ASTRONOMY & ASTROPHYSICS
SUPPLEMENT SERIES

Astron. Astrophys. Suppl. Ser. **61**, 365-373 (1985)

Photoelectric *UBV* colours of supernovae

P. F. Younger and S. van den Bergh

Dominion Astrophysical Observatory, Herzberg Institute of Astrophysics,
5071 West Saanich Road, Victoria, B.C. Canada V8X 4M6

Received February 4, accepted March 22, 1985

Summary. — A catalogue is given of published photoelectric *UBV* photometry of supernovae. These data are used to study the light curves and intrinsic colours of supernovae as a function of supernova type and time after maximum. Plots of the evolution of *B-V* and *Q* with time show real differences between individual supernovae of the same classification type. The rate of colour change at $\Delta T = 20$ days is found to be significantly greater for SNI than it is for SNII.

Key words : supernovae — photometry.

1. Introduction.

Data from photoelectric photometry of supernovae is very widely dispersed throughout the astronomical literature. The present paper represents an attempt to bring together all published photoelectric *UBV* photometry of supernovae. In a few cases it was not clear whether published *B-V* and *U-B* colours were based on photographic or photoelectric observations; such data have *not* been included in table I. (It would be appreciated if readers could call our attention to any possible omissions.) For each supernova with published *UBV* photometry this table contains the following information : the supernova designation from the Palomar Supernova Master List (Kowal, 1983), the supernova type (from spectroscopic observations whenever possible), the best estimate of the date of maximum, the last four digits of the Julian Date of maximum, the estimated magnitude at maximum light, the name of the galaxy in which the supernova occurred, the Hubble type of the parent galaxy, usually taken from *The Uppsala General Catalogue of Galaxies* (Nilson, 1973), the 1950 coordinates of the galaxy, and the galactic absorption in blue light taken from Burstein and Heiles (1984).

Previous discussions of the *UBV* colours and colour evolution of supernovae are by Arp (1961), Mihalas (1962), Pskovskii (1971) and Barbon *et al.* (1973).

The main body of the table gives the Julian Date of observation, the time since maximum light ΔT, V, B-V, U-B, the reddening-free parameter $Q = U\text{-}B - 0.72(B\text{-}V)$ (Johnson and Morgan, 1953), and references and notes.

Send offprint requests to : P. F. Younger.

2. Supernova light curves.

It has been recognised for many years (e.g. Minkowski, 1964) that the light curves of supernovae of type II differ significantly from object to object. On the other hand supernovae of type I appear to be a more homogeneous class of object, which exhibit more nearly similar light curves. On the basis of *photographic* photometry Barbon *et al.* (1973) concluded that SNI could be divided into fast (SNIa) and slow (SNIb) subgroups. More recently Pskovskii (1977) has suggested that the light curves of SNI exhibit a continuous range that he characterises by a parameter β, which appears to correlate with the absolute magnitude of supernovae at maximum light (Branch, 1981). The apparent rate of decline of a supernova may, however, be strongly affected by photometric scale errors. It therefore seems worthwhile to check on the reality of such differences by using only photoelectric observations. A tabulation of the rates of decline for the 8 best photoelectrically observed supernovae of type I is given in table II. These data suggest, but do not prove, that there is a small but real dispersion in the rate of decline of SNI at 20 days past maximum. Unfortunately the overlap with Pskovskii (1977) is insufficient to provide a check on his photographically determined β parameters. The light curves of the two best-observed supernovae of type I are compared in figure 1. The figure shows subtle but almost certainly real differences between the light curves of SN 1972e and 1975n, which are most easily seen near $\Delta T = 40$ days. More photoelectric observations are urgently needed to quantify the differences between individual supernovae of type I.

The present photoelectric data confirm that the light curves of type II supernovae exhibit considerable differences from object to object. A good example is provided by the light curves of SN 1959d and 1968l, which are intercompared in figure 2. The rates of decline at $\Delta T = 20$ days for the 4 best-observed supernovae of type II are listed in table III. These data confirm the reality of the large differences in the rates of decline of different SNII. The mean rates of decline at $\Delta T = 20$ days are 0.065 ± 0.007 and 0.027 ± 0.009 mag day^{-1} for supernovae of types I and II respectively.

3. *B-V* colours of supernovae.

3.1 SUPERNOVAE OF TYPE I. — Table I contains observations of the *B-V* colours of 19 supernovae of type I. These data confirm (e.g. Mihalas, 1962) that SNI are intrinsically quite blue just before maximum, become steadily redder for the next month and subsequently become bluer again for the next two months. For most well-observed supernovae the initial reddening in *B-V* proceeds at a nearly constant rate of 0.04 to 0.05 magnitudes per day.

Table III lists the colours, corrected for a galactic foreground reddening $E_{B-V} = 0.25\ A_B$, of well-observed SNI at 15 days after maximum light. Uncertain values are marked by a colon; extrapolated values are followed by an « e ». The data in table III show that $(B\text{-}V)_0^{15}$, the supernova colour 15 days after maximum, ranges from ~ 0.1 to ~ 1.5 for SNI. Three factors might contribute to this large dispersion :

1) The adopted dates of maximum might be in error. An error of 10 days in ΔT will, typically, result in an error of 0.4 to 0.5 mag in $(B\text{-}V)_0^{15}$.

2) Individual supernovae may suffer large amounts of reddening within their parent galaxies.

3) Individual SNI might exhibit differing colour evolution.

Figure 3 shows that most individual *B-V* observations of SNI lie above (or to the left) of the ΔT *versus* *B-V* relation for the bright and particularly well-observed supernova 1972e in NGC 5253. Possibly the adopted ΔT values of individual SNI are typically 10 to 20 days too small. Alternatively the ΔT value for SN 1972e might be too large by the same amount. Although it is perhaps not entirely ruled out the latter explanation appears improbable for this well-observed object. Another possible explanation for the distribution of observations in figure 3 is that SNI are, on average, reddened by $E_{B-V} \sim 0.5$. This explanation would, however, appear to be inconsistent with the comparison between the maximum luminosities of SNI in spirals and in (presumably dust-free) ellipticals shown by Tammann (1981). Alternatively it might, of course, be assumed that Tammann's data on SNI in spirals are strongly biassed against heavily reddened objects. Finally it is possible that SNI in spirals redden sooner than SN 1972e, which occurred in the peculiar elliptical NGC 5253.

Good photoelectric observations of *B-V* starting before maximum light and extending to at least 40 days past maximum light will be required to distinguish between the various alternatives discussed above.

3.2 SUPERNOVAE OF TYPE II. — Table I contains data on the colours of 6 supernovae of type II at or near $\Delta T = 15$. The table shows that SNII, which have a mean colour $\langle (B\text{-}V)_0^{15} \rangle = 0.34 \pm 0.10$, are, on average, bluer than SNI for which $\langle (B\text{-}V)_0^{15} \rangle = 0.67 \pm 0.12$. The observed colour differences between individual SNII are probably largely due to differing amounts of reddening in the parent galaxy of each supernova. Nevertheless there is clear evidence for small differences in the *B-V* *versus* ΔT curves of different individual supernovae (see Fig. 4).

Table IV lists the rate of colour evolution at $\Delta T = 20$ days for all 6 SNII with good photoelectric observations. These data show that $\langle \mathrm{d}(B\text{-}V)/\mathrm{d}T \rangle = 0.019 \pm 0.02$ mag day^{-1}. This is less than half the rate at which SNI redden near $\Delta T = 20$ days, suggesting that the rate of colour change near $\Delta T = 20$ days provides a clearcut method for distinguishing between supernovae of types I and II.

Because of its very rapid decline in *B* Wegner (1977) tentatively assigned SN 1975s to type II. The rate of colour change of this object $\mathrm{d}(B\text{-}V)/\mathrm{d}T = 0.13$ mag day^{-1} is, however, much larger than that of any other SNII which makes its classification suspect.

4. Intrinsic colours of supernovae.

Figures 5 and 6 show plots of the reddening-free parameter *Q* (Johnson and Morgan, 1953) as a function of ΔT, the time elapsed since maximum light, for supernovae of types I and II respectively. The scatter in these diagrams is disappointingly large. In addition to intrinsic dispersion of unknown size this scatter is due to (1) errors in the estimated dates of maximum light (which might typically be as large as ~ 10 days) and (2) errors resulting from the uncertainties inherent in the photometry of faint objects superimposed on a bright (and often non-uniform) background. For supernovae in spiral galaxies, in which the ultraviolet background is bright, most of the observed dispersion in *Q* is, no doubt, a result of observational errors in *U-B*. At large values of ΔT, when the spectra of supernovae develop strong bands, uncertainties in the transformation from the instrumental to the *UBV* system is expected to add to the dispersion in the observations.

Figure 5 shows that SNI have $\langle Q \rangle \approx -0.25$ at $\Delta T = 0$. Their colours subsequently become bluer reaching $\langle Q \rangle \approx -0.4$ at $\Delta T = 50$ days. This contrasts with the behavior of SNII which are quite blue ($\langle Q \rangle \approx -0.8$) at $\Delta T = 0$ but subsequently redden rapidly reaching $\langle Q \rangle \approx -0.2$ at $\Delta T = 35$ days. The large scatter in the observations of individual supernovae makes it very difficult to say whether supernovae of a given type all exhibit similar colour evolution or if real differences exist between individual supernovae of a given type. Clearly more *UBV* photometry of supernovae is required to answer this question.

Individual intrinsic colour curves for the four best-observed supernova are collected in figure 7. This figure supports the conclusions about the variations of *Q* with time that were previously derived from figures 5 and 6. Available data do not allow one to draw any conclusions about the reality of the differences between the *Q* *versus* ΔT relations of individual supernovae of the same type that appear to be indicated by the light curves plotted in figure 7.

Acknowledgements.

We thank Mr. Charles Kowal for sending us updated versions of the computerised Palomar Supernova Master List from time to time.

References

ARP, H. : 1961, *Astrophys. J.* **133**, 883.
BARBON, R., CIATTI, F., ROSINO, R. : 1973, *Astron. Astrophys.* **25**, 241.
BRANCH, D. : 1981, *Astrophys. J.* **248**, 1076.
BURSTEIN, D., HEILES, C. E. : 1984, *Astrophys. J. Suppl.* **54**, 33.
DE VAUCOULEURS, G., DE VAUCOULEURS, A., CORWIN, H. G. : 1976, *Second Reference Catalogue of Bright Galaxies* (Univ. of Texas Press, Austin).
JOHNSON, H. L., MORGAN, W. W. : 1953, *Astrophys. J.* **117**, 313.
KOWAL, C. T. : 1983, *unpublished Palomar Supernova Masterlist*.
MIHALAS, D. : 1962, *Publ. Astron. Soc. Pacific* **74**, 116.
MINKOWSKI, R. :. 1964, *Ann. Rev. Astron. Astrophys.* **2**, 247.
NILSON, P. : 1973, *Uppsala General Catalogue of Galaxies, Uppsala Astron. Observ. Ann. 6 Ser. V : A,* Vol. **1.**
PSKOVSKII, Y. P. : 1971, *Soviet Astron.-A.J.* **14**, 798.
PSKOVSKII, Y. P. : 1977, *Soviet Astron.-A. J.* **21**, 675.
TAMMANN, G. A. : 1981, *A Survey of Current Research,* Eds. M. J. Rees and R. J. Sonham (Reidel, Dordrecht) p. 371.
WEGNER, G. : 1977, *Monthly Notices Roy. Astron. Soc.* **181**, 677.

TABLE I. — *Photoelectric U, B, V observations of supernovae.*

1954*a* Type I 1954 Apr. 16-21(4849-54) Mag=9.1-9.9 (Ref. 1)
NGC 4214 Irr R.A.=12 13.1 Dec.=+36 37 A_B=0.00

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2434894.72	43	...	1.02	...	...	1	
4902.75	51	...	1.00	0.45	-0.27	1	
4903.83	52	...	...	0.4	...	1	
4905.83	54	...	0.93	0.43	-0.24	1	
4910.80	59	...	0.85	0.61	0.00	1	
4959.67	108	...	0.52	0.33	-0.04	1	

1. Wild, P. (1960). *Publ. Astron. Soc. Pac.* 72, 97.

1954*b* Type I 1954 Apr. 27(4860): m_{pg}=12.2: (Ref. 1)
NGC 5668 Sc R.A.=14 30.9 Dec.=+04 40 A_B=0.05

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2434871.82	12	...	0.27	-0.02	-0.21	1	
4872.74	13	...	0.20	-0.06	-0.20	1	
4873.74	14	...	0.36	0.06	-0.20	1	
4874.73	15	...	0.26	0.09	-0.10	1	
4892.80	33	...	1.05	...	...	1	

1. Wild, P. (1960). *Publ. Astron. Soc. Pac.* 72, 97.

1959*c* Type I 1959 June 23(6743) m_{pg}=14.0 (Ref. 1)
UGC 8263 Sbc R.A.=13 08.8 Dec.=+03 40 A_B=0.05

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2436760.71	18	14.42	0.22	0.08	-0.08	2	
6762.69	20	14.54	0.24	0.09	-0.08	2	
6763.69	21	14.55	0.29	0.10	-0.11	2	
6778.68	36	15.27	0.91	0.13	-0.53	2	
6784.67	42	15.59	0.93	0.04:	-0.63:	2	

1. Greenstein, J.L., & Zwicky, F. (1962). *Publ. Astron. Soc. Pac.* 74, 35.
2. Mihalis, D.M. (1962). *Publ. Astron. Soc. Pac.* 74, 116.

1959*d* Type II (Ref. 2) 1959 July 4(6754) B=13.78 (Ref. 1)
NGC 7331 Sb R.A.=22 34.8 Dec.=+34 10 A_B=0.33

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2436752.98	-1	13.58	0.35	-0.62	-0.87	1	
6753.97	0	13.45	0.33	-0.44	-0.68	1	
6755.96	2	13.75	0.34	-0.42	-0.66	1	
6760.95	7	13.89	0.49	-0.05	-0.40	1	
6762.98	9	13.93	0.59	0.11	-0.31	1	
6763.90	10	13.93	0.67	0.20	-0.28	1	
6763.98	10	13.95	0.63	0.22	-0.23	2	
6777.97	24	14.42	0.90	1.13	+0.48	1	
6784.97	31	14.72	1.33	1.06	+0.10	1	
6785.94	32	14.79	1.34	1.06	+0.10	1	
6793.90	40	14.97	1.36	1.04:	+0.06:	2	
6816.74	63	15.55	1.62	0.99	-0.18	1	
6818.90	65	16.46:	1.53:	...	...	1	A
6821.74	68	15.71	1.78	1.11	-0.17	1	
6849.80	96	18.12	0.99	...	...	1	

1. Arp, H. (1961). *Astrophys. J.* 133, 883.
2. Walker, M.F. (1960). *Publ. Astron. Soc. Pac.* 72, 127.
A. Apparently incorrect measure.

1960r Type I (Ref. 2) 1960 Dec. 23(7292): Mag=12.0: (Ref. 1)
NGC 4382 SO R.A.=12 22.9 Dec.=+18 28 A_B=0.04

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2437315.5	24	13.08	1.27	0.25	-0.66	2	

1. The Palomar Supernova Master List.
2. Sandage, A.R. (1961). *Harvard Coll. Obs. Announcement Card No.* 1521.

1962*l* Type I Pec 1962 Dec. 7(8006) (Note A) B=13.94 (Ref. 1)
NGC 1073 Sbc R.A.=02 41.2 Dec.=+01 10 A_B=0.07

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2437998.50	-8	13.66	0.58	0.10	-0.32	1	
8001.49	-5	13.38	0.70	0.12	-0.38	1	
8002.46	-4	13.33	0.70	0.14	-0.36	1	
8004.44	-2	13.28	0.69	0.16	-0.34	1	
8015.38	9	13.39	1.10	0.40	-0.39	1	
8016.41	10	13.46	1.15	0.34	-0.49	1	
8017.36	11	13.57	1.19	0.39	-0.47	1	

1962*l* (*continued*)

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2438020.46	14	13.79	1.26	0.45	-0.46	1	
8021.40	15	13.82	1.28	0.46	-0.46	1	
8025.33	19	14.21	1.42	0.42	-0.60	1	
8026.38	20	14.43	1.52	0.42	-0.67	1	

1. Bertola, F. (1964). *Annales D'Astrophysique* 27, 319.
A. Supernova located in knot. Maximum Dec. 10 in V, Dec. 7 in B, and Dec. 6 in U.

1967*c* Type I (Ref. 3) 1967 Feb. 28(9550) Mag=13.0 (Ref. 1)
NGC 3389 Sc R.A.=10 45.8 Dec.=+12 48 A_B=0.06

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2439556.8	7	13.28	0.27	-0.19	-0.38	2	
9559.7	10	13.48	0.35	-0.10	-0.35	2	
9561.9	12	13.60	0.37	-0.05	-0.32	2	
9562.8	13	13.62	0.44	-0.03	-0.35	2	
9564.8	15	13.79	0.49	0.11	-0.24	2	
9565.8	16	13.74	0.60	0.03	-0.40	2	
9566.8	17	13.85	0.65	0.04	-0.43	2	
9569.9	20	14.10	0.79	0.30	-0.27	2	

1. The Palomar Supernova Master List.
2. de Vaucouleurs, G. & Solheim, J.E. (1967). *IAU Circ. No.* 2004.
3. Chuadze, A.D., & Barblishvili, T.I. (1969). *Bull. Abastumani Astrophys. Obs. No.* 37, 9.

1968*l* Type II 1968 July 13(0051) B=11.9 (Ref. 1)
NGC 5236 .SXS5.. (Note A) R.A.=13 34.3 Dec.=-29 37 A_B=0.14

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2440053.5	2	11.90	0.10	...	...	1	
0054.5	3	11.85	0.25	...	...	1	
0055.5	4	11.96	0.28	...	...	1	
0056.5	5	11.83	0.29	...	...	1	
0069.5	18	11.88	0.62	...	...	1	
0070.5	19	11.96	0.62	...	...	1	
0071.5	20	11.99	0.65	...	...	1	
0074.5	23	11.99	0.62	...	...	1	
0075.5	24	11.90	0.81	...	...	1	
0076.5	25	11.90	0.77	...	...	1	
0080.5	29	11.99	0.72	...	...	1	
0082.5	31	11.99	0.81	...	...	1	
0083.5	32	12.07	0.80	...	...	1	
0087.5	36	12.16	0.98	...	...	1	
0092.5	41	12.23	0.91	...	...	1	
0098.5	47	12.07	0.99	...	...	1	
0102.5	51	11.93	0.94	...	...	1	
0107.5	56	11.96	0.78	...	...	1	
0111.5	60	12.16	1.03	...	...	1	
0113.5	62	12.16	0.90	...	...	1	
0115.5	64	12.07	0.99	...	...	1	

1. Wood, R. & Andrews, P.J. (1974). *Mon. Not. R. Astron. Soc.* 167, 13.
A. RC2 Revised type.

1970*g* Type II 1970 July 25(0793) B=11.5 (Ref. 1)
NGC 5457 Sc R.A.=14 01.5 Dec.=+54 35 A_B=0.00

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2440803.69	11	11.65	0.29	-0.26	-0.47	2	A
0804.71	12	11.66	0.29	-0.23	-0.44	2	A
0805.74	13	11.67	0.33	-0.23	-0.47	2	A
0806.76	14	11.76	0.32	-0.14	-0.37	2	A
0807.71	15	11.70	0.44	-0.07	-0.39	2	A
0808.70	16	11.78	0.43	-0.08	-0.39	2	A
0809.68	17	11.75	0.47	0.07	-0.27	2	A
0819.68	27	12.15	0.71	-0.01	-0.52	2	A
0820.70	28	12.17	0.72	-0.08	-0.60	2	A
0821.69	29	12.16	0.67	0.08	-0.40	2	A
0822.69	30	12.14	0.81	0.19	-0.39	2	A
0826.69	34	12.26	0.70	0.21	-0.29	2	A
0828.68	36	12.18	0.78	0.10	-0.46	2	A
0829.68	37	12.18	0.87	0.08	-0.55	2	A

1. The Palomar Supernova Master List.
2. Winzer, J.E. (1974). *J. R. Astron. Soc. Can.* 68, 36.
A. Observations contaminated by H II region.

TABLE I *(continued)*.

1971*g* Type I 1971 Apr. 11±2(1053±2) B=13.2±0.2 (Ref. 1)
NGC 4165 Sb RA=12 09.7 Dec.=+13 31 A_B=0.05

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2441064.73	12	14.40	0.34	0.07	−0.17	1	A
1064.73	12	14.42	0.32	0.06	−0.17	1	A
1065.77	13	14.47	0.395	0.105	−0.18	1	A
1067.77	15	14.64	0.505	0.20	−0.16	1	A
1068.75	16	14.80	0.57	0.22	−0.19	1	B

1. de Vaucouleurs, G., de Vaucouleurs, A., & Brown, G.S. (1971). *Astrophys. Lett.* 9, 77.
A. Aperture 0.24 arcmin.
B. Aperture 0.12 arcmin.

1971*i* Type I 1971 May 29(1101) B=11.9±0.2 (Ref. 1)
NGC 5055 Sb R.A.=13 13.5 Dec.=+42 17 A_B=0.00

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2441097.02	−4	12.09	0.16	0.00	−0.12	2	
1101.66	1	12.10:	0.35	...	...	1	
1102.71	2	11.98:	0.31	...	...	1	
1103.66	3	11.74	0.48	...	...	1	
1125.75	25	13.39	1.19	...	...	1	
1131.68	31	13.83	1.23	...	...	1	
1135.71	35	13.97	0.86	...	...	1	
1146.69	46	14.05	1.20	...	...	1	

1. Deming, D., Rust, B.W., & Olson, E.C. (1973). *Publ. Astron. Soc. Pac.* 85, 321.
2. Ishida, K. (1971). *IAU Circ. No.* 2332.

1972*e* Type I 1972 May 0.5±2.0(1438.0±2.0) B=7.75±0.10 (Ref.1, Note G)
NGC 5253 .I.O.P. (Note A) R.A.=13 37.1 Dec.=−31 24 A_B=0.19

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2441455.33	17	8.68:	0.16	−0.10	−0.22	2	
1455.51	18	8.69	0.17	−0.11	−0.23	1	B
1455.56	18	8.69	0.18	−0.09	−0.22	1	C
1456.45	18	8.74	0.17	...	...	3	D
1456.75	19	8.76	0.20	−0.06	−0.20	1	
1457.22	19	8.80	0.20	−0.06	−0.20	2	
1457.31	19	8.78	0.21	...	...	3	D
1458.21	20	8.86	0.22	−0.04	−0.20	2	
1458.27	20	8.83	0.24	...	...	3	D
1458.62	21	8.85	0.25	0.00	−0.18	1	
1458.70	21	8.86	0.24	−0.06	−0.23	4	
1458.73	21	8.84	0.23	−0.04	−0.21	5	
1459.35	21	8.89	0.28	...	...	3	D
1459.41	21	8.92	0.26	0.00	−0.19	2	
1459.62	22	8.95	0.26	0.05	−0.14	4	
1459.66	22	8.91	0.28	0.04	−0.16	1	
1459.72	22	8.98	0.26	0.03	−0.16	4	
1460.24	22	8.96	0.28	0.02	−0.18	2	
1460.35	22	8.93	0.34	...	...	3	D
1460.72	23	8.98	0.29	0.06	−0.15	5	
1461.37	23	9.01	0.37	...	...	3	D
1461.81	24	9.06	0.34	0.01	−0.23	6	
1461.92	24	9.02	0.34	0.04	−0.20	6	
1462.24	24	9.08	0.42	...	...	3	D
1462.69	25	9.10	0.39	0.10	−0.18	5	
1463.31	25	9.11	0.50	...	...	3	D
1463.58	26	9.10	0.51	0.17	−0.20	1	
1463.73	26	9.15	0.45	0.11	−0.21	5	
1464.55	27	9.17	0.58	0.17	−0.25	1	E
1465.50	28	9.21	0.64	0.19	−0.27	1	
1465.66	28	9.22	0.65	0.19	−0.28	1	
1466.49	28	9.24	0.71	0.22	−0.29	1	F
1466.69	29	9.25	0.72	0.22	−0.30	1	F
1470.28	32	9.41	0.90	...	...	3	D
1471.27	33	9.46	0.90	0.24	−0.41	2	
1471.31	33	9.45	0.93	...	...	3	D
1472.34	34	9.51	0.96	...	...	3	D
1473.30	35	9.57	0.97	...	...	3	D
1474.23	36	9.61	1.01	...	...	3	D
1475.24	37	9.68	1.03	0.23	−0.51	2	
1476.24	38	9.71	1.05	...	...	3	D
1477.24	39	9.76	1.05	...	...	3	D
1478.23	40	9.81	1.07	...	...	3	D
1478.73	41	9.80	1.13	0.09	−0.72	5	
1479.24	41	9.87	1.06	...	...	3	D
1480.22	42	9.92	1.09	...	...	3	D
1481.28	43	10.00	1.05	...	...	3	D
1482.24	44	10.06	1.05	...	...	3	D

1972*e* (*continued*)

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2441484.68	47	10.24	1.19	0.22	−0.64	5	
1485.35	47	10.21	1.04	...	...	3	D
1485.70	48	10.17	1.05	0.19	−0.57	5	
1486.24	48	10.24	1.03	...	...	3	D
1487.25	49	10.29	1.00	...	...	3	D
1488.28	50	10.33	0.99	...	...	3	D
1489.24	51	10.37	1.01	...	...	3	D
1490.24	52	10.45	0.96	...	...	3	D
1492.30	54	10.49	0.98	...	...	3	D
1492.69	55	10.55	1.05	0.24	−0.52	5	
1496.68	59	10.60	0.93	0.15	−0.52	5	
1496.92	59	10.74	0.83	0.27	−0.33	7	
1497.66	60	10.62	0.81	0.18	−0.40	5	
1497.91	60	10.77	0.81	0.26	−0.32	7	
1498.24	60	10.69	0.90	...	...	3	D
1498.66	61	10.72	0.94	0.18	−0.50	5	
1499.30	61	10.70	0.89	...	...	3	D
1499.67	62	10.85	0.92	0.23	−0.43	5	
1500.24	62	10.72	0.90	...	...	3	D
1500.67	63	10.76	0.90	0.15	−0.50	5	
1500.88	63	10.85	0.78	0.25	−0.31	7	
1501.23	63	10.76	0.86	...	...	3	D
1501.67	64	10.76	0.87	0.15	−0.48	5	
1503.04	65	10.84	0.82	0.02:	−0.57:	7	
1503.24	65	10.83	0.86	...	...	3	D
1503.60	66	10.85	0.91	0.26	−0.40	1	F
1507.23	69	10.92	0.83	...	...	3	D
1508.23	70	10.97	0.82	...	...	3	D
1508.48	70	10.98	0.85	0.31	−0.30	1	
1509.31	71	10.96	0.82	...	...	3	D
1511.28	73	11.01	0.81	...	...	3	D
1512.33	74	11.06	0.80	...	...	3	D
1515.25	77	11.11	0.74	...	...	3	D
1516.25	78	11.16	0.78	...	...	3	D
1518.22	80	11.23	0.75	...	...	3	D
1533.23	95	11.62	0.65	...	...	3	D
1538.23	100	11.71	0.65	...	...	3	D
1541.24	103	11.83	0.60	...	...	3	D
1541.50	104	11.84	0.49	0.43	+0.08	1	
1550.25	112	12.00	0.59	...	...	3	D
1564.23	126	12.27	0.51	...	...	3	D
1567.23	129	12.33	0.49	...	...	3	D
1569.50	132	12.86	0.21	0.62	+0.47	1	
1584.49	146	13.27	0.01	0.95	+0.94	1	
1587.48	149	13.06	0.20	0.86	+0.72	1	
1588.50	150	12.95	0.25	0.81	+0.63	1	
1589.49	151	13.01	0.27	0.85	+0.66	1	
1698.54	261	14.42	0.47	...	...	3	D
1724.50	286	14.89	0.45	...	...	3	D
1753.42	315	15.10	0.52	...	...	3	D

1. Ardeberg, A. & de Groot, M. (1973). *Astron. Astrophys.* 28, 295.
2. Cousins, A.W.J. (1972). *Info. Bull. Var. Stars No.* 700.
3. van Genderen, A.M. (1975). *Astron. Astrophys.* 45, 429.
4. Osmer, P.S., Hesser, J.E., Kunkel, W.E., Lasker, B.M., McCarthy, M.F., & Landolt, A.U. (1972). *Nature Phys. Sci.* 238, 21.
5. Lee, T.A., Wamsteker, W., Wisniewski, W.Z., & Wdowiak, T.J. (1972). *Astrophys. J. (Letters)*, 177, L59.
6. Walker, Christie, Feasey, & Freeth (1972). *IAU Circ. No.* 2413.
7. Przybylski, A. (1972). *IAU Circ. No.* 2434.
A. RC2 Revised type.
B. Average of 17 observations.
C. Average of 8 observations.
D. Transformed from Walraven system (see Reference 3).
E. Average of 4 observations.
F. Average of 2 observations.
G. The adopted value of B(max) is based on an extrapolation from two *photographic* observations and may be too bright.

1975*a* Type I 1975 Jan. 20(2433) B=14.6 (Ref. 1)
NGC 2207 SXT4P (Note A) R.A.=06 14.3 Dec.=−21 21 A_B=0.49

JD	ΔT	V	B-V	U-B	Q	Ref.	Note
2442429.76	−3	14.90	−0.05	−0.36	−0.32	2	
2430.78	−2	14.72	−0.03	−0.29	−0.27	2	
2432.78	0	14.66	0.08	−0.14	−0.20	2	

1. The Palomar Supernova Master List
2. Green, R. (1975). *IAU Circ. No.* 2743.
A. RC2 Revised type.

TABLE I *(continued)*.

1975*n* Type I 1975 Nov. 5(2722) B=13.74±0.04 (Ref. 1)
NGC 7723 .SBR3.. (Note A) R.A.=23 36.4 Dec.=−13 14 A_B=0.08

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2442715.63	−6	13.95	0.18	−0.23	−0.36	2	
2716.62	−5	13.89	0.21	−0.29	−0.44	2	
2722.32	0	13.45	0.29	0.01	−0.20	1	
2723.34	1	13.41	0.34	0.11	−0.13	1	
2727.29	5	13.54	0.50	0.17	−0.19	1	
2744.31	22	14.39	1.25	0.41	−0.49	1	
2745.32	23	14.445	1.24	0.35	−0.54	1	
2747.33	25	14.55	1.23	0.365	−0.52	1	
2748.36	26	14.62	1.24	0.32	−0.57	1	
2749.31	27	14.73	1.215	0.32	−0.55	1	
2754.29	32	14.99	1.09	0.24	−0.54	1	
2785.31	63	15.665	0.78:	0.12	−0.44:	1	

1. Wegner, G. (1977). *Mon. Not. R. Astron. Soc.* 181, 677.
2. Thompson, L.A. (1975). *IAU Circ. No.* 2866.
A. RC2 Revised type.

1975*s* Type II? (Ref. 2, Note A) 1975 Dec. (2762): (Ref. 1); B=14.5: (Ref. 2)
NGC 1325 .SAS4.. (Note A) R.A.=03 22.3 Dec.=−21 43 A_B=0.03

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2442782.31	20	15.09	0.53	0.095	−0.29	2	
2783.33	21	15.15	0.69	0.215	−0.28	2	
2784.35	22	15.22	0.75	0.52	−0.02	2	
2785.33	23	15.32	0.795	0.34	−0.23	2	
2789.31	27	15.59	1.04	0.82	+0.07	2	

1. The Palomar Supernova Master List.
2. Wegner, G. (1977). *Mon. Not. R. Astron. Soc.* 181, 667.
A. SN type determined photoelectrically.
A. RC2 Revised type.

1976*b* Type I 1976 Apr. 4-5 (Note A) (2873.5) (Ref. 1); B=15.15±0.05 (Ref. 2)
NGC 4402 S R.A.=12 23.6 Dec.=+13 23 A_B=0.12

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2442871.70	−2	14.07	1.11	0.26	−0.54	2	
2893.37	20	14.58	1.69	0.67	−0.55	2	
2894.37	21	14.65	1.66	0.86	−0.34	2	
2903.29	30	14.99	2.04	0.51	−0.96	2	
2904.38	31	15.08	2.02	0.97	−0.48	2	
2905.36	32	15.13	2.14	0.90	−0.64	2	
2929.23	56	16.15	1.86	...	...	2	

1. de Vaucouleurs, G. (1984). Private communication.
2. de Vaucouleurs, G., de Vaucouleurs, A., & Odewahn, S. (1981). *Publ. Astron. Soc. Pac.* 93, 181.
A. Published date in Ref. 2 is incorrect.

1976*g* Type I (Note A) 1976 Oct.(3065): B=14.6: (Ref. 1)
NGC 488 Sb R.A.=01 19.2 Dec.=+05 00 A_B=0.09

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2443096.38	31	16.03	1.12	0.84:	+0.03:	1	
3097.37	32	16.04	1.07	1.26:	+0.49:	1	
3100.36	35	16.12	1.13	1.11:	+0.30:	1	

1. Wegner, G. (1979). *Astron. J.* 84, 532.
A. SN type determined photoelectrically.

1976*j* Type I (Note A) 1976 Dec. 20:(3133:) B=15.3: (Ref. 1)
NGC 977 Sb R.A.=02 31.8 Dec.=−10 51 A_B=0.12 (Ref. 2)

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2443151.31	18	15.98	0.87	0.92:	+0.29:	1	
3152.30	19	16.01	0.97	0.53:	−0.17:	1	
3166.30	33	16.99	0.96	−0.04:	−0.73	1	

1. Wegner, G. (1979). *Astron. J.* 84, 502.
2. Burstein, D., & Heiles, C. (1982). *Astron. J.* 87, 1165.
A. SN type determined photoelectrically.

1979*c* Type II (Ref. 5) 1979 Apr. 15:(3979): B≤11.6: (Ref. 1)
NGC 4321 Sc R.A.=12 20.4 Dec.=+16 06 A_B=0.04

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2443986.74	8	12.19	0.18	−0.67	−0.80	1	
3987.73	9	12.11	0.19	−0.60	−0.74	1	
3988.60	10	12.16	...	...	...	2	
3990.77	12	12.34	0.27	−0.57	−0.76	1	
3991.69	13	12.36	0.26	−0.54	−0.73	1	
3992.65	14	12.37	0.29	−0.51	−0.72	1	
3993.64	15	12.37	0.2	−0.46	−0.65	1	
3994.36	15	12.45	0.28	−0.40	−0.60	3	
3994.38	15	12.49	0.27	−0.41	−0.60	3	
3994.60	16	12.09	...	...	...	4	
3995.36	16	12.56	0.29	−0.36	−0.57	3	
3995.38	16	12.50	0.29	−0.40	−0.61	3	
3995.45	16	12.49	0.31	−0.43	−0.65	3	
3996.32	17	12.59	0.33	−0.40	−0.64	3	
3996.35	17	12.65	0.34	−0.34	−0.58	3	
3996.41	17	12.63	0.28	−0.33	−0.53	3	
3996.60	18	12.42	...	...	...	4	
4008.29	29	12.81	0.41	−0.16	−0.46	3	
4009.38	30	12.86	0.47	−0.06	−0.40	3	
4011.40	32	12.89	0.48	−0.07	−0.42	3	
4012.30	33	12.84	0.58	−0.09	−0.51	3	
4012.36	33	12.86	0.53	−0.04	−0.42	3	
4012.40	33	12.87	0.53	−0.04	−0.42	3	
4014.63	36	12.96	0.63:	...	...	1	
4015.65	37	12.96	0.64	...	...	1	
4016.64	38	12.97	0.64	0.01	−0.45	1	
4016.64	38	12.97	0.70	...	...	1	
4017.64	39	13.07	0.69	...	...	1	
4018.37	39	13.13	0.62	−0.04	−0.49	3	
4018.39	39	13.11	0.66	0.01	−0.47	3	
4019.35	40	13.28	0.62	0.07	−0.38	3	
4019.37	40	13.25	0.63	0.06	−0.39	3	
4020.37	41	13.24	0.65	0.01	−0.46	3	
4020.38	41	13.29	0.66	0.04	−0.44	3	
4020.70	42	13.26	0.68	0.05	−0.44	1	
4021.33	42	13.29	0.71	0.10	−0.41	3	
4021.69	43	13.29	0.71	0.07	−0.44	1	
4022.65	44	13.34	0.72	0.08	−0.44	1	
4023.65	45	13.39	0.74	0.05	−0.48	1	
4024.40	45	13.50	0.71	0.05	−0.46	3	
4024.65	46	13.50	0.71	0.06	−0.45	1	
4028.32	49	13.81	0.82	0.04	−0.55	3	
4028.39	49	13.77	0.81	0.09	−0.49	3	
4041.34	62	14.18	0.76	−0.11	−0.66	3	
4042.34	63	14.28	0.73	...	...	3	
4046.33	67	14.36	0.70	−0.23	−0.73	3	
4050.32	71	14.55	0.68	−0.25	−0.74	3	
4051.68	73	14.62	0.73	0.08	−0.45	1	
4052.70	74	14.62	0.71	0.06	−0.45	1	
4054.33	75	14.63	0.61	...	...	3	
4075.28	96	15.26:	0.38:	...	...	3	
4081.30	102	15.44:	0.35:	...	...	3	
4229.61	251	18.26	0.41	−0.37	−0.67	3	
4285.59	307	18.62	0.31	−0.53	−0.75	3	

1. de Vaucouleurs, G., de Vaucouleurs, A., Buta, B., Ables, H.D., & Hewitt, A.V. (1981). *Publ. Astron. Soc. Pac.* 93, 36.
2. Zissell, R.E. (1979). *IAU Circ. No.* 3353.
3. Balinskaya, I.S., Bychkov, K.V., & Neizvestny, S.I. (1980). *Astron. Astrophys.* 85, L19.
4. Zissell, R.E. (1979). *IAU Circ. No.* 3359.
5. Branch, D., Falk, S.W., McCall, M.L., Rybski, P., Uomoto, A.K., & Wills, B.J. (1981). *Astrophys. J.* 244, 780.

1980*k* Type II (Ref. 3) 1980 Nov. 1(4545) B=11.7±0.1 (Ref. 1)
NGC 6946 Scd R.A.=20 33.8 Dec.=+59 59 A_B=1.62

JD	ΔT	V	B−V	U−B	Q	Ref.	Note
2444547.65	3	11.39:	0.40	−0.57	−0.86	1	
4548.61	4	11.41	0.40	−0.54	−0.83	1	
4549.60	5	11.43	0.42	−0.52	−0.82	1	
4550.61	6	11.46	0.43	−0.50	−0.81	1	
4551.3	6	11.38	0.49	−0.62	−0.97	2	
4551.60	7	11.51	0.45	−0.46	−0.78	1	
4551.60	7	11.50	0.41	−0.51	−0.81	1	
4552.59	8	11.54	0.46	−0.46	−0.79	1	
4552.61	8	11.56	0.42	−0.47	−0.77	1	
4553.60	9	11.59	0.47	−0.42	−0.76	1	
4553.62	9	11.58	0.47	−0.40:	−0.74:	1	
4554.64	10	11.63	0.48	−0.37	−0.72	1	
4555.35	10	11.55	0.50	−0.47	−0.83	2	
4555.62	11	11.68	0.50	−0.33	−0.69	1	
4558.27	13	11.75	0.59	−0.45	−0.87	2	
4560.33	15	11.90	0.56	−0.24	−0.64	2	
4562.57	18	12.03	0.63	...	...	1	

TABLE I *(continued)*.

1980*k* *(continued)*

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
4576.6	32	12.60	0.86	0.56	–0.06	1	
4577.6	33	12.63	0.88	0.55	–0.08	1	
4578.6	34	12.67	0.92	0.62	–0.04	1	
4579.61	35	12.71	0.93	0.65	–0.02	1	
4582.64	38	12.82	0.98	0.80	+0.09	1	
4583.60	39	12.84	0.99	0.82	+0.11	1	
4584.56	40	12.87	1.01	0.85	+0.12	1	
4598.57	54	13.41:	1.29:	...	...	1	
4601.58	57	13.50:	1.29:	...	...	1	
4668.99	124	16.28:	1.09:	...	...	1	A
4677.00	132	16.24:	0.91:	...	...	1	A
4729.92	185	17.25	0.99	0.79	+0.08	1	B

1. Buta, R.J. (1982). *Publ. Astron. Soc. Pac.* **94**, 578.
2. Dapergolas, A. (1980). *IAU Circ. No.* 3542.
3. Kirshner, R. (1980). *IAU Circ. No.* 3534.

A. Uncertain due to low altitude and onset of dawn.
B. Excludes a faint companion star.

1980*n* Type I (Ref. 2) 1980 Dec.(4589): Mag=12.5* (Ref. 1)
NGC 1316 PLXSOP. (Note A) R.A.=03 20.7 Dec.=–37 25 A_B=0.00

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2444584.6	–4	12.58	–0.05	...	...	2	
4588.7	0	12.42	0.20	...	...	2	
4590.60	2	12.45	0.27	...	...	3	
4595.59	7	12.62	0.63	...	...	3	
4597.60	9	12.80	0.57	...	...	4	
4598.58	10	12.84	0.61	...	...	4	
4599.58	11	12.96	0.68	...	...	4	
4603.60	15	13.17	0.94	...	...	4	
4604.69	16	13.24	1.00	...	...	4	
4605.56	17	13.30	1.03	...	...	4	
4606.62	18	13.35	1.10	...	...	4	
4607.61	19	13.41	1.11	...	...	4	

1. The Palomar Supernova Master List.
2. Landolt, A.U. & Connolly, L.P. (1980). *IAU Circ. No.* 3556.
3. Koornneef, J., Lub, J. & Barbier, R. (1980). *IAU Circ. No.* 3556.
4. Olszewski, E.O. (1982). *Info. Bull. Var. Stars No.* 2065.

A. RC2 Revised type.

1981*b* Type I (Ref. 5) 1981 Mar. 8(4672) B=12.00 (Ref. 1)
NGC 4536 Sb/Sc R.A.=12 32.0 Dec.=+02 28 A_B=0.00

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2444670.77	–1	11.99	0.00	–0.24	–0.24	1	
4671.42	–1	11.97	0.08	–0.20	–0.26	2	
4671.43	–1	11.97	0.03	–0.16	–0.18	2	
4671.80	0	11.98	0.02	–0.20	–0.21	1	
4672.72	1	11.96	0.05	–0.19	–0.23	1	
4673.32	1	11.92	0.10	–0.19	–0.26	2	
4673.46	1	11.95	0.06	–0.11	–0.15	2	
4674.65	3	11.98	0.15	–0.10	–0.21	3	
4675.65	4	12.05	0.10	0.01	–0.06	3	
4675.73	4	11.91	0.16	–0.18	–0.30	4	
4676.71	5	12.08	0.18	...	...	3	
4676.92	5	11.96	0.21	–0.03	–0.18	1	
4681.92	10	12.16	0.43	0.17	–0.14	1	
4684.83	13	12.40	0.54	0.11	–0.28	1	
4686.81	15	12.43	0.60	0.10	–0.33	1	
4688.80	17	12.62	0.87	–0.08	–0.71	1	
4690.39	18	12.73	0.80	0.32	–0.26	2	
4691.80	20	12.85	0.80	0.75	+0.17	1	
4695.30	23	12.97	1.03	0.30	–0.44	2	
4695.35	23	12.97	0.98	0.54	–0.17	2	
4696.65	25	12.94	1.17	0.37	–0.47	1	
4698.82	27	13.23	...	...	...	1	
4704.39	32	13.54	...	14.91	...	2	A
4704.45	32	13.64	1.18	0.16	–0.69	2	
4705.27	33	13.54	1.17	...	...	2	
4705.36	33	13.64	1.18	0.16	–0.69	2	
4705.45	33	13.79	1.03	0.41	–0.33	2	
4706.45	34	13.80	0.97	0.44	–0.26	2	
4714.80	43	13.92	1.07	...	...	1	
4719.28	47	14.44	0.73	0.57	+0.04	2	
4720.72	49	14.21	0.94	...	...	1	
4721.75	50	14.20	1.02	...	...	1	
4728.28	56	14.36	0.96	0.93	+0.24	2	
4729.70	58	14.42	0.95	0.34	–0.34	1	
4737.63	66	14.70	0.81	...	...	1	
4741.63	70	14.78	0.70	...	...	1	
4742.63	71	14.57	1.04	...	...	1	

1981*b* *(continued)*

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2444747.75	76	14.84	0.66	...	...	1	
4749.64	78	14.90	0.46	...	...	1	
4750.65	79	14.94	0.77	...	...	1	

1. Buta, R.J., & Turner, A. (1983). *Publ. Astron. Soc. Pac.* 95, 72.
2. Tsvetkov, D. Yu. (1982). *Sov. Astron. Lett.* 8(2), 115.
3. Busko, I., Jablonski, F., & Torres, C.(1981). *IAU Circ. No.* 3589.
4. Veron, M. (1981). *IAU Circ. No.* 3584.
5. Panagia, N. and Wamsteker, W. (1981). *IAU Circ. No.* 3584.

A. U magnitude.

1981*f* Type I (Ref. 1) May (4740:) Mag.=15.* (Ref. 2)
NGC 4716 R.A.=12 47.9 Dec.=–09 11 A_B=0.00 (Ref. 3)

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2444764.55	25:	14.98	0.41	–0.17	–0.47	4	

1. Kirshner, R. (1981). *IAU Circ. No.* 3611.
2. The Palomar Supernova Master List.
3. Burstein, D., & Heiles, C. (1982). *Astron. J.* 87, 1165.
4. Osmer, P. (1981). *IAU Circ. No.* 3611.

1981*i* 1981 Aug. (4832): Mag=15: (Ref. 1)
ESO 356-G20 Sa R.A.=02 55.6 Dec.=–35 46 A_B=0.00

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2444829.9	–2	16.18	0.42	0.18	–0.12	2	

1. The Palomar Supernova Master List.
2. Alday, L., Graham, J., & Landolt, A.(1981). *IAU Circ. No.* 3628.

1983*g* Type I Mar. 28.5±2 (5422±2) (Ref. 1) V=12.8 (Ref. 2)
NGC 4753 Irr II R.A.=12 49.8 Dec.=–00.56 A_B=0.00

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2445434.66	13	12.77	0.26	0.31	+0.12	1	
5435.64	14	12.80	0.28	0.35	0.15	1	
5438.74	17	12.83	0.44	0.21	–0.11	3	
5440.84	19	12.95	0.53	0.31	–0.07	3	
5441.77	20	13.23	0.63	0.26	–0.19	1	
5442.78	21	13.18	0.68	0.29	–0.20	1	
5443.77	22	13.25	0.70	0.22	–0.28	1	

1. Harris, G.L.H., Hesser, J.E., Massey, P., Peterson, C.J., & Yamananka, J.M. (1983). *Publ. Astron. Soc. Pac.* 95, 607.
2. The Palomar Supernova Master List.
3. Corwin, H.G. (1983). *IAU Circ. No.* 3794.

1983*k* Type II 1983 June 23±2(5509±2) B=12.4±0.1 (Ref. 1)
NGC 4699 Sab R.A.=12 46.4 Dec.=–08 24 A_B=0.09

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2445500.5	–8	13.15	–0.30	...	...	2	
5557.5	48	13.27	0.46	...	...	2	

1. Niemela, V.S., Ruiz, M.T., and Phillips, M.M.(1984). Preprint.
2. Phillips, M.M. (1984). Private communication.

1984 Type II? (Ref. 1, Note A) 1984 July 31±1(5913±1) Mag=13.2 (Ref. 2)
NGC 1559 Sbc R.A.=04 17.0 Dec.=–62 55 A_B=0.00

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2445914.27	1	13.40	0.48	–0.49	–0.84	1	B

1. Evans, R.(1984). *IAU Circ. No.* 3989.
2. Buta, R. (1984). *IAU Circ. No.* 3967.

A. SN Type determined photoelectrically.
B. Measurements corrected for brightness of galaxy (see Veron *et al.* (1982), *Astron. Astrophys.* 113, 46).

1984 Type II (Ref. 1) 1984 Aug. 19±4(5931±4) (Ref. 2) B=13.5:
NGC 991 .SXT5.. (Note A) R.A.=02 33.2 Dec.=–07 22 A_B=0.00

JD	ΔT	V	B–V	U–B	Q	Ref.	Note
2445944.2	13	13.87	0.49	–0.03	–0.38	2	

1. Buta, R. (1984). *IAU Circ. No.* 3983.
2. Buta, R. (1984). *IAU Circ. No.* 3981.

A. RC2 Revised type.

TABLE II. — *Rate of decline of supernovae.*

Type I

Supernova	dV/dT*
1962 l	0.100:
1967 c	0.064:
1971 i	0.084:
1972 e	0.050
1975 n	0.064
1976 b	0.044
1980 b	0.052
1981 b	0.063

Type II

Supernova	dV/dT*
1959 d	0.031
1968 l	0.004
1970 g	0.024
1980 k	0.048

* in magnitudes per day measured at ΔT = 20 days

TABLE III. — *Colours of supernovae at ΔT = 15 days corrected for galactic foreground reddening.*

Type I

Supernova	$(B-V)_0^{15}$
1954 b	0.25:
1959 c	0.15 e
1962 l	1.26
1967 c	0.48
1971 g	0.49
1971 i	0.87
1972 e	0.07 e
1975 n	0.92
1976 b	1.54:
1976 j	0.80: e
1980 n	0.34
1981 b	0.65
1983 g	0.33

Type II

Supernova	$(B-V)_0^{15}$
1959 d	0.72
1968 l	0.52
1970 g	0.39
1979 c	0.27
1980 k	0.18
1983 k	-0.01:

TABLE IV. — *Rate of colour change of SNII at ΔT = 20 days.*

Supernova	d(B-V)/dT mag day^{-1}
1959 d	0.028
1968 l	0.017
1970 g	0.022
1979 c	0.015
1980 k	0.017
1983 k	0.013

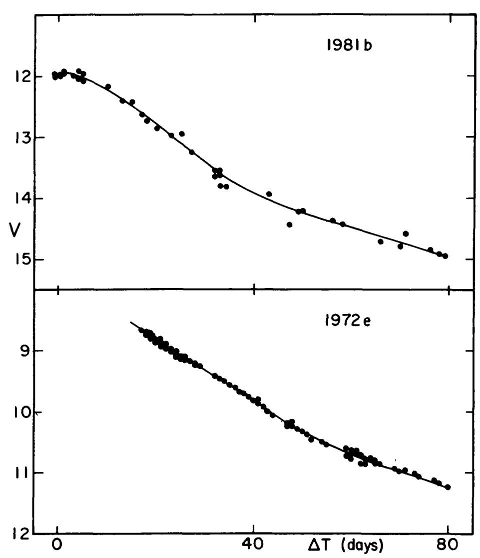

FIGURE 1. — Light curves of the type I supernovae 1972e and 1981b. Note the difference in the shape of the light curves near ΔT = 40 days.

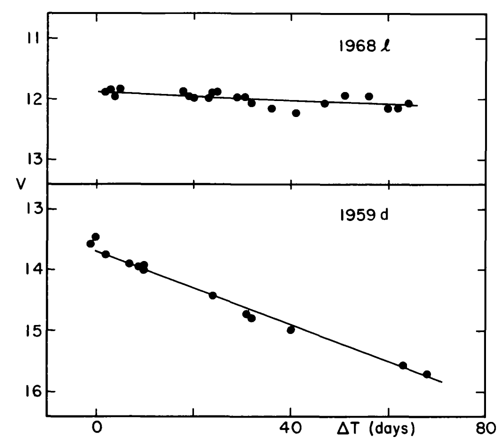

FIGURE 2. — Light curves of the type II supernovae 1959d and 1968l show clear-cut differences in their rates of decline.

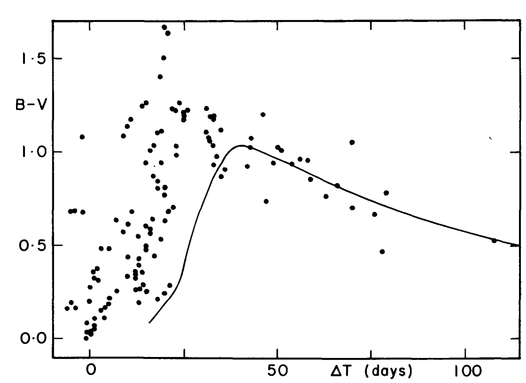

FIGURE 3. — Colour evolution of the well-observed bright supernova 1972e. Dots represent all other *B-V* observations (corrected for galactic foreground absorption) of SNI. The figure shows that SN 1972e forms an approximate lower envelope to the observations of all other SNI. None of the points in the figure refer to SNI in (dustless) ellipticals.

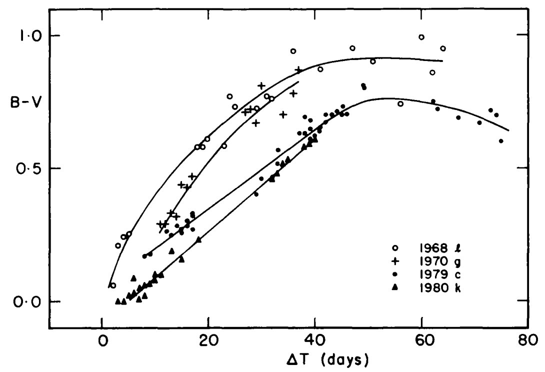

FIGURE 4. — Colour evolution of 4 supernovae of type II. The figure shows that individual supernovae exhibit small but real differences in their colour evolution.

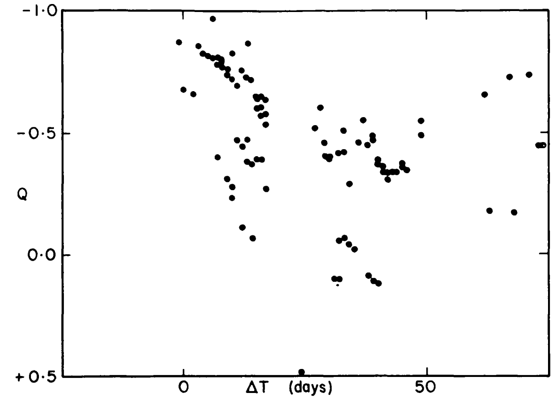

FIGURE 6. — Plot of the intrinsic colour index Q *versus* ΔT for all observations of SNII.

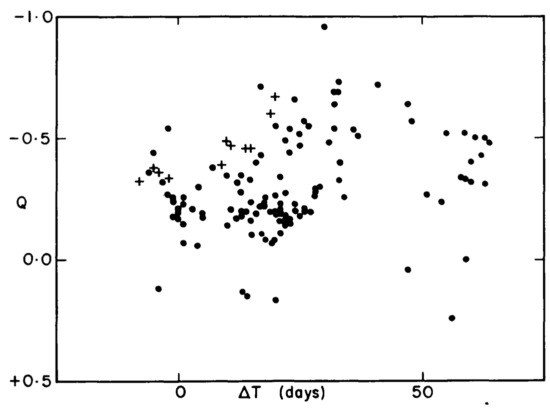

FIGURE 5. — Plot of the intrinsic colour index Q *versus* ΔT for all observations of SNI. Observations of SNIpec are shown as crosses.

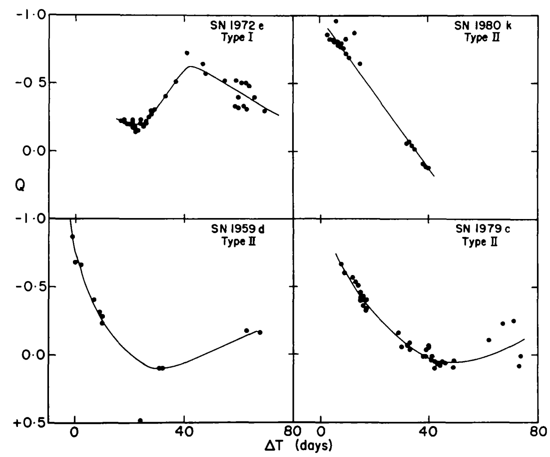

FIGURE 7. — Evolution of the intrinsic colour index Q with time for 4 well-observed supernovae. Note the marked systematic differences between SNI and SNII.