

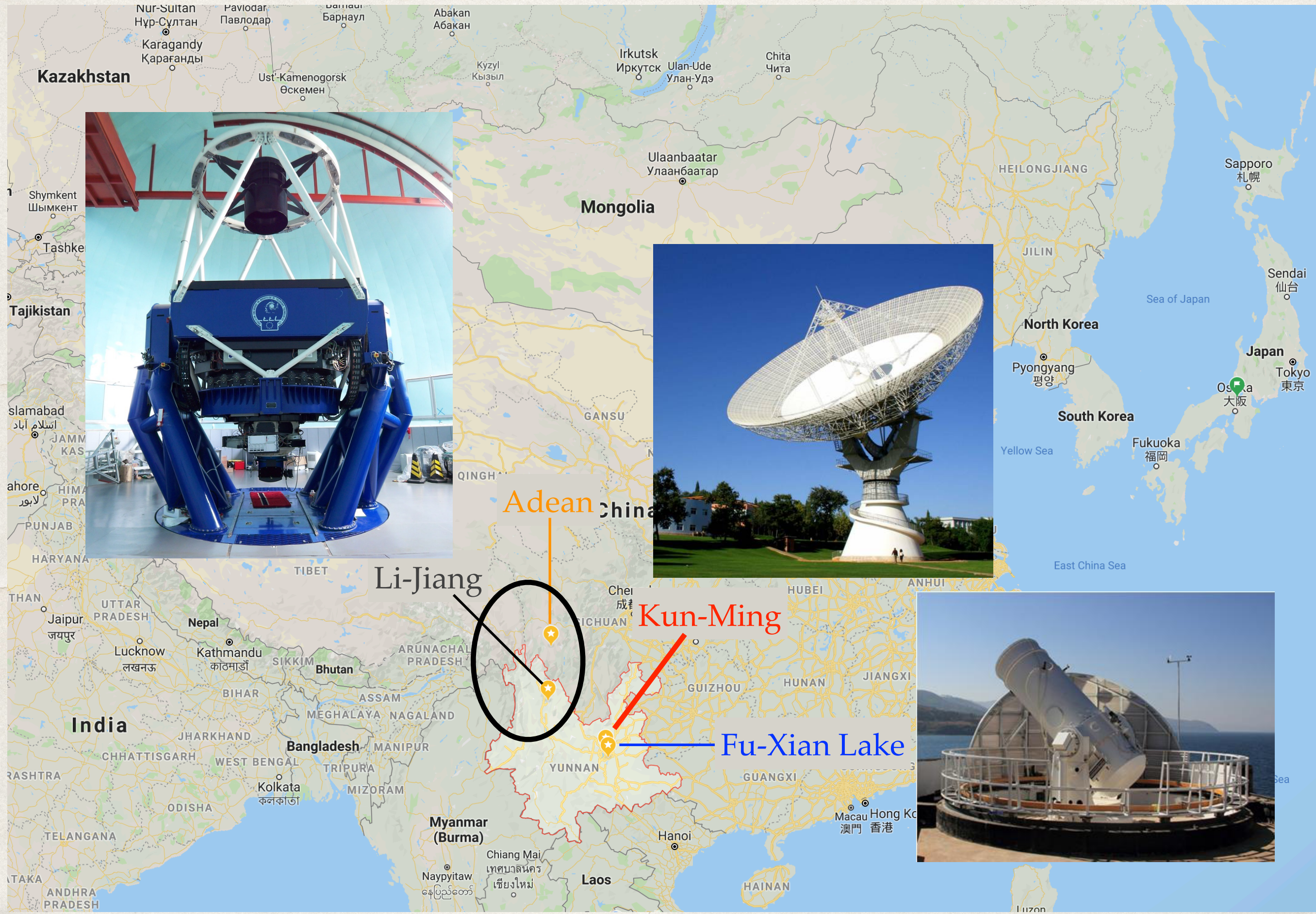
Observation of SNe & GW event at Yunnan Observatories

Ju-Jia Zhang

Yunnan Observatories, Chinese Academy of Sciences

1. Overview of Yunnan Observatories
2. Li-Jiang transient programs (LiONS and Mephisto)
3. Blue transient survey at the New site (Daocheng-Aden)

1. Overview of Yunnan Observatories



Li-Jiang Observatory

† Position:

100°2'(E), 26°42'(N)

Dec.: +90~-44°

(e.g., SN 2016adj at -43°)

† Altitude: 3200m

† Obs. time: 2200h/yr

† Seeing: ~1.0"

† Sky brightness:

V = 21.54 mag

B = 22.34 mag

† Extinction:

V = 0.14 mag

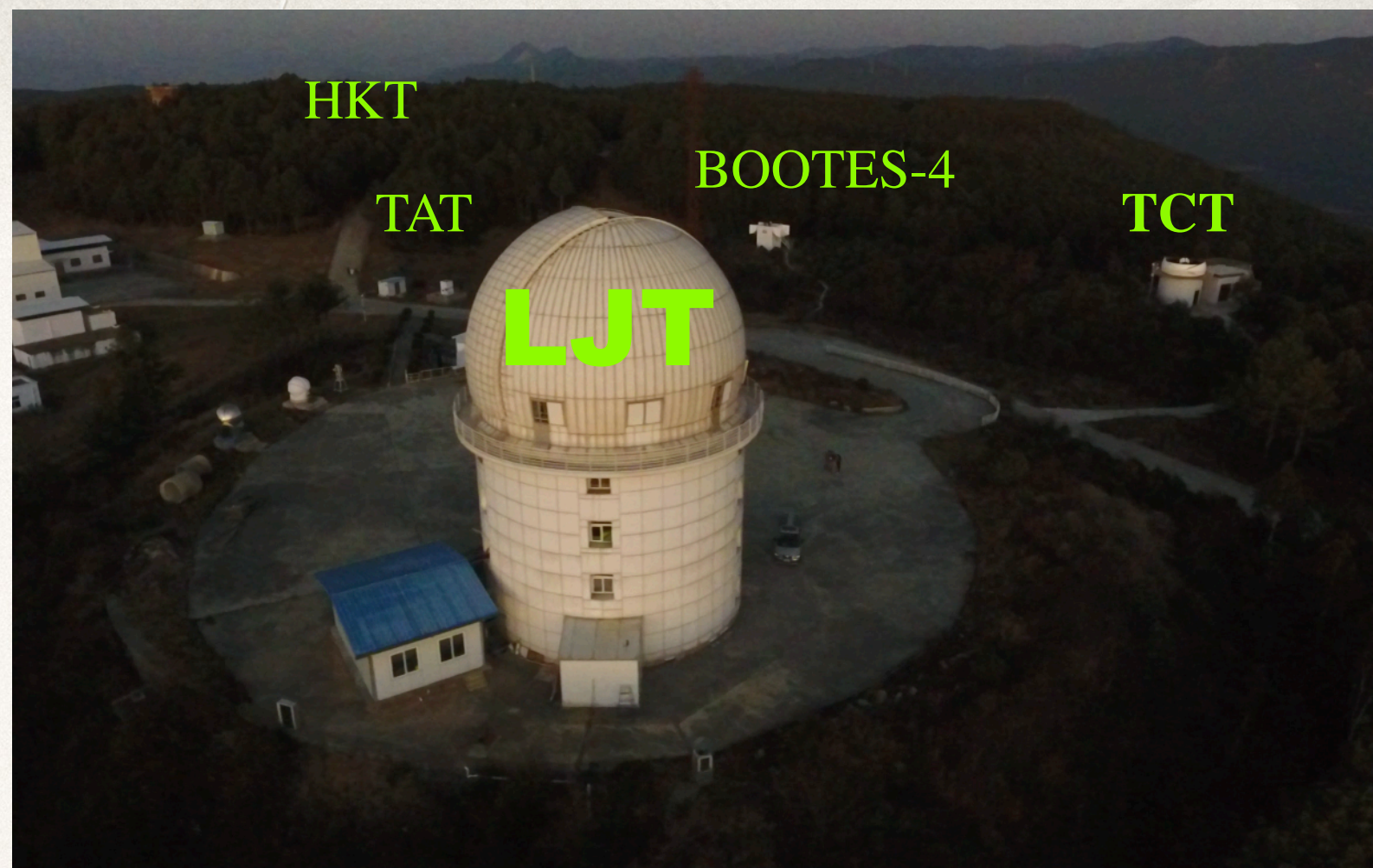
B = 0.27 mag

U = 0.50 mag

† Vapor:

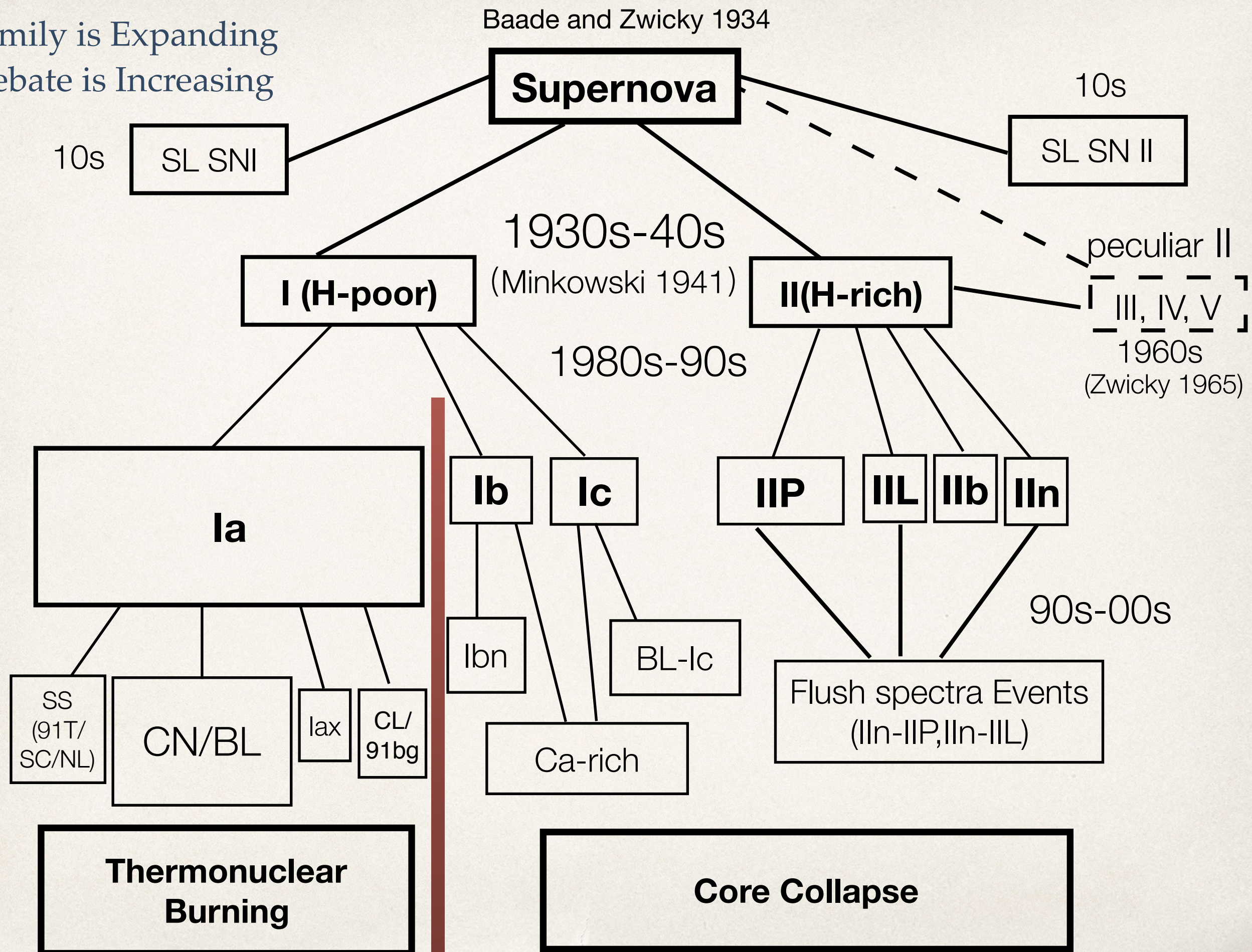
4.3 mm (Oct.~April)

13.0 mm (May~Sep.)

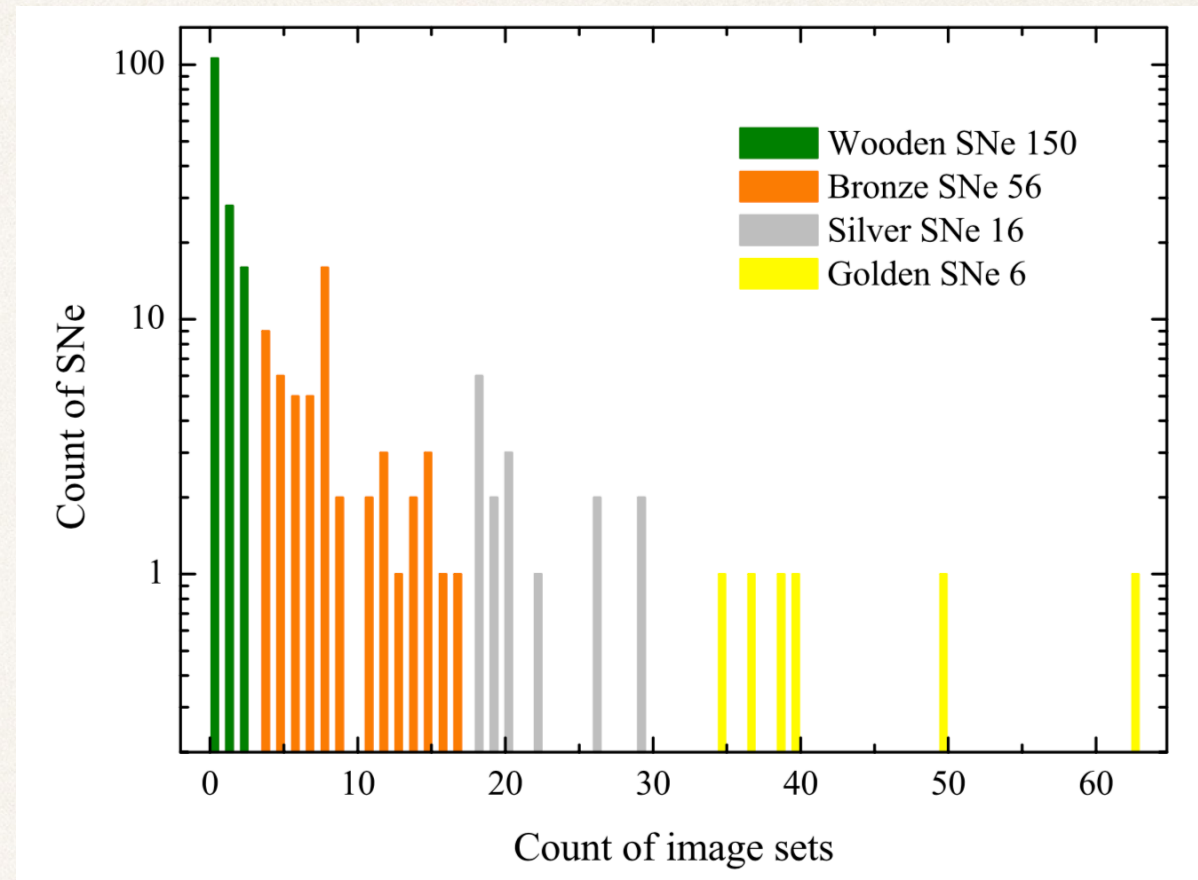
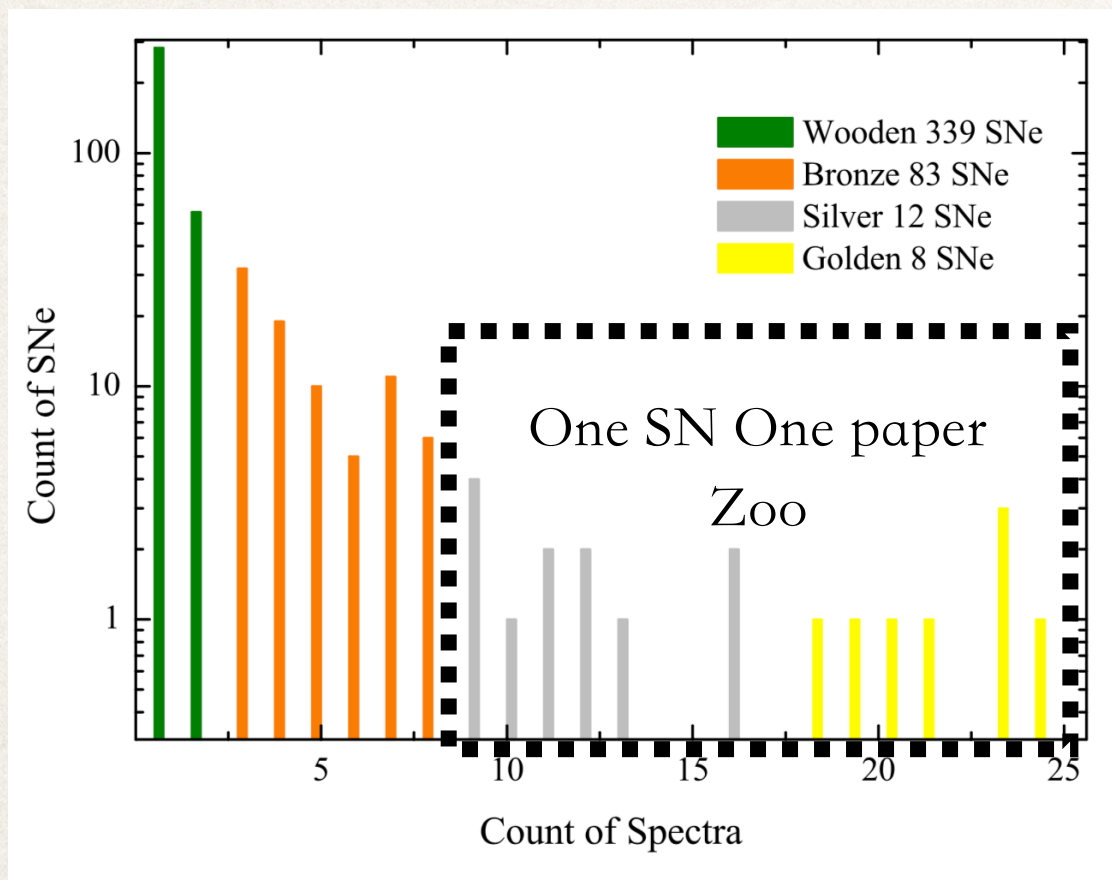


2. Li-Jiang transient programs (LiONS and Mephisto)

Family is Expanding
Debate is Increasing



Li-jiang One hour per Night Supernova program (LiONS) with LJT
classified > 200 SNe (70% before the peak)



- Ia:** SN 2011hr (Zhang J.J.,+2016), SN 2012fr(Zhang J.J., +2014a), iPTF 14bdn (Smitka+2015), SN 2013dy (Zhai+2016), SN 2011fe(Zhang K.C.+2016), SN 2014J (Zhang K.C. + 2018), SN 2018oh(Li W.X., + 2018), SN 2014ek (Li L.Y.,+2018), SN 2013gy (Holmbo+ 2018), SN 2013gs (Zhang T.M., + 2019), SNe Statistics (Zhao + 2015, 2016).
- Ib/c:** SN 2014L(Zhang J.J., +2018.) , SN 2014av (Pastorello+2016), SN 2016coi (Prentice +2018), SN 2017ein (Xiang+2018).
- IIP:** SN 2013am (Zhang J.J., +2014b), SN 2013ej(Huang+2015), SN 2014cx(Huang+2016), iPTF 14hls (Arcavi+ 2017), SN 2016X (Huang+2018).

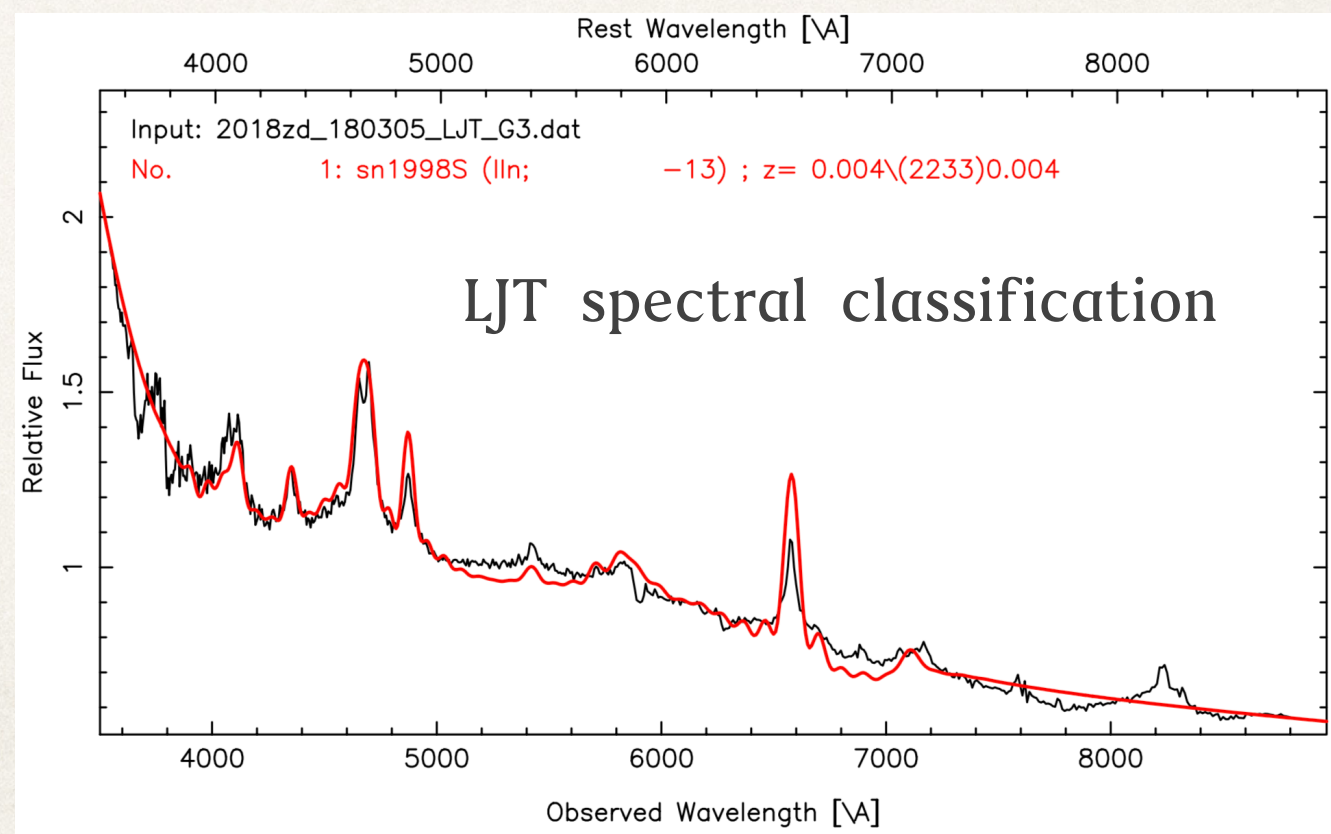
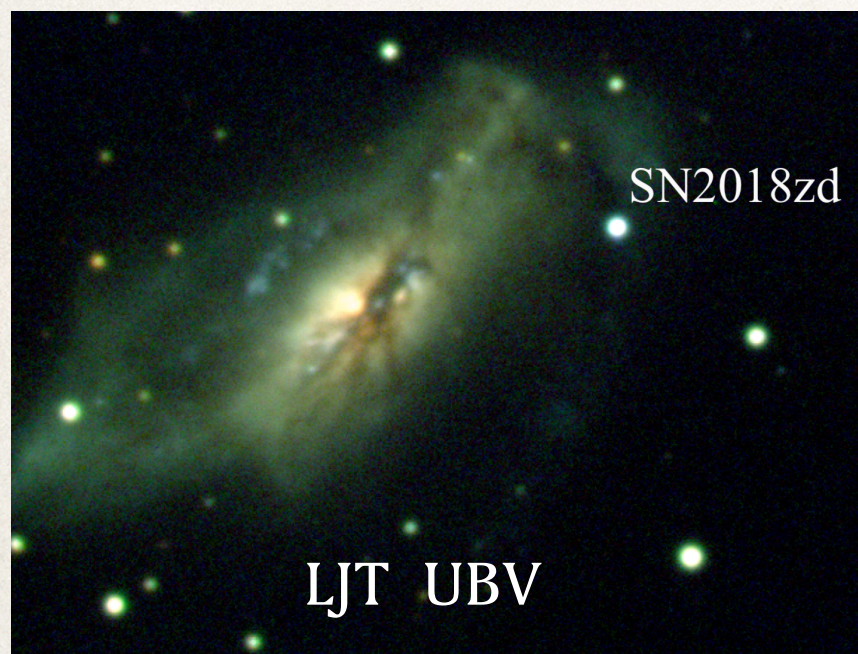
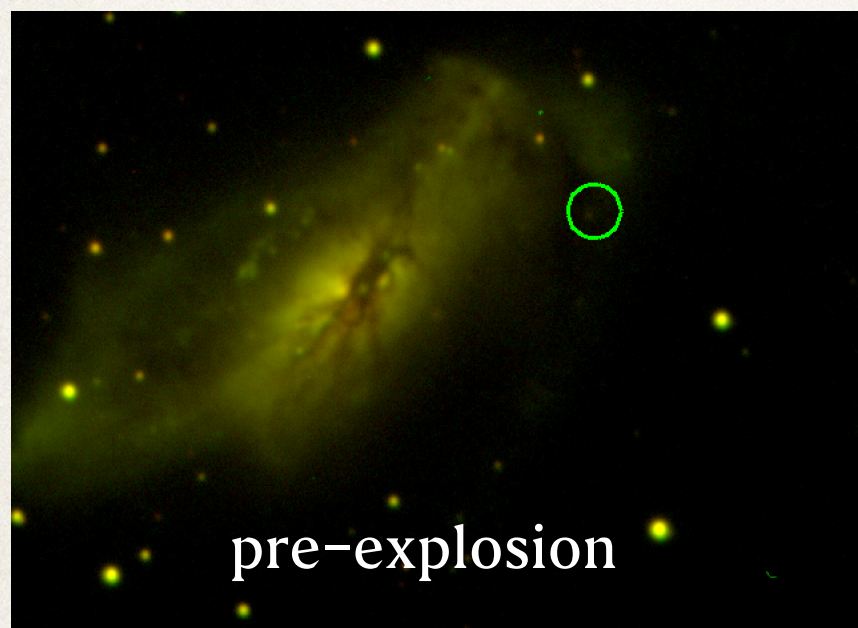
A case of LiONS project: SN 2018zd (in prep.)

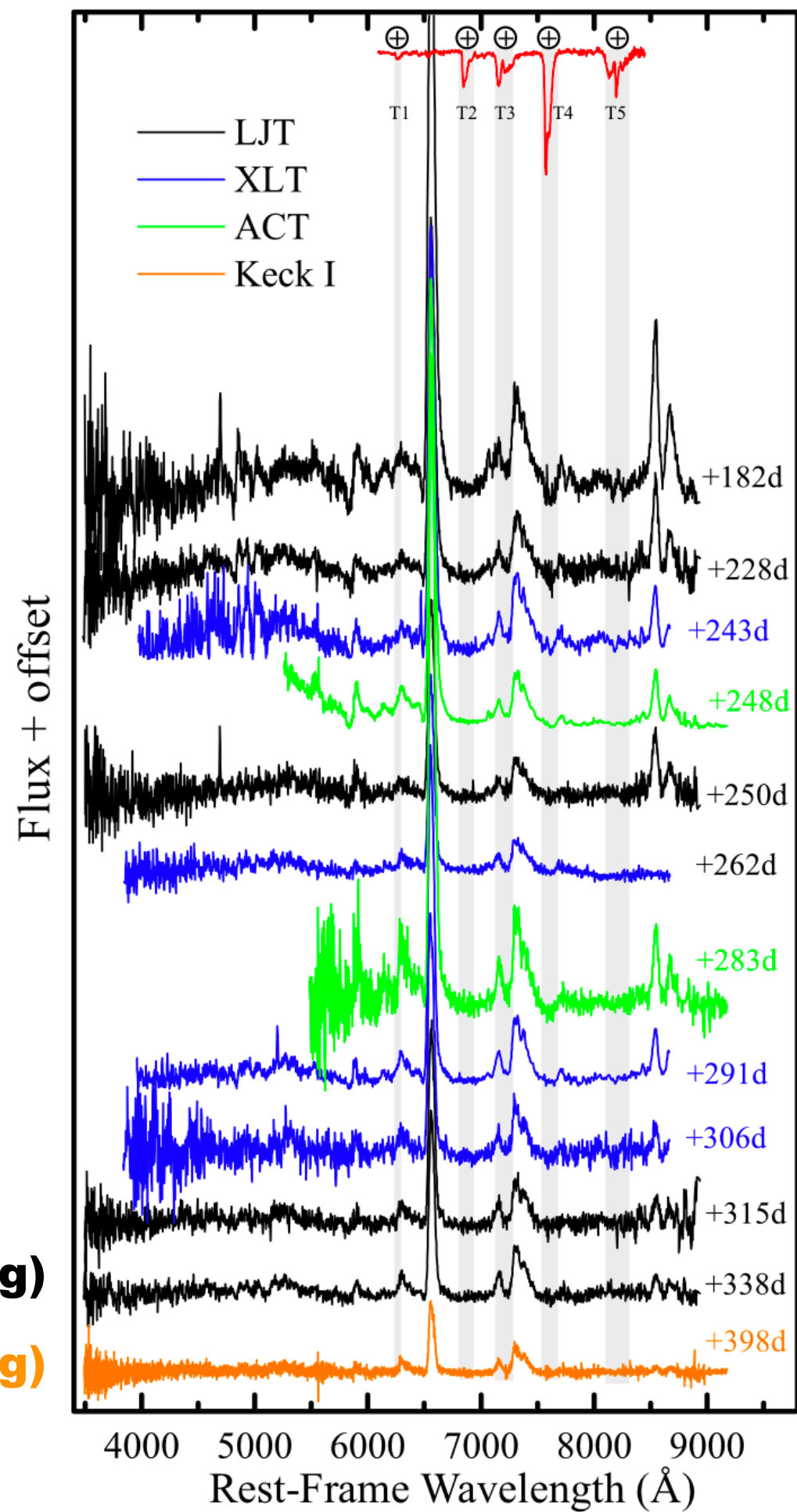
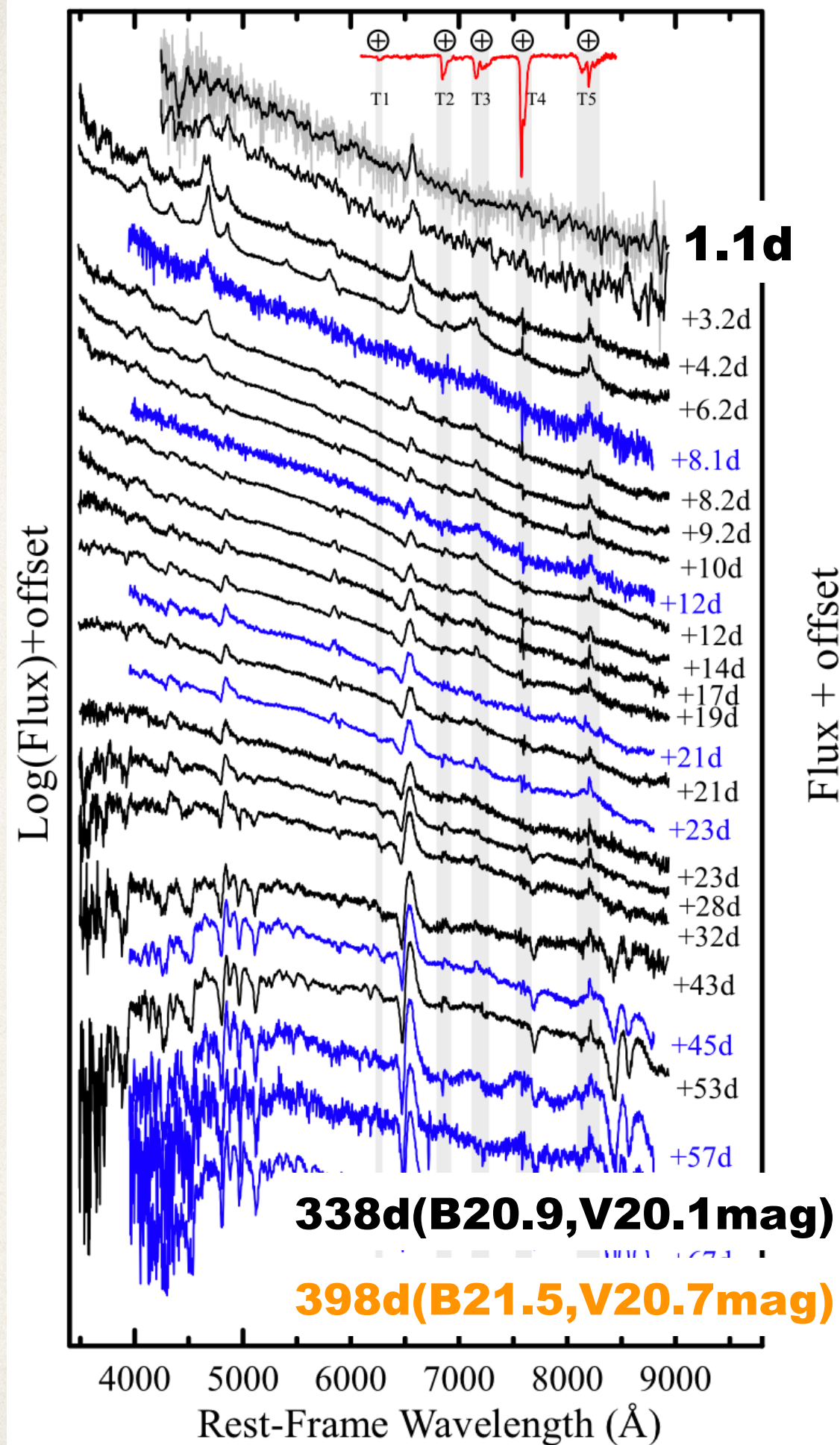
SN II with Short-lived 'flash emission'

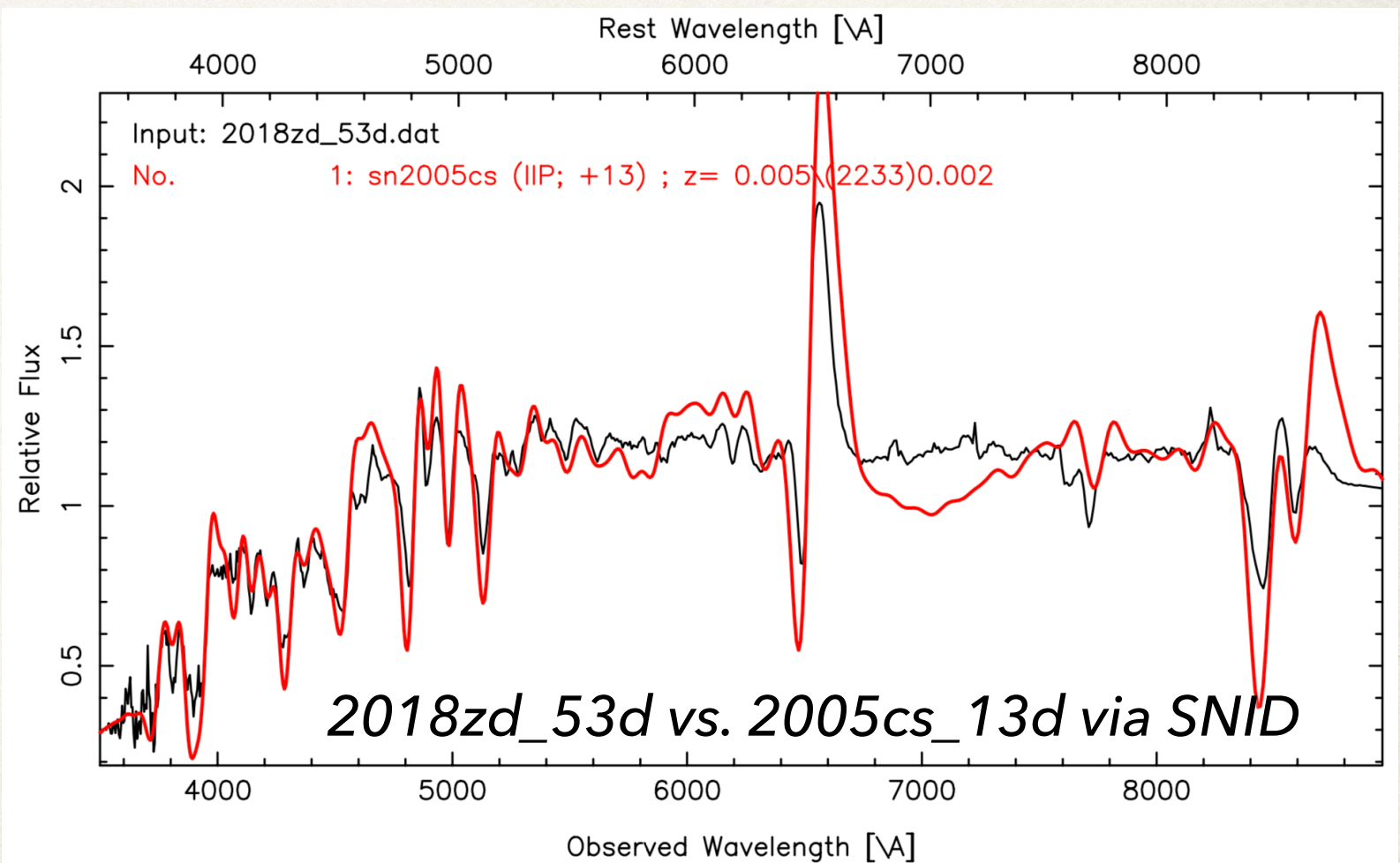
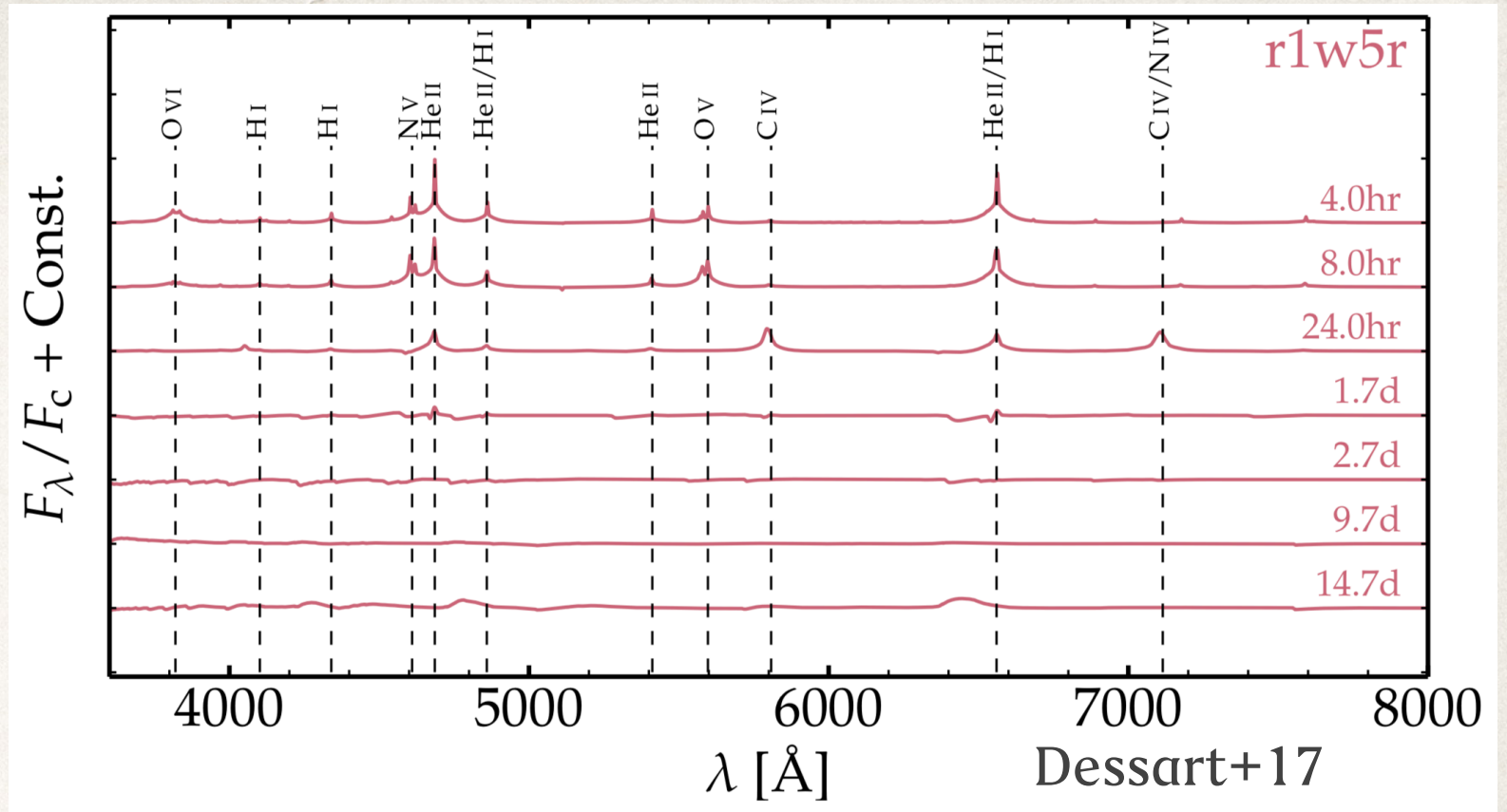
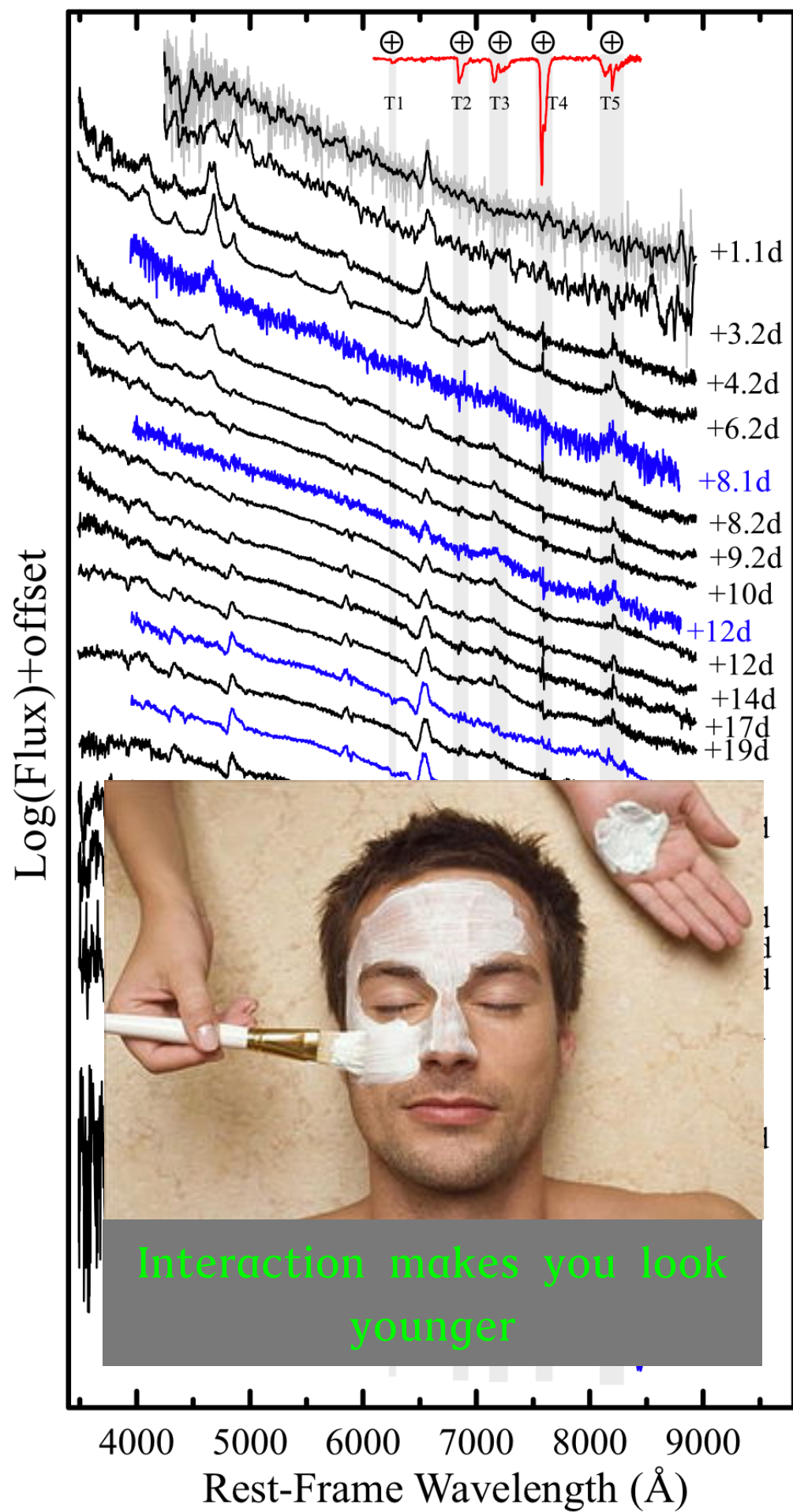
NGC 2146 (18Mpc)

Discovered by Koichi Itagaki

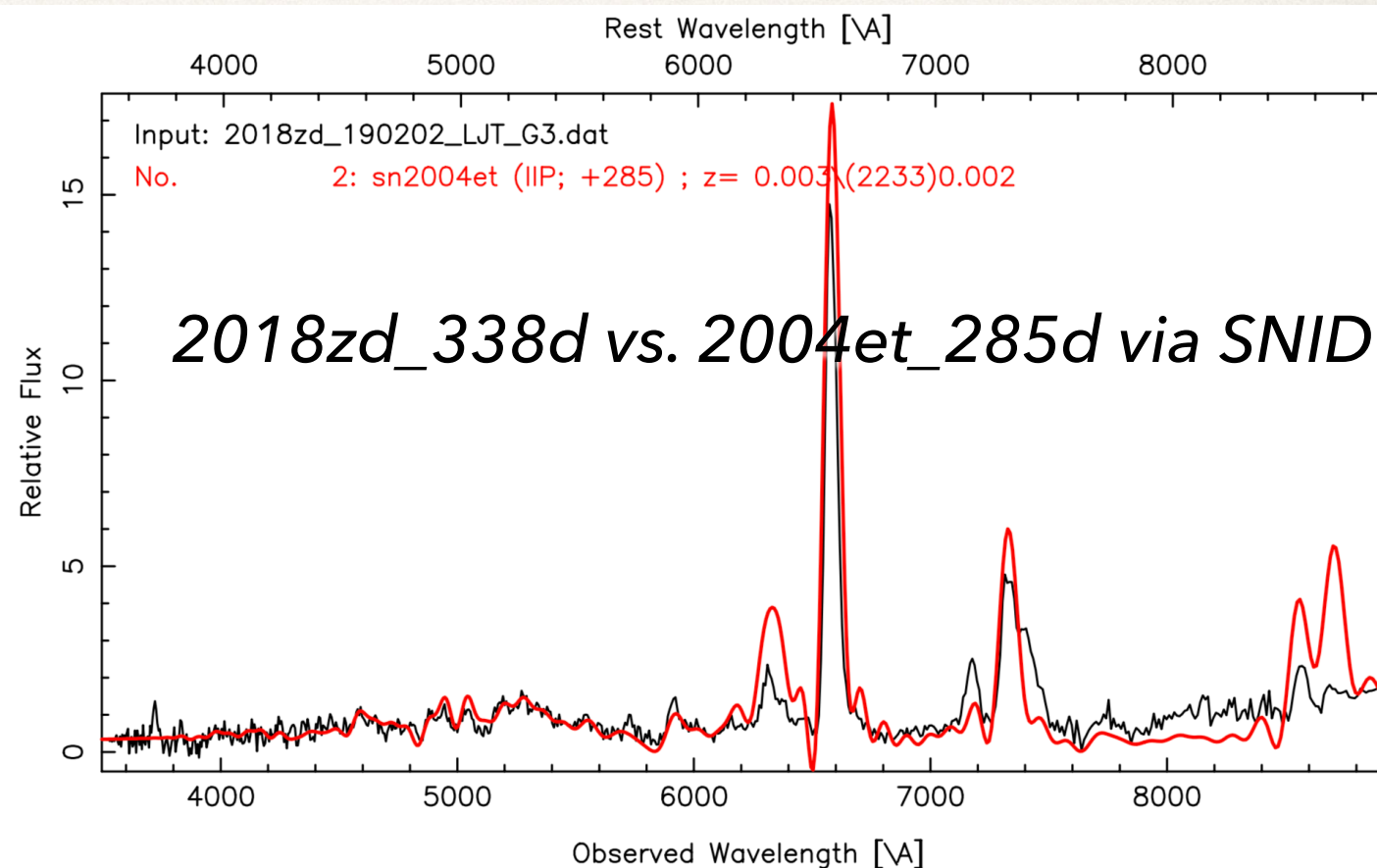
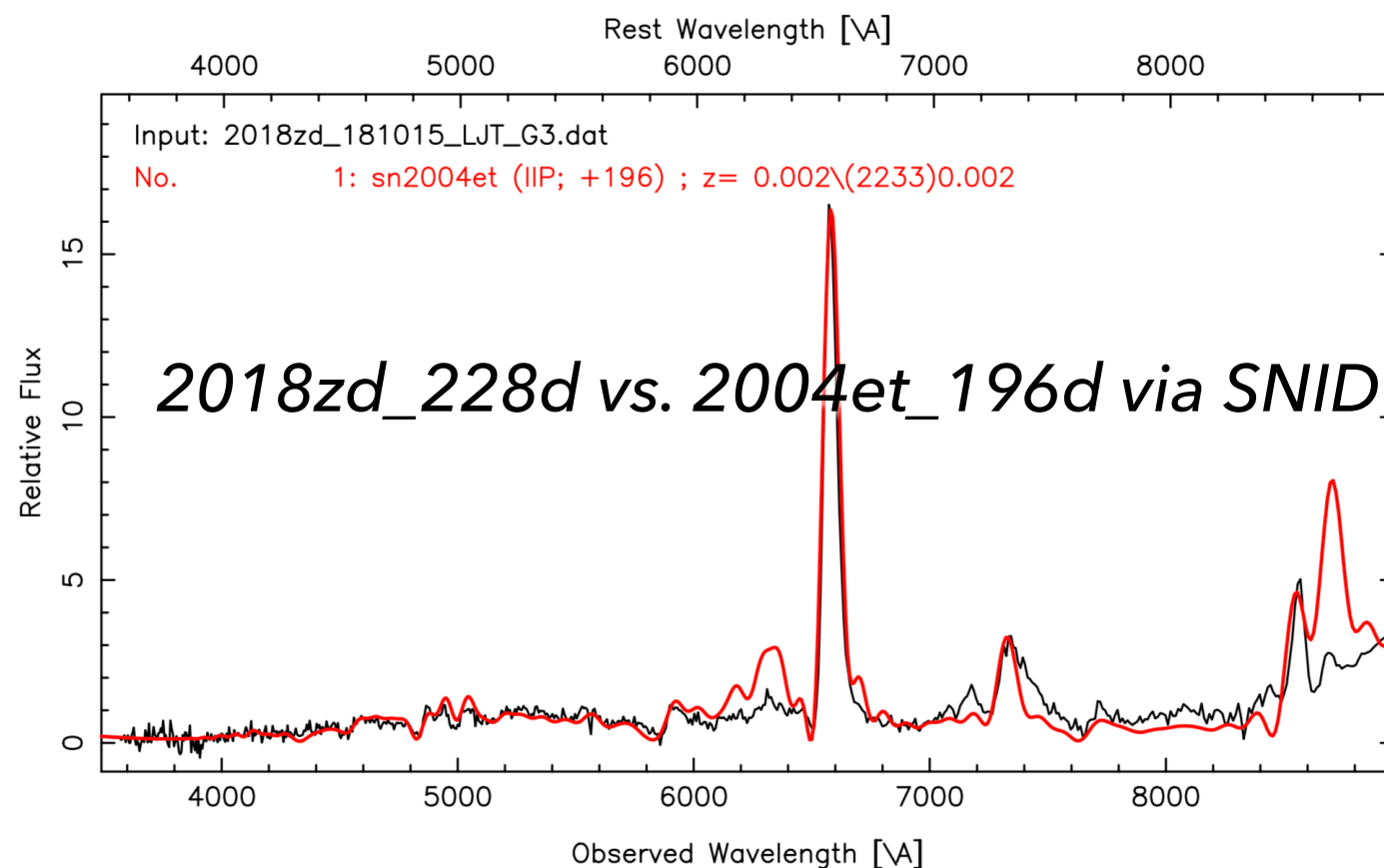
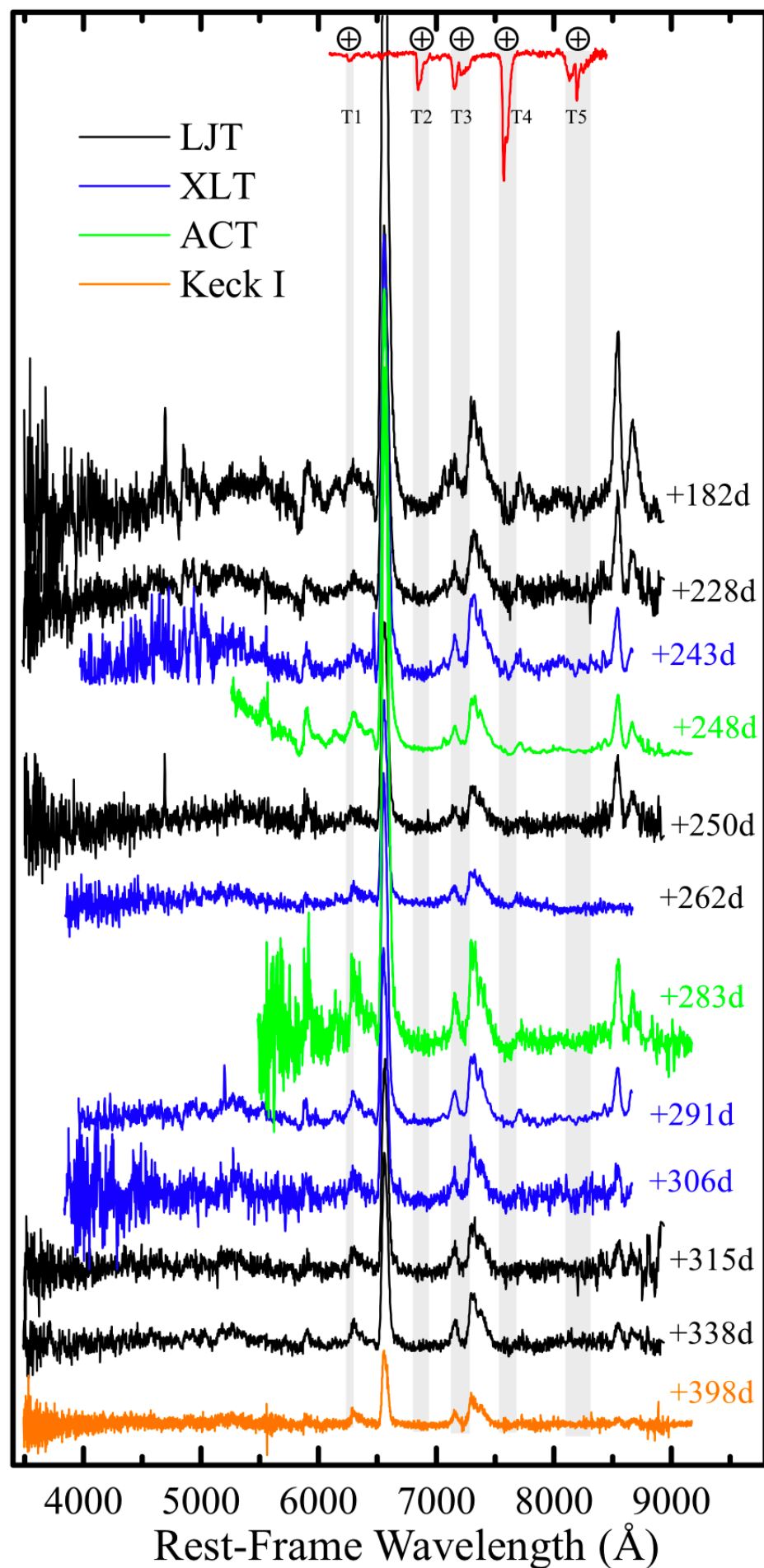
Spectral Classified by LJT (Zhang+18)

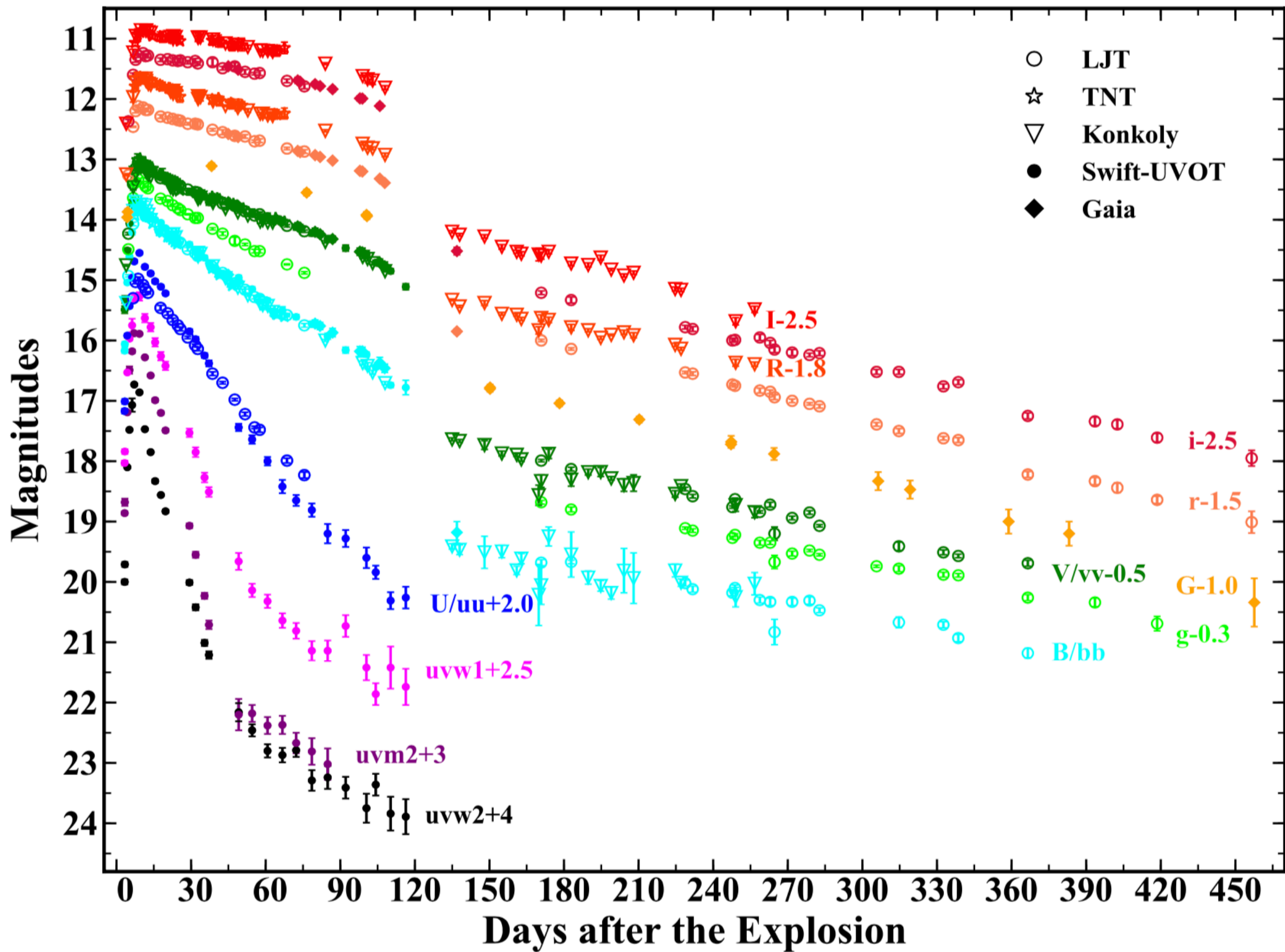


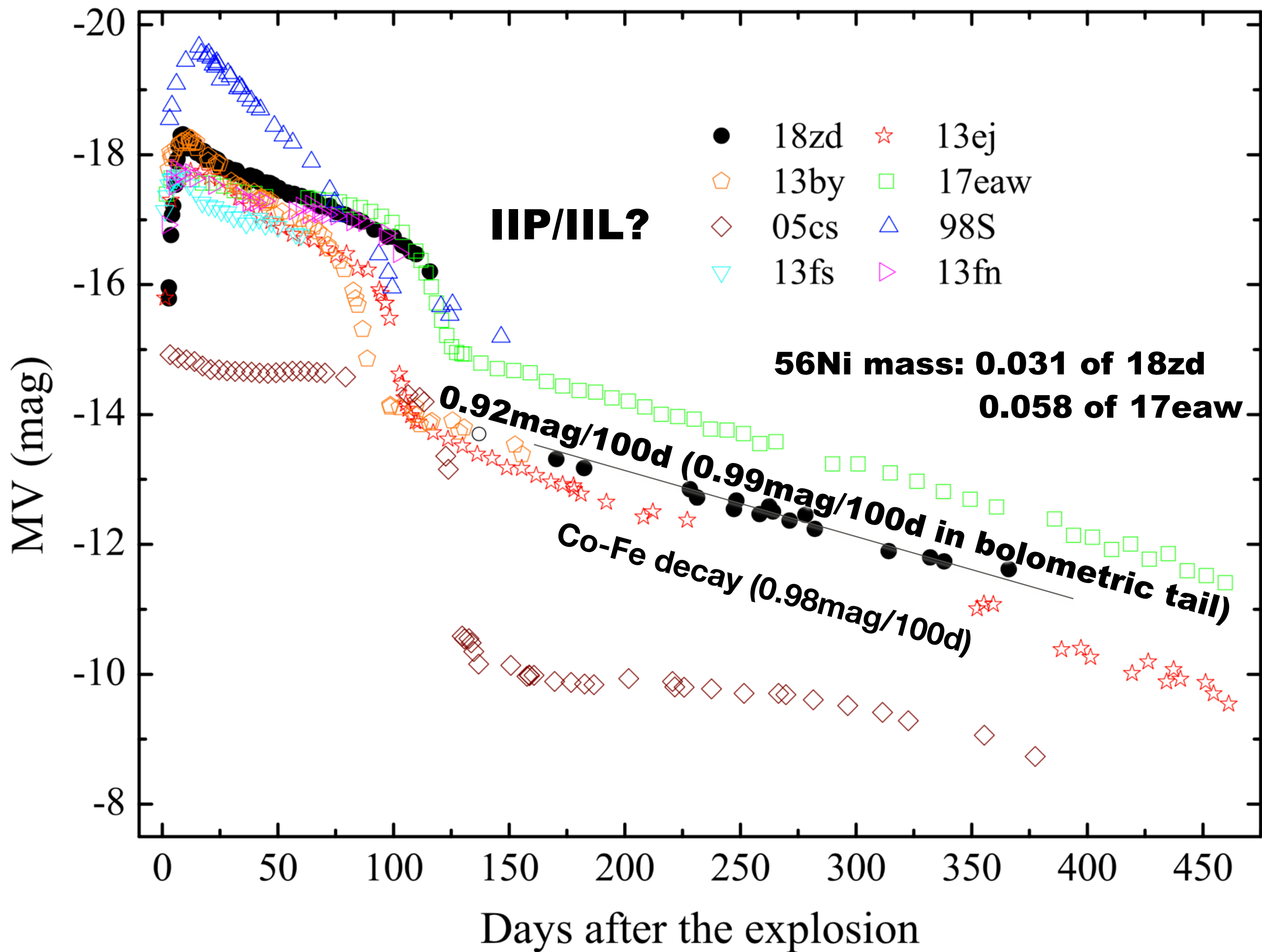


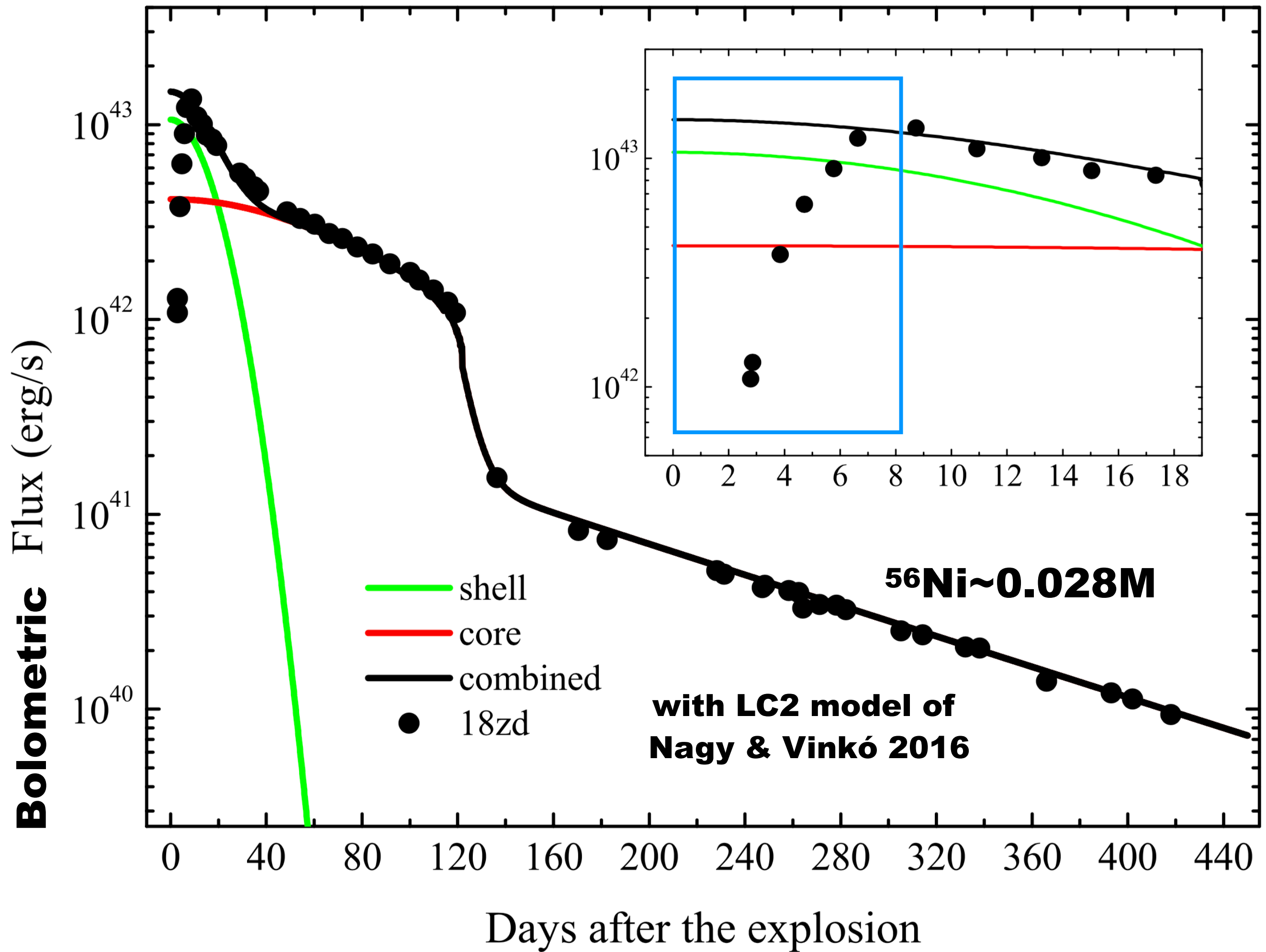


Flux + offset



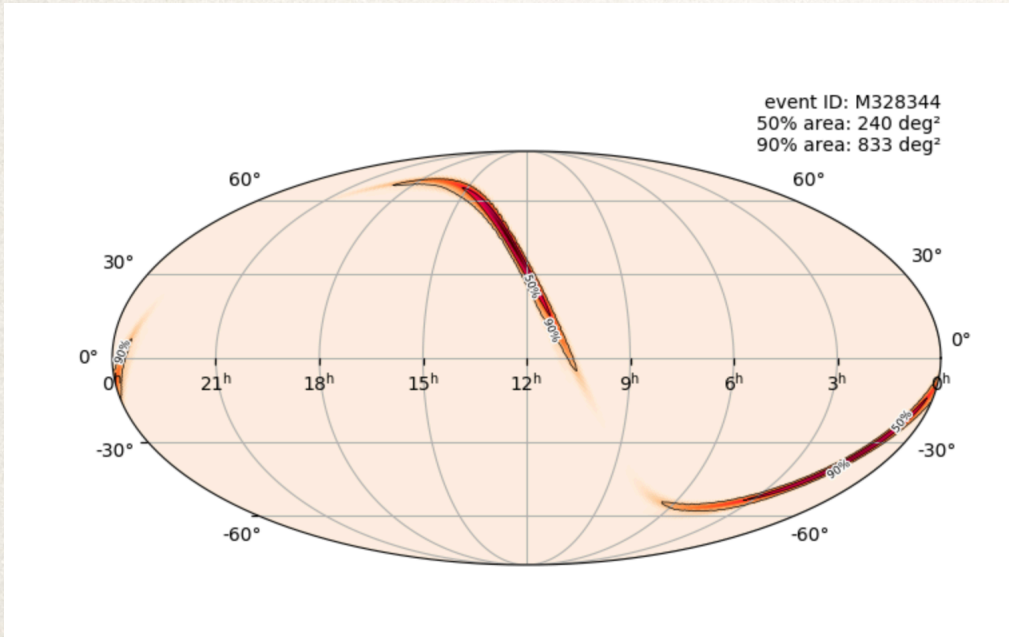




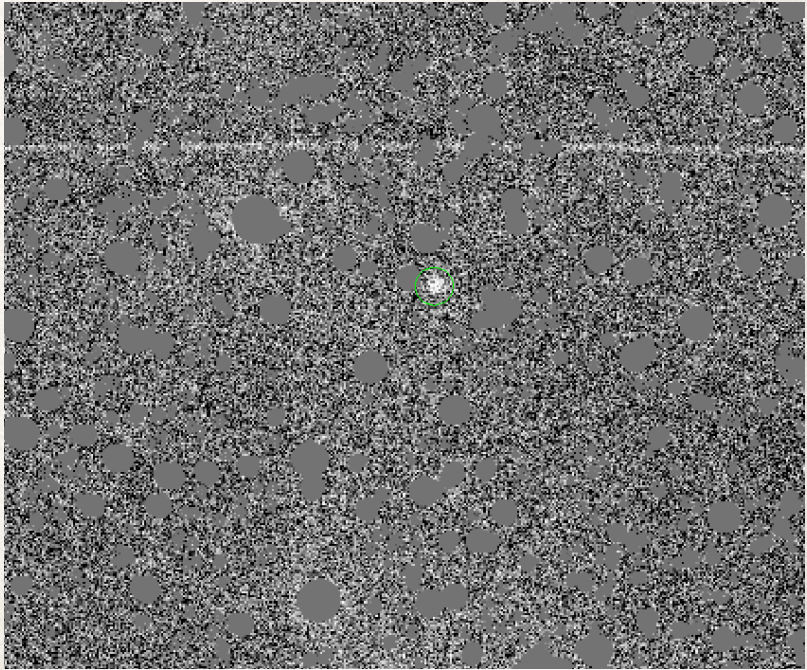
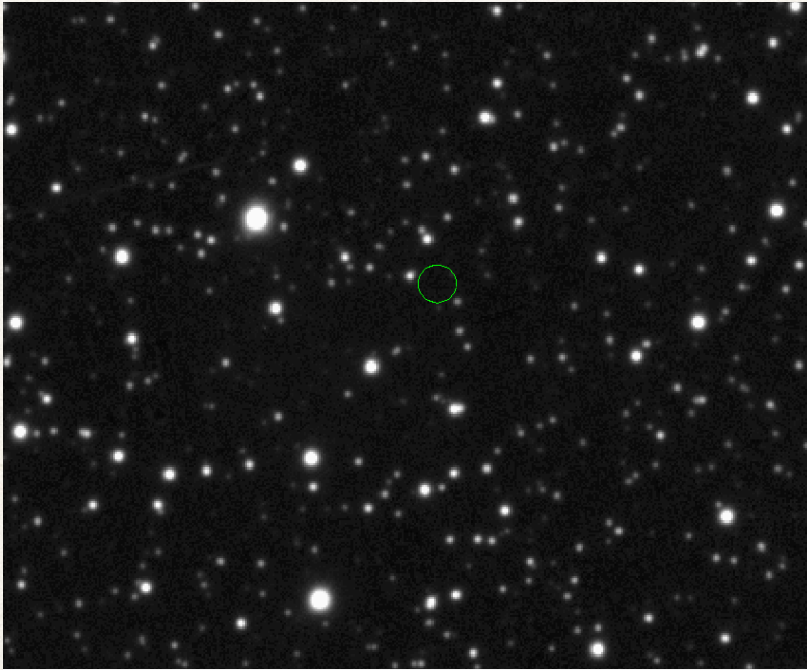
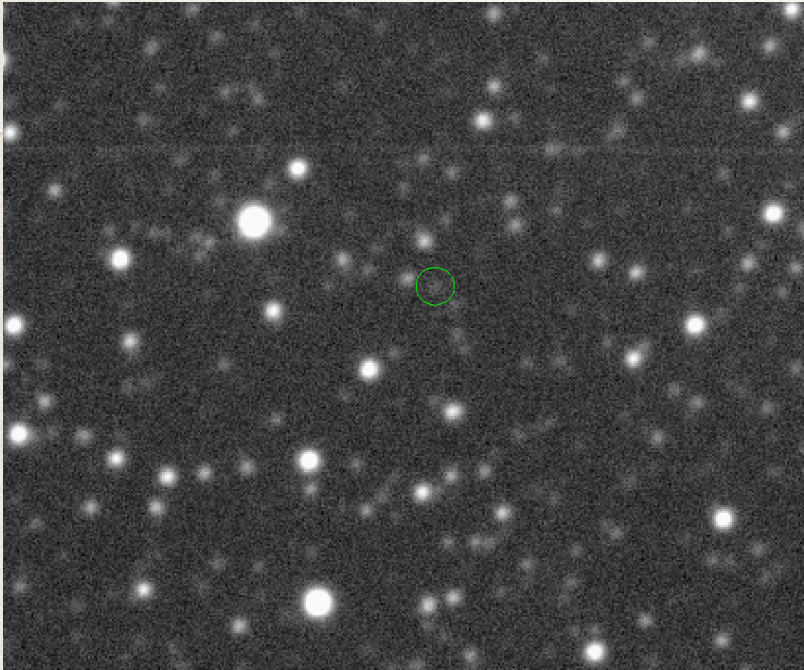


Try to detect optical signal of GW at LJT

Scan the possible galaxies located in the region of GW-alert



MS190330i000	12	45	50.16	+45	17	54.20	J2000	MS190330i001	12	46	01.77	+45	12	26.42	J2000
MS190330i002	12	56	48.28	+48	17	48.58	J2000	MS190330i003	12	38	39.12	+43	08	12.01	J2000
MS190330i004	13	00	52.32	+48	39	01.01	J2000	MS190330i005	12	47	26.88	+45	48	23.80	J2000
MS190330i006	13	01	50.88	+49	01	18.26	J2000	MS190330i007	12	55	45.60	+47	41	54.31	J2000
MS190330i008	12	55	59.57	+48	26	43.37	J2000	MS190330i009	12	10	36.73	+34	57	23.34	J2000
MS190330i010	13	08	10.11	+50	39	49.13	J2000	MS190330i011	12	56	49.92	+48	17	59.28	J2000
MS190330i012	12	37	15.12	+43	33	46.40	J2000	MS190330i013	12	06	16.79	+33	31	33.26	J2000
MS190330i014	12	55	44.16	+48	17	14.35	J2000	MS190330i015	12	50	59.76	+46	59	35.45	J2000
MS190330i016	12	22	30.48	+39	04	06.53	J2000	MS190330i017	12	44	08.21	+44	53	30.80	J2000
MS190330i018	12	56	43.44	+48	16	25.57	J2000	MS190330i019	12	55	56.74	+48	30	39.36	J2000
MS190330i020	12	56	23.53	+48	15	22.33	J2000	MS190330i021	12	41	07.44	+43	46	30.97	J2000
MS190330i022	13	02	33.86	+49	58	10.10	J2000	MS190330i023	13	09	55.20	+51	20	01.93	J2000
MS190330i024	12	55	35.29	+48	28	25.44	J2000	MS190330i025	12	23	22.56	+39	02	06.68	J2000
MS190330i026	12	04	36.00	+32	35	50.42	J2000	MS190330i027	13	00	27.36	+49	32	24.83	J2000



LJT-image

PanStarrs-template

On-building project at Li-Jiang Observatory

Mephisto

Multi-channel Photometric Survey Telescope

SWIFAR (South-Western Institute For Astronomy Research) & YNAO

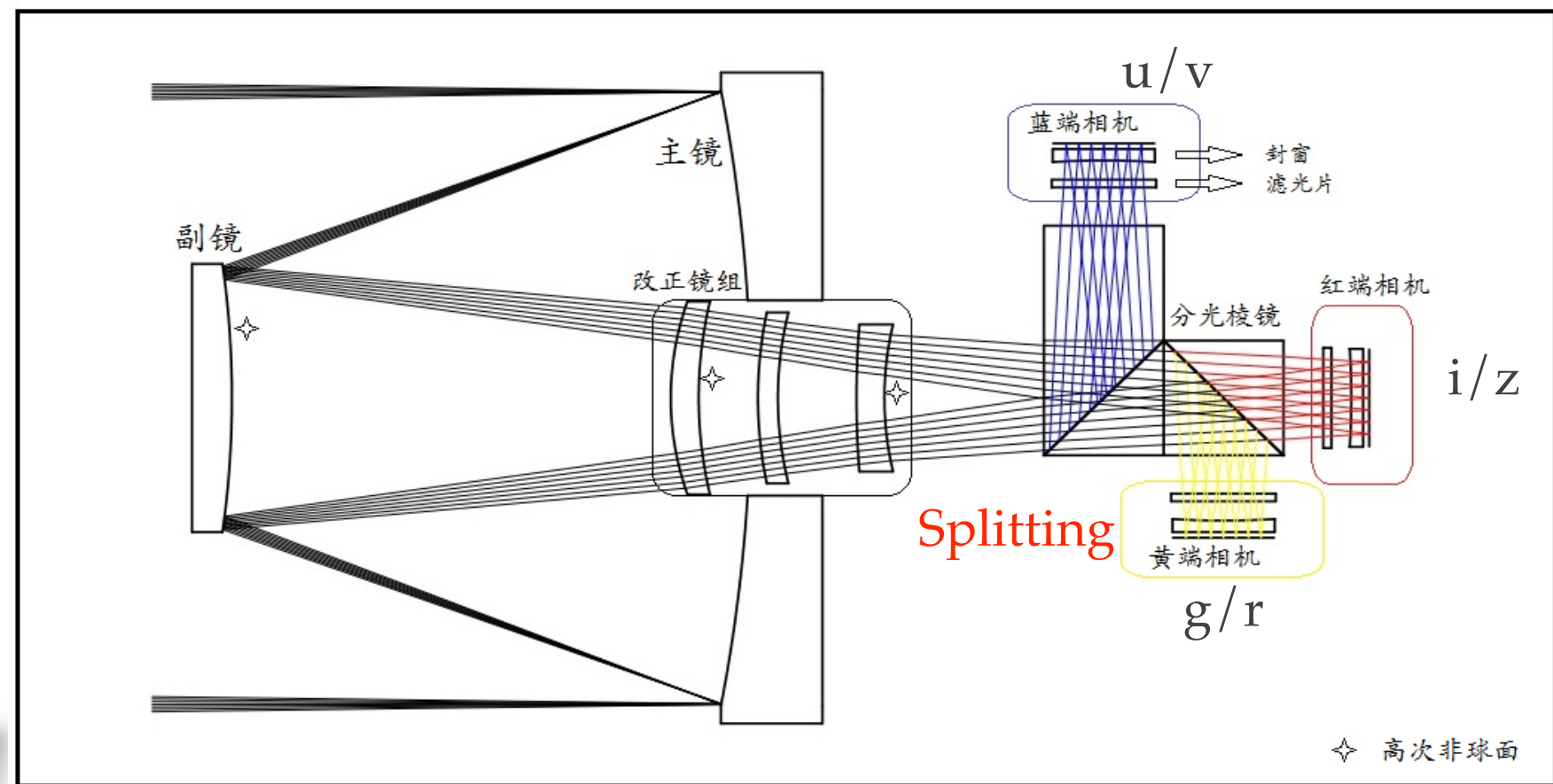
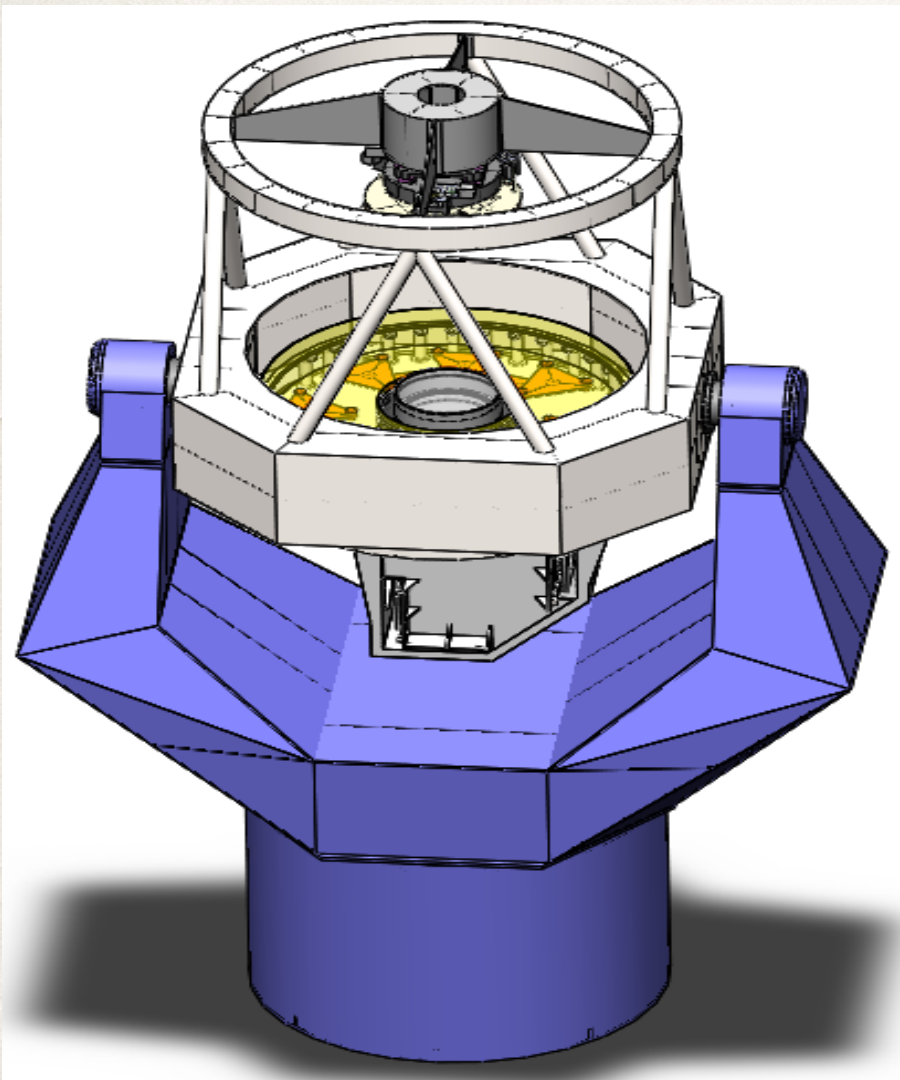
1.6 m wide field telescope (3.14deg^2)

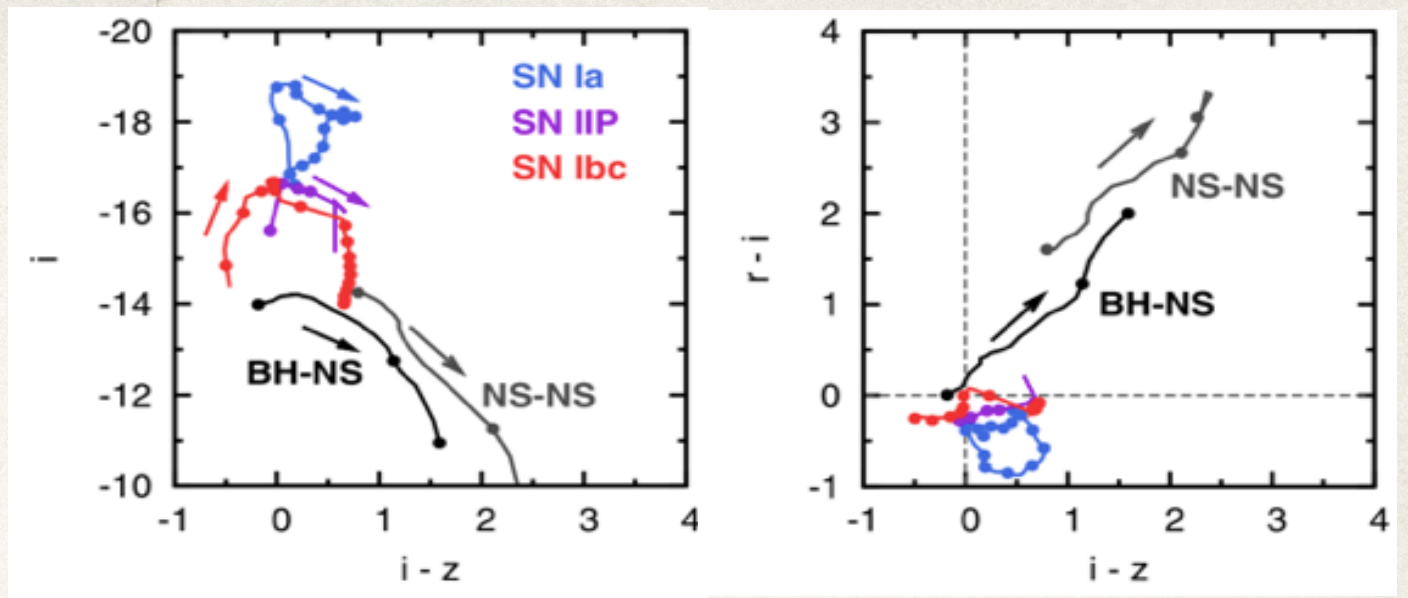
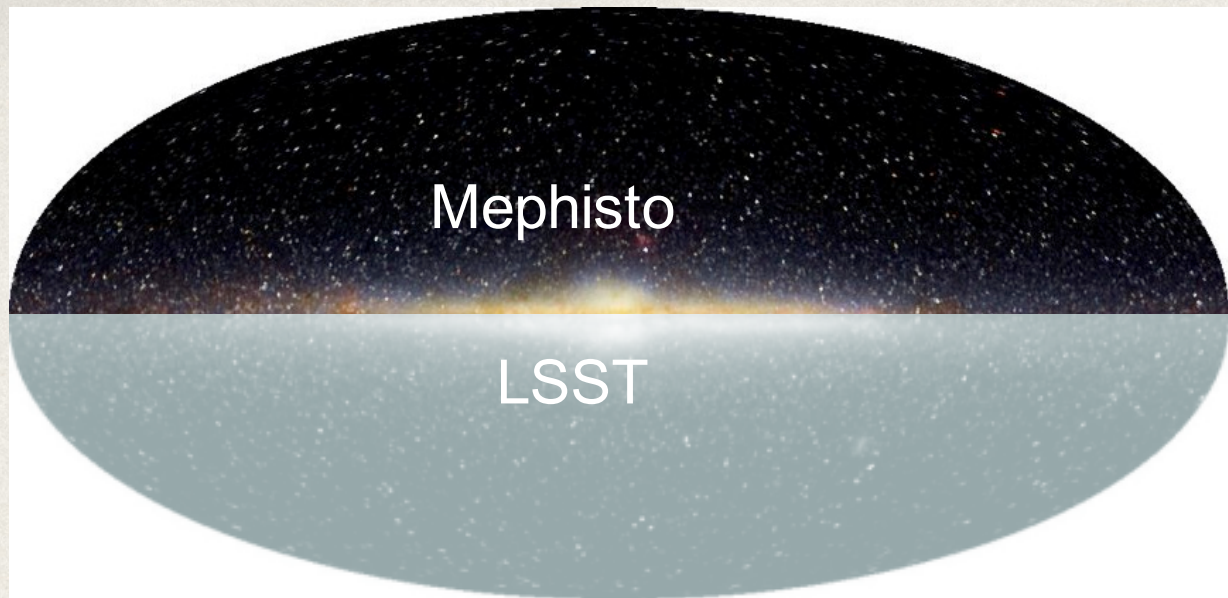
Real-time 3-colors (ugi or vrz): take real-color film of sky

$1800\text{ deg}^2/\text{night}$

High color calibration accuracy: 0.2-0.5%

First Light at 2021, Survey since 2022





Theoretical model (Tanaka et al. 2014)

Blue, Yellow and Red channels: Camera x 3

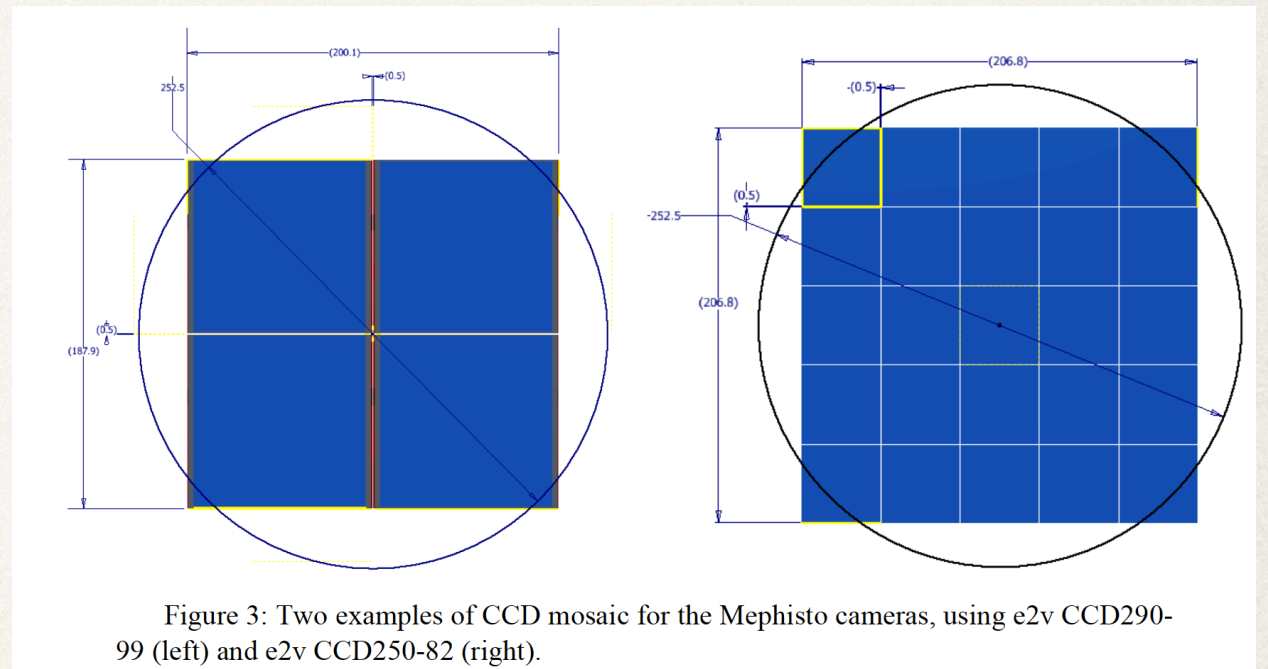
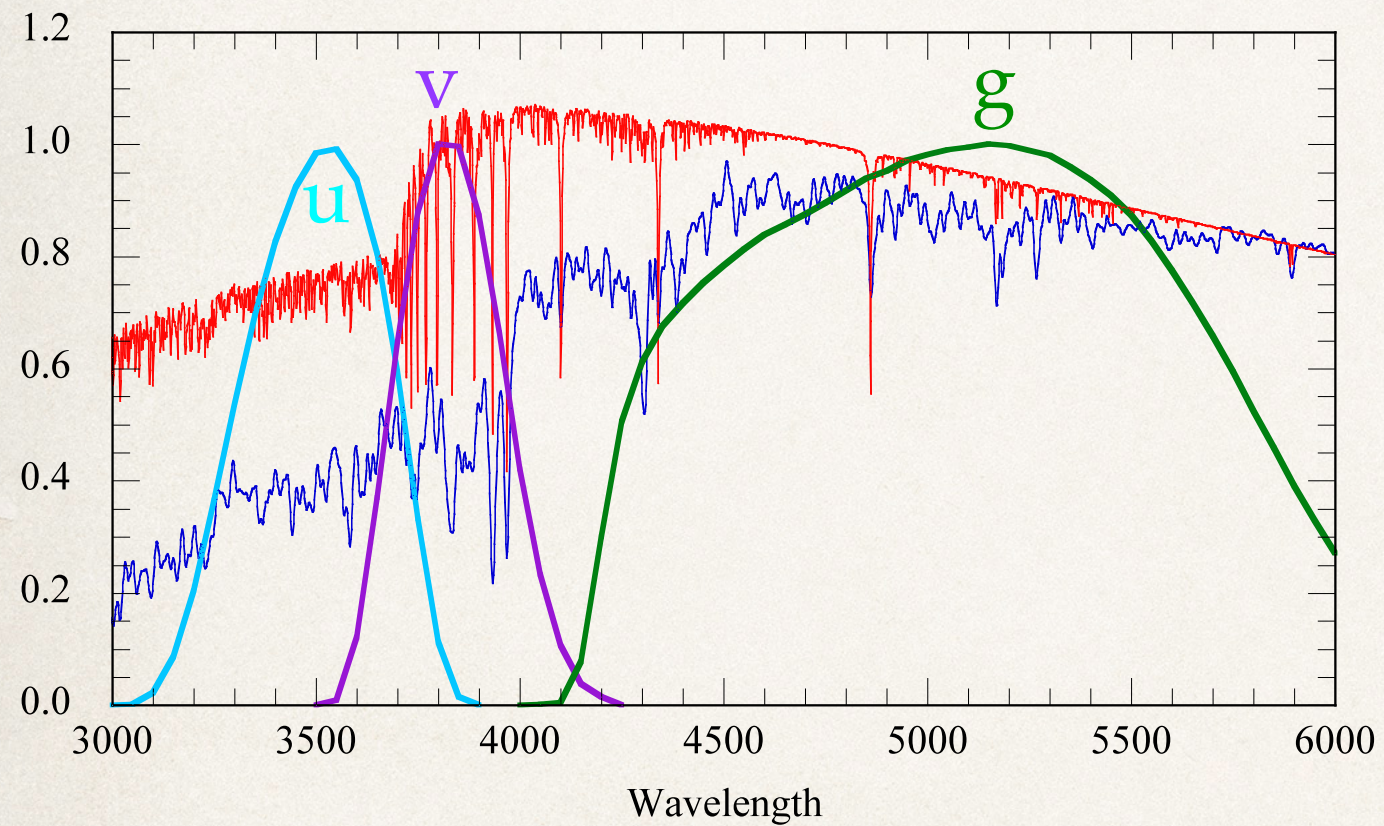


Figure 3: Two examples of CCD mosaic for the Mephisto cameras, using e2v CCD290-99 (left) and e2v CCD250-82 (right).

Mephisto	LSST
1.4 Giga pix	3.2 Giga pix
3 x 3.14 deg ²	9.6 deg ²
0.286"/pixel	0.2"/pix

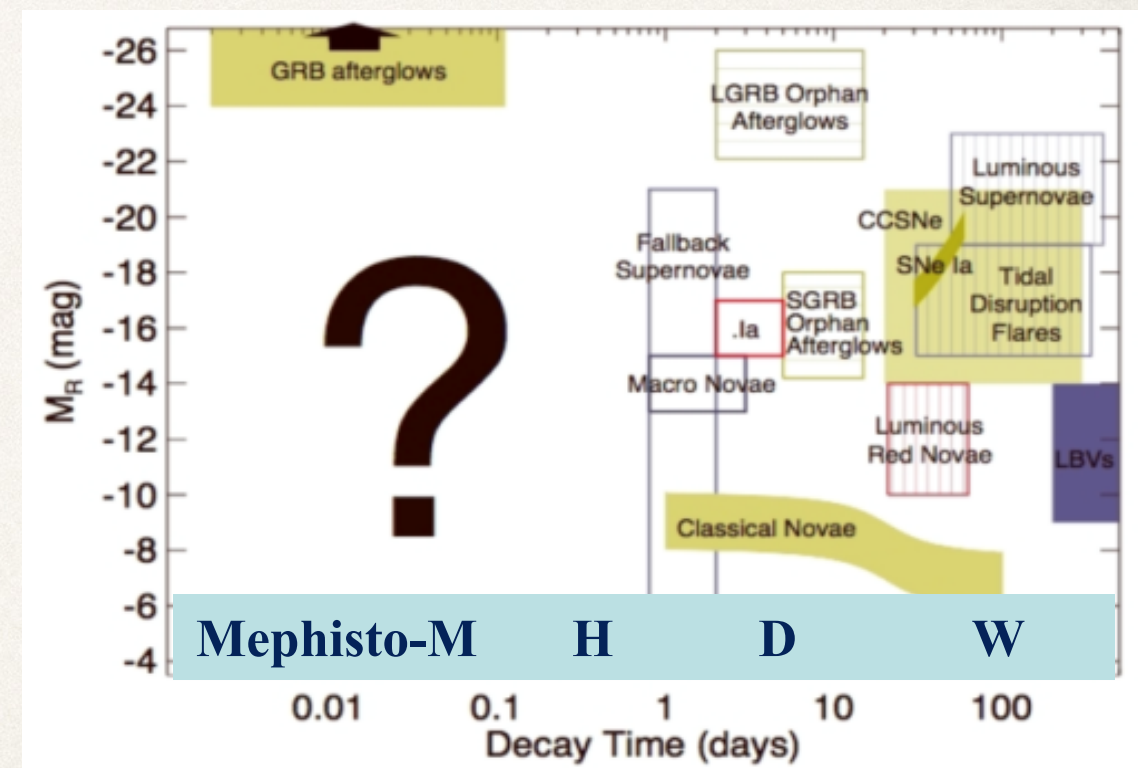
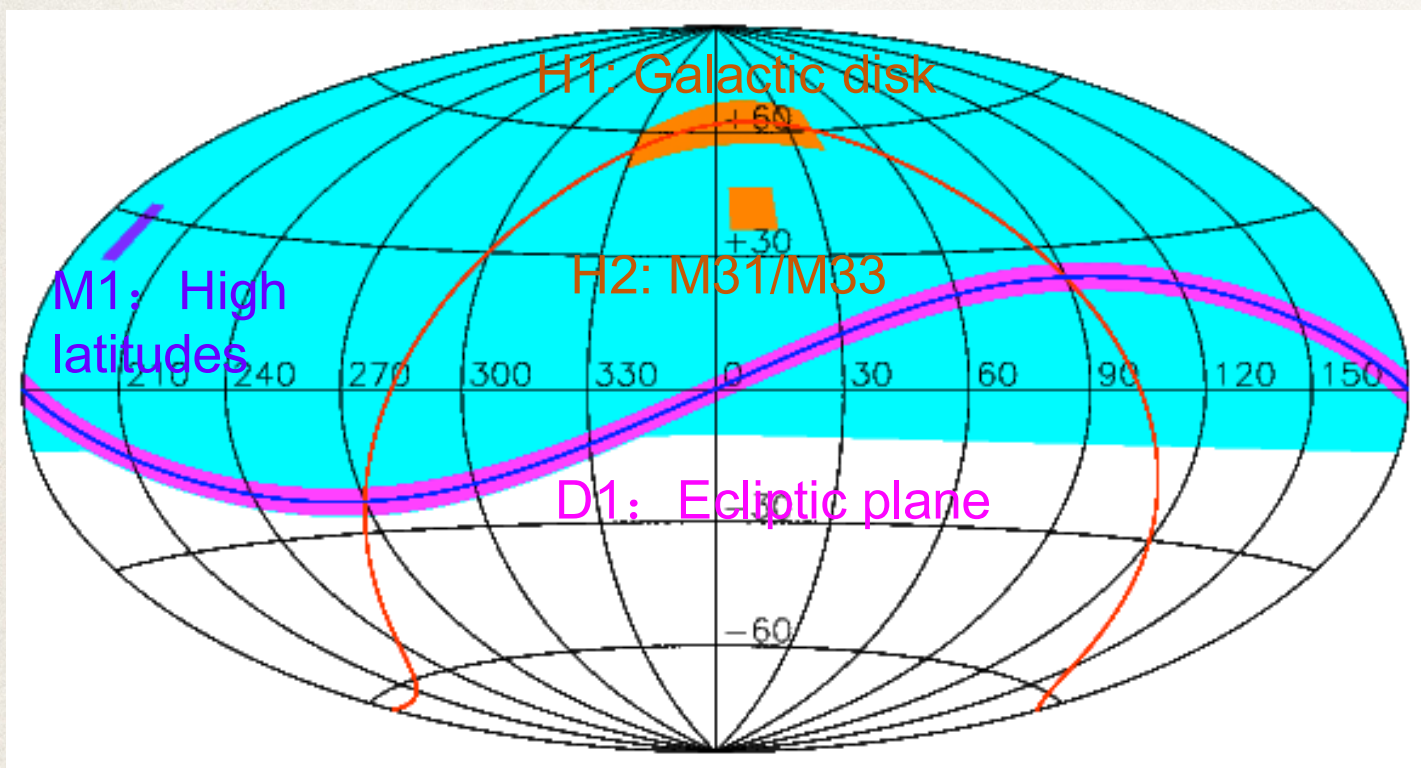
Mephisto Survey Plan: 10 years

W survey: 26000 deg², Real-color images of the North sky (whole of 2022 and 30% of 2023-2031)

D survey: 1800 deg² in the cadence of day

H survey: 180 deg² in the cadence of hour

M survey: 18 deg² in the cadence of minute



3. Blue transient survey at the New site (Daocheng-WMS无名山 4780m)

Fast iterative project: Start quickly and Keep updating

Telescope array (2x2 x n)

u&g bands (Even to NUV)

Wide-field (20 deg² for each)

High cadence (hourly, 4-5 time/night)

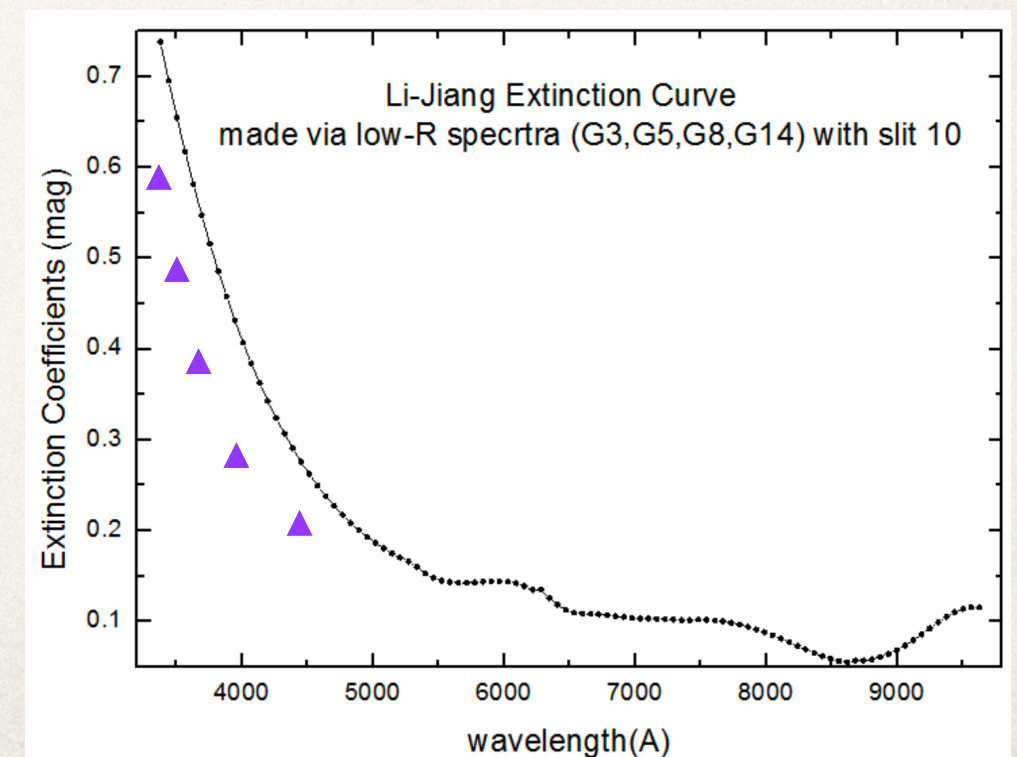
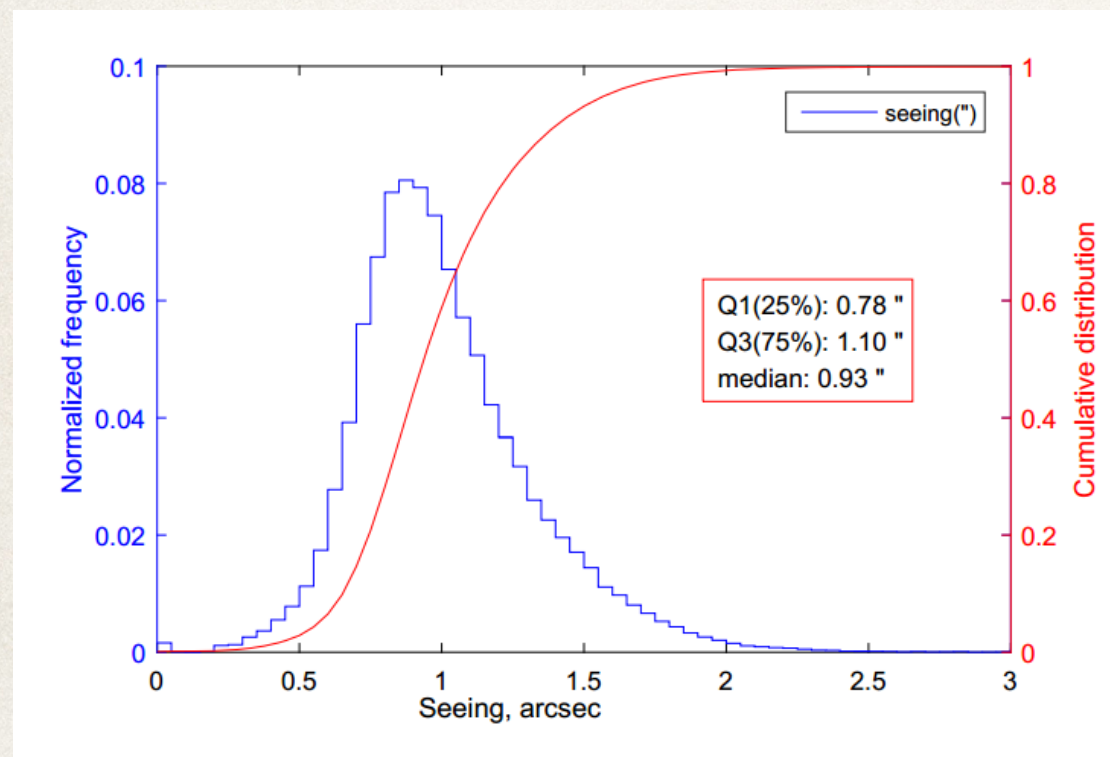
Focus on the extremely early signal of explosion



Longitude: 100 °06'32"East Latitude : 29°06'25"North
Altitude : 4780 m (site 2)



Longitude: 100 °04'12"East Latitude : 29°09'1"North
Altitude : 4680 m (site 1)



At the “Big data” era, astronomical data is still limited

Extremely early observation is Urgently required at the Multi-Messenger era

We hope to find the short-lived phenomenon immediately with high cadence,
wide field survey in the Bluer band