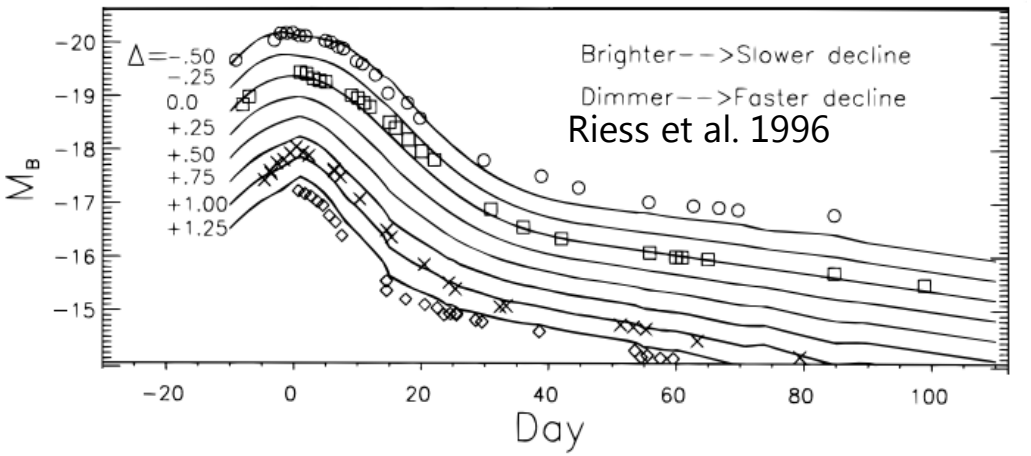
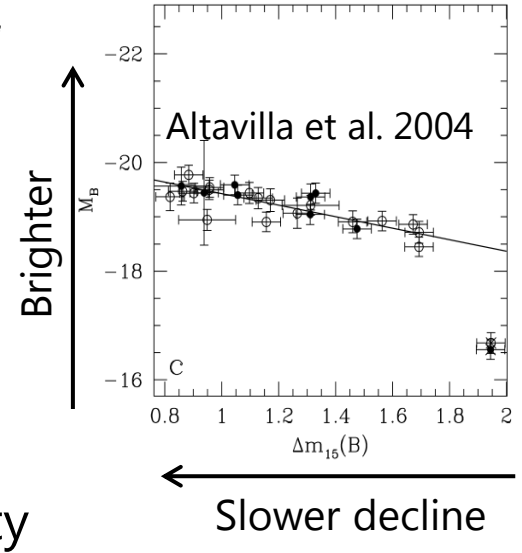
かなた望遠鏡による爆発直後のIa型超新星の観測とTomo-e Gozenへの期待

Miho Kawabata (Hiroshima Univ.)

Type Ia Supernovae

- When a white dwarf (WD) in a binary system gains mass and it approaches the Chandrasekhar limit mass (~1.4$M_\odot$), it causes thermonuclear runaway.



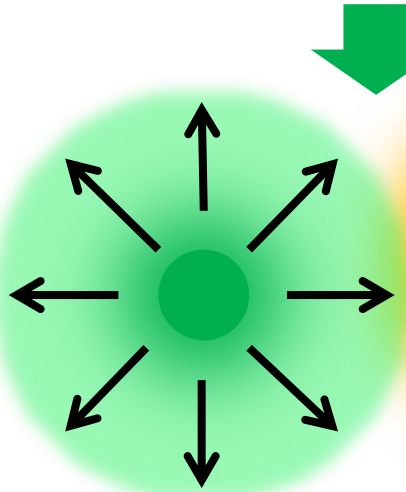


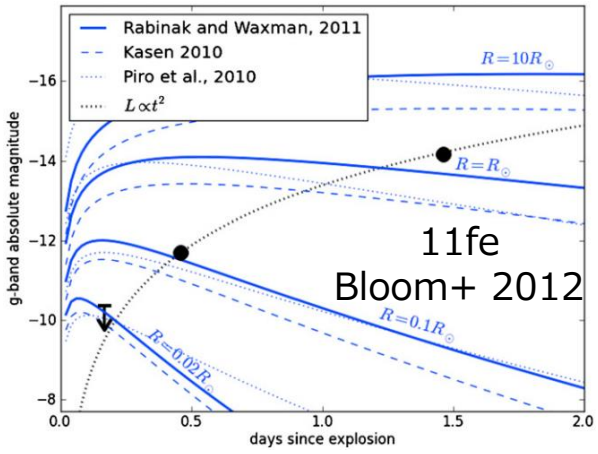
- Tight correction between the peak luminosity and following decline rates.

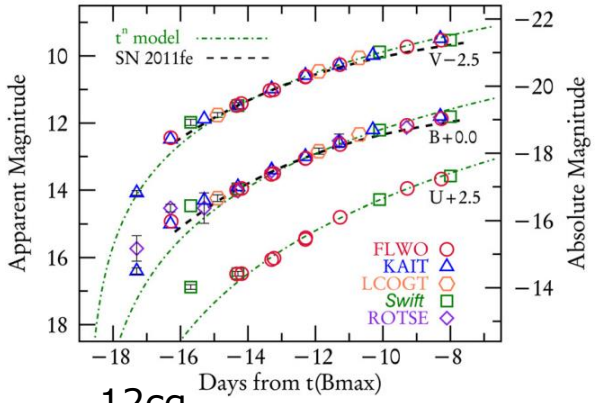
  → Utilized for distance measurements of remote galaxies

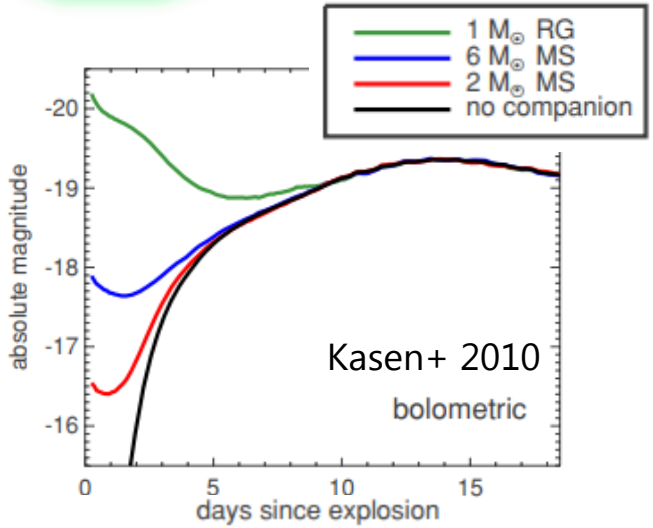
Type Ia Supernovae

- Possible excess of blue light in the earliest phase
  → produced by the impact the SN on a binary companion
- Excess can detect only for a few days after explosion
  → We can confine the progenitor system



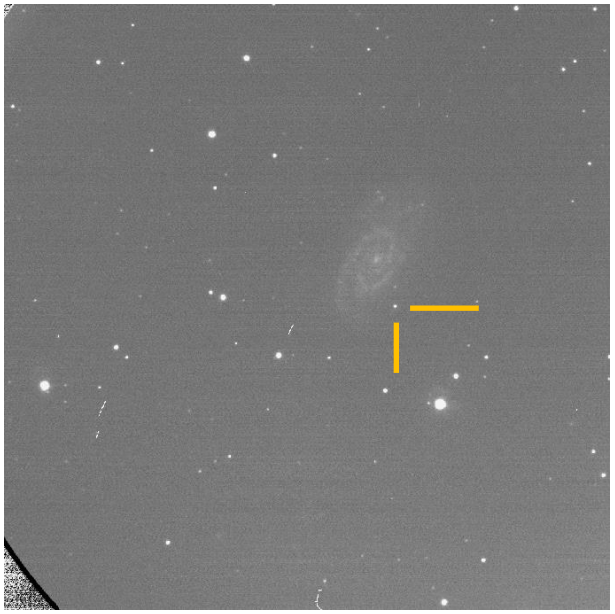




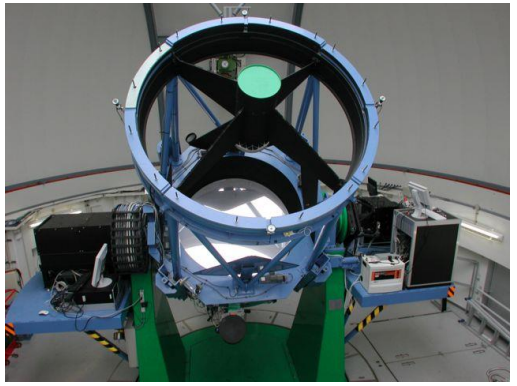


Observation

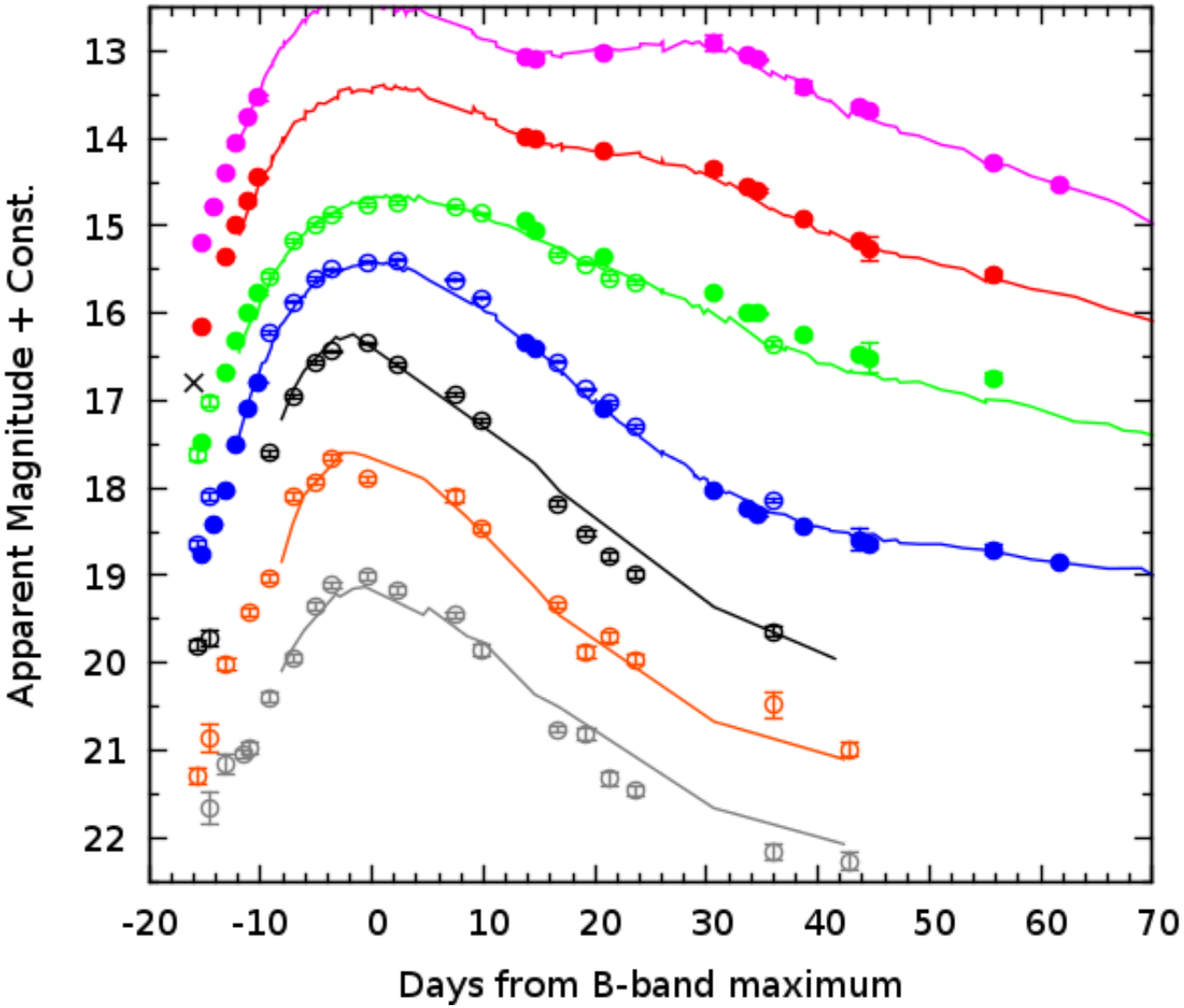
- SN 2017erp
- Host galaxy: NGC 5861 (26Mpc)
- Discovery: 2017 Jun. 13.6
  → Follow-up Observation
  started Jun. 14~



- Kanata telescope / HOWPol
  Optical photometry, Spectroscopy
- Swift / UVOT
  UV photometry



Light Curves

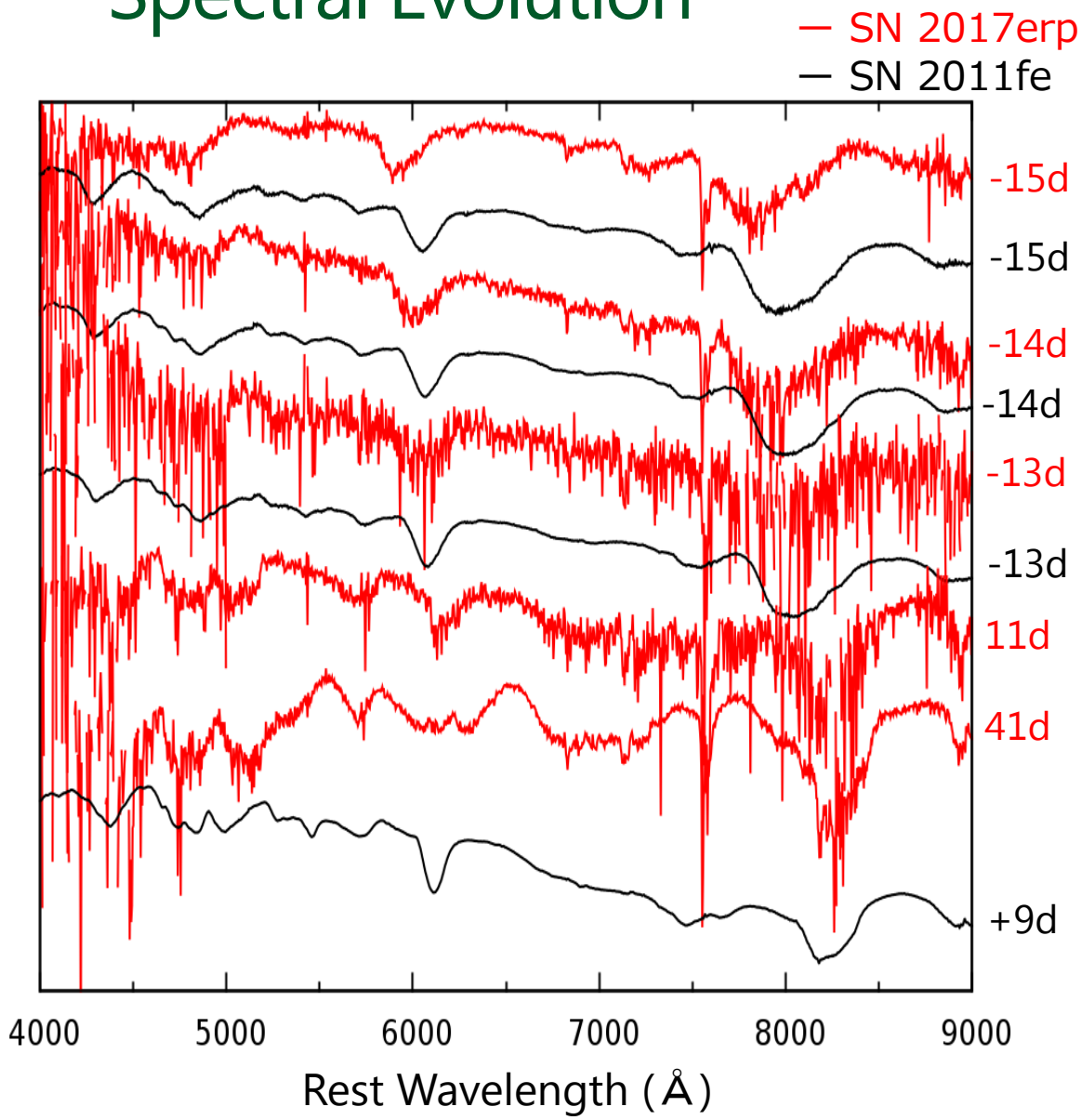


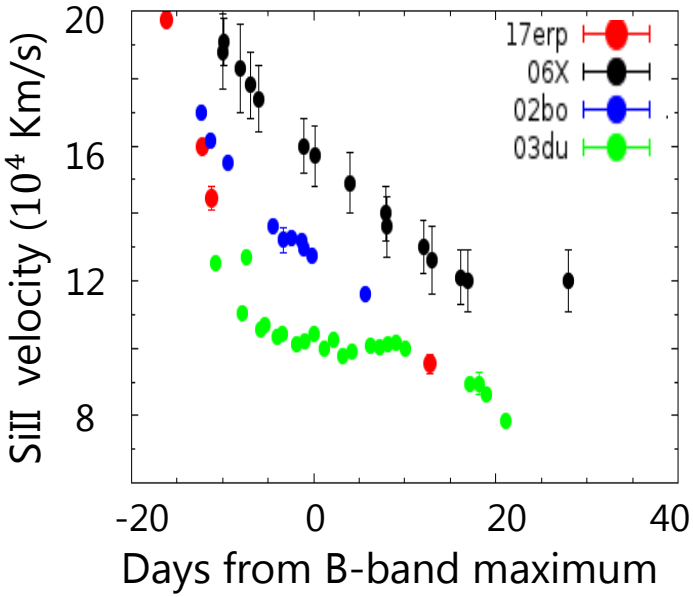
Discovery (Clear) ×
B-band +1.5
V-band +1
R-band
I-band -1
uvv +1.0
ubb +1.5
uuu +2.5
uw1 +2.5
uw2 +2.5

— SN 2005cf
(Normal SN Ia)

Discovery: ~-16day

Spectral Evolution



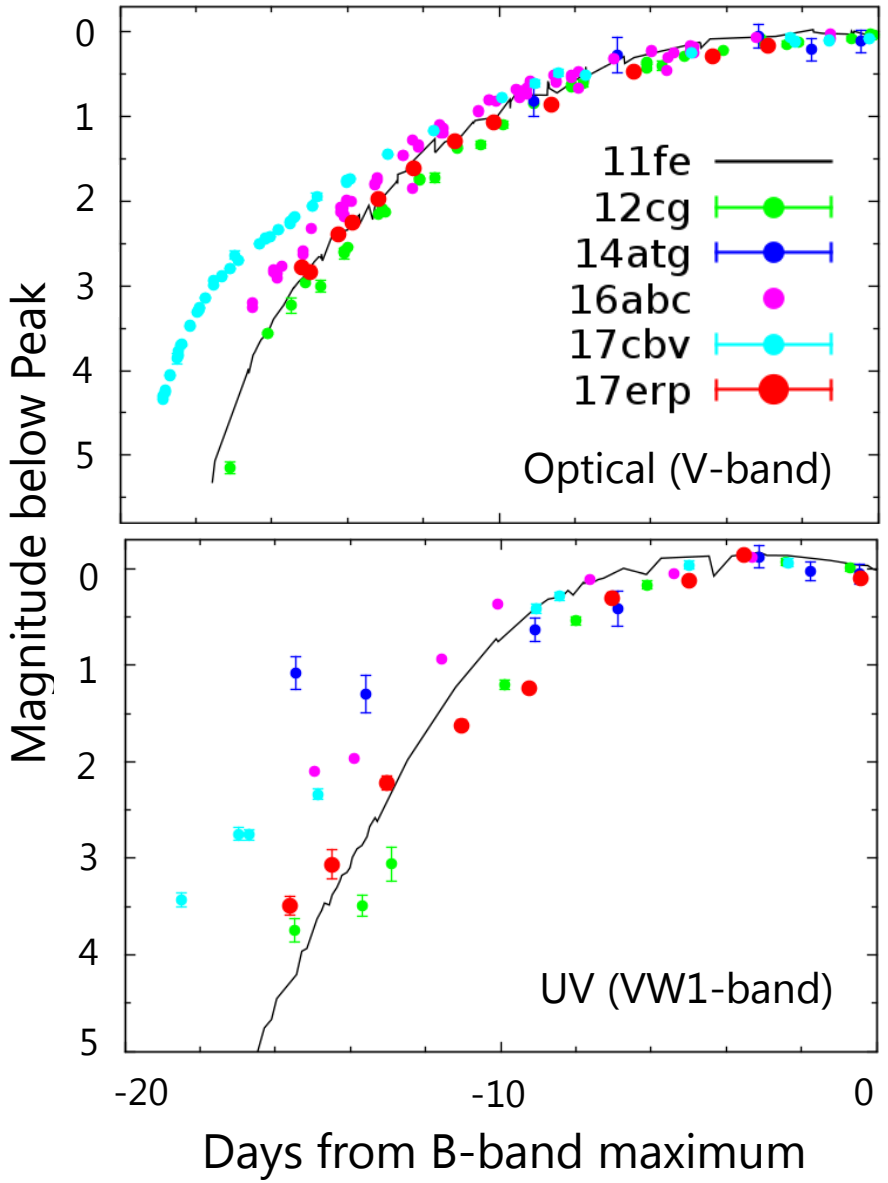


- Similar to normal SN Ia
- High velocity future

Early Phase Light Curves

- Compare with SNe Ia that show the excess in the early phase

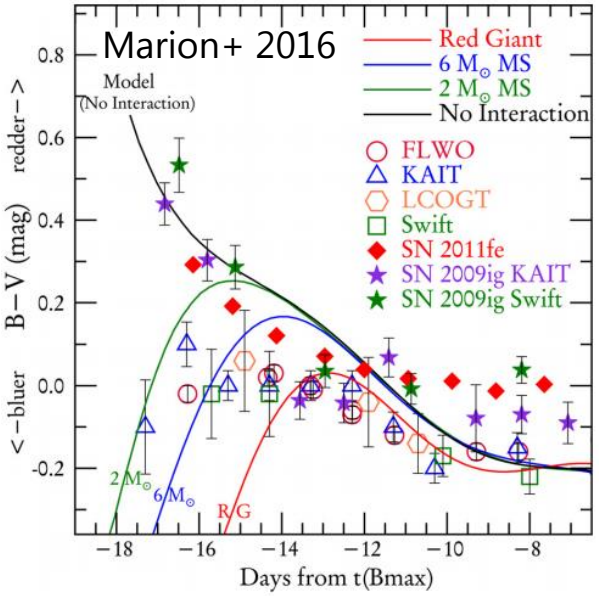
- 17erp
  Optical : No excess
  UV : Slight excess
  → Interaction?

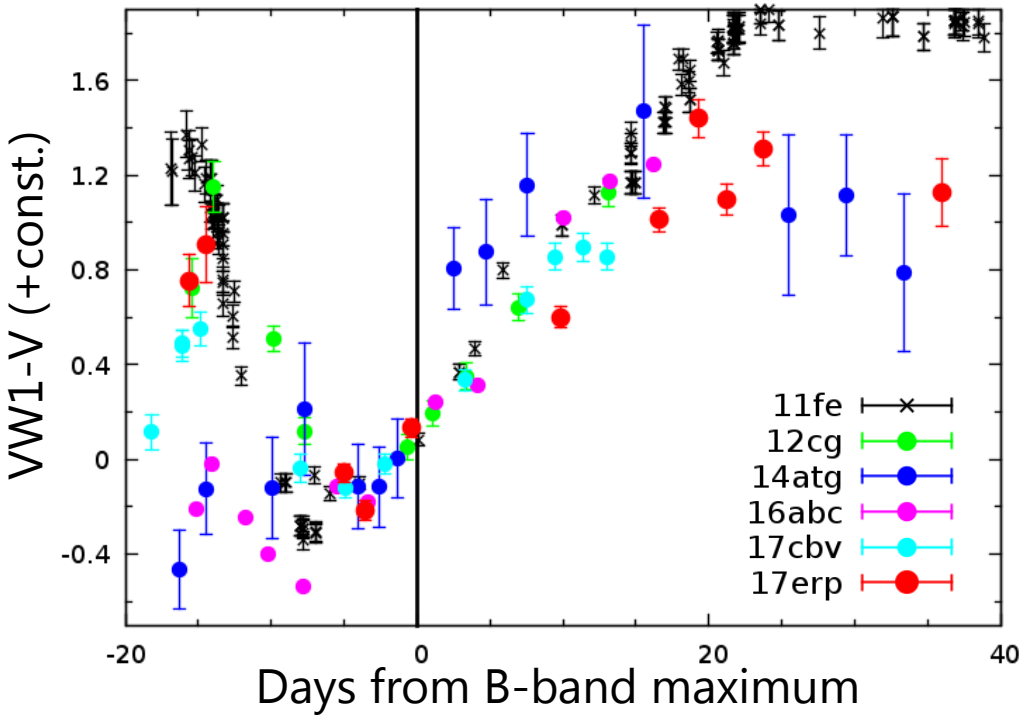


Color Evolution

- SN Ia without the excess
  The color is red in the early phase,
  it turns to be blue.

- SN Ia with the excess
  The color is bluer.
  The evolution is constant
  or turns to be red.





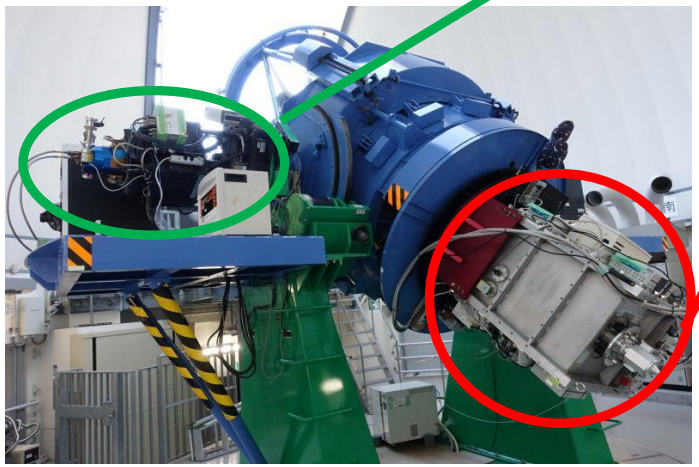
Follow-up Observation

Discovery

Photometry ~19 mag
Spectroscopy ~17 mag

SNe Ia in the nearby galaxy (<50 Mpc)

Follow-up Observation



1.5m Kanata telescope
@ Higashi-Hiroshima Observatory

Hiroshima One-shot Wide-field Polarimeter (HOWPol)
- Optical Photometry
- Optical Spectroscopy (R~400)
- Optical Polarimetry

Hiroshima Optical and Near-InfraRed camera (HONIR)
- Optical & NIR Photometry
- Optical & NIR Spectroscopy (R~300)
- Optical & NIR Polarimetry
- Optical & NIR Polarimetric spectroscopy

Summary

- We performed UV-optical photometry and optical spectroscopy of SN 2017erp.
  → In UV bands, it show the excess.
  → The interaction with the companion star

- SN 2017erp is similar to normal SNe Ia.
  Before B-band maximum, it have high velocity component and the color is bluer.

- The color evolution in the early phase of SNe Ia show diversity.
  → From multi-band observation, we can confine the progenitor system.