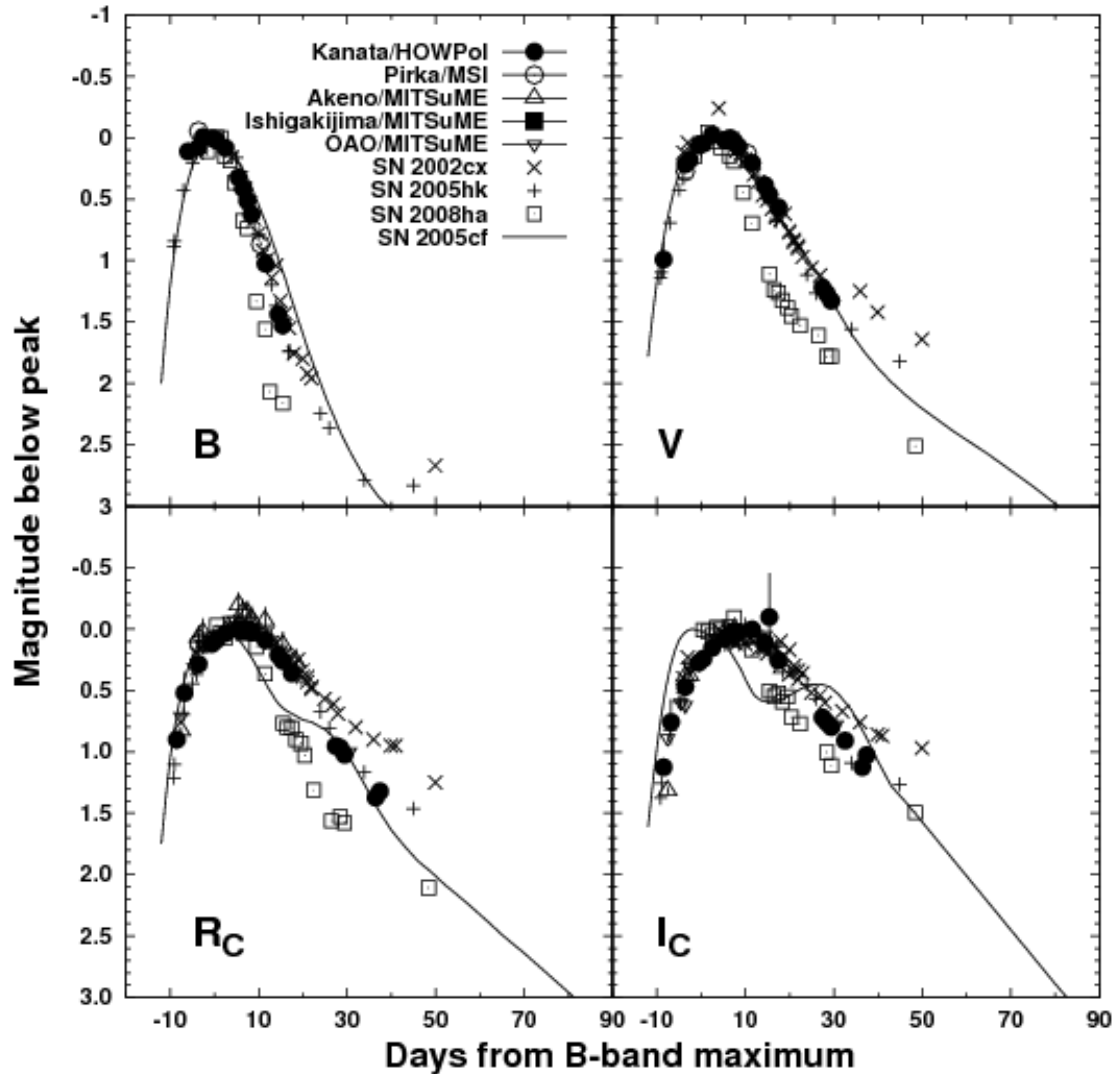
Spectral Evolution



Compared with SN 2005hk



Optical Light Curves

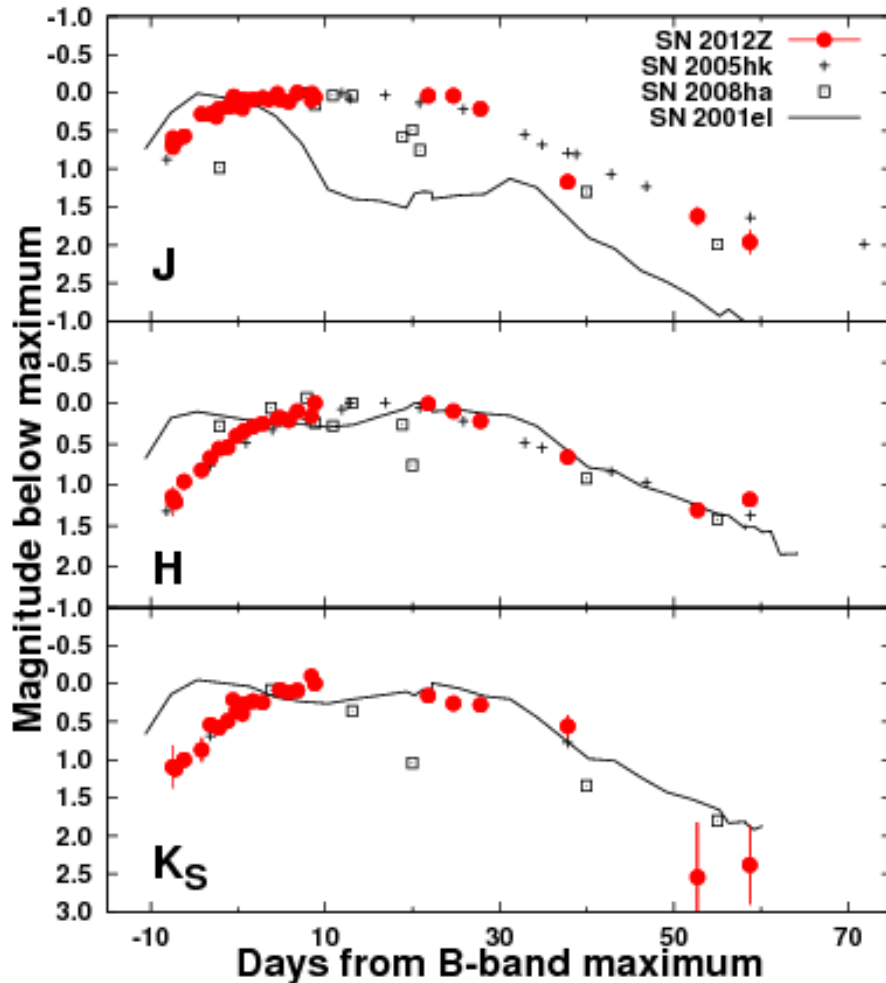


We got the dense light curves since -10d to +30d.

The behaviors in BVRcIc-bands are similar to SN 2005hk.

We cannot see secondary maximum in Ic-band, also similar to SN 2002cx-like object.

Near-infrared Light Curves



J&H light curves also similar to SN 2005hk

The brightness reached maximum at later in longer wavelength.

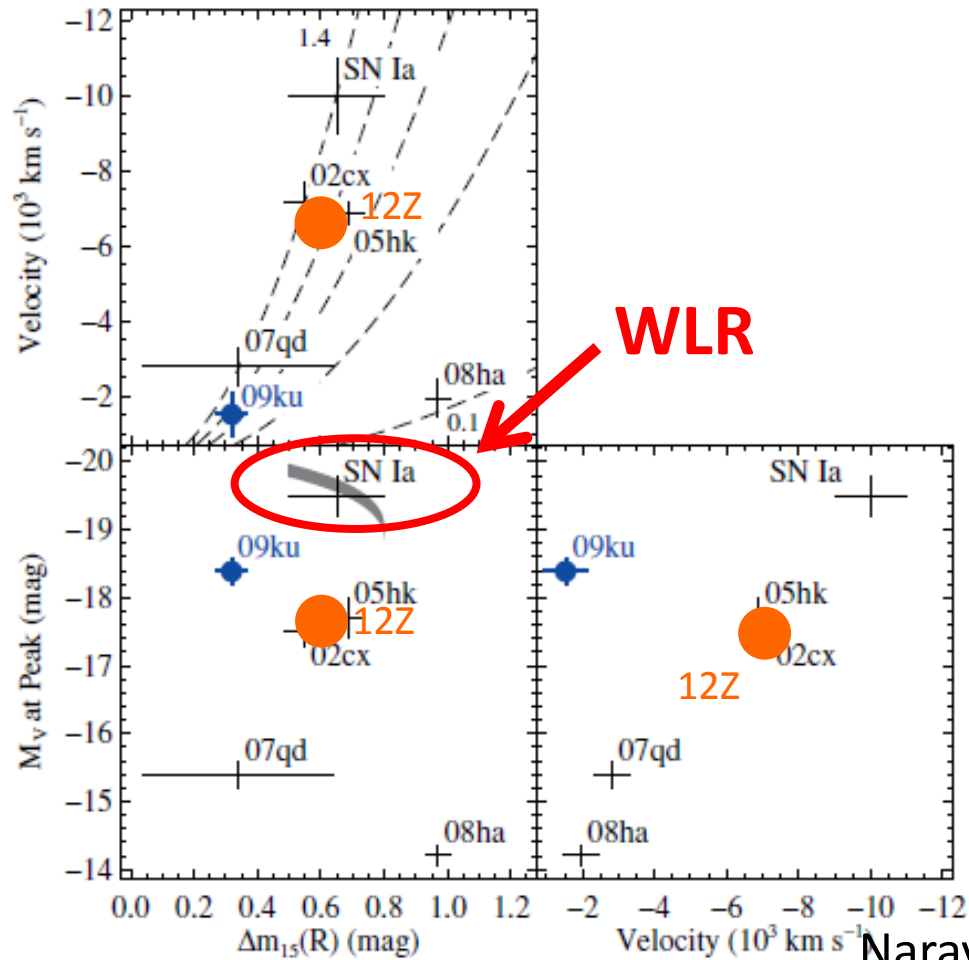
We got the dense light curves in K_s-band (first in O2cx-like object.)

We roughly estimate the host extinction as zero.

Bolometric correction

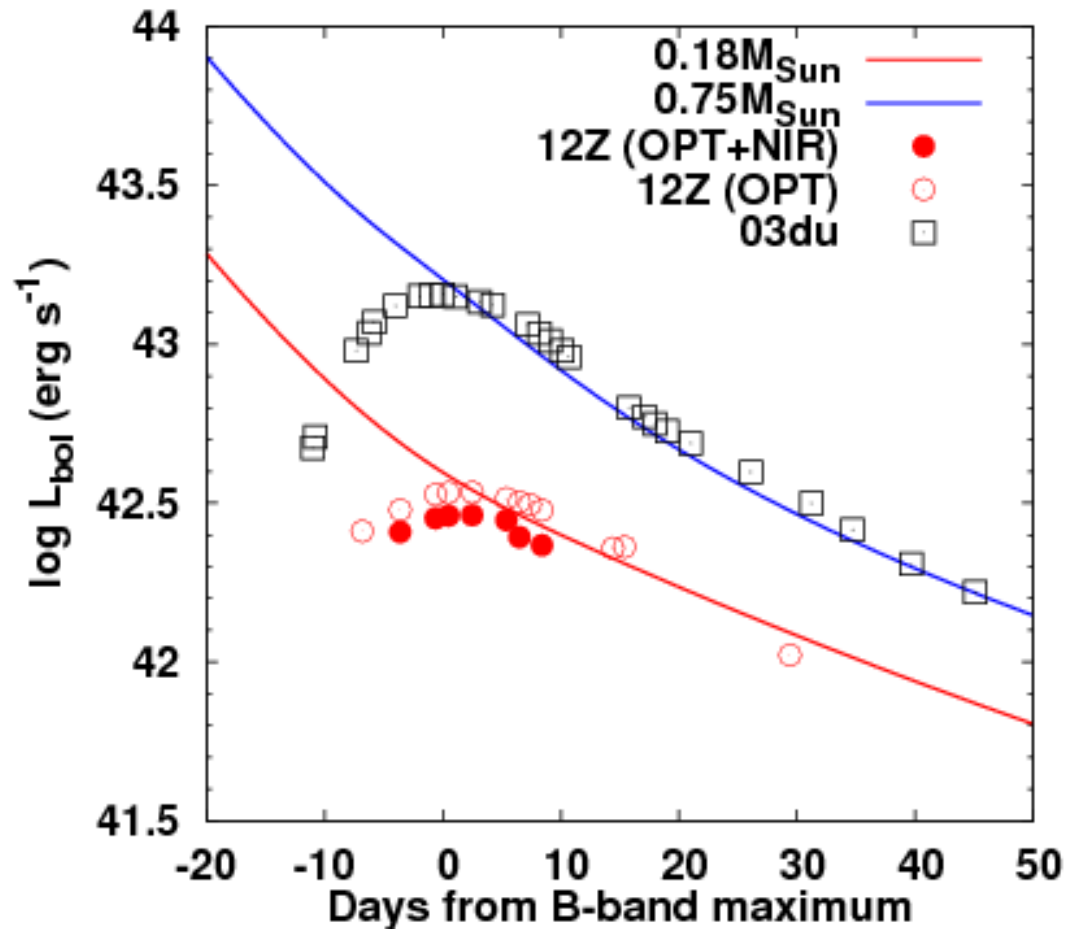
$F_{\text{NIR}}/F_{\text{OPT+NIR}} \sim 0.1$ (around max)

Is SN 2012Z a twin of SN 2005hk ?

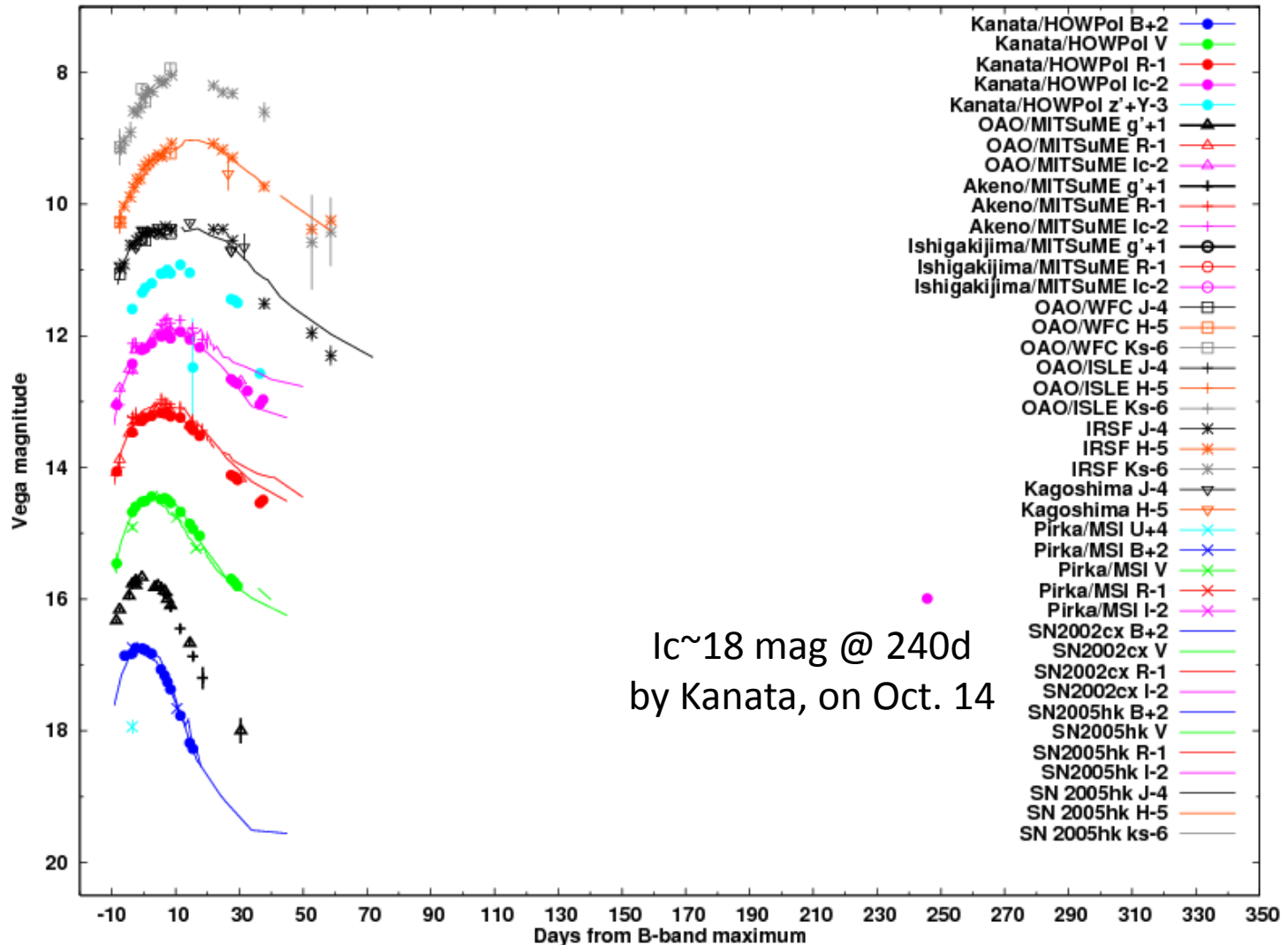


Narayan et al. 2011

Quasi-bolometric light curves of SN 2012Z



Late-phase photometry !



SUMMARY

- We have been got the dense photometric and spectroscopic data of seven nearby SNe using 19 telescopes at domestic observatories.
- We could successfully canceled out the weak points, bad weather in Japan
- SN 2012Z could be a twin of peculiar Type Ia SN 2005hk from our observations. We got dense Ks-band photometry in O2cx-like object.

