Analysis of the first supernova discovered beyond the redshift of one.

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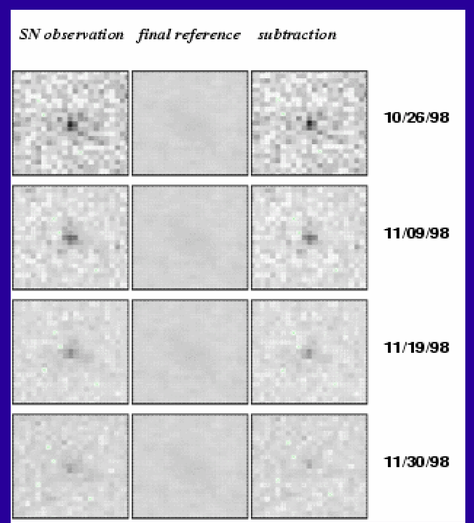
Ground-based data from Keck were analized with standard SCP aperture photometry on subtracted images.

We used PSF fitting with host galaxy modelling to extract the SN fluxes from HST data: WFPC2/F814W and NICMOS2/F110W.

The host galaxy shape was parameterized from the final reference, and then used in the PSF fit. The relative SN/galaxy position was derived from the fit to the WFPC2 data and used for NICMOS photometry. The galaxy flux in WFPC2 images was included as a fit parameter to avoid the CTE modelling for extended sources.

The HST co-added images and subtractions are shown below for illustraction.



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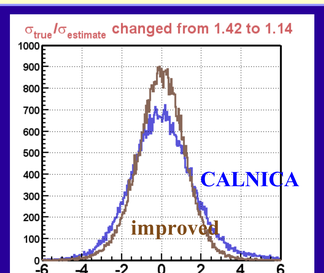
SN 1998eq at redshift 1.20 was discovered in a dedicated search with the Keck 10-m telescope, and followed with HST WFPC2 and NICMOS imaging. It was the first discovery with spectroscopic confirmation of a supernova which exploded far into the epoch of deceleration when the effects of a cosmological constant were negligible, and set the stage for subsequent supernova searches beyond redshift 1. We report on the photometry for SN 1998eq, which includes a treatment of the very significant host-galaxy contamination, and the resulting lightcurve fit. The SN colors indicate a low extinction, but the uncertainty calculation is complicated due to overlap of the HST and Keck I-band filters with the NICMOS J-band filter. We attempt to use the well-measured SN spectrum as an additional input to the the extinction measurement.

We assessed the following systematic uncertainties in the photometry.

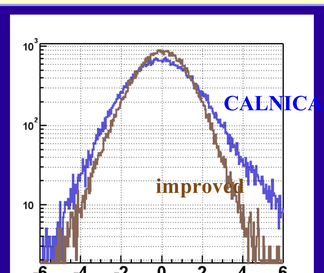
- ***WFPC2 images*:**
  - **Host galaxy modelling**
  - **PSF shape variation with epoch**
  - **CR rejection**
- ***NICMOS images*:**
  - **Relative SN/galaxy position**
  - **Host galaxy shape amplitude**
  - **Host galaxy shape modelling**
  - **PSF modelling**
  - **SAA rejection algorithm**
  - **CR rejection**
  - **Diffraction spike**
  - **Photometric scale accuracy**

NICMOS photometry used the count rate uncertainty derived from the pipeline. The following modifications were made to make the estimate reliable:

(1) Better CR rejection (joint fit to regions before/after CR jump)
(2) Accounting for CR inter-pixel correlations (edge neighbors)
(3) More precise error analysis (signal correlations for different readouts).

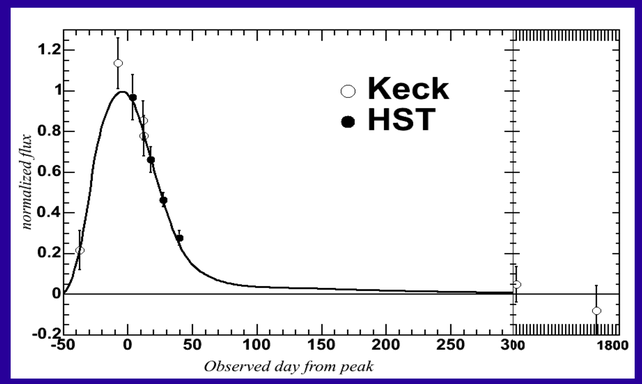


Count Rate pull distribution



Count Rate pull distribution

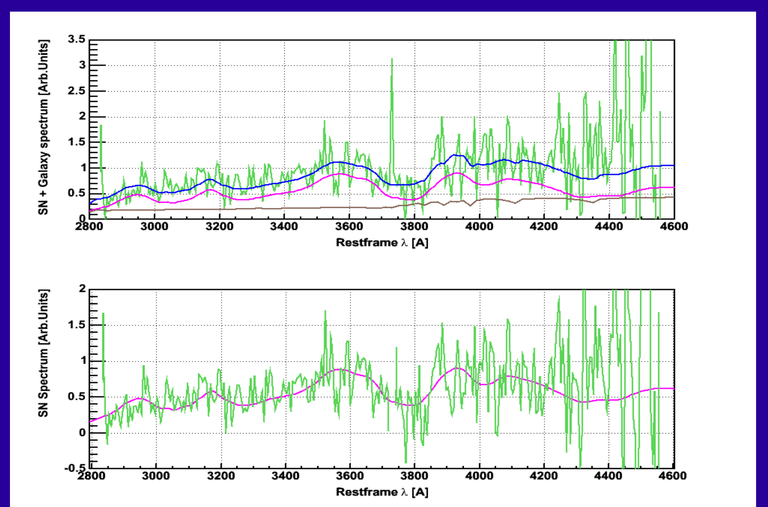
SN 1998eq lightcurve after color-correcting LRIS and WFPC2 data to the Bessel I-band.



Color comparison of the I-band lightcurve with F110W value results in extinction estimate of $E_{B-V} = 0.00 \pm 0.08$

We also fit the measured spectum to the extincted spectral model and a starburst galaxy spectrum, obtained from PEGASE simulations. This satisfies the observed SN and galaxy colors and EW(O_{II}).

After marginalizing over other fit parameters and the model simulation space, we obtain $E_{B-V} = -0.23^{+0.13}_{-0.11}$ **Combined with the color measurements, this results in the estimate of** $E_{B-V} = -0.03 \pm 0.09$



Spectral fit to the SN and host galaxy components (top), and the SN-only component after the galaxy shape subtraction (bottom).