The Supernova Legacy Survey

Mark Sullivan
University of Toronto

http://legacy.astro.utoronto.ca/
http://cfht.hawaii.edu/SNLS/
French Group
Reynald Pain, Pierre Astier, Julien Guy, Nicolas Regnault, Jim Rich, Stephane Basa, Dominique Fouchez

UK
Gemini PI: Isobel Hook
Richard McMahon

USA
LBL: Saul Perlmutter
CIT: Don Neill

Victoria Group
Chris Pritchet, Dave Balam

Toronto Group
Ray Carlberg, Mark Sullivan, Andy Howell, Kathy Perrett, Alex Conley

Full list of students and associates at: http://cfht.hawaii.edu/SNLS/
CFHT Legacy Survey (2003-2008)

- 5 year survey, goal: 500 distant SNe Ia to measure “w”
- Uses CFHT/“Megacam”
- 36 CCDs, good blue response
- 4 filters for good k-corrections and color measurement

Megapprime
### CFHT-LS Organisation

**CFHT-LS (imaging) – 2003-2008**

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### SNLS collaboration

- Data-processing
- Major Spectroscopic Program
  - Gemini (Canada/UK/USA)
    - 120 hrs/yr (60:40:20)
  - VLT (France/Other Euros)
    - 120 hrs/yr
  - Keck (through LBL)
    - 40 hrs/yr
- Cosmological analyses

### Magellan near-IR study (Freedman et al.)
- Rest-frame I-band Hubble diagram

### Keck SN Ia UV study (Ellis/Sullivan et al.)
- LRIS high-S/N - metallicity through UV lines
- Testing accuracy of k-corrections in the UV

### SN IIP study (Nugent/Sullivan/Ellis et al.)
- Using SNe IIP as standard candles
- Independent Hubble diagram to z=0.5
\[ \Omega_M = 0.263 \pm 0.042 \text{ (stat)} \pm 0.032 \text{ (sys)} \]

\[ <w> = -1.02 \pm 0.09 \text{ (stat)} \pm 0.054 \text{ (sys)} \]

Astier et al. 2006
Third year" SNLS
Hubble Diagram
(preliminary)

Best-fit for SNLS+flatness

$\Omega_{M} = 0.26^{+0.03}_{-0.03}$

$\Omega_{M}=0.3, \Omega_{\Lambda}=0$

$\Omega_{M}=1.0, \Omega_{\Lambda}=0$

Sullivan et al. 2007
Cosmological Constraints (Preliminary)

SNLS + BAO (No flatness)

SNLS + BAO + simple WMAP + Flat

7% measure of $w$
SNLS Vital Statistics

**Duration/Area/Number of SNe Ia**
- 5 Years (2003-2008), ~500 confirmed, ~1000 all z photo-typed
- 4 sq degrees; 10 “sq. deg. years”

**Redshift and Filter coverage**
- 0.08<z<1.06 (0.2<z<0.9): 50% @ z=0.85
- g’r’i’z’: 4 filters are essential over 0.2<z<1.0
Redshift distribution

- Survey running for 3.5 years
- >2000 likely SN detections
- ~310 confirmed distant SNe Ia (+ 40-50 not yet processed)
  - 500 spectroscopically confirmed SNe Ia by survey end
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- $0.08 < z < 1.06$ (0.2 < z < 0.9): 50% @ z = 0.85
- g’r’i’z’: 4 filters are essential over 0.2 < z < 1.0

Cadence
- Queue Scheduled: 3-4 days during 14-18 days/month (5 epochs/month)
- “Cadence within a night”: 15 images over two hours
Cadence: “Rolling” light-curves
SNLS Vital Statistics

Duration/Area/Number of SNe Ia
- 5 Years (2003-2008), ~ 500 confirmed, ~ 1000 all z photo-typed
- 4 sq degree fields; 6 months/yr/field; 10 “sq. deg. years”

Redshift and Filter coverage
- $0.08 < z < 1.06$ (0.2$< z < 0.9$): 50% @ $z = 0.85$ (2.6$x10^3$ Gpc$^3$ per field)
- g’r’i’z’: 4 filters are essential over $0.2 < z < 1.0$

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Seeing
- Median 0.65” in i’; regularly 0.6” or better
Seeing – detection filter (i’)

![Graph showing seeing distribution for detection filter (i')]
Seeing

- $g'$: 0.79
- $r'$: 0.71
- $i'$: 0.66
- $z'$: 0.65
Seeing versus S/N

PSF photometry of $i=20-22$ stars

S/N strongly depends on seeing (almost a linear relation)

Seeing also affects quality of PSF-matching

If seeing degrades by 50%, exposure times must be doubled to reach the same S/N

CFHT spent considerable resources on optimising megacam image quality
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Depth for SNe (AB):
- Can’t take 5-σ point source limiting mag and claim this as the depth
- Detection depth (RTA) SNe Ia: 50% @ i=24.3 (peak) ~ z=1.05
  (Spectroscopic depth: i=24.0, 30% increase over host)
- Core collapse SNe: z=0.4-0.5
- (Point source depth: 5-σ ➔ i=25.0)
Perrett et al. 2007

Simulations based on realistic SN populations (including A+B) and RTA software

Redshift

Magnitude
SNLS Vital Statistics

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