NIR Cosmology

Does it Get Any Better Than This?

New advances in NIR type Ia supernova science

Pittsburgh, April 2018

CARNEGIE SCIENCE | The Carnegie Observatories

What's New, SNooPy

- On github: `https://github.com/obscode/snpy`

- Now an anaconda package
  ```
  conda config --add channels cburns1
  conda install snpy
  ```

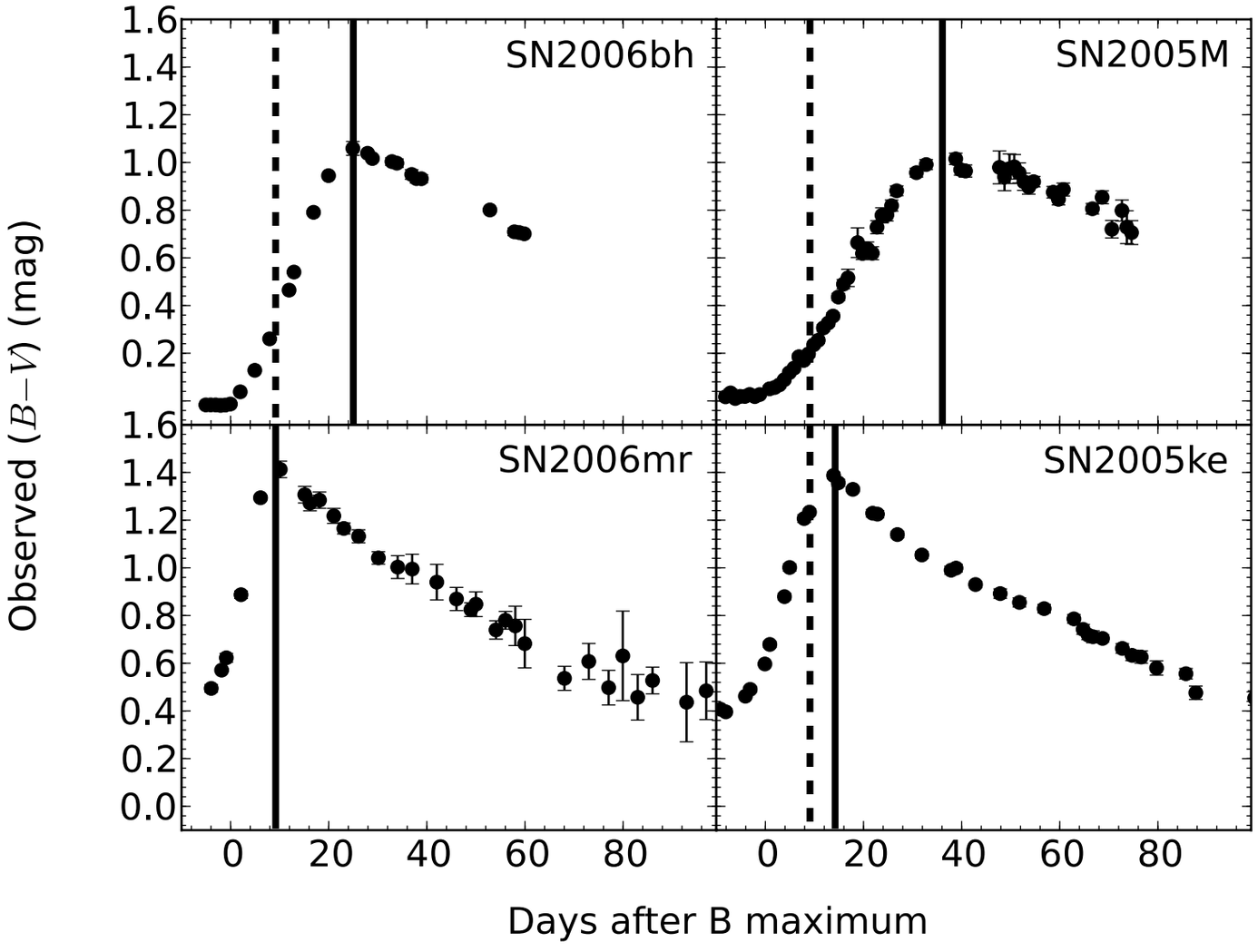
- Much faster fitting (K-corrections)

- Optional MCMC fitter (for specifying priors)

- Bolometric flux/luminosity calculator

- In the works: better SED-based LC templates (A&M)

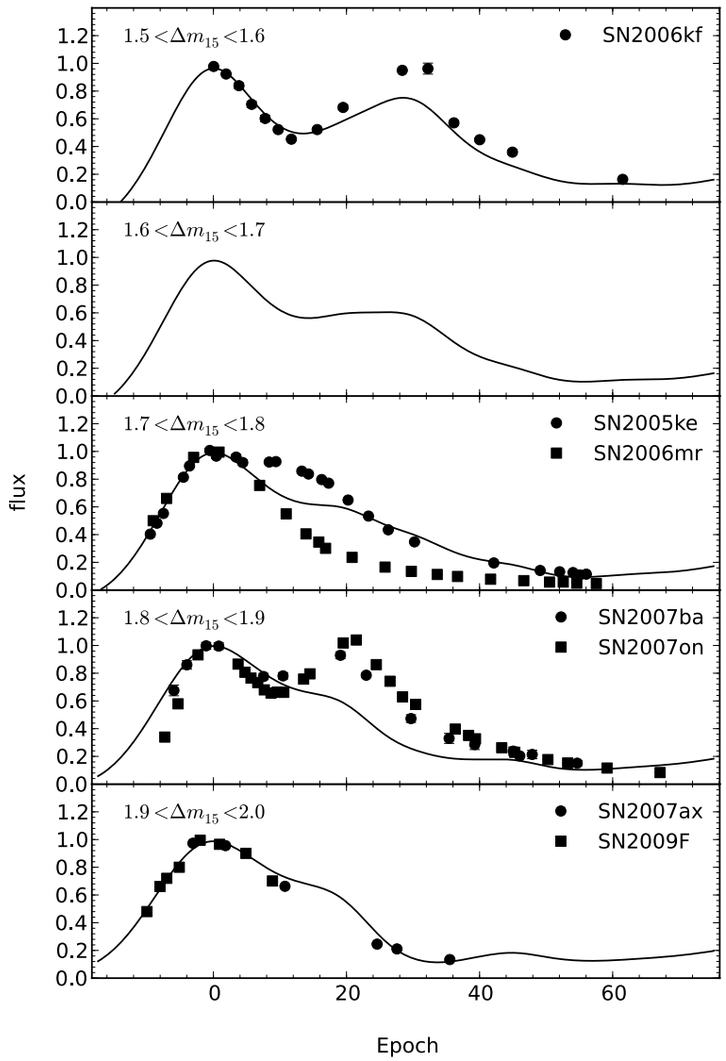
s_{BV}: Color Stretch

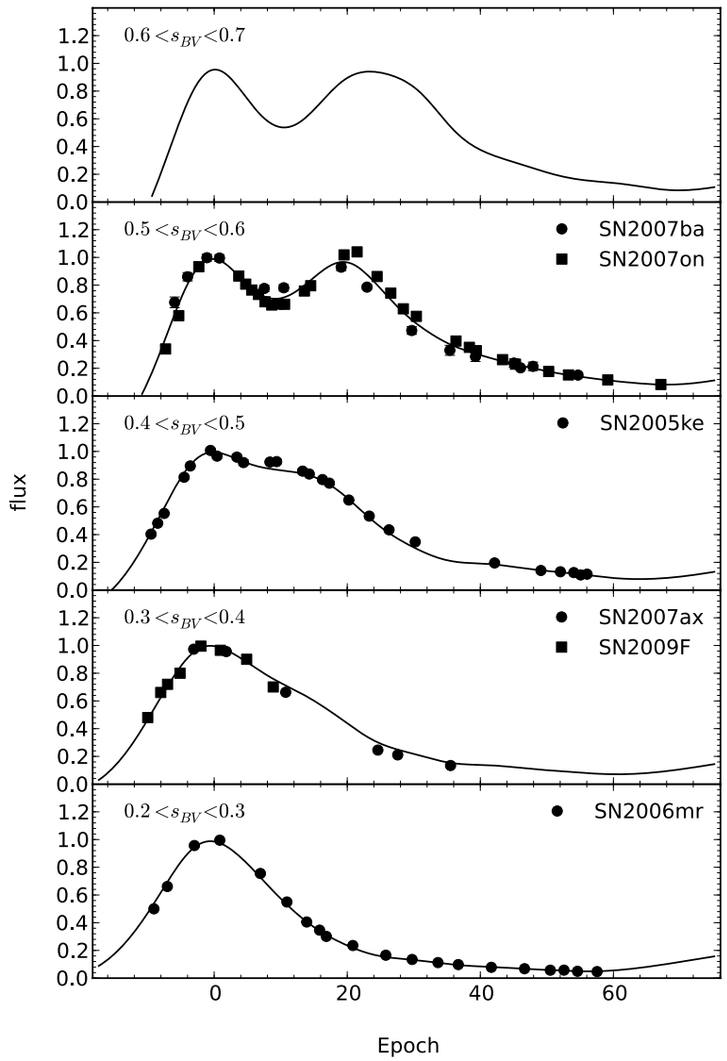


Define color stretch:

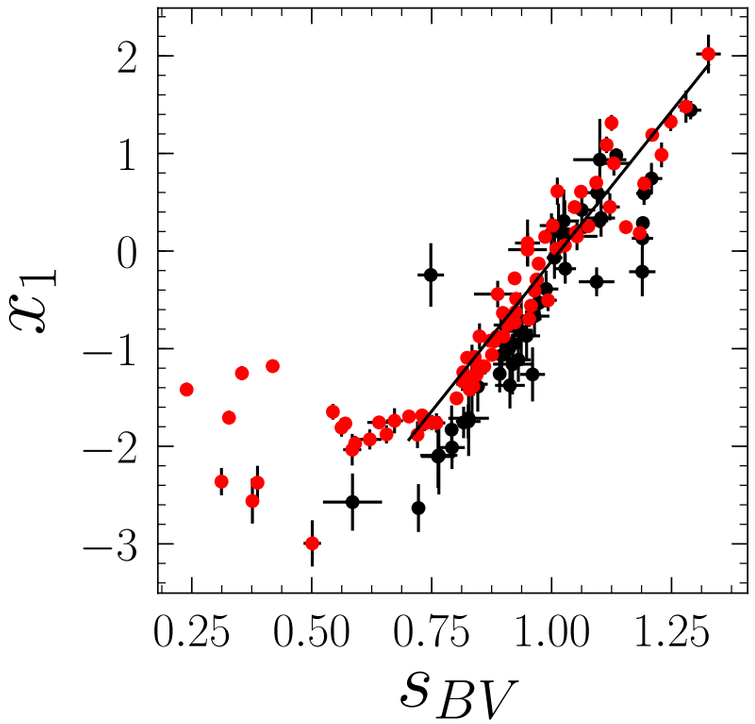
$$s_{BV} = \frac{t\left[(B-V)_{max}\right]}{30 \ \ \text{days}}$$

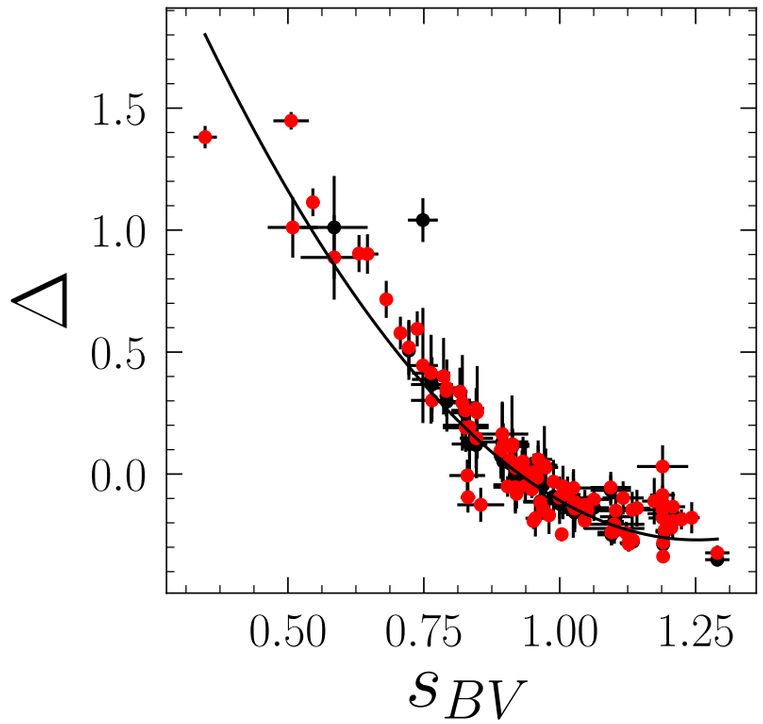
s_{BV} motivated by NIR light-curves

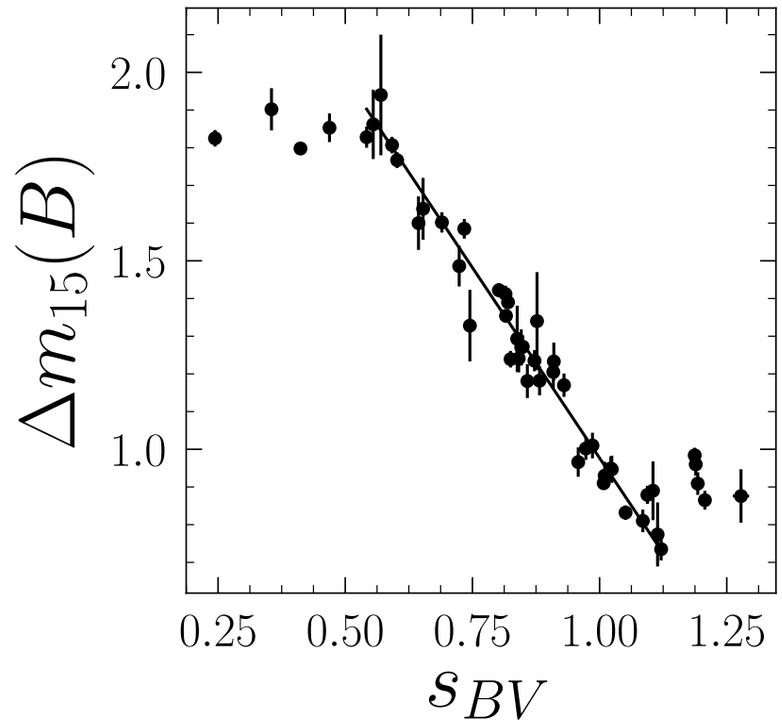




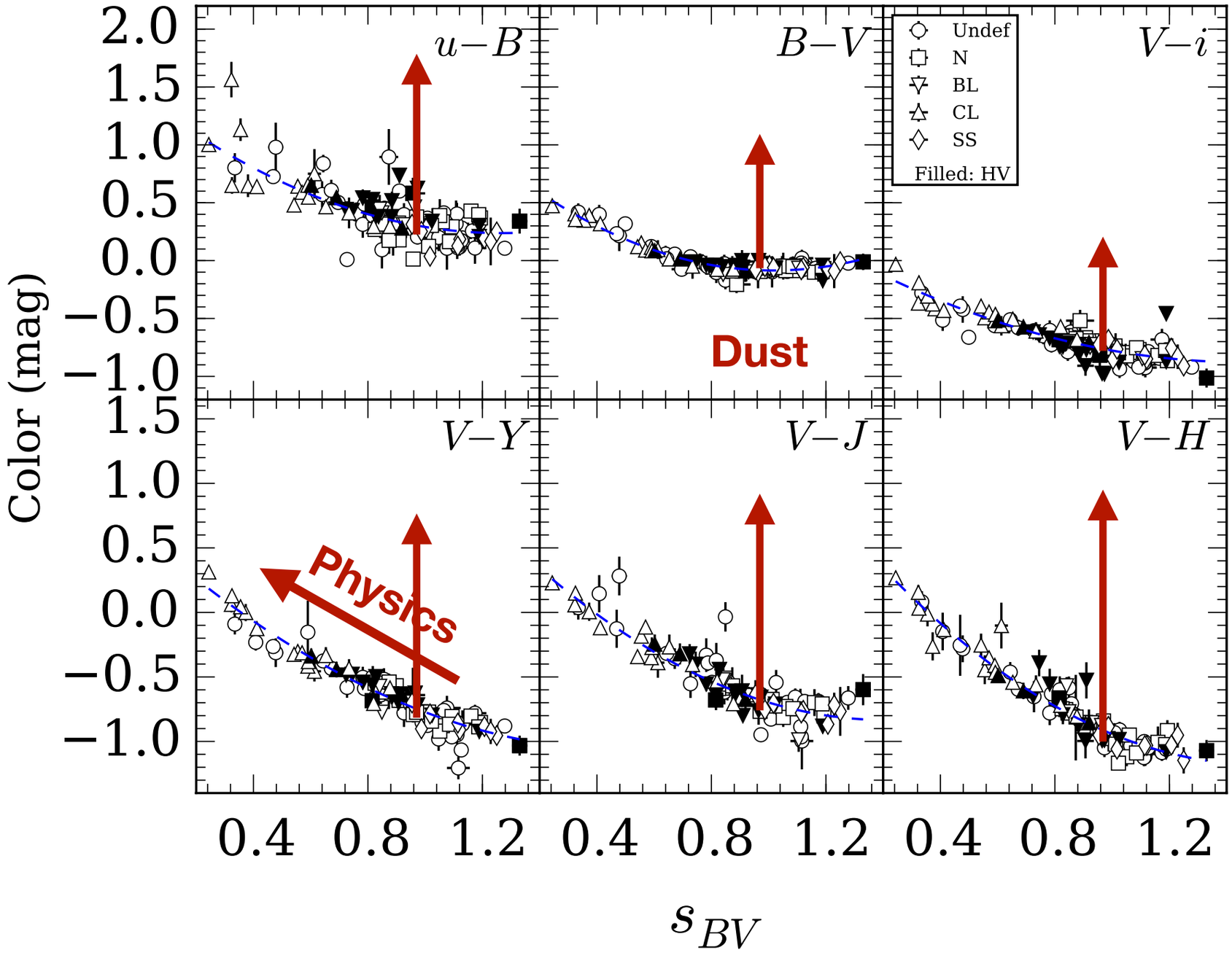
s_{BV} seems to have a bit more to say.



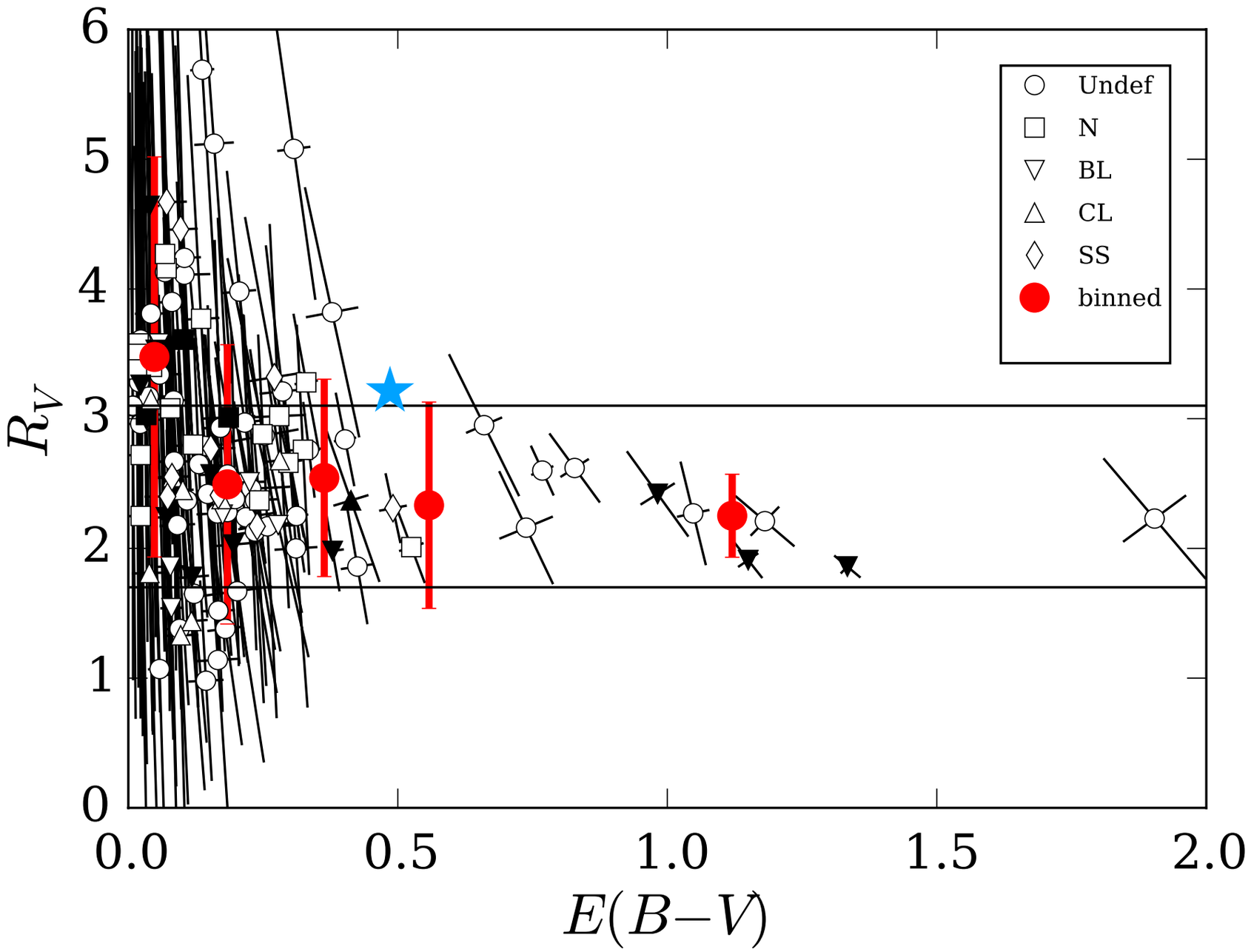




Why are SNeIa Red?

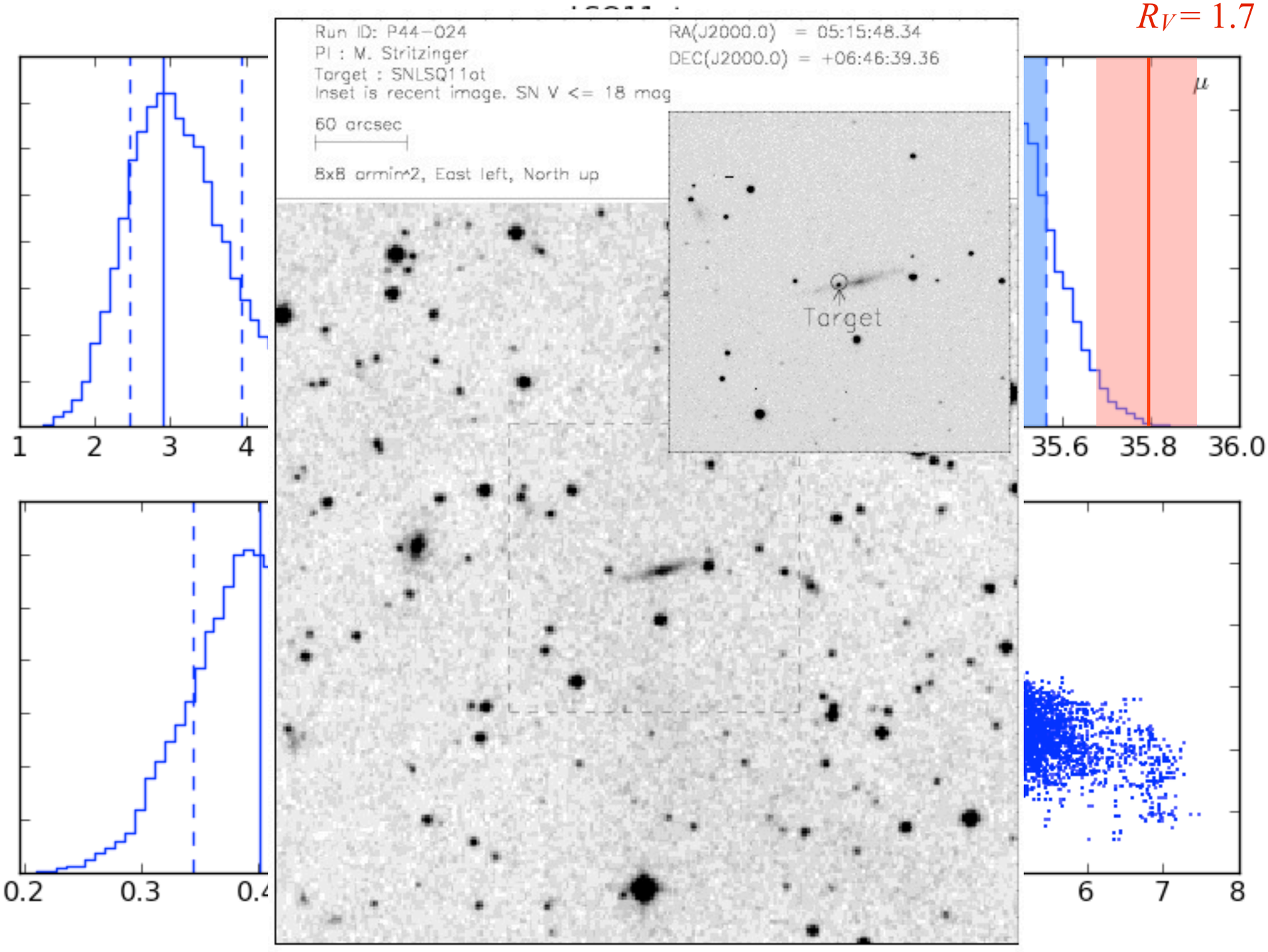


We need to stop apologizing for this

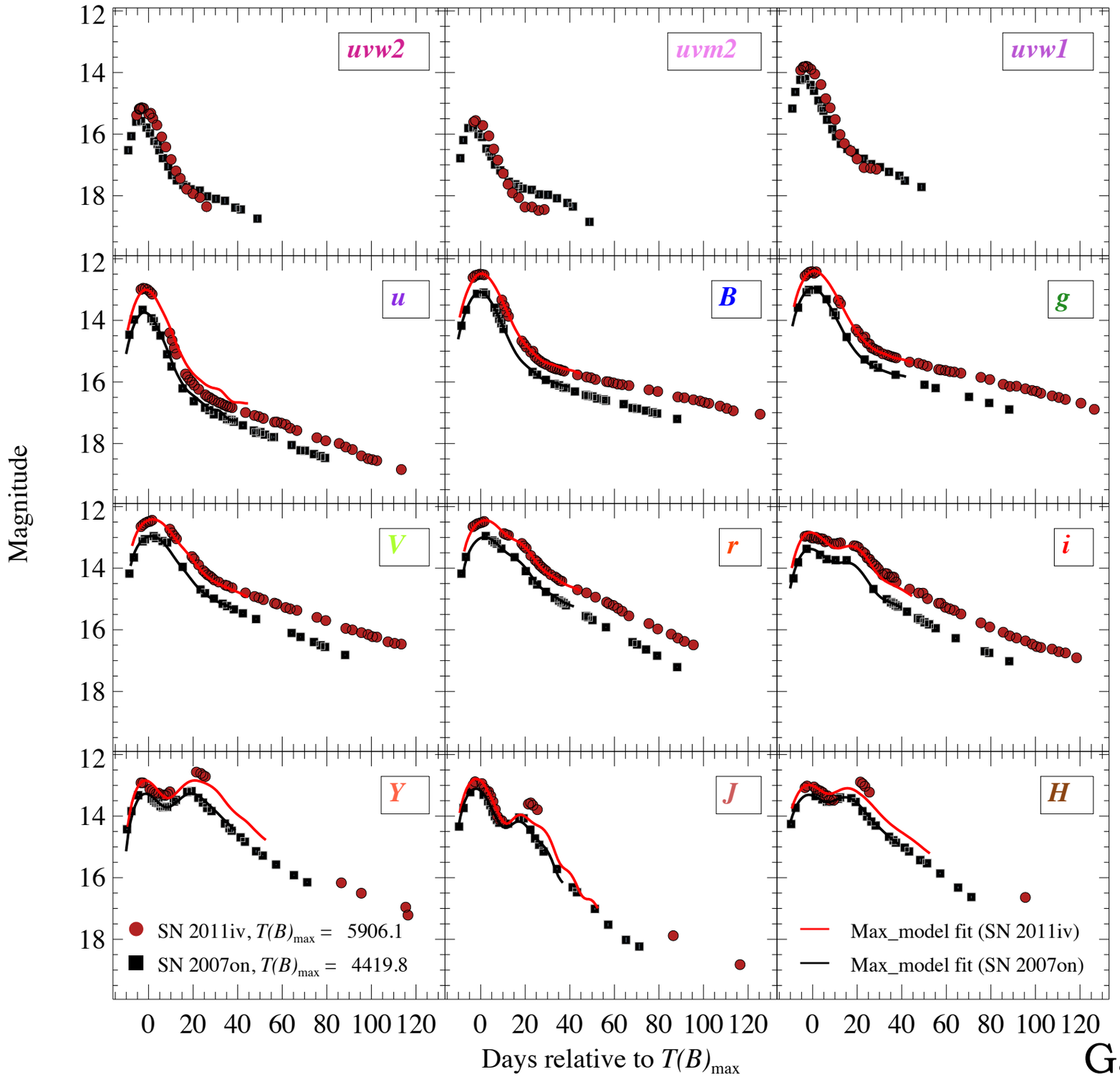


Using Fitzpatrick (1999) reddening law

CSP-II: Higher z



Just when you think you've got it all figured out...



Gall et al. (2018)

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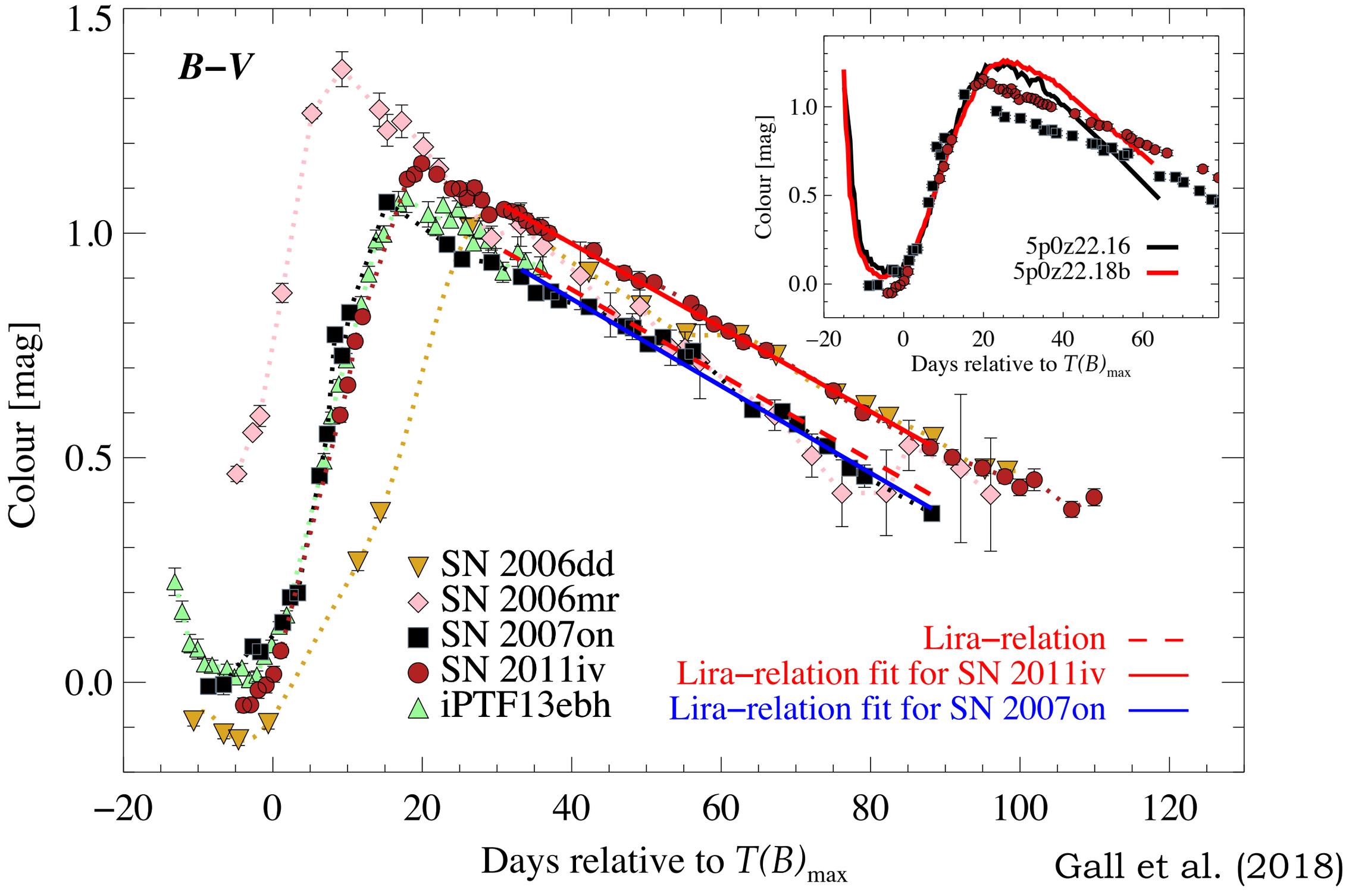

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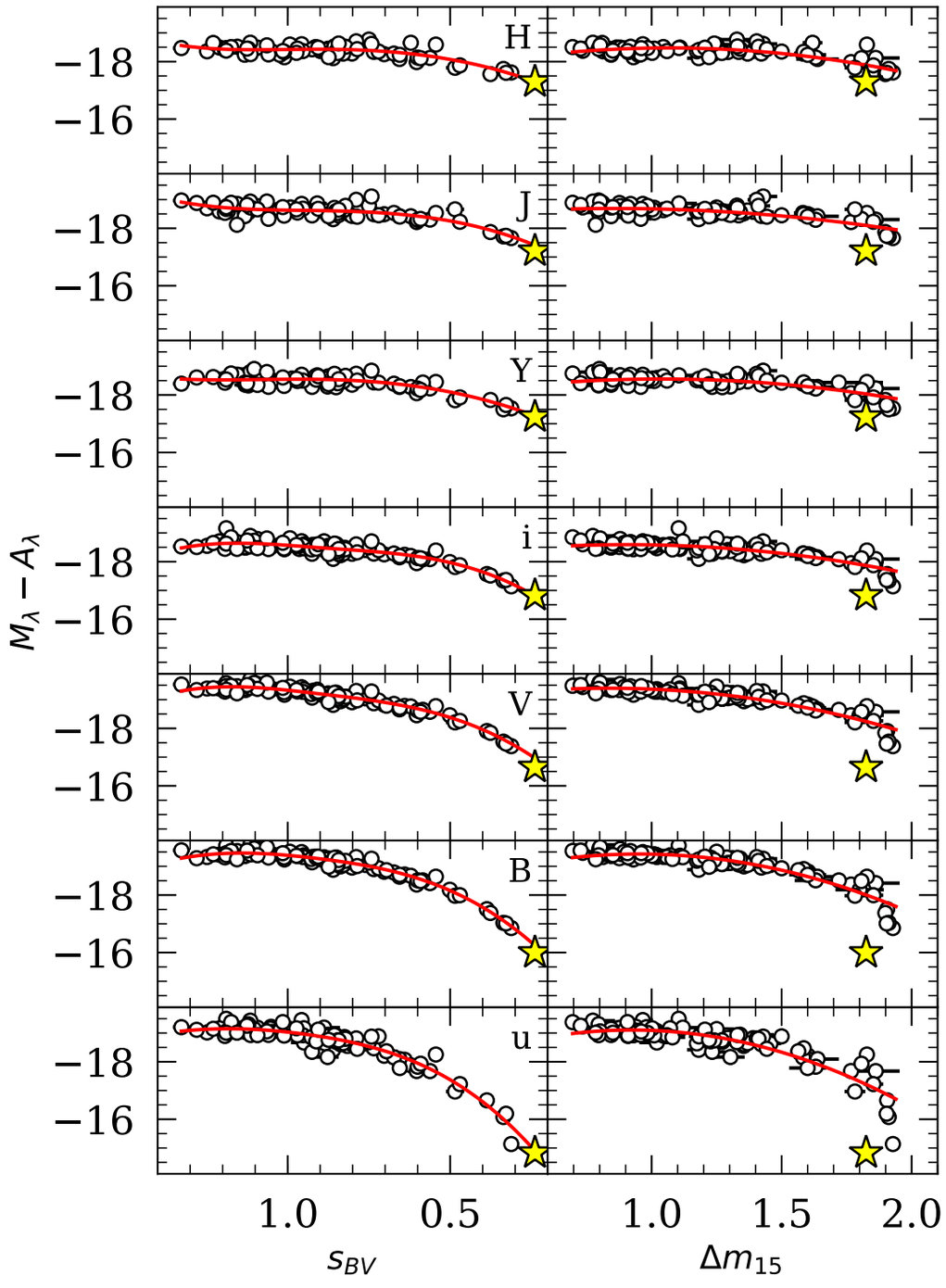
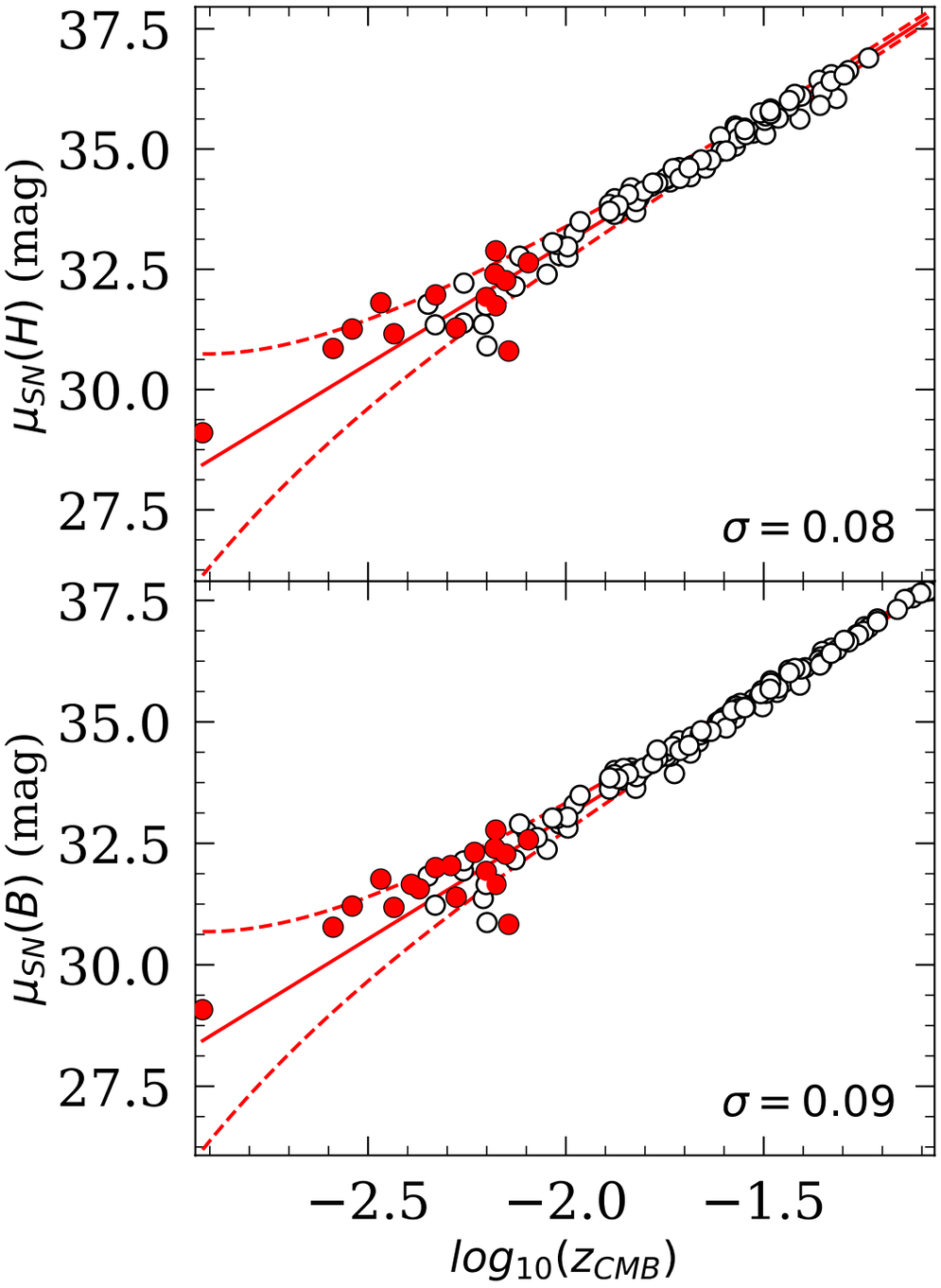


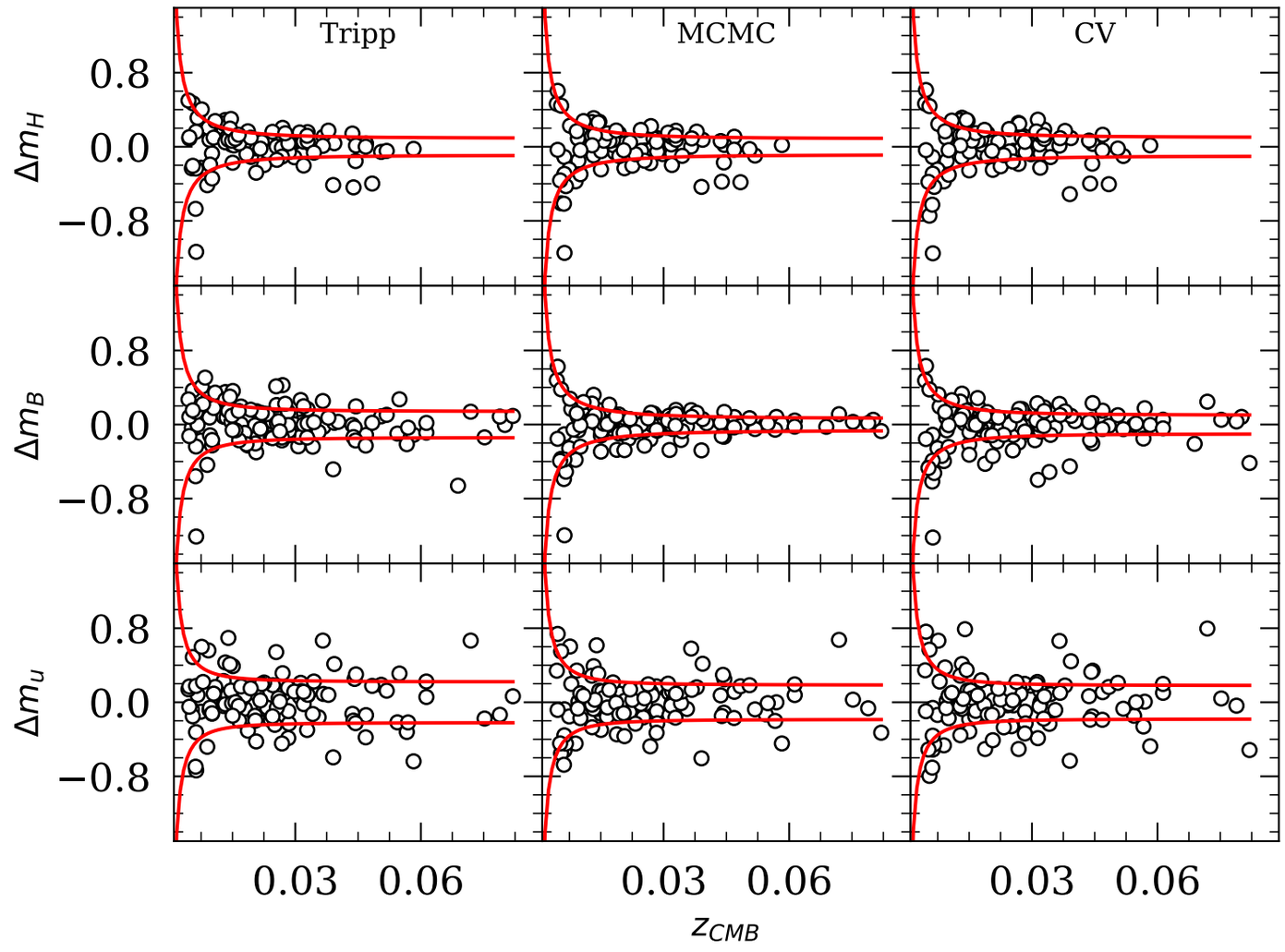
The color stretch better classifies objects at the fast end.

Does only slightly better for "normal" Ia's, so its utility is limited where the experiment cuts out the fast decliners.

Possibly does better for the slow end too, but need more data to say for sure.

Hubble Diagram



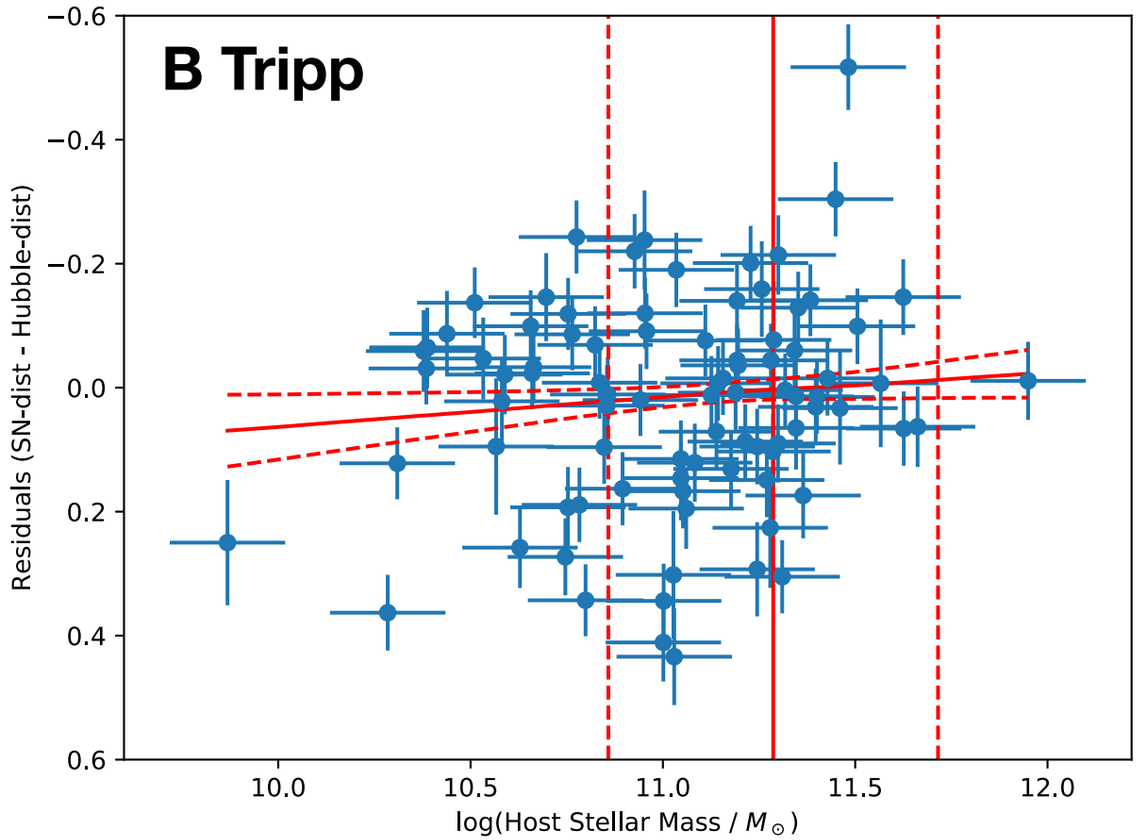


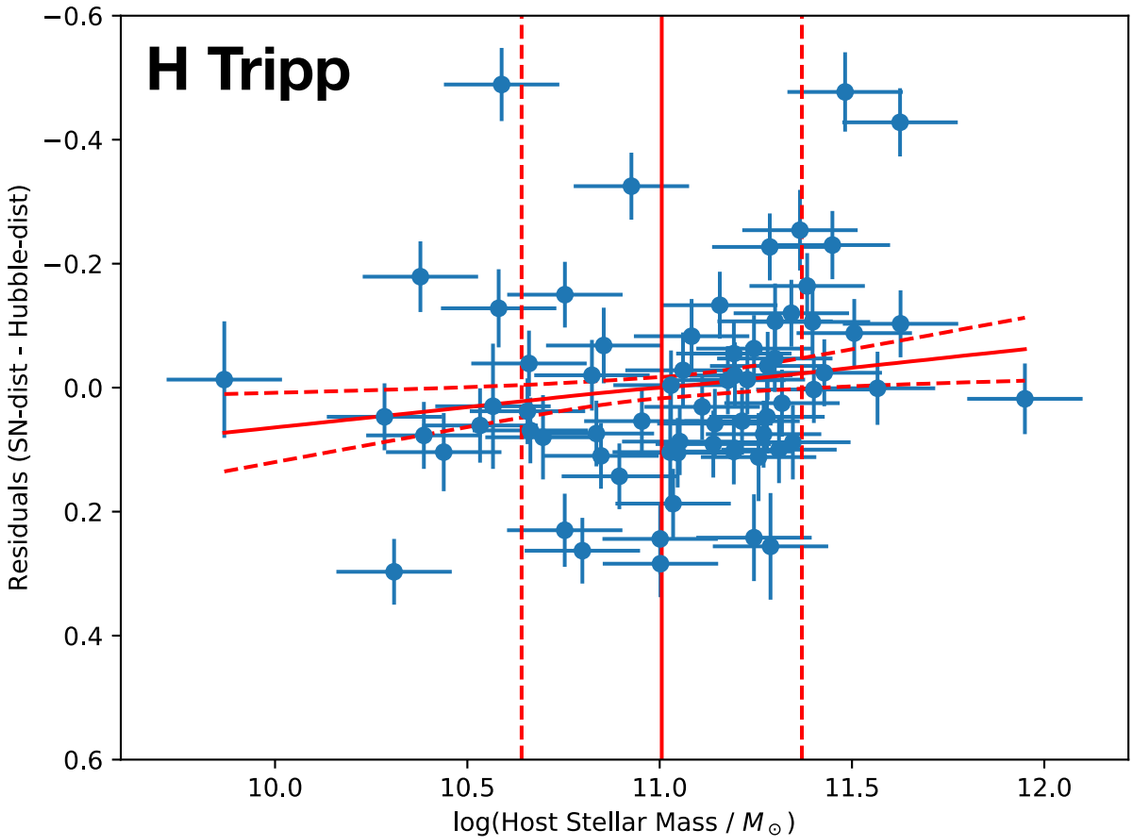
Hubble Residuals vs Host Mass

- Use the cross-validation residuals
- K-band photometry of host galaxies from 2MASS extended source catalog, converted to Mass assuming constant M/L and +/- 0.2 dex for error due to variance in star formation history.

$$\log_{10}(M/M_{\odot}) = \frac{\mu(z) - m_K}{2.5} + 1.32$$

- Fit for slope, break point, intrinsic dispersion and peculiar velocity.


B Tripp
Residuals (SN-dist - Hubble-dist)
log(Host Stellar Mass / $M_\odot$)
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
10.0
10.5
11.0
11.5
12.0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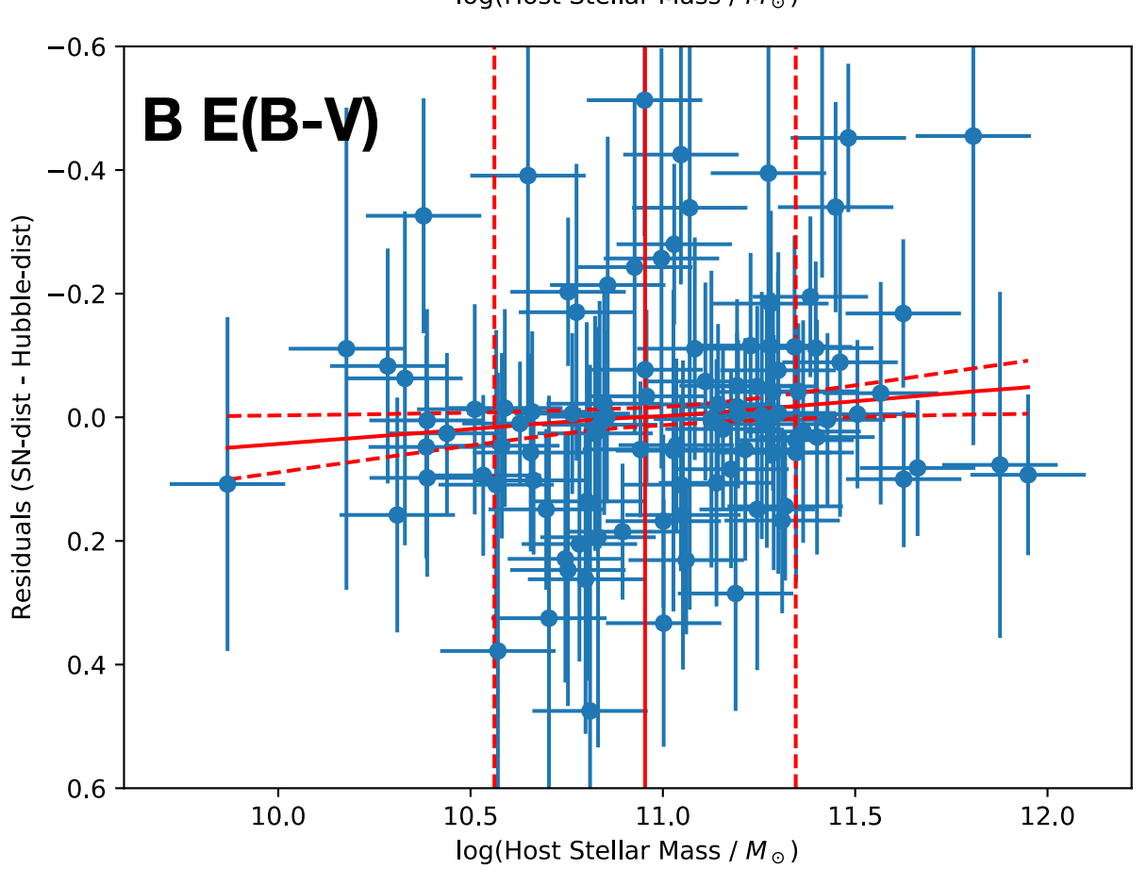
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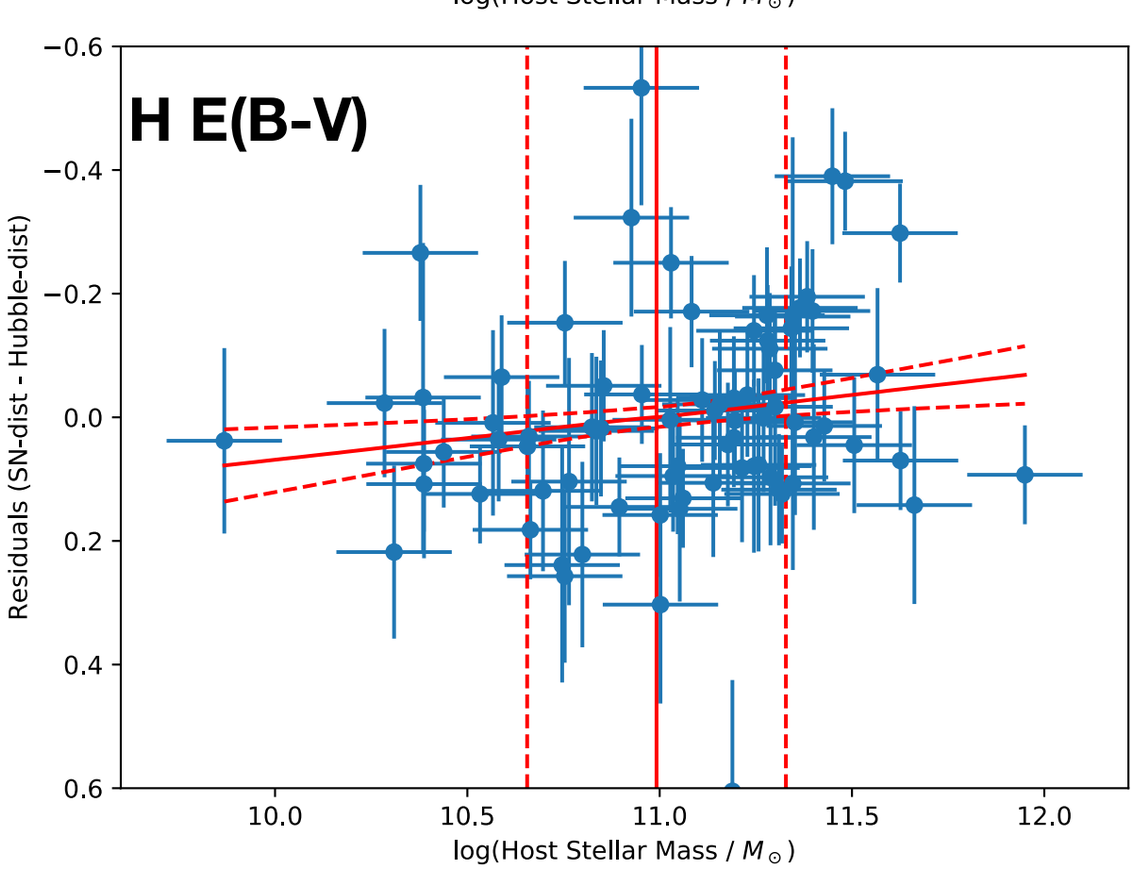
H E(B-V)
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0.6
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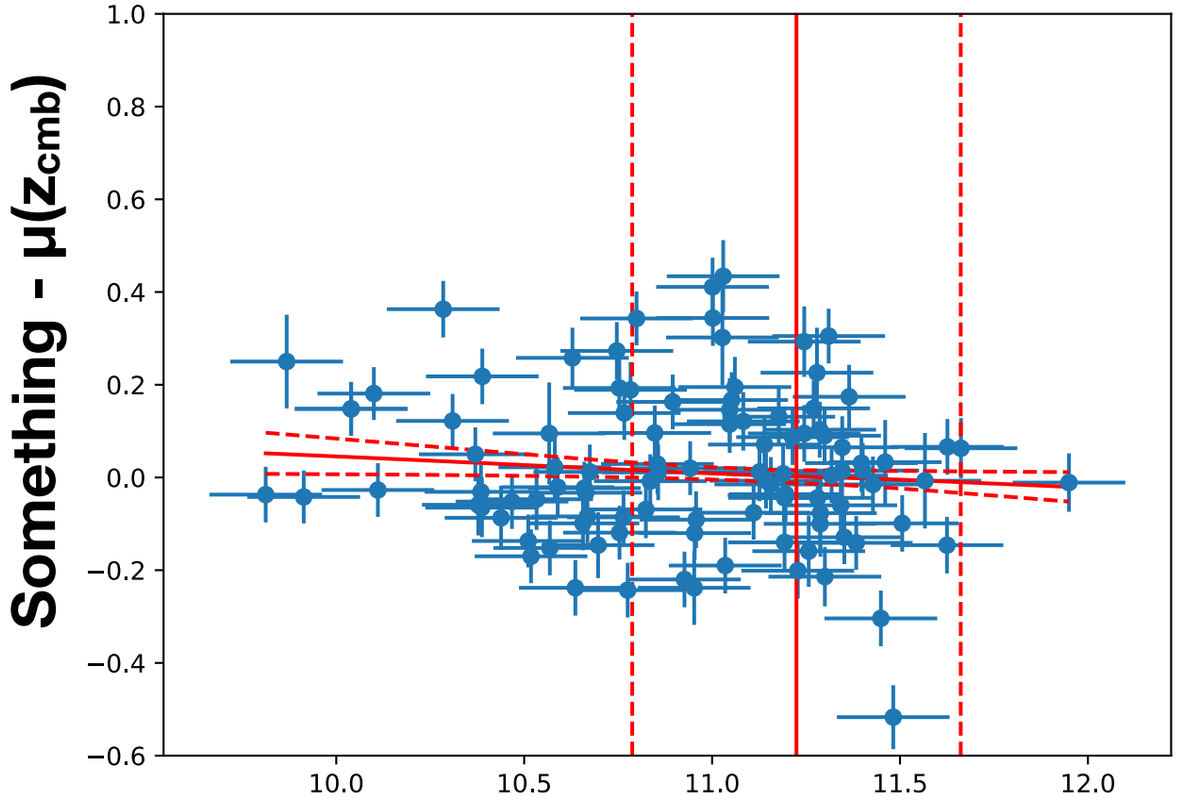
11.0
11.5
12.0



Kelly et al. (2010)