Giacomo Terreran

Margutti, Coppejans, Milisavljevic, Dong, Bersier, Chornock, Elias-Rosa, Bietenholz, Migliori, ASASSN et al.

Northwestern University

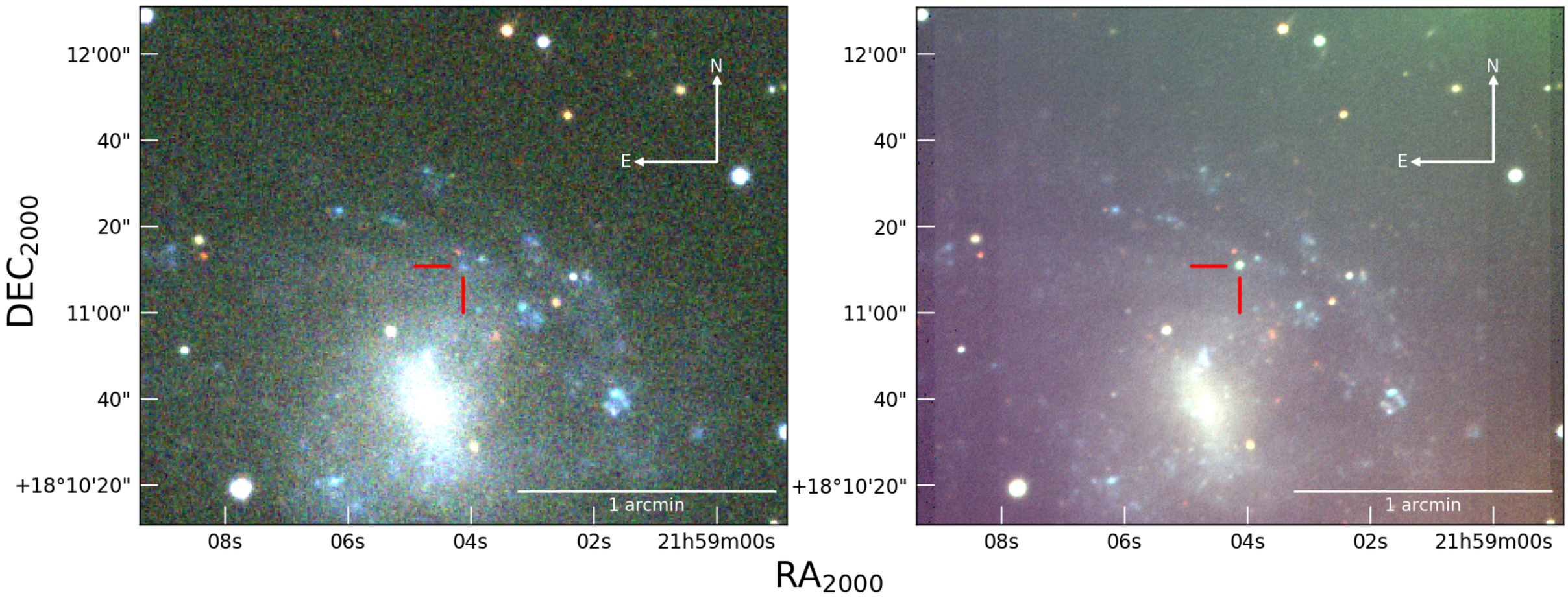
CIERA

The "He-rich" Type Ic SN 2016coi and its massive progenitor

25 Feb 2019 Chicago

THE UNIVERSITY OF CHICAGO

SN 2016coi / ASASSN-16fp



UGC 11868

M_R = –17.90 **~18 Mpc**

SFR=0.078 M⊙ y^{-1} **Z=1/3 Z⊙**

HOT!!

BROAD-LINED SUPERNOVA 2016COI WITH HELIUM ENVELOPE

Masayuki Yamanaka[1], Tatsuya Nakaoka[2], Masaomi Tanaka[3], Keiichi Maeda[4,5], Satoshi Honda[6], Hidekazu Hanayama[7], Tomoki Morokuma[8], Masataka Imai[9], Kenzo Kinugasa[10], Katsuhiro L. Murata[11],Takefumi Nishimori[12], Osamu Hashimoto[13], Hirotaka Gima[12], Kensuke Hosoya[6], Ayano Ito[12], Mayu Karita[6], Miho Kawabata[2], Kumiko Morihana[6], Yuto Morikawa[12], Kotone Murakami[12], Takahiro Nagayama[12], Tatsuharu Ono[14], Hiroki Onozato[15], Yuki Sarugaku[16], Mitsuteru Sato[17], Daisuke Suzuki[18], Jun Takahashi[6], Masaki Takayama[6], Hijiri Yaguchi[6], Hiroshi Akitaya[2,19], Yuichiro Asakura[20], Koji S. Kawabata[2,19], Daisuke Kuroda[21], Daisaku Nogami[4], Yumiko Oasa[22], Toshihiro Omodaka[12], Yoshihiko Saito[23], Kazuhiro Sekiguchi[3], Nozomu Tominaga[1,5], Makoto Uemura[2,19], and Makoto Watanabe[24].

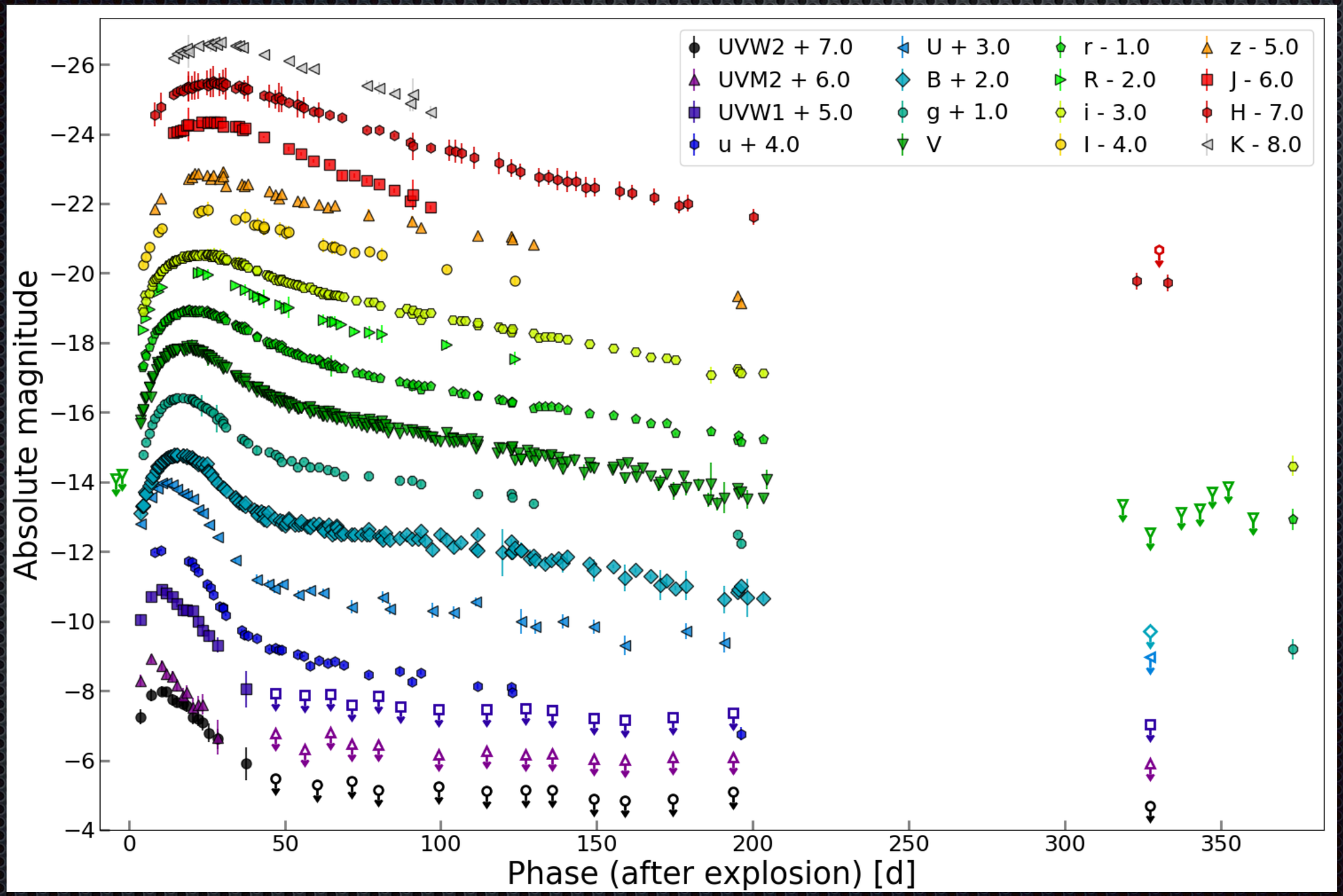
ASASSN-16fp (SN 2016coi): A transitional supernova between Type Ic and broad-lined Ic

Brajesh Kumar[1]⋆, A. Singh[1], S. Srivastav[1], D. K. Sahu[1] and G. C. Anupama[1]

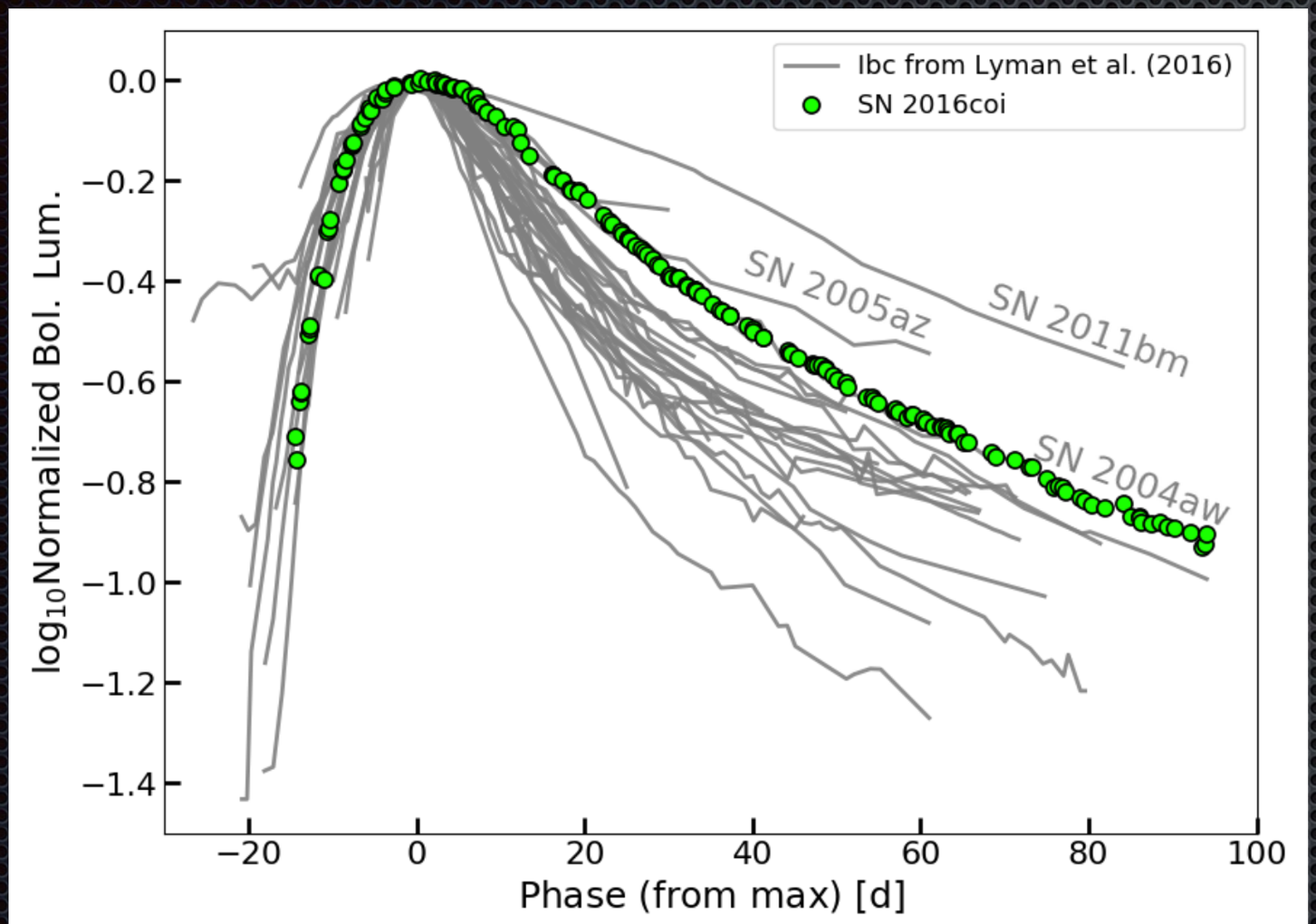
SN 2016coi/ASASSN-16fp: An example of residual helium in a type Ic supernova?

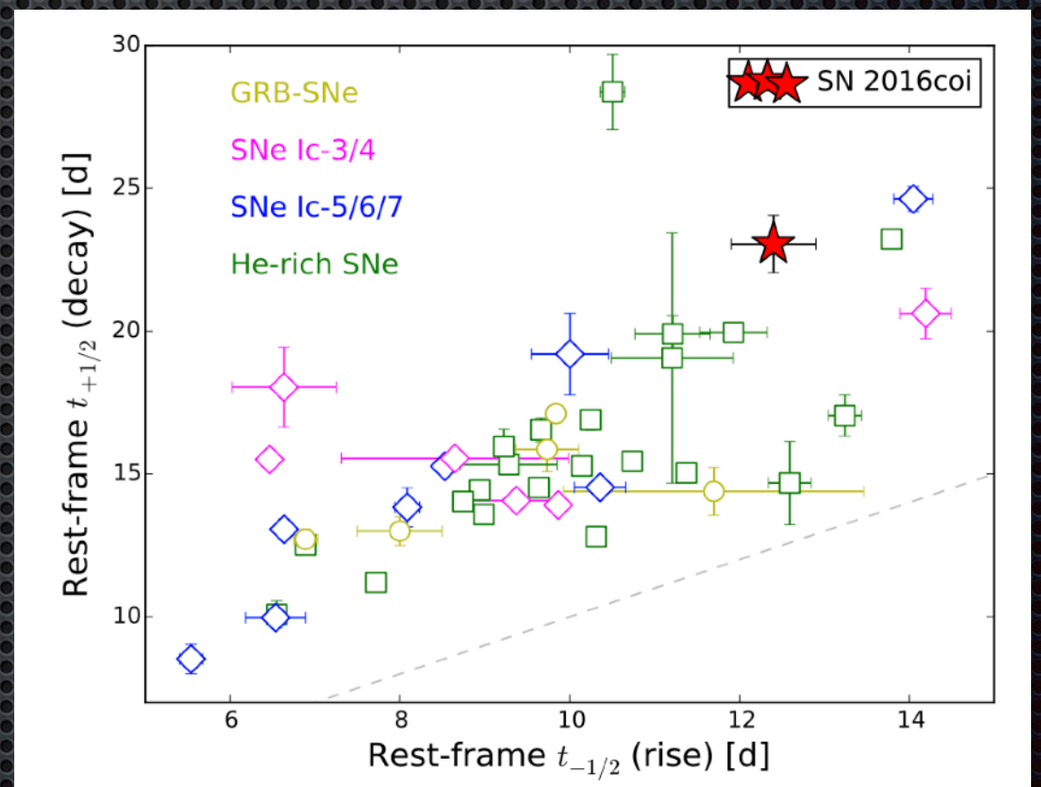
S. J. Prentice[1]⋆, C. Ashall[1], P. A. Mazzali[1,2], J.-J. Zhang[3,4,5], P. A. James[1], X.-F. Wang[6], J. Vinkó[10,12,13], S. Percival[1], L. Short[1], A. Piascik[1], F. Huang[6], J. Mo[6], L.-M. Rui[6], J.-G. Wang[3,4,5], D.-F. Xiang[6], Y.-X. Xin[3,4,5], W.-M. Yi[3,4,5], X.-G. Yu[3,4,5], Q. Zhai[3,4,5], T.-M. Zhang[7], G. Hosseinzadeh[8,9], D. A. Howell[8,9], C. McCully[8,9], S. Valenti[14], B. Cseh[10], O. Hanyecz[10], L. Kriskovics[10], A. Pál[10], K. Sárneczky[10], Á. Sódor[10], R. Szakáts[10], P. Székely[11], E. Varga-Verebélyi[10], K. Vida[10], M. Bradac[14], D. E. Reichart[15], D. Sand[16], L. Tartaglia[14,16]

Photometry


UVW2 + 7.0
UVM2 + 6.0
UVW1 + 5.0
u + 4.0
U + 3.0
B + 2.0
g + 1.0
V
r - 1.0
R - 2.0
i - 3.0
I - 4.0
z - 5.0
J - 6.0
H - 7.0
K - 8.0
Absolute magnitude
−26
−24
−22
−20
−18
−16
−14
−12
−10
−8
−6
−4
0
50
100
150
200
250
300
350
Phase (after explosion) [d]

Bolometric light curve

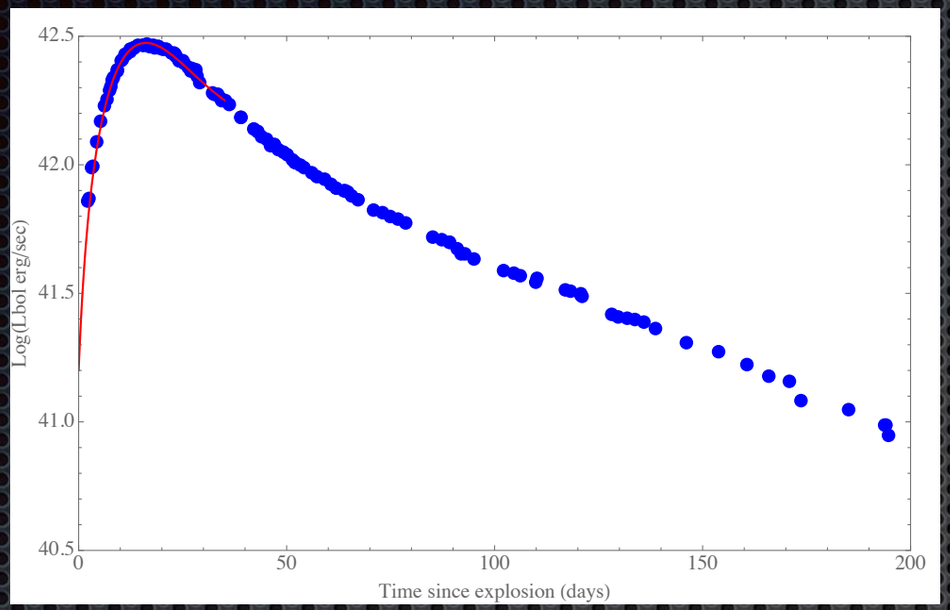


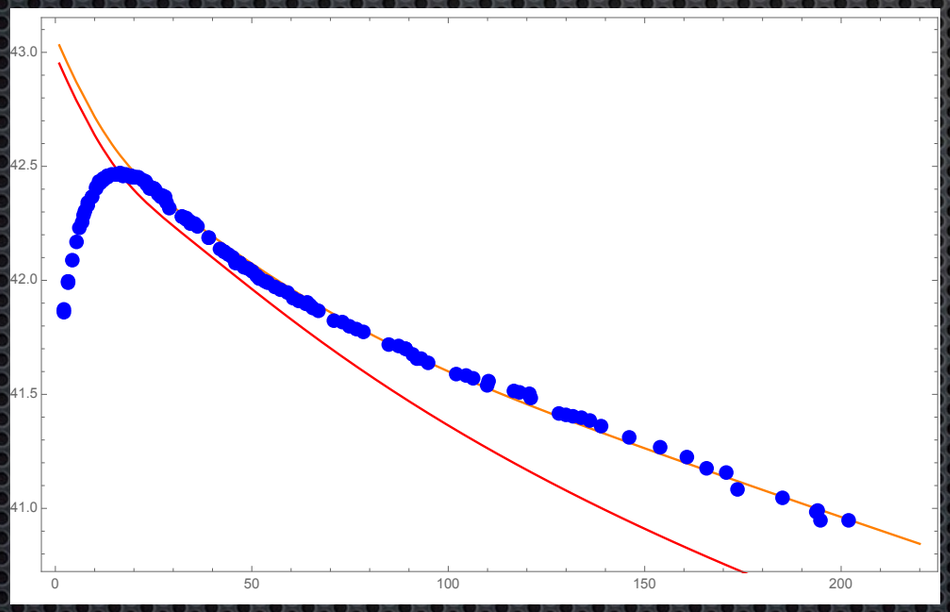


Prentice, et al. 2018, MNRAS, 478, 4162

Massive ejecta!

Light curve modeling





-t<30 d

E_k~7 x 10^{51} erg

M_{Ni}~0.13 M⊙

M_{ej}~4 M⊙

Total

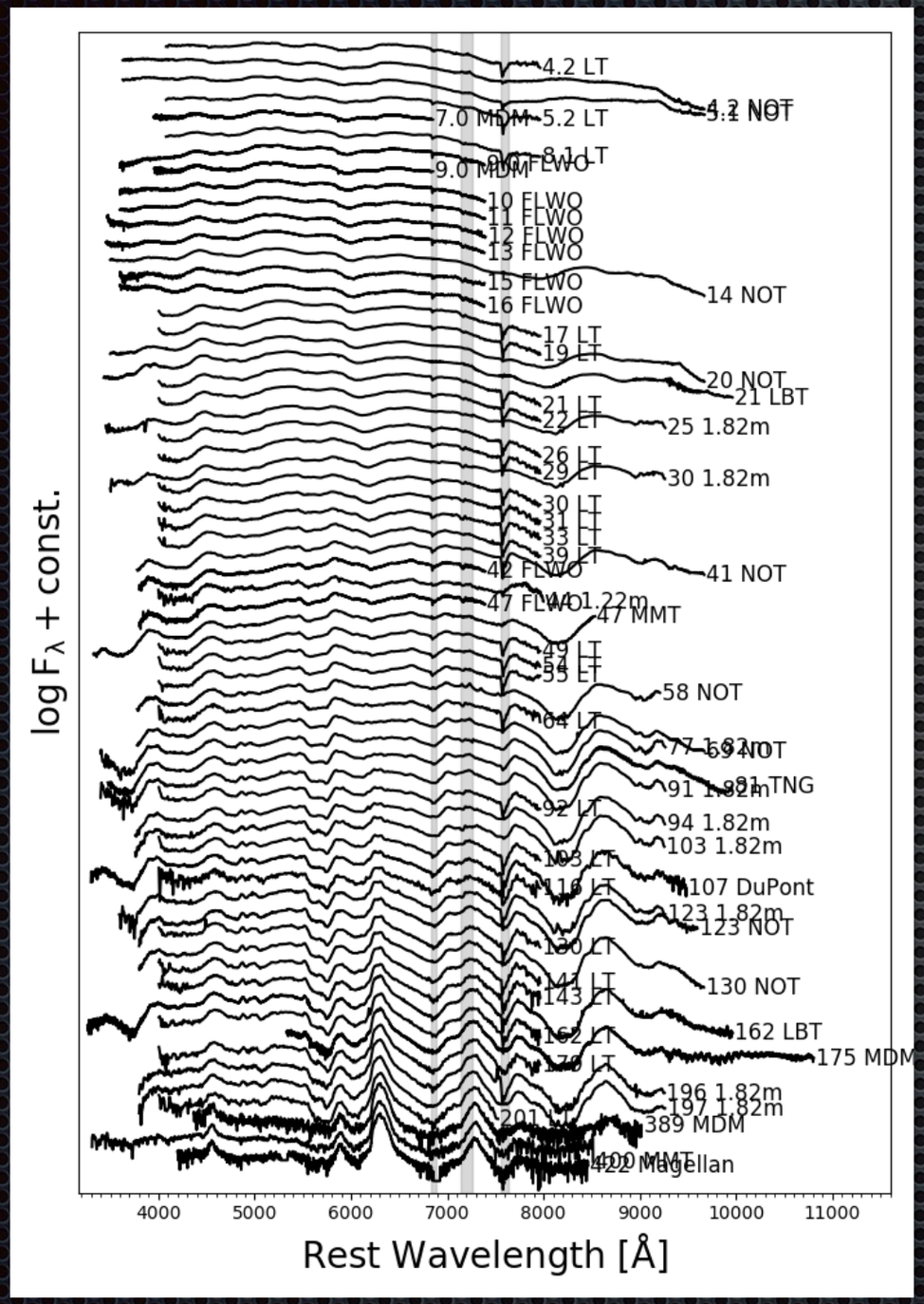
M_{ej}~4-7 M⊙

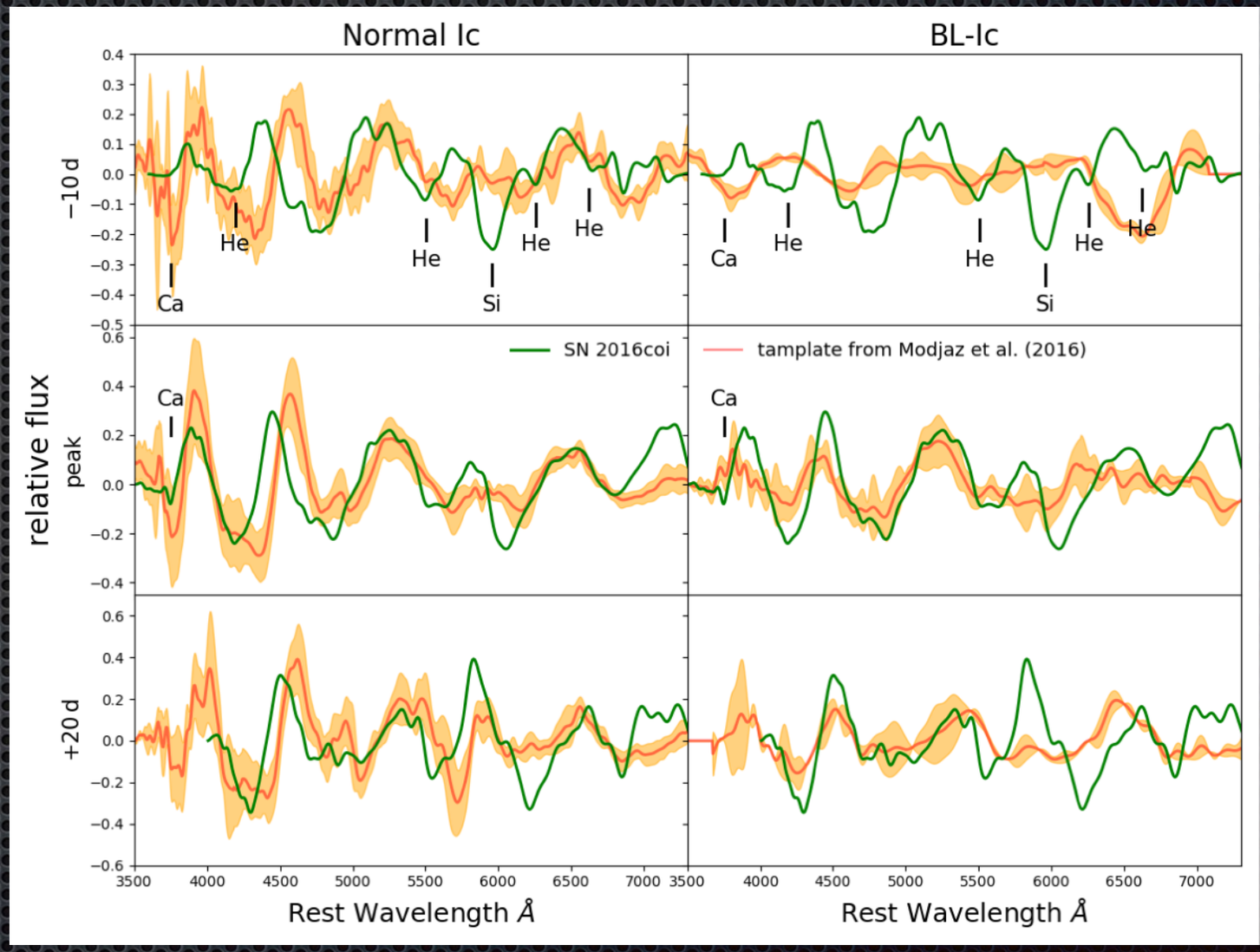
E_k~7-8 x 10^{51} erg

M_{Ni}~0.15 M⊙

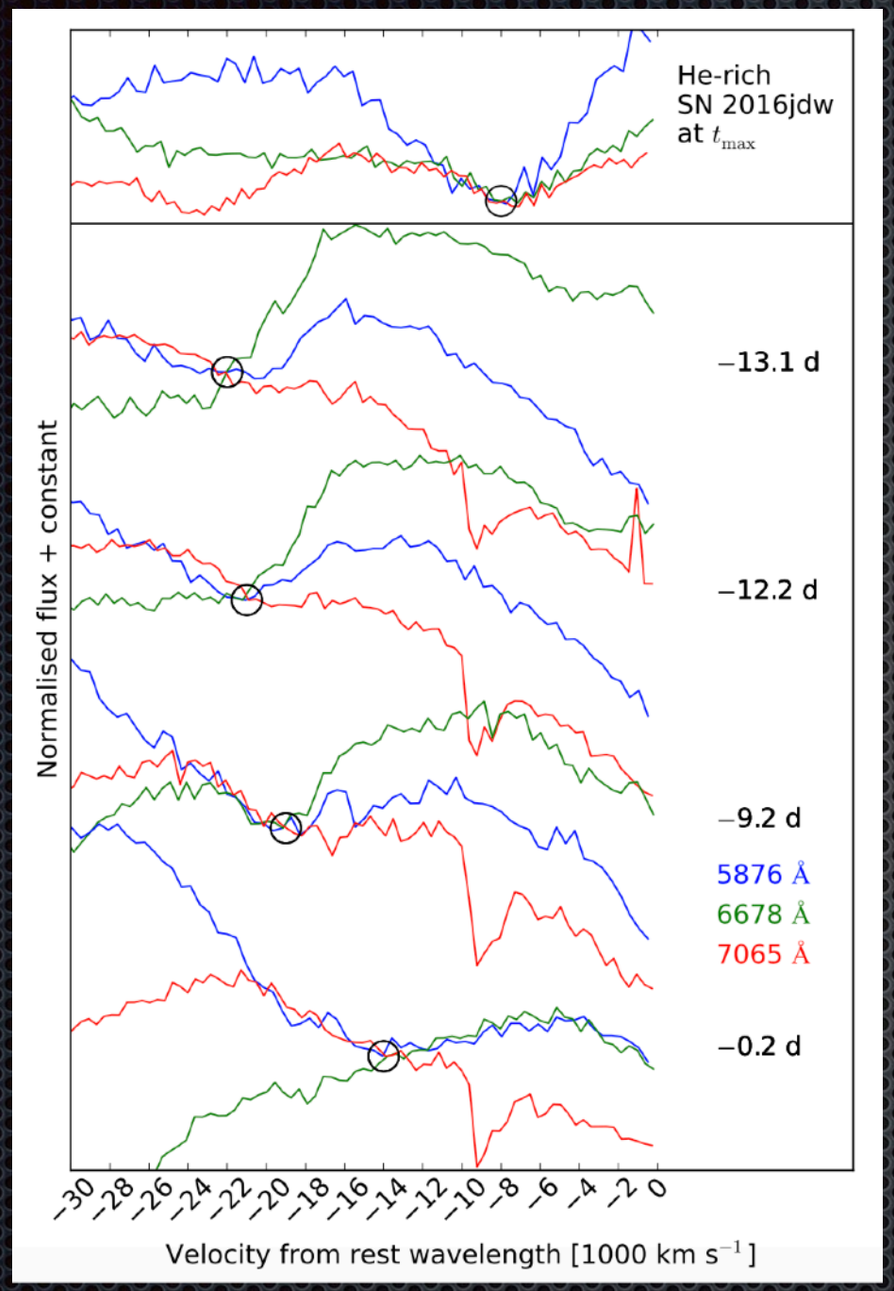
only ``rough" agreement with other papers, because of different methods used and different wavelength covered

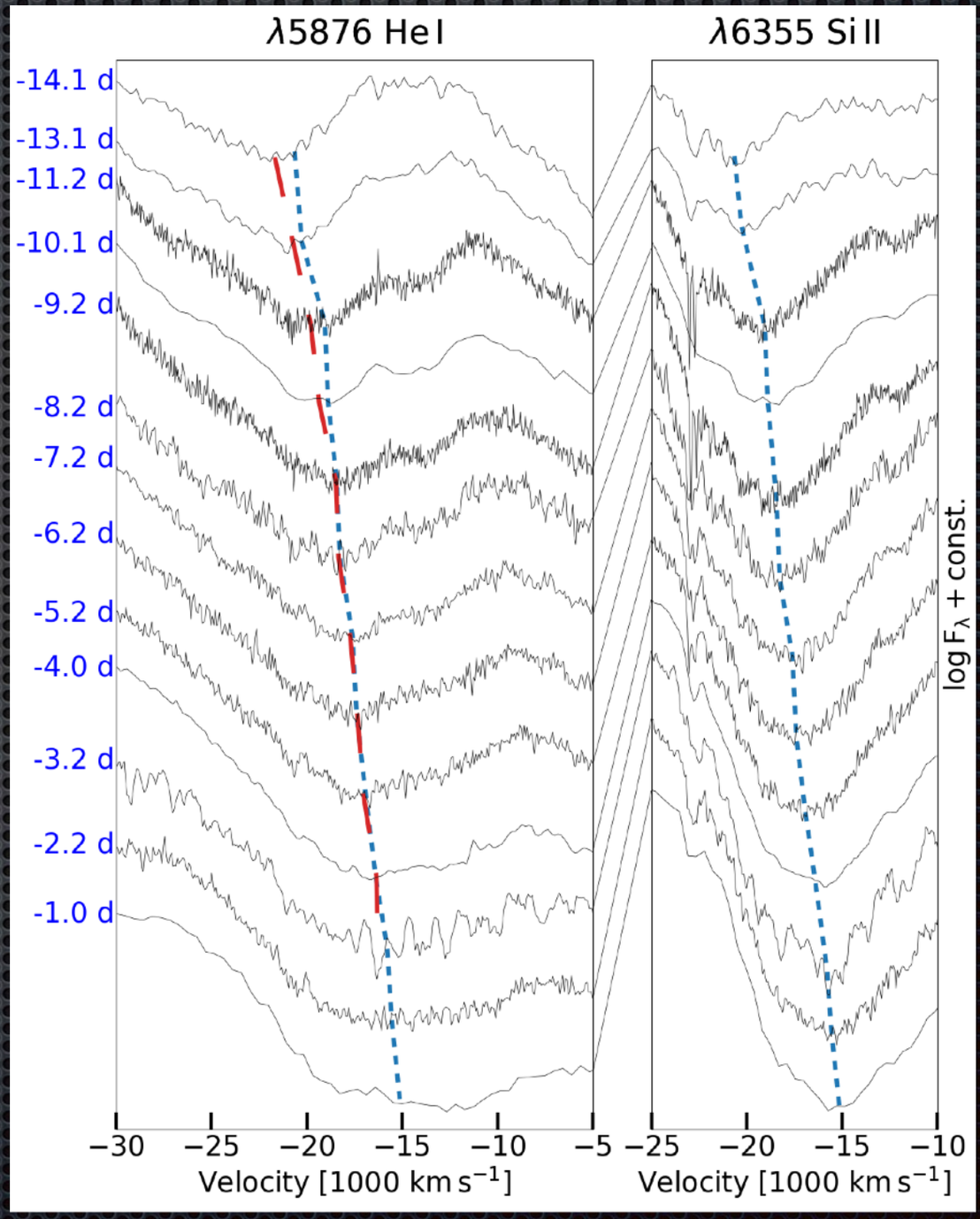
Spectroscopic evolution





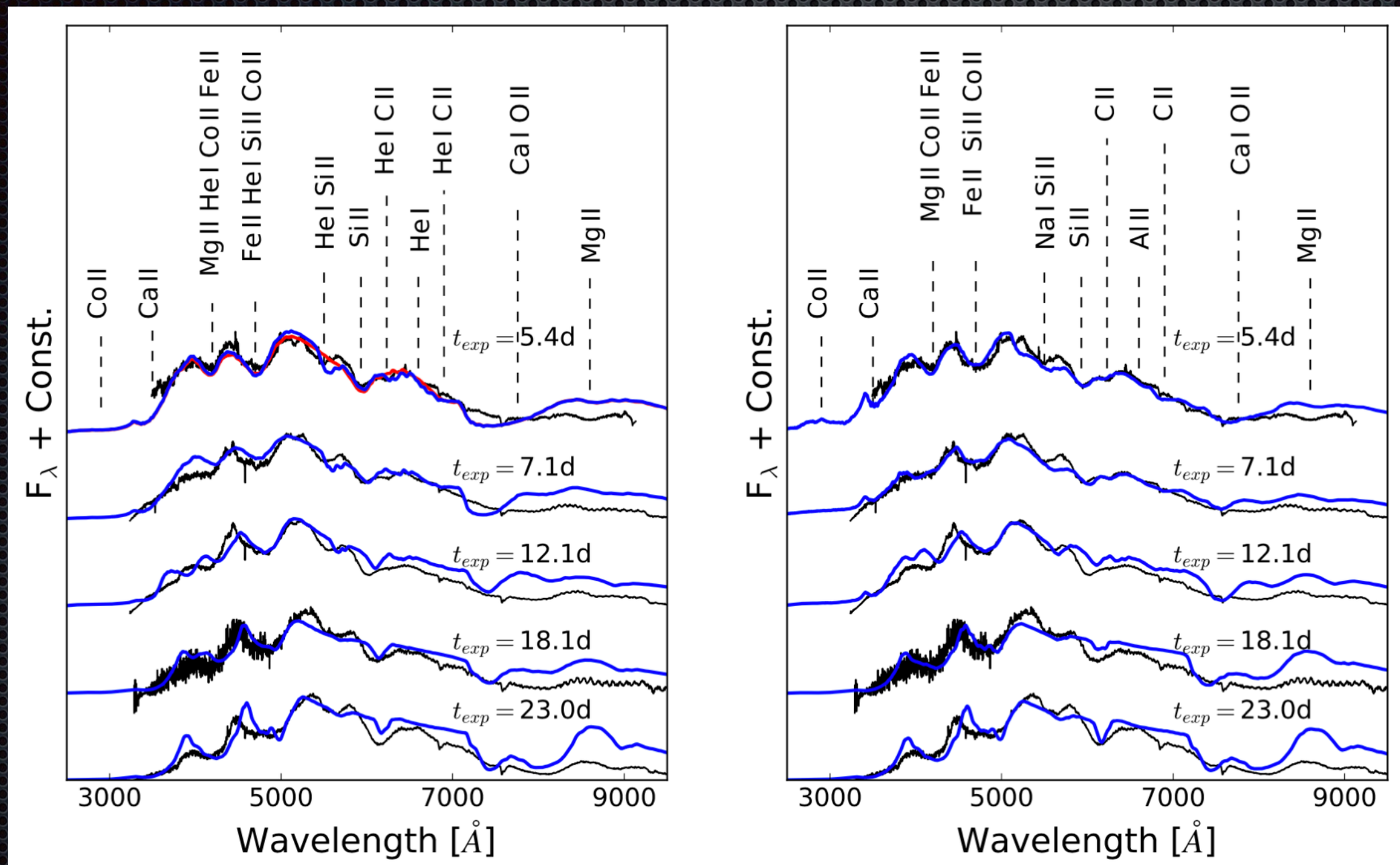
He evolution





Prentice, et al. 2018, MNRAS, 478, 4162

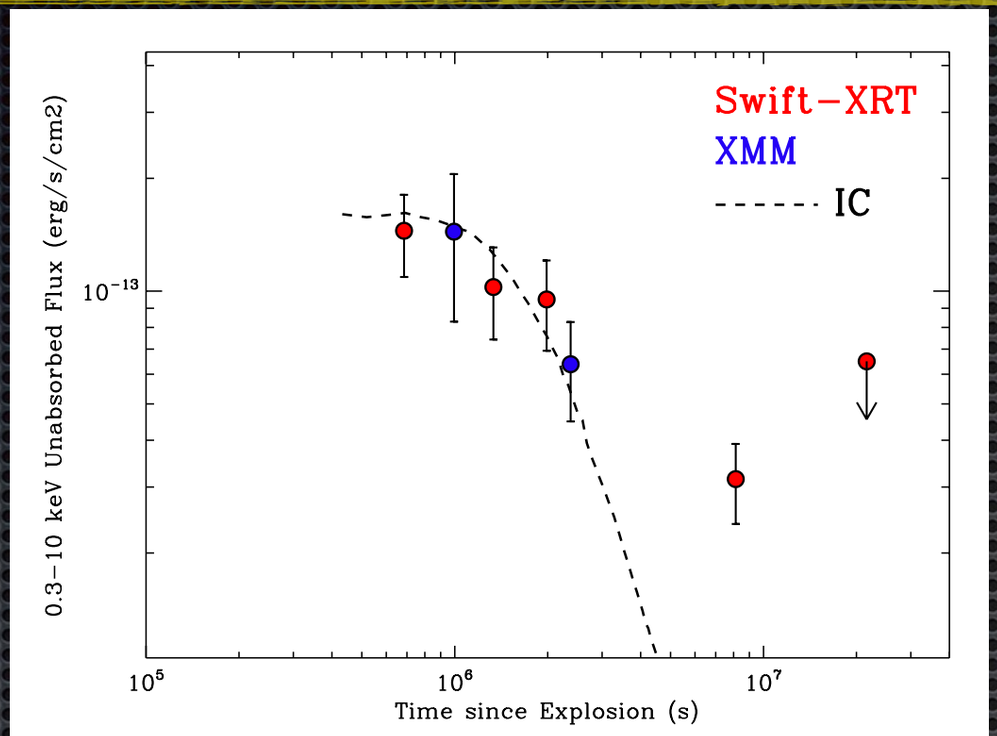
What else could it be?



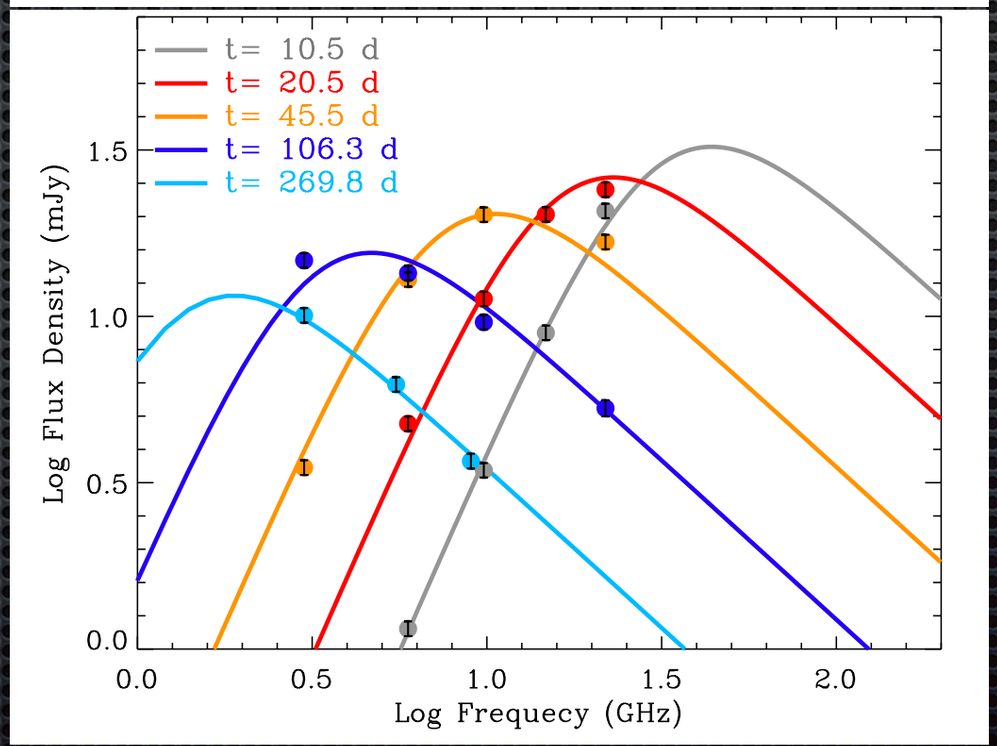
Prentice, et al. 2018, MNRAS, 478, 4162

Multi-wavelength follow-up

X-rays



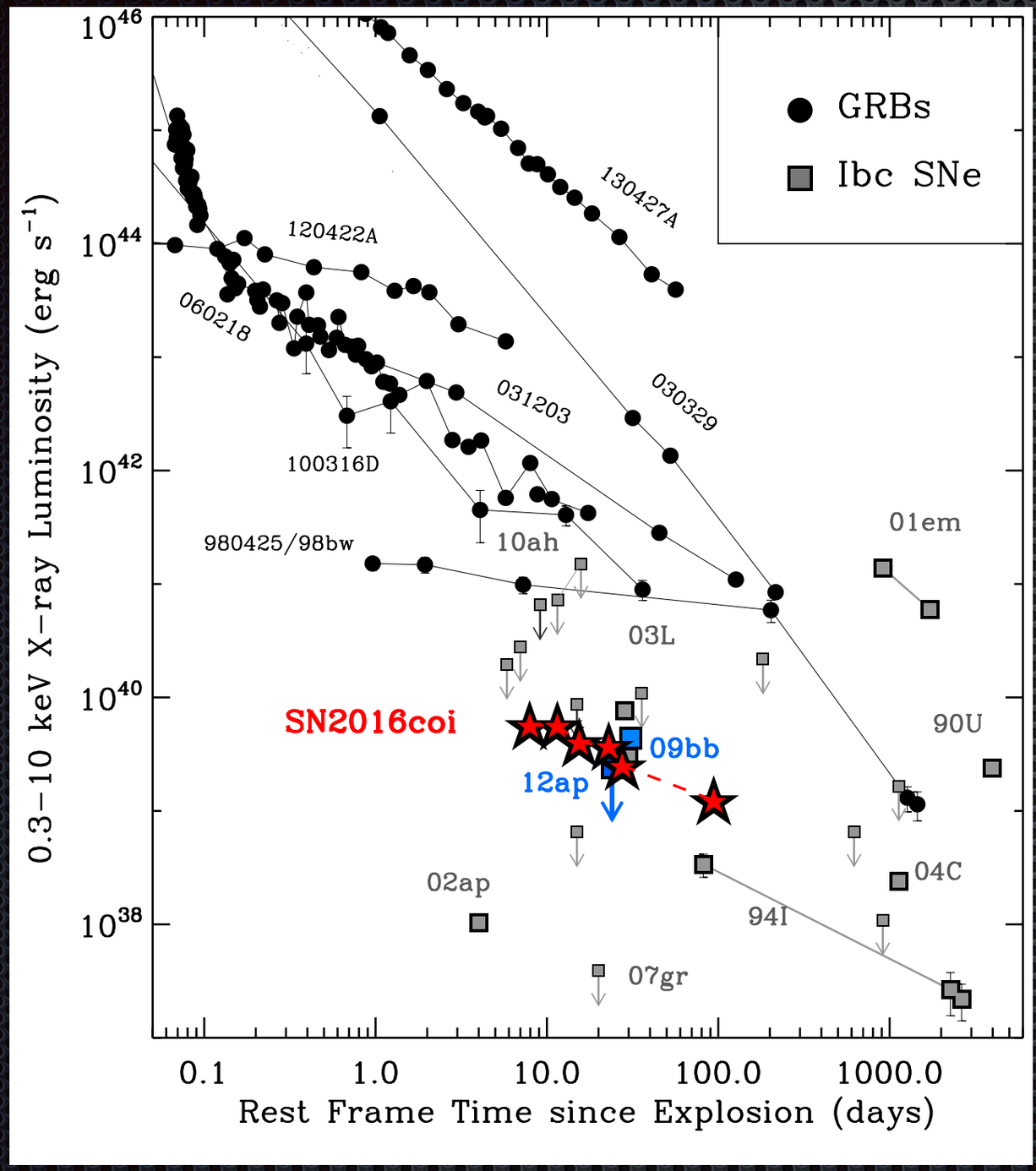
Radio

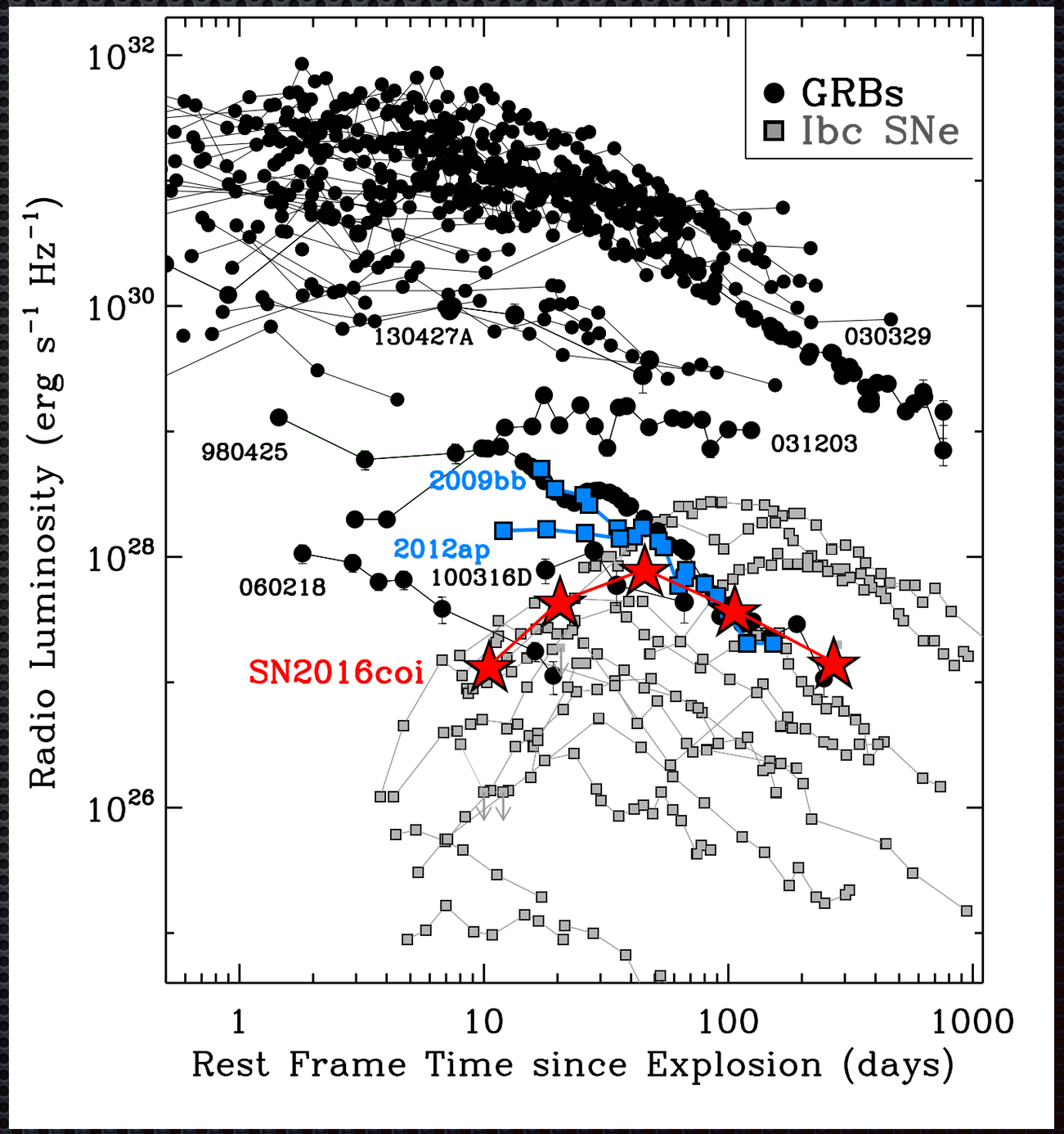


$\dot{M} \sim (3 - 7)\ 10^{-5}\ M_\odot\ yr^{-1}$

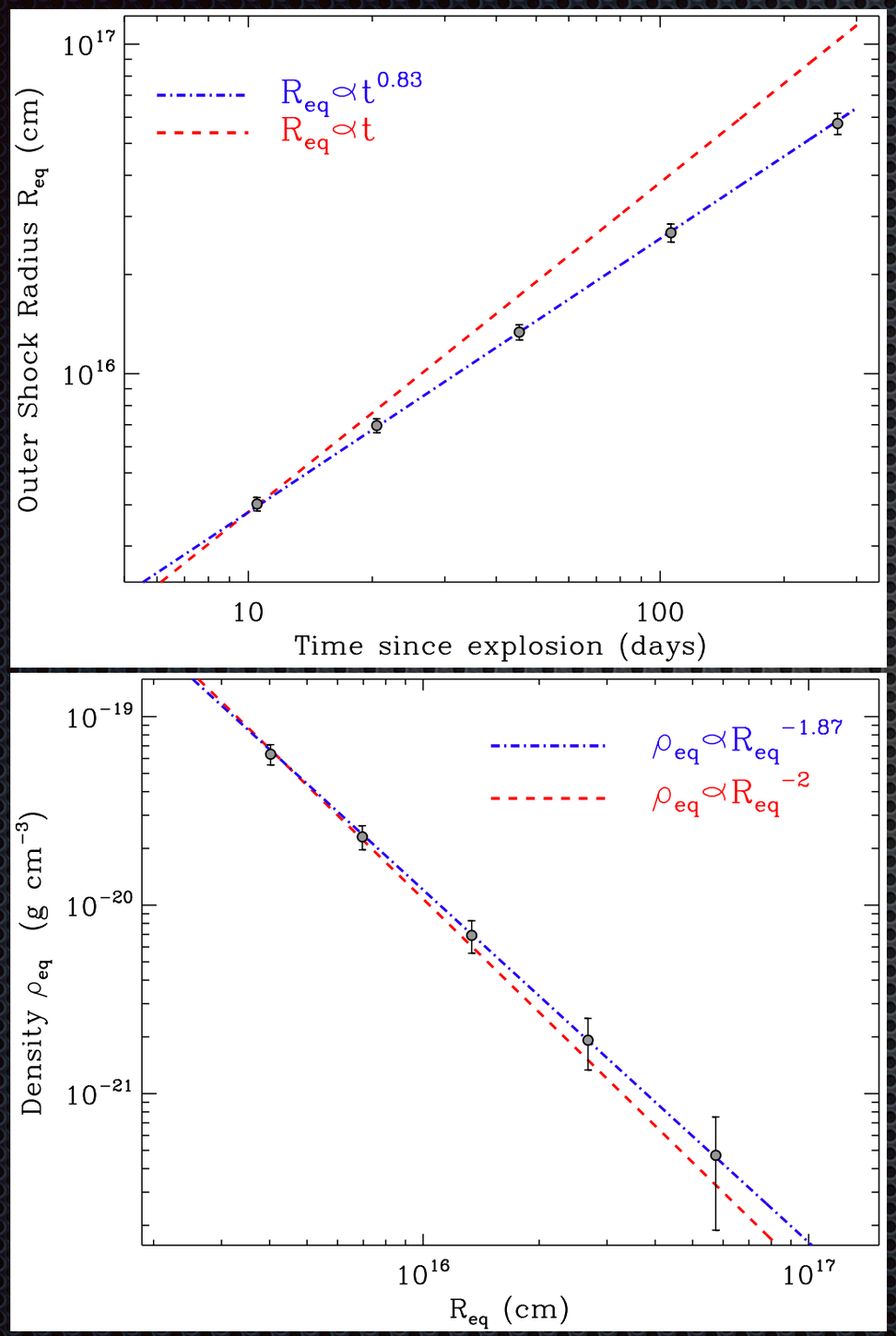
$v_{sh} \sim 0.25\ c$

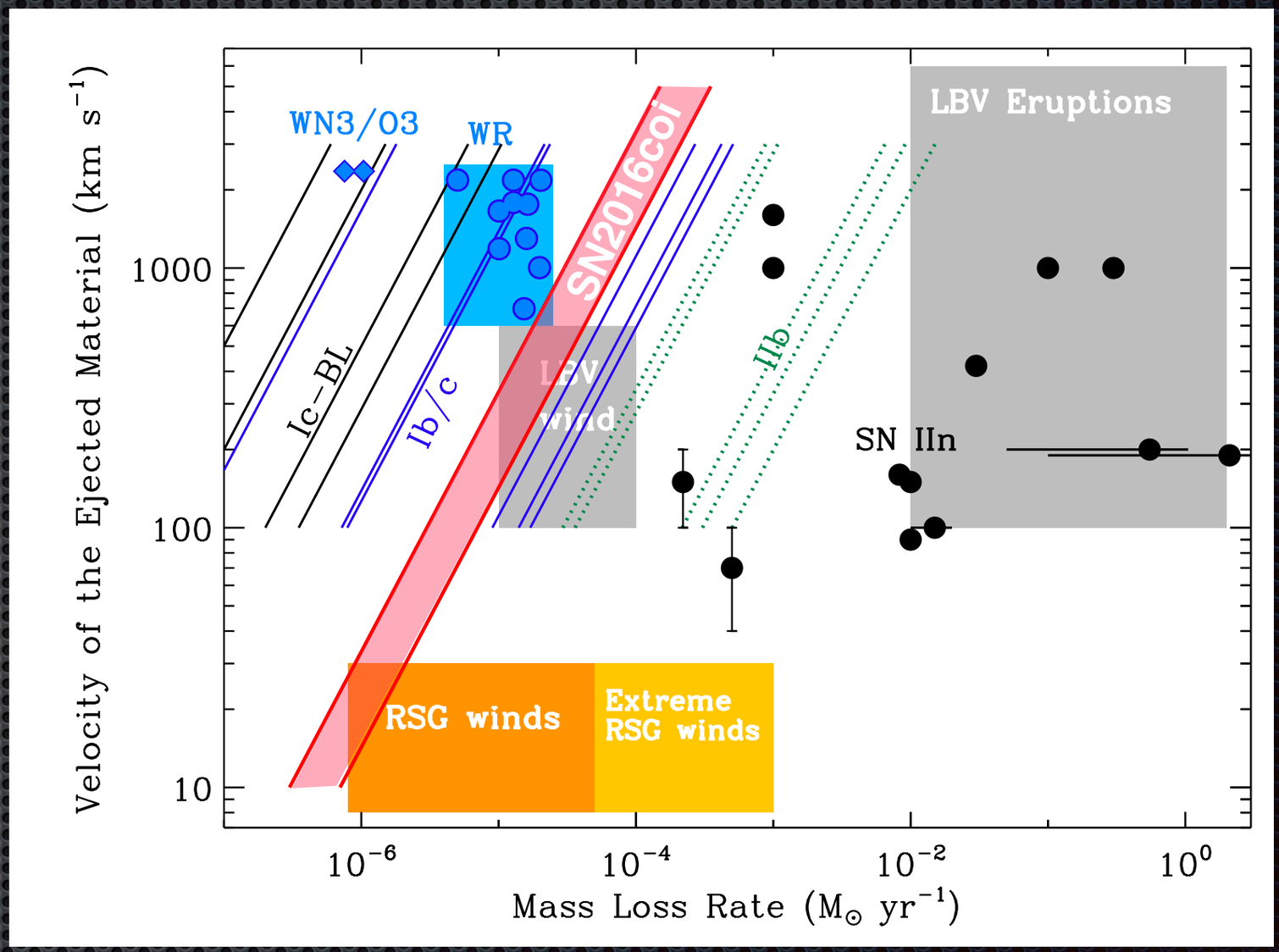
Comparison with other objects





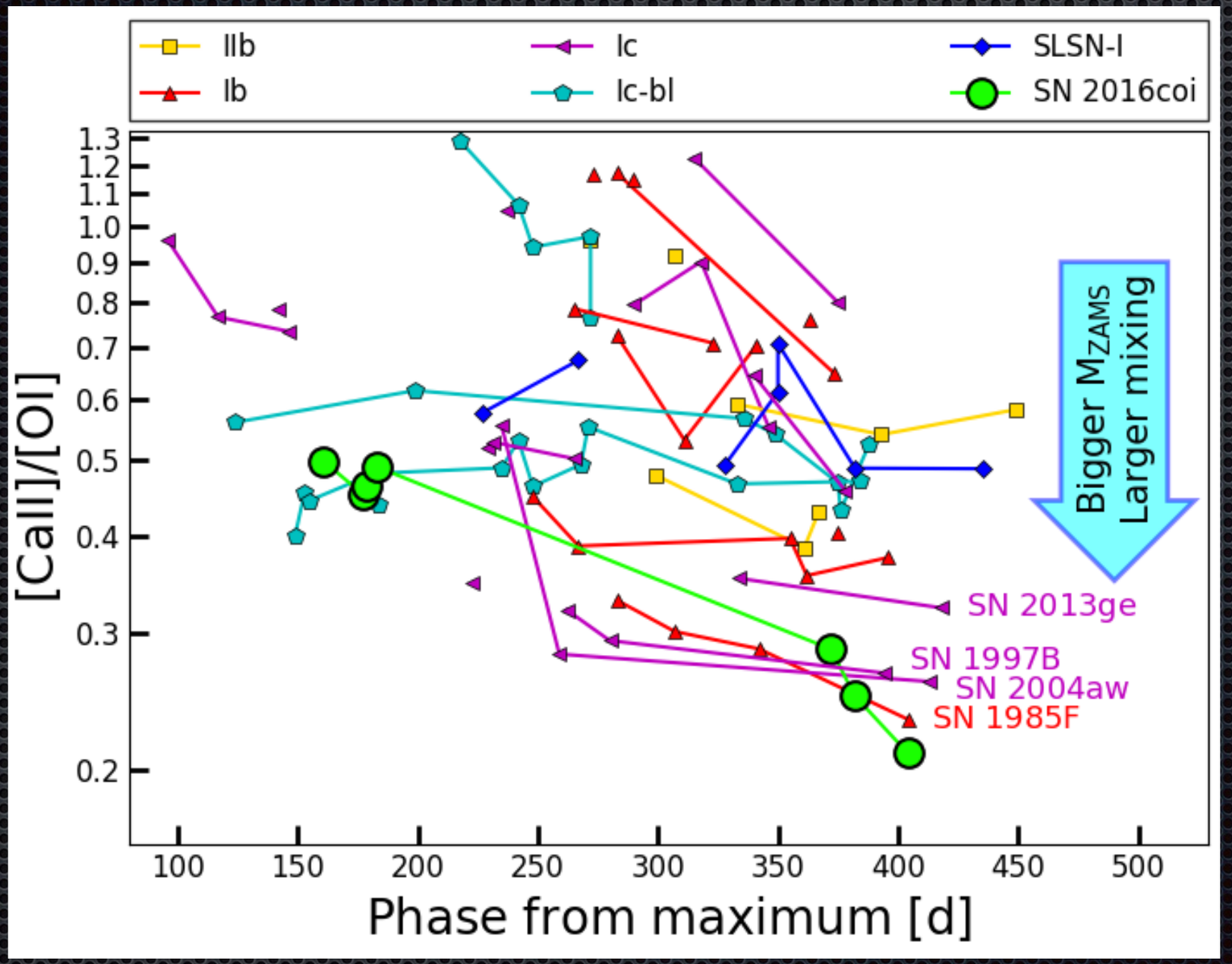
Dense environment





Massive progenitor

[Ca II]/[O I] ratio



Massive ZAMS progenitor

Conclusions

- SN 2016coi is an intermediate object between Ib and Ic
- Broad bolometric light-curve, suggestive of large ejecta mass.
- Low [Ca II]/[O I] ratio, suggestive of a large progenitor core mass
- Luminous source of X-rays, due to a dense environment sculpted by sustained mass-loss, significantly larger than in Ic-BL SNe.
- Massive ejecta, and dense environment. No need for a companion to explain the stripping.