CSP I SNe IIb/Ib/Ic papers

(1) Data paper (Stritzinger et al.)

(2) Reddening paper (Stritzinger, Taddia et al.)

(3) Light curve analysis paper (Taddia et al.)

(4) Spectroscopy paper (Holmbo et al.)

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The CSP SN IIb/Ibc sample

a) **34** SE SNe followed by the CSP.

b) **29** of these objects have ***ugriBV***-band light curves, **5** objects lack *u*-band photometry.

c) **24** objects with ***YJH***-band photometry.

d) The sample consists of **10 SNe IIb** (little H), **11 SN Ib** (no H), and **13 SNe Ic** (no He).

UNIQUE **NIR COVERAGE**, AND UNIQUE **QUALITY OF THE PHOTOMETRY** AS COMPARED TO OTHER SN Ibc SAMPLES IN THE LITERATURE.

U to H band coverage, high quality of the light curves------------------>

Methods to estimate host-galaxy reddening of stripped-envelope supernovae*

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Key words. supernovae: general – supernovae: individual: SN 2004ew, SN 2004ex, SN 2004fe, SN 2004ff, SN 2004gq, SN 2004gt, SN 2004gv, SN 2005Q, SN 2005aw, SN 2005bj, SN 2005em, SN 2006T, SN 2006ba, SN 2006bf, SN 2006ep, SN 2006fo, SN 2006ir, SN 2006lc, SN 2007C, SN 2007Y, SN 2007ag, SN 2007hn, SN 2007kj, SN 2007rz, SN 2008aq, SN 2008hh, SN 2009K, SN 2009Z, SN 2009bb, SN 2009dp, SN 2009dt – dust and reddening

1. Introduction

Stripped-envelope (SE) core-collapse (CC) supernovae (SN) are thought to be the terminal endpoint in the lives of massive stars that have shed their hydrogen (Type IIb/Ib) and possibly helium (Type Ic) layers prior to exploding. The majority of mass loss for single massive stars is probably due to radiatively line-driven winds, while for massive stars in a binary system, the majority of mass loss is probably due to mass transfer to the companion via Roche lobe overflow and/or through common

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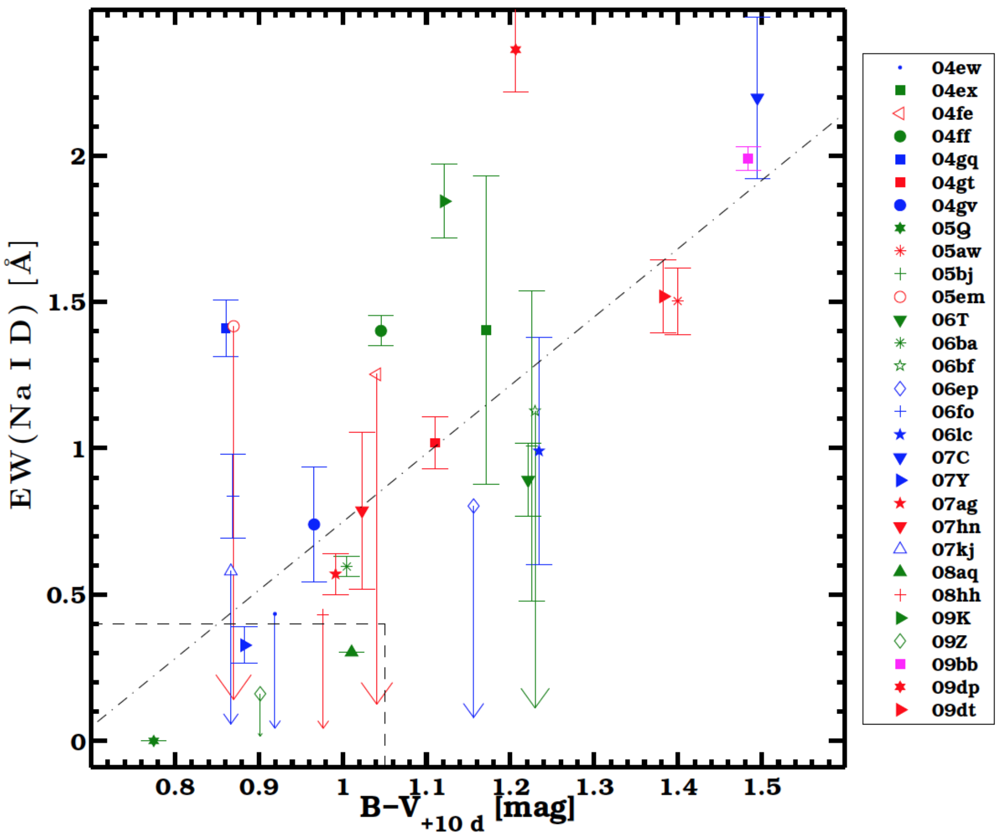
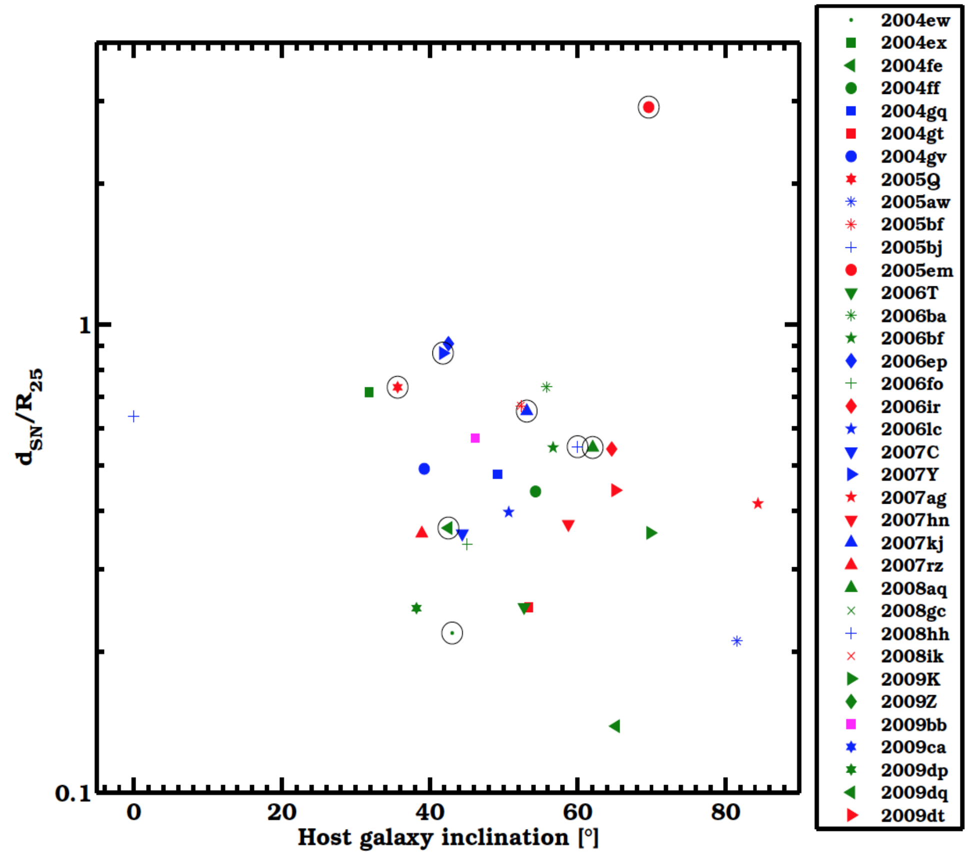
“Unreddened” objects





1) Low B-V
2) Low or negligible EW(Na I D)

3) Not in strongly tilted galaxies
4) Not close to the host galaxy nucleus

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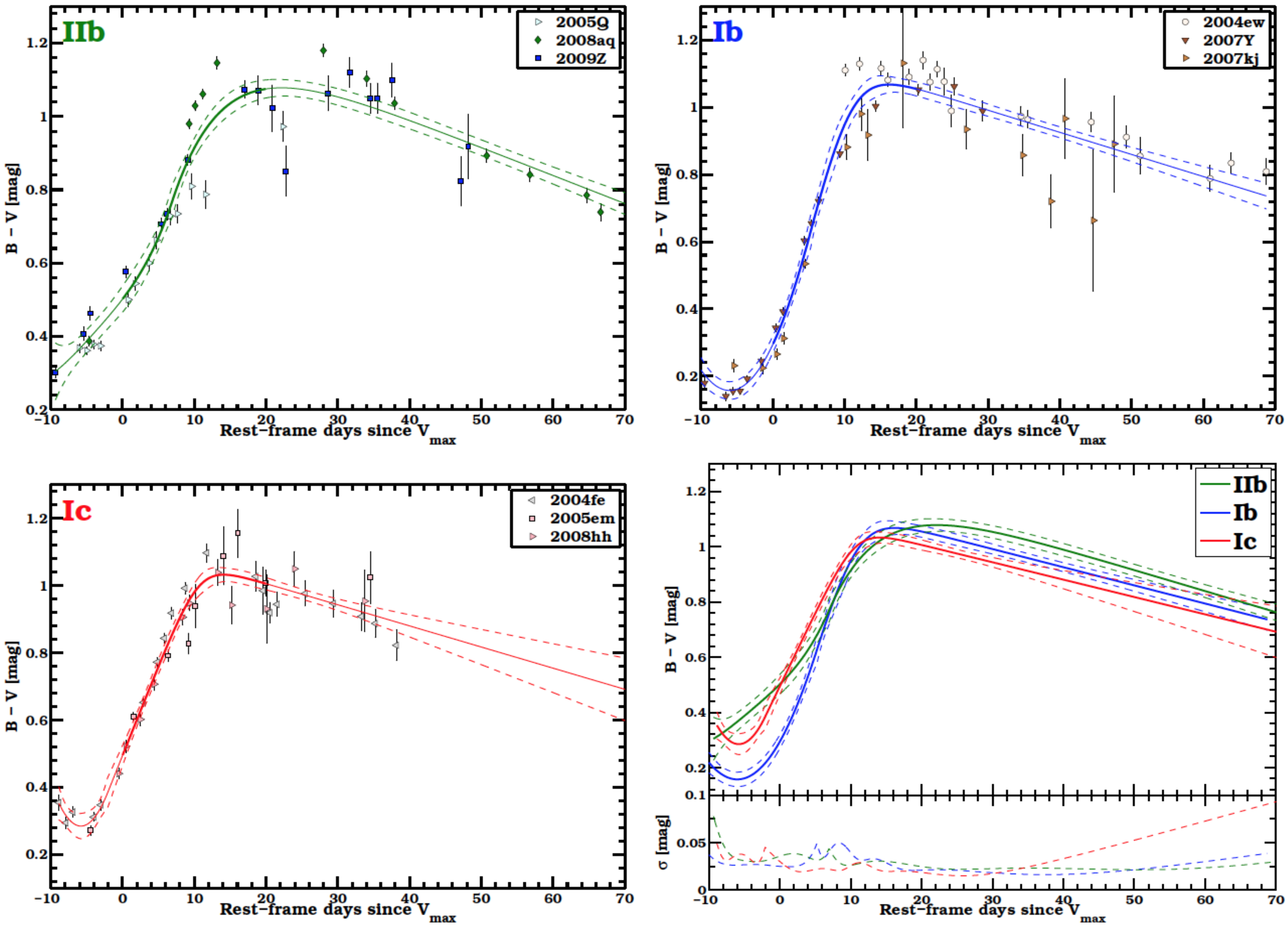
SE SN intrinsic B-V



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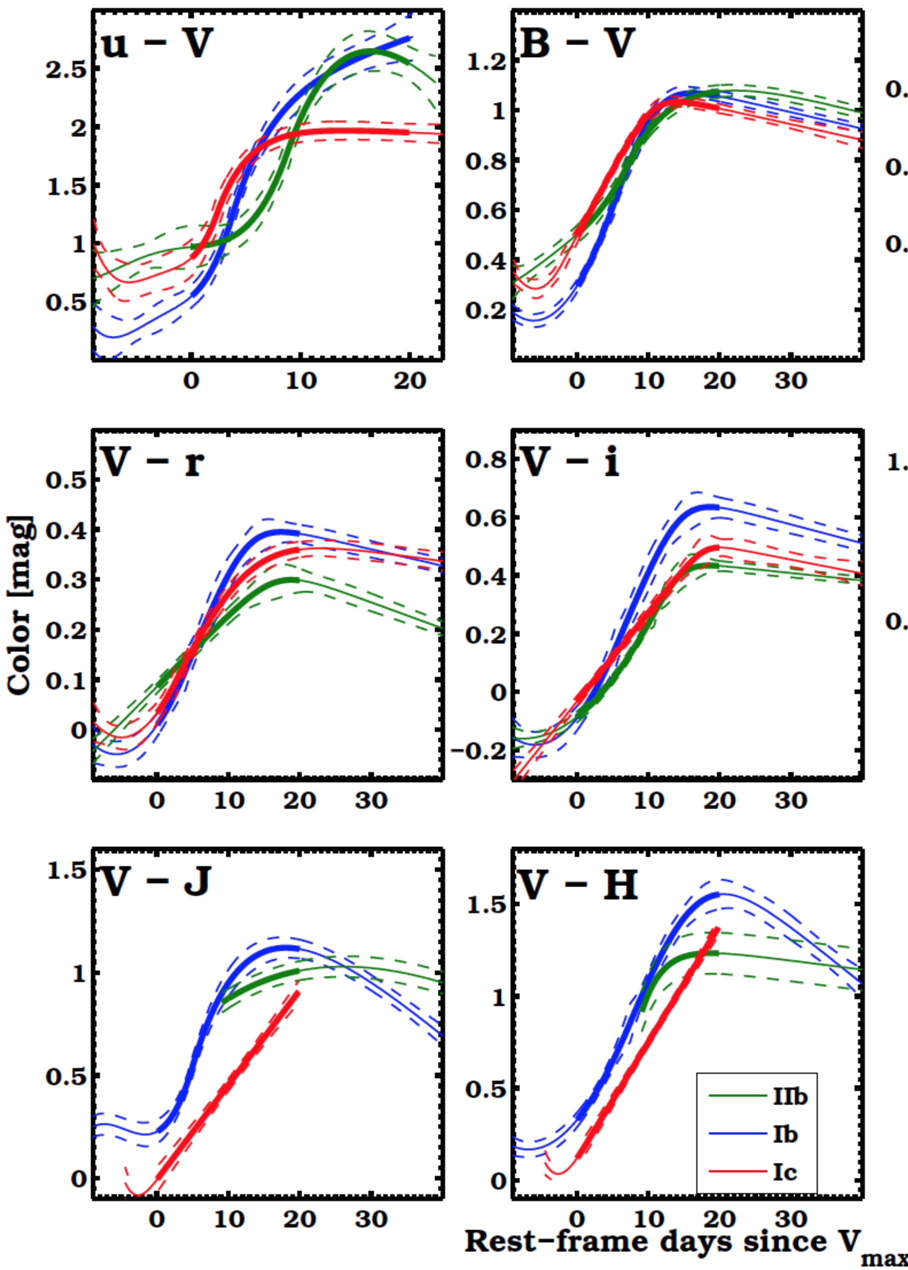
SE SN intrinsic (V-X) colors



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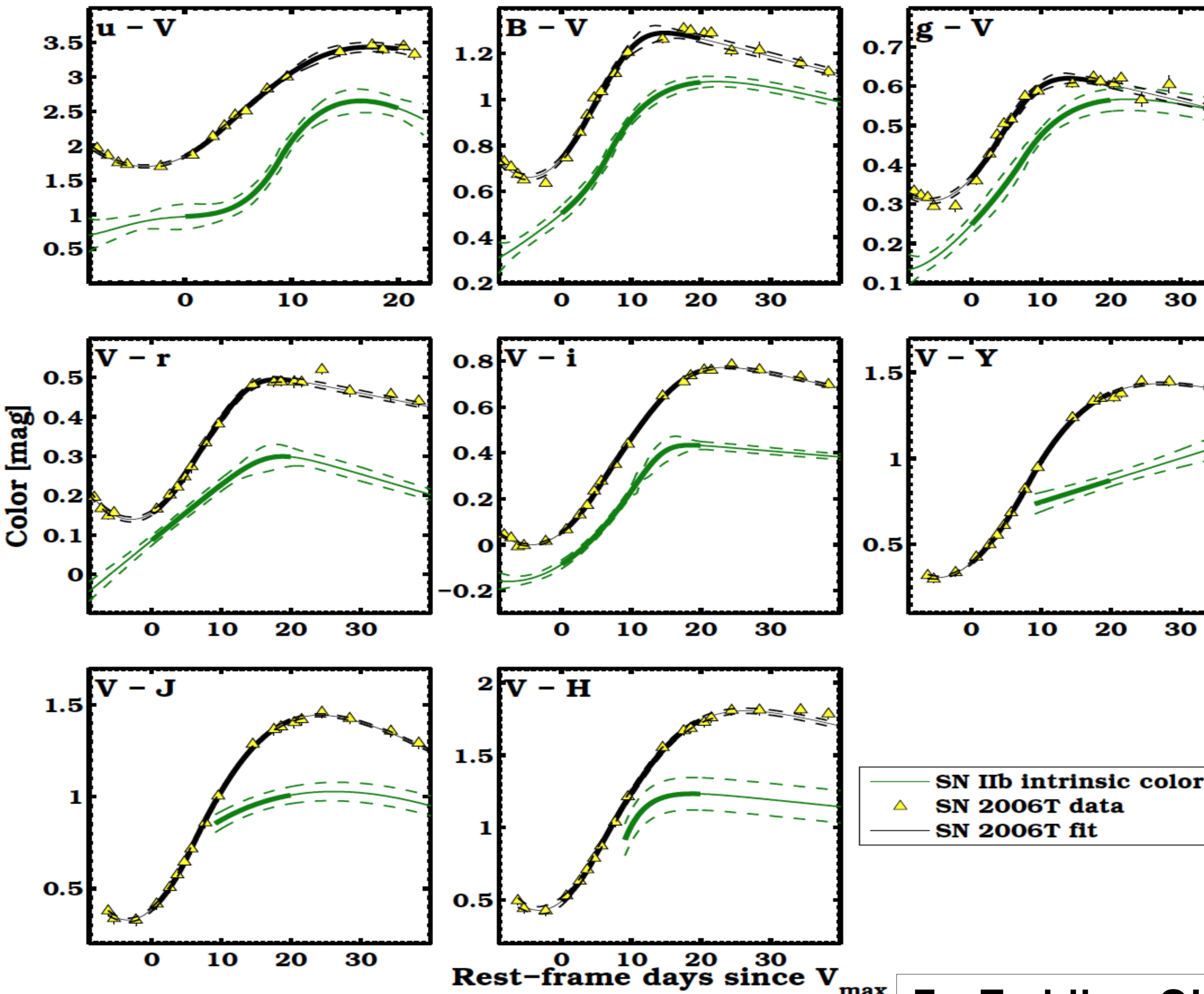
SE SN color excesses [E(V-X)]



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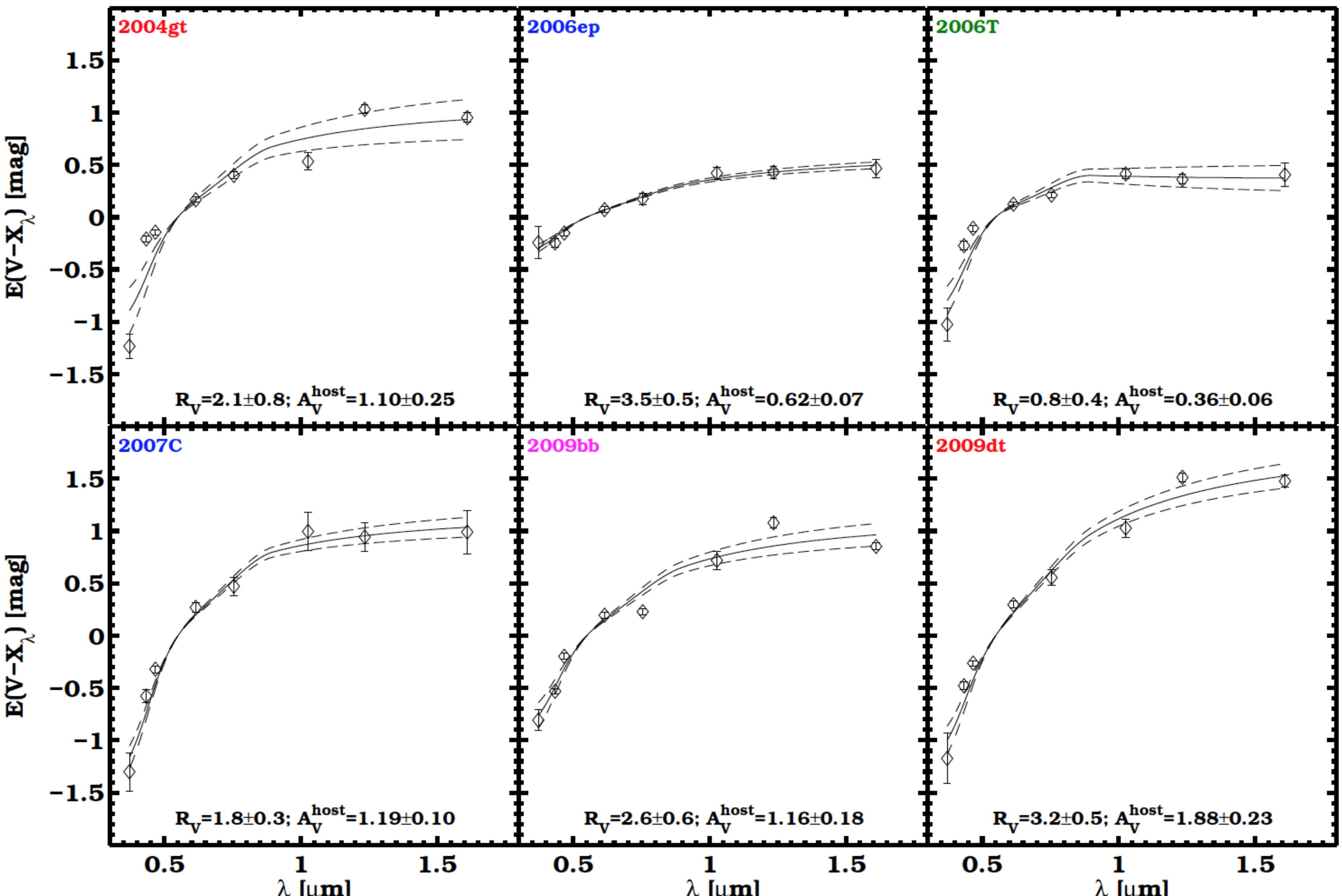
R_V and A_V from $E(V\text{-}X_\lambda)$ vs λ



Cardelli extinction law

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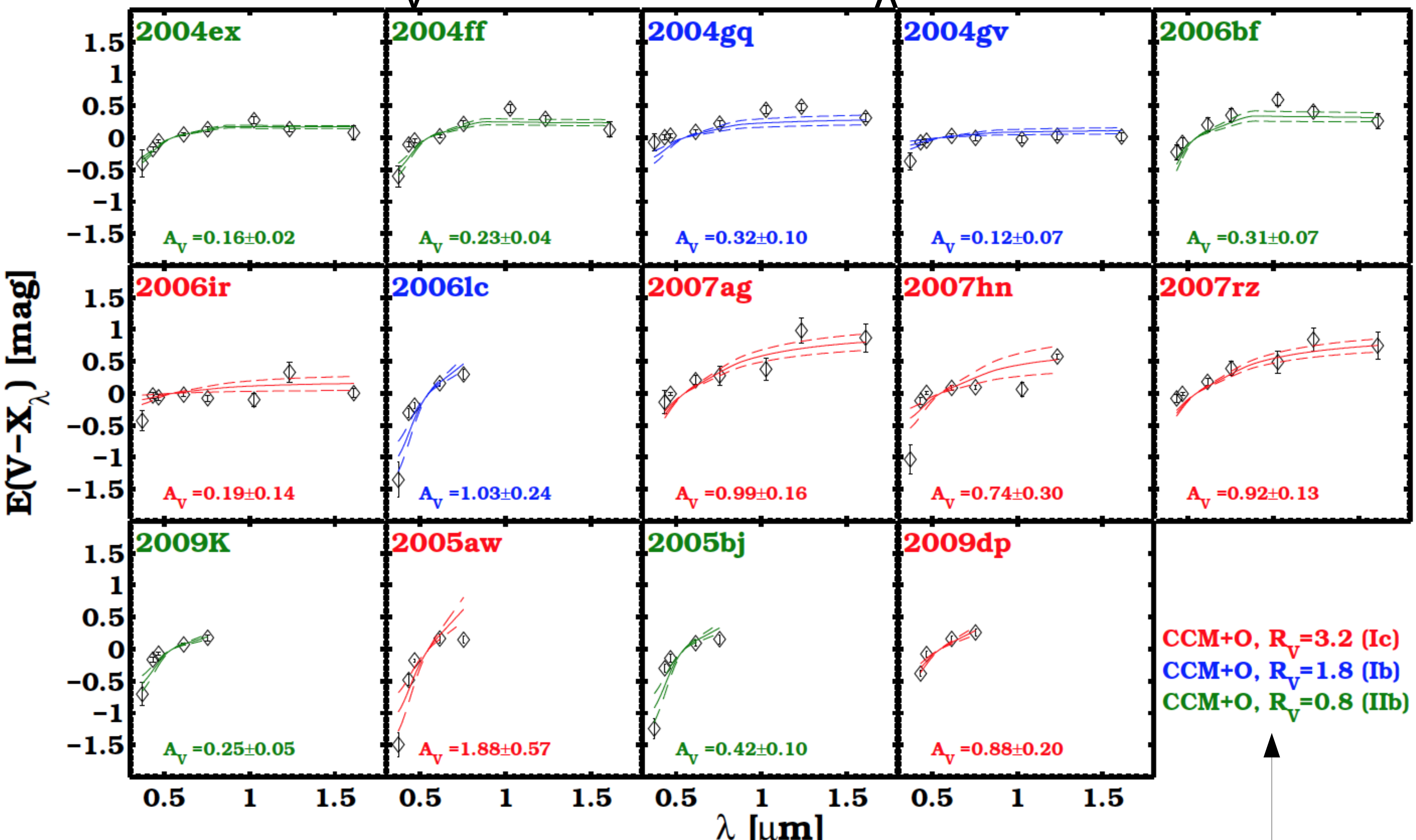
A_V from $E(V-X_\lambda)$ vs λ



Cardelli extinction law with fixed R_V for each subclass if A_V is too low to determine R_V

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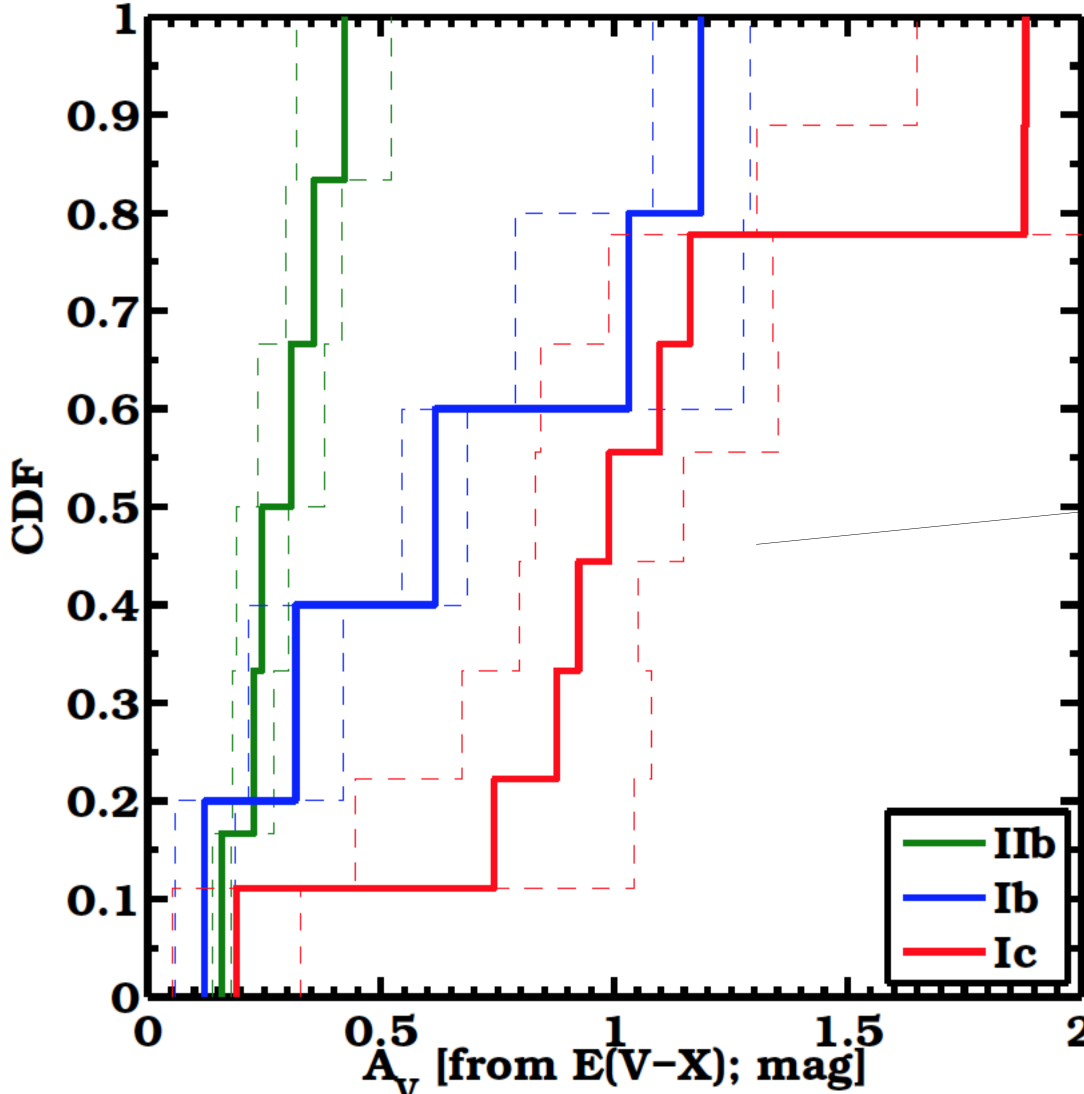
A_V for different SE SN subclasses



SNe Ic suffer larger host extinction

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Things to do/discuss on the reddening paper

1) Need to find a final convergence on which R_V for the events where we cannot constrain it due to low A_V.

2) We used Cardelli so far, what about Goobar et al. 2008 for the reddening law? It does fit well for many SNe.

3) EW(Na I D) and EW(DIBs) vs A_V.

4)....

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The Carnegie Supernova Project: analysis of stripped-envelope core-collapse supernovae light-curves*

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Abstract

Here is a story, a very nice story.

Key words. supernovae: general

1. Introduction

Stripped-envelope (SE) core-collapse supernovae (SNe) are associated with the deaths of massive stars that have experienced significant mass loss over their evolutionary lifetimes. The severity of mass loss drives the sequence defining the contemporary spectroscopic classification system of Type IIb →Ib→Ic. The progenitors of SNe IIb are thought to retain a residual amount ($\sim 0.01\ M_{\odot}$) of hydrogen prior to exploding, and as an outcome exhibit prevalent hydrogen features in pre-maximum spectra. However, soon after maximum (t_{max}) their spectra evolve to resemble normal SN Ib (e.g., SN 1993J; Filippenko et al. 1994), exhibiting conspicuous helium features and only traces

tinent details regarding each SN. Section 3 contains the detailed analysis of the photometric light curve properties. This is followed by Section 4 which examines the absolute luminosities. Subsequently, in Section 5 spectral energy distributions (SEDs) are used to construct UVOIR light curves, from which explosion parameters are estimated in Section 6. Finally, a discussion and the conclusions on our results are presented in Sections 7 and 8.

2. The CSP stripped-envelope supernova sample

Table 1 contains the list of the 34 SE SNe followed by the CSP. Twenty nine of the objects have $ugriBV$ band light curves, 5

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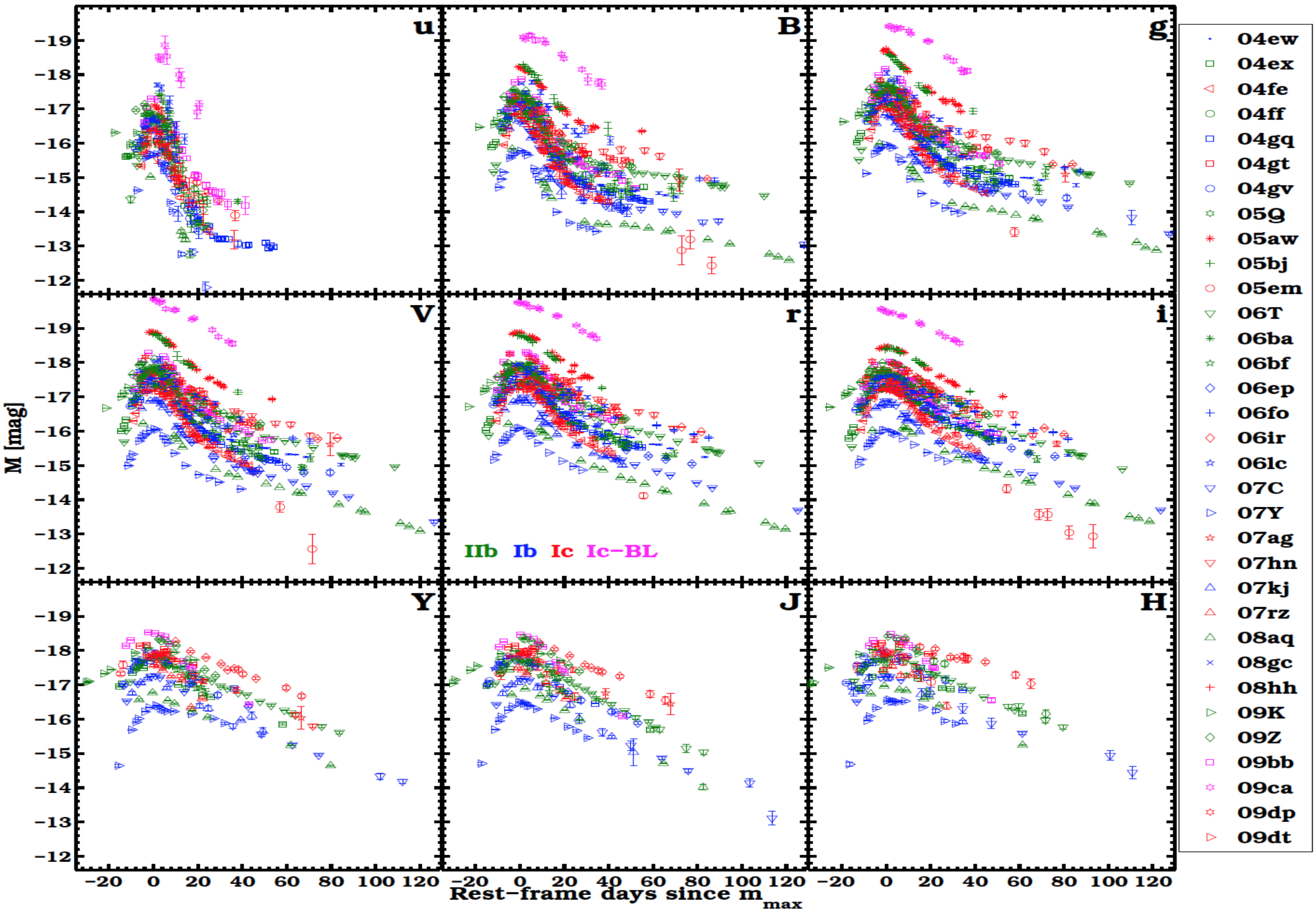
Light curve analysis



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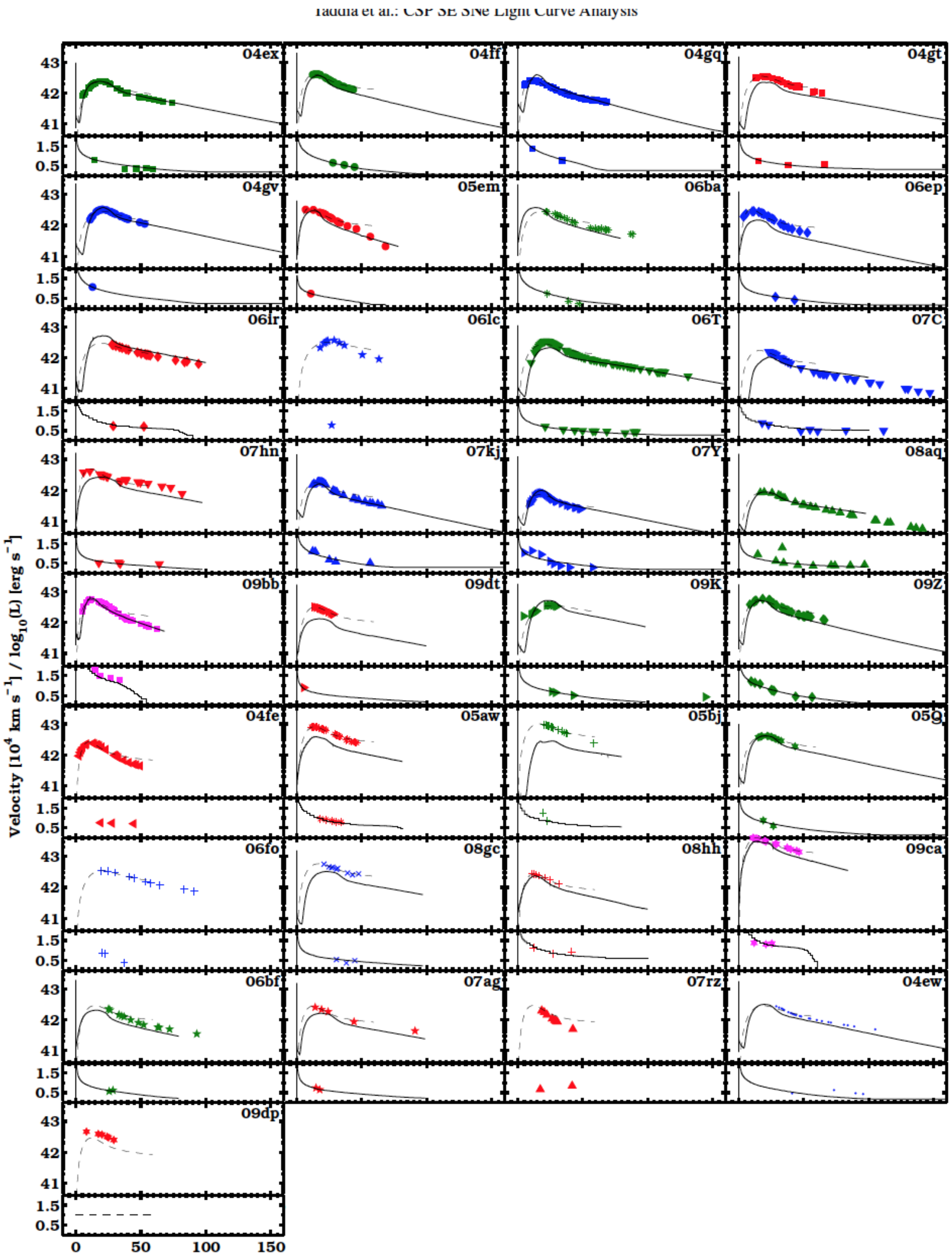

Fitting the bolometric light curves

1) Analytic model (Arnett)

2) Hydrodynamical models (Bersten et al.)

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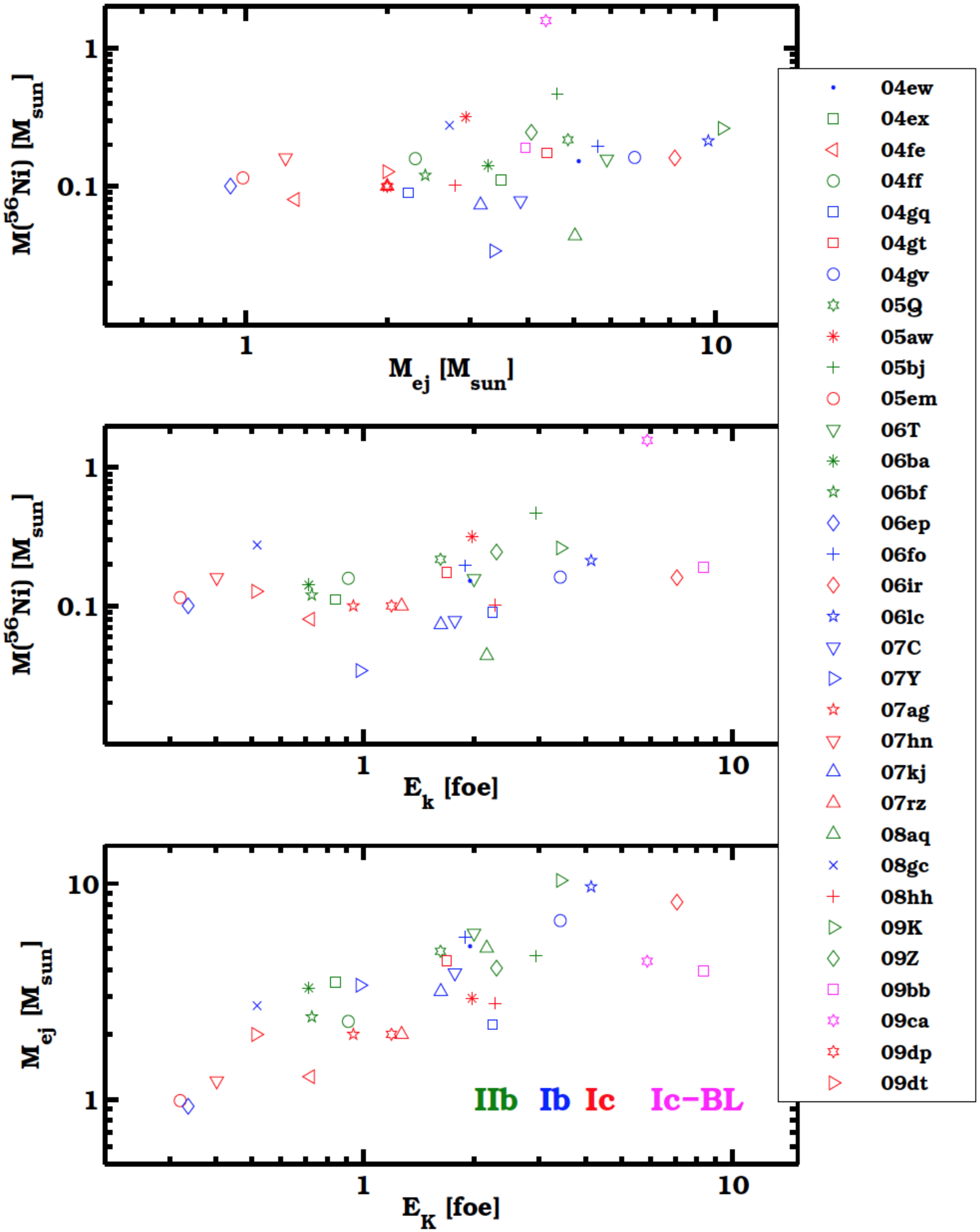

Progenitor parameters

↓

E_K, M_ej,
Ni mass,
Ni mixing

Any difference between SN Ic and Ib? Not significant for the moment.

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Progenitor nature

a) Massive (M_ZAMS > 25-30 M_sun) WR stars?

b) Lower mass (12 ~< M_ZAMS ~< 20 M_sun) binary stars?

→ TO ANSWER, WE NEED GOOD ESTIMATES OF THE EJECTA MASS

We need to model the proper expansion velocity to be sure about the ejecta mass!
Fe II **expansion velocity** for the hydro model, and He I / O I for Arnett? See Dessart+ 2016

Hydromodels are better than Arnett as they do not assume constant **opacity**, which is important to estimate the ejecta mass. See Dessart+ 2016.

We are using stars rich in He for both SNe Ib and Ic, should we try to **produce C+O progenitors** for SNe Ic?

Things to do/discuss on the light curve analysis paper

1) Decide on the final R_V and A_V values.
2) Finalizing the modelling with new hydromodels by Melina based on the final bolometric results and on the proper velocities.
3) Comparing our final result to new sample in the literature (Lyman, Modjaz, Prentice).

4) ...

(1) Data paper (Stritzinger et al.)

(2) Reddening paper (Stritzinger, Taddia et al.)

(3) Light curve analysis paper (Taddia et al.)

(4) Spectroscopy paper (Holmbo et al.)

(1) Data paper (Stritzinger … l.)

Advanced draft

(2) Redde… per (Stritzinger, Taddia et al.)

(3) Light curve analysis paper (Taddia et al.)

(4) Spectroscopy paper (Holmbo et al.)

(1) Data paper (Stritzinger ... l.)

Advanced draft

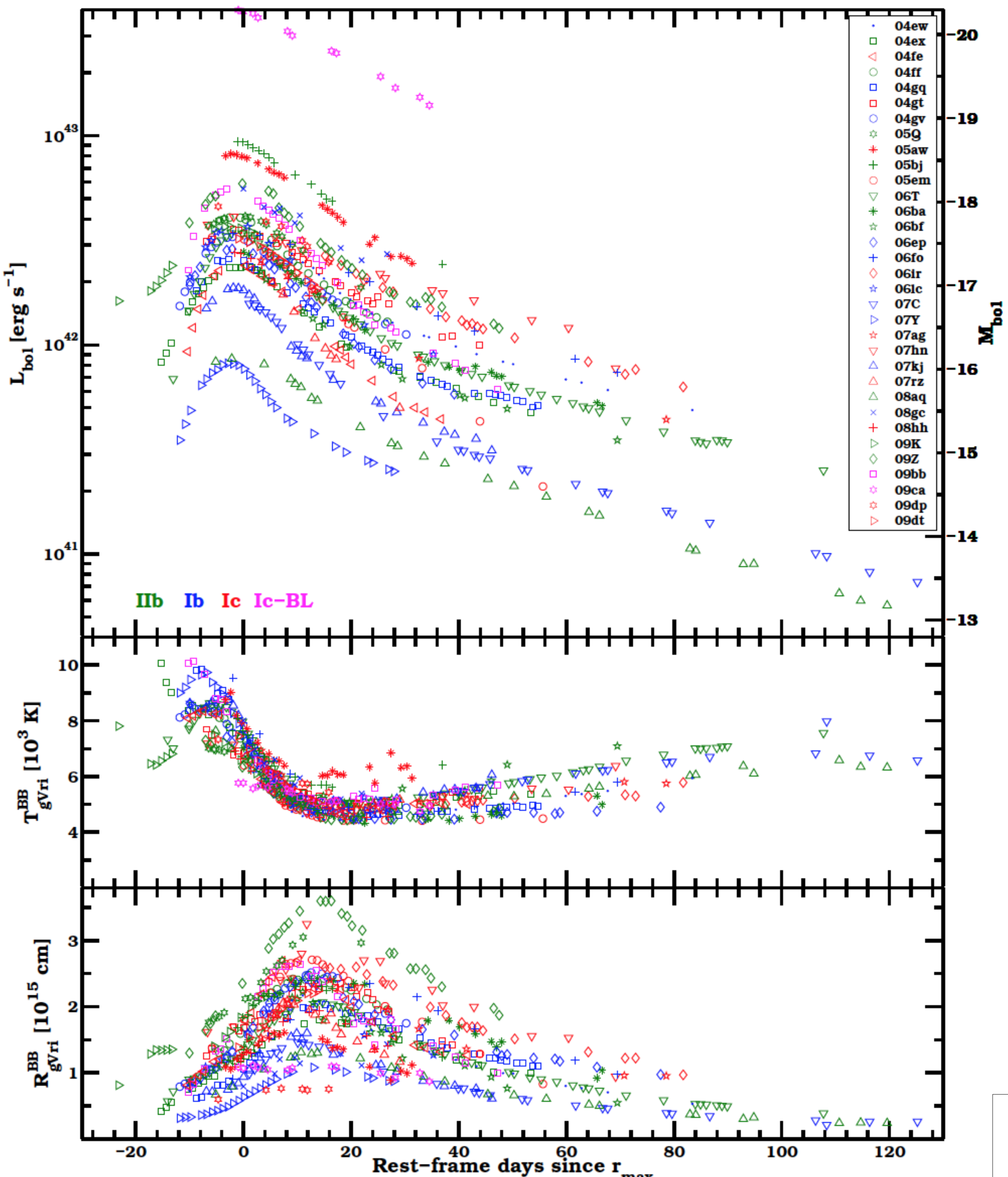
(2) Redde ... per (Stritzinger, Taddia et al.)

(3) Light curve ... er (Taddia et al.)

Waiting for final R_V and A_V
and then refine modelling

(4) Spectroscopy paper (Holmbo et al.)

Bolometric properties



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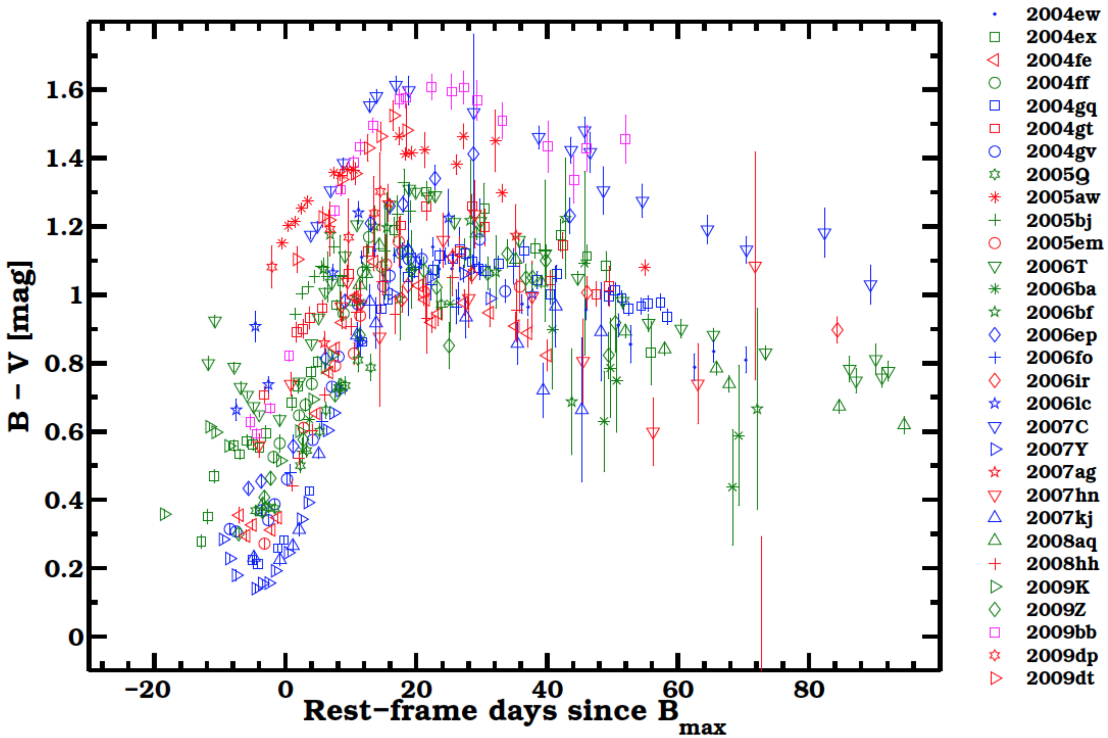
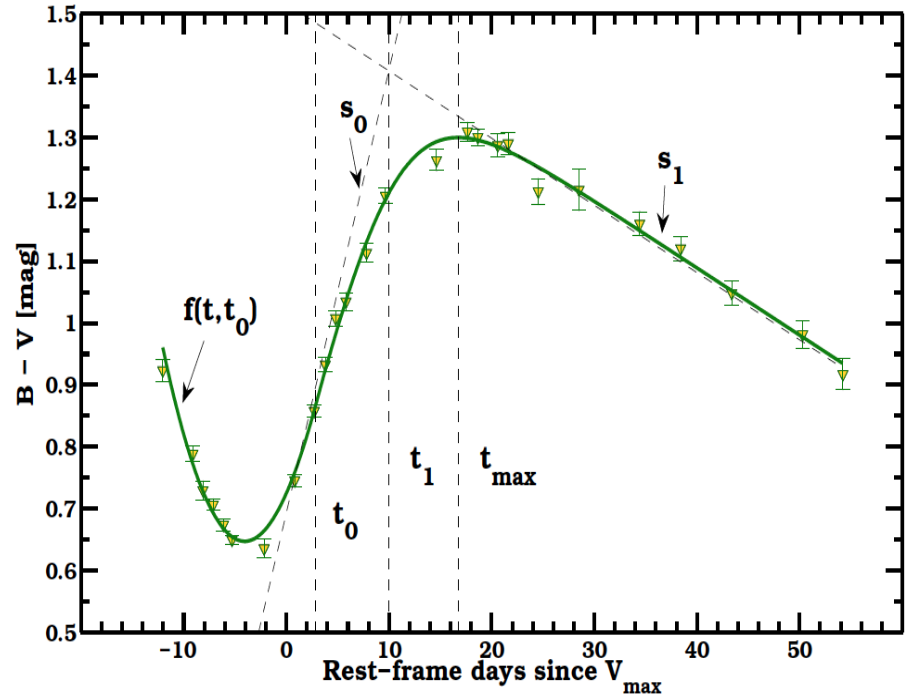
FITTING SN Ibc COLORS





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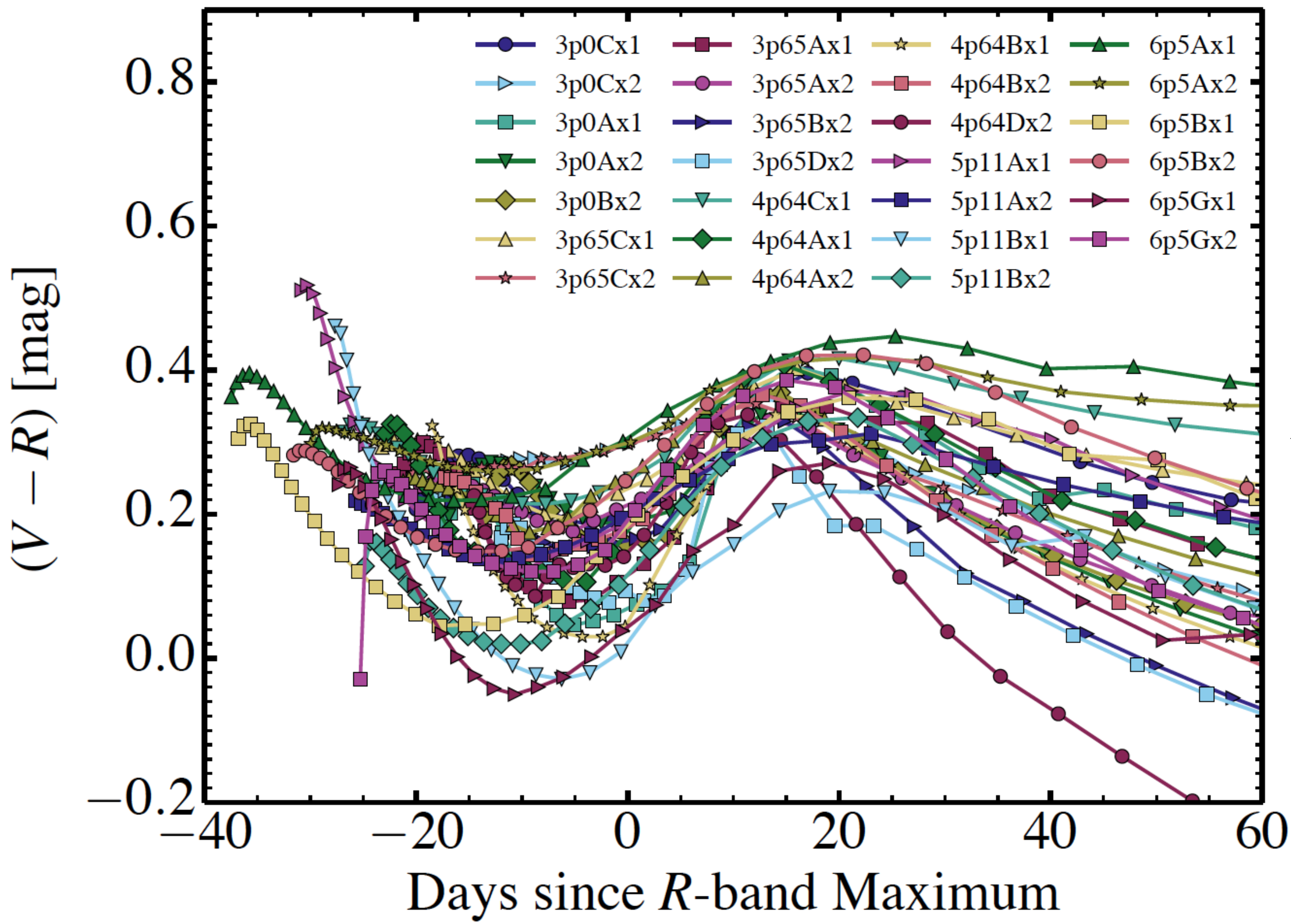
SN Ibc models and intrinsic colors



Dessart et al. 2016

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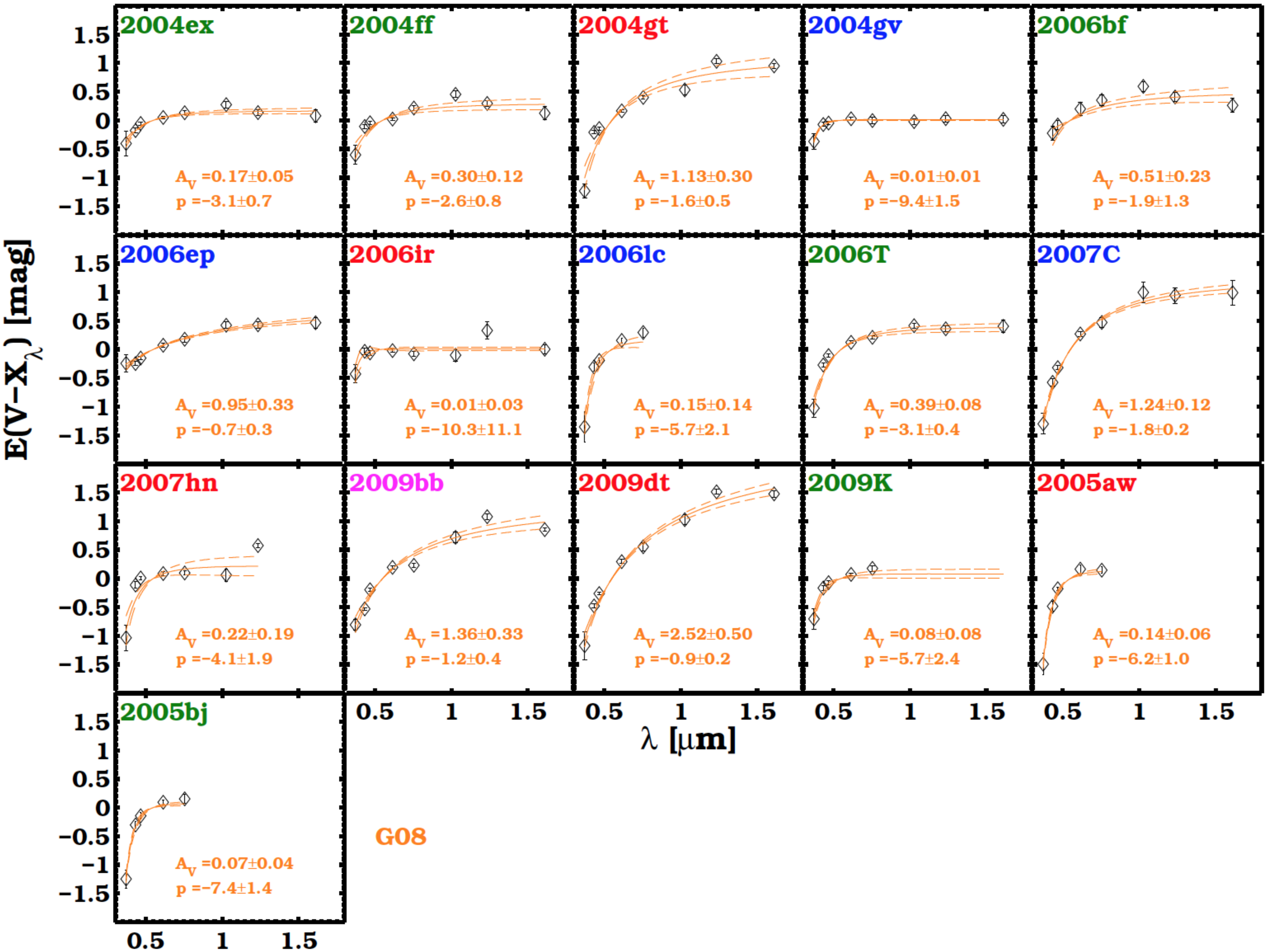
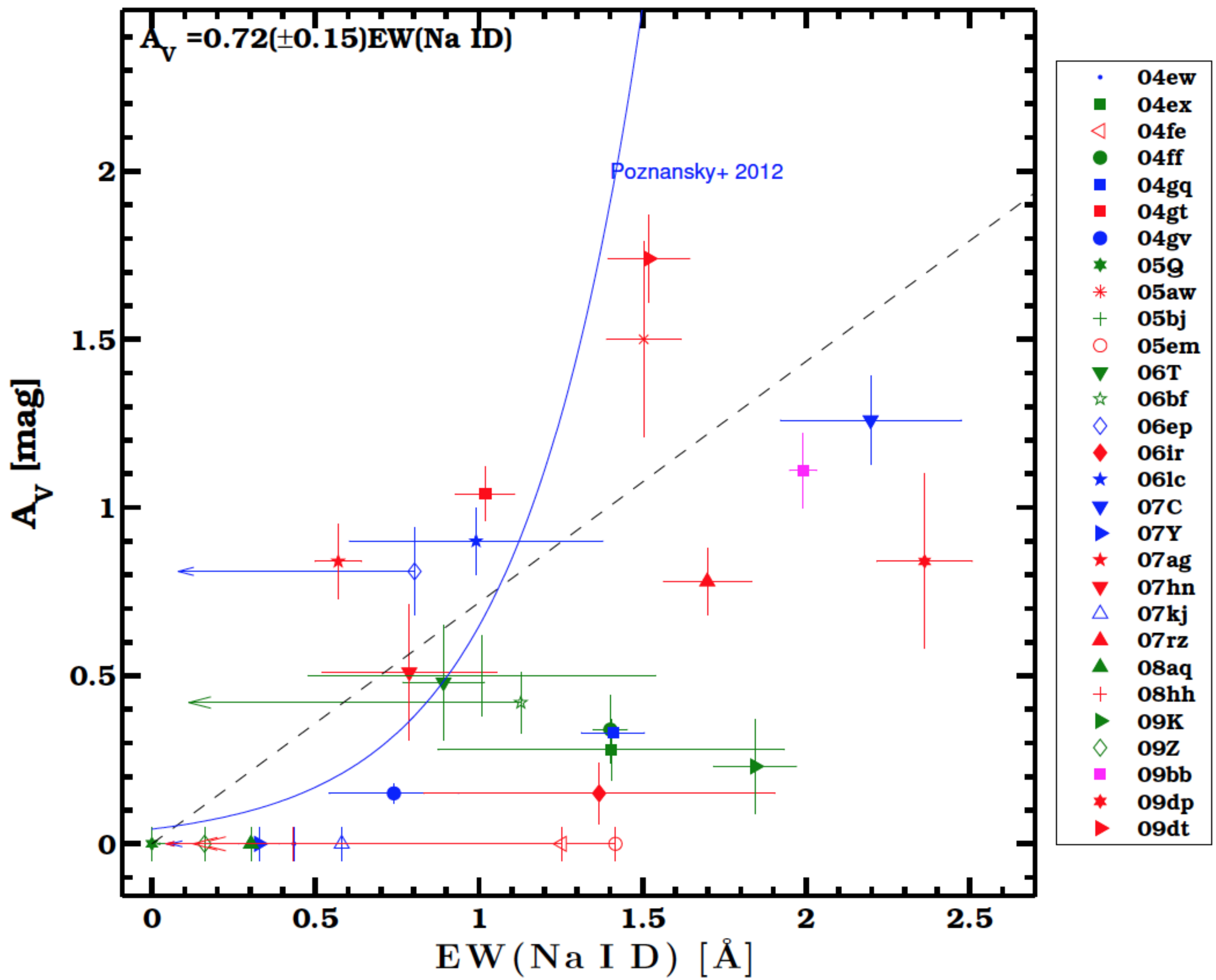
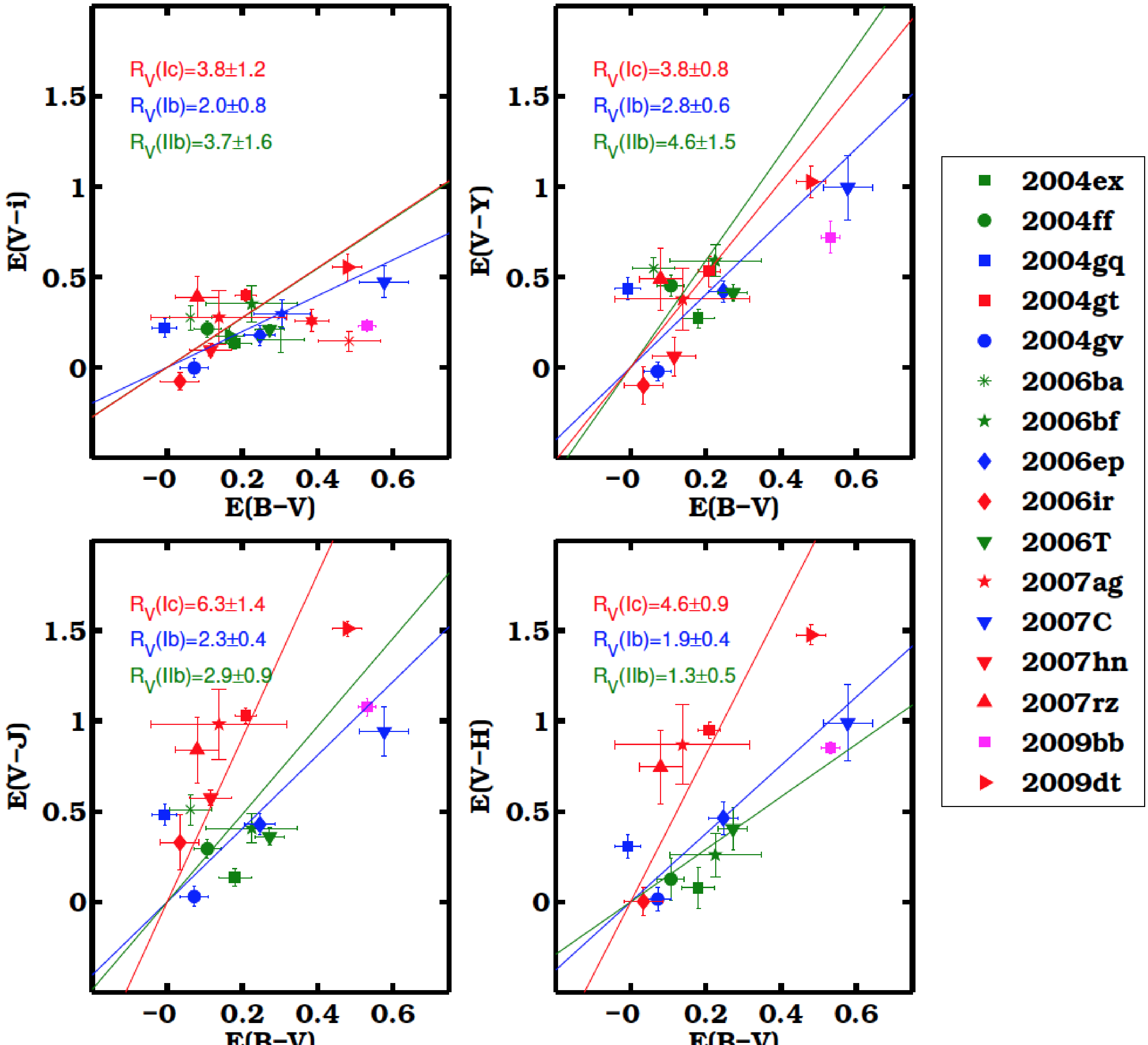


2004ex
A_V =0.17±0.05
p =−3.1±0.7
2004ff
A_V =0.30±0.12
p =−2.6±0.8
2004gt
A_V =1.13±0.30
p =−1.6±0.5
2004gv
A_V =0.01±0.01
p =−9.4±1.5
2006bf
A_V =0.51±0.23
p =−1.9±1.3
2006ep
A_V =0.95±0.33
p =−0.7±0.3
2006ir
A_V =0.01±0.03
p =−10.3±11.1
2006lc
A_V =0.15±0.14
p =−5.7±2.1
2006T
A_V =0.39±0.08
p =−3.1±0.4
2007C
A_V =1.24±0.12
p =−1.8±0.2
2007hn
A_V =0.22±0.19
p =−4.1±1.9
2009bb
A_V =1.36±0.33
p =−1.2±0.4
2009dt
A_V =2.52±0.50
p =−0.9±0.2
2009K
A_V =0.08±0.08
p =−5.7±2.4
2005aw
A_V =0.14±0.06
p =−6.2±1.0
2005bj
A_V =0.07±0.04
p =−7.4±1.4
G08
$E(V-X_\lambda)$ [mag]
λ [μm]


A_V =0.72(±0.15)EW(Na ID)
Poznansky+ 2012
A_V [mag]
EW(Na I D) [Å]
0
0.5
1
1.5
2
2.5
04ew
04ex
04fe
04ff
04gq
04gt
04gv
05G
05aw
05bj
05em
06T
06bf
06ep
06ir
06lc
07C
07Y
07ag
07hn
07kj
07rz
08aq
08hh
09K
09Z
09bb
09dp
09dt



R_V(Ic)=3.8±1.2
R_V(Ib)=2.0±0.8
R_V(IIb)=3.7±1.6
E(V−i)
E(B−V)
R_V(Ic)=3.8±0.8
R_V(Ib)=2.8±0.6
R_V(IIb)=4.6±1.5
E(V−Y)
E(B−V)
R_V(Ic)=6.3±1.4
R_V(Ib)=2.3±0.4
R_V(IIb)=2.9±0.9
E(V−J)
E(B−V)
R_V(Ic)=4.6±0.9
R_V(Ib)=1.9±0.4
R_V(IIb)=1.3±0.5
E(V−H)
E(B−V)
2004ex
2004ff
2004gq
2004gt
2004gv
2006ba
2006bf
2006ep
2006ir
2006T
2007ag
2007C
2007hn
2007rz
2009bb
2009dt