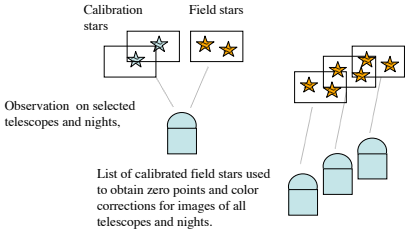
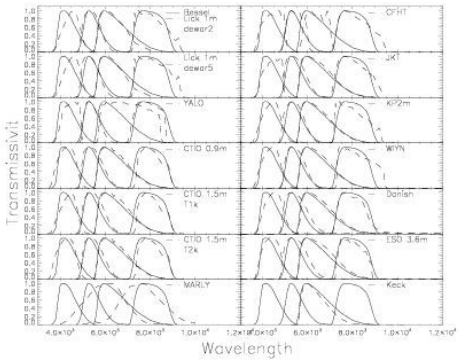
Systematics and more:
A set of nearby SNe Light Curves

Type Ia SNe represent the best distance indicators for cosmology, having established the presence of dark energy through measurement of the expansion history of the universe. While high-z SNe are used to study the change in the expansion rate, low-z SNe establish a baseline for brightness comparisons and provide the important calibration used for standardization. Besides the statistical gain in precision from a large number of SNe, a good understanding of their systematic variations is essential. We present the B, V, R, I lightcurves for a sample of nearby supernova, obtained by the Supernova Cosmology Project in collaboration with several other supernova groups. A unique challenge of this dataset is that seventeen different instruments were used to obtain the follow-up photometry. We focus on the analysis procedure developed for cross-calibrating the data from various instruments. In particular we discuss the results of transforming the observations from the different instruments into the common Johnson-Kron-Cousin band pass system.

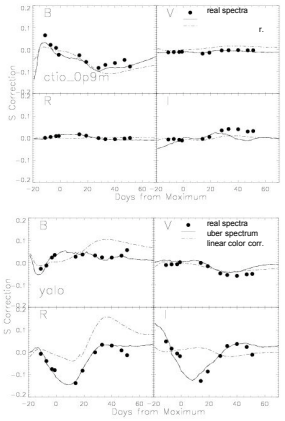


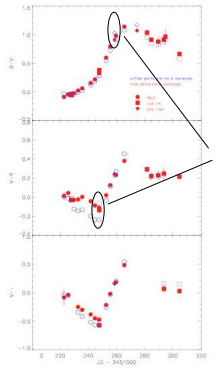


Pass bands are obtained by multiplying filter transmissivity, CCD QE, mirror reflectivity and atmospheric extinction for all instruments. Pass bands are adjusted to reproduce synthetic photometry of calibration stars.

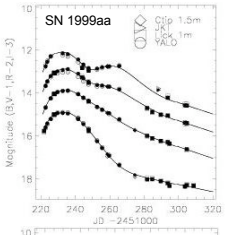
S-corrections: $\Delta S(t) = 2.5\log(\int [F_{inst} - F_{bessel}] \cdot SED(t) d\lambda)$

Corrections are calculated using real spectra as well as interpolated spectra (Uber spectrum). Example shown for SN 1999aa and CTIO 0.9 m and the YALO telescope.





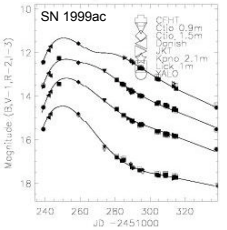
Example of correction effect: B-V,V-R and V-I color evolution of SN 1999aa. Filled symbols are S corrected, empty symbols are uncorrected.

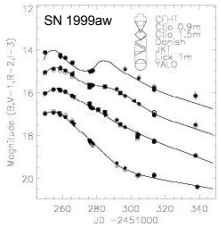


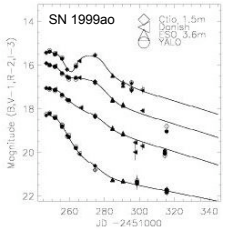
A few selected light curves in BVRI:

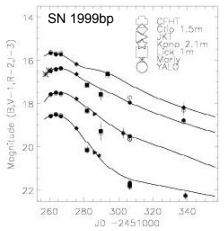
SN 1999aa, 1999ac, 1999ao, SN 1999aw, SN 1999bp.

- Line is result of fit.
- Filled circles are S-corrected
- Empty circles are uncorrected





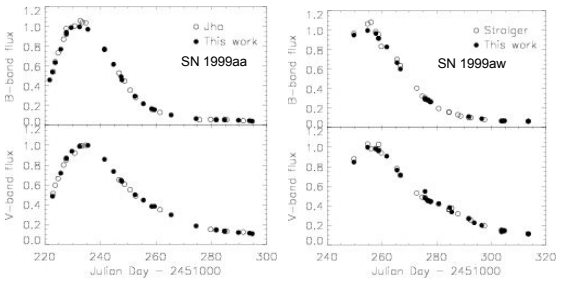




Comparison with previously published work

SN 1999aa:
Jha (PhD thesis, 2002)
different observations
different analysis

SN 1999aw:
Strolger et al (AJ, 2002).
mostly same observations
different analysis



- SNe observation performed using a network of different telescopes & instruments.
- Dedicated analysis to calibrate the instruments and correct for different responses.
- Detailed knowledge of filter and CCD response necessary for S corrections.
- S-corrections improves data consistency. Corrections depend significantly on band pass, red-shift and SN phase.
- Sub-sample of SNe have been observed & analyzed by other groups. Systematic difference of about 5 % observed around maximum. Most likely source is different (uncorrected) instrumental response. Similar uncertainties expected for most published SNe.

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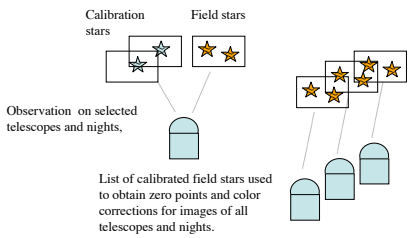

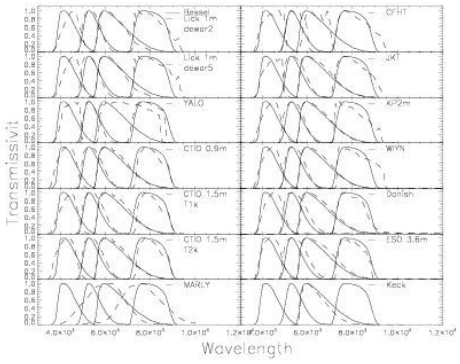

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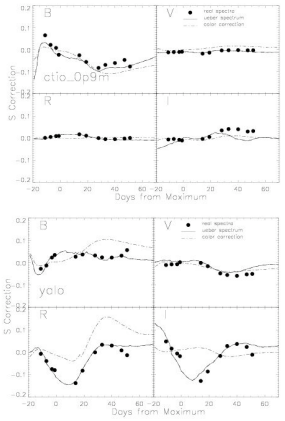

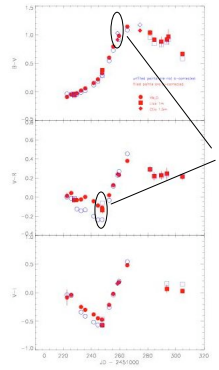

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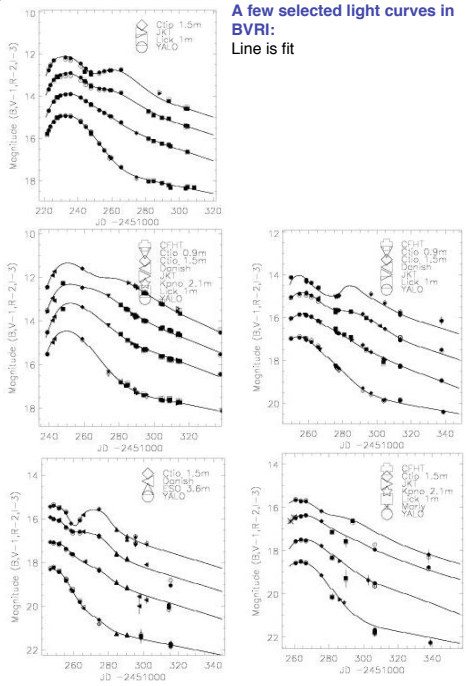

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Line is fit

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Different observations
Different analysis

SN !999aw:
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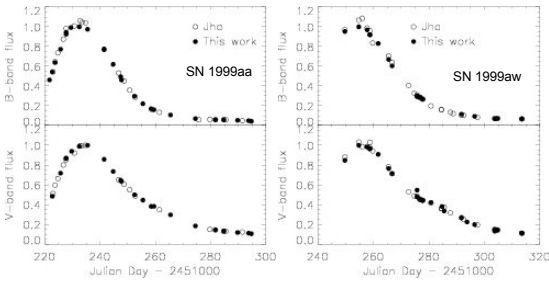
Mostly same observations
Different analysis



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