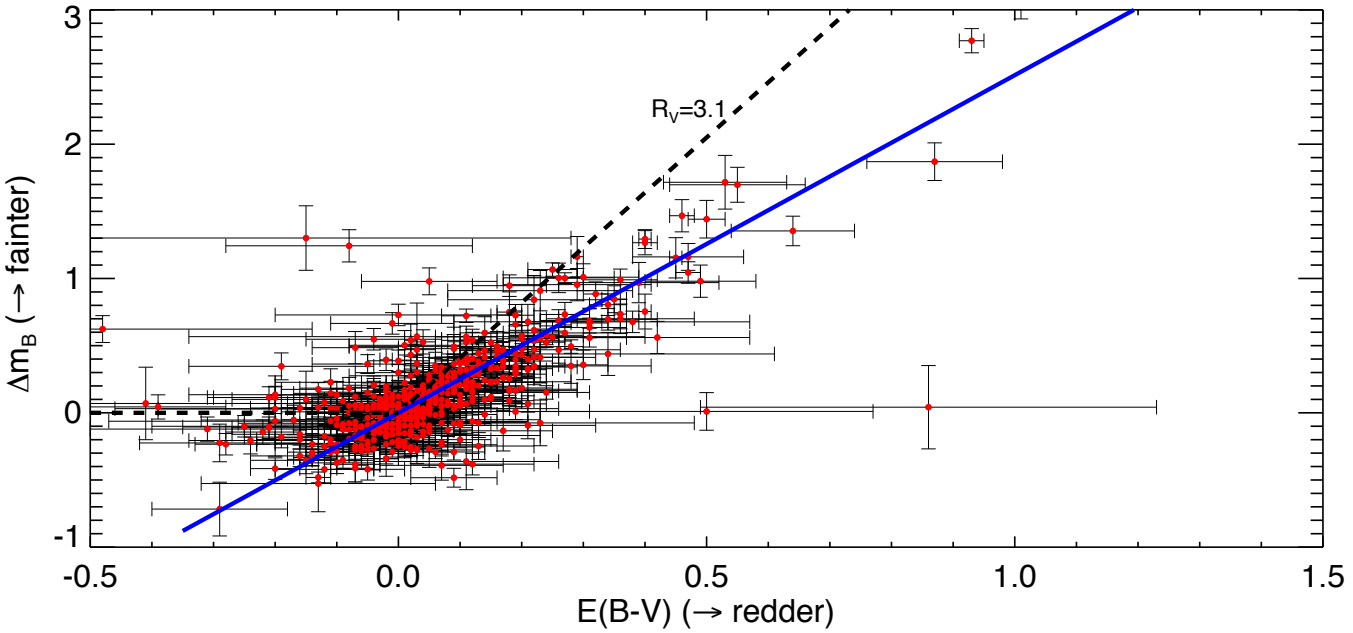
SN Ia reddening



Measure individual color laws

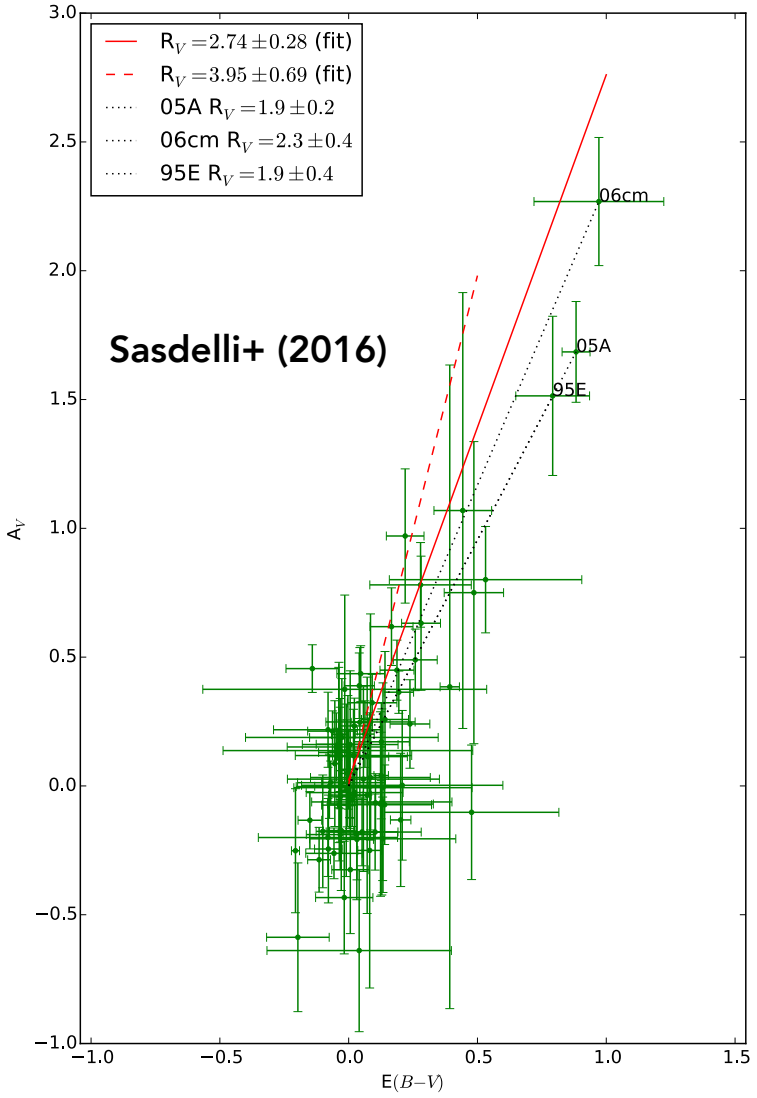
1. Intrinsic color variability with SN properties

2. Measure the extinction assuming known SN colors

Reddening and spectral features

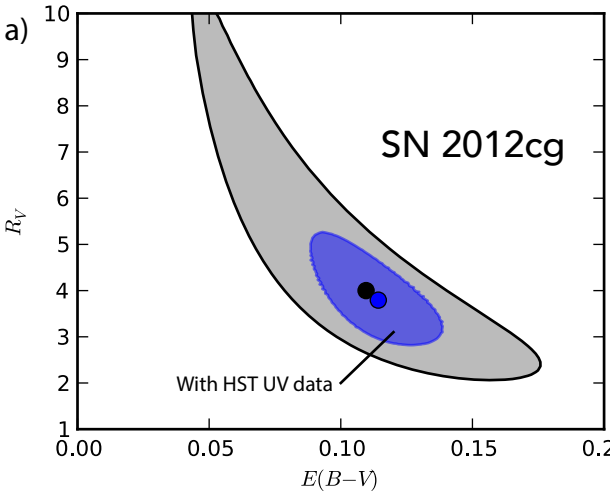
- Color law and ejecta velocity: HV intrinsically redder (Wang+ 2009, Foley+ 2011)
- Spectral features and intrinsic colors (e.g. Nordin+ 2011, Chotard+ 2011, Scolnic+ 2014)
- Similar spectra should have similar colors (Sasdelli+ 2016)

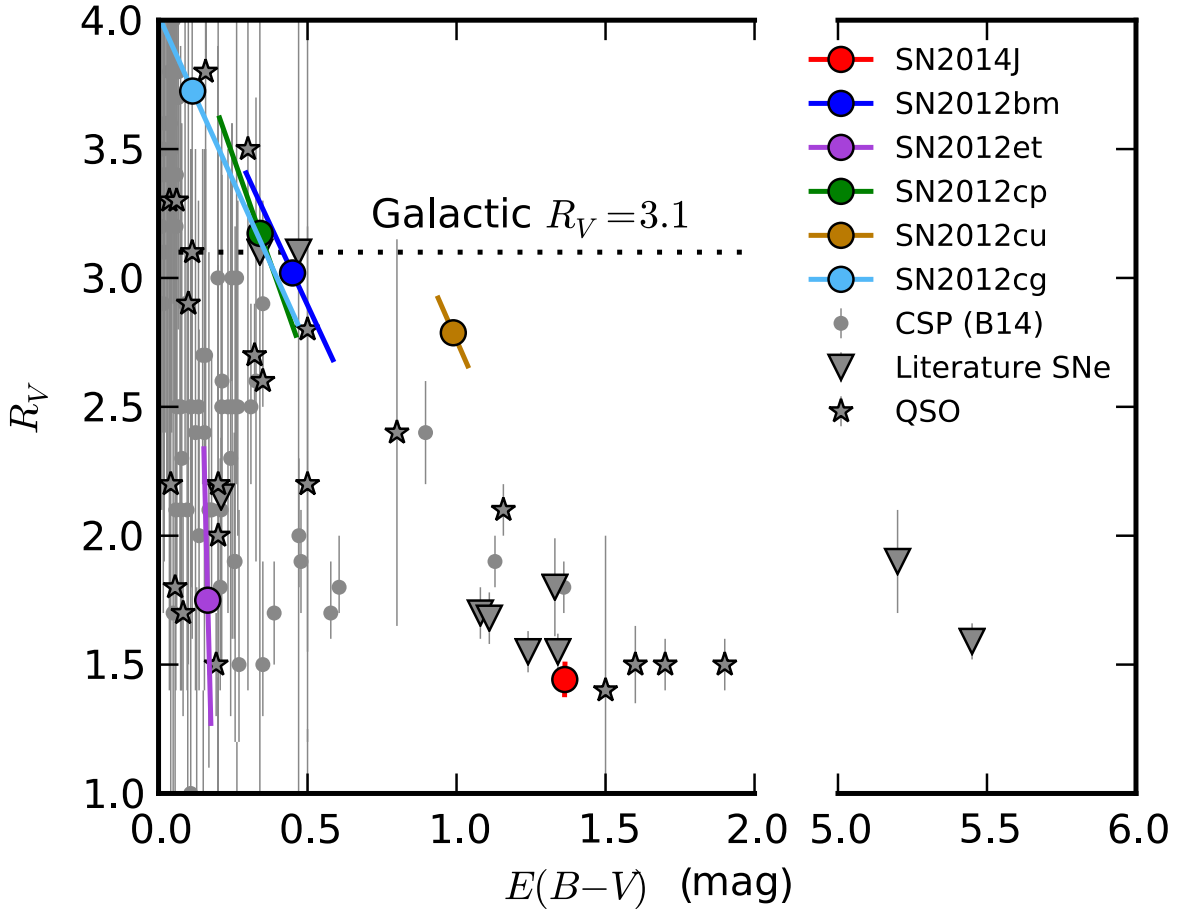
$R_V \sim 3$



Extinction law assuming known colors

- Extinction using NIR as anchor
- Low reddening sample (e.g. Folatelli+ 2010)
- Mandel+ (2014), Burns+ (2014): Redder SNe prefer low R_V
- UV data reduces the uncertainty on R_V with ~50% for $E(B\text{-}V)$~0.2





Is there a redder-lower RV effect?

Extinction from dust tracers

- High-resolution spectroscopy, ISM lines Ca II, Na I D, K I, DIBs
- Time-variability (e.g. Patat+ 2007, Sternberg+ 2014) and blueshift excess (Sternberg+ 2011, Maguire + 2013)
- DIB 5780Å best tracer of extinction (Phillips+ 2013)
- Get first epoch multi-epoch high resolution spectroscopy early