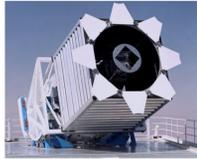


# Preliminary CCSN Rate from the SDSS-II Supernova Survey

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## DATA COLLECTION



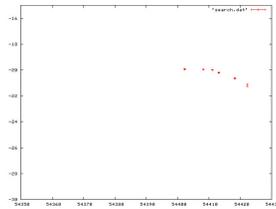
SDSS 2.5m primary telescope  
(Apache Point, New Mexico USA)

rolling photometric search  
surveys a 300 sq. degree stripe of sky  
entire stripe re-imaged every two days

Image subtraction reveals transient objects

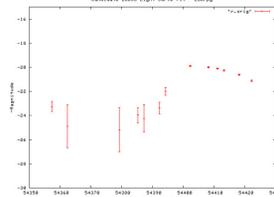


## PHOTOMETRY



Scene Modeling Photometry

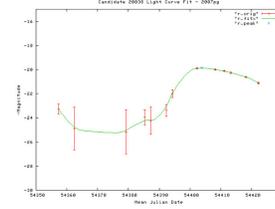
higher quality analysis  
computationally intensive  
concentrates on likely supernovae



Search Photometry

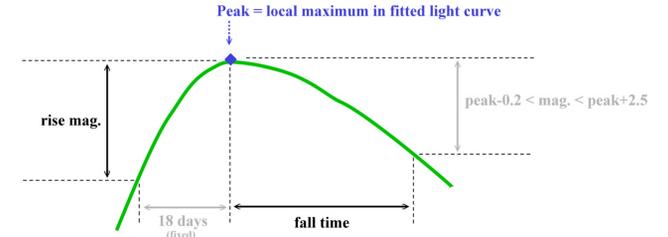
initial detection of candidates  
computationally inexpensive  
all transient objects processed

## SN PEAK DETECTION



Fit Light Curve to find SN Peak

SDSS r band only  
interpolate points to fill time gaps, with high error  
separate cubic polynomial fit at each time point  
data weighted by proximity to point of fit



Candidate Criteria:

- rise mag.  $\geq 0.85$
- fall time  $\geq 10$  days
- no other peaks within 15 days
- no peak within 1.0 mag. on entire light curve
- selection finalized by visual inspection

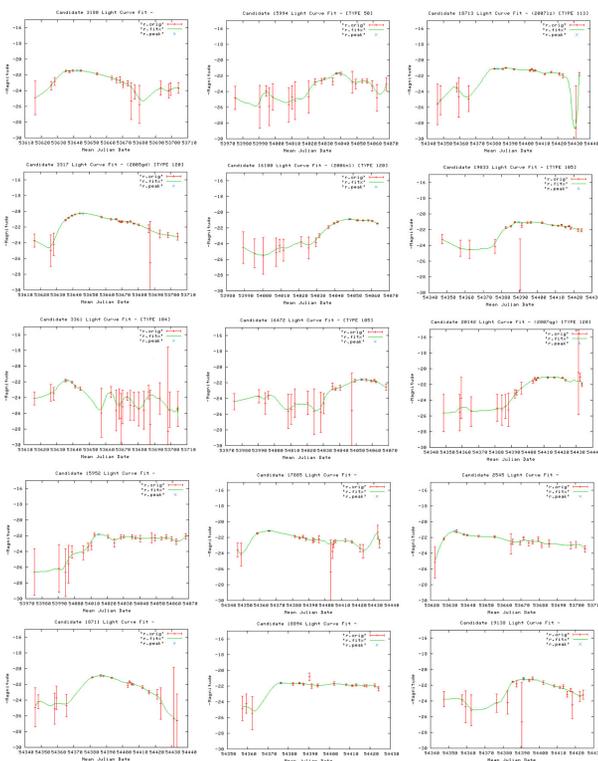
## SN RATE SAMPLE

136 confirmed SNIa  
178 probable SNIa  
18 confirmed CCSN  
258 unconfirmed

## CONVERTING ANGULAR RATE TO VOLUMETRIC RATE

a few examples ...

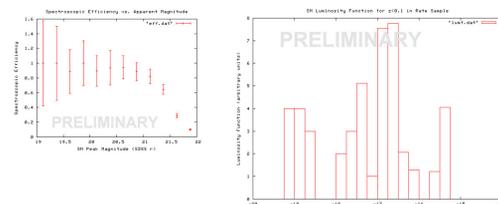
590 total SN candidates



$$\rho_{\text{SN}} = \left( \frac{5}{\ln 10} \right) \frac{\langle N(m) \times 10^{-0.6 m} \rangle}{\langle 10^{-0.6 M} \rangle \tau \Omega}$$

### Luminosity Factor

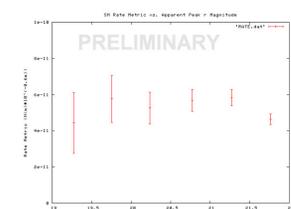
depends only on SN luminosity function (absolute mag.)  
extracted from subsample with known  $z < 0.1$   
weighted by spectroscopic efficiency



$$\langle 10^{-0.6 M} \rangle = 9.22 \pm 4.58 \pm 1.41 \times 10^{10}$$

### SN Rate Metric

depends only on angular rate, binned by apparent mag.  
averaged over mag. range with acceptable detection efficiency



### Survey Range

includes only time/RA range  
over which SNe are efficiently detected

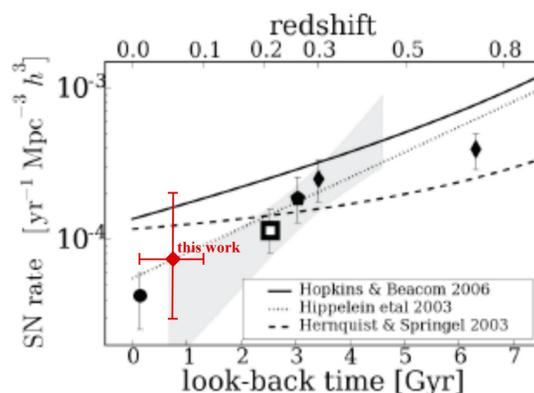
$$\tau = 0.460 \text{ yrs}$$

$$\Omega = 0.0305 \text{ sr}$$

$$\langle N(m) \times 10^{-0.6 m} \rangle = 5.63 \pm 1.85 \pm 0.23 \times 10^{-11}$$

## PREVIOUS CCSN RATE RESULTS

Figure from Botticella et al., astro-ph/0710.3763 (2007)



### Subtract SNIa Rate from Total SN Rate

$$\rho_{\text{SN}} = 0.947 \pm 0.564 \pm 0.039 \times 10^{-4} \frac{h^3}{\text{Mpc}^3 \text{ yr}}$$

$$- \rho_{\text{SNIa}} = 0.293 \pm 0.017 \pm 0.090 \pm 0.004 \pm 0.071 \times 10^{-4} \frac{h^3}{\text{Mpc}^3 \text{ yr}}$$

(Dilday et al., ApJ 682, 262 (2008))

$$\rho_{\text{CC}} = 0.654 \pm 0.564 \pm 0.098 \times 10^{-4} \frac{h^3}{\text{Mpc}^3 \text{ yr}}$$

## FUTURE WORK

- ◆ More precise luminosity factor from other SN surveys
- ◆ Scene Modeling Photometry completes processing on all data
- ◆ Verify light curve fit method using SDSS SN simulator