The Amazing SN 1999as

Peter Nugent (LBNL)
Spring 1999 Search

Objectives:
- More well observed supernovae - discovered in an unbiased way
- All supernovae caught before peak brightness
- Excellent follow-up both spectroscopically and photometrically

Results:
- Over 40 supernovae discovered
- 20 Type Ia supernova which met the stated criteria
- Manpower - 10+ FTE's for 3 months
- Computing - 8 Sparc Stations and 32 nodes on a Linux Cluster
- 3 of us worked 18+ hour days to keep the data flow going and follow-up on schedule and on target

(only 2 casualties..)

Peter Nugent

KITP: Supernovae and GRBs
# Sky Coverage

## Nearby Supernova Campaign: Survey Parameters

<table>
<thead>
<tr>
<th>Search</th>
<th>Type</th>
<th>Aper (m)</th>
<th>FOV (deg$^{-2}$)</th>
<th>Scale (&quot;/pixel)</th>
<th>Exp (sec)</th>
<th>Time (hrs)</th>
<th>Filter</th>
<th>Coverage (deg$^2$)</th>
<th>Ia</th>
<th>II</th>
<th>Ic</th>
<th>Untyped (faint)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EROS</td>
<td>Staring</td>
<td>1.0</td>
<td>1.00</td>
<td>0.60</td>
<td>300</td>
<td>125</td>
<td>B &amp; R</td>
<td>~450</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>MOSAIC/CTIO</td>
<td>Staring</td>
<td>0.9</td>
<td>1.00</td>
<td>0.43</td>
<td>240</td>
<td>48</td>
<td>R</td>
<td>~175</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>NEAT</td>
<td>Staring</td>
<td>1.0</td>
<td>2.54</td>
<td>1.40</td>
<td>60</td>
<td>15</td>
<td>open</td>
<td>~425</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Spacewatch</td>
<td>Drift Scan</td>
<td>0.9</td>
<td>0.57×t</td>
<td>1.05</td>
<td>430</td>
<td>140</td>
<td>OG515</td>
<td>~150</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>QUEST</td>
<td>Drift Scan</td>
<td>1.0</td>
<td>2.30×t</td>
<td>1.00</td>
<td>550</td>
<td>4</td>
<td>V</td>
<td>~140</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other Searches</td>
<td>IAUC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>~1340</td>
<td>29</td>
<td>8</td>
<td>1</td>
<td>14</td>
</tr>
</tbody>
</table>
Follow-up

Photometry:
- Lick 1-m
- YALO 1-m
- CTIO 0.9-m, 1.5-m
- Danish 1.5-m
- and all the search facilities

Spectroscopy:
- Lick 3-m
- KPNO 4-m, 2.1-m
- CTIO 4-m, 1.5-m
- ES0 3.6-m
**Discovery**

**Date:** Feb 18.43

**Magnitude:** R~17.5

**Host:** zip

---

```
Date: Feb 18.43
Magnitude: R~17.5
Host: zip
```

---

```
File: neat_99feb18_53
Scanner: gerson
Subtractions: 3
Host: -5
Shape: 5
Position: 0
Motion: 5
Overall: 3
```

```
"Spontaneous Creation" I cannot explain it away.
```

---

```
1999-02-28 13:19:15.00
```

---

Peter Nugent

KITP: Supernovae and GRBs
Mar 6.4 was the first spectrum.

MDM
First Interesting Spectrum

Mar 16.4 was the first good spectrum.
Clearly a Ib/c but with some very interesting narrow features.

Redshift 
z=0.127
M_V=-21.2
Comparison Spectra
Spectral Evolution
A detached shell is the only way to explain the narrow lines.
Spectral Fits

Fe II
Ti II
Lightcurve
Bolometric LC

![Bolometric Light Curve (LC) Graph]

- The graph shows the bolometric light curve over time (days).
- The x-axis represents time in days, ranging from 0 to 70.
- The y-axis represents the bolometric magnitude ($M_{bol}$), ranging from -22 to -18.
- The data points are marked with error bars indicating uncertainty.

Peter Nugent  KITP: Supernovae and GRBs  13
Possible GRB....

<table>
<thead>
<tr>
<th>Name</th>
<th>TJD</th>
<th>Peak Flux</th>
<th>RA</th>
<th>Dec</th>
<th>sig(deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11182g</td>
<td>85552</td>
<td>0.236</td>
<td>131.7</td>
<td>3.5</td>
<td>30.9</td>
</tr>
</tbody>
</table>
Models

![Graph showing models for GRB 11182g](image)
Host Spectrum

Preliminary measurement of the host has the metallicity at < 1/3 solar.
Other SNe like this?

SN 2001bb was caught < 5 days after explosion.
No event like SN 1999as has been found in over ~200 SCP high-z supernovae, ~200 SNLS Supernovae, or during the first year (159 supernovae) for the SN Factory.

Even though the effective volume for finding these objects and the length of its lightcurve make it much more easy to discover.

It is a very rare event.....