

Searching for Supernovae

Berto Monard
Bronberg Observatory
CBA Pretoria



November
2002

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Overview

- Introduction: what are supernovae (SNe)?
- Types of SNe
- Types of galaxies
- Galaxy parameters
- Target Programs for a SN search
- Sources of information
- CCD Images of SNe



What are supernovae?

Immense explosions

Extreme implosions

Cataclysmic endings

Enormous amounts of energy released

Outshine the home galaxy



Types of Supernovae

- Type II:

Progenitor: heavy (single) star ($> 8 M_{\odot}$)

Location: in spiral arms / star formation regions /
OB associations

Very energetic SN / neutrinos

End product: neutron star, black hole



Types of Supernovae

- Type Ia:

Progenitor: accreting white dwarf ($> 1 M_{\odot}$)

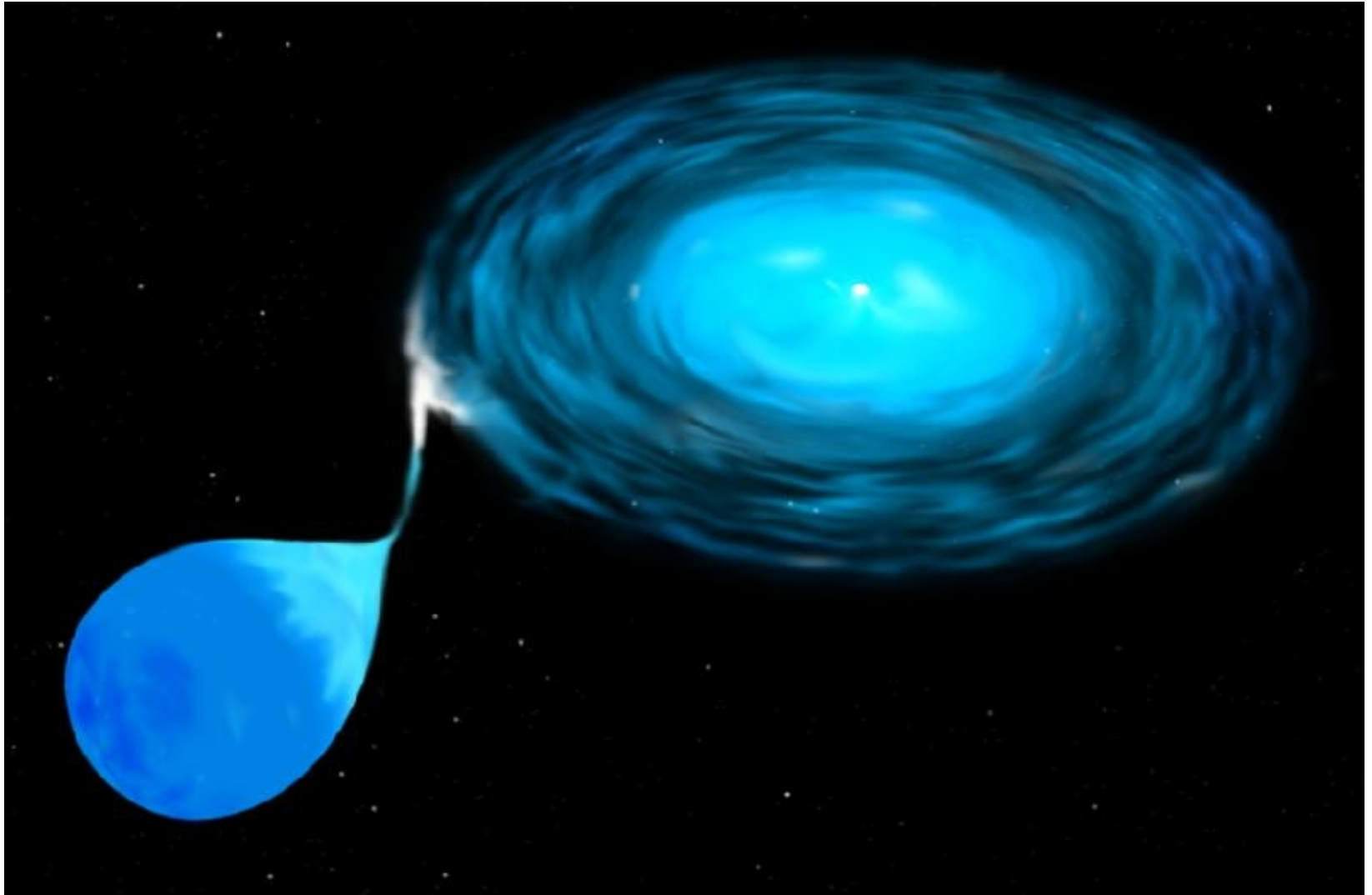
Location: old star regions

in bulge

outside the spiral arms



Cataclysmic System



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Types of Supernovae

Type Ia cont':

Less energetic SN than type II, but more visible light

SN starting conditions more or less identical

Best standard candles in the universe

End result: nothing ?



Types of Galaxies

Supernovae occur in all types of galaxies

Late spiral galaxies are the most prolific producers



Galaxy Parameters

General parameters:

Coordinates (RA, DE)

Apparent size (arcmin)

Galaxy brightness (V or B)

Inclination (from face-on to side-on)

Parameter affecting the SN brightness:

Distance (Mpc) or recession speed (km/s)



SN brightness calculation

Empirical...

$$M_V (\text{type II}) = 13.3 + 2.5 \log (d/10)^2$$

$$M_V (\text{type Ia}) = M_V (\text{type II}) - 1.9$$

With d in Mpc (1 Mpc = 3.26 lightyear)



Galaxy Parameters

Parameters affecting the SN production:

Absolute luminosity of the galaxy:

expressed in solar luminosities ($L_{\odot}$)

Morphological type of the galaxy:

middle to late type spirals and
irregulars are most productive



Typical SN rates

Galaxy Type	No of SNe Type Ia / $10^{10} L_{\odot}$ / 100yr	No of SNe Type II / $10^{10} L_{\odot}$ / 100yr
E	0.15	-
L / S0	0.2	-
Sa	0.2	0.3
Sb	0.22	0.7
Sc	0.22	1.1
Sd	0.22	0.9
Sm	0.22	0.8
Irr	0.4	0.9



Table of target galaxies

		Name	R.A.- Decl.	Type	length/incl	magn.	Recess.	Dist.	Size	Type Ia	Type II,...
		NGC,IC,ESC	Simb.2000		/ degr	B	km / s	Mpc	10 ¹⁰	SNR / cen	SNR / cent
2	*	NGC 0922	022505-2447	SBcd	1.8 / 25	12.4	3060	40	3.5	0.8/14.3	3.5/16.3
4		NGC 1762	050337+0134	Sc	1.1 / 40	13.3	4633	75	5	1.1/15.7	5.5/17.7
2	*	NGC 2642	084044-0407	SBbc	1.7 / 0	13.3	4406	50	3	0.7/14.8	2.7/16.8
2		ESO 373-5	093054-3541	Sc	2.0 / 5			40	2	0.4/14.3	2.2/16.3
2	*	NGC 3464	105441-2104	SBc	2.2 / 50	12.8	3800	50	3.5	0.8/14.9	3.8/16.9
2	*	NGC 5468	140635-0527	Scd	2.7 / 00	12.6	2830	38	4.3*	0.9/14.2	4.3/16.2



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Information on www

- Galaxy catalogues: (via Vizier)

<http://adc.gsfc.nasa.gov/viz-bin/VizieR>

RC3 (de Vaucouleurs 1991)

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- SN websites:

<http://cfa-www.harvard.edu/cfa/ps/lists/RecentSupernovae.html>

<http://www.rochesterastronomy.org/snimages/>



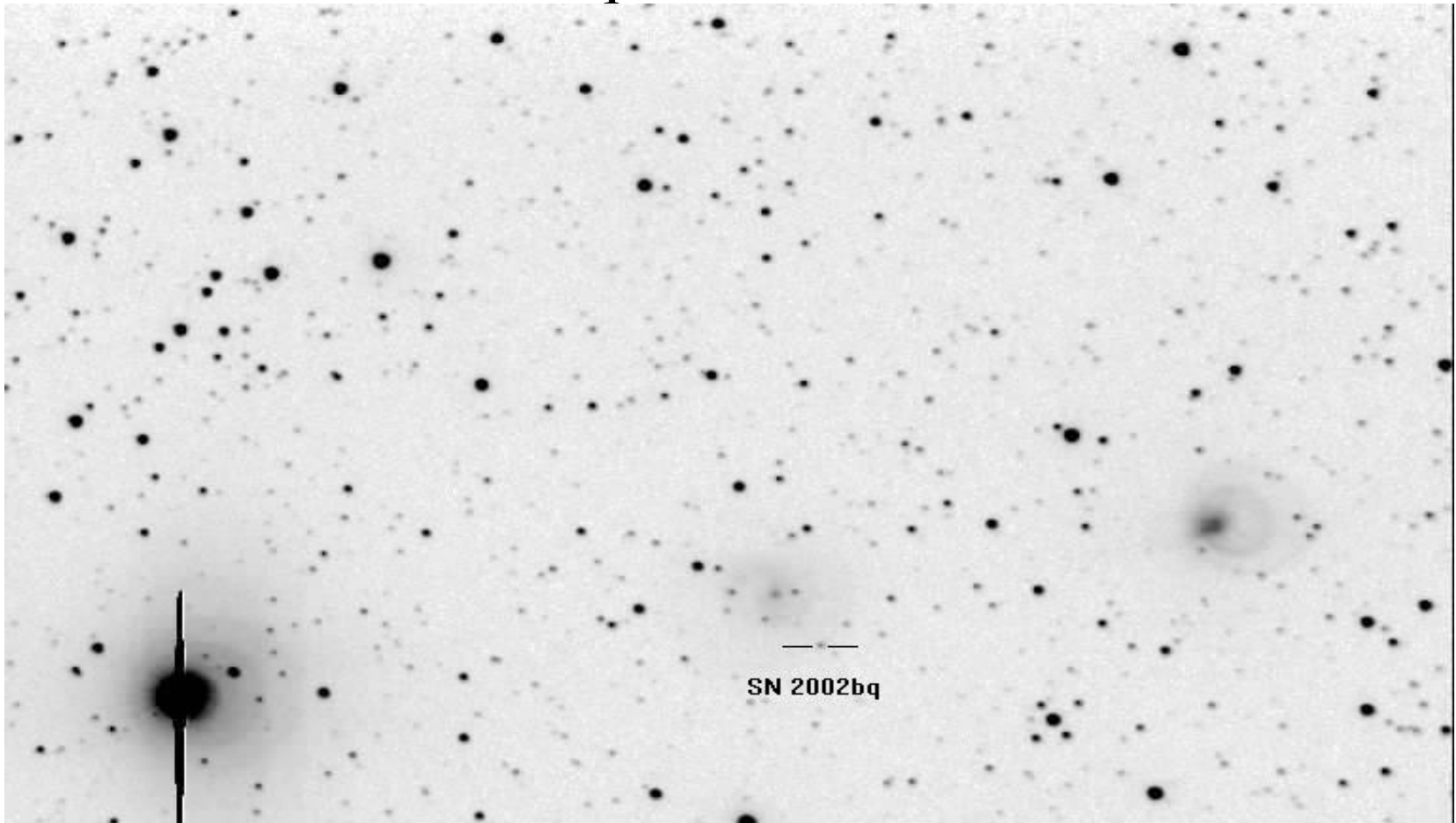
SN 2001el in NGC 1448



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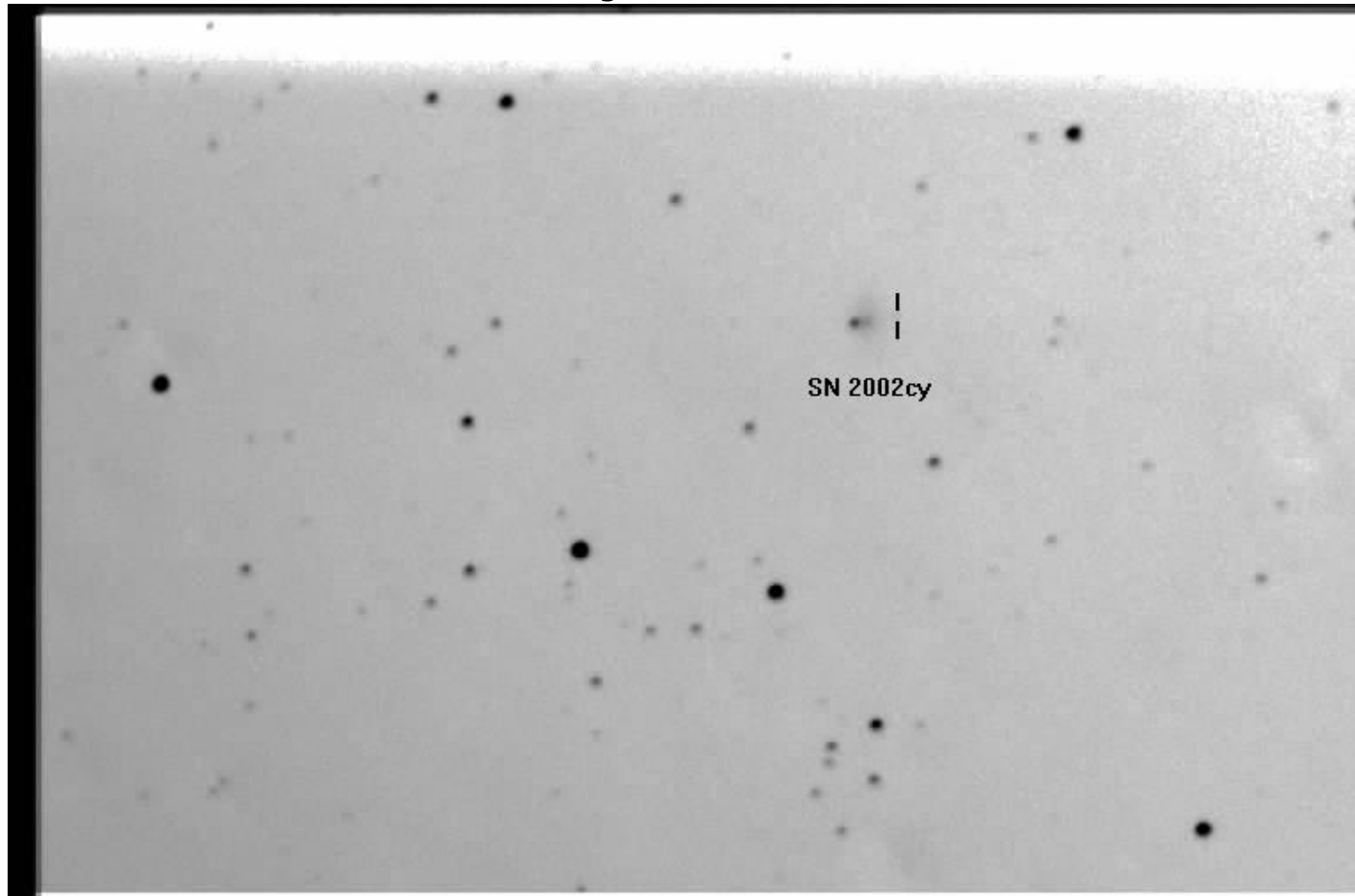
SN 2002bq in ESO 373-G005



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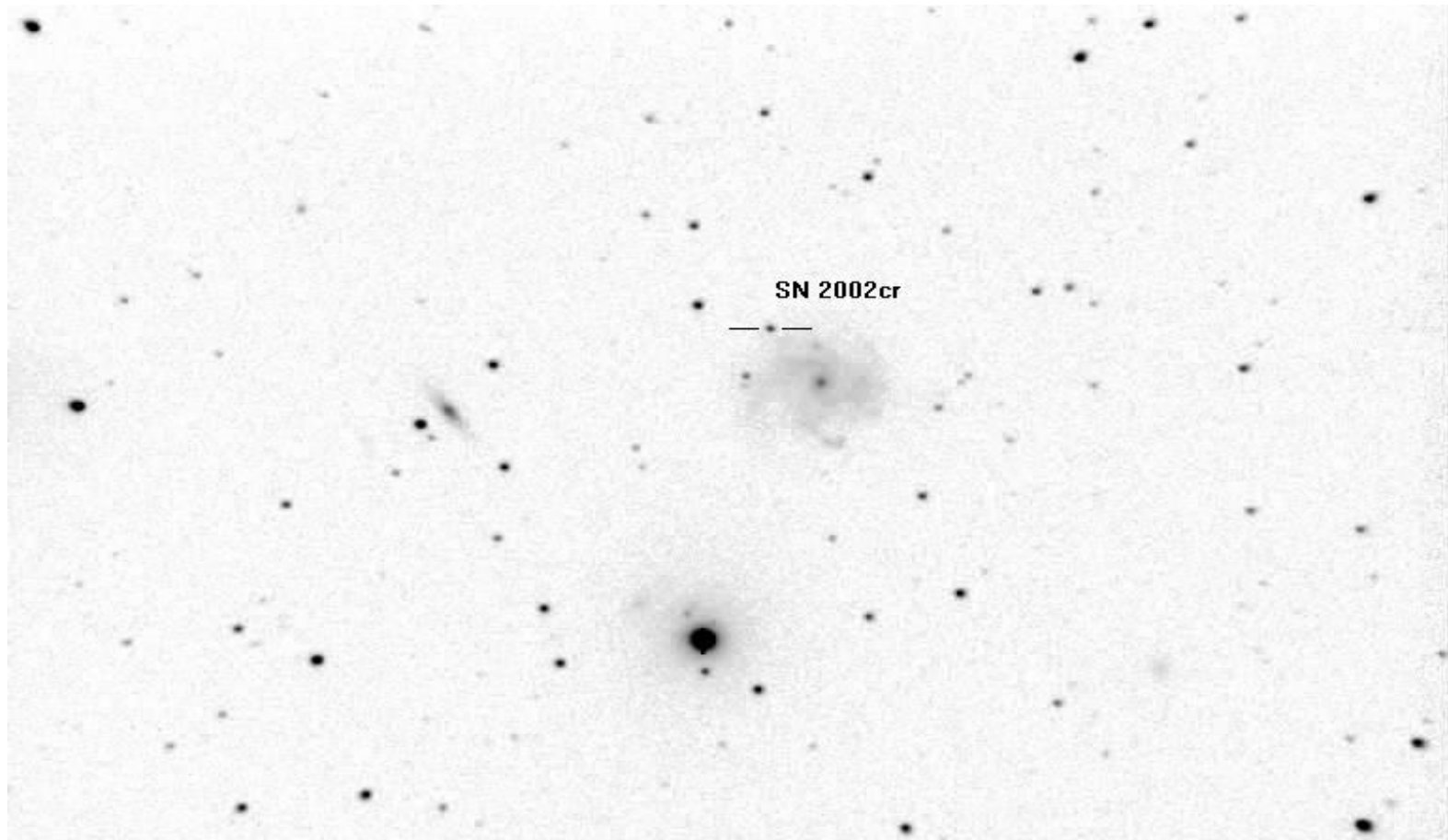
SN 2002cy in NGC 1762



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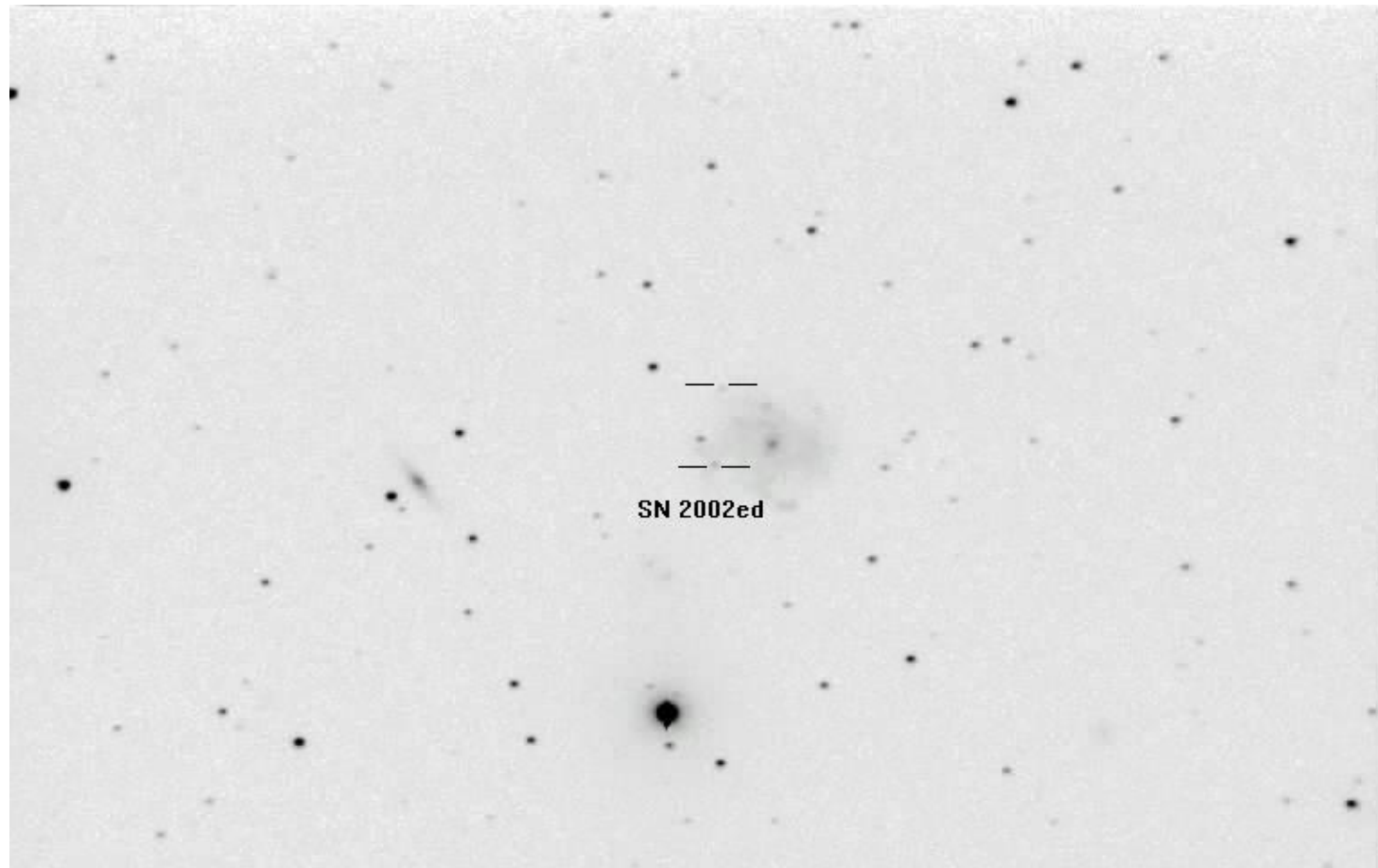
SN 2002cr in NGC 5468



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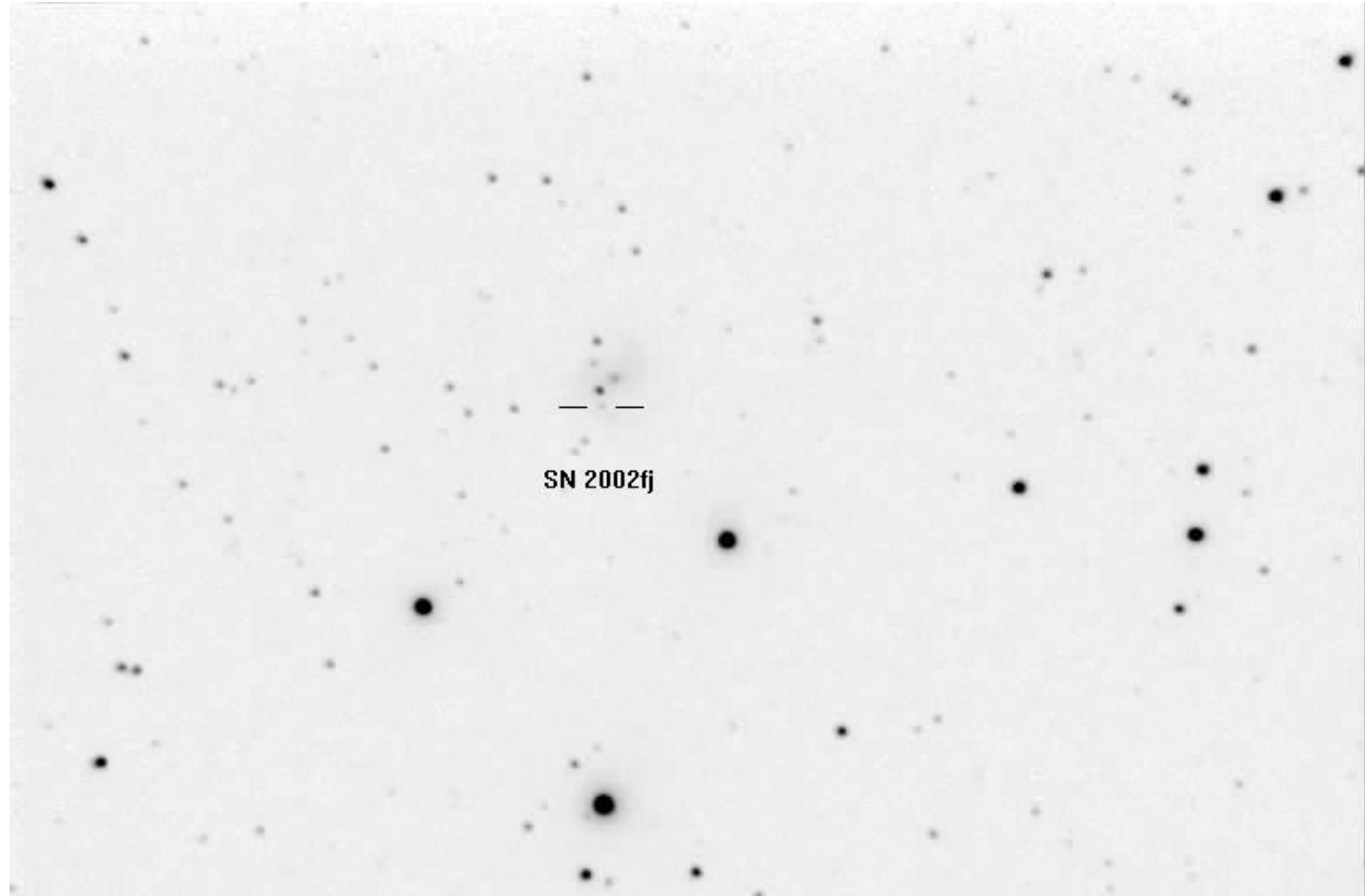
SN 2002ed in NGC 5468



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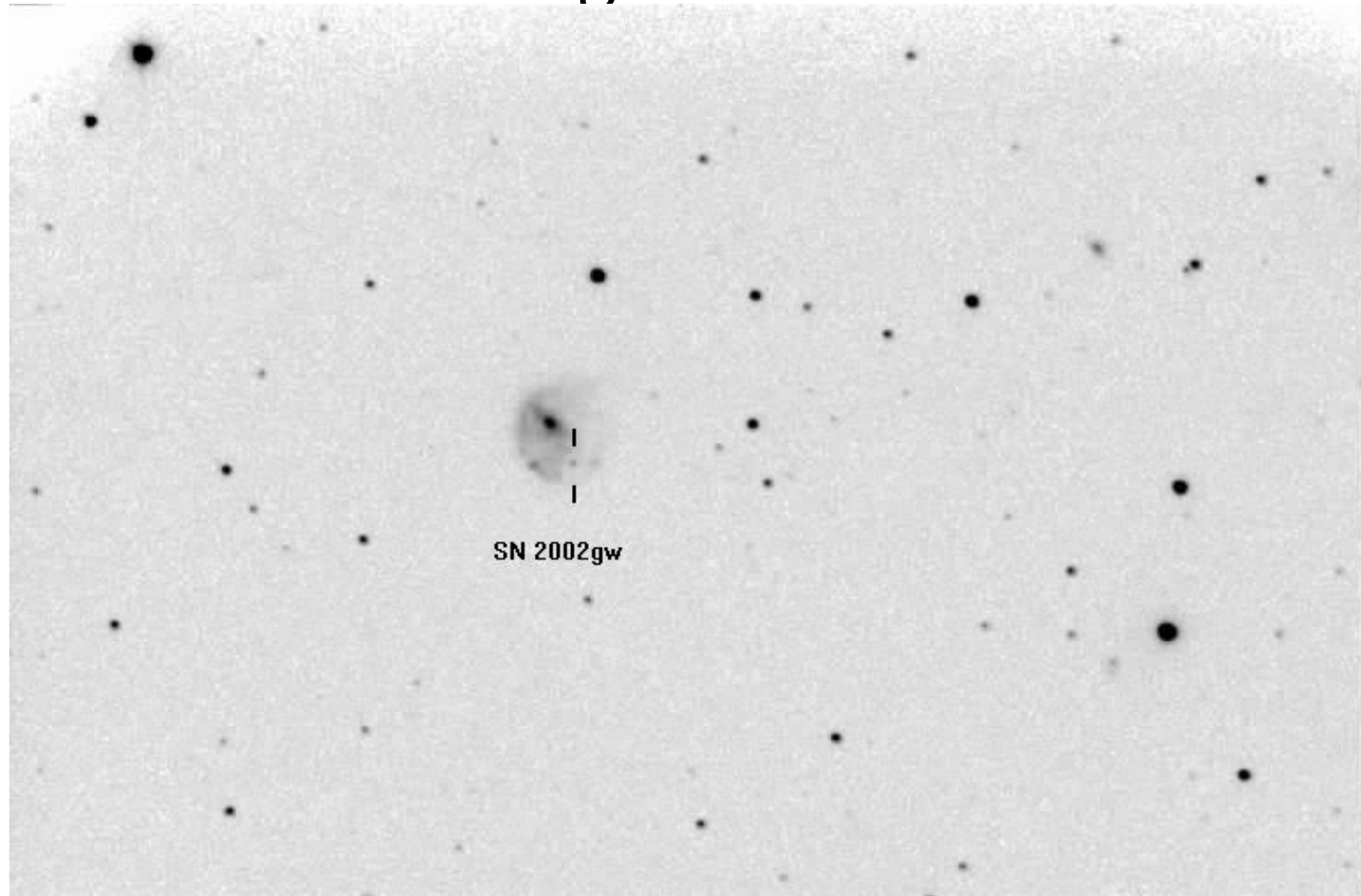
SN 2002fj in NGC 2642



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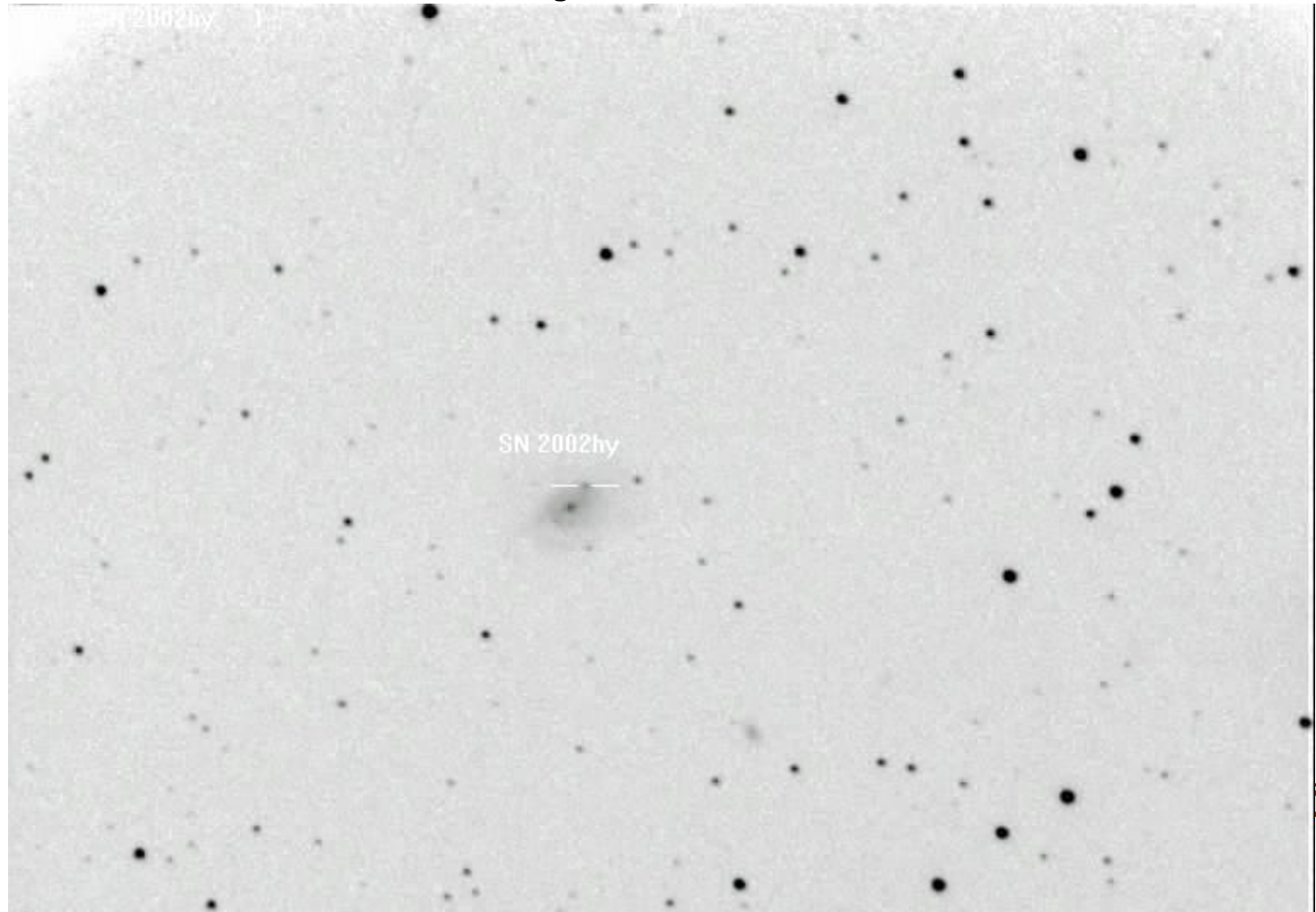
SN 2002gw in NGC 922



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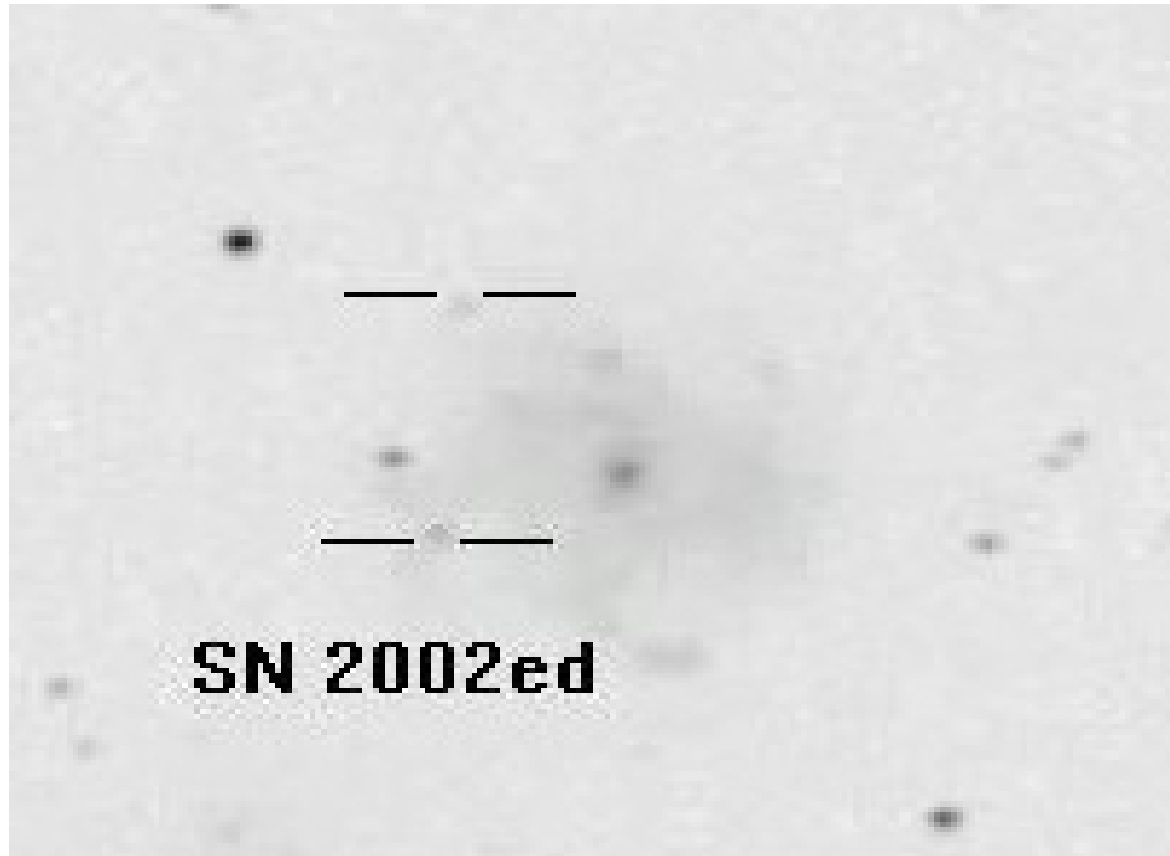
SN 2002hy in NGC 3464



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SN 2002ed in NGC 5468



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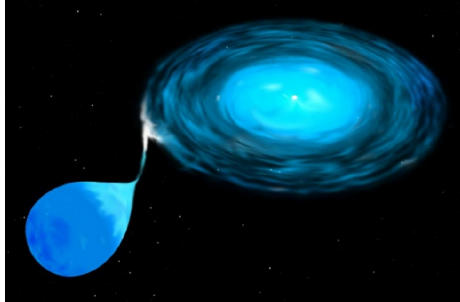
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Cataclysmic System



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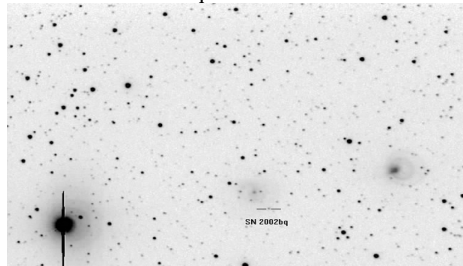


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SN 2002bq in ESO 373-G005

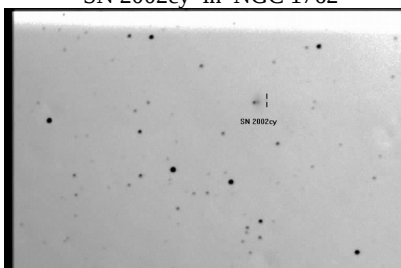


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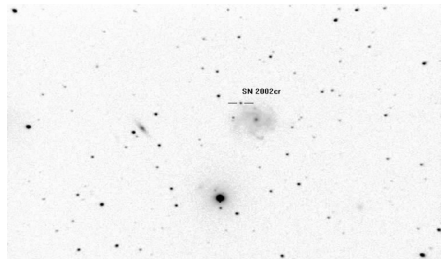


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SN 2002cr in NGC 5468

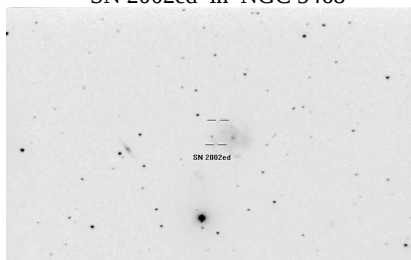


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SN 2002ed in NGC 5468

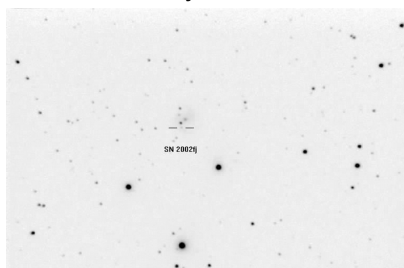


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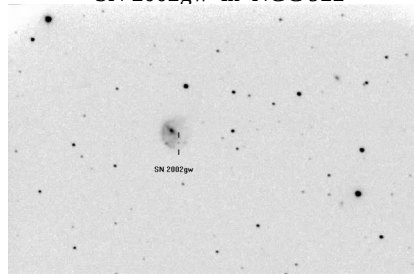


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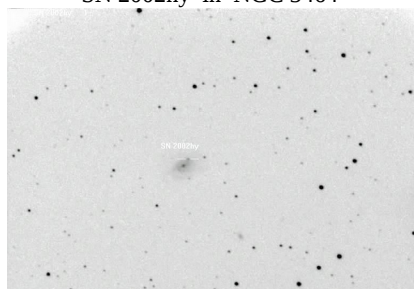


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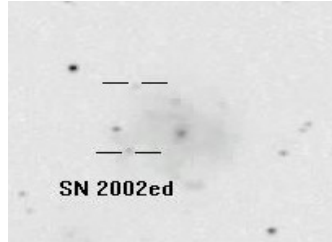


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