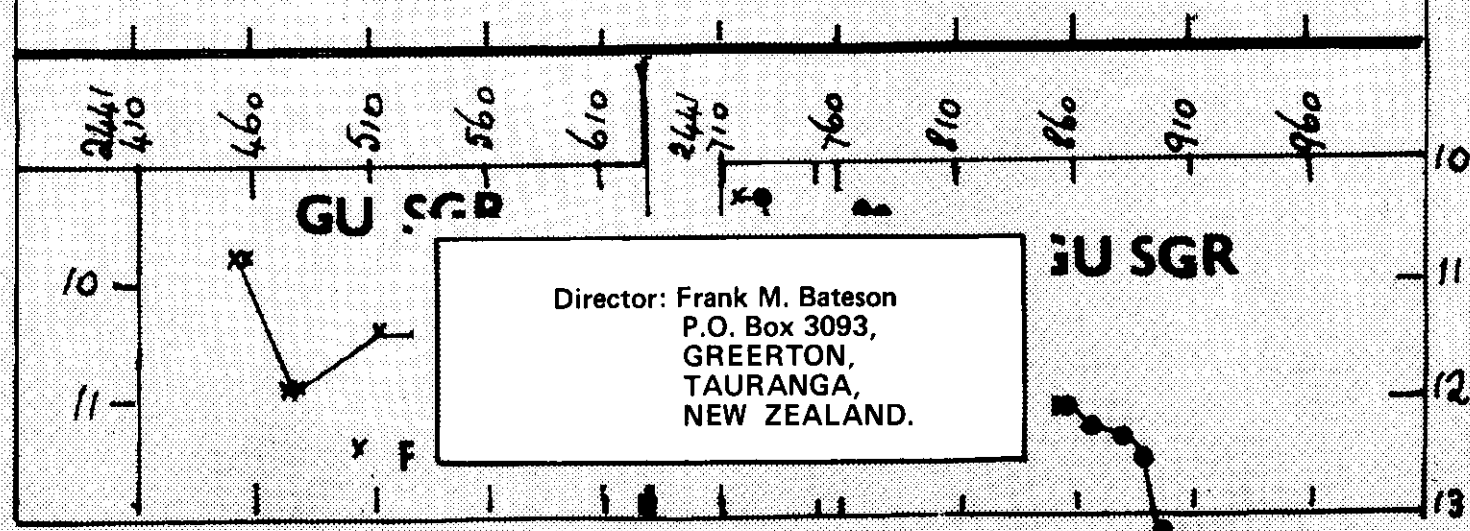


FIGURE 5

PUBLICATIONS of VARIABLE STAR SECTION, ROYAL ASTRONOMICAL SOCIETY OF NEW ZEALAND



PUBLICATIONS OF THE VARIABLE STAR SECTION, ROYAL ASTRONOMICAL SOCIETY OF NEW ZEALAND.

No. 12

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THE Z CAM TYPE VARIABLE, WW CETI---1978 - 1981.

Frank M. Bateson & A.W. Dodson
Variable Star Section, R.A.S.N.Z.

SUMMARY: A mean cycle of $29^d.3$ is derived from visual observations of WW Ceti from 1978 to 1981. Wide outbursts have a mean maximum magnitude of 11.1 and a width of $9^d.6$. Corresponding values for narrow maxima are $12^m.18$ and $4^d.68$ respectively. At standstills the star varies with amplitudes ranging from $0^m.5$ to $1^m.5$ over intervals of a few days. Light curves and a table of observed outbursts are presented.

.

1. INTRODUCTION

Visual observations from J.D. 2,440,066 to 2,443,722 were discussed by Bateson & Jones (1). Their paper gives details of charts and comparison stars. They divided outbursts into the following four types:-

- W1 = Wide. Width 7^d , or longer.
- W2 = Wide. Width 7^d , or more, but with a distinct pause of 4 days on the decline at $11^m.0$ following a rapid fall from a maximum brighter than normal.
- N = Narrow. Width less than 6 days.
- P = Minor peaks. Very short duration. Maximum magnitude fainter than for other types.

The present paper discusses observations from J.D. 2,443,722 to 2,444,971.

2. OBSERVATIONS

All observations were made visually by members of the V.S.S., R.A.S.N.Z. These are summarised in Table 1.

TABLE 1 - OBSERVERS' TOTALS.

JONES, A.F.	285	
MARINO, B.F.	53	
TAYLOR, N.W.	36	
HOVELL, S.	19	
WILLIAMS, P.	19	
SUMNER, B.	17	
10 observers with less than 10 obs. ea	<u>41</u>	TOTAL 470

It is difficult to monitor WW Ceti on a continuous basis because (a) there is a break of three months between observing seasons, and, (b) the position of WW Ceti is such that it is usually impossible to observe it for about 10 days during full moon.

The individual observations have been plotted in Figures 1a to 1d, each of which covers one observing season as shown below.

SEASON 1. 1978 August 3 to 1979 January 20 (J.D. 2,443,724 - 2,443,894)	=170 days
SEASON 2. 1979 May 30 to 1980 January 17 (2,444,024 - 2,444,256)	=232 days
SEASON 3. 1980 April 19 to 1981 January 8 (2,444,349 - 2,444,613)	=264 days
SEASON 4. 1981 April 24 to 1981 December 31 (2,444,719 - 2,444,970)	=251 days

Occasionally two observations were made at the same magnitude and time. These are plotted in the Figures as a single observation for the sake of clarity.

2.

The first day of each calendar month is shown along the top of each Figure, with the Julian Dates marked along the bottom at ten day intervals. The horizontal scale is 4mm = 2 days and the vertical one magnitude = 1cm.

3. DISCUSSION

There were only 44 observations during the first season. All were negative except for three in the range of $14^m.3$ to $14^m.5$. Figure 1a might suggest that the star was inactive in this season, but it is possible that outbursts occurred during the many gaps in the observations.

There was better coverage in the other three seasons although it was certainly not complete. In Season 2 there was a gap in the records at each Full Moon. This was generally for seven days centred on the full phase. Such gaps, in Seasons 3 and 4 usually occurred from 4 days before to 6 days after Full Moon.

The observed outbursts are listed in Table 2, which is a continuation of the table in the previous paper (1). It is impossible to state with certainty that any two outbursts were successive. The mean cycle from those maxima that seem likely to have been consecutive is $29^d.3$, which differs little from the $31^d.2$ found previously.

No maxima of type W2 were observed, possibly because the declines from the brighter maxima were poorly observed. One maximum is classified as type P, whilst the remainder, when they could be definitely assigned to a type, were either W1 or N. The mean maximum magnitude of type W1 was 11.1, and their mean width at $13^m.0$ was $9^d.6$. The corresponding values for type N were 12.18 and 4.68.

There is an indication that, during what is regarded as the standstill phase on the decline, WW Cet varies with amplitudes of from $0^m.5$ to $1^m.5$ in intervals of a few days (e.g. 070-090; 190-200). These intervals are too short to give firm conclusions.

No information can be given on the behaviour at minimum since the star is then well below the threshold of the instruments used. Nor are the observations frequent enough to provide any data on short term variations due to the orbital period.

4. CONCLUSIONS

It is impossible to monitor WW Cet continuously because of its position. Observations will always be fragmentary. The mean cycle, from those maxima that are possibly successive is $29^d.3$. Maxima are either wide with a mean magnitude at maximum of 11.1, or narrow with a mean maximum magnitude of 12.18. Their respective widths, at $13^m.0$, are $9^d.6$ and 4.68. Wide and narrow maxima do not alternate as sometimes wide maxima occur in pairs whilst at other times successive wide maxima are separated by several narrow maxima. The intervals between successive wide maxima differ widely.

ACKNOWLEDGEMENTS

We thank all observers for their observations, and especially A.F. Jones who contributed 60% of the results.

REFERENCE

(1) Bateson, F.M. & Jones, A.F. 1979. Publ. V.S.S., R.A.S.N.Z. 7 (C79).

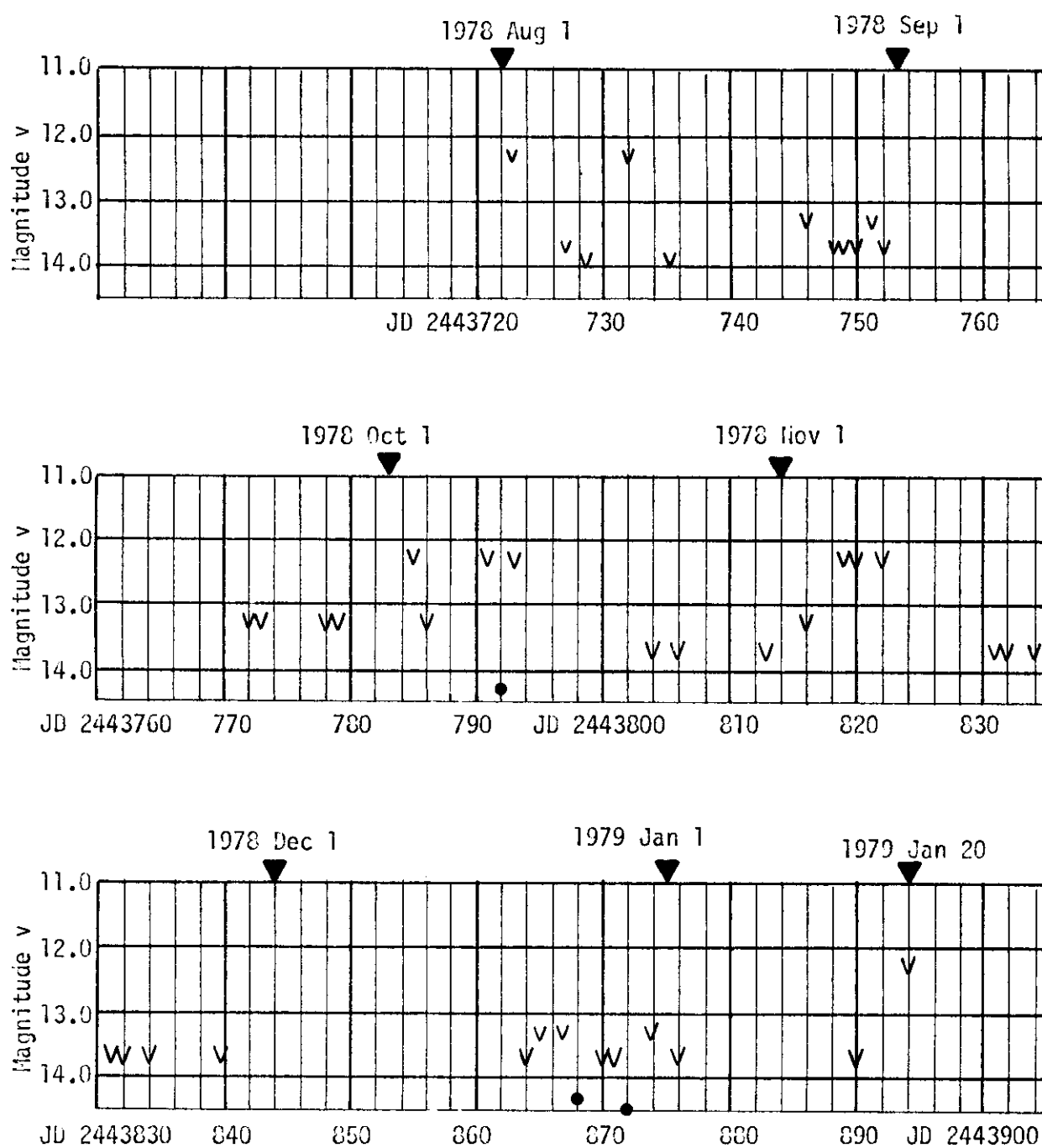


Figure 1a 000612 - WW CETI - LIGHT CURVE.
1978 - 1979

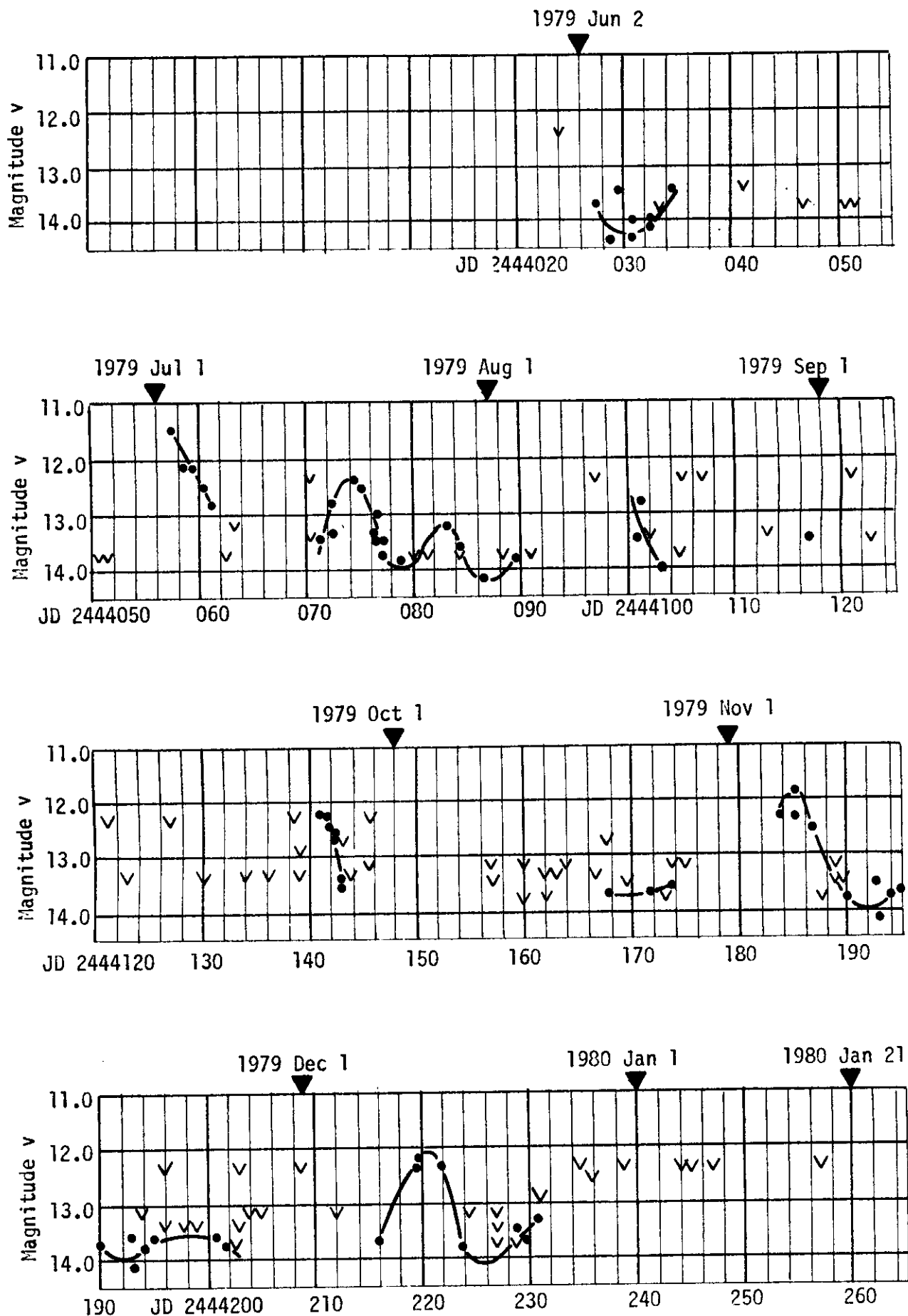


Figure 1b

000612

-

WW CET1
1979 - 1980

-

LIGHT CURVE.

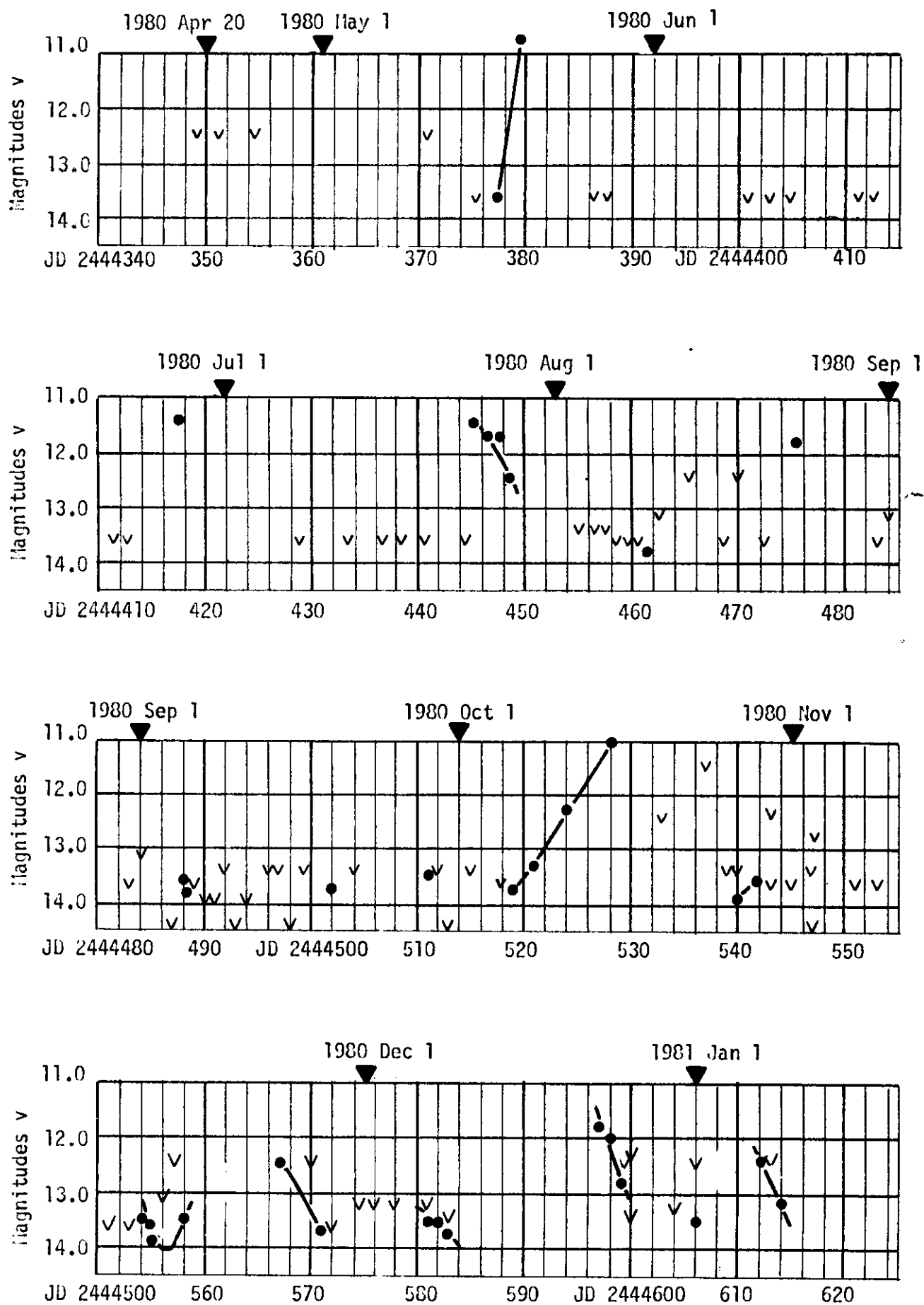


Figure 1c 000612 - WW CETI - LIGHT CURVE.
1980 - 1981

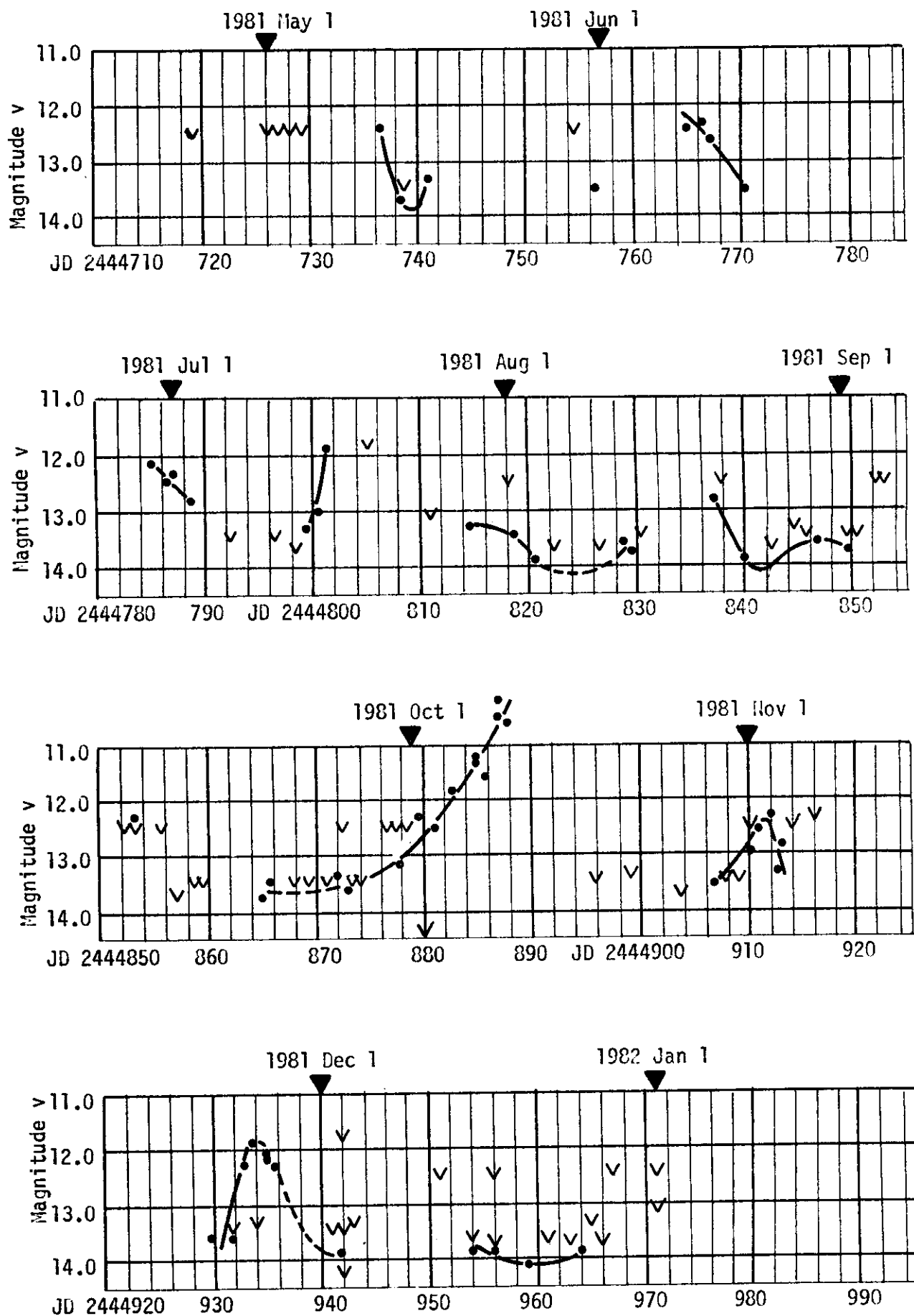


Figure 1d 000612 - WW CET1 - LIGHT CURVE.
1981 - 1982

TABLE 2.

OBSERVED OUTBURSTS OF WW CETI.

No.	TYPE	J.D.	m_v	INT	Z = 13 ^m .0		13 ^m .0	Z=12 ^m .0		12 ^m .0	No.
		MAXIMA 2,444,...			R	F	WIDTH	R	F	WIDTH	
				d			d			d	Obs.
39	W1	057.7	11.4	...	...	061.5	...	...	059.0	...	6
40	N	074.2	12.3	16.5	072.1	076.1	4.0	...	...	...	11
41	P	083.2	13.2	9.0	...	...	...	...	...	...	3
42	N?	100?	12.8?	16.8	...	100.7	...	...	...	...	3
43	N	140.9	12.2	40.9	...	142.5	...	...	...	...	9
44	W1	184.9	11.9	44.0	180	187	7	184	185.5	1.5	9
45	N	219.8	12.2	34.9	217.5	223.0	5.5	...	...	...	7
46	W1?	379.2	10.7	(159.4)	377.9	...	...	378.7	...	...	2
47	?	417?	11.3	37.8	...	...	...	...	...	...	1
48	N?	445.2	11.4	28.2	...	449.9	...	...	447.5	...	4
49	?	475?	11.7	29.8	...	...	...	...	...	...	1
50	W1	528.0	11.0	53	522	533?	11	525	532?	7?	5
51	W1	564?	11.6?	36	559	569	10	562?	566?	4?	6
52	?	597	11.8	33	...	600	...	...	598	...	3
53	N?	610?	12.0?	13	607	613.7	6.7	...	...	...	3
54	?	736	12.4?	(126)	...	737	...	...	...	...	3
55	W1	762	12.0?	26	758?	768.4	10.4	...	...	...	5
56	W1?	785?	12.1?	23	...	789	...	...	...	...	4
57	N?	801.2	11.9	16.2	800	...	...	...	...	...	3
58	N	834?	12.3?	32.8	831?	836.5	5.5	...	...	...	4
59	N?	853?	12.4?	19?	...	...	...	...	...	...	1
60	W1	887.2	10.1	34.2	878	...	...	883	...	...	12
61	N	912	12.3	24.8	909.5	912.7	3.2	...	...	...	6
62	N	934	11.9	22	931.8	937	5.2	933	935	2	8

N.B. Only positive observations are included in the last column, although negative observations have been used to help determine dates of maxima.

VISUAL OBSERVATIONS OF THE 1983 ECLIPSE OF BL TELESCOPII.

Peter F. Williams
Sutherland Astronomical Society, Sydney, Australia.

SUMMARY: Visual observations of the 1983 eclipse of BL Tel are presented. These suggest that mid-eclipse occurred about four days later than predicted.

.....

1. INTRODUCTION

Cousins (1) derived a period of 778.1 days from his observations of the 1953 and 1962 eclipses of BL Tel. Cousins & Lagerwey (2), when reporting on observations of the 1966 eclipse, stated that this eclipse occurred about three days earlier than expected. They pointed out that the superimposed intrinsic variations of the brighter star will cause small differences between eclipse curves. This will cause phase displacements that will affect the intervals between successive minima. Subsequent papers reported on the eclipses of 1968 (3): Gaposchkin (4) published a light curve from a study of Harvard plates from 1891-1953. He gave the period as 778.210 days.

My interest in BL Tel came from a note by I. Ferrin in IAU Circ. 3827. This interesting eclipsing system comprises a F8supergiant and an evolved M companion. Gaposchkin's elements predicted that the 1983 eclipse would commence on August 2 and end on October 19, with mid-eclipse on September 10, all dates being subject to some uncertainty. At maximum BL Tel has $V=7.0$ with minimum varying from cycle to cycle from $V=8.47$ to $V=9.29$.

2. COMPARISON STARS

Table 1 lists the comparison stars and the source for their V magnitudes.

3. OBSERVATIONS

All observations, except one, were made visually by the author using 10x50mm binoculars, while observations around minimum were made with a 15cm Newtonian reflector. A single observation was made by G. Hayward using a 20cm Schmidt-Cassegrain on 569.070.

The object of the observations was to attempt to determine the time of mid-eclipse. This made it unnecessary to correct the magnitudes of the comparison stars to the visual scale. The observations are plotted in Figure 1 using the tracing paper method described by Isles (5). It appears that minimum occurred on 1983 September 14 U.T. (J.D. 2,445,591.5). This is four days later than predicted from Gaposchkin (4) and 5.5 days later than Banachiewicz (6).

In Figure 1 bars, marked "i" and "e", represent the dates of beginning and end of eclipse according to Gaposchkin. The original observations are plotted as dots, whilst crosses show the plots by the tracing paper method.

4. DISCUSSION

The results of the observations indicate the following:-

Eclipse commenced	J.D. 2,445,563.0
Mid-eclipse	2,445,591.5
Eclipse ended	2,445,620.0
Visual magnitude at mid-eclipse	8.6.

These results must be treated with caution because the observations were made visually and are therefore not as precise as might be desirable; the observations are those from a single observer and there were few observations near minimum light.

The fact that mid-eclipse occurred later than predicted is not disturbing since from the remarks quoted earlier from (2) eclipses can be expected to be a few days earlier or later than predicted.

These results indicate that the next eclipse of BL Tel should occur about 1985 October 31 U.T. Visual observations, accurately timed and made with care, can determine the precise date of mid-eclipse provided there are sufficient observations. The magnitude even at the faintest minimum makes this system suitable for visual observers.

REFERENCES

- (1) Cousins, A.W.J. 1966. Mon. Notes astr. Soc. Sth. Afr. 25, 40.
- (2) Cousins, A.W.J. & Lagerwey, H.C. 1966. Mon. Notes astr. Soc. Sth. Afr. 25, 170.
- (3) Cousins, A.W.J. & Lagerwey, H.C. 1969. Mon. Notes astr. Soc. Sth. Afr. 28, 17.
- (4) Gaposchkin, S. 1970. Astr. J. 75, 641.
- (5) Isles, J.E. 1982. J. Br. astr. Assoc. 92, 76.
- (6) Banachiewicz, T. Roczn. astr. Obs., Krakow,

TABLE 1.

COMPARISON STARS FOR BL TELESCOPII

	RA	(1950)	DEC	V	B-V	SOURCE
176557	18h 59m 34s	-50° 23.3'		7.19	+1.46	2
176664	19 00 04	-51 05.5		5.93	+1.24	1
176756	19 00 26	-51 15.0		8.80	+1.31	1
177060	19 01 44	-51 07.1		9.23	+0.22	1
177101	19 02 13	-53 37.1		8.0	+1.0	3
177365	19 03 00	-50 24.2		6.31	-0.09	2
178710	19 08 22	-51 53.8		8.43	+0.48	1
178734	19 08 29	-51 53.4		7.05	+1.48	1
179034	19 09 41	-50 53.5		8.01	+0.46	1

- Source : 1 : Nicolet B. (1978) Astron. Astrophys. Suppl. 34, 1.
 2 : Hirshfeld A. et al. 1982. Sky Catalogue 2000.0, photoelectric photometry.
 3 : Hirshfeld A. et al. 1982. Sky Catalogue 2000.0, photographic photometry.

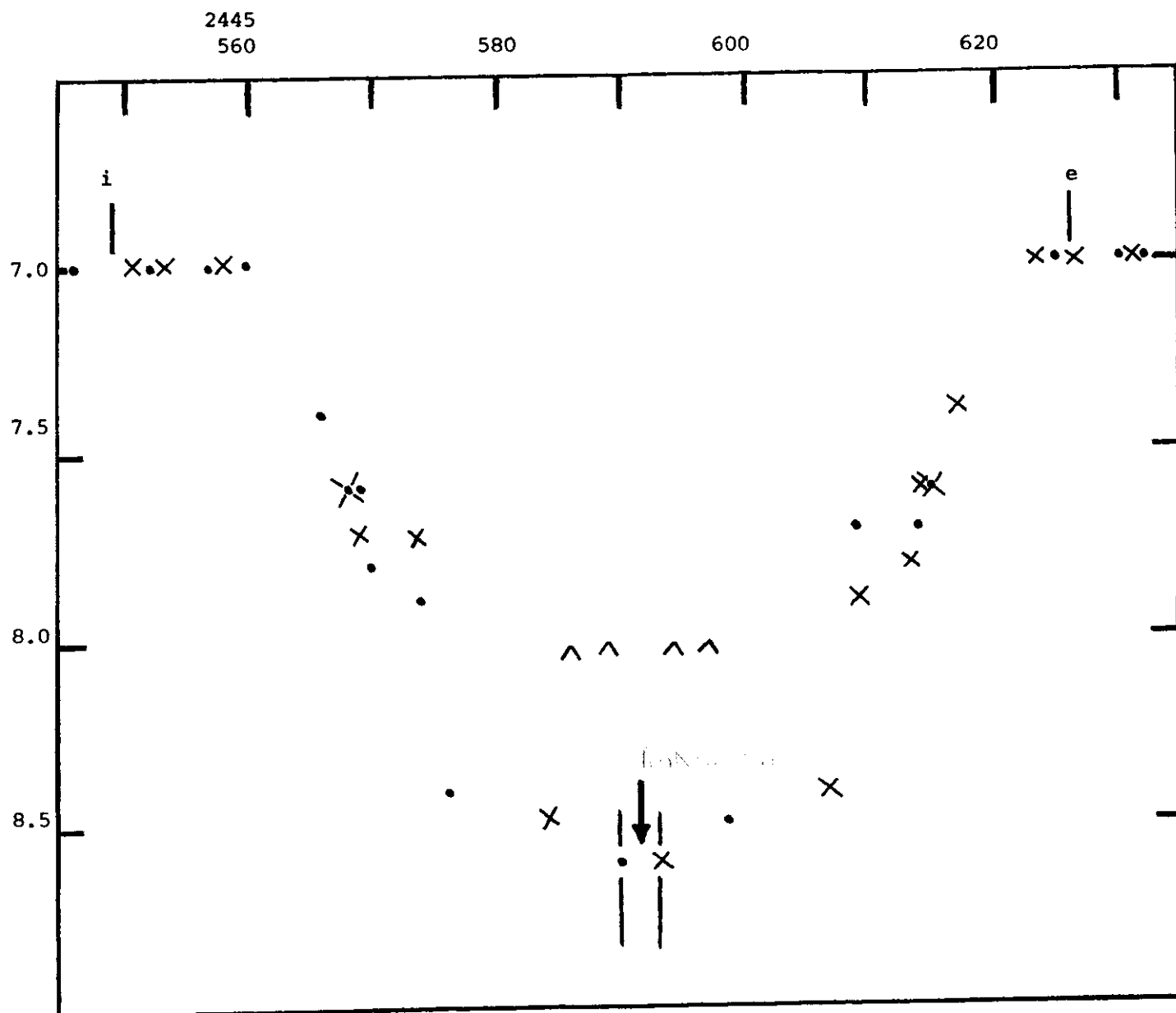


Figure 1. Light curve of the 1983 eclipse of BL Tel. Dots represent original plots; crosses show plots by tracing paper method. Tick marks "i" and "e" represent dates of eclipse beginning and end according to Gaposchkin.

TABLE 2.

VISUAL OBSERVATIONS OF BL TELESCOPII.

JD2445000+	MAGNITUDE (v)	JD2445000+	MAGNITUDE (v)
546.035	7.0	588.896	(8.0
551.968	7.0	589.927	8.6
556.875	7.0	596.917	(8.0
559.935	7.0	599.972	8.5
565.917	7.4	608.935	7.7
567.875	7.6	613.907	7.7
569.070	7.6	614.894	7.6
569.951	7.8	624.918	7.0
573.910	7.9	629.927	7.0
575.911	8.4	631.834	7.0

PROVISIONAL UBV SEQUENCE FOR TWO MIRA VARIABLES

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 P.O. Box 9, Observatory 7935
 South Africa

SUMMARY. Provisional photoelectric UBV data for 16 comparison stars in the field of the Mira variables, V and AC Antliae are given.

... ..

1. INTRODUCTION

Charts 618 and 619 (1) show the Mira variables, V and AC Antliae, which both lie within the same field. Comparison stars were identified on Chart 619 by letters. At the request of Dr. F.M. Bateson these sequence stars have been measured photoelectrically in the UBV system and the results are listed in Table 1..

2. OBSERVATIONS

The observations were mostly made with the 0.5m telescope of the South African Astronomical Observatory. All data was reduced to the standard system in the usual way. The results in Table 1 are provisional. It is not expected that any new data will change the provisional values by more than 0.^m01 to 0.^m02.

REFERENCE

- (1) Bateson, F.M., Morel, M & Sumner, B. 1982. Charts for Southern Variables, Series 14. Published by Astronomical Research Ltd., Tauranga, N.Z.

TABLE 1

<u>CHART LETTER</u>	<u>V</u>	<u>(B-V)</u>	<u>(U-B)</u>	<u>N</u>	
a	10.071	1.066	0.858	3	CoD - 33° 6891
b	10.490	0.314	0.088	5	CoD - 34° 6649
c	10.452	1.308	1.342	2	CoD - 34° 6628
d	10.721	0.774	0.356	3	CoD - 33° 6898
e	10.933	0.612	0.091	2	CoD - 34° 6622
f	11.550	0.621	0.070	2	CoD - 34° 6619
g	11.642	0.42	0.092	2	CoD - 34° 6629
h	11.616	0.472	0.03	2	CoD - 34° 6646
k	12.021	0.340	0.083	2	CoD - 34° 6653
l	11.955	0.989	0.74	2	CoD - 34° 6642
m	12.048	1.591	1.79	2	CoD - 34° 6644
o	12.685	0.618	0.106	2	
p	13.17	0.53	0.06	2	
q	13.43	0.73	0.25	2	
r	14.11	0.59	-0.01	1	
s	14.50	0.52	0.10:	1	

THE IRREGULAR VARIABLE BO CARINAE

Frank M. Bateson (1) & G. Stephanopoulos (2)

(1) Director, Variable Star Section, R.A.S.N.Z.

(2) Member, Variable Star Section, R.A.S.N.Z.

SUMMARY. A Light Curve of BO Car is presented covering 31 years of visual observations. It is shown that there was a brightening of half a magnitude over an interval of 1,500 days. Poorly expressed periods of 130 and 300 days are superimposed on a longer term change.

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1. INTRODUCTION.

BO Car (CPD -58°2683; CoD -58°3547; HD 93420) is an irregular variable, type Lc; spectrum M4lb; photographic range 9^m.3 to 10^m.4 (1). An eleventh magnitude companion, separation 10" has a B8III spectrum (1). S. Gaposchkin (2) stated, "The Harvard material has not provided any information concerning this star. It is too near to another star to be satisfactorily estimated."

2. CHARTS AND SEQUENCES.

G. De Vaucouleurs & O. Eggen (3) chart and sequence for Eta Car were used by visual observers to January 1, 1960. From February, 1960, charts 24 and 25 (4) were used. These showed the photo-visual sequence by Bok (5).

3. OBSERVATIONS

A total of 6,377 visual observations by members of the Variable Star Section, Royal Astronomical Society of New Zealand, are discussed. These cover the interval J.D. 2,434,205 (1952, July 10) to 2,445,448 (1983 April 23).

Observations have been grouped into ten day means shown in Figures 1 to 8. A cross is used to denote a mean from a single observation; a filled circle for means from 2, 3 or 4 observations and an open circle for means from 5, or more, observations. All plotted points have been connected in the figures, but a separate plot was used for the purpose of drawing a smooth curve through the points, having due regard to the reliability of each mean.

4. DISCUSSION

BO Car is a difficult object for visual observers, despite its brightness, because of the background of nebulosity and the contrast in colours between the variable and the comparison stars. The companion would not be separated in most of the instruments used.

Figures 9a and 9b are a plot from 100 day means. Means derived from 10, or fewer, observations are shown by crosses; means from 11 to 30 observations by a dot and means from more than 30 observations by an open circle. Most of the last group of means were derived from a large number of observations, ranging from 31 to 176 in a mean.

It appears from the 100 day means that are dependent on 30 or more observations that BO Car brightened by half a magnitude from J.D. 2,437,200 over the following 1,500 days. Thereafter the star varied from $7^m.11$ to $7^m.95$ without any strongly expressed period. Observations prior to 2,437,200 were limited but suggest that BO Car was oscillating around eighth magnitude. These early observations were mainly made by three observers and it could be that they showed a systematic tendency to estimate the variable slightly too faint. This has been tested by comparing their observations made at later epochs when a large number of observers were making estimates. It was found that the estimates of the original three observers were in good agreement with the other observers and no tendency was found indicating that their estimates were too faint. This implies that BO Car probably commenced to brighten earlier than 2,437,200.

The overall brightening is shown in Table 1, which shows the mean magnitude during each one thousand days.

TABLE 1.

MEAN VISUAL MAGNITUDES OF BO CARINAE FOR EACH 1000 DAYS.

<u>J.D. COMMENCING</u>	<u>MEAN</u> <u>M_v</u>	<u>No. of</u> <u>OBSERVATIONS.</u>	<u>NOTES</u>
2,434,200	7.92	156	1
2,435,000	7.77	86	
2,436,000	7.82	63	
2,437,000	7.94	384	
2,438,000	7.28	533	
2,439,000	7.36	763	
2,440,000	7.68	646	
2,441,000	7.55	585	
2,442,000	7.56	1120	
2,443,000	7.53	844	
2,444,000	7.42	961	2
2,445,000	7.47	226	

Notes

- (1) Covers 800 days.
- (2) Covers 400 days.

Following the brightening BO Car has over long intervals remained constant. However, variations over shorter intervals appear to occur with at times poorly expressed periods of 130 and 300 days. At other times any semblance of a period is absent.

5. CONCLUSIONS

We consider that BO Car is an irregular variable despite the presence of poorly expressed periods of around 130 and 300 days at times. It appears that the star did brighten slowly over an interval of 1,500 days since which it has varied in an irregular manner from M_v 7.11 to 7.94 with a mean brightness of 7.5. We stress that whilst the large number of observations has eliminated the systematic errors inherent in individual estimates, the difficulty of observing BO Car implies caution in any attempt to extract periods from the data.

We suggest that visual observers should now drop BO Car from their programmes.

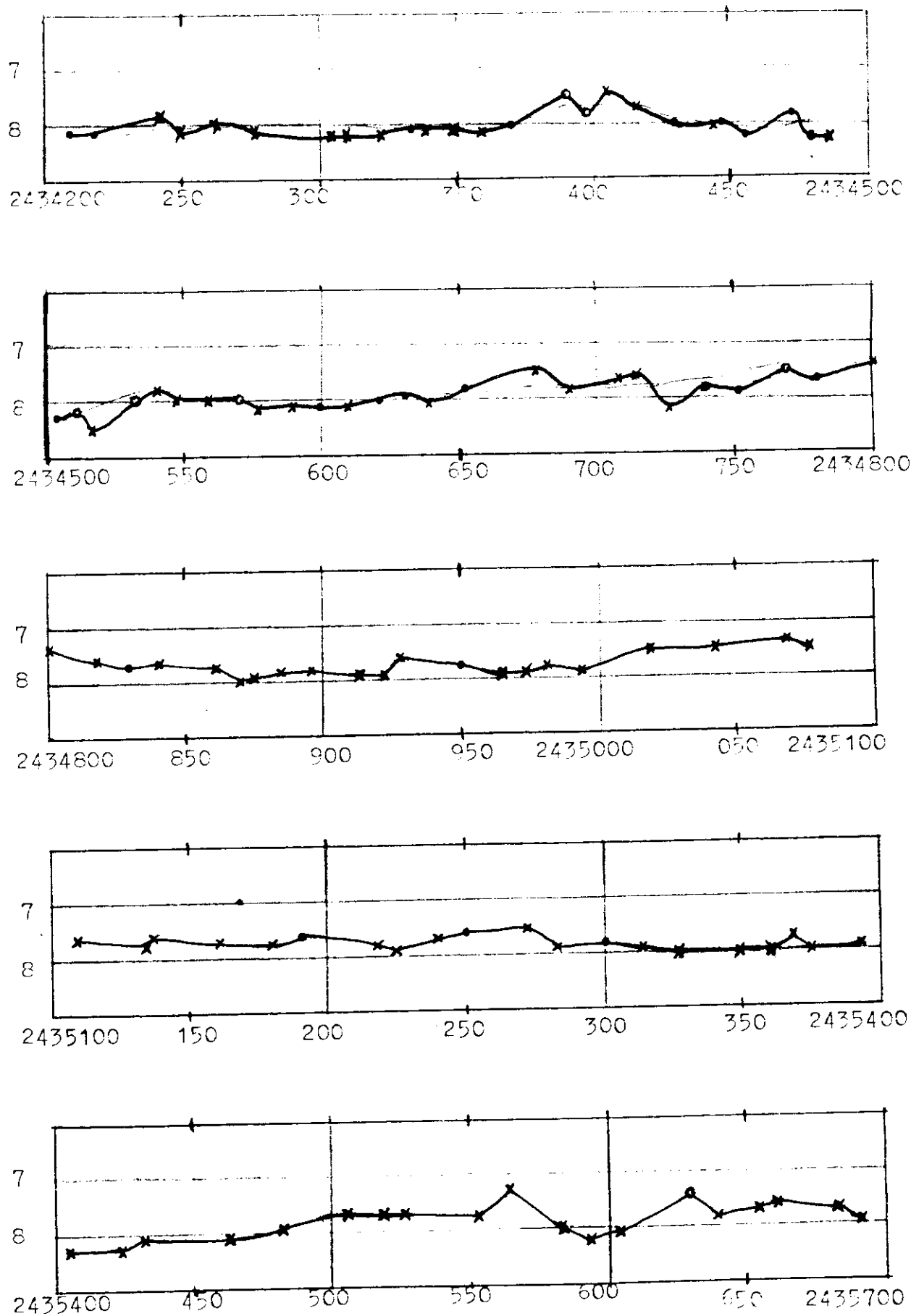


FIGURE 1. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS-2,434,200-2,435,700

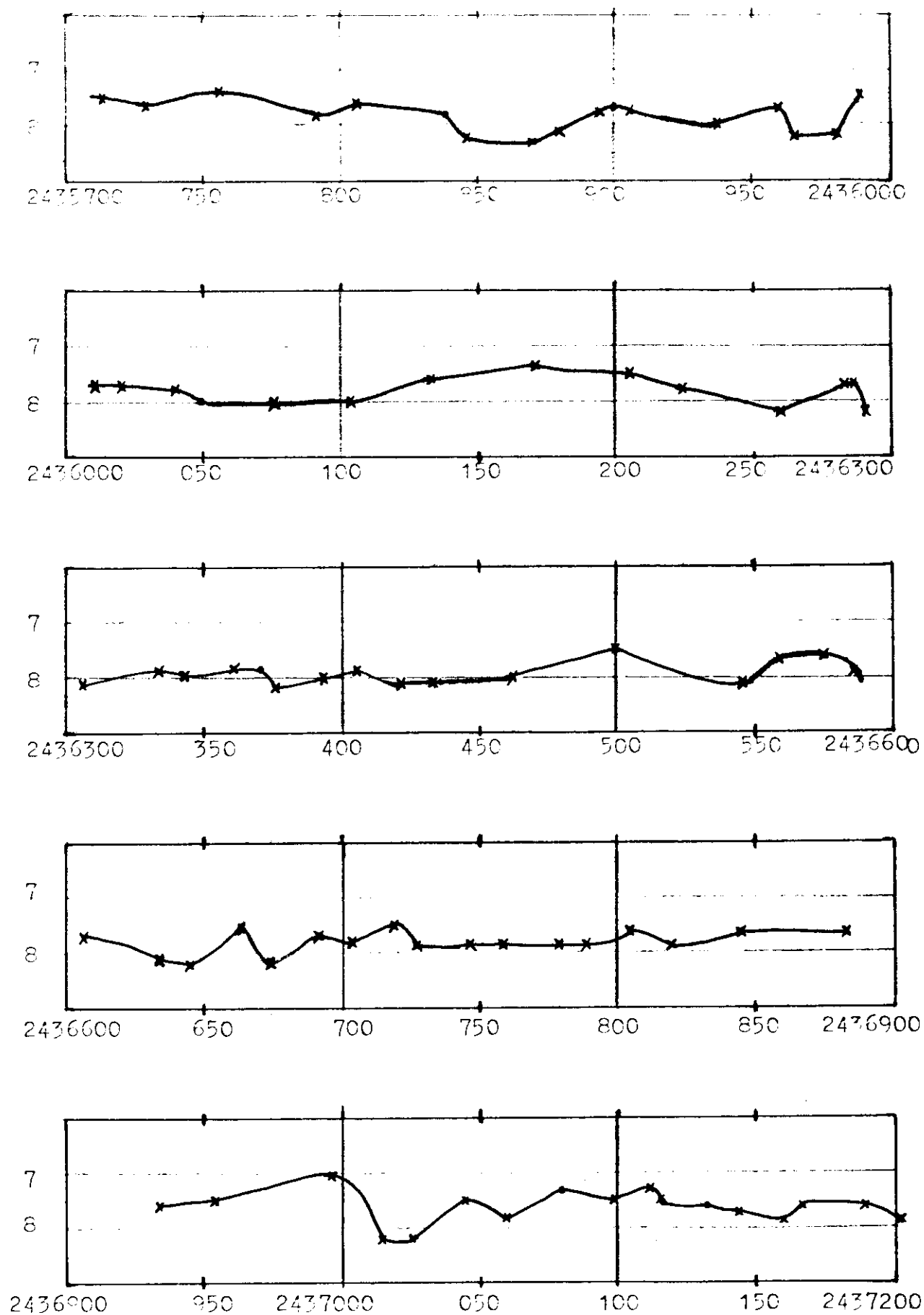


FIGURE 2.

LIGHT CURVE BO CARINAE FROM TEN DAY MEANS --2,435,700 - 2,437,200

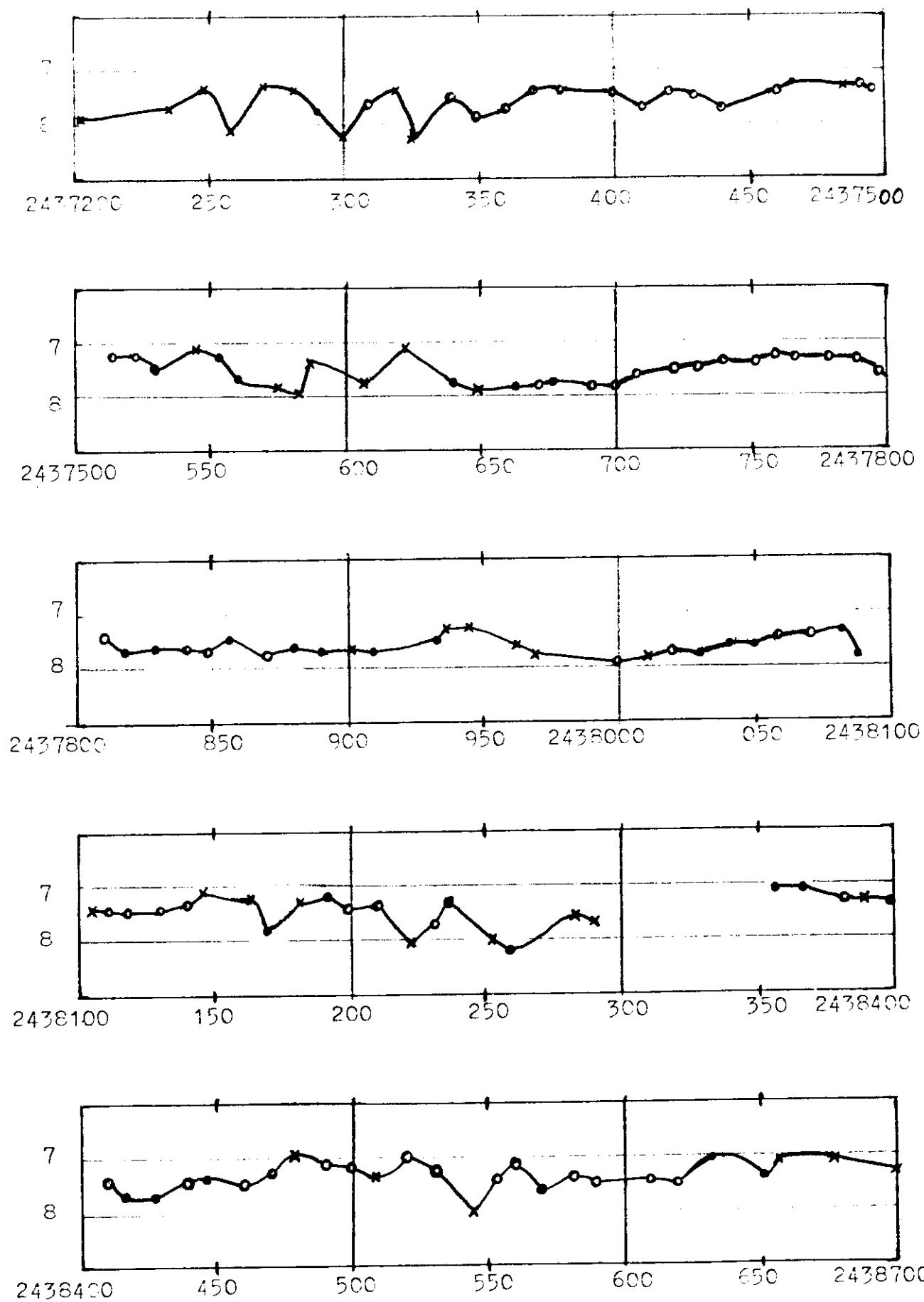


FIGURE 3. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS--2,437,200 - 2,438,700

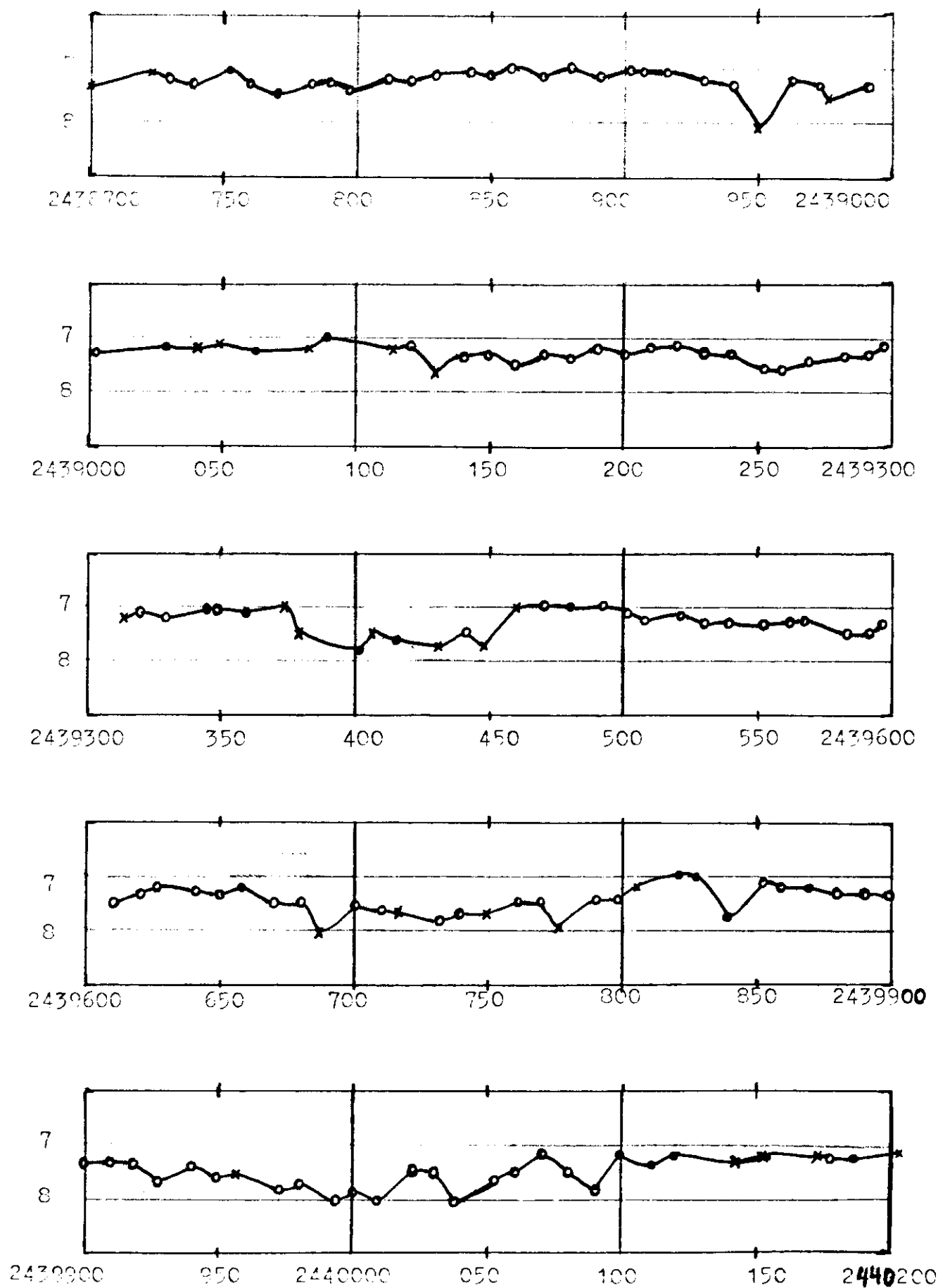


FIGURE 4. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS--2,438,700 - 2,440,200

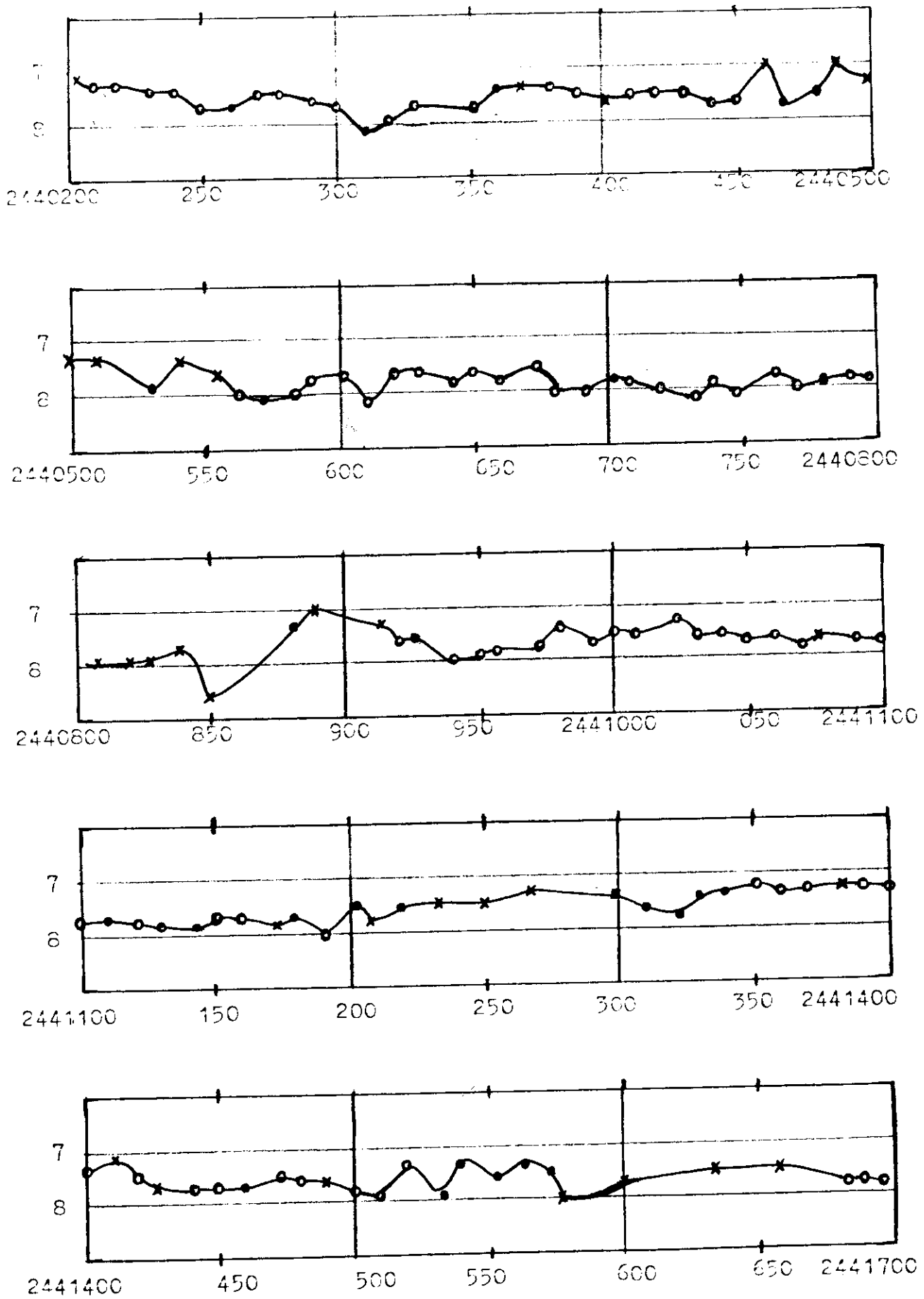


FIGURE 5. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS - 2,440,200 - 2,441,700

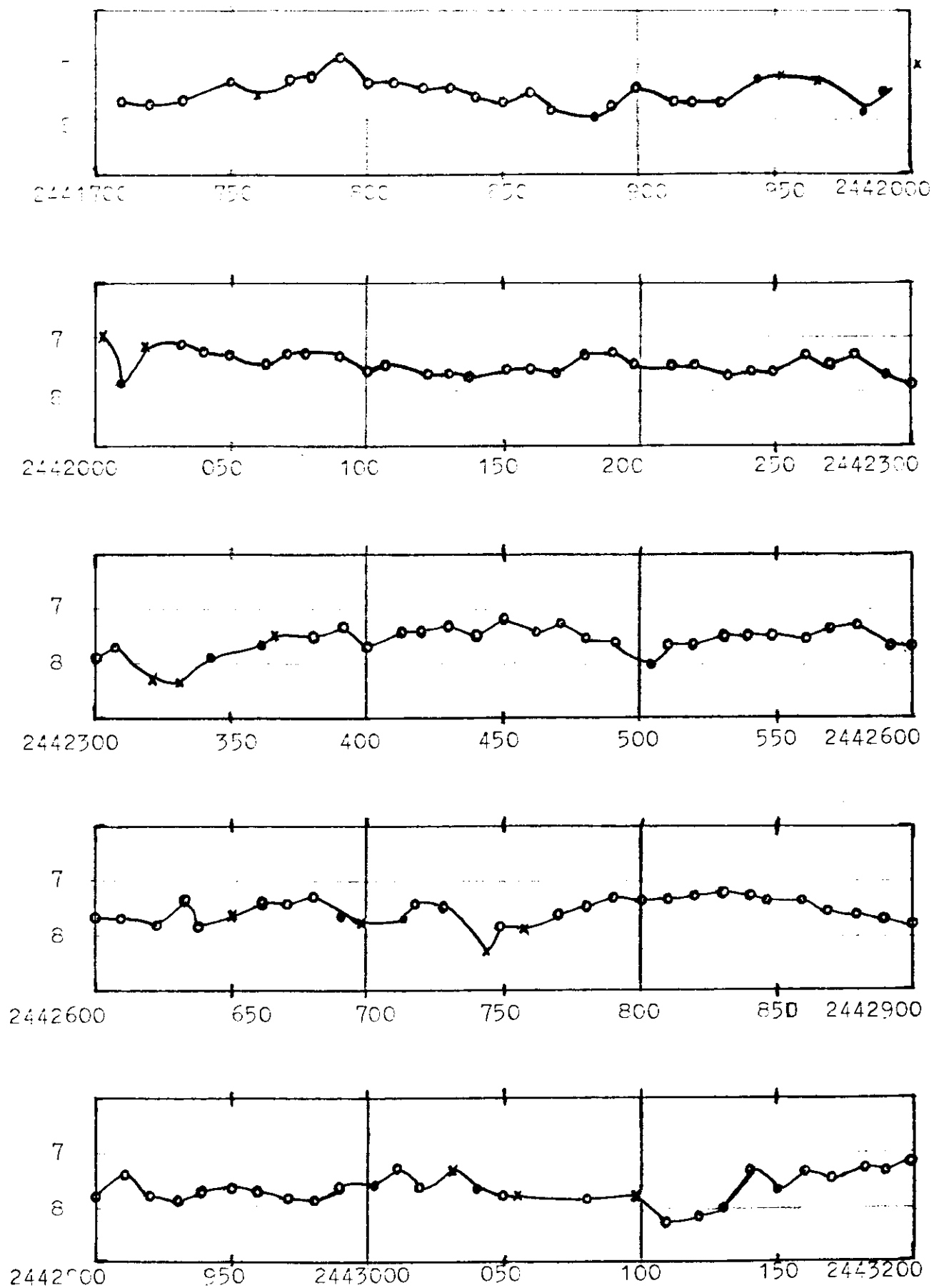


FIGURE 6. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS - 2441,700 - 2,443,200

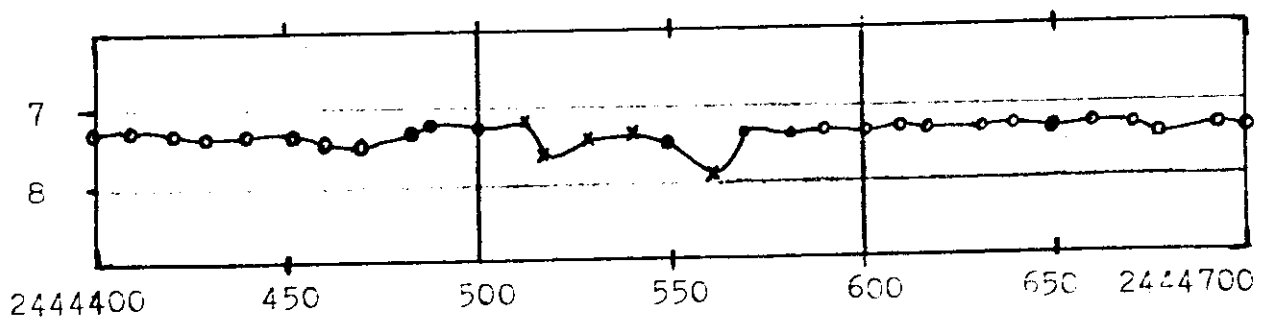
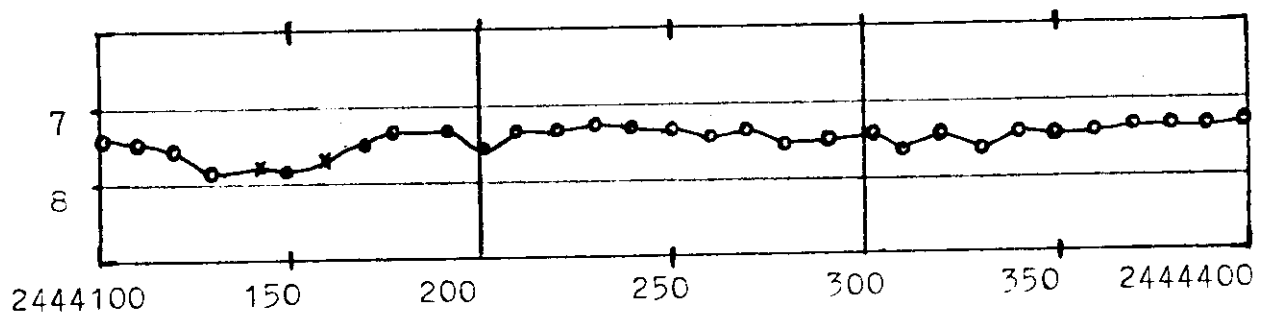
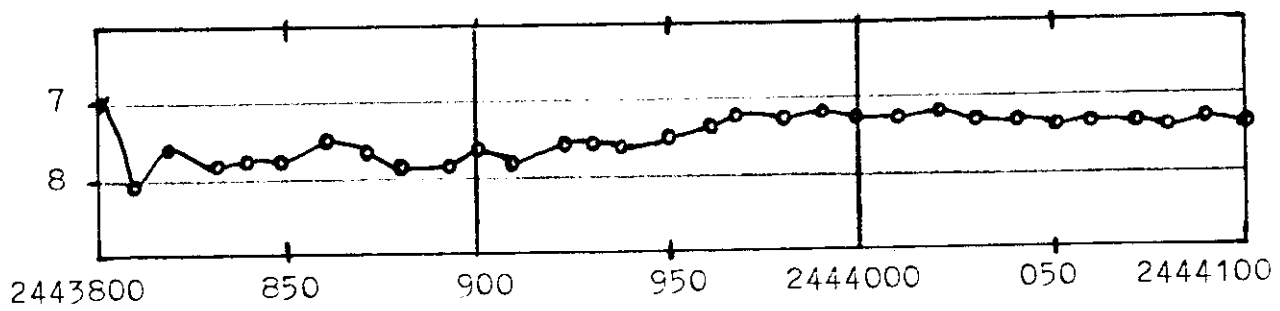
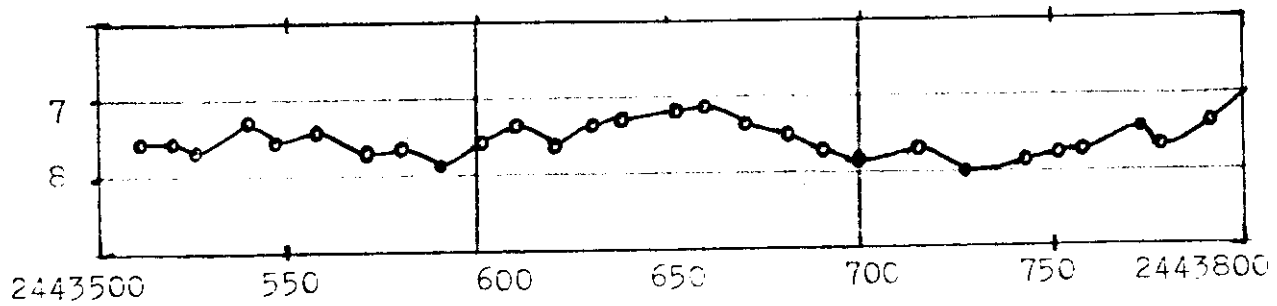
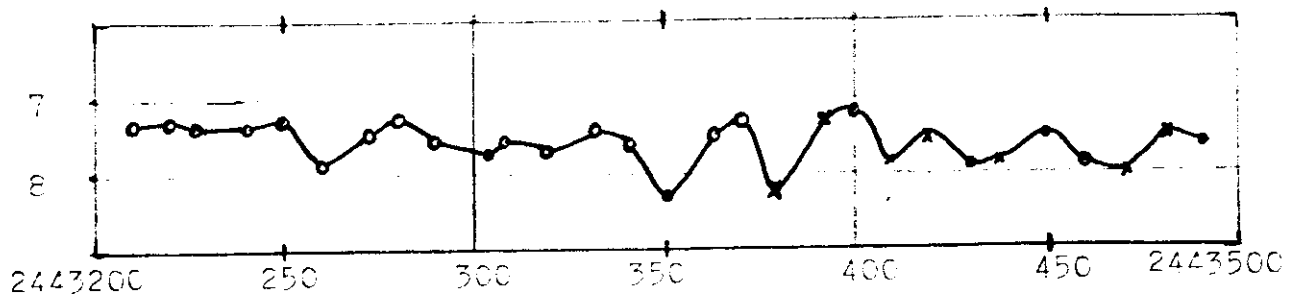


FIGURE 7. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS - 2,443,200 - 2,444,700

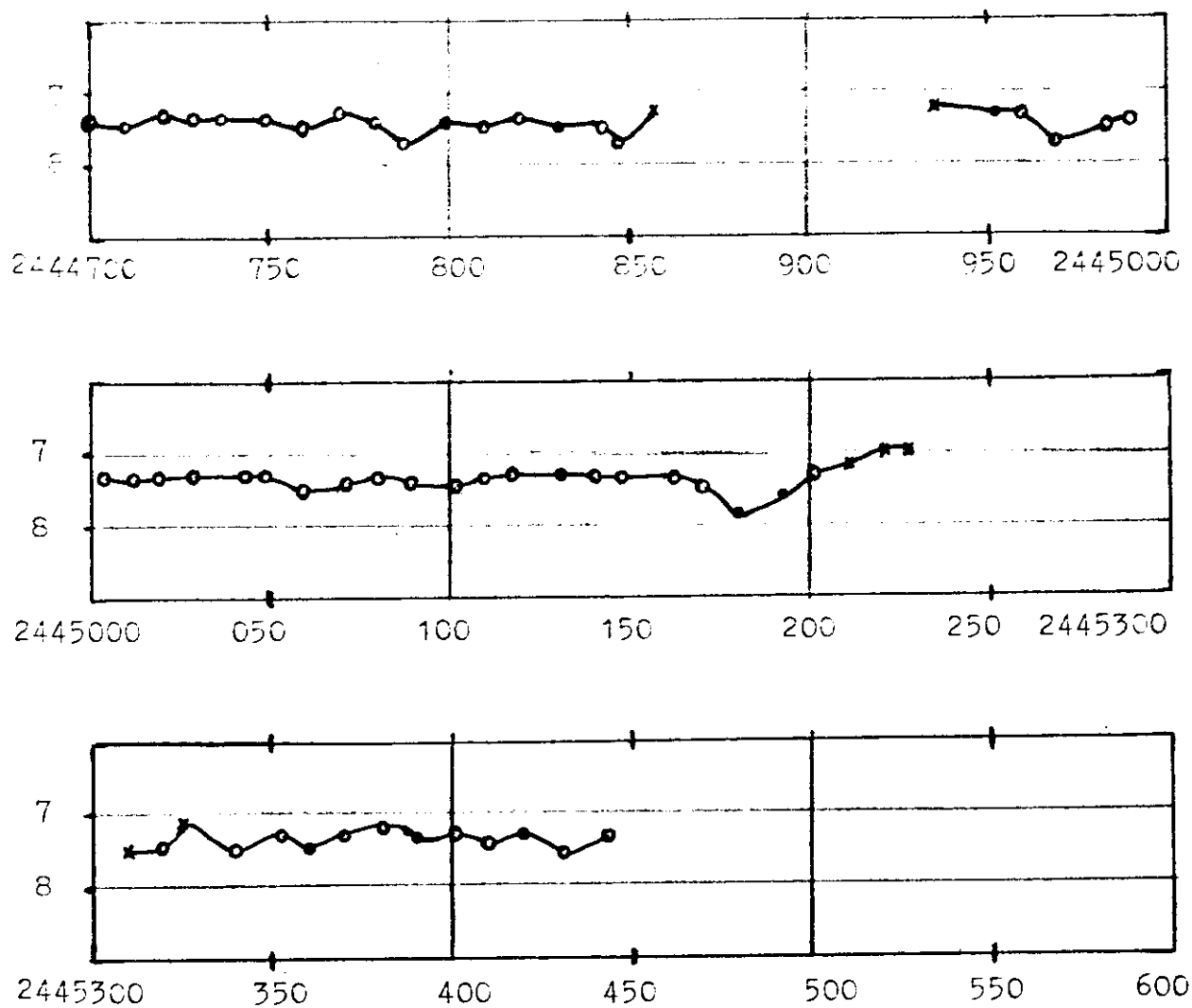


FIGURE 8. LIGHT CURVE BO CARINAE FROM TEN DAY MEANS - 2,444,700 - 2,445,450.

REFERENCES

- (1) Kukarkin, B.V., et al. 1974. 2nd Suppl. to 3rd ed. General Catalogue of Variable Stars, Nauka, Moscow.
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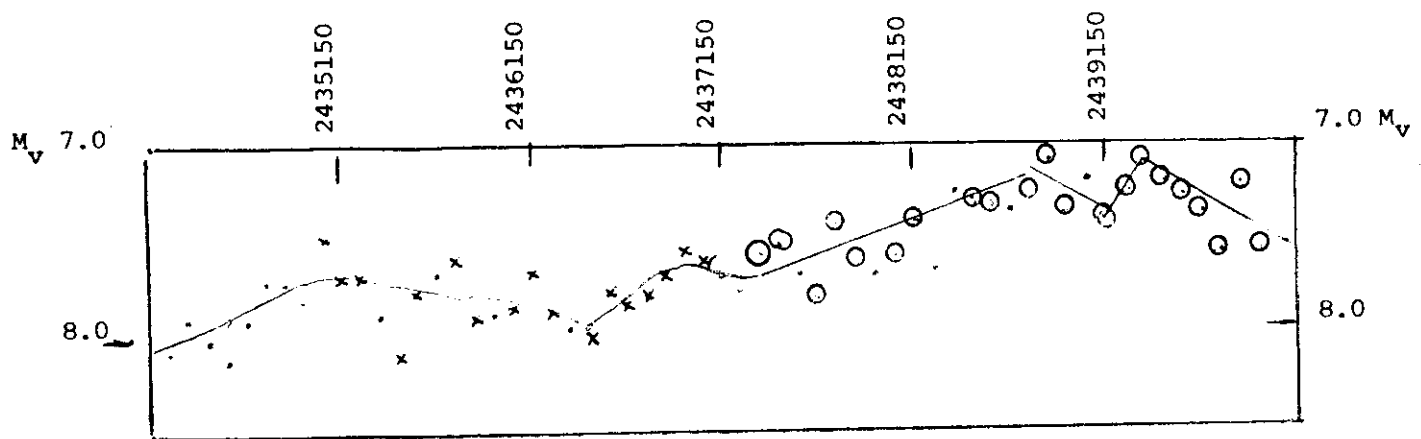


FIGURE 9a. BO CARINAE. 2,434,250 to 2,440,050.
Plot of 100 day means. See Text for explanation
of symbols.

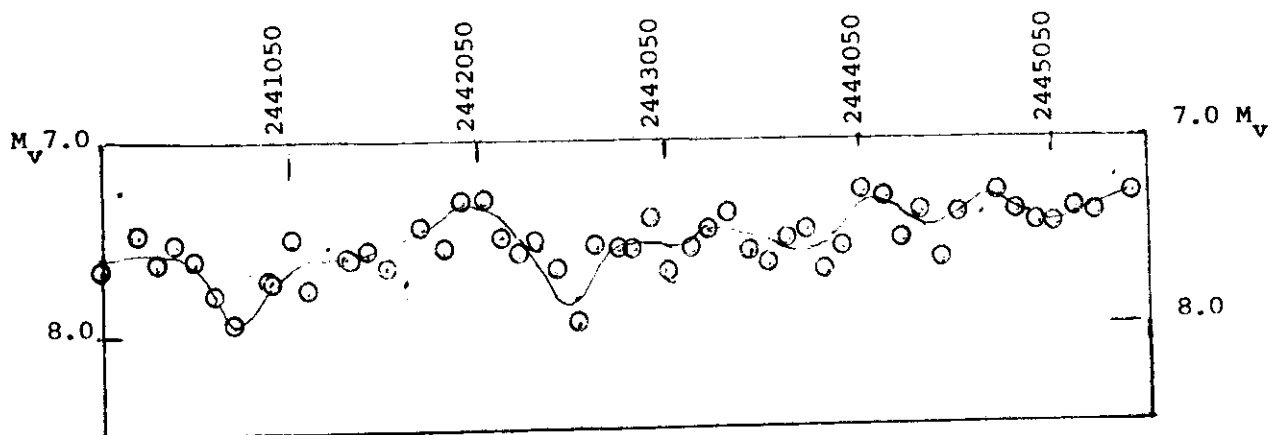


FIGURE 9b. BO CARINAE. 2,440,050 to 2,445,450.
Plot of 100 day means. See Text for explanation
of symbols.

NSV 01032

R.D. Winnett
Member Variable Star Section, R.A.S.N.Z.

SUMMARY : It is shown that NSV 01032 is a low amplitude variable with a visual range of 8.4 to 9.0. No period could be found.

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1. INTRODUCTION.

NSV 01032 (=CPD -59°251 =CoD -59°572 =HD 19298 = SAO 232980 =HV 11912 =CSV 272) was investigated by E.H. Boyce on Harvard plates (1). She gave the range as 10.3 - 11.3 ptg and tentatively classified it as a cluster type variable. She was unable to derive any period. The H.D. gives its spectral type as Ma.

2. CHARTS & SEQUENCE.

This suspected variable is shown on chart 92 for V and X Hor (2). The sequence stars shown on that chart had SP_v magnitudes (3).

3. OBSERVATIONS.

NSV 01032 was placed on the observing list of the Variable Star Section, R.A.S.N.Z. because of its spectral type and its proximity to other variables under observation. Between J.D. 2,439,654 (1967 Jun 12) and 2,444,249 (1980 January 9) a total of 718 visual observations were made by members of the V.S.S.

Table 1 shows the distribution for each year of the magnitudes recorded. These fall between the extremes 8.0 and 9.8.

4. DISCUSSION.

The observations were first grouped into ten day means and the means plotted. This made it obvious that there was no resemblance to a period. Next the estimates were grouped as in Table 1, which shows that 93.3% of the observations were between visual magnitude 8.4 to 9.0 with 80.9% falling between 8.5 and 8.8.

Individual observations were then taken and it was found that estimates brighter than 8.4 and fainter than 9.0 could be disregarded because either (a) they had been recorded by the less experienced observers whose systematic deviation was known to make their estimates too bright or too faint, or (b) the estimate had been classed as 2 or 3 by the observer concerned due to cloud, haze, bright moonlight or some other hindrance to observing conditions.

A plot of the remaining observations, on a large scale, suggested that there could be a short period variation of about one day. However, the evidence for this was not convincing because the small range was only slightly greater than the errors inherent in visual observation, and also because the observations when frequent were spaced a day apart.

5. CONCLUSIONS.-

Visually NSV 01032 is a low amplitude variable with an extreme range of 8.4 to 9.0. It appears to oscillate around a mean magnitude and such variations are only slightly greater than the probable errors of observation. No semblance of a period could be found. No definite evidence could be derived to show that this star is a short period variable. It is suggested that the star is not suitable for visual observers and should be dropped from their programmes.

ACKNOWLEDGEMENTS

I have to thank all observers for their estimates. My appreciation is also due to Frank M. Bateson for his assistance and advice.

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- (3). Jackson, J. & Stoy, R.H. 1958. Annals, Cape Observatory. XX.

MAG	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	TOT.
8.0		1													1
8.1	1	2					1			1					5
8.2		1													1
8.3		1	1	1							1				4
8.4	2	6	1	4	2	2	4	1			1				23
8.5	2	7	13	8	7	14	14	4	1	7	12	19	12	1	121
8.6	2	13	11	16	13	10	3	3	5	7	13	20	8		124
8.7	2	11	14	13	6	6	3	9	19	5	10	9	11		118
8.8	2	19	21	9	17	4	11	8	20	29	34	21	22	1	218
8.9		10	6	13	5	4			1	2					41
9.0		7	2	1	2	1		1	1	4	3	2	1		25
9.1		3		2	3					3					11
9.2		4	1	1	2				2		2				12
9.3		2	2	1				1		1					7
9.4		1			3										4
9.5	1											1			2
9.8												1			1
	12	88	72	69	60	41	36	27	49	59	76	73	54	2	718

TABLE 1 OBSERVATIONS OF NSV 01032 1967-1980, PER MAGNITUDE AND PER YEAR

SY PHOENICIS --- A LOW AMPLITUDE VARIABLE

Frank M. Bateson & C.W. Venimore
Variable Star Section, R.A.S.N.Z.

SUMMARY: Occasional visual observations of SY Phe from 1959 to 1981 have a mean range of 9.24 to 9.80. The observations are too widely scattered in time to provide any information on the suspected rapid variations.

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1. INTRODUCTION

Members of the Variable Star Section, R.A.S.N.Z., have observed SY Phe visually using chart 56(1) and the sequence of V magnitudes(2) thereon. The catalogued data on this star gives a range of 9.75 to 9.96V; spectrum F8 and type Isb? (3).

2. OBSERVATIONS

Table 1 shows that 239 observations were made from 1959 to 1981 with no observer making frequent estimates. Comparison stars were selected on the basis of those that had reliable published V magnitudes at the time the chart was published. This meant that the comparison stars were not well spaced around the variable but were all somewhat to the south of the variable. This has probably resulted in errors in estimates, especially by inexperienced observers.

TABLE 1.

SY PHOENICIS--OBSERVER'S TOTALS

JONES, A.F.	51	
CROMPTON, A.	32	
MATCHETT, V.L.	18	
MENZIES, B.	17	
ROWE, G.	15	
VENIMORE, C.W.	14	
HULL, O.R.	12	
20 observers with less than 10 observations each	<u>80</u>	TOTAL 239

Seventeen observations were rejected because either they were obvious errors in identification, or the observer classed his estimate as 2 or 3, due to cloud, haze, bright moonlight or other hindrance to seeing.

The remaining observations are summarised in Table 2 which shows for each year the number of estimates; the mean magnitude; the extreme range and comments where necessary.

Of the total individual estimates 213 (88%) fall within the range 8.8 to 9.8; five are 8.6 or brighter with the remainder fainter than 9.8.

TABLE 2.SY PHOENICIS--YEARLY SUMMARY OF OBSERVATIONS

<u>YEAR</u>	<u>No. Obs</u>	<u>MEAN M_v</u>	<u>RANGE</u>	<u>COMMENTS</u>
1959	1	9.2	9.2	
1960	-	-	-	
1961	2	9.50	9.3-9.7	
1962	11	9.40	9.2-9.6	
1963	12	9.28	9.0-9.6	
1964	6	9.25	9.1-9.5	
1965	13	9.24	8.6-10.1	Estimate at 8.6 doubtful.
1966	7	9.76	9.2-10.1	
1967	8	9.80	9.5-10.4	
1968	22	9.50	8.9-9.8	Estimates at 7.9 & 8.2 rejected both made by new observer
1969	14	9.69	9.1-10.1	
1970	38	9.61	9.3-9.8	Estimates at 10.9 and 11.6 rejected --obvious misidentifications.
1971	4	9.57	9.3-9.8	
1972	6	9.37	9.1-9.8	
1973	18	9.60	8.9-9.8	Estimates at 10.3 and 10.5 rejected both made by new observer
1974	12	9.64	9.3-9.8	Class 2 estimate at 10.5 rejected
1975	10	9.44	8.9-9.8	Four class 2 or 3 estimates all 7.9 to 8.8 rejected.
1976	8	9.37	9.0-9.8	
1977	6	9.25	8.9-9.6	Class 2 estimate at 10.4 rejected
1978	13	9.31	8.8-9.7	Four estimates by new observer at 10.3 rejected.
1979	5	9.46	8.9-9.8	Estimate at about 10½ rejected
1980	-	-	-	
1981	6	9.40	8.8-10.0	

3. DISCUSSION.

The observations are too widely scattered in time to prove, or disprove, any possible rapid variations. Table 2 shows that the yearly means range from 9.24 to 9.80. This small change in the mean magnitude is probably correct and caused by chance inasmuch as it depends on the phase at which the variable was observed. The only years in which one observer contributed most of the estimates were those up to 1966, when A.F. Jones recorded most of the estimates. In other years the observations were widely distributed amongst observers so that any systematic deviation of an individual observer did not affect the means because those who tend to estimate too bright by small amounts were offset by those with the opposite tendency.

4. CONCLUSIONS.

SY Phe is a low amplitude variable with a mean visual range of 9.24 to 9.80. No information can be obtained from the records on the possible rapid variations.

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A LIGHT CURVE OF S SCULPTORIS, A MIRA VARIABLE

Frank M. Bateson
Director, V.S.S., R.A.S.N.Z.

SUMMARY: A computer light curve from 39 years of visual observations of S Scl is reproduced. Tables of observed maxima and minima are presented. Various periods are discussed, and it is shown that a sudden change in period occurred .

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1. INTRODUCTION

It is proposed to present observations of Mira variables made by members of the Variable Star Section, Royal Astronomical Society of New Zealand, as computer light curves covering several decades. S Scl was chosen for the pilot scheme, because it had a limited number of observations. This made it easier to amend, if necessary, the programme before using it on those variables with many thousands of observations. The computer programme was written by Ranald McIntosh.

2. OBSERVATIONS

The observations discussed cover the interval J.D. 2,426,890 (1932 July 1) to 2,445,295 (1982 November 21). However, observations prior to 2,431,295 (1944 June 17) are omitted from the light curve, because they are limited in number and widely scattered in time. Observers who contributed results are shown in Table 1.

TABLE 1.

OBSERVERS.

JONES, A.F.	872	TAYLOR, N.W.	40	
JONES, M.V.	92	HULL, O.R.	33	
PHILPOTT, D.A.	91	PARKINSON, M.	29	
OVERBEEK, M.D.	78	MATCHETT, V.L.	27	
LUMLEY, E.	58	HARRIES-HARRIS, E.	24	
BATESON, F.M.	53	MASEYK, N.L.	24	
STEPHENSON, S.M.	40	MENZIES, B.	23	
		GILLER, R.H.	22	
		CROMPTON, A.	22	
42 observers with less than 20 observations ea.		297	TOTAL	1,825.

3. DISCUSSION

The points plotted in the light curve are ten day means. Crosses denote means from 4, or more, observations. Squares represent means with less than 4 observations.

The Julian Dates for maxima and minima found from the observations are listed in Tables 2 and 3. These were determined from both the light curve and from the individual observations since the plotted means are often dependent on single observations.

In the Tables a running number has been assigned to each maximum. The other columns then give the J.D., visual magnitude, the interval, in days, between consecutive maxima; M-m, in days, the interval from the preceding minimum; the differences between observed and calculated dates of maxima, in days, in accordance with the periods discussed below.

The same data is given for minima with the exception that the column, m-M, shows, in days, the interval from the preceding maximum.

The O-C values in Table 2 were derived from the following ephemeris:-

$$\text{J.D. (Max). } 2,434,739 + 366^{\text{d}}.2. \text{ M-m } 175^{\text{d}}.78 \text{ (48\%P).}$$

The above agrees with the values in (1). The mean O-C values for maxima are $+ 4^{\text{d}}.5$; for minima $+ 7^{\text{d}}.6$.

The period changed abruptly after J.D. 2,435,661. Sudden changes in periods of Mira variables are common.

The O-C values in Table 3 were derived from the following ephemeris:

$$\text{J.D. (Max) } 2, 437, 641 + 362^{\text{d}}.6. \text{ M-m } 165^{\text{d}}.3 \text{ (45.6\%P).}$$

The periods given elsewhere are: J.D. (Max) 2,440,530 $+ 365^{\text{d}}.57$ (2) and J.D. (Max) 2,442,343 $+ 365^{\text{d}}.32$ (3). Both give M-m as 48% of the period.

These do not appear to fit the dates in Table 3 as well as the period of $362^{\text{d}}.6$, although the period $365^{\text{d}}.32$ fits maxima 28 to 39 very well with mean O-C values of $+ 4.8$ but for maxima earlier than No. 28 the O-C values are much larger. The M-m value of 48% of the period appears to be well out for the minima shown in Table 3, even allowing for the fact that several minima are not well determined.

4. CONCLUSIONS

There was a sudden change in the period of S Scl after 2,435,661. It is shown that the observations in Tables 2 and 3 are best represented by different periods as given above. The interval M-m also appears to have changed.

The main objective of this programme of testing out the computer basis for light curves of Miras has been achieved.

ACKNOWLEDGMENTS

I wish to thank Dr. J.A. Mattei, AAVSO, for a copy of her computer programme. I am deeply indebted to Randal McIntosh for adopting the material from Dr. Mattei to our requirements and for writing the computer programme as well as providing the computer light curve for S Scl. My thanks are also due to the observers for their results.

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TABLE 2.

S Sc1--OBSERVED MAXIMA & MINIMA--PERIOD 366.^d₂.

No.	MAXIMA					MINIMA				
	J.D. Max. 24.....	MAX. M _v	INT. d	M-m d	O-C d	J.D. MINMIN. 24.....	MINMIN. M _v	INT d	m-M d	O-C d
1	31,439	6.7	...	...	-4	31,626	12.3	...	187	-8
2	797	6.5	358	171	-12	32,026	12.9	400	229	+26
3	32,177	6.9	380	151	+1	361	13.0	335	184	+5
4	552	6.5	375	191	+10	740	13.6	379	188	+8
5	899	7.2	347	159	-9	33,106	13.1	366	207	+8
6	33,275	6.5	376	169	+1	480	12.8	374	205	+15
7	636	6.6	361	156	-4	840	12.7	360	204	+9
8	999	6.6	363	159	-8	34,192	13.1	352	193	-5
9	34,371	6.9	372	179	-2	560	12.7	368	189	-3
10	740	6.6	369	180	+1	930	13.0	370	190	+1
11	35,104	7.0	364	174	-1	35,294	13.3	364	190	-2
12	470	6.4	366	176	-1	661	12.9	367	191	-1

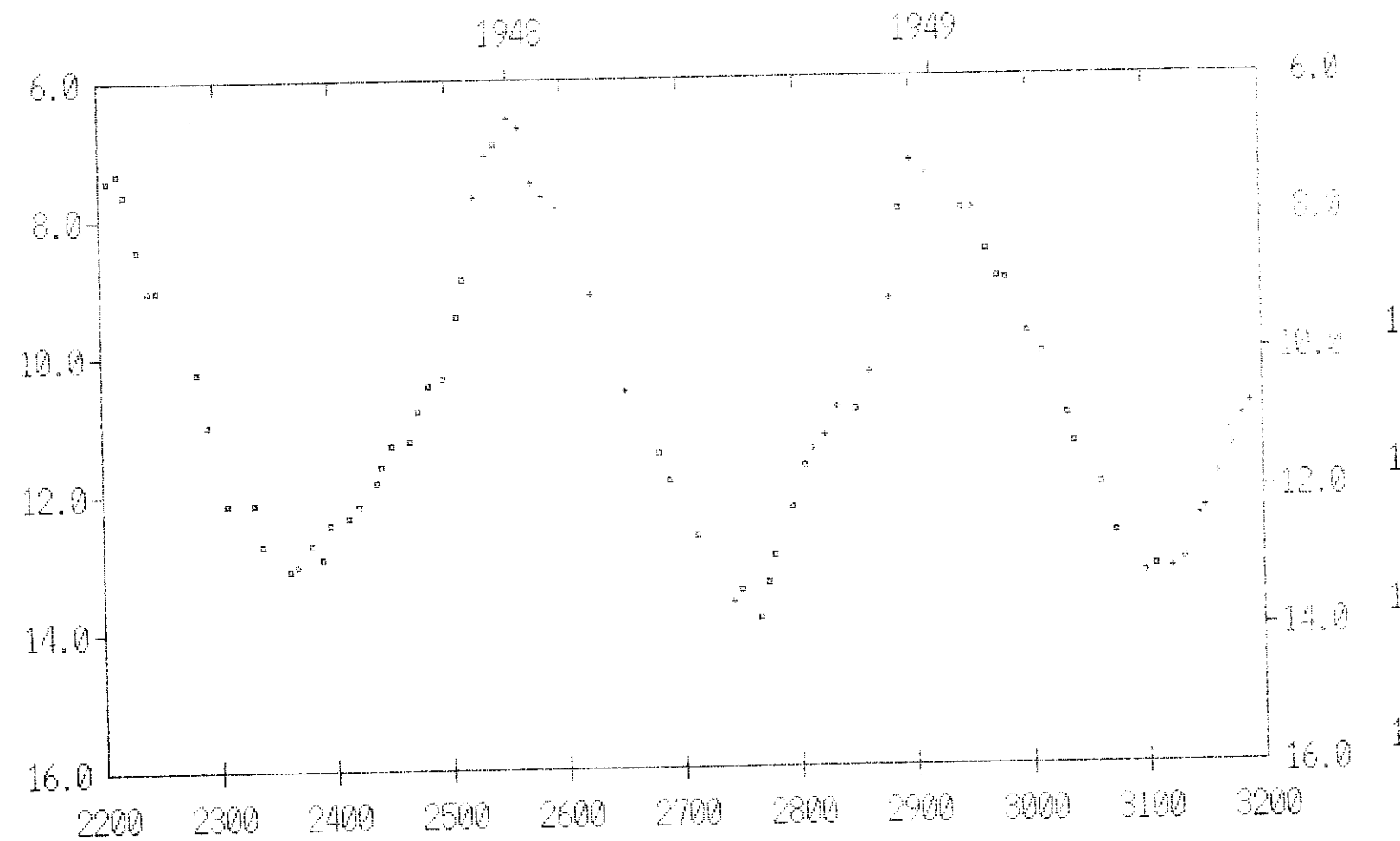
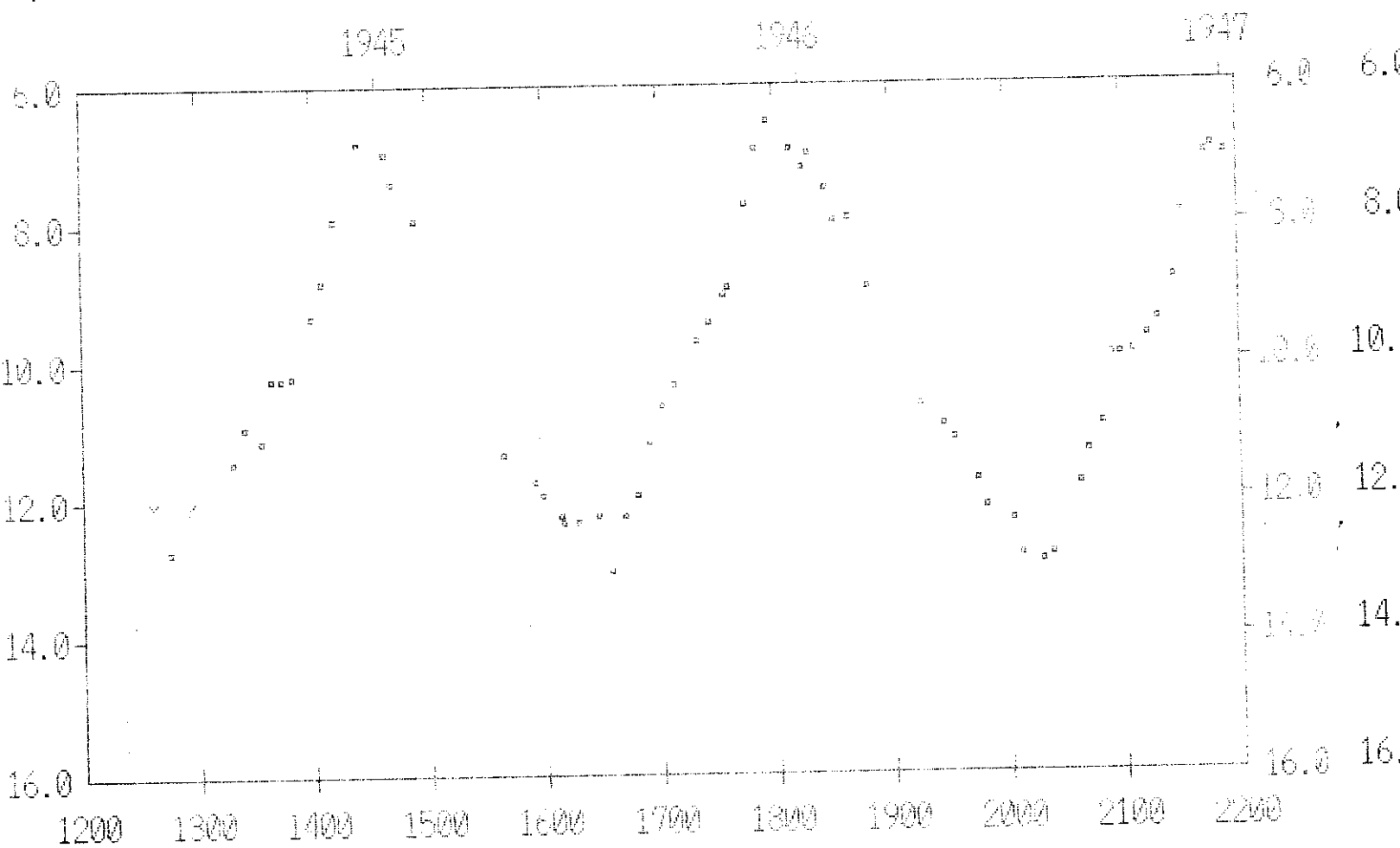
TABLE 3.

S Sc1--OBSERVED MAXIMA & MINIMA--PERIOD 362.^d₆

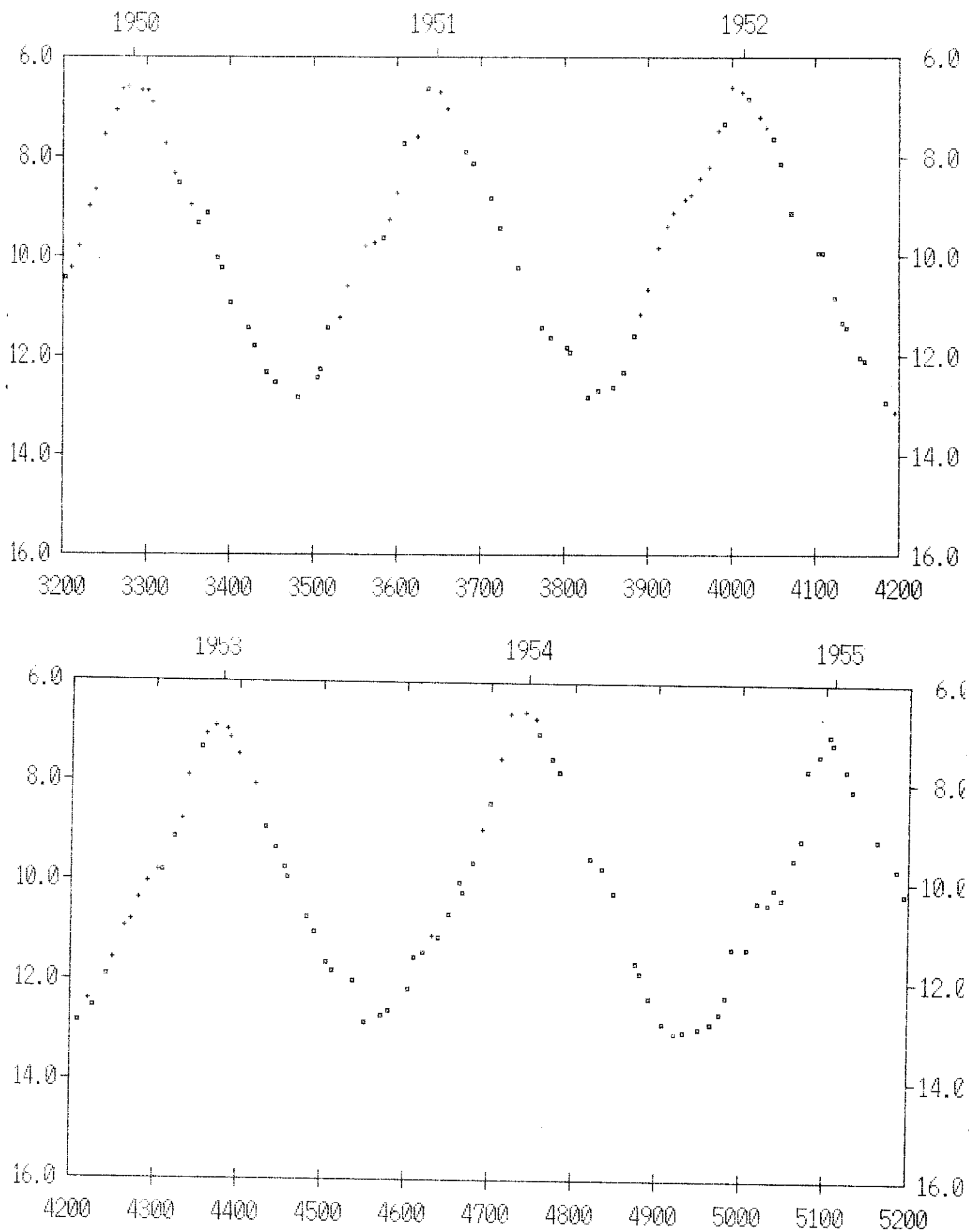
No.	MAXIMA					MINIMA				
	J.D. MAX. 24.....	MAX. M _v	INT. d	M-m d	O-C d	J.D. MIN.MIN 24.....	MIN.MIN M _v	INT d	m-M d	O-C d
13	35,819	6.2	349	158	-9	36,025	13.3	364	206	+0
14	36,184	6.5	365	159	-7	385	13.2	360	201	-3
15	572	7.1	388	187	+19	751	12.8	366	179	+0
16	919	6.4	347	168	+3	37,110	12.6	359	191	-3
17	37,279	7.0	360	169	+1	474	12.8	364	195	-2
18	641	6.4	362	167	+0	834	13.2	360	193	-4
19	38,000	6.9	359	166	-4	38,202	13.6	368	202	+1
20	382	7.7	382	180	+16	563	12.7	361	181	-1
21	732	6.5	350	169	+3	930	13.2	367	198	+4
22	39,090	6.8	358	160	-1	39,265	12.7	335	175	-24
23	446	6.2	356	181	-8	646	13.7	381	200	-5
24	811	8.0	365	165	-6	998	13.8	352	187	-16
25	40,177	6.7	366	179	-2	40,355?	13.6?	357?	178?	-22
26	530	7.6	353	175?	-12	747	13.0	392?	217	+8
27	890	7.0	360	143	-14	41,110?	?	363?	220?	+8
28	41,250	6.7	360	140?	-17	480?	?	370?	230?	+16
29	610	6.9	360	130?	-20	822	13.0	342?	212	-5
30	977	7.2	367	155	-15	42,193	12.8	371	216	+3
31	42,343	6.0	366	150	-12	559	13.0	366	216	+7
32	713	7.0	370	154	-4	930?	12.5?	371?	217?	+15?
33	43,079	6.9	366	149?	-1	43,250?	?	320?	171?	-27?
34	455	7.5	376	205?	+12	?	?	?	?	?
35	808	6.5	353	?	+3	44,020	13.0	?	212	+17
36	44,170	6.4	362	150	+2	372?	?	352?	202?	+7?
37	542	6.8	372	170	+12	734	12.9	362	192	+6
38	907	6.9	365	173	+14	45,109	12.5	375	202	+19
39	45,261	6.1	354	152	+5					

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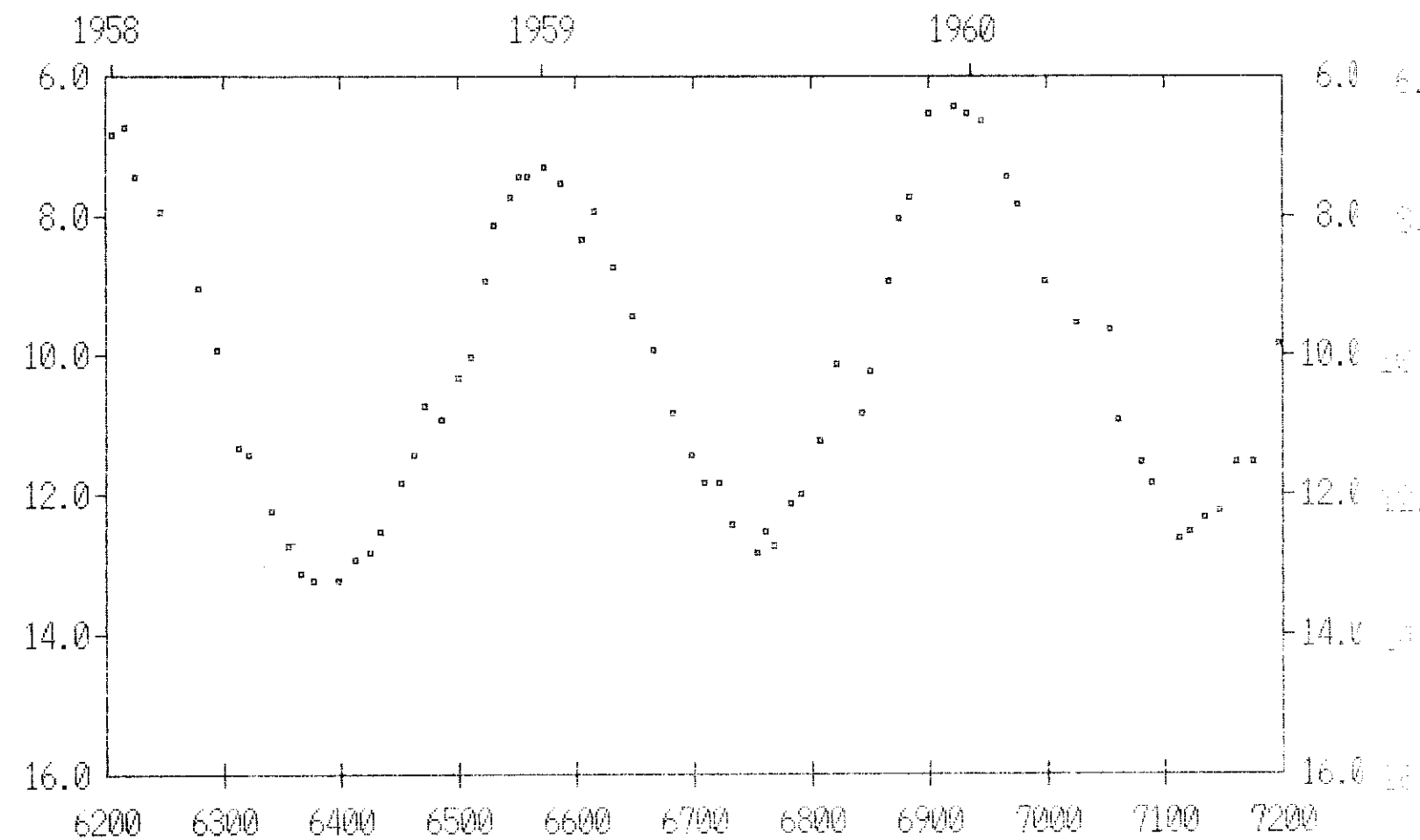
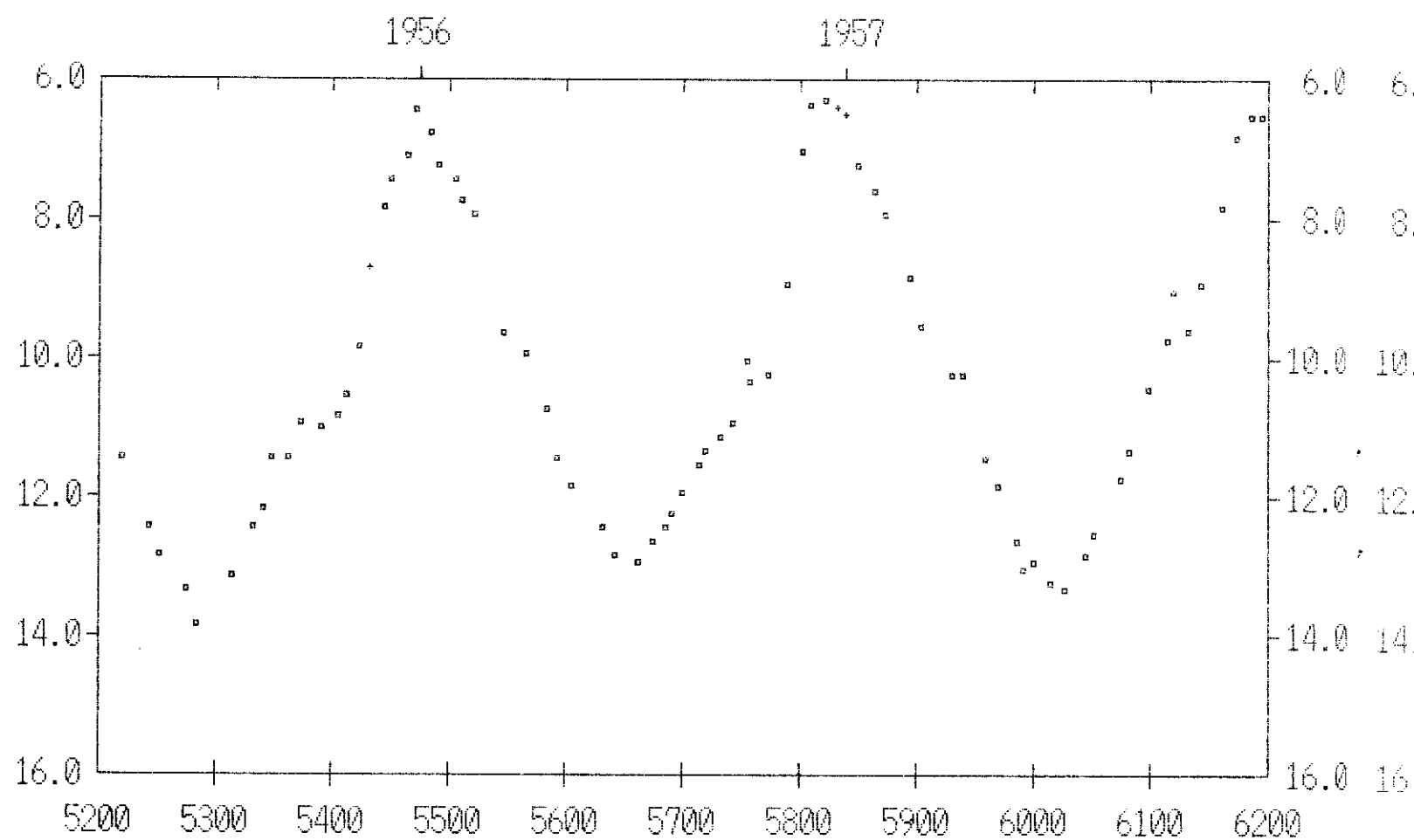
S Sc1--LIGHT CURVE--2,431,200 to 2,433,200



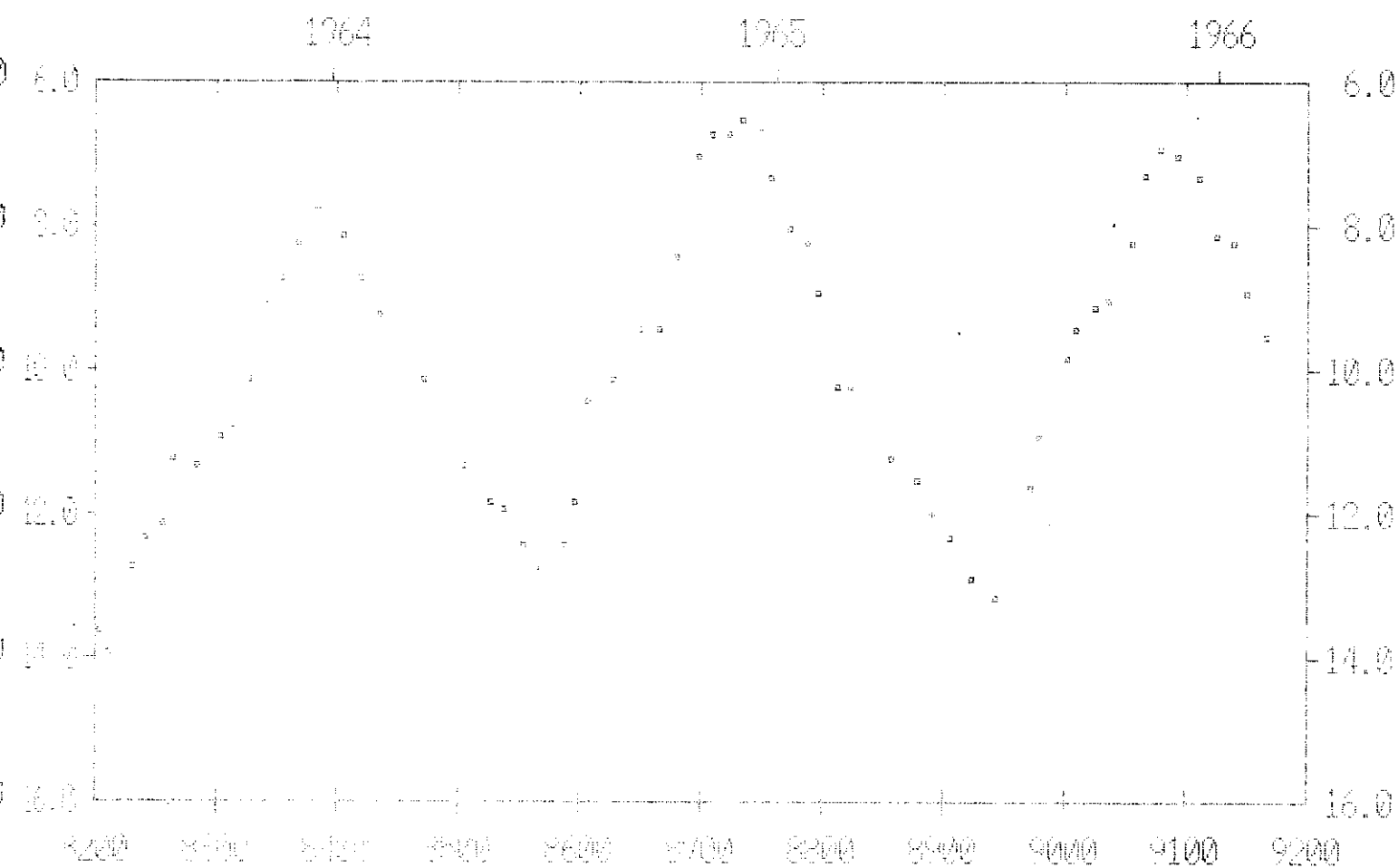
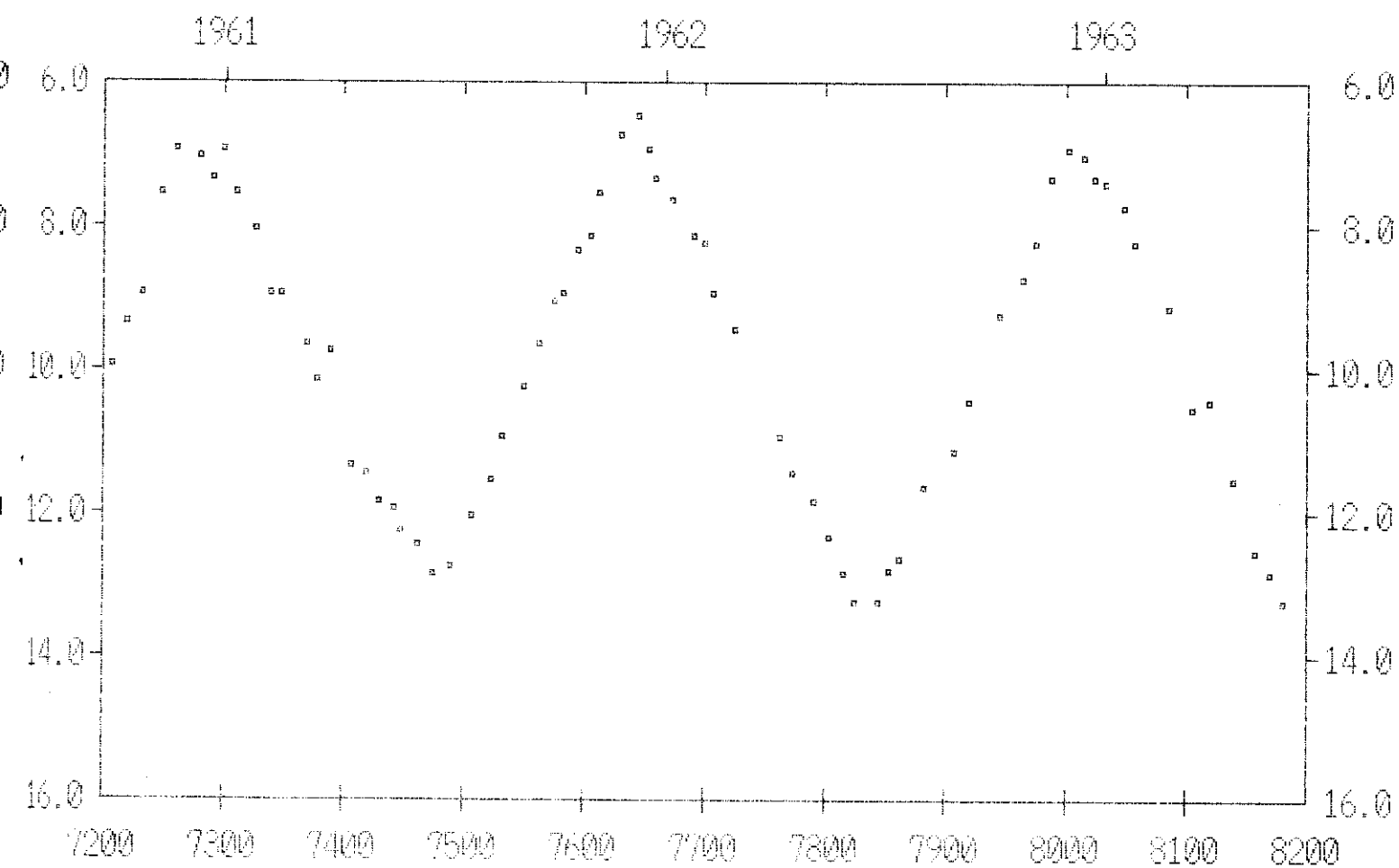
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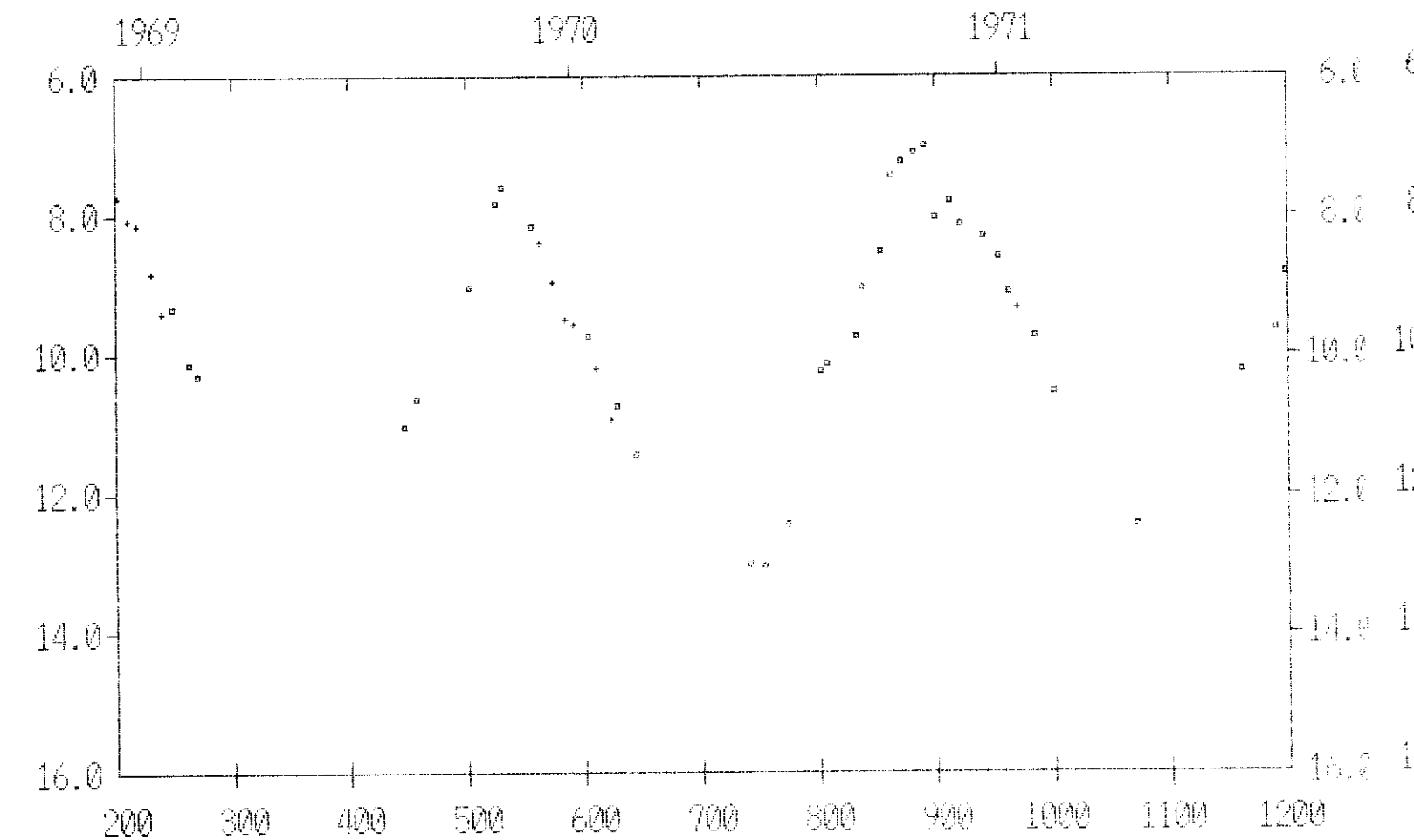
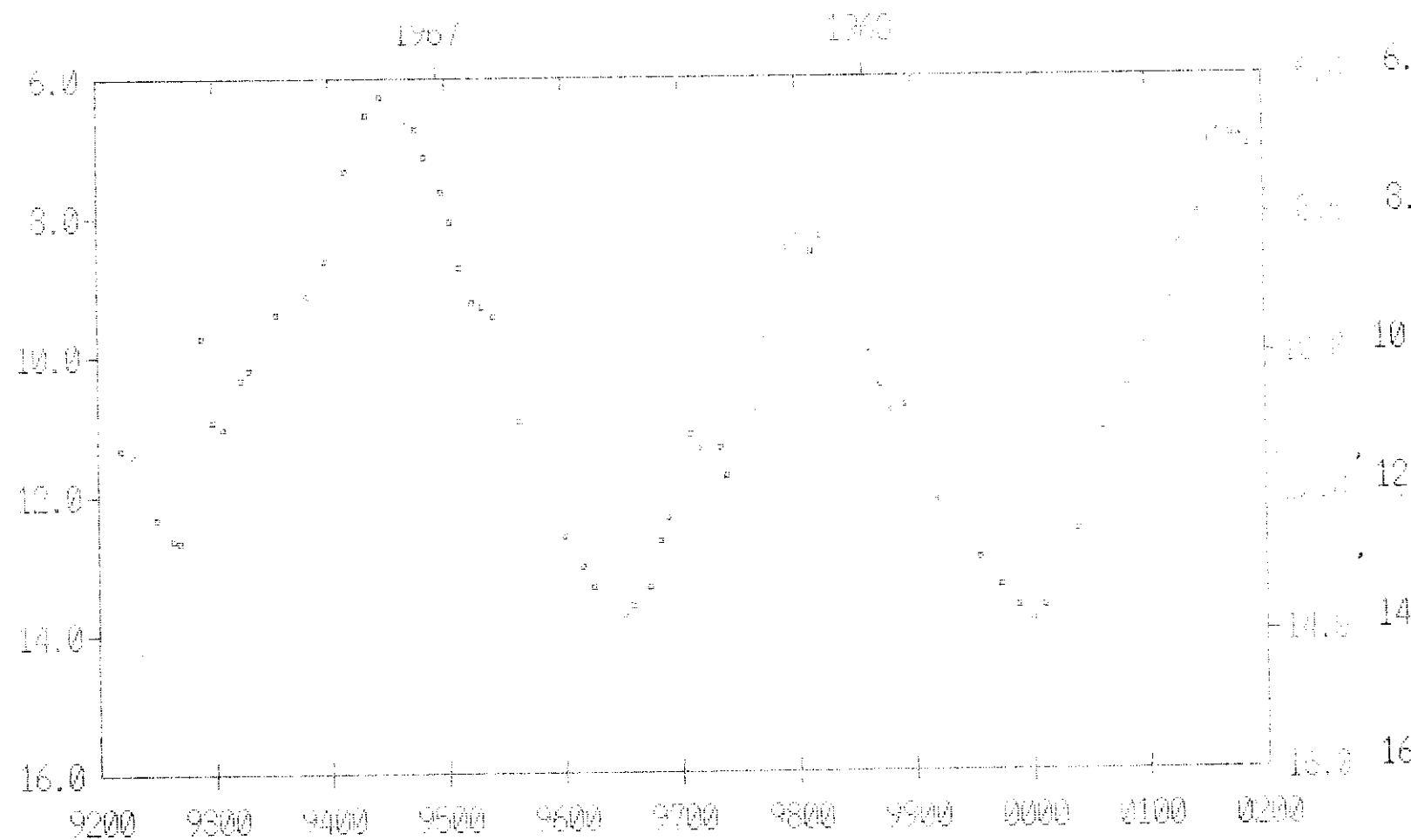
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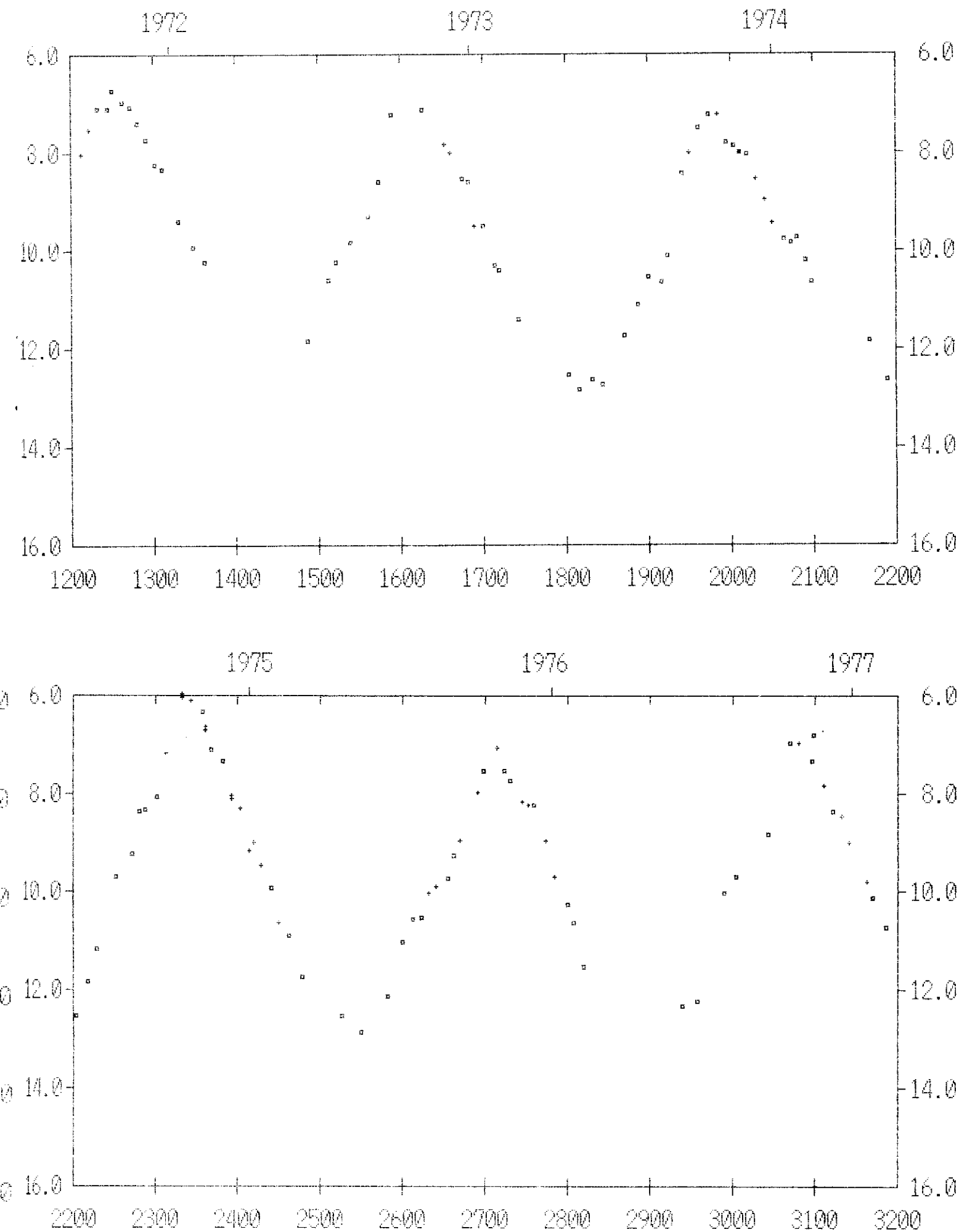
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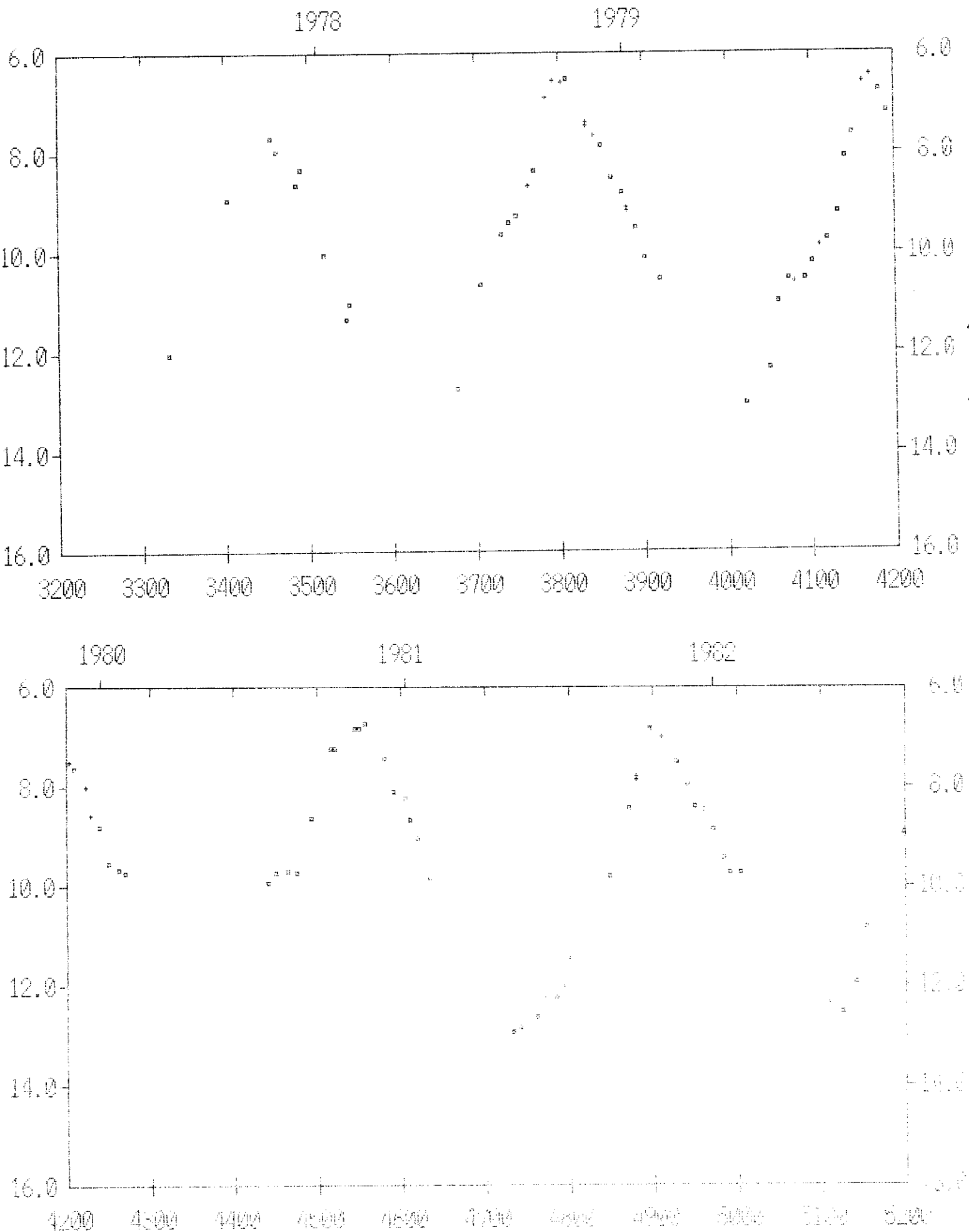
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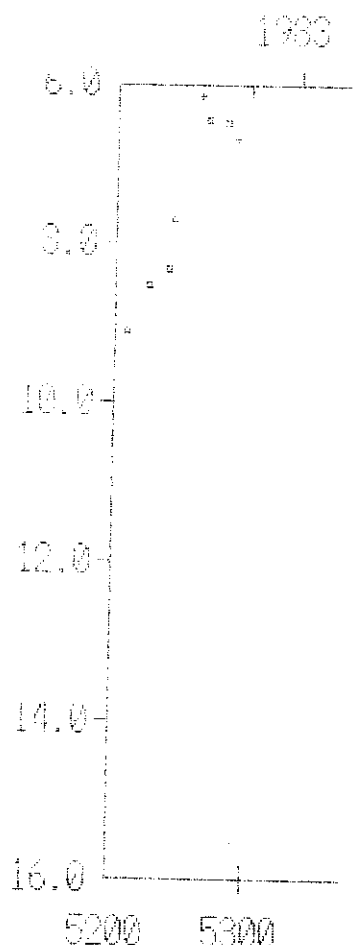


S Scl--LIGHT CURVE--2,441,200 - 2,443,200



S Scl--LIGHT CURVE--2,443,200 - 2,445,200





S Sc1. LIGHT CURVE

2,445,200 - 2,445,300.

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PHOTOELECTRIC OBSERVATIONS OF V818 SCORPII AND NEARBY VISUAL SEQUENCE STARS.

Brian F. Marino

Auckland Observatory of the Auckland Astronomical Society.

SUMMARY: Three colour UBV observations are presented for V818 Sco (Sco X-1) and for some of the nearby visual comparison stars.

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1. INTRODUCTION

V818 Sco was observed photoelectrically from the Auckland Observatory on six nights between 1984 July 16 and July 27. This was within the dates of a programme planned by observers at the University of Birmingham (U.K.) (1).

The equipment used was the Griffiths photon detection system with the Mark 1 photometer mechanical and optical section and standard three colour UBV filters, on the Edith Winstone-Blackwell 50cm Cassegrain telescope described previously (2)..

HD146935, $V=8.55$, $B-V=0.25$, $U-B=0.22$ and HD146950, $V=9.88$, $B-V=0.33$, $U-B=0.27$, were used as comparison and check stars respectively for all of the observations. HD146950 is marked "A" on chart 387 (3), and HD146935 is the star immediately west of "A".

2. OBSERVATIONS

Table 1 lists the three colour observations of V818 Sco. Columns 3, 5 and 7 give the 1 sigma values for each set of observations. Column 8 gives the number of observations making up the set on that night. The phases given in column 9 are calculated using the ephemeris (4):-

$$J.D._{min} = 2,440,081.13 + 0.787313n^d$$

TABLE 1. Three Colour UBV Observations of V 818 Scorpii.

J.D. 2445000+	V		B - V		U - B		no.	phase
897.846	12.42	0.05	+0.18	0.04	-0.72	0.02	4	7388.060
898.845	12.22	0.04	0.16	0.04	-0.75	0.02	2	7389.329
899.795	12.71	0.04	0.22	0.04	-0.70	0.05	2	7390.536
899.854	12.48	0.03	0.13	0.01	-0.70	0.06	2	7390.610
901.820	12.44	0.03	0.17	0.02	-0.77	0.02	2	7393.108
907.919	12.90	0.02	0.24	0.00	-0.74	0.02	2	7400.855
908.855	12.45	0.04	0.12	0.01	-0.77	0.02	2	7402.044
909.017	12.31	0.08	0.14	0.07	-0.73	0.04	2	7402.249

TABLE 2. Three Colour UBV Observations of Stars Near V 818 Scorpii

star	J.D. 2445000+	V	B-V	U-B
check	897.8459	9.87	+0.36	+0.31
	898.8475	9.86	0.37	0.32
	899.7913	9.86	0.37	0.32
	899.8556	9.88	0.36	0.31
	901.8223	9.87	0.37	0.32
	907.9242	9.88	0.37	0.31
	908.8573	9.89	0.35	0.33
	909.0219	9.88	0.37	0.34
B = 11.4	897.8585	11.30	+0.71	+0.11
	899.8403	11.30	0.70	0.17
	901.8301	11.31	0.70	0.14
C = 11.4	897.8559	11.48	+1.33	+1.19
	899.8377	11.47	1.31	1.31
	901.8273	11.48	1.34	1.31
12.4	897.8627	12.34	+0.86	+0.21
	899.8479	12.34	0.83	0.39
	901.8335	12.35	0.86	0.49
13.4	897.8655	13.35	+0.78	+0.29
	899.8452	13.29	0.71	0.36
	901.8363	13.29	0.89	0.27

3. COMPARISON STARS

The visual comparison stars "134", "124", "114=C" and "114=B" on chart 387 were observed on three nights as a check to confirm that they were non-varying. These observations are listed with the results of the check star in Table 2.

No evidence of variability greater than the expected errors of observation were found on the check star, or on any of the measured sequence stars during the observations. An improved visual light curve may result if the comparison values of B and C are revised to 11.3 and 11.5 respectively.

REFERENCES

- (1) Bateson, F.M. 1984 July 11. Special Circ.V.S.S., Royal astr. Soc. of N.Z.
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- (3) Bateson, Morel, M. & Winnett, R.D. 1977. Charts for Southern Variables, Series 9. Publ. by F.M. Bateson, Tauranga, N.Z.
- (4) Gottlieb, E.W., Wright, E.L. & Liller, W. 1975. Ap.J. 195, L33.

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THE SEMI-REGULAR VARIABLE, V HOROLOGII

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SUMMARY: A light curve and list of observed maxima and minima of V Hor are presented. The mean visual range is 7.07 to 7.57 with a semi-regular period of 64 days.

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1. INTRODUCTION

V Hor has been observed by members of the V.S.S., R.A.S.N.Z. from J.D. 2,438,759 (1964 December 29) to 2,444,579 (December 5, 1980). Very few observations were made in 1964, 1965 and 1966. All observations were made visually using chart 92 (1) and its sequence of SP_v magnitudes. The main observers are listed in Table 1.

TABLE 1.

OBSERVERS.

LUMLEY, E.	427	MARINO, B.F.	26
HULL, O.R.	203	MENZIES, B.	25
VENIMORE, C.W.	84	ROWE, G.	25
CROMPTON, A.	40	CHRISTIE, G.W.	21
MOREL, M.	37	PATERSON, D.	20
JONES, M.V.	26	27 observers with less than	
		20 observations each.	239

TOTAL 1,173

2. LIGHT CURVE

Observations were grouped into ten day means, which are shown on Figures 1a, 1b and 1c. In the figures a cross denotes a single observation; a dot a mean from 2 to 4 observations, and an open circle means from five, or more, observations. The few observations made prior to 2,439,800 have been omitted.

3. OBSERVED MAXIMA AND MINIMA

Table 2 lists the observed dates of maxima and minima in the usual form. These dates appear to be the most probable ones, having regard to the individual observations and plotted means. The distribution of observations is uneven. This, coupled with the small visual range and intervals of little change in brightness, makes some of the dates uncertain.

4. DISCUSSION

The visual magnitude at maximum ranges from 6.7 to 7.4 with a mean of 7.07. Magnitudes at minimum are 7.3 to 8.2 with a mean of 7.57.

The best defined maxima and minima give mean periods of 63.^d2 and 65.^d5 respectively. There are several intervals during which the variations are so slight that it is difficult to define accurately the dates of maxima and minima except to say that the intervals between successive phases appears to be twice the mean period. Intervals between successive maxima, or minima, vary within wide limits showing that it is a semi-regular variable for which it is impossible to predict maxima and minima.

5. CONCLUSIONS

V Hor is a semi-regular variable, probably of type SRb with an approximate period of 64 days, but with large deviations from this mean period. The mean visual range is 7.07 to 7.57. However V Hor has a larger amplitude at times so that maxima can vary from magnitude 6.7 to 7.4 and minima from 7.3 to 8.2.

ACKNOWLEDGEMENTS

I wish to thank all observers for their observations. My thanks are also due to Dr. Frank Bateson for his advice and encouragement.

REFERENCE

- (1) Bateson, F.M., Jones, A.F. & Stranson, I. 1966. CHARTS FOR SOUTHERN VARIABLES, Series 3. Publ. by F.M. Bateson, Tauranga, N.Z.

TABLE 2.

V HOROLOGII--OBSERVED MAXIMA AND MINIMA.

<u>MAXIMA</u>				<u>MINIMA</u>		
<u>No</u>	<u>J.D. Max.</u> 24.....	<u>Max.</u> M _v	<u>Int</u> d	<u>J.D. Min.</u> 24.....	<u>Min.</u> M _v	<u>Int</u> d
1	39,913	7.2	...	39,938	7.6	...
2	40,046	7.0	133	40,085	7.7	147
3	40,174	6.9	128	40,207	7.5	122
4	40,293	6.9	119	40,318	7.8	111
5	40,353	7.4	60	40,385	7.9	67
6	40,404	7.0	51	40,426	7.5	41
7	40,478	7.0	74	40,515	8.2	89
8	40,547	7.1	69	40,615	7.9	100
9	40,666	7.1	119	40,708	7.6	93
10	40,746	7.0	80	40,768	7.4	60

TABLE 2 (cont)

V HOROLOGII--OBSERVED MAXIMA AND MINIMA.

No	MAXIMA			MINIMA		
	J.D. Max. 24.....	Max.M _v	INT d	J.D. Min. 24.....	Min.M _v	INT d
11	40,788	7.1	42	40,829	7.5	61
12	40,853	7.1	65	40,937	7.7	108
13	40,984	6.7	131	41,027	7.6	90
14	41,062	7.0	78	41,113	7.6	86
15	41,133	7.2	71	41,153	7.5	40
16	41,165	7.3	32	41,210	7.5	57
17	41,254	7.1	89	41,297	7.4	87
18	41,326	7.2	72	41,346	7.4	49
19	41,370	7.0	44	.....	...	...
20	41,575	7.1	(205)	41,603	7.5	(257)
21	41,621	7.0	46	41,667	7.6	64
22	41,705	7.0	84	41,723	7.8	56
23	41,800?	7.0?	95?	41,860	7.5	137
24	41,907	7.2	107	41,923	7.5	63
25	41,955	7.2	48	42,010	7.5	87
26	42,031	7.0	76	42,045	7.7	35
27	42,087	7.0	56	42,120?	7.5?	75?
28	42,167	7.0	80	42,216	7.6	96
29	42,260?	7.2?	93?	42,322	7.5	106
30	42,385	7.1	125	42,402	7.9	80
31	42,454	7.0	69	42,444	7.9	72
32	42,495	7.3	41	42,520	7.6	46
33	42,569	7.0	74	42,606	7.9	86
34	42,693?	7.4?	124?	42,737	7.7	131
35	42,780	6.9	87	42,805	7.7	68
36	42,843	7.3	63	42,872	7.9	67
37	42,892?	7.2?	49?	42,911?	7.4?	39?
38	42,966	6.7	74	42,995	7.5	84
39	43,032	7.0	66	43,075	7.3	80
40	43,088	7.1	56	43,136	7.8	61
41	43,156	7.2	68	43,196	7.8	60
42	43,226	7.3	70	43,273	7.5	77
43	43,292	7.2	66	43,325	7.5	52
44	43,353	7.0	61	43,405	7.4	80
45	43,456	6.9	103	43,486	7.4	81
46	43,506	7.0	50	43,558	7.4	72
47	43,566	7.2	60	43,580	7.5	22
48	43,598	6.9	32	43,628	7.5	48
49	43,655	7.1	57	43,700	7.4	72
50	43,731	7.1	76	43,779	7.4	79
51	43,790	7.0	59	43,831	7.3	52
52	43,849	7.0	59	43,896	7.4	65
53	43,917	7.0	68	43,956	7.3	60
54	43,972	7.0	55	44,000?	7.5?	44
55	44,191	7.0	(219)	44,331	7.4	(331)
56	44,383	7.0	(192)	44,415	7.5	84
57	44,445	7.1	62	44,468?	7.5?	53?

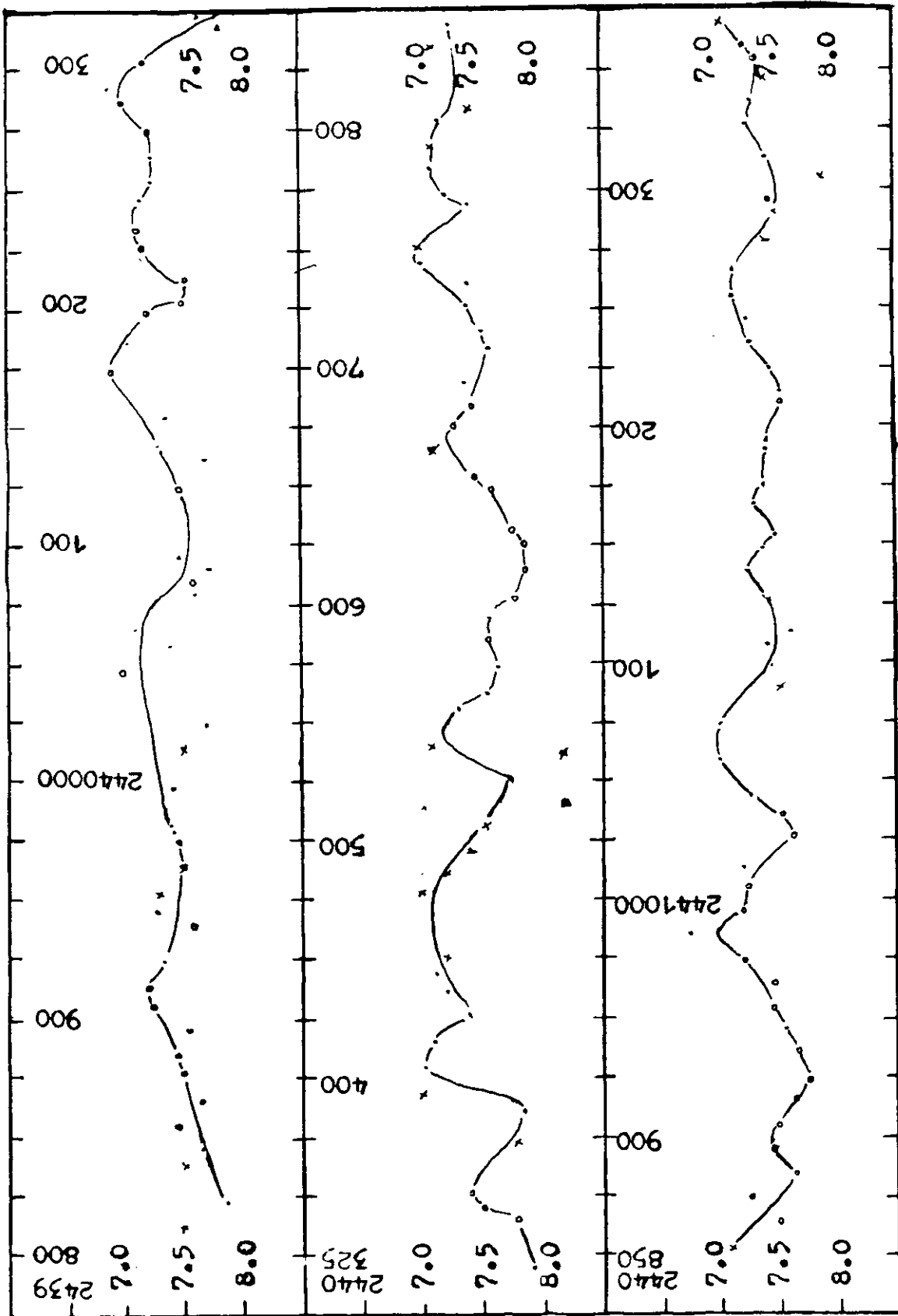


Figure 1a: Light Curve of V Hor. from Ten Day Means.

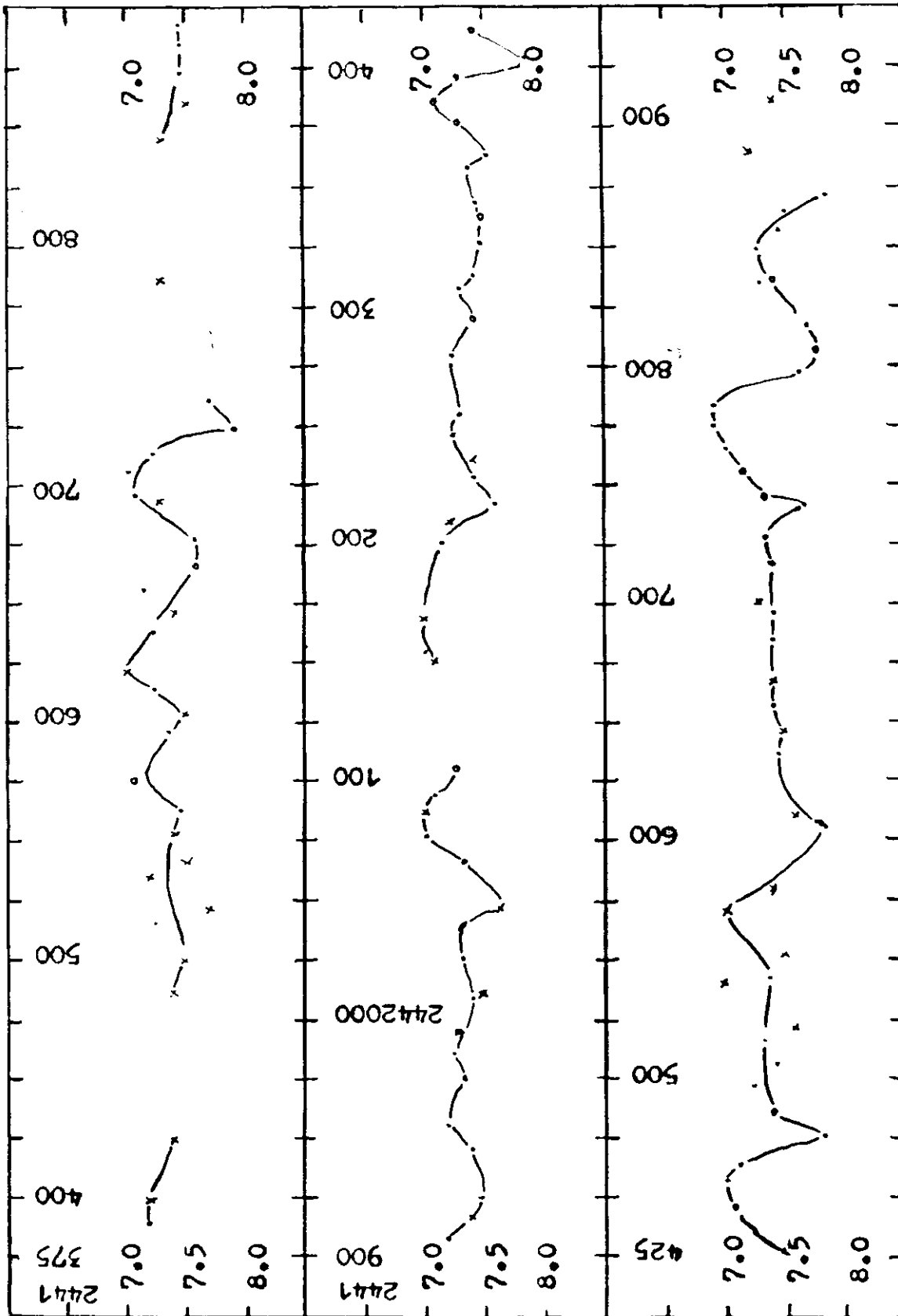


Figure 1b: Light Curve of V Hor. from Ten Day Means.

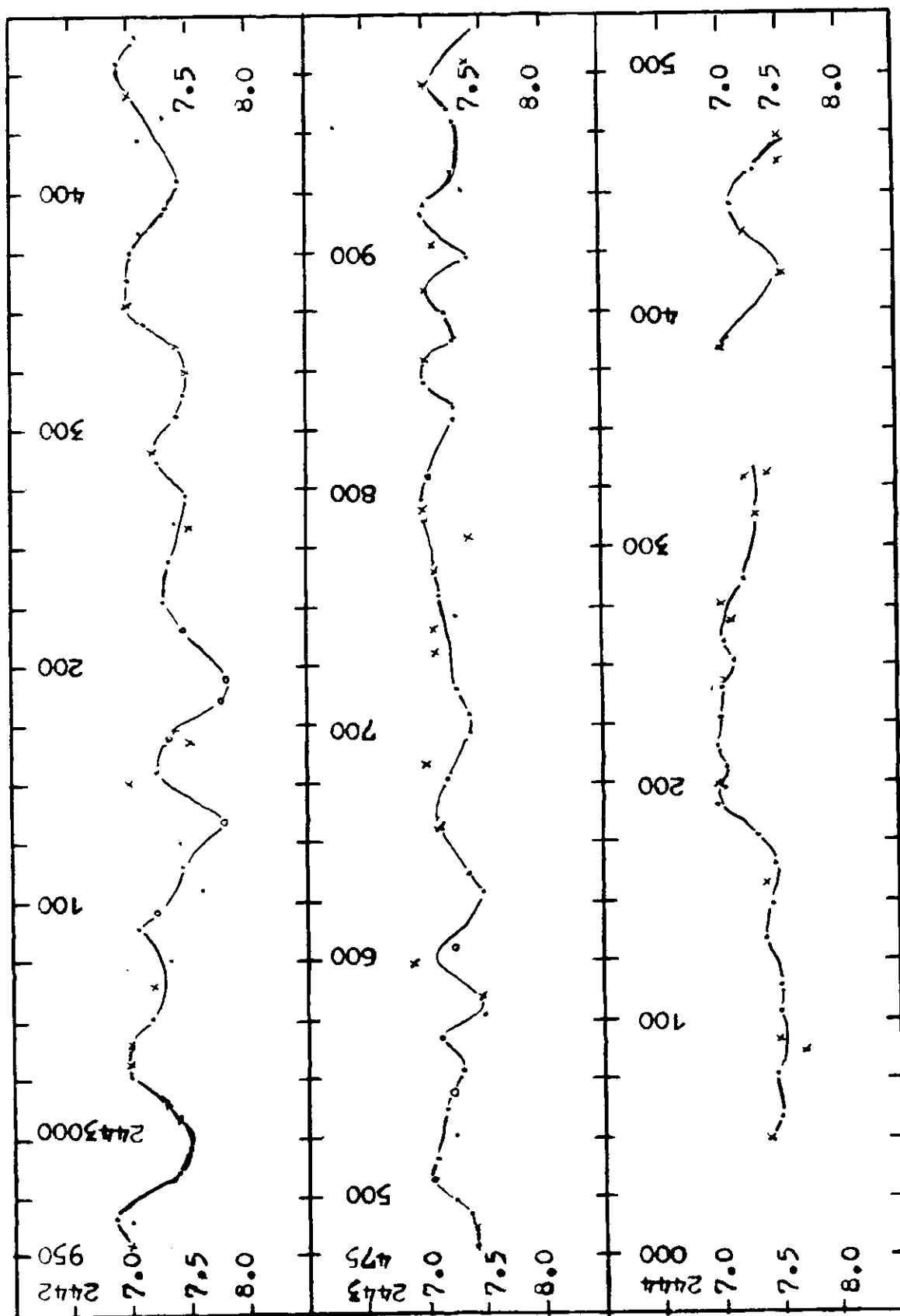


Figure 1c: Light Curve of V Hor. from Ten Day Means.

OUTBURSTS OF TWENTY-FIVE FAINT DWARF NOVAE.

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SUMMARY: Visual observations of outbursts of 25 faint dwarf novae are tabulated, in continuation of previous papers. A brief discussion of the results for each star is presented.

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1. INTRODUCTION.

Tables of observed outbursts of the following dwarf novae are given on the following pages in continuation of previous papers.

WW Cet; XZ Eri; AH Eri; AQ Eri; BI Ori; CW Mon; SV CMi; UY Pup; BV Pup;
 BX Pup; BB Vel; V373 Cen; V485 Cen; BR Lup; AB Nor; IK Nor; MM Sco; FV Ara;
 BF Ara; V1830 Sgr; DH Aql; RZ Sge; KK Tel; TU Ind; KX Aql.

For each star the interval covered by the observations is given along with the total observations as an indication of how closely the star was monitored. References to previous papers are given. These are followed by a table giving the details of observed outbursts. The first column of each table gives the running number of each maximum, followed by the J.D. of maximum; maximum visual magnitude; the interval, in days, from the previous maximum observed. The next column shows the width of each maximum, in days. Unless otherwise stated this is the duration of visibility. The last two columns give the type of maximum, in accordance with the symbols below and, the number of positive observations for each maximum.

SYMBOLS FOR TYPES OF MAXIMA:

- N = Normal, or narrow. Duration 5 days or less.
- W = Wide. Duration 6 days, or longer. Where previous papers have divided wide maxima into sub-types the same symbols as used previously are shown.
- S = Supermaxima. Have a brighter maximum magnitude and a longer duration than other maxima of the same star.
- P = Faint peaks. Maximum brightness much fainter than for other types.

WW Cet is the only star for which the duration at different magnitudes can be stated.

The maximum magnitude of almost all the stars discussed are at the threshold of most instruments used, or only slightly above that limit. The outbursts recorded therefore depend to a large extent on whether those observers with larger apertures have been observing. It is probable that many maxima have gone unobserved. The majority of the observations were negative showing that the variable was invisible and below a certain magnitude. For this reason the individual estimates are not published but copies can be obtained on application. These negative observations have often been used to define the duration of maxima.

2. WW CETI.

J.D. 2,444,971 - 2,445,902. Previous papers (1) and (2). Observed maxima are listed on page 46 in the same form as in the previous papers.
 372 observations.

TABLE 1.

WW CETI--OBSERVED OUTBURSTS.

No.	J.D. MAX. 24.....	MAX m_v	INT. d	Z=13.0		WIDTH d	Z=12.0		WIDTH 12.0 _d	TYPE	No Obs
				R	F.		R	F			
63	44983.5	11.5	49.5	982.6	986.3	3.7	982.8	985.0	2.2	N	5
64	45117.4	11.2	(133.9)	116.7	121.7	5.0	116.9	119.6	2.7	N	5
65	45216	11.1	98.6	212.5	221.5	9.0	213.3	220.1	6.8	W	7
66	45286	11.1	70	283.3	289.5	6.2	283.9	288.5	4.6	N	8
67	45313	11.4	27	.....	.....	...	.....	.....	...	N	2
68	45349?	11.8?	36	.....	351.7	...	.....	350.3	...	N	3
69	45482	11.1	(133)	477	488?	11?	478.3	485.7	7.4	W1	6
70	45524?	12.0?	42?	522.5	.....	...	.....	.....	...	N	2
71	45551?	12.7?	27?	.....	.....	...	.....	.....	...	N	6
72	45570?	12.0?	19?	.....	576.5	...	.....	.....	...	N	6
73	45600?	?	30?	.....	603.3	...	.....	.....	...	?	15
74	45639	11.0?	39?	635.9	649.3	13.4	637.2	648	10.8	W2	14
75	45820?	12.7?	(181)	.....	.....	...	.....	.....	...	N	1
76	45882	11.0?	62?	881.1	890.2	9.1	881.7	888.5	6.8	W1	5

NOTES TO TABLE 1.

- No. 64. Probably at standstill at 13^m.5 for at least 18 days after decline.
 No. 65. Slow rise from 14^m.6 on 202 to 13^m.8 on 209. Rise & decline observed but not the maximum phase.
 No. 68. Decline only observed.
 No. 72. Decline only observed. At standstill at 13^m.8 for 12^d after decline.
 No. 73. Decline only observed. At standstill at 13^m.5 - 14^m.0 for at least 17 days following decline.
 No. 74. Maximum presumably brighter than 11^m.0. Distinct pause on decline at 11^m.0 for 5 days.
 No. 76. Rise & fall observed but 5 day gap in observations during maximum. At standstill for at least 5 days at 13^m.9 before rise commenced.

DISCUSSION

It is impossible to state definitely that any two maxima are consecutive because WW Cet has not been closely monitored. A mean cycle of 31.1 is derived from those maxima that are possibly consecutive. This is close to the values of 31.2 and 29.3 in the previous papers. Standstills occur between 13^m.5 and 14^m.0 on the decline. Small amplitudes apparently are present at such times but the observations are too few to make definite statements on these.

2. XZ ERIDANI

J.D. 2,436,754 - 2,436,810 and 2,444,249 - 2,445,882. 300 observations.
 No previous papers.

TABLE 2.

XZ ERIDANI---OBSERVED OUTBURSTS.

No.	J.D. MAX. @\$.	MAX. m_v	INT. d	WIDTH d	TYPE	No. Obs.
1	44,632	14.4	...	1	N?	1
2	45.371	14.0	739	1	N	4

DISCUSSION

XZ Eri has been poorly observed, being too faint for most instruments. Magnitudes for the faint comparison stars have been estimated owing to the lack of reliable magnitudes. The variable has been generally reported as fainter than $15^m.4$ - $15^m.7$, when larger apertures used. A single positive observation estimated the magnitude as about 16.2.

3. AH ERIDANI

J.D. 2,444,971 - 2,445,919. 501 observations. Previous paper (3).

TABLE 3

AH ERIDANI---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX.</u> 24.....	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
14	44,972	13.8	16	1	N	1
15	45,056?	14.3?	84	?	N?	1
16	45,205?	13.8?	(149)	?	?	1
17	45,318	14.0	(113)	1?	N?	1
18	45,332	13.9	14	2	N	2
19	45,553	13.8	(221)	?	?	1
20	45,647	13.9	94	3	N	3

NOTES TO TABLE 3.

16. Outburst may have lasted longer than usual as seen at $15^m.0$ on 212.

19. Gap of 15 days before this positive observation.

DISCUSSION

The data in Table 3 should be treated with caution since it depends on very few observations. That is due to the faintness of maxima. Possibly outburst 14 is consecutive to No. 13 in the previous paper; 17 and 18 may also be consecutive. All that can be said from the scanty data in this, and the previous paper, is that the mean cycle is probably short.

4. AQ ERIDANI

J.D. 2,444,971 - 2,445,821. 1,095 observations. Previous paper (3).

TABLE 4.

AQ ERIDANI--OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX.</u> 24.....	<u>MAX.</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
15	44,990	12.7	54	1	N	4
16	45,043	13.8	53	1	N	2
17	45,057	13.7	14	1	N	1
18	45,202	13.8	(145)	1	N	1
19	45,263	13.8	61	2	N	4
20	45,300	13.7	37	1	N	1
21	45,341	12.8	41	16	W	64
22	45,367	13.8	26	1	N	1
23	45,403	13.6	36	1	N	2
24	45,591	13.2	(188)	2	N	3
25	45,681	13.3	90	1	N	1
26	45,701	12.3	20	12	W	39

DISCUSSION.

AQ Eri was closely monitored each year through the observing season of August through April. It is unlikely that any wide maxima were missed during these months. On the other hand, normal maxima, because of their very short duration, were probably often unobserved. Combining the data in Table 4 with that previously published, well determined maxima give the following results:

WIDE MAXIMA: Mean magnitude 12.66. Mean width 10.7.^d
 NORMAL MAXIMA: " " 13.39. " " 1.4

Those maxima which are probably consecutive give a mean cycle of 52.2^d.

Eight wide maxima have been observed with intervals between them ranging from 20 to 759 days. The mean is 366 days. The well observed wide outbursts Nos. 21 and 26 show some scatter in the observations. Unfortunately several observers failed to time their observations precisely enough to determine whether the apparent small amplitude variations were due to superhumps, or even eclipses. Visual observers of AQ Eri should always give the precise time of their observations during outbursts to at least three decimals of a Julian Day. It may be worth while for photoelectric observers to pay attention to AQ Eri during its wide maxima.

SUSPECTED VARIABLE.

Comparison star "D" on chart 322 (4) has been reported on some occasions as being fainter than 13.0. Its magnitude according to Vogt (5) is:

$$V=10.98 \quad B-V = 1.26 \quad U-B = 1.38$$

It is probably a long period variable. Observers are requested to observe this star whenever they are recording AQ Eri.

5. BI ORIONIS

J.D. 2,443,818 to 2,445,717. 820 observations. No previous paper.

TABLE 5.

BI ORIONIS---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX.</u> 24.....	<u>MAX.</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
1	43,890	13.9	...	5	N	6
2	43,951	14.6	61	4?	N	3
3	43,964	14.4	13	1	N	1
4	44,117	14.4	(153)	?	N?	1
5	44,220	14.5	(103)	1	N	1
6	44,230	14.2	10	1	N	5
7	44,255	14.2	25	3	N	5
8	44,342	14.4	87	1	N	1
9	44,589	14.2	(247)	1	N	1
10	44,829	14.0	(240)	1?	N	1
11	44,906	14.4	77	2	N	2
12	44,958	13.7	52	1	N	1
13	44,971	14.6	13	1	N	1
14	44,983	13.7	12	1	N	2
15	45,046	14.4	63	1	N	1
16	45,231	14.8	(185)	1	N	1
17	45,258	14.8	27	1	N	1
18	45,287	14.5	29	1	N	1
19	45,345	14.3	58	3	N	2
20	45,381	14.0	36	6	W	5
21	45,426	13.2	45	1	N	1
22	45,579	14.2	(153)	1	N	1
23	45,622	14.6	43	?	N?	1
24	45,678	14.7	56	1	N	2
25	45,696	13.9	18	8	W	5

NOTES TO TABLE 5

Nos. 2 & 3. Faded to 16.2 between these two outbursts.

Nos. 5 & 6. Faded to fainter than 15.3 between these two outbursts.

DISCUSSION.

Outbursts of BI Ori are only recorded when observers with larger apertures are operating. All outbursts are faint and for this reason BI Ori has not been monitored closely. Minima appear to be fainter than 16^m.0.

Outbursts are regarded as occurring when the star is brighter than 15^m.0. The data in Table 5 should be treated with caution since most outbursts depend on a single positive observation. There were 11 outbursts that were probably consecutive and these show that the mean cycle is short, probably about 25 days. Mean maximum magnitude is 14.26. Most outbursts appear to be very short although this may be caused by their faintness. There is, however, some evidence to show that BI Ori also has wide maxima.

6. CW MONOCEROTIS.

J.D. 2,444,971 to 2,445,792. 662 observations. Previous paper (3).

TABLE 6.CW MONOCEROTIS---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> 24.....	<u>MAX</u> m_v	<u>INT,</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
20	45,084	12.8	155	5	N	8
21	45,235	13.4?	151	?	?	1
22	45,309	12.4	74	3	N	6
23	45,750	13.2	(441)	1?	N	3

DISCUSSION.

It is probable that several outbursts of CW Mon passed unobserved. Two possible outbursts have been excluded from Table 6 because both depend on single positive observations, which the observer considered doubtful being uncertain of correct identification. The mean cycle is 127^d.0 which is close to the 121^d.7 in the previous paper.

7. SV CANIS MINORIS.

2,443,894 to 2,445,074. 143 observations. No previous paper.

TABLE 7.SV CANIS MINORIS---OBSERVED OUTBURSTS

<u>No.</u>	<u>J.D. MAX.</u> 24.....	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
1	43,902	13.3	....	..2	N	3
2	43,932	13.3	30	5	N	5
3	43,966	13.5	34	2?	N	2
4	44,582	12.5	(616)	?	W	2
5	44,716?	14.4?	(134)	?	?	1
6	44,964?	14.0	(248)	?	?	4
7	45,001	13.4	37	1	N	2
8	45,022	14.0?	21	?	?	2
9	45,045	13.4	23	1	N	2
10	45,054	12.5	9	4+	W	4
11	45,071	11.1	17	?	?	3

NOTES TO TABLE 7

No. 5. Date uncertain as gaps in observations for 6 days before and 4 days after 716.

No. 6. Decline only observed. Gap of 3 days before 964.

No. 10. Rise not seen.

No. 11. Maximum magnitude appears to be too bright.

DISCUSSION.

Observations of SV CMi were fragmentary. All that can be said for the data is that it suggests that the mean cycle is very short.

8. UY PUPPIS

J.D. 2,443,890 to 2,445,425. 391 observations. No previous paper.

TABLE 8.UY PUPPIS---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX.</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>NO. OBS.</u>
1	43,907	14.1	.....	3	N	5
2	43,927	14.1	20	2?	N	2
3	43,936	13.8	9	6	W	8
4	43,968	13.4	32	5	N	4
5	44,011	13.5	43	2?	N	3
6	44,173	13.8	(162)	?	?	1
7	44,202	13.9	29	?	?	1
8	44,231	13.4	29	6	W	7
9	44,255	15.1	24	1	P	1
10	44,263	15.1	8	1	P	1
11	44,283	14.8	20	1	P	1
12	44,504	13.7	(221)	?	?	1
13	44,524	13.4	20	?	?	1
14	44,577	13.8	53	11	W	4
15	44,611	14.1	34	8	W	6
16	44,634	13.8	23	2	N	3
17	44,640	13.4	6	6?	W?	4
18	44,664	14.1	24	?	?	1
19	44,693	14.1	29	6	W	2
20	44,707	14.0	14	?	?	1
21	44,727	14.0	20	?	N?	1
22	44,747	13.9	20	10?	W?	2
23	44,755	13.6	8	7	W	3
24	44,912	14.1	(157)	?	?	1
25	44,964	13.5	52	5	N	6
26	44,971	13.7	7	?	?	1
27	44,998	13.7	27	4	N	4
28	45,017	13.2	19	1	N	2
29	45,028	13.9	11	?	?	1
30	45,071	13.7	43	6	W	6
31	45,103	13.2	32	11	W	5
32	45,136	13.8	33	?	N	1
33	45,258	14.4	(122)	?	?	1
34	45,316	13.4	58	11	W	14
35	45,352	13.8	36	10	W	10
36	45,376	14.2	24	4	N	2
37	45,398	13.8	22	6	W	3

DISCUSSION.

Both wide and normal maxima of UY Pup have a mean maximum magnitude of 13.7. There are also faint peaks with a maximum brightness of around 15^m.0. It is often difficult to decide to which type a maximum belongs because only the brighter segment of any outburst is observed. At minimum UY Pup is fainter than 16^m.0.

The mean cycle appears to be about 23 days, but may be shorter since many maxima would pass unobserved. This star is probably a member of the Z Cam sub-type.

9. BV PUPPIS.

J.D. 2,444,971 to 2,445,782. 469 observations. Previous paper (3).

TABLE 9.BV PUPPIS--OBSERVED OUTBURSTS

<u>No.</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> _d	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS.</u>
40	44,974	13.3	11	1	N	1
41	44,983	13.3	9	1	N	1
42	45,018	13.8	35	5	N	3
43	45,044	14.1	26	2	N	3
44	45,056	13.6	12	8	W	5
45	45,078	13.5	22	3	N	4
46	45,086	13.5	8	4	N	4
47	45,101	13.9	15	11	W	5
48	45,134	14.0	33	2	N	2
49	45,143	13.8	9	?	N?	1
50	45,258	14.1	(115)	?	?	1
51	45,318	13.3	(60)	9	W	8
52	45,336	13.3	18	5	N	4
53	45,350	13.6	14	5	N	11
54	45,365	13.7	15	14	W	6
55	45,380	13.2	15	6	W	9
56	45,397	13.2	17	7	W	4
57	45,415	13.6	18	?	?	2
58	45,430	13.2	15	5	N	8
59	45,463	13.6	33	?	?	1
60	45,486	13.6	23	3	N	3
61	45,582	13.8	(96)	?	?	1
62	45,678	13.3	(96)	9	W	6
63	45,708	13.4	30	6	W	8
64	45,721	14.1	13	1	N	2
65	45,727	13.5	6	8	W	9
66	45,741	14.3	14	1	N	2
67	45,756	13.3	15	6	W	7
68	45,779	14.0	23	?	?	1

DISCUSSION

Mean maximum magnitude is 13.44 for wide and 13.67 for normal maxima. The mean cycle is 18 days. These three values are similar to those previously published.

10. BX PUPPIS.

J.D. 2,444,971 to 2,445,734. 260 observations. Previous paper (3).

TABLE 10.BX PUPPIS---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS</u>
19	45,000	13.7	34	1	N	3
20	45,042	13.0	42	?	N	1
21	45,077	14.4	35	1	N	2
22	45,264	14.2	(187)	6	W	2
23	45,344	14.1	80	7	W	4
24	45,358	14.4	14	?	?	1
25	45,478?	13.2?	(120)	?	?	1
26	45,714	14.2	(236)	1	N	1

DISCUSSION.

The mean maximum magnitude is 13.90, much the same as previously found. Nothing can be said about the mean cycle except that it appears to be short. BX Pup has been recorded occasionally between 14^m5 and 15^m0. These may be faint peaks or merely fluctuations at minimum but it is impossible to be definite on this. The star has both wide and normal maxima and is probably of Z Cam class.

11. BB VELORUM

J.D. 2,444,971 to 2,445,773. 637 observations. Previous paper (3).

TABLE 11.BB VELORUM--OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX.</u> <u>24.....</u>	<u>MAX.</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS.</u>
8	44,986	13.5	27	10	W	8
9	44,999	13.6	13	1	N	1
10.	45,045	14.2	46	1	N	1
11	45,102	14.0	57	5	N	4
12	45,322	13.5	(220)	7	W	6
13	45,359?	14.7	37	?	?	2
14	45,403	14.4	44	1	N	2
15	45,704	14.1	(301)	7	W	4
16	45,714?	13.8?	10	1	N	2
17	45,758	13.4	44	12	W	14

NOTES TO TABLE 11.

No. 13. Possibly brighter than shown but negative observations indicate it was not brighter than 14^m0.
No. 16. Rose 1^m7 in less than 0^d5.

DISCUSSION.

Mean maximum magnitude is 13.92, very close to the value in the previous paper. It is difficult to state which maxima are truly consecutive, but those which appear likely to be so have intervals from 10 to 57 days with a mean of 37 days. The true mean cycle is probably shorter than that.

12. V373 CENTAURI

J.D. 2,445,121 to 2,445,434. 96 observations. Previous paper (6).

TABLE 12.

V373 CENTAURI---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS</u>
16	45,130	13.2	75	4	N	7
17	45,166	13.2	36	5	N	4
18	45,426	13.5	(260)	?	?	1

DISCUSSION

Combined with the previous results the mean cycle is 53.^d5. The mean maximum magnitude 13.73.

13. V485 CENTAURI

J.D. 2,445,162 to 2,445,861. 467 observations. Previous paper (6); (7).

TABLE 13.

V485 CENTAURI---OBSERVED OUTBURSTS.

<u>No</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS</u>
8	45,403	14.4	(623)	?	N?	2
9	45,413	14.1	10	1	N	2
10	45,443	13.9	30	?	?	1
11	45,757	13.4	(314)	7	W	3

DISCUSSION.

Combined with the data in (6) the mean maximum magnitude is 13.97. Nothing can be said about the mean cycle since it is obvious that many faint maxima have gone unobserved.

14. BR LUPI

J.D. 2,445,139 to 2,445,825. 388 observations. . Previous paper (7).

TABLE 14.

BR LUPI---OBSERVED OUTBURSTS

<u>No</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS</u>
15	45,178	13.5	116	5	N	4
16	45,533	13.8	(355)	?	?	1
17	45,823	13.8	(290)	3?	N	2

Mean maximum magnitude has continued to be 13.7. It appears that many maxima occur at 14.^m0 or fainter and are therefore rarely observed. For that reason no reliable information can be derived for the mean cycle.

54.

15. AB NORMAE.

J.D. 2,445,139 to 2,445,878. 164 observations. Previous paper (6).
No outbursts were observed.

16. IK NORMAE

J.D. 2,445,143 to 2,445,915. 482 observations. Previous paper (6).

TABLE 15.

IK NORMAE---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> 24.....	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
5	45,868	13.5	1088	2?	N?	2

DISCUSSION

In addition to outburst No. 5 IK Nor was reported at $12^m.9$ on 2,445,206.82. This observation has been rejected because another observer recorded the variable at the same time as being invisible and fainter than $13^m.6$ making the positive observation too doubtful to be accepted. Another doubtful observation of $12^m.3$ on 2,445,557.985 has also had to be disregarded as negative observations at the same time made the star invisible and fainter than $13^m.1$.

The mean maximum magnitude from the 5 outbursts observed to date is 13/66. The data is too scanty to comment on the mean cycle.

17. MM SCORPII

J.D. 2,445,028 to 2,445,600. 197 observations. Previous paper (6).

TABLE 16.

<u>No.</u>	<u>J.D. MAX</u> 24.....	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. Obs</u>
17	45,434	13.4	678	6+	W	2

DISCUSSION

The wide outburst No. 17 conforms to the previous finding that wide maxima are about half a magnitude brighter than the normal maxima. With only one outburst to report nothing can be added to the previous paper about the possible mean cycle.

18. FV ARAE.

J.D. 2,445,000 to 2,445,239. 96 observations. Previous paper (6).

No further outbursts observed.

19. BF ARAE.

J.D. 2,445,014 to 2,445, 558. 96 observations. Previous paper (6).

DISCUSSION

Table 17 on page 55 lists additional outbursts observed. BF Arae was reported at $12^m.0$ on 2,445,272 but as the observer was uncertain of correct identification this observation has been disregarded. The mean maximum magnitude from all six outbursts is 13.5. The mean cycle may be around 300 days but the sample of observed outbursts is too small to be definite on this point.

TABLE 17.BF ARAE---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS</u>
5	45,121	13.7	333	4?	N	2
6	45,545	13.8	424	4	N	3

20. V1830 SAGITTARII.

J.D. 2,445,187 to 2,445,913. 288 observations. Previous paper (6).

TABLE 18.V1830 SAGITTARII---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX.</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS.</u>
3	45,492	11.5	701	?	?	1
4	45,821	11.8	329	4?	N?	1

NOTES TO TABLE 18.

No.3. The single positive observation appears correct but there were 4 day gaps both before and after 492.

DISCUSSION.

The two outbursts in Table 18 appear to confirm that V1830 Sgr has bright maxima at long intervals. This is a difficult star to observe because of the crowded field. However it certainly requires much closer monitoring.

21. DH AQUILAE.

J.D. 2,445,107 to 2,445,571. 90 Observations. Previous paper (6)

TABLE 19.DH AQUILAE---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS.</u>
2	45,479	12.3	1024	3	N	4

DISCUSSION.

No comment can be made with only two outbursts observed.

22. KX AQUILAE

J.D. 2,445,084 to 2,445,604. 96 observations. Previous paper (6)

TABLE 20.KX AQUILAE---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> <u>24.....</u>	<u>MAX</u> <u>m_v</u>	<u>INT.</u> <u>d</u>	<u>WIDTH</u> <u>d</u>	<u>TYPE</u>	<u>No. OBS.</u>
11	45,118	13.6	244	1	N	1

DISCUSSION.

Coverage of KX Aql was very poor.

23. RZ SAGITTAE

J.D. 2,444,830 to 2,445,562. 103 observations. Previous paper (6).

TABLE 21.RZ SAGITTAE---OBSERVED OUTBURSTS.

<u>NO.</u>	<u>J.D. MAX.</u> 24.....	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
11	44,875	11.9	(359)	7	W	12
12	45,498	10.5	(623)	?	S?	1

NOTES TO TABLE 21.

No.12. A single positive observation when RZ Sge first reappeared in the morning sky. Large gaps in observations before and after 498. The magnitude suggests that this was a supermaximum.

DISCUSSION.

All observations to date suggest that the mean cycle may be around 64 days, with supermaxima tending to reoccur in about every 310 days. One can only presume that the wide maxima have really been supermaxima because of the limited number of observations. RZ Sge deserves closer attention.

24. KK TELESCOPII.

J.D. 2,445,040 to 2,445,862. 95 observations. Previous paper (6).

No further outbursts of KK Tel were observed.

25. TU INDI.

J.D. 2,444,971 to 2,445,538. 95 observations.

TABLE 22.TU INDI---OBSERVED OUTBURSTS.

<u>No.</u>	<u>J.D. MAX</u> 24.....	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
16	45,201	13.1	(269)	?	N?	1
17	45,226	13.5	25	3	N	4
18	45,247	13.8	21	4	N	2
19	45,286	13.8	39	?	?	1
20	45,307	14.0	21	?	?	1
21	45,477	14.0	(170)	?	?	1

DISCUSSION

The above outbursts, despite the fragmentary nature of the observations, appears to confirm the previous statement that the mean cycle is short, and the mean maximum magnitude 13.7.

OBSERVERS

Table 23 lists the main contributors to the observations reported in this paper.

TABLE 23.OBSERVERS' TOTALS.

HULL, O.R.	1,310	TAYLOR, N.W.	259
JONES, A.F.	1,308	ROWE, G.	229
OVERBEEK, M.D.	1,229	MENZIES, B.	131
MARINO, B.F.	1,059	SUMNER, B.	126
HERS, J.	778	WILLIAMS, P.	122
HOVELL, S.	501	CRAGG, T.A.	97
BROWN, N.	400	EMMERSON, R.	54
HARRIES-HARRIS, E.	260	TREGASKIS, T.B.	51
GOLTZ, W.	260		
14 observers with less than 50 Obs. each		<u>159</u> TOTAL	8,333

CONCLUSIONS.

The data in this and previous papers will enable observers to select those stars, whose outbursts are within the range of their instruments. On the other hand, it should be remembered that those stars for which no, or very few outbursts, have been recorded can well have outbursts at very long intervals. Such stars probably belong to the WZ Sge sub-class and whilst disheartening to monitor can ultimately result in the detection of an outburst. The recent outburst of RZ Leo is an example of how persistent observing can pay off. Observers should also remember that, when it is obvious from the records that a star never rises above the threshold of their instrument it is useless their monitoring such stars, as one or two observers have tended to do.

Those possessing apertures capable of observing the faint dwarf novae are asked to do so. The aim of such observations is to provide better information on the behaviour of such stars. This, in turn, enables professionals to select stars that warrant observing with large apertures.

ACKNOWLEDGEMENTS

I wish to thank all observers for their records and for the care in which they have monitored difficult objects.

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OUTBURSTS OF THE DWARF NOVA, TU MENSAE---1982-84.

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SUMMARY: Seven outbursts observed in 1982-84 are discussed. It is shown that supermaxima usually have widths of around 9 days, but at very long intervals unusually long supermaxima occur, which last for 20 days, or more.

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1. INTRODUCTION.

Visual observations from 1963 May 31 to 1981 December 31 were discussed in previous papers (1) and (2). The present paper presents the observations from 1982 Jan. 1 to 1984 December 31.

2. OBSERVATIONS

All observations were made visually. The threshold of most instruments were from $13^m.5$ to $14^m.0$, but some observers used apertures capable of getting down to $16^m.0$. Table 1 lists the observers.

TABLE 1.

TU MENSAE--OBSERVERS" TOTALS

JONES, A.F.	475	TAYLOR, N.W.	77	
OVERBEEK, M.D.	394	CRAGG, T.A.	71	
HULL, O.R.	349	GOLTZ, W.	61	
MENZIES, B.	185	ROWE, G.	55	
MARINO, B.F.	145	HOVELL, S.	54	
HARRIES-HARRIS, E.	90	HERDMAN, G.	44	
Eight observers with less than 40 observations each			<u>54</u>	TOTAL 2,054

Observations were made on 924 nights, which is 84% of the total nights in the three years. The only substantial gaps in the observations were each of six consecutive nights in 1983 August; 1983 October and 1984 July. Apart from these there were occasional gaps of three consecutive nights but most breaks in the continuous monitoring were for only one or two nights.

3. OUTBURSTS

The outbursts observed during the three years are listed in Table 2, in the same form as in the previous papers. In addition to those listed there were single positive observations of $14^m.3$ on 2,446,046 and $14^m.1$ on 2,446,054. Both were noted as class 3 by the observer and they have been disregarded on that account.

Outbursts Nos. 100 and 102 also depend on single positive observations. However these appear to be definite peaks and the magnitudes recorded appear to be reliable.

The very close monitoring of TU Men in 1982-84 means that no supermaxima passed unobserved. It is also likely that very few, if any, normal maxima were missed. However, some minor peaks must have been missed, especially when their maximum brightness was $14^m.0$ or slightly fainter. This would place them below the threshold of most instruments.

Five outbursts are shown in Figures 1 to 5. Comments on these outbursts are given after Table 2.

TABLE 2.

TU Men---OBSERVED OUTBURSTS 1982-84.

<u>No.</u>	<u>J.D. Max.</u> 2,445,000+	<u>MAX</u> m_v	<u>INT.</u> d	<u>WIDTH</u> d	<u>TYPE</u>	<u>No. OBS.</u>
97	074	12.0	109	9	S	45
98	238	12.1	164	5+	S?	14
99	441	12.1	203	5	N	13
100	607	13.7	166	1	P	1
101	684	12.0	77	8	S	19
102	707	13.2	23	1	P	1
103	930	11.9	223	8	S	17

NOTES ON OUTBURSTS.

No. 97. Very well observed. The interval from the previous supermaximum was 517 days, which is much longer than the mean cycle of 194 days between consecutive superoutbursts. This long interval probably was caused by the duration of the previous supermaximum, which lasted for 24.5 days. The small amplitude variations on most nights during outburst 97 was considered to be real and due to superhumps. Attempts to check these with the superhump period failed because most observers did not record the times of their observations to a sufficient degree of accuracy. It is essential that all observers record the times of their observations of SU UMa type dwarf novae to at least three decimals of a J.D..

No. 98. Probably a supermaximum but maximum phase only observed.

No. 99 The apparent variations on some nights appear to be incorrect, because the somewhat brighter estimates are all due to an observer whose systematic deviation is such that his estimates always tend to be too bright.

No. 101. The limited number of observations on any one night indicate possible superhumps but it cannot be definitely stated these were observed.

No. 103. The rise is uncertain owing to bright moonlight. The curve has been drawn to show possible superhumps close to maximum but these must be regarded with caution due to moonlight affecting the observations. Tu Men was badly placed during this outburst.

4. MINIMA

Sixty positive observations were recorded at, or near, minimum. These ranged from $14^m.7$ to $16^m.0$. These magnitudes can only be regarded as approximate, because, in the absence of reliable magnitudes for the fainter comparison stars, they are dependent on visual estimates of the magnitudes of comparison stars "w" and "x" on chart 374 (3). These were estimated to be $14^m.3$ and $14^m.5$ respectively. The observations do appear to indicate that TU Men varies when near minimum with amplitudes of about one magnitude.

5. DISCUSSION

The mean magnitude of the supermaxima observed in 1982-84 was 12.0. The value found previously (2) was $11^m.95$. Their mean width was $8^d.3$, slightly shorter than the $9^d.8$ from earlier observations.

The mean cycle from 13 supermaxima that were considered to be definitely consecutive was given as $194^d.4$ (2). They ranged from 123 to 262 days. It is clear that in 1982-84 no supermaxima were missed. The intervals between those recorded in the past three years range from 164 to 517 days with a mean of 343 days.

Outburst No. 74 on 2,442,369 lasted for 20 days and No. 90 on 2,444,557 for 24.5 days.

No long-enduring outbursts were recorded in the past three years. The interval between outbursts Nos. 74 and 90 is 2,188 days. The intervals from these outbursts to the first supermaximum that followed them were 462 and 517 days respectively. The intervals from the preceding outbursts to Nos. 74 and 90 were 239 and 215 days. It appears that long lasting supermaxima are rare events and that they are followed by a longer than normal interval before the next super outburst.

The 2,188 days between outbursts 74 and 90 is almost equal to 11 mean cycles of 194.^d4 between successive supermaxima. I checked back over the records to see if it was possible that a long enduring supermaximum could have occurred at about the same interval prior to outburst 74. This took me to 2,440,179 which is 96 days after the commencement of a thousand day interval during which no supermaxima or normal maxima were observed. During that time the only activity came in the form of ten faint peaks. There was a poorly observed outburst on 2,440,083 which may have been a supermaximum but certainly not a long enduring one. Prior to this all the supermaxima appear to come close to their normal mean cycle and have widths of 6 to 10 days. Does this mean that TU Men undergoes some change at intervals of around 2,100 days? I do not know but if this is the case it may warrant close attention to TU Men around November-December 1986. Probably no importance can be given to what may purely be chance but at least it may be worth checking in due time.

The orbital period of TU Men is 0.^d1176 (4) placing it in the well known gap between 2 and 3 hours. It is possible that the behaviour of TU Men has changed with time but there appear to be no early photoelectric results against which to check this.

CONCLUSIONS

TU Men had no abnormally long super outbursts during 1982-84. It appears that these are rare events which occur at very long intervals. It is possible to obtain the superhump period from visual observations provided observations are accurately timed and reported to three, and preferably four, decimals of a J.D. The amplitude of superhumps appear to be about 0.^m4 in the early stages of a super maximum, and decrease to 0.^m2 as the outburst progresses.

It is considered definite that no super outburst were missed during the three years 1982-84 and probably very few, if any, normal outbursts passed unobserved. The very short duration and faintness of minor peaks makes it probable that a number of these were not observed.

ACKNOWLEDGEMENTS

My grateful thanks are due to all observers for the manner in which they have monitored TU Men so closely.

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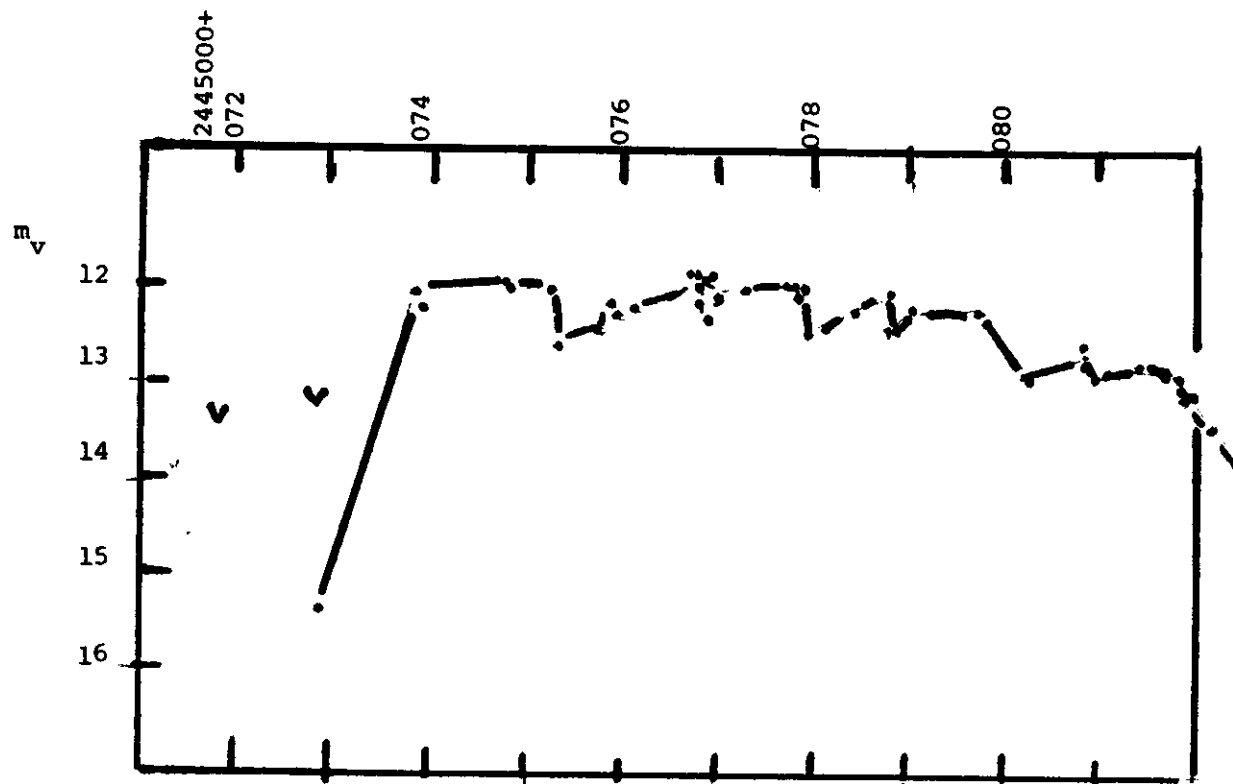


Figure 1. TU Men. Outburst No. 97

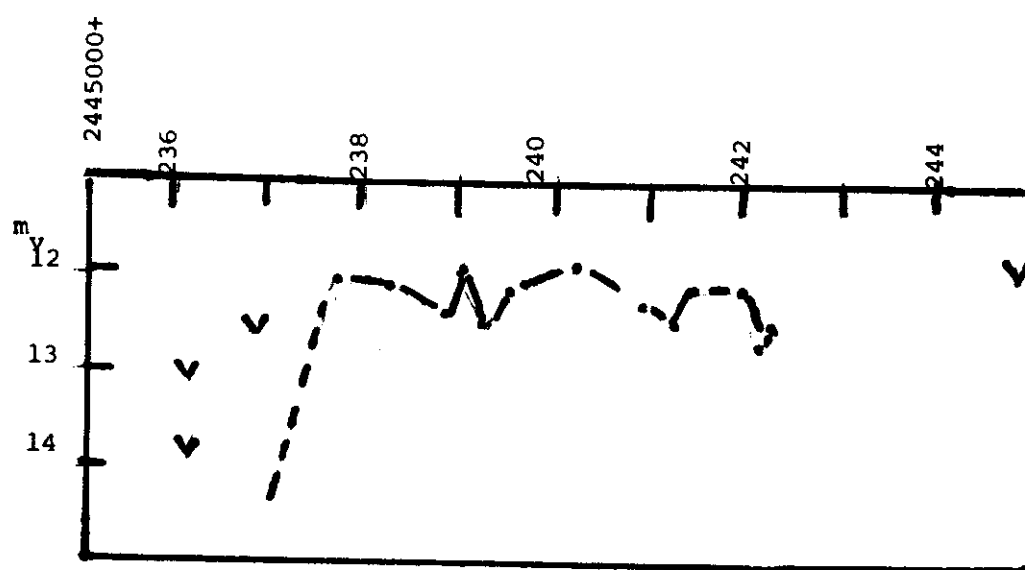


Figure 2. TU Men. Outburst 98.

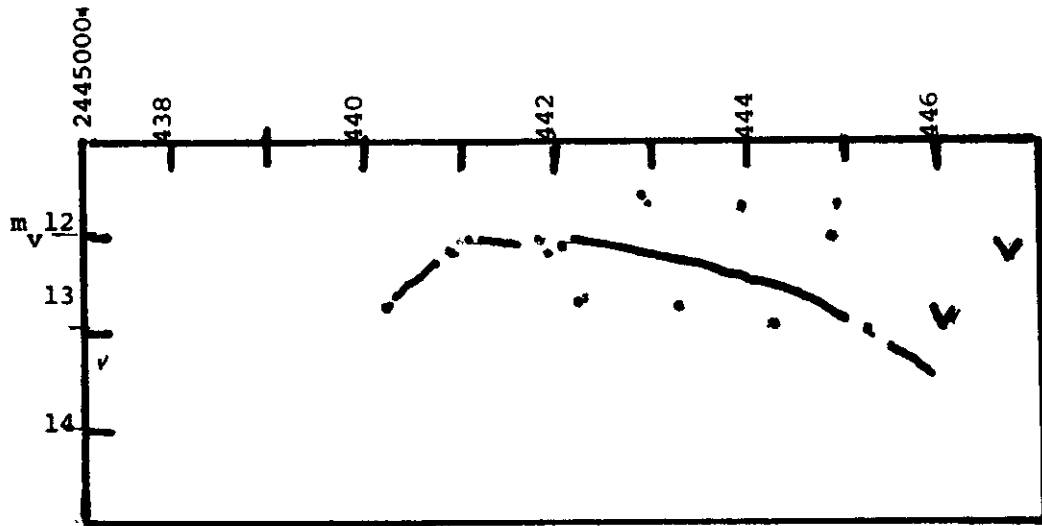


Figure 3. TU Men. Outburst 99.

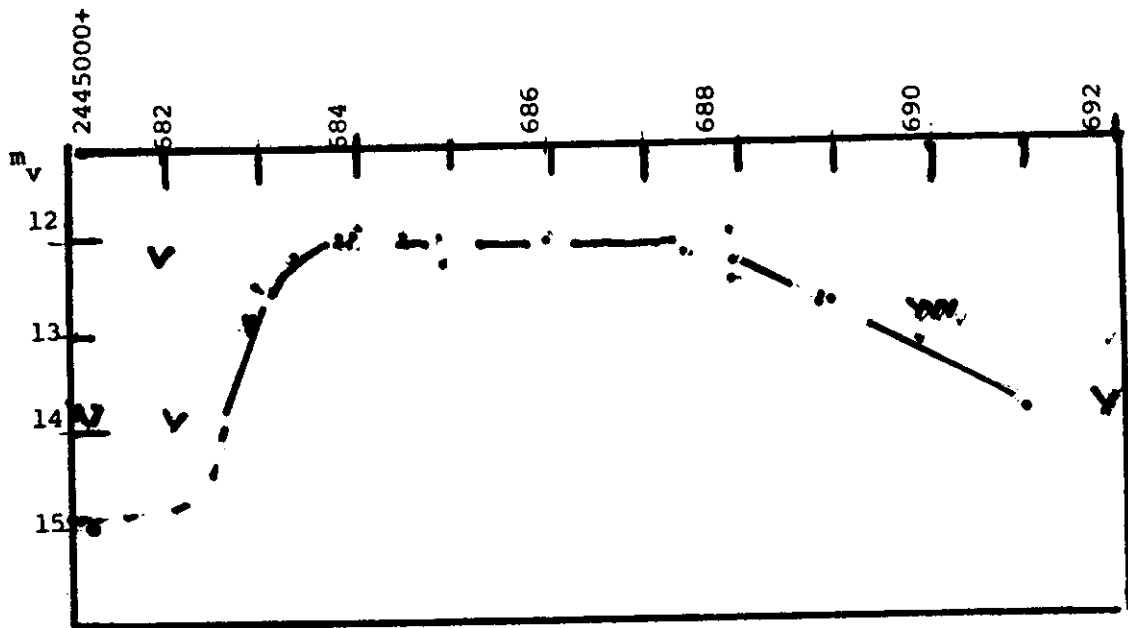


Figure 4. TU Men. Outburst 101.

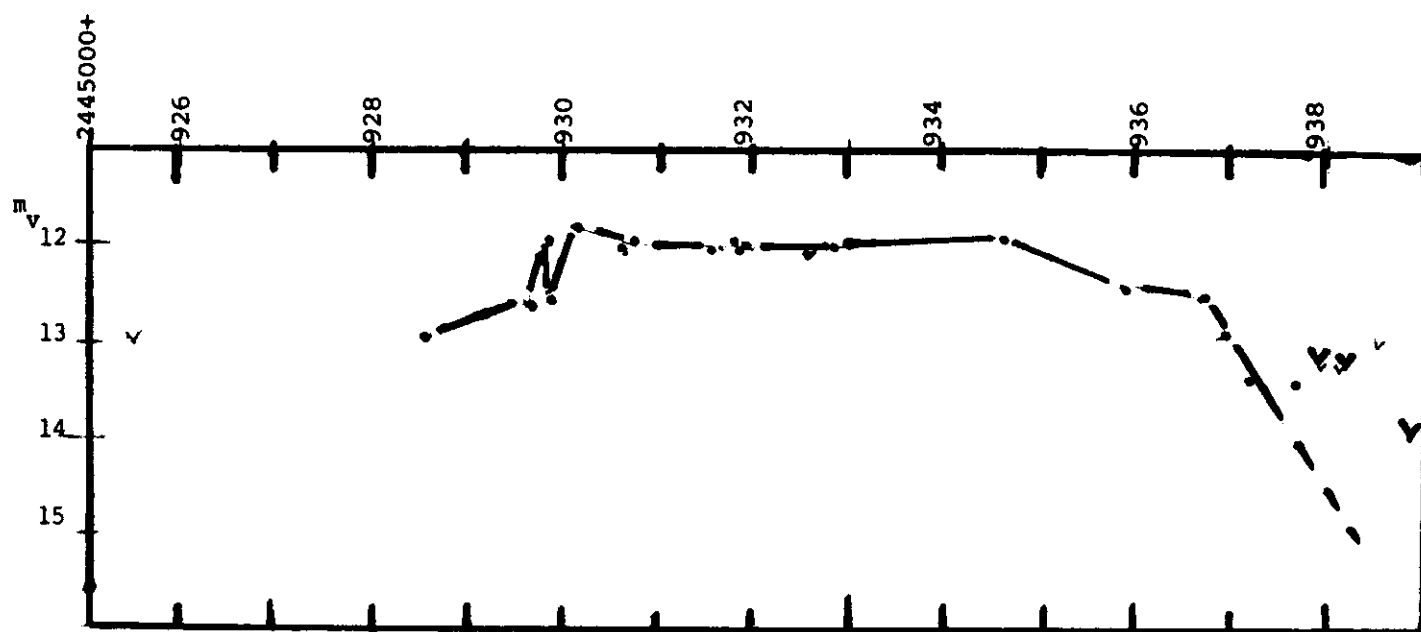
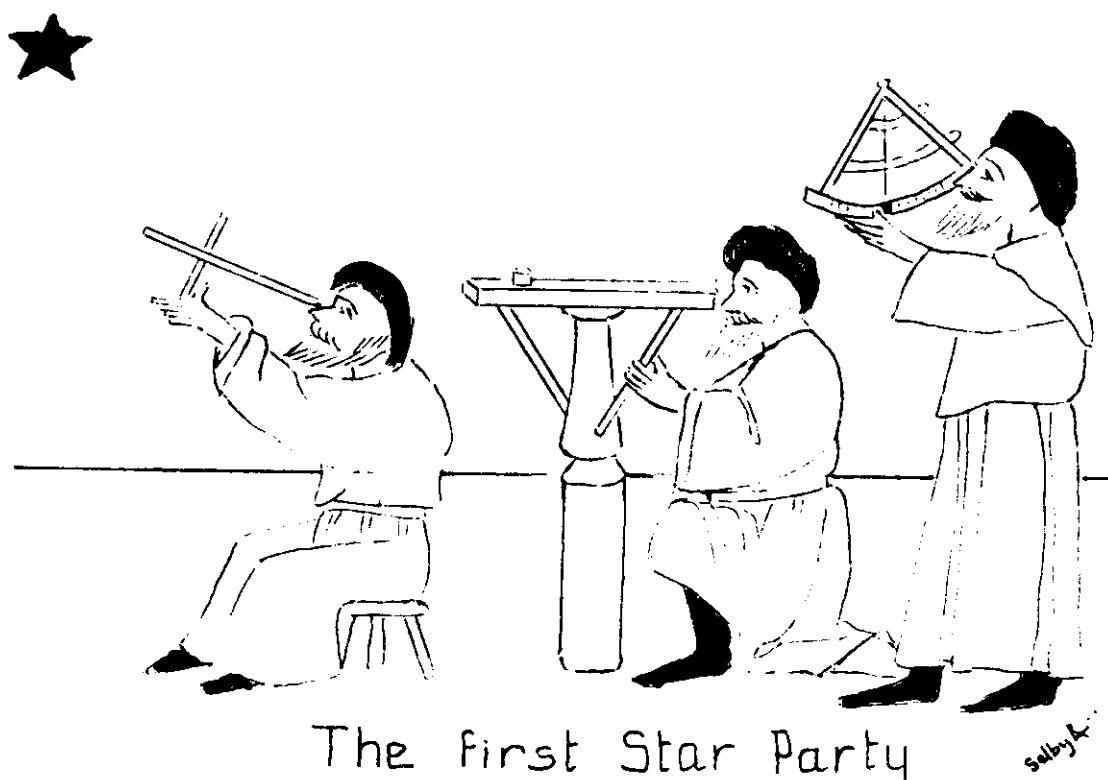


Figure 5. TU Men. Outburst 103.

THIS DELIGHTFUL DRAWING WAS ON THE CHRISTMAS CARD FROM DANIE OVERBEEK



A CHART AND SEQUENCE FOR HDE 293373, THE VARIABLE CENTRAL STAR OF NGC 2346.

B.F. Marino(a) and M. Morel(b).

- (a) Auckland Observatory of the Auckland Astronomical Society.
 (b) Variable Star Section, R.A.S.N.Z.

SUMMARY: A chart with a photoelectrically determined sequence of V magnitudes for the range 10.3 to 15.2 has been prepared for visual observers of this unique and interesting system. B-V values are tabulated for the same stars for the reduction of photographic observations.

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1. INTRODUCTION

The central star of the bipolar planetary nebula NGC 2346 is a spectroscopic binary with a period of 15.991 days (1). In 1982 Kohoutek (2), (3), announced suprisingly large variations in brightness (from the normal 11th magnitude down to 13.43V) where none had been observed previously. These have continued with increasing amplitude in 1982-83, and have been attributed to the sudden onset of a progressive occultation of the central star by an unusually dense dust cloud (4).

Field identification has been published by Kohoutek (3) who gave photoelectric UBV magnitudes for five nearby field stars (labelled a, b, c, d in Table 1 and 63 in Table 2 below).

In this note we reproduce chart 792 from Series 17 of "Charts for Southern Variables" published by Astronomical Research Ltd (5). Also tabulated are the V magnitudes and B-V colours of several of the fainter stars in the field.

2. PHOTOELECTRIC PHOTOMETRY.

Claría (4) using the Cerro Tololo Inter-American Observatory's 1 metre telescope, has made further UBV observations of stars a, b, c and d. These, together with the values published by Kohoutek are summarised in Table 1.

Photoelectric V and B magnitudes for fifteen of the fainter comparison stars have been supplied by R.H. Mendez, of Instituto de Astronomia y Fisica del Espacio (IAFE) from photometry conducted by Roel Gathier. These are listed in Table 2. Column 7 of Table 1 and column 4 of Table 2 give recommended values to be used by visual observers and photographic observers using a "photovisual" system. For photographic observers using a blue (panchromatic) system the values tabulated in columns 8 and 5 can be used for reduction to photographic "B" magnitudes.

3. THE CHART

The chart has been prepared to the same format as previous series charts and has a scale of 10"=1mm. The magnitudes shown are the visual values recommended above. Charts 790 (60"=1mm) and 791 (20"=1mm) have also been published (5). These serve as finder charts for HDE 293373.

4. VISUAL OBSERVATIONS

Observations by visual observers will be useful, and should be carefully made using chart 792. Such observations should be accurately timed with the Julian Date given to three decimals of a day. The observations should be reported to the Variable Star Section, R.A.S.N.Z., on the usual monthly returns.

5. PHOTOELECTRIC OBSERVATIONS OF NGC 2346

Observers wishing to observe the central star of NGC 2346 photoelectrically are

referred to section 2, "New Photoelectric Observations" of reference (4), where problems of observation relating to the nebula background are described.

6. PHOTOGRAPHIC OBSERVATIONS OF NGC 2346.

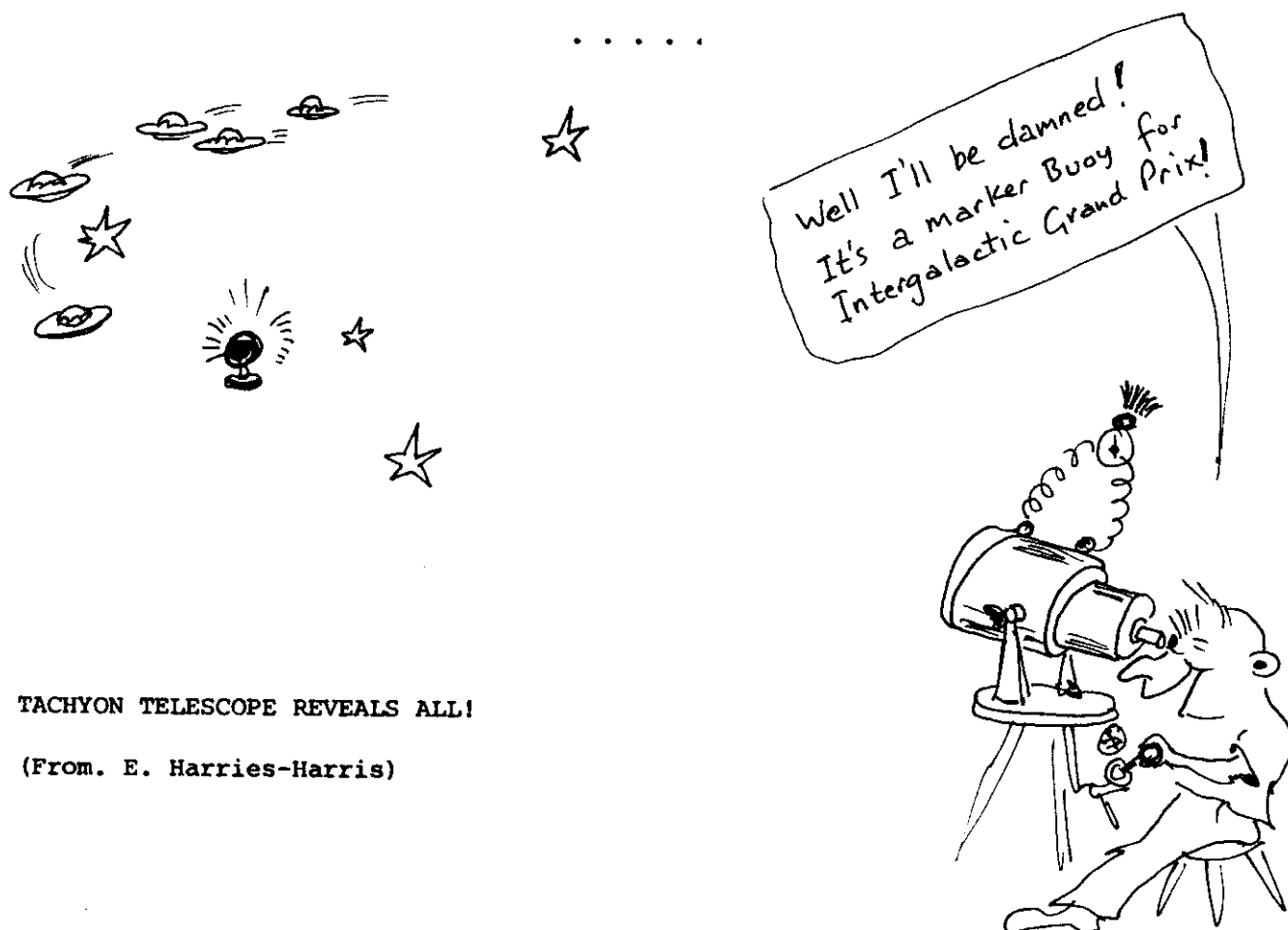
Visual magnitude estimates from photographs of the field have proved of high accuracy and of considerable value to date (4). The photovisual system, i.e. including an orange filter to approximate visual magnitudes, shows high consistency with V photoelectric magnitudes down to approximately $V = 14$. Below this level the estimates become increasingly too bright. For "blue" exposures the same effect is apparent but at a brighter magnitude making these estimates of lower accuracy. A photovisual system is preferred where possible. The over-brightness effect is considered to be due to the influence of the background nebulosity which has an increasing effect on the photographic image density (or size) as the brightness of the stellar component decreases. For further discussion refer to (4).

ACKNOWLEDGEMENTS

We thank Drs. R. Gathier and R.H. Mendez for undertaking the photoelectric photometry of the faint stars of the sequence, and for permission to publish their results here.

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TACHYON TELESCOPE REVEALS ALL!

(From. E. Harries-Harris)

Table 1. Three colour magnitudes for brighter comparison stars.

star	observer	V	B-V	U-B	no.	recommended		Chart 12 HDE No.
						visual	phtr	
a	Kohoutek	10.24	+0.14	+0.17	4	10.3	10.4	293372
	Claria	10.26	0.15	0.20	16			
b	Kohoutek	11.02	+0.36	+0.13	6	11.0	11.4	293371
	Claria	11.04	0.36	0.12	4			
c	Kohoutek	12.01	+0.11	+0.12	2	12.0	12.1	293348
	Claria	12.02	0.12	0.15	3			
d	Kohoutek	12.80	+0.25	+0.21	7	12.8	13.1	
	Claria	12.83	0.25	0.23	3			

Table 2. Two colour magnitudes for fainter stars from Mendez and Gathier.

star	V	B-V	recommended	
			visual	photographic
44	13.16	+0.56	13.2	13.7
63	13.25	0.09	13.2	13.3
84	13.26	0.17	13.3	13.4
85	13.33	0.28	13.3	13.6
49	13.44	0.52	13.4	14.0
71	13.74	0.26	13.7	14.0
60	13.79	0.18	13.8	14.0
45	13.83	0.24	13.8	14.1
87	13.87	0.19	13.9	14.1
74	13.91	0.19	13.9	14.1
90	14.36	0.25	14.4	14.6
66	14.58	0.22	14.6	14.8
57	14.65	0.65	14.7	15.3
80	14.82	0.44	14.3	15.3
56	15.18	0.27	15.2	15.5

792

070400 HDE 293373 = AGK -0° 965=Central star in NGC 2346

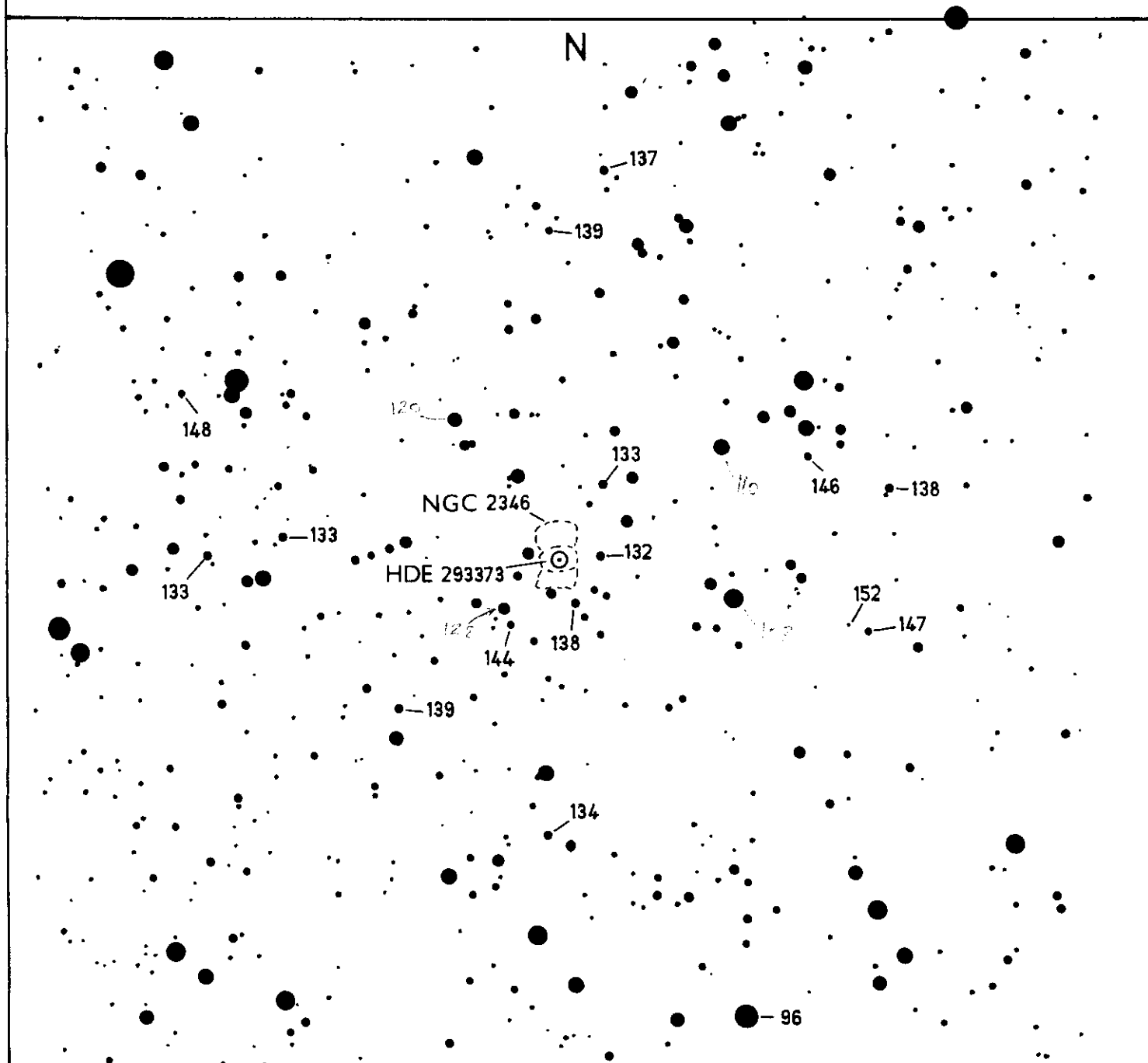
(1950): 07^h 06^m 49^s.641 -00° 43' 30".57

(2000): 07 09 22.7 -00 48.2

SEE ALSO CHARTS 790 & 791

EB & Irr. 11.29 - 15.5V 15^d.991. A5.

SCALE: 10" = 1mm



Traced by M.M. from photo by H.O. Williams & AAVSO preliminary chart (Feb.1984)
MAGNITUDES: V

F.M.B. 31.5.84

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CN ORIONIS

Frank M. Bateson & A.W. Dodson
Variable Star Section, R.A.S.N.Z.

SUMMARY: Visual observations from the Variable Star Sections of the B.A.A. and R.A.S.N.Z. have been combined to reproduce the light curve of CN Ori. This covers the interval 1979 Jan.19 to 1983 Dec. 31. A table of observed outbursts is given. The parameters for three types of maxima are tabulated. An expanded light curve is also published. This was used to investigate small amplitude variations during outburst. It is shown that the preliminary period determined is consistent with rotation.

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1. INTRODUCTION

CN Ori is a dwarf nova of the Z Cam sub class. It is possibly related to the DQ Her stars. Observations by members of the Variable Star Section, R.A.S.N.Z., from 1950 October 7 to 1979 January 16 were discussed by Bateson(1).

2. OBSERVATIONS

The main observing season for CN Ori is September through April. This star is in the equatorial zone and is more adequately monitored when observations from observers in both hemispheres are combined. The Variable Star Sections of the British Astronomical Association and the Royal Astronomical Society of New Zealand have a programme that enables their observations of variables in the equatorial zone to be combined.

This paper presents the combined observations of CN Ori for the interval J.D. 2,443,893 to 2,445,700 (1979 Jan. 19 to 1983 Dec. 31). A total of 2,579 visual observations were made, of which 1,848 came from the R.A.S.N.Z. and 731 from the B.A.A. The observers are listed in Table 1, in which B.A.A. members are marked with the sign "+" and R.A.S.N.Z. members with "*".

TABLE 1.

OBSERVERS OF CN ORIONIS.

*JONES, A.F.	519	*WILLIAMS, P.	39
*HULL, O.R.	283	*SUMNER, B.	38
+STOTT, D.	255	*CRAGG, T.A.	36
*MARINO, B.F.	212	+PICKARD, R.D.	34
*OVERBEEK, M.D.	179	*STEPHANOPOULOS, G.	33
*TAYLOR, N.W.	137	+KAY, S.J.	33
+GAINSFORD, M.J.	102	+BUENO, A.T.A.	29
*HOVELL, S.	97	*TREGASKIS, B.	28
+PATERSON, R.A.H.	84	+COADY, G.A.V.	26
*ORCHISTON, W.	56	*GOLTZ, W.	23
*VENIMORE, C.W.	55	+SHANKLIN, J.D.	23
*ROWE, G.	48		
+18 observers with less than 20 observations each			145
*13 observers with less than 20 observations each			65
			<u>TOTAL</u> 2,579

The observations from both organisations are extraordinarily complementary, in good agreement and provide better coverage than a single group could supply.

3. OUTBURSTS

The details of observed outbursts are listed in Table 6, which is a continuation of a table in the previous paper (1). Outbursts have been divided into the following three types:

- WIDE (W). Width at $13^m.0$ longer than $6^d.1$.
 ANOMALOUS (A) The rise from $13^m.0$ to maximum brightness exceeds 4 days.
 NARROW (N) Width at $13^m.0$ is $6^d.0$, or less.

The table of outbursts in the previous paper included a number of faint peaks of short duration. The present paper includes none of this type of outburst, which appear to be due solely to outbursts only partially observed.

The main features for each type of maximum are summarised in Tables 2, 3 and 4 below. These tables are based solely on those outbursts for which the details in Table 6 are definite.

TABLE 2

CN ORIONIS---MAGNITUDES AT MAXIMA.

<u>TYPE</u>	<u>MEAN MAXIMUM MAGNITUDE</u>	<u>S.D.</u>	<u>EXTREMES</u>	<u>No.</u>
W	12.09	$+0^m.16$	$11^m.7 - 12^m.5$	35
A	11.98	$+0.10$	$11.7 - 12.2$	13
N	12.35	$+0.17$	$12.0 - 12.6$	10

TABLE 3.

CN ORIONIS---WIDTHS OF MAXIMA AT $13^m.0$.

<u>TYPE</u>	<u>MEAN WIDTH</u>	<u>S.D.</u>	<u>EXTREMES</u>	<u>No.</u>
W	$8^d.5$	$+0^d.84$	$7^d - 12^d$	35
A	9.9	$+1.3$	$7.5 - 11.5$	13
N	4.6	$+1.3$	$3 - 6$	10

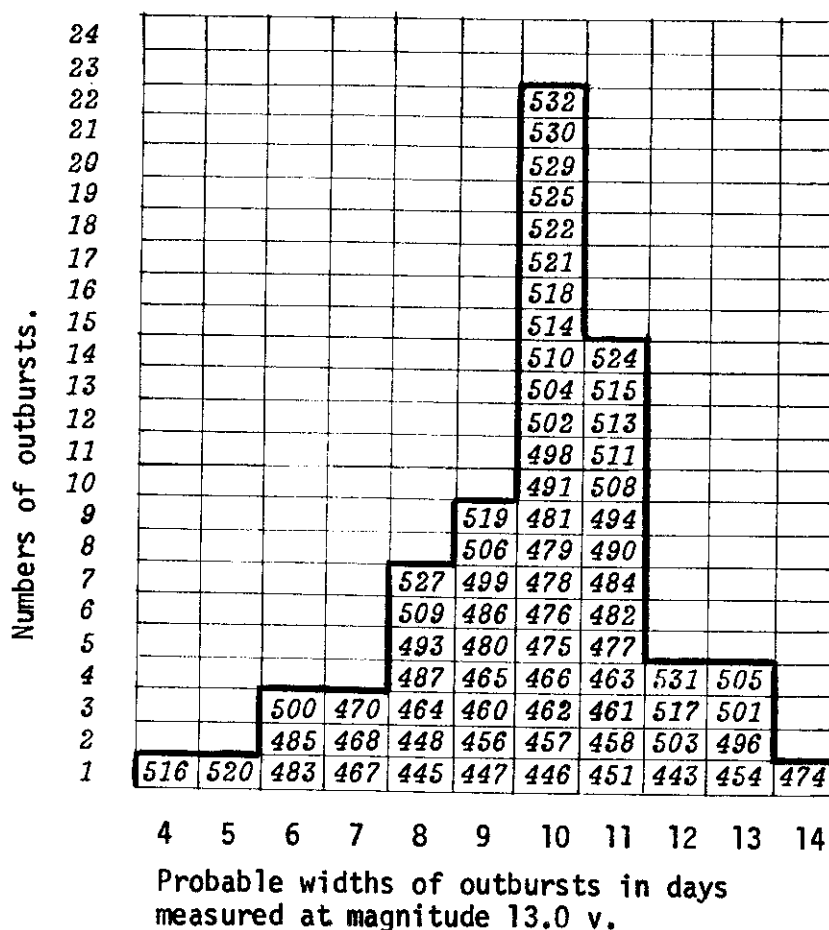
TABLE 4.

CN ORIONIS---RISE & DECLINE TIMES $13^m.0$ TO & FROM MAXIMA

<u>TYPE</u>	<u>MEAN RISE</u>	<u>S.D.</u>	<u>EXTREMES</u>	<u>MEAN DECLINE</u>	<u>S.D.</u>	<u>EXTREMES</u>	<u>No.</u>
W	$3^d.6$	$+0^d.46$	$3^d - 4^d$	$4^d.9$	$+0^d.67$	$3^d - 6^d$	35
A	5.5	$+0.5$	$4.5 - 7$	4.4	$+0.8$	$3 - 6$	13
N	1.9	$+0.31$	$1 - 3$	2.7	$+0.90$	$1 - 4$	10

The observations are plotted in Figures 1a to 1h. It should be noted that the curve shown is often displaced to the right or left for clarity from its true mean position. This was necessary because of the large number of observations shown. However, one of us (FMB) has compiled Tables 2, 3, 4 and 6, using the actual observations and the true light curve superimposed on the plotted points.

TABLE 5.



Outbursts with no determined widths due to insufficient observations:

442, 444, 449, 450, 452, 453, 455, 459, 469, 471, 472, 473, 488*, 489, 492, 495, 497, 507, 512*, 523, 526, 528.

* Probable outburst that went unobserved.

Each rectangle forming the histogram contains the assigned outburst number.

Independently (AWD) has shown the widths of maxima in Table 5, above, using his plotted light curves as shown in Figures 1a to 1h. This table tends to slightly increase the widths in comparison with those given in Tables 3 and 6.

There are 59 maxima which are certainly successive and for which the intervals between them are definite. These give a mean cycle of 17.^d78 with the individual intervals ranging from 11 to 24 days. The average deviation from this mean cycle is ± 1.92 .

4. SMALL AMPLITUDE VARIATIONS

An inspection of Figures 1a - 1h suggests that there is a fair amount of scatter in the observations. This appearance is due to the difficulty of plotting a large number of points on a small scale. A number of the best observed maxima have been plotted on an enlarged scale in Figures 2a to 2i. Two curves are shown in each of these figures---one through the points of maxima and the other through the minima points.

These curves show that during outbursts the observations fall almost entirely within a spread in amplitude that averages $0^m.7$ but ranges from $0^m.4$ to $1^m.0$. The smaller amplitudes tend to occur during the first stages of the rise to maximum and the larger amplitudes tend to be close to the maximum phase. It has not always been possible in Figures 2a - 2i to show clearly the small differences in the times of observations on the same date.

We checked whether any apparent scatter in the observations was due to actual errors or to rotation by using the actual observations in conjunction with the light curves. For this purpose all observations for which an observer expressed doubts, or which were classed as 2 or 3 due to the presence of clouds, moonlight or some other hindrance to observations were disregarded. All the remaining observations of maxima of these small amplitude variations were then tabulated and checked to make certain that the observations on either side of them showed a rising or fading trend that was consistent with the points of maxima.

This procedure gave us 103 well established points of maxima from which the period below was found.

$$\text{HJD Maximum } 2,444,336.3576 \pm 0.^d.16297$$

We must stress that this result must be regarded as a preliminary one and a more detailed tabulation of all phases has yet to be completed. This will form the subject for a later paper. However, this result does confirm the high degree of accuracy attained by the observers in enabling a rotation period to be determined from their estimates.

5. STANDSTILLS

Z Cam variables are generally considered to exhibit intervals of constant brightness at a phase intermediate between maximum and minimum. These are standstills. They last sometimes for several cycles. There is no evidence in the observations in this paper for any definite standstill of CN Ori. It appears to have varied continuously with the possible exceptions of poorly observed outbursts (e.g. Nos. 447-453; 489-492). Even the limited observations at these outbursts suggest that CN Ori had no standstill..

6. MINIMUM

A few minima occurred in the range $14^m.5$ to $15^m.3$ when CN Ori did not fade completely but rose again immediately. Apart from these few occasions the star fell below the threshold of the instruments used. It can be concluded that normal minima are fainter than $15^m.0$ and therefore there is no information on its behaviour at minimum.

7. DISCUSSION

There is little difference between wide and anomalous maxima. The latter have a slower rise time and a slightly quicker decline and are wider at phase $13^m.0$. We conclude that the division between these two types of maxima is unnecessary.

Normal maxima are of comparatively short duration and slightly fainter on the average than wide maxima.

The occurrence of the different types of maxima appears to be random. There appears to be no relationship between the type of maximum and the one that immediately preceded or followed.

CN Ori, during the interval discussed in this paper, had no standstills. There was no firm evidence of standstills in the observations previously reviewed (1). The absence of standstills contrasts with the behaviour of the type star Z Cam(2,3,4).

8. CONCLUSIONS

It is obvious from this paper that more complete monitoring of CN Ori has been possible by combining the observations made by the Variable Star Sections of the British Astronomical Association and the R.A.S.N.Z. This suggests that it is desirable to treat all stars in the equatorial zone in the same way.

CN Ori has varied continuously with a mean cycle of $17^d.78$. We conclude that there are only two types of maxima, wide and normal. The inclusion of anomalous maxima as a separate type is shown to be unnecessary because CN Ori does not behave like stars of the SU UMa and U Gem classes in having rapid rises of 24 hours, or less. Thus for CN Ori the definition of what should be regarded as an abnormally slow rise is not clear. The differences between wide and normal maxima is simply that the former are of longer duration and attain a maximum brightness about $0^m.4$ brighter.

We conclude that CN Ori is not a typical Z Cam type variable inasmuch as it does not have standstills at an intermediate magnitude which is generally considered to be a characteristic of Z Cam stars.

We have shown that a preliminary investigation of the small amplitude variations of CN Ori gives a rotation period of:-

$$\text{HJD Maximum } 2,444,336.3576 \pm 0^d.16297.$$

This has been derived from 103 maxima but is subject to a more detailed discussion in a later paper. The amplitude of these variations ranges from $0^m.4$ to $1^m.0$ with the largest amplitudes occurring at maximum phase. This result shows that visual observations of a high standard are capable of yielding a rotation period, provided all observations are accurately timed and given to three decimals of a J.D.

ACKNOWLEDGEMENTS

We wish to thank all observers for their results, which obviously have been made with care and accuracy.

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TABLE 6

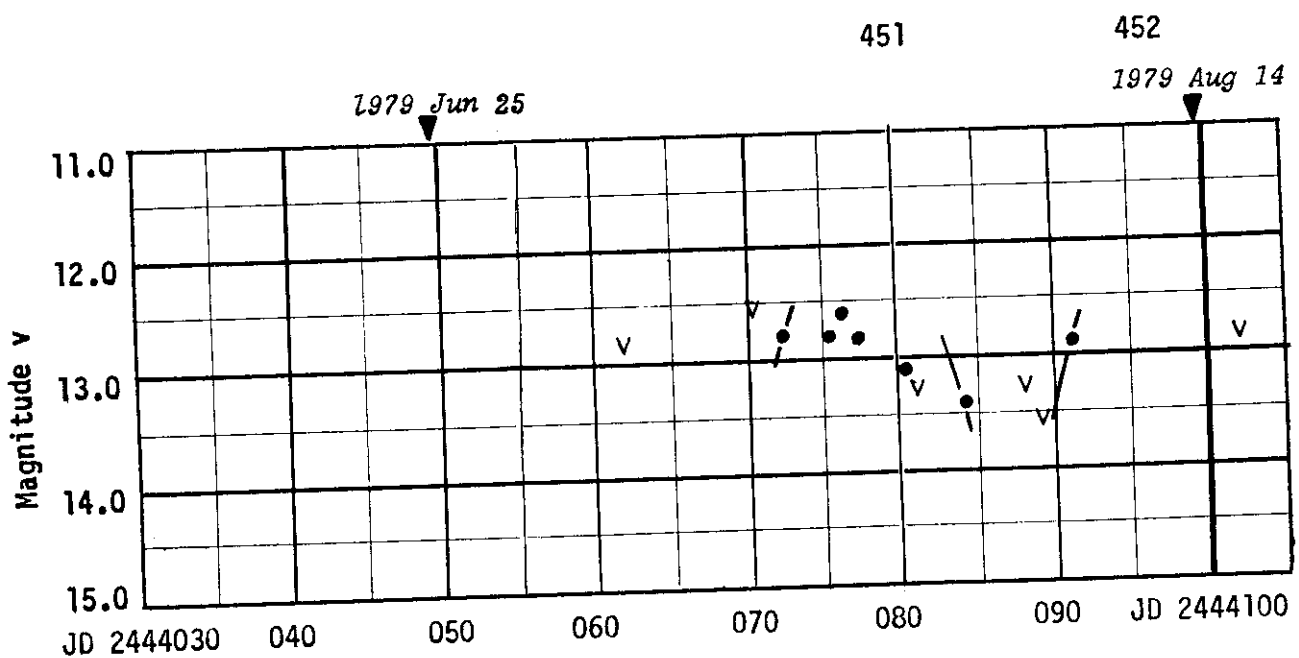
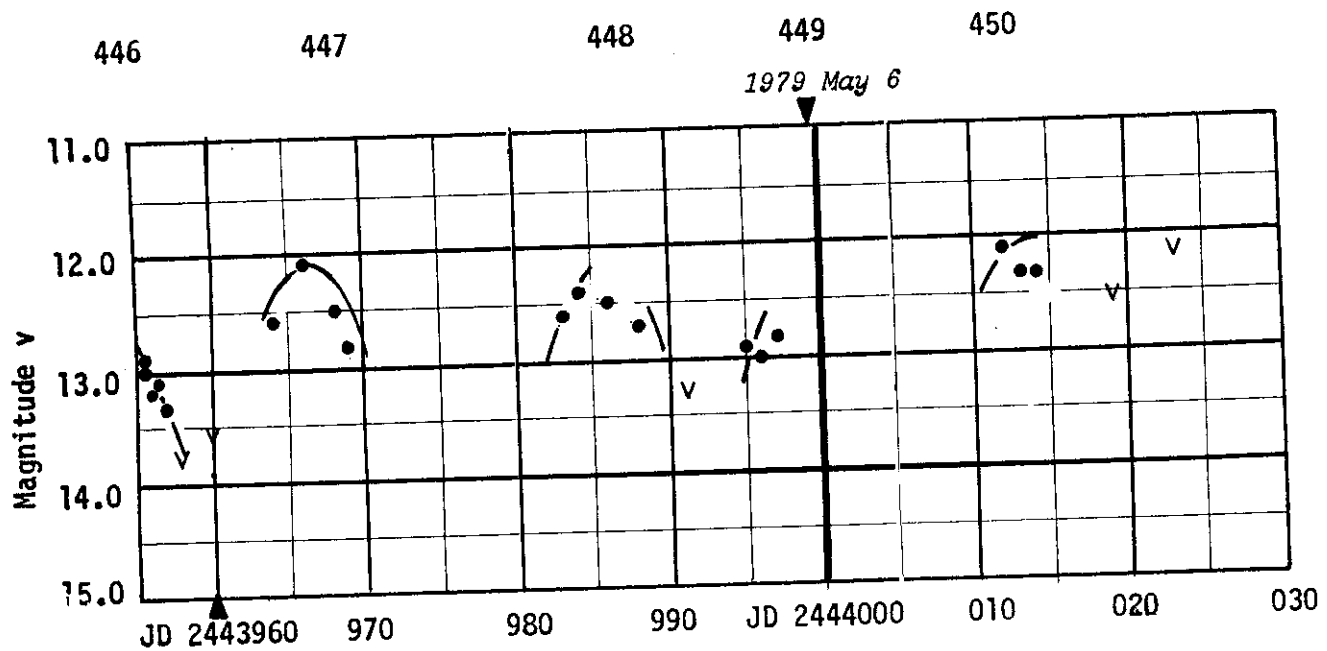
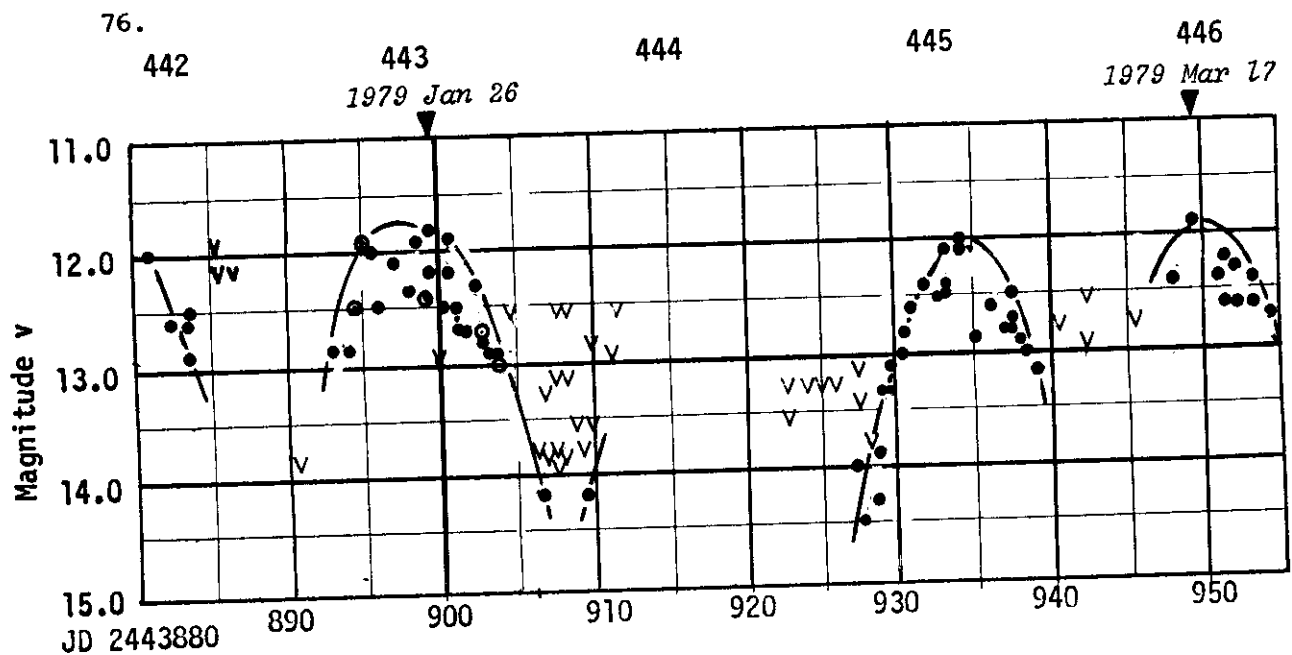
OBSERVED OUTBURSTS OF CN ORIONIS

No.	TYPE	MAXIMUM	INT	CN = 13 ^m .0		WIDTH	No. of OBS.
		JD 24.....	MAX _v d	R	F.	d	
443	A	43,898	11.8 16	892.5	904	11.5	32
444	?	915?	? 17?	...	...	...	1
445	W	934	12.0 19?	930	938.5	8.5	27
446	W	950	11.9 16	946	955	9	15
447	W	966	12.1 16	962?	970	8?	4
448	W	985	12.4 19	982	990	8	4
449	?	44,000?	12.3?15?	995	...	...	3
450	?	012?	12.0 12?	...	...	...	3
451	W	075?	12.3?(63?)	072	080	8	6
452	?	095?	12.0?20?	091	...	...	1
453	?	110?	? 15?	...	...	...	1
454	A	128?	12.0?18?	121	134	13	5
455	A?	148?	12.0?20?	142	...	...	4
456	A	165	12.2 17?	160	168	8	10
457	W	180	12.4 15	176	186	10	11
458	A	198	12.0 18	192	203	11	22
459	W	215	12.1 17	...	221	...	16
460	W	232	11.9 17	228	237	9	41
461	A	250	11.9 18	244	255	11	47
462	W	265	12.0 15	261	270	9	16
463	A	282	12.0 17	277	288	11	33
464	W	301	12.0 19	297.5	305	7.5	17
465	W	318	12.3 17	314	323	9	21
466	W	337	12.1 19	333	342	9	29
467	N	356?	12.0?19	354	360	6	2
468	A	374	12.1 18?	369.5	377	7.5	6
469	?	431?	12.5?(57)	429	...	...	2
470	W	441?	12.0?10?	439	446	7	6
471	N	457	12.6 16?	456	459	3	5
472	N?	472	12.3 15	...	475	...	2
473	N	490	12.6 18	488	492	4	8
474	W	505?	11.9?15?	501	511?	10?	5
475	A?	524	12.1 19	519	...	...	6
476	W	541	12.2 17	537	544	7	12
477	W	557	12.3 16	553	561	8	15
478	A	574	12.0 17	569	578	9	21
479	W	589	12.2 15	585	594	9	20
480	W	609	12.0 20	605	614	9	44
481	A	628	12.0 19	623	632	9	31
482	W	644	12.1 16	640	648	8	41
483	N	658	12.2 14	656	662	6	17
484	A	673	11.9 15	667	678	11	23
485	N	692	12.2 19	689	694	5	20
486	W	708	12.0 16	705	713	8	13
487	W	729	12.4 21	726	733	7	12
488	NO OUTBURST SEEN						
489	W	750	12.3 21	747	755	8	5
490	?	799?	12.8?(49?)	...	799.5	...	3
491	A	818?	12.7 19?	813	822	9	5
492	?	833?	12.9?15?	830	...	...	4

TABLE 6 (cont)

No.	TYPE	MAXIMUM JD 24.....	MAX m_v	INT d	CN = 13. ^m ₀ R F		WIDTH d	No. of Obs.
493	W	44,854	12.5	21	850	858	8	10
494	W	870	12.3	16	867?	876	9?	18
495	A?	890?	12.4	20?	885	...	...	4
496	W	901	12.2	11	897	907	10	10
497	W	918	12.2	17	916	924?	8?	5
498	W	939	11.9	21	936	943	7	36
499	W	957	12.1	18	953	962	9	33
500	N	974	12.2	17	972	977	5	29
501	W	992	11.8	18	988	997	9	52
502	W	45,014	12.0	22	010	018	8	42
503	A	031	11.9	17	024	035	11	16
504	W	050	12.4	19	046	054	8	13
505	A	070	11.7	20	064	075	11	15
506	W	087	12.0	17	084	091	7	26
507	?	170?	12.5?(83?)		...	...	...	2
508	W	202	12.2 (32)		198	208	10	10
509	N	227	12.0 (25)		225	231	6	12
510	A	246	12.0	19	241	251?	10?	6
511	W	259	12.1	13	256	265	9	13
512	NO OUTBURST SEEN							
513	W	292	11.9 (33)		289	298	9	26
514	W	313	12.0	21	310	317	7	25
515	W	334	11.9	21	330	339	9	37
516	N	350	12.4	16	348.5	352	3.5	27
517	W	367	11.7	17	364	376	12	55
518	W	390	12.0	23	386	395	9	26
519	W	409	12.0	19	406	413	7	27
520	N	428	12.6	19	426	429	3	8
521	N	442	12.3	14	440	446	6	16
522	N?	458?	12.2?16		...	462	...	7
523	(Insufficient observations)							
524	?	540?	11.9?(82?)		536	546?	10?	4
525	N	556?	12.0?16?		553	559	6	7
526	(Insufficient observations--possibly maximum around 575)							
527	N	592	12.4 (36)		590	595	5	13
528	W?	611	12.0	19	...	616	...	8
529	A	635	12.1	24	630	639	9	7
530	W	653	12.0	18	649	658	9	23
531	W	670	12.0	17	667	675	8	44
532	A	689	12.1	19	683.5	692	8.5	24
533	(OUTBURST IN PROGRESS AT 31 December 1983)							

N.B. The number of observations given in the last column refer s only to the total positive observations at each outburst.



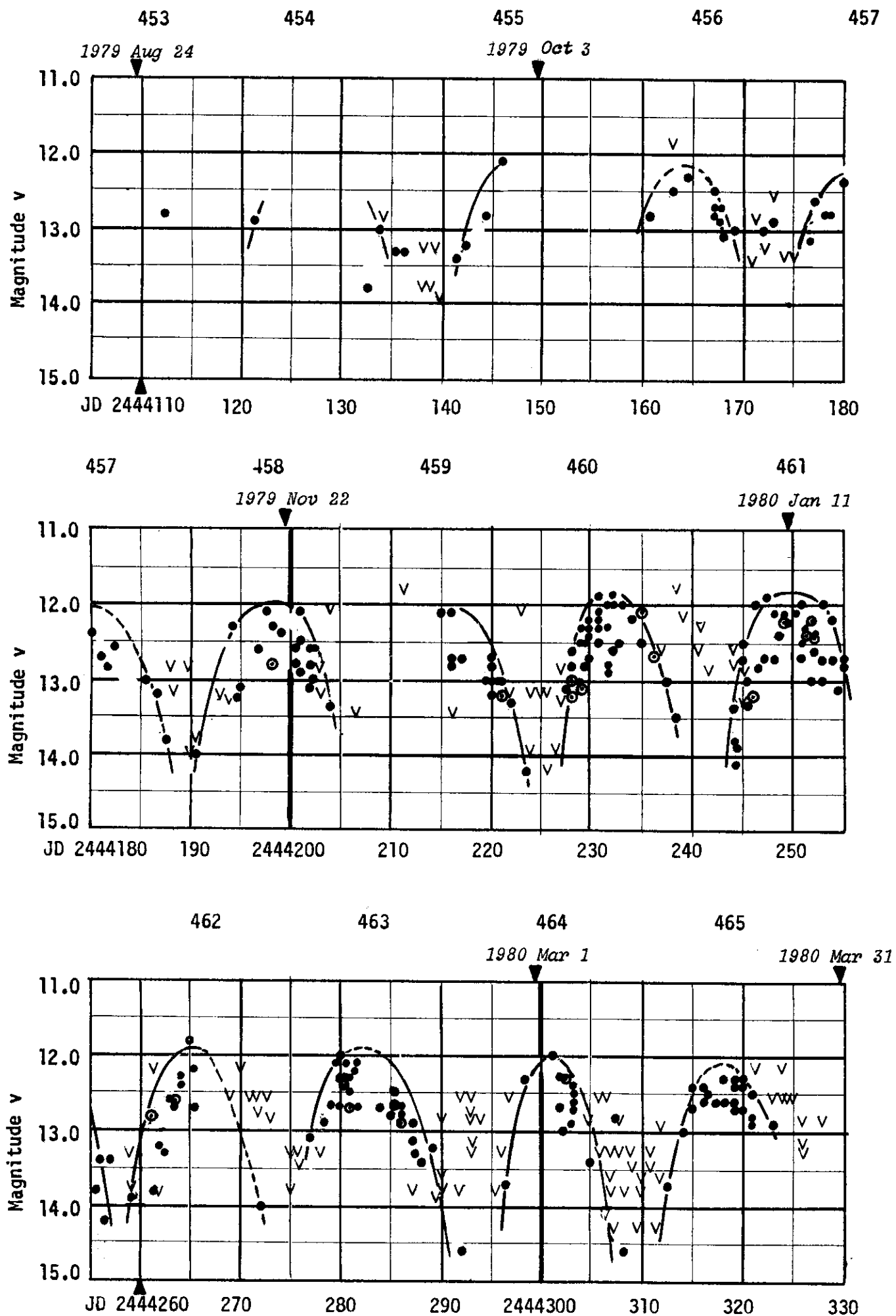


Fig 1b

054705

CN Orionis

Light Curve

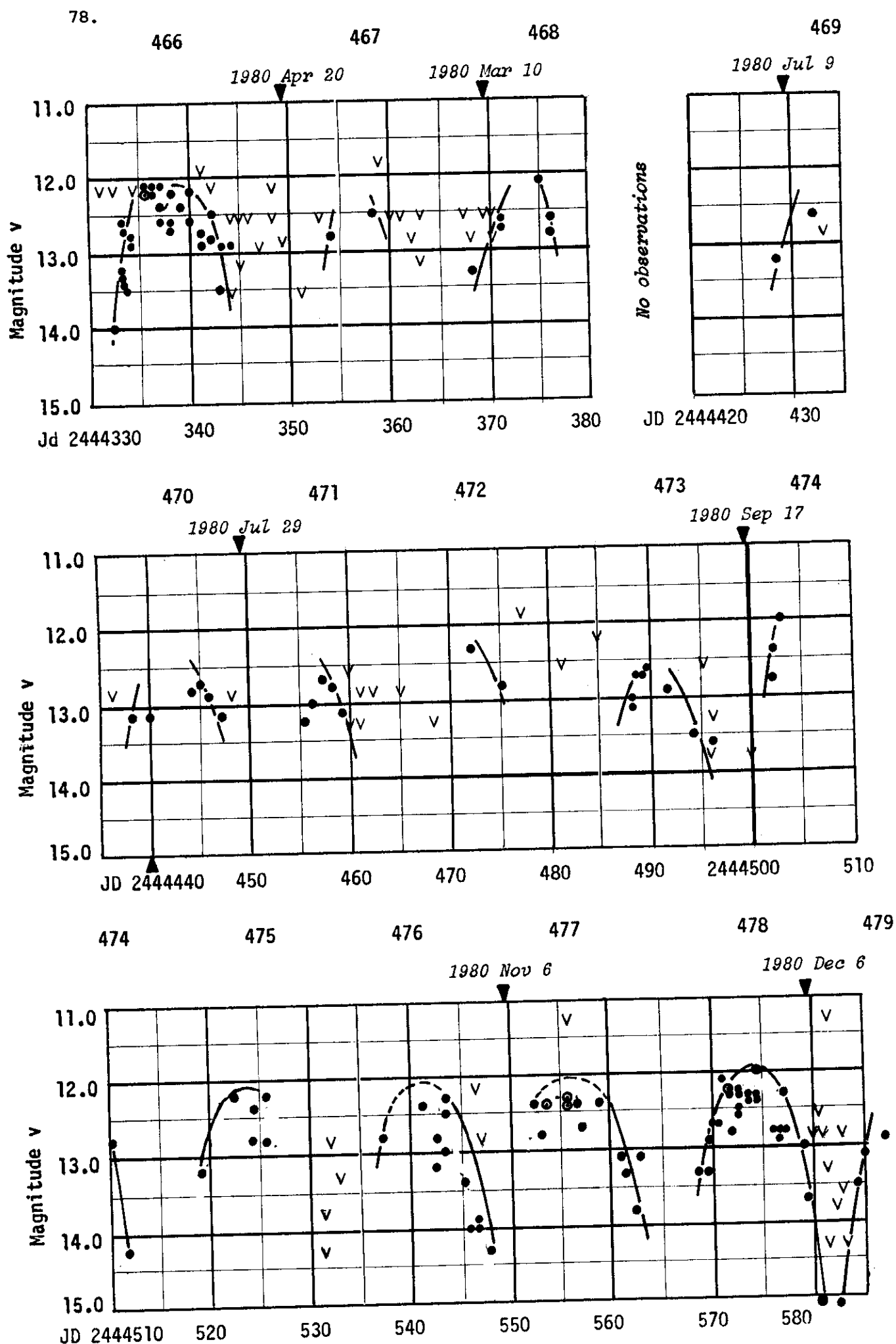


Fig 1c

054705

CN Orionis

Light Curve

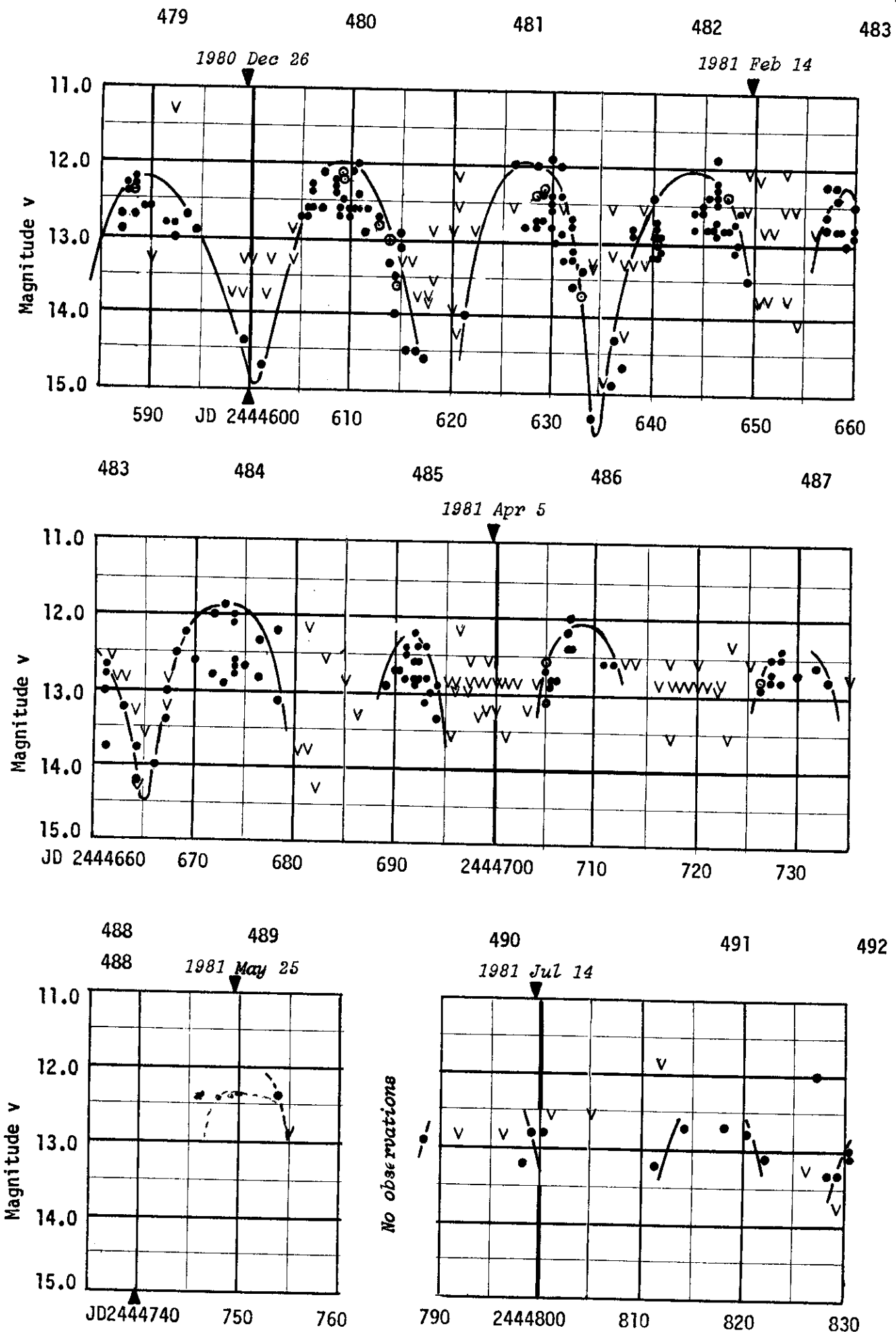


Fig 1d 054705

CN Orionis

Light Curve

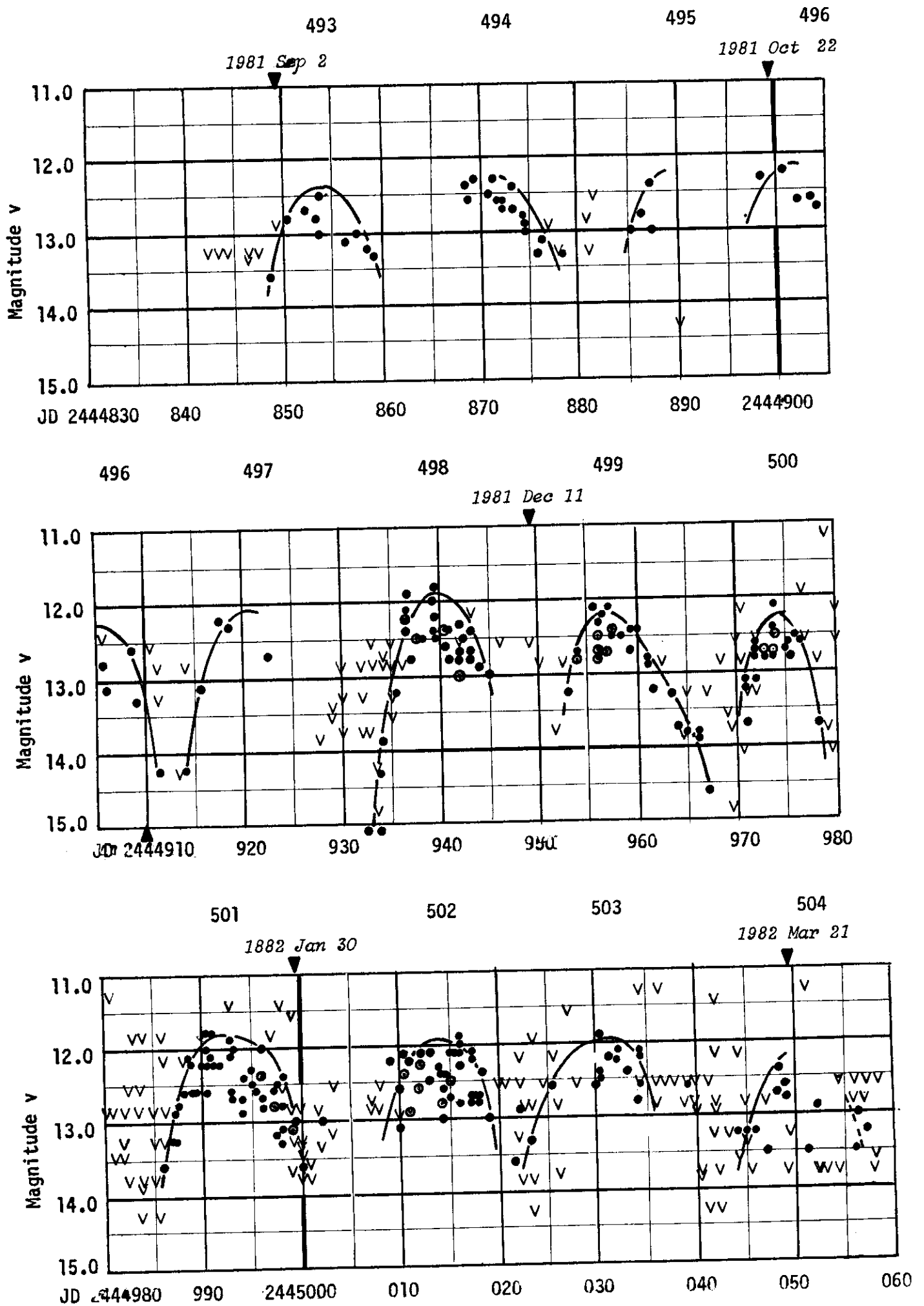


Fig 1e 054705

CN Orionis

Light Curve

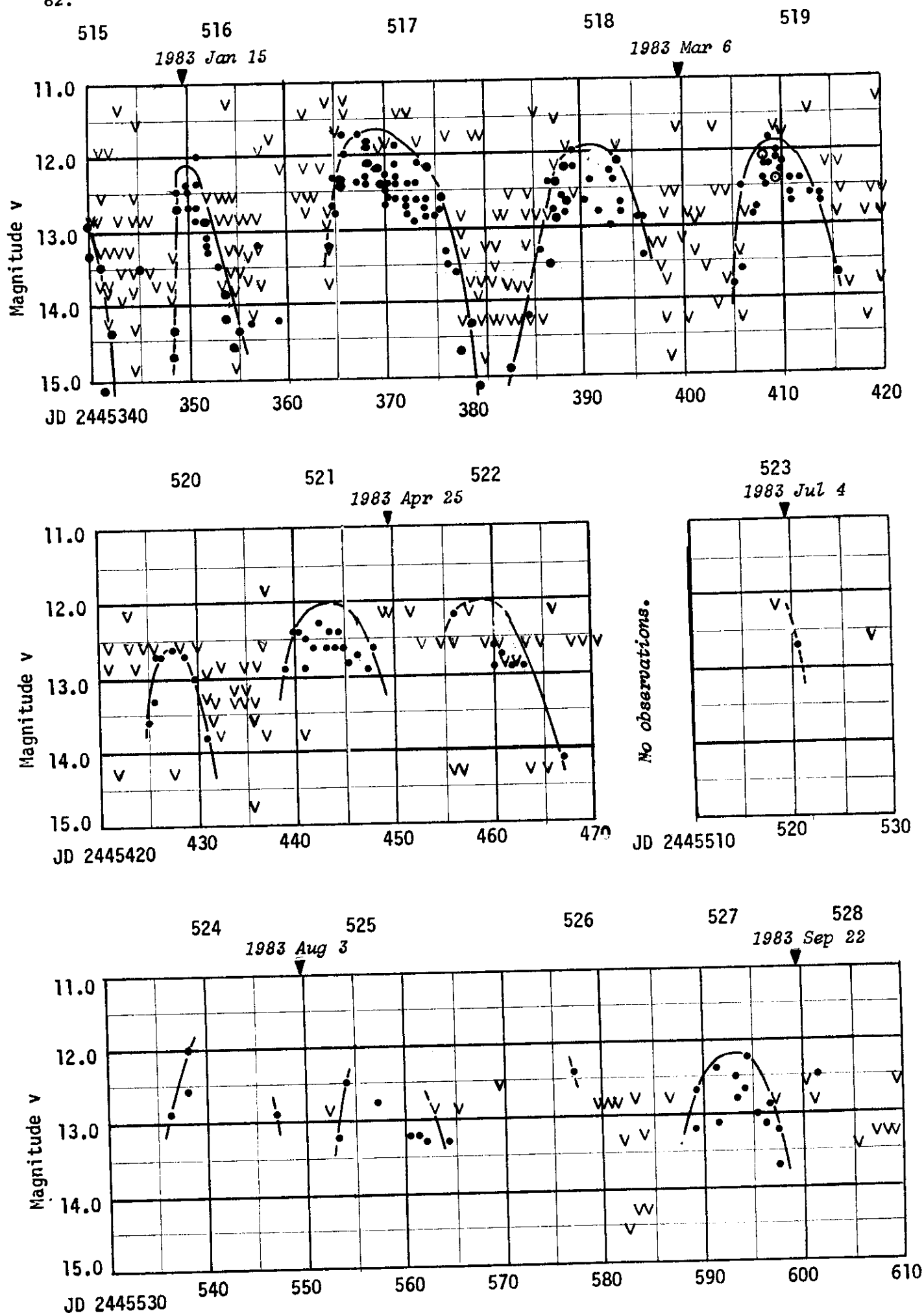


Fig 1g 054705

CN Orionis

Light Curve

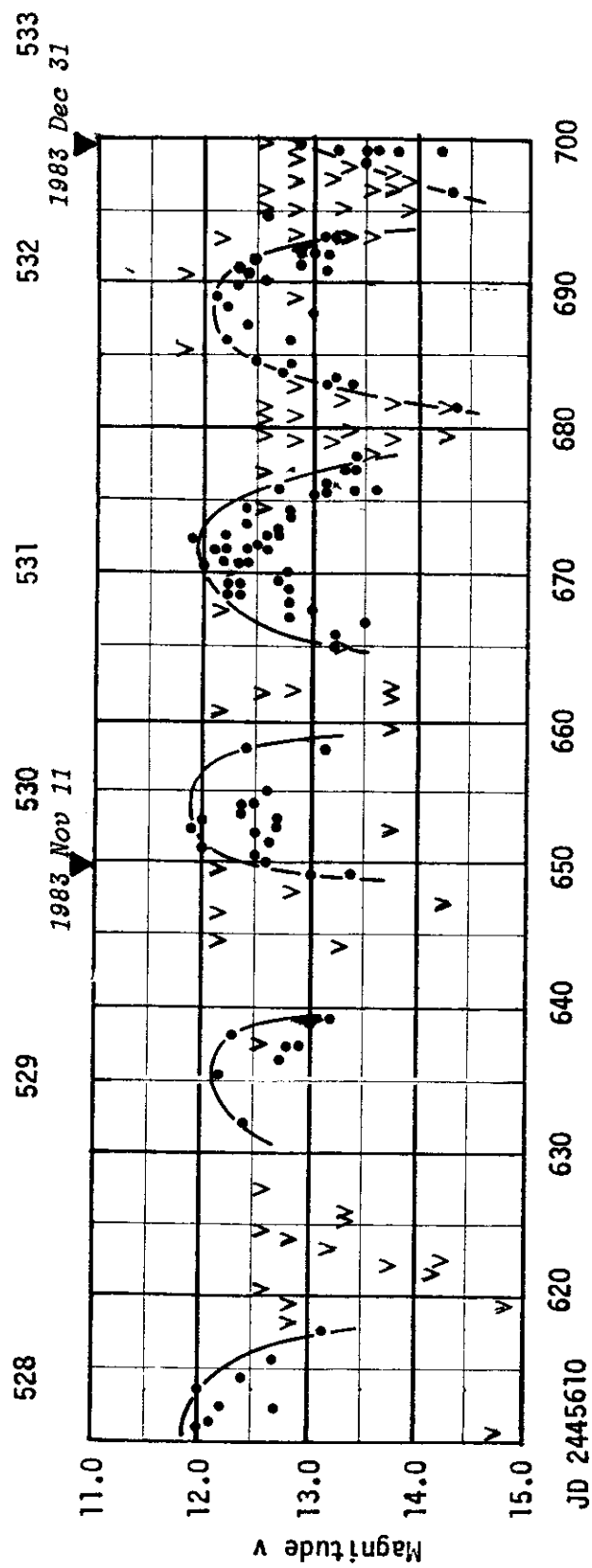


Fig 1h 054705 CN Orionis Light Curve

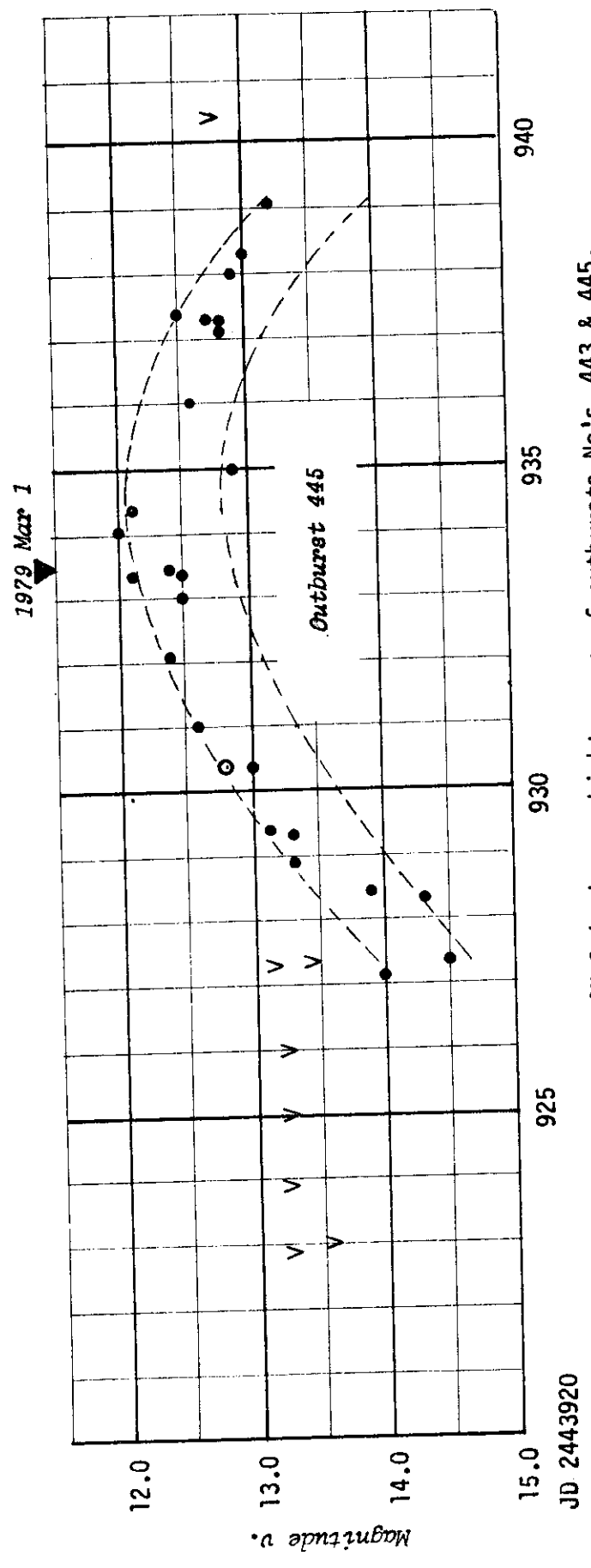
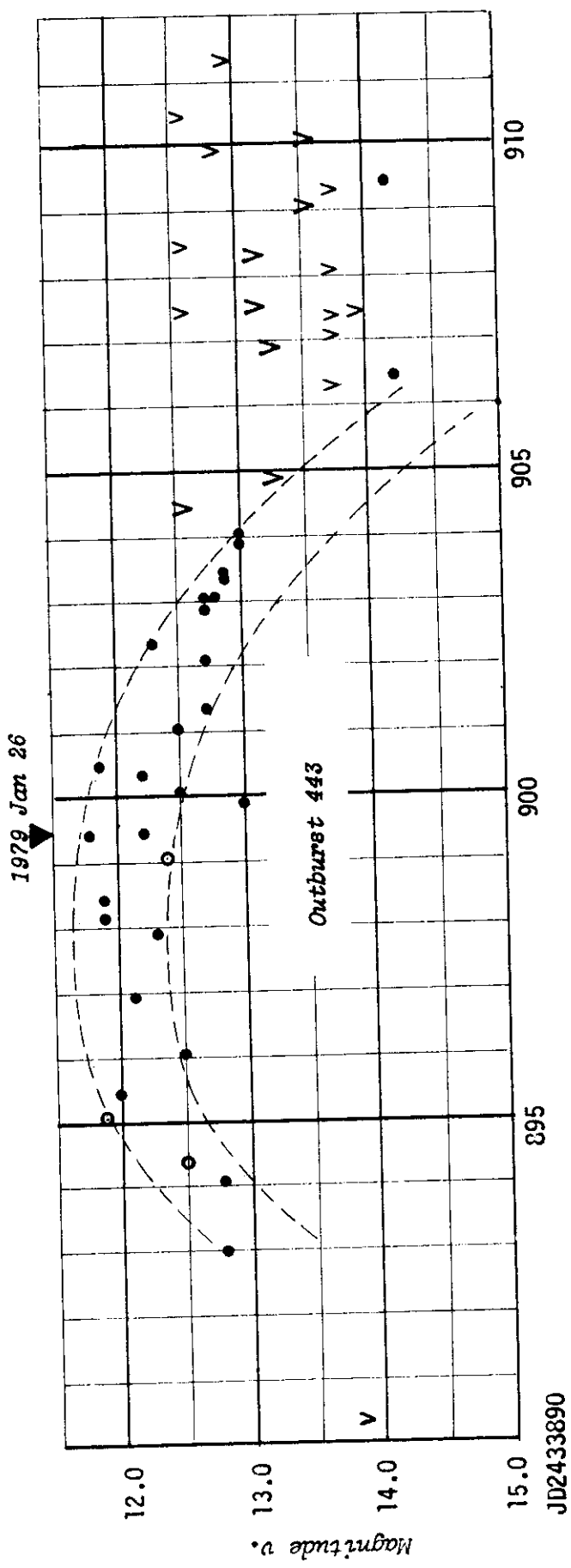


Fig 2a. 054705 CN Orionis Light curve of outbursts No's 443 & 445.

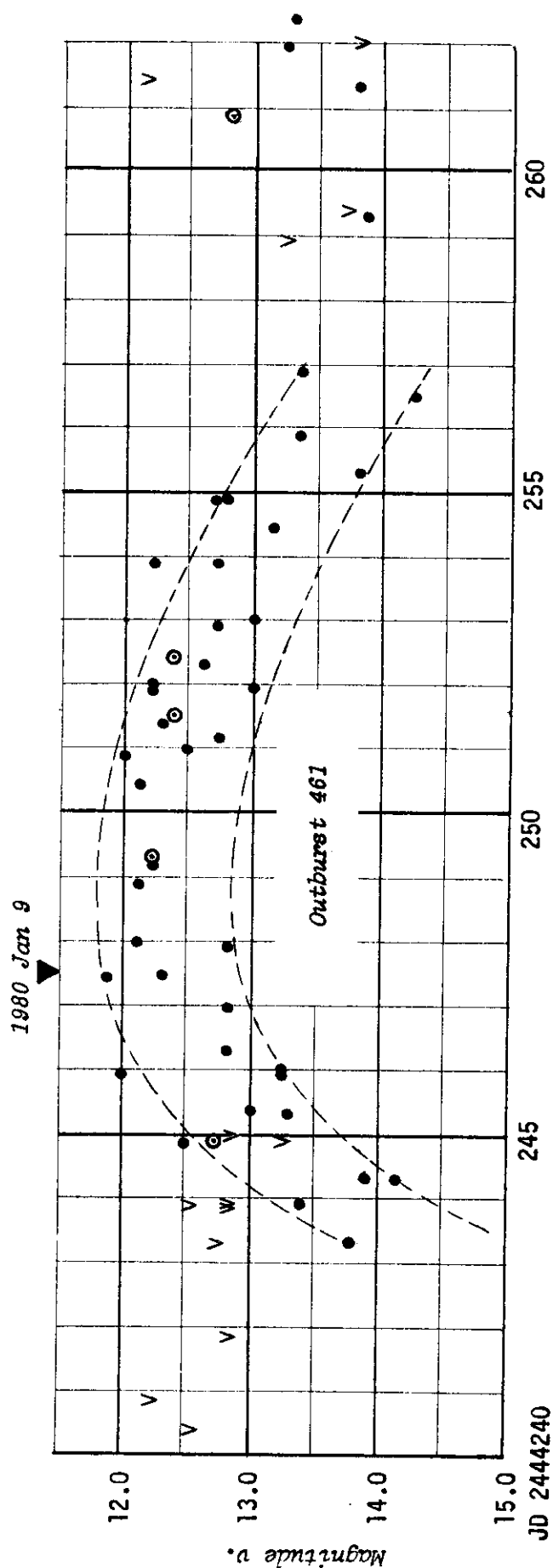
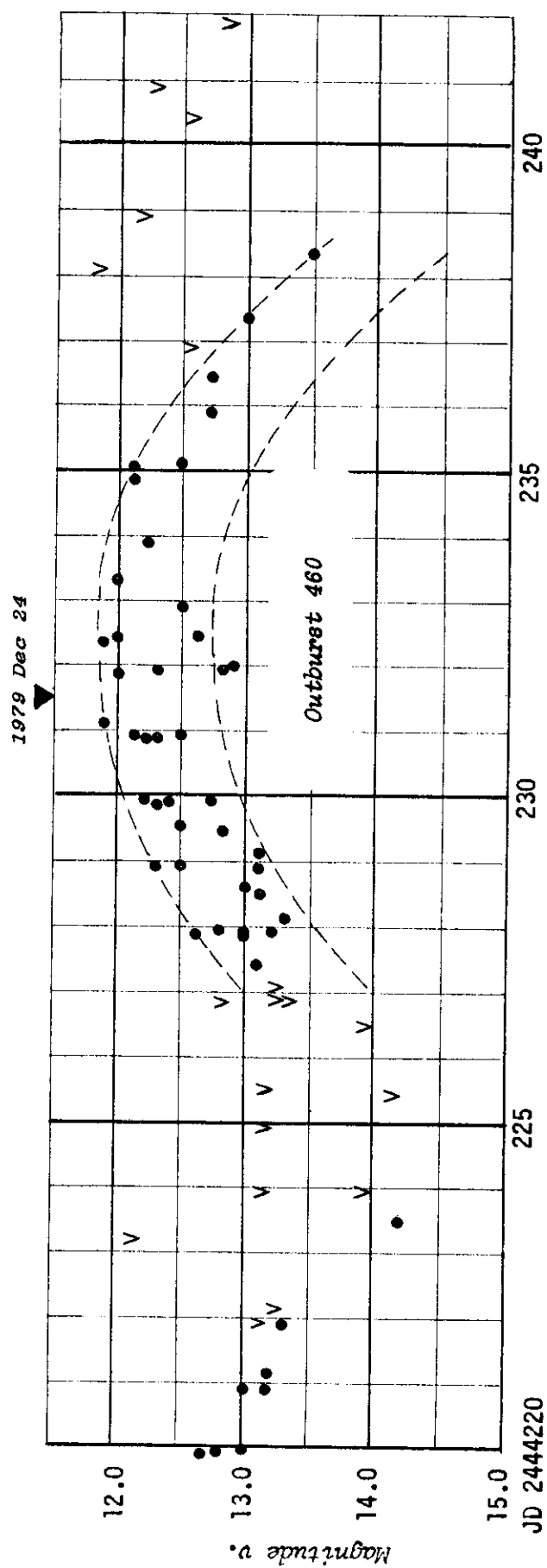


Fig 2b. 054705 CN Orionis Light curve of outbursts No's 460 & 461.

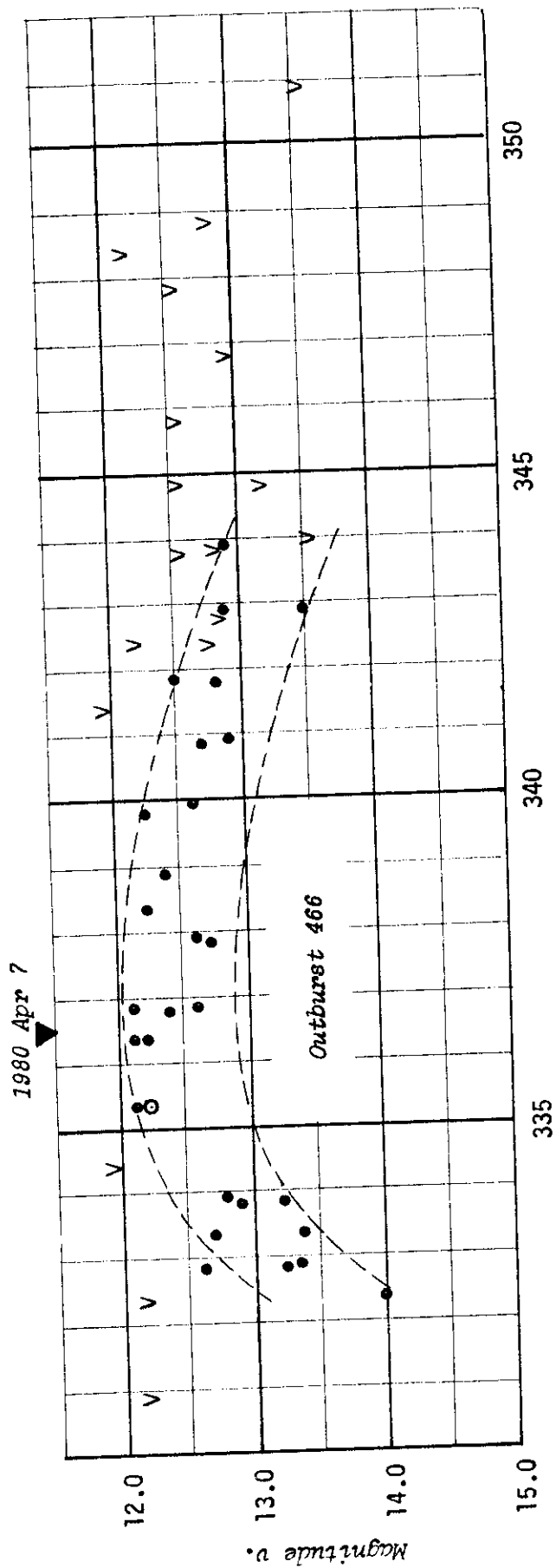
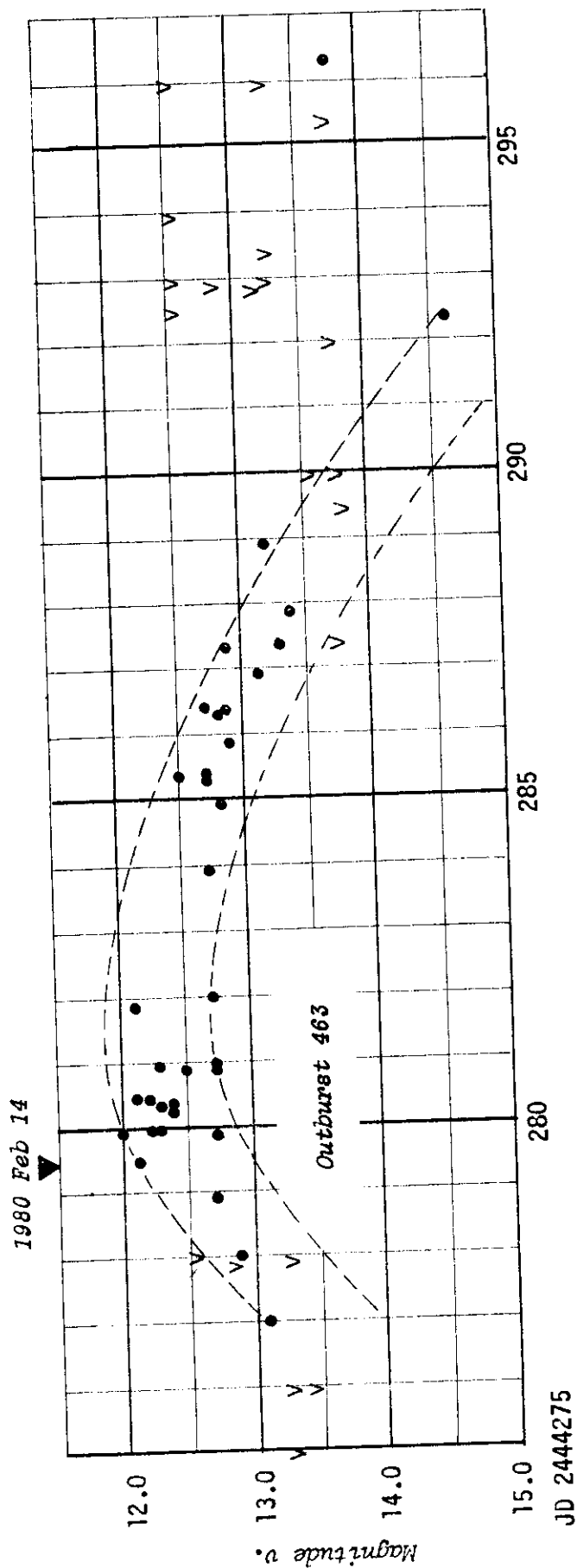


Fig. 2c.054705 CN Orionis Light curve of outbursts No's. 463 & 466.

JD2444330

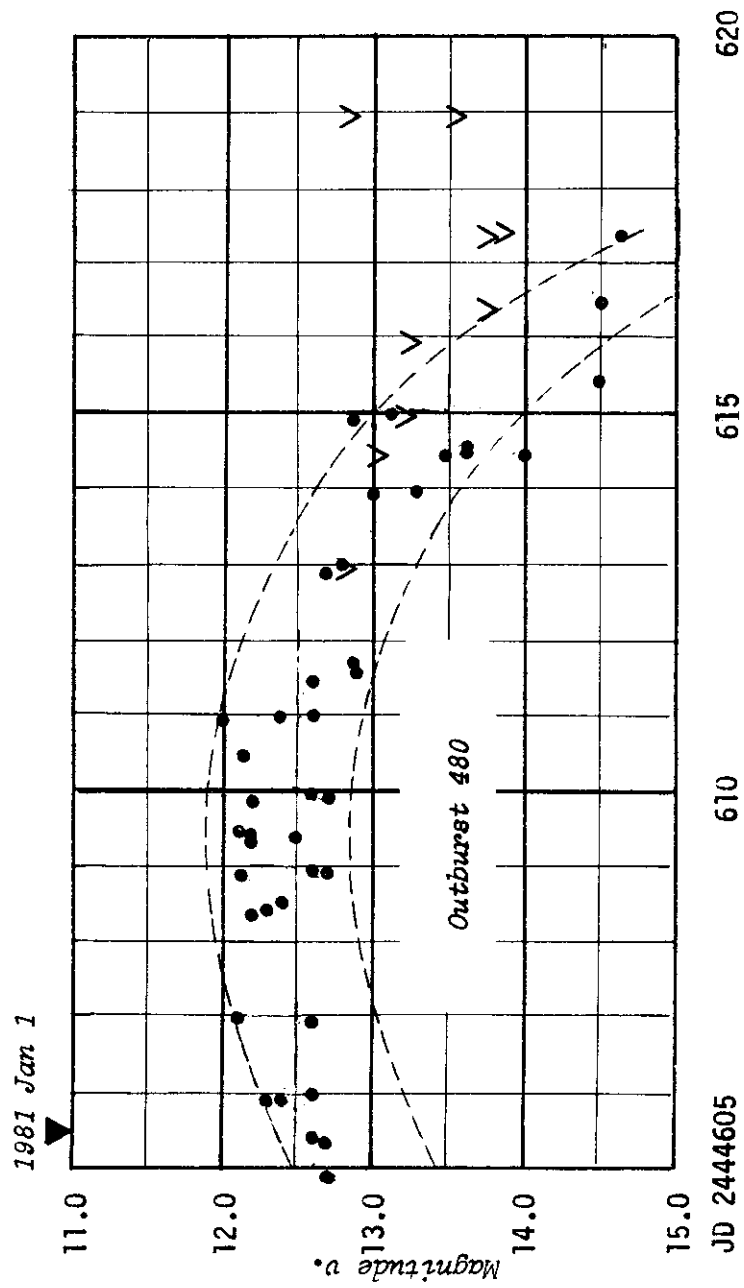


Fig. 2d 054705 CN Orionis Light curve of outburst on JD 2444605 No. 480

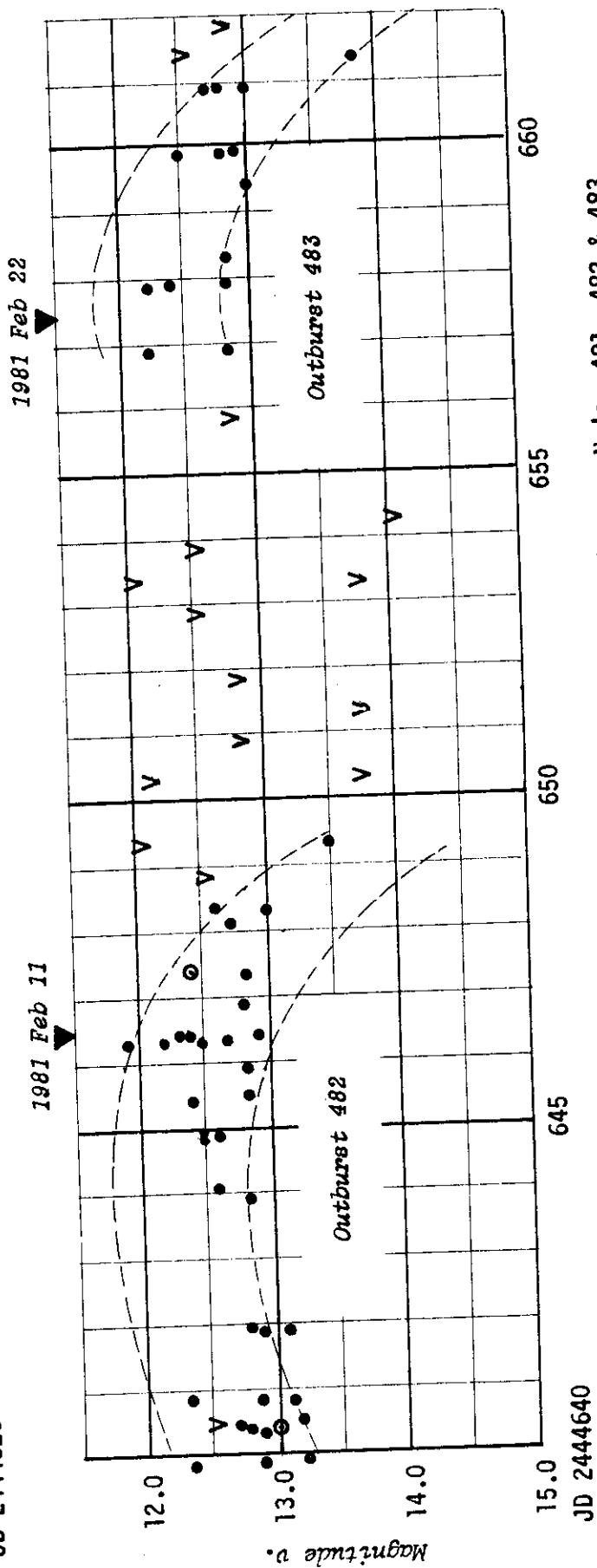
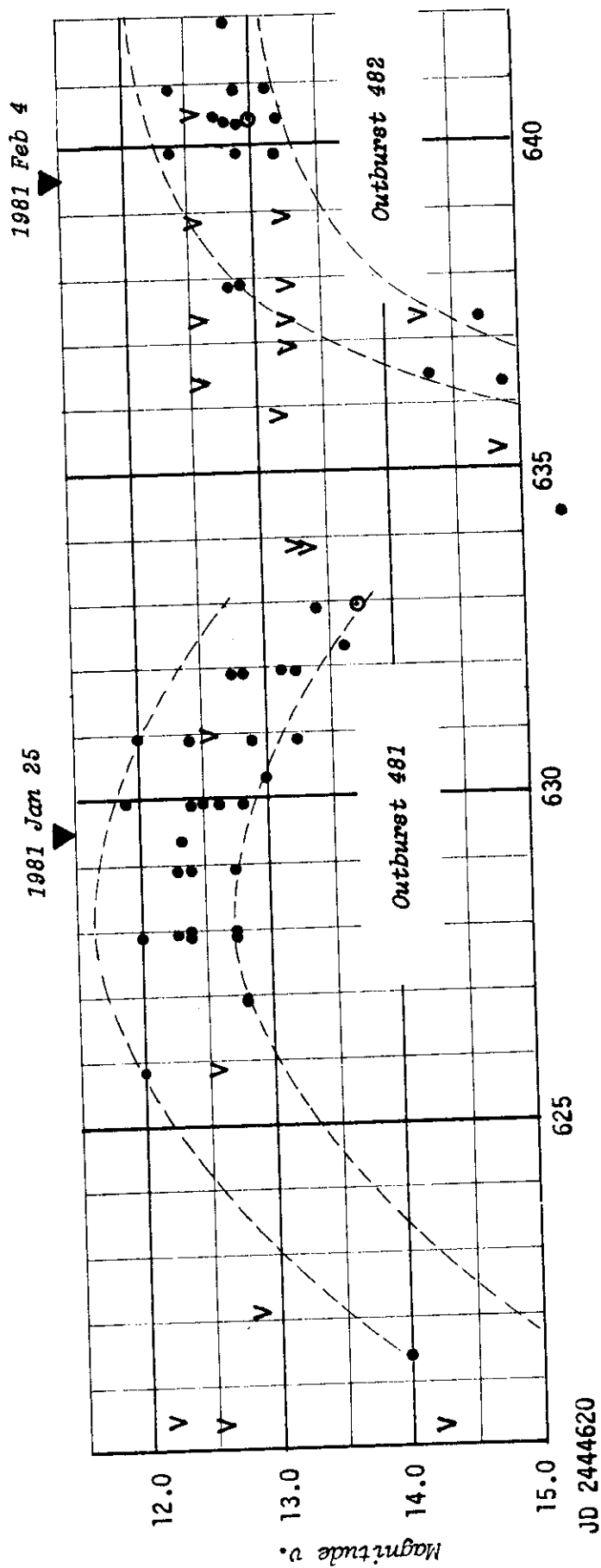


Fig 2e. 054705 CN Orionis Light curve of outbursts No's. 481, 482 & 483

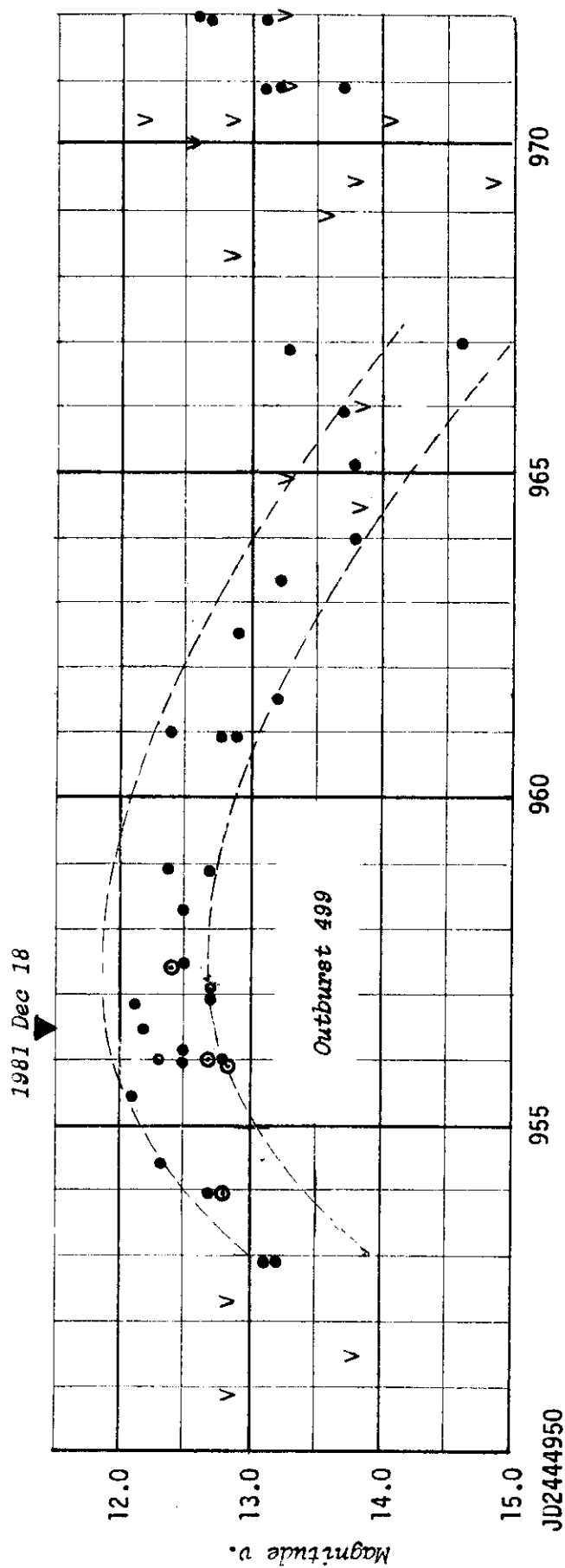
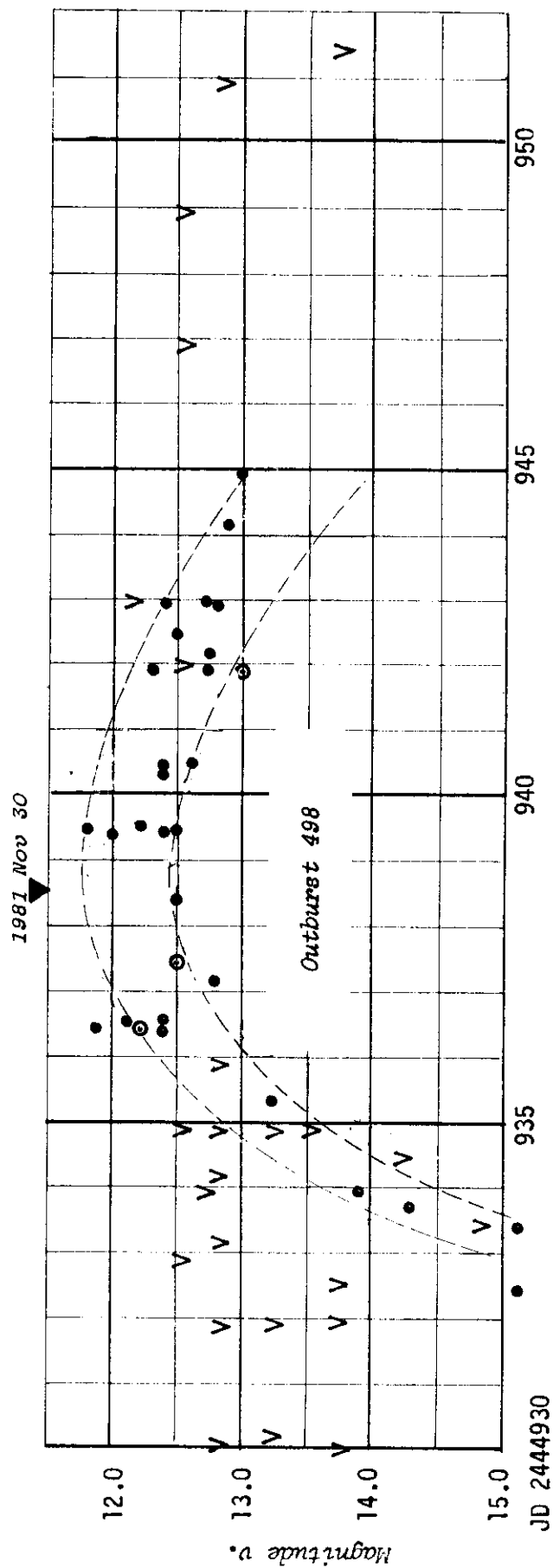


Fig 2f. 054705 CN Orionis Light curve of outbursts No's. 498 & 499.

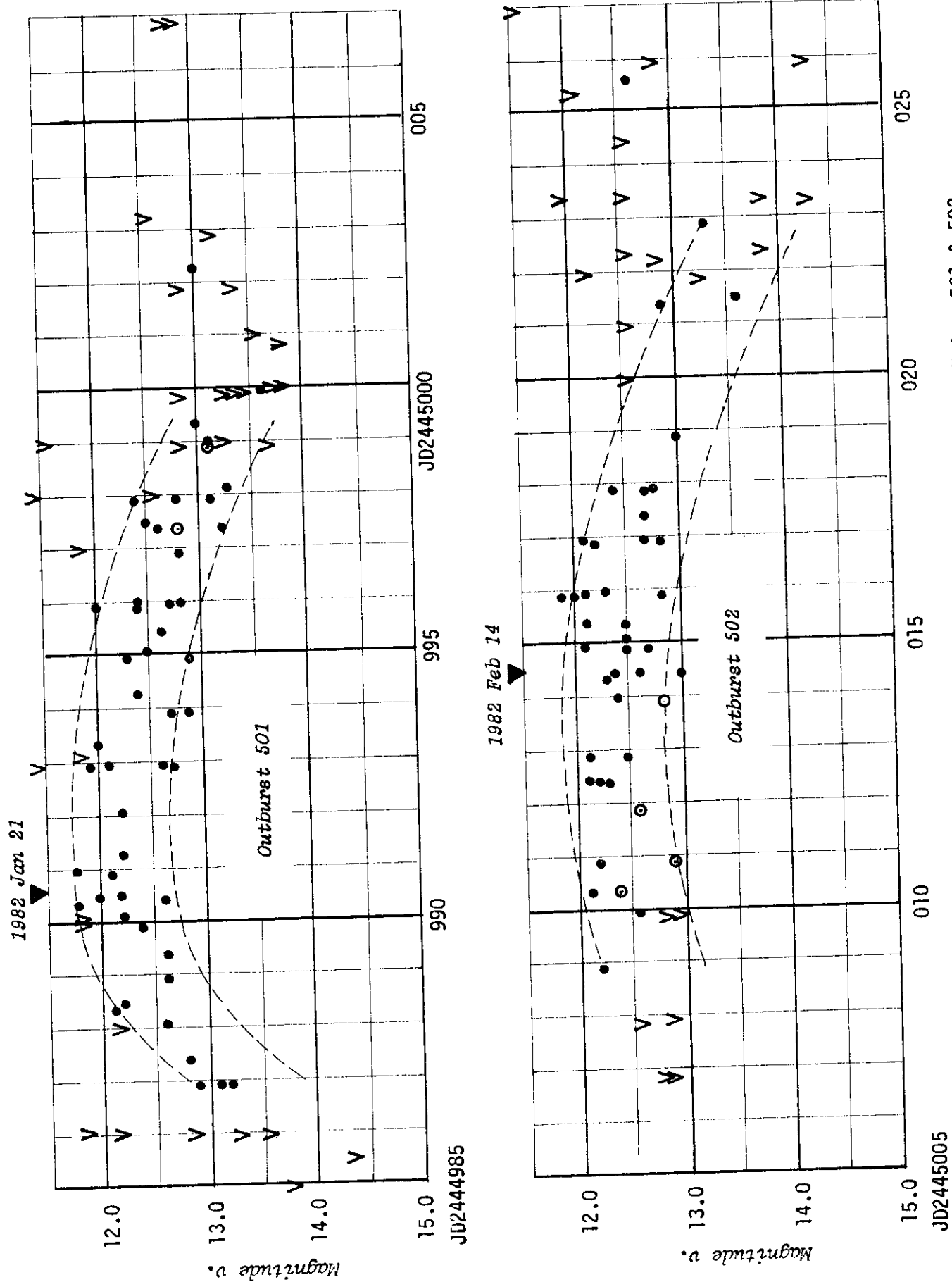


Fig 2g. 054705 CN Orionis Light curve of outbursts No's. 501 & 502.

JD2445005

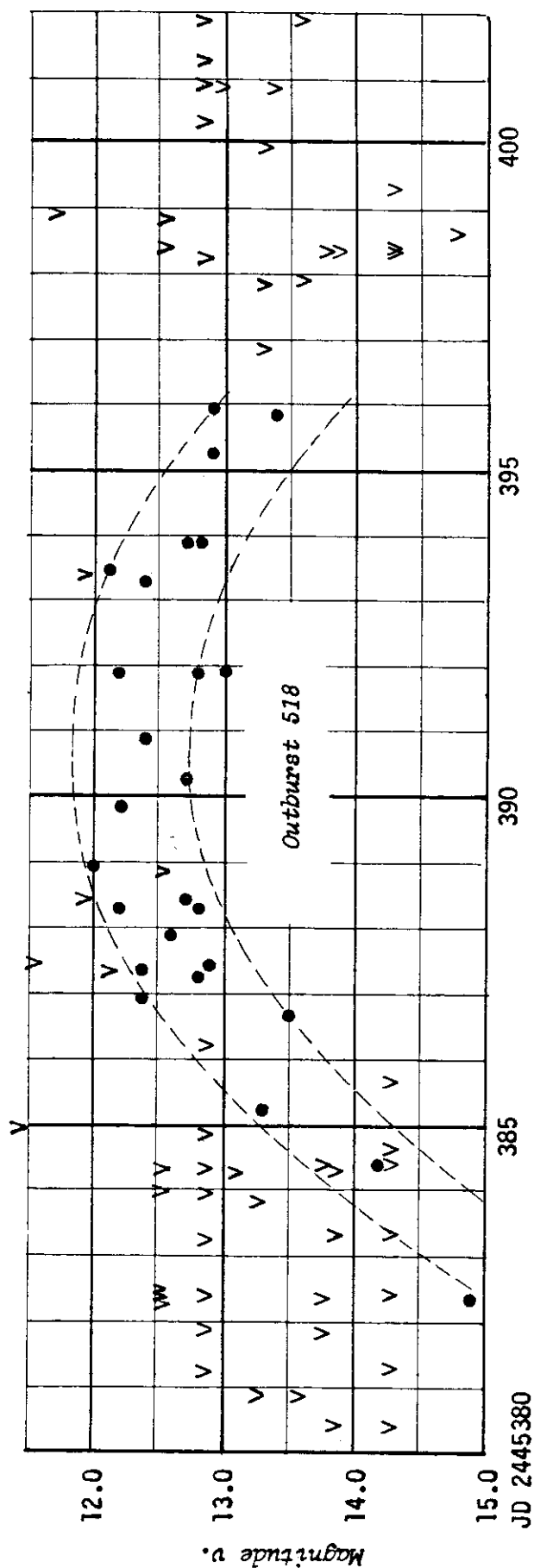
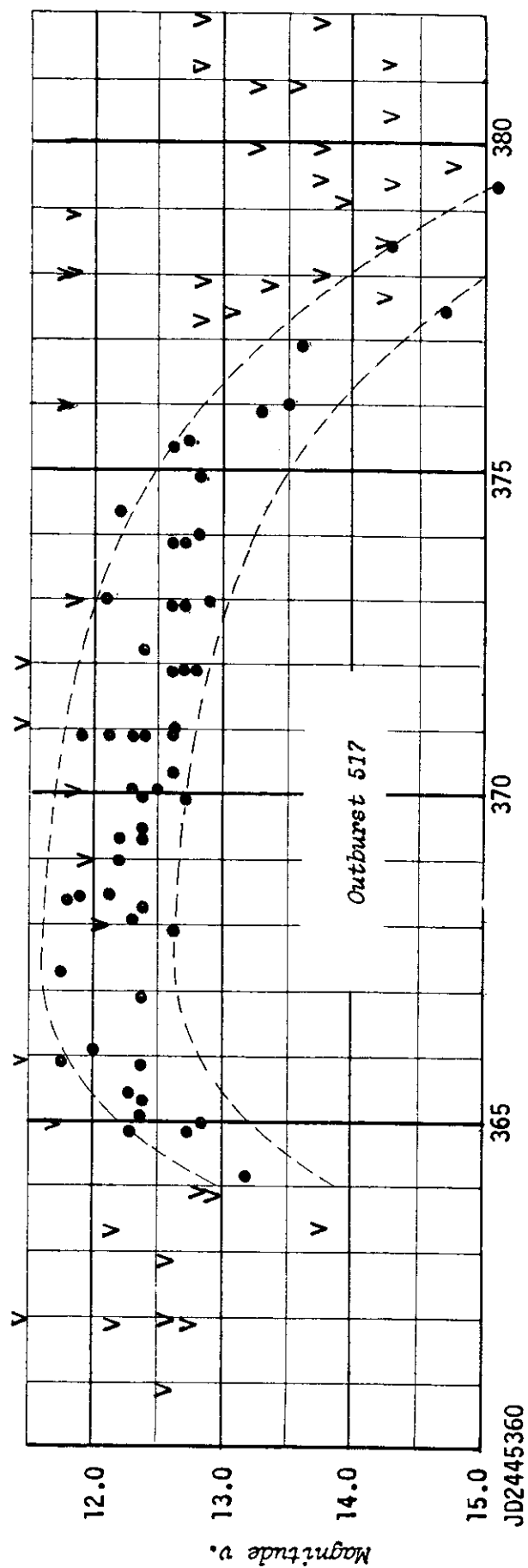
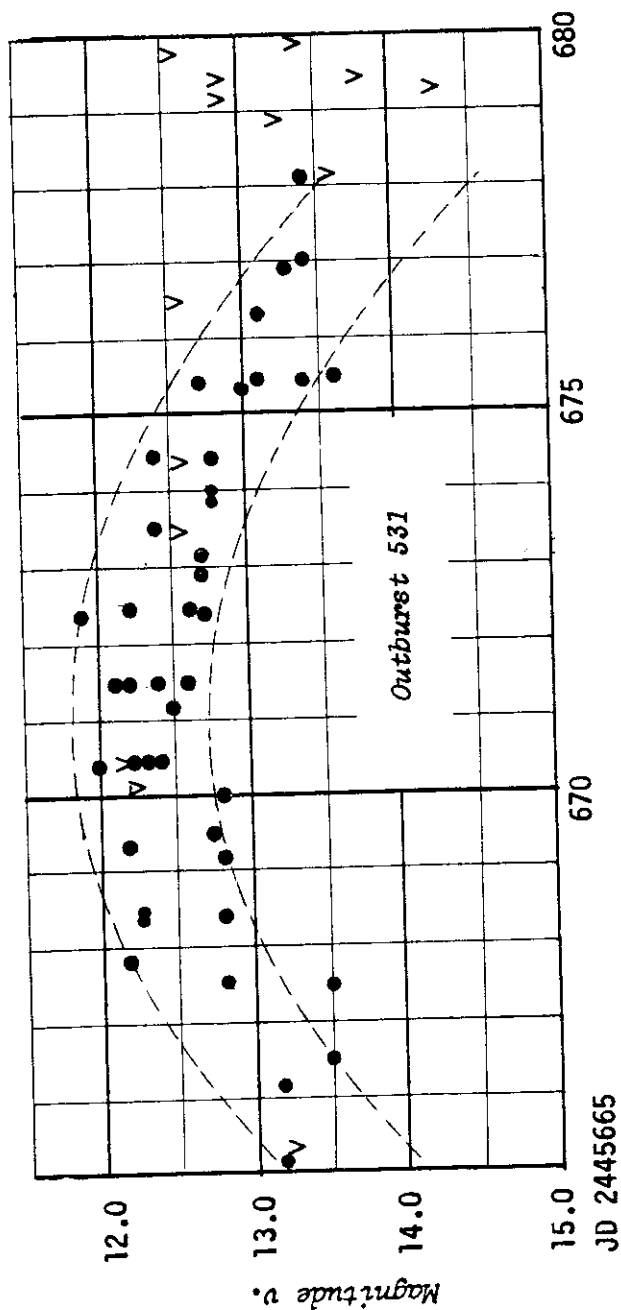


Fig 2h. 054705 CN Orionis Light curve of outburst No's. 517 & 518.

1983 Dec 4



1983 Dec 18

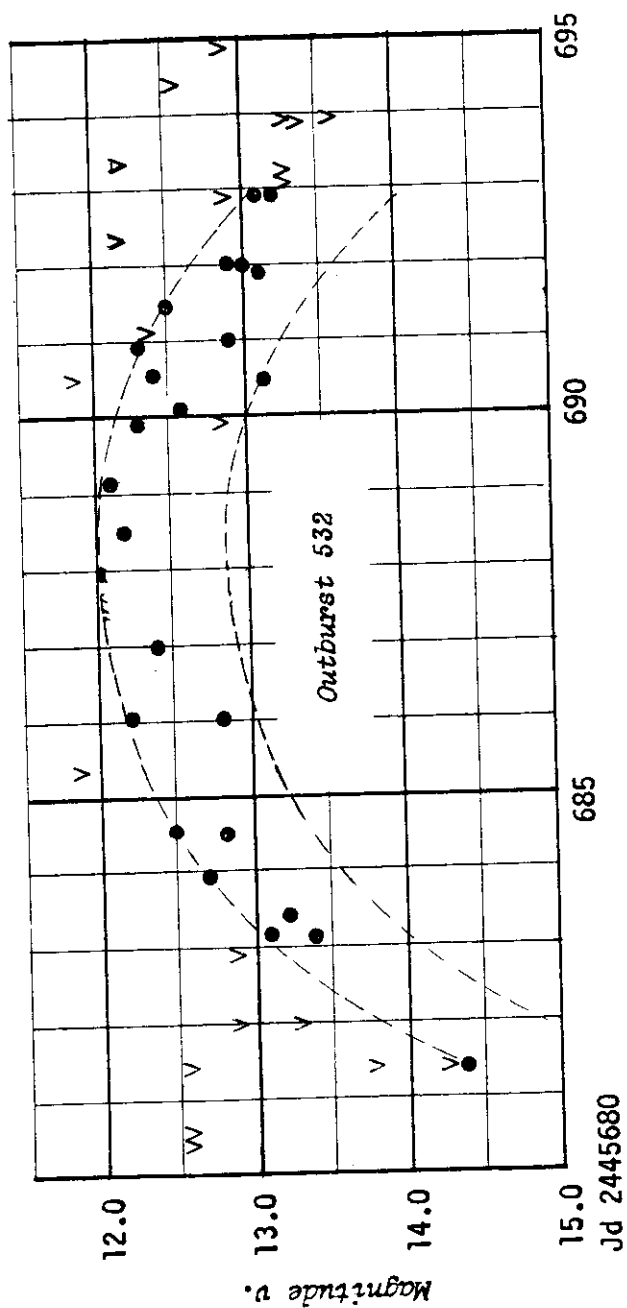


Fig 2i 054705 CN Orionis Light curve of outbursts No's 531 & 532.

WHY OBSERVE THAT STAR?

Frank M. Bateson

SUMMARY: This paper is an enlarged version of a brief talk given at the 1984 Annual Conference of the R.A.S.N.Z. It is published in this issue at the request of members who did not attend that meeting. The paper shows the value of, and reasons for visual observations of Variable Stars.

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1. INTRODUCTION

My purpose in this paper is twofold. Firstly, to stress the need for visual observations of Variable Stars. Secondly, to show why such observations are useful and important by giving a few examples of classes of variable stars for which these observations are essential.

Nobody contends that visual observations are as accurate as those made photoelectrically. However, visual observations made by skilled observers can be surprisingly accurate as many of the papers that have appeared in these Publications show. That degree of skill can be acquired, with practice, by any member with normal eyesight. It is essential that all observations be pooled at one of the recognised centres such as our own Variable Star Section. This enables observations from many observers, widely separated geographically, to be used to provide a continuous record of a star's behaviour. This is not possible, or desirable, by photoelectric methods since the objective of such methods is to provide very accurate data on a particular star at various wavelengths during a more limited space of time.

There are many different types of variable stars for which a continuous record of their variations are required over long intervals of time, measured in decades. Continuous monitoring of such stars is only possible by visual observation with observers using the same charts and sequences. This monitoring too enables prompt alert advice to be given to the astronomical community when a star reaches a phase in its light variations that warrant more precise observations either with large ground base telescopes or from space. The visual observations also provide the basic optical light curves that are essential for comparison with observations made at other wave lengths.

Members of the Variable Star Section are widely spread between latitudes S. 46° and N. 39° . In longitude their sites lie between W. 57° to E. 176° and thence to E. 20° . The only substantial gaps in this chain of observers are those caused by the major oceans of the Southern Hemisphere. Even these gaps are partly filled by isolated members on islands. It is thus possible to provide almost 24 hour coverage of many stars.

The foregoing remarks indicate why visual observations of variable stars are needed and important. The following sections will demonstrate why such observations are useful and important for various types of variable stars.

2. R CrB VARIABLES

These are high luminosity stars, spectral types F-K and R. They are hydrogen deficient, carbon rich with a number having an infra-red excess.

Their main optical features are:-

- (a) Sudden, unpredictable fades of up to nine magnitudes at irregular intervals.
- (b) Semi-periodic pulsations around $0^m.5$, or less.

Obviously, it would be a waste of time and money for anyone to observe any of these stars photoelectrically night after night in the hope that the start of a major decline would be seen. Some professionals are interested in observing the start of such fades and the subsequent decline. Their observations provide a better understanding of how the ejected gas cloud cools and condenses into small graphite particles and their subsequent dissipation. Continuous visual monitoring enables prompt detection of the fades to be observed and alert notices given.

Decades of visual observations of R CrB variables are used to test the theory that the semi-periodic pulsations should decrease or increase with time according to whether the star concerned is contracting or expanding. The rate of change enables tests to be made of evolutionary models. Our results for S Aps and UW Cen, for example have been so used.

Not all R CrB stars behave in the same manner. There are notable differences as between some stars and others. In the Southern Hemisphere there are a number of these stars which are little known. We seek to remedy this position.

3. MIRA VARIABLES

These are giants of late spectral type with well expressed periods of from 90 to 1,000 days. Optical amplitudes are six magnitudes, or more.

Miras require consistent observations over long periods of time to provide records of their variations and the differences that exist from one star to another. Once a Mira has been observed for many years it is possible to predict its dates of maxima and minima with reasonable accuracy. Such predictions are required by those who wish to observe a particular star at a certain phase.

The amplitude of any particular Mira can vary widely from one cycle to the next. These stars do not behave all in the same way. Some have decreasing periods (e.g. R Hya); some have marked secondary or tertiary periods (e.g. K Hor); others have double maxima and minima in the same cycle (e.g. R Cen).

All the International and National Variable Star Organisations pool their observations of Miras at the one centre to enable the best predictions of their future maxima and minima to be made. The result is that professionals can obtain from one source the information that is essential to them for planning their observations.

Secondary and tertiary periods are important in theories of the mode of pulsation. Changes of period are important in evolutionary models. All the basic data depends on visual observations which cannot be duplicated from any other method. There are many Miras in the southern sky of which comparatively little is known. Some of these stars are unusual (e.g. BH Cru). The V.S.S., R.A.S.N.Z. commenced many years ago observations of these little known Miras. Sufficient data has now been secured on them with the result that a series of papers which include their light curves are now commencing to be published.

4. X-RAY OBJECTS

It is suprising that in this age of x-ray detectors on satellites that visual observation of x-ray objects can be useful. However, such is the case. One example is A0 538-66 in the Large Magellanic Cloud. This is a transient source that turns on and off. It has a regular period of 16.6 days when it is turned on. The peaks are then short and have a decreasing amplitude. Naturally, it is entirely unproductive for a large instrument to be used to monitor this object so the visual observer can provide an alert system that notifies the professionals when this source turns on. That is why our members are asked to observe it frequently.

Visual observers are also encouraged to monitor sources such as V818 Sco (Sco X-1) over long intervals of time. These sources have regular periods and it may well be that such periods will change with time. It is possible to detect such changes from visual observations.

5. UNIQUE VARIABLES

There are a few stars that are simply classified as unique because their various properties and optical behaviour are such that they do not neatly fit into any one class of variable stars. One example is V348 Sgr, for which a light curve was published in Publ. 10, V.S.S., R.A.S.N.Z. V348 Sgr, in some respects resembles R CrB stars, but it has other features that set it apart from them.

This star is currently being studied from space in an endeavour to learn more about it. It is necessary to assist those observations by providing an alert service that gives prompt advice when the star is increasing or decreasing. In addition a continuous visual light curve is required to compare the optical state with observations at other wave lengths.

6. NOVAE

The visual observer, should he or she so desire, search for novae or merely observe these objects after discovery. Over many years scores of amateurs have written to me seeking advice on searching for novae. Few, if any, have persisted in their searches be they photographic or visual. Visual observers because they know the stars so well have been succesful in being the first to see bright novae. A typical example was the indepent discovery of Nova Aql 1918 by A.G. Crust and G.V. Hudson, both from New Zealand. It happens infrequently but there is always the possibility that a bright nova may appear and that it will be discovered first by an amateur as he glances around the sky before commencing his night's observing.

Searching for novae must be done on a systematic basis and calls for great patience and care. It is best carried out with binoculars over a limited region of the Milky Way. The observer must get to know all the stars in the small area he selects down to around magnitude 9 or 10. He carefully ticks off each star on each night of his observing and ultimately is bound to find a nova below naked eye visibility. That discovery can come after a few hours of searching or it may require many hundreds of hours of painstaking work.

Photographic searches are perhaps easier inasmuch as an exposure can be taken at regular intervals without undue trouble. The difficulty comes in having the time and equipment by which to compare the film with a standard one on which all the known variables are marked since these can appear and give the false impression of a nova if one has not prepared properly. Few photographic observers have persisted at this work.

Once a nova has been discovered it is generally very well observed both by amateurs with photoelectric photometers and by professionals for a limited time. Then they tend to forget the nova in favour of some other object. It is the amateur visual observer who by persistently observing a nova until it falls below the threshold of his instrument that produces the complete light curves that are so valuable. Such curves are essential now that so many observations are made in the infra-red, or other wavelengths. That has been the case with Nova Mus 1983 for which Patricia Whitelock has used our visual observations for comparison with her infra-red light curve.

Professionals often become interested in old novae especially when their small amplitude variations reveal the orbital period. Often they then wish to know how the nova has behaved over the past few decades. Again they have to turn to the light curves of the visual observer. Two examples are RR Pic (Nova Pic 1925) and CP Pup (Nova Pup 1942) for both of which our observations have provided continuous light curves from discovery to date.

7. CATACLYSMIC VARIABLES (C.V.'s).

C.V.'s include a very wide variety of objects that include novae, recurrent novae, dwarf novae, nova-like stars; S Dor type variables; many x-ray objects and other types.

It is only the patience of the visual observer that leads to the discovery of the outbursts of recurrent novae. Recording their magnitudes night after night for decades is discouraging but essential. It can be done in no other way. Success ultimately comes and prompt notification of such outbursts can lead to very important professional observations. That was the case with Albert Jones's detection of the outburst of V1017 Sgr.

Members of the V.S.S. will hardly need my reminder of the importance of visual observations of dwarf novae since this has been stressed in so many special and monthly circulars over the years. It appears as if a change in the thrust of professional observing has come as a result of what has been done over recent years. More detailed knowledge has been acquired by observations at many different wave lengths so that there has been built up a better understanding of how an outburst progresses through the various parts of these close binaries. This has not settled all the arguments as to the cause of the outbursts but at least has placed more emphasis on observations in the x-ray and U.V. bands and less on the U,B,V results for at least the better known members of dwarf novae. This change of direction has, however, meant no change for the visual observer who must still provide the basic monitoring to produce the continuous optical light curve and at the same time provide the alert notices when selected stars are at outburst. The value of these visual observations can be seen from the frequent use that is made of the results, a number of which are briefly mentioned in a subsequent note in this issue.

There is also the need to investigate more closely some of the lesser known members of this type of C.V.'s. There is little doubt that dwarf novae include stars that differ widely in both their general optical behaviour; the frequency of their outbursts and in the manner in which these occur. A typical example of a star that requires a great deal more attention is PS74 PsA, a member of the SU UMa sub-class. Observations must be continued of those dwarf novae that have been well observed over the past 2 or 3 decades. Changes are certain to occur in some of these systems in time. It is the visual observer who is likely to detect such changes first.

Nova-like stars resemble dwarf novae inasmuch as they have outbursts, albeit on a smaller scale than dwarf novae. Observing them can be frustrating since they change little over long intervals and then suddenly become active. Visual monitoring is necessary to detect these active intervals. The same comments can be applied to the S Dor type variables, which show considerable irregular variations at times. The changes in AG Car over the past three years is an example. S Dor variables are highly luminous. One day, maybe to-morrow or maybe in a thousand or so years one of them will erupt in a supernova explosion.

8. CONCLUSION

I have not mentioned many types of variables for which visual observations are required. To do so would simply take too much space, but I have tried to show that, despite the more advanced methods of observation used to-day, the visual observer can and does make a very valuable contribution to our knowledge of variable stars.

I urge all observers to take a full part in all the special programmes that are announced from time to time in the Special and Monthly Circulars of the V.S.S. In addition the observer should then select the number of variables that he feels he can observe on a regular basis and endeavour to observe those stars on a regular basis. Provided that such observations are made with care and accuracy; reported monthly and accurately timed they will be a valuable contribution, be their numbers large or small. The objective is to maintain the standards of accuracy that has been set over the years and which is so obvious from the papers that appear in these Publications.

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NOTES OF INTEREST TO MEMBERS.

(Several members have suggested that the inclusion of brief notes and references to publications in which the observations of the Section have been used would be welcomed. Below an attempt has been made to comply with these suggestions. Ed).

NOVA MUS 1983 (Mon. Not. R. astr. Soc (1984) 211, pp. 421-432.

The aim of this paper by P.A. Whitelock, et al, is to describe the infrared development of this nova; relate this to similar observations of previous novae, especially to the problem of dust formation and to use optical observations for comparison and to establish the class of nova to which Nova Mus belongs.

Our observations have been used to reproduce a combined V and visual light curve. The systematic difference between the V and visual observations is considered to be due to the additional contribution to the eye estimates from the very strong H-alpha emission. The discovery of this nova by Liller on January 18, 1983 is taken as the date of maximum brightness, especially as the pre-discovery photographic magnitudes on January 15 (Bateson, I.B.V.S. 2316) indicate that it was still rising. The nova declined by two magnitudes in 18 days, which suggests that Nova Mus belongs to the fast nova class. Subsequent development was slower suggesting that the nova was of the moderately fast type. It is possible that maximum occurred several days before January 18 and that the pre-discovery photos were of a post maximum oscillation. The development of infrared thermal dust emission, which has been predicted for an object with this decline rate, did not occur.

X-RAY OBSERVATIONS OF C.V.'s. (Mon. Not. R. astr. Soc (1984) 205, pp.879-897.

F.A. Cordova & K.O. Mason present the results of a X-ray survey of thirty-one known or suspected C.V.'s. Stars included in this survey which are observed by the V.S. are: TT Ari; SY Cnc; YZ Cnc; SV CMi; BV Cen; V436 Cen; T Cen; U Gem; VW Hvi; WX Hvi; X Leo; RS Oph; T Pyx; V1017 Sgr; U Sco and TW Vir. The visual data used in this paper came from the AAVSO and the VSS, R.A.S.N.Z.

R CrA Variable Stars (1982) 21, 5, pp. 677-681.

V.I. Kardopolov reports on photoelectric observations of R CrA in 1977-79. He finds the amplitude of variation in V about 3 magnitudes and considers very, rapid, irregular variations questionable. A light curve from our published observations is reproduced with the individual estimates from six of our most experienced observers plotted separately.

S Aps. Mon. Not. R. astr. Soc. (1983) 205, pp. 907-912.

D. Kilkenny uses our observations (both published and unpublished) to discuss the small amplitude variations. These previously had a period of about 120 days. This period has changed to near 40 days and it is suggested that this may be due to a change from the fundamental mode of pulsation to an overtone. Our light curve is published. The observations on which this paper is based totalled about 8,000 estimates by members of the V.S.S. covering the years 1960-82.

V2051 Oph Mon. Not. R. astr. Soc. (1983) 205, pp. 465-470.

M.C. Cook & C.C. Brunt report on spectral and UBV observations.. They find an orbital period of 89.9 minutes and find strong evidence that the white dwarf component is eclipsed. Our report that the star was on two occasions more than one magnitude brighter than normal and the absence of the emission spectrum on some plates is the only evidence for any gross variation in V2051 Oph.

INFRARED & OPTICAL OF C.V.'s. Mon. Not. R. astr. Soc. (1983) 205, pp. 265-273.

M.R. Sherrington & R.F. Jameson report on their observations of 22 C.V.'s. Their work was assisted by the alert advices of outbursts supplied by the V.S.S. and the A.A.V.S.O. This is an example of the value of the prompt reporting of outbursts to those engaged in securing data with large telescopes.

X-RAY EMISSION FROM C.V.'s. Preprint.

This paper by K.O. Mason reports on EXOSAT results on C.V.'s. The main point of interest to members in this paper is that the soft x-ray flux of VW Hyi, like that of SS Cyg and U Gem, is strongly pulsed. Unlike the latter two stars the pulsation in VW Hyi, which has a period of 14.07 seconds, was coherent. It is suggested that the white dwarf in this system might be magnetic and that the period of 14.07 seconds is its rotation period. The observations were made during the 1983 November superoutburst. If the period is confirmed when the 1984 superoutbursts are discussed then VW Hyi has the shortest period of any known white dwarf and must be rotating near break-up speed. Our optical light curve is shown. A more detailed paper on this superoutburst has just been completed by Van der Woerd, Heise & Bateson.

This paper also includes details of the x-ray emission from EX Hya and Mason shows that when the 0.04 - 2.0 keV data is folded on the known 98 minute period there is a broad dip lasting about one-third of the cycle and with an amplitude about half that of the 67 minute modulation in the same band. The centre of the broad dip precedes the time of optical eclipse by about 75° . He interprets this as caused by absorption in material associated with the mass transfer stream from the companion star.

EX Hya is discussed in more detail in a separate preprint by Cordova, Mason & Kahn.

VW & WX HYI Mon. Not. R. astr. Soc. (1983) 203, pp. 865-885.

This is another paper by B.J.M. Hassall, et al discussing observations of these two dwarf novae. The observations were made during special co-operative programmes in which members took part and our prompt alert notices of outbursts were important. Light curves of a normal outburst of VW Hyi and of a superoutburst of WX Hyi are published.

Eta Car. Mon. Not. R. astr. Soc. (1983) 203, pp. 385-392.

P.A. Whitelock et al discuss JHKL photometry which shows a slow brightening of Eta Car between 1972 and 1980 with a more rapid increase in 1980/81. The total range is about $0^m.4$ at K. Visual brightness also increased in 1972-82. The light curve, from our published observations, is shown.

S Aps & UW Cen. Mon. Not. R. astr. Soc. (1983) 203, pp. 19-24.

D. Kilkenny & C. Flanagan examine the small amplitude variations of S Aps & UW Cen based entirely on our observations. The period of these variations appears to be changing rapidly for S Aps and slowly, if at all, for UW Cen.

EDITORIAL NOTE. The purpose of the foregoing comments is not to review the papers listed but to show members a partial list of published papers over the past two years in which their observations have been used.

BOOK REVIEWS.

(EDITORIAL NOTE. Included in the suggestions from members of what they would like included in these Publications were several requests for a Section reviewing books, not necessarily on Variable Stars. The following pages attempt to satisfy these requests. Appreciation is due to those who have supplied the reviews.)

LET'S FIND THE SOUTHERN CROSS by Eric Harries-Harris. Rigby Publishers, Adelaide. Distributors: Landsdowne-Rigby, 176 South Creek Road, Dee Why West, N.S.W., Australia. \$A 9.95. 100pp.

I was asked to review this slim volume because I am not an astronomer but do wish to find my way around the main stars and constellations.

The book is divided into 11 chapters, of which one occupies 50 pages. This is the main part of the book and includes 48 charts showing the main star groups. There are 12 charts for each season arranged so that there are four charts for each month. The monthly charts are to depict the sky at 8 p.m. as the user faces each cardinal point. I found them very clear and easy to follow because they are not cluttered up with a multitude of stars or star names. The main stars on each chart have numbers, for which the names are given in the short description that appears beneath each chart.

The book is obviously directed at people, like myself, who only wish to be able to find the main stars and clusters without being confused by a host of detail. For this purpose the charts proved ideal especially as the book could be laid flat on a table whilst I followed the directions. It would prove satisfactory too for any youngster wishing to find his way around the sky.

An unusual feature of this book that I found useful is that a short simple glossary precedes the main chapters. This allowed me to learn the terms with which I was not familiar before reading the main chapters. These deal simply with such topics as the Celestial Sphere, the Zodiac, Telescopes and the planets and other heavenly bodies.

The book is well printed, readable and simple. It appears ideal for use by those with little, or no previous knowledge of how to find the main stars. One or two statements puzzled me. such as that on page 28 that states that the Seven Sisters appear to twinkle because of the nebulosity surrounding them. I have read in other books that stars twinkle because of disturbances in the Earth's atmosphere. On page 86 it is made clear that Jupiter has a number of fainter moons than those listed but it is not made clear that Saturn too has far more moons than the list given indicates.

Despite my puzzlement over a few statements this book is ideal for the novice and I can recommend it for that purpose since I have learnt at least the main stars from it, whereas before I only knew the Southern Cross.

A.W.

OBSERVER'S HANDBOOK. ed. by R.L. Bishop. The Royal Astronomical Society of Canada. 184pp.

This well known Handbook is now in its 77th year of publication. Handbooks range in size and usefulness from the inexpensive, simple but adequate Carter Observatory Handbook through the no nonsense B.A.A. Handbook to the beautiful produced and illustrated Japanese Asahi Cosmos. Many are designed for use in a particular country and have little use beyond its boundaries.

The Canadian Observer's Handbook combines the usual details of phenomena visible from North America with the up to date information on the planets, stars, clusters, nebulae and galaxies that makes it a quick and accurate reference source..

Most of the contents can be used from any location. This year's edition includes two charts for Comet Halley, one from August 10 when the comet will be visible in large amateur instruments, and, the other from October 27, when it should be visible with binoculars and the naked eye.

There are the usual lists giving details of the brightest stars; the nearest stars; double and multiple stars; variable stars; star clusters; nebulae; the Messier catalogue; galaxies and radio sources. All these, and other lists, are a handy and up to date reference source. The star maps for each month are well printed and include one for the southern sky.

This Handbook is so packed with readily accessible facts that no library is complete without a copy.

F.M.B.

ORBITS FOR AMATEURS WITH A MICROCOMPUTER by D. Tattersfield. Stanley Thornes (Publishers) Ltd., Cheltenham, U.K. Stg. 15.95. 171pp. 1984.

There have been, in the past few years, a number of books published to assist the amateur in using his microcomputer, which because of their reasonable price are now in wide use. This is certainly one of the best such books, because it is well printed in clear type without any reduction. The book also has the virtue that it can be readily opened at any page and will remain flat.

The book is solely concerned with cometary orbits, which is not clear from the title. All aspects of the subject are dealt with in four main sections. These are:-

- (a) Construction of an ephemeris for an orbiting comet in both an elliptical or parabolic orbit.
- (b) Determination of the elements of a comet orbit.
- (c) Perturbations by major planets.
- (d) The differential correction of a comet orbit.

Each section has a brief introduction, followed by the calculation steps and details of which formula to use. Numerical examples follow prior to the programme listings. These are written for the Sinclair ZX81 or the Sharp PC1211 microcomputers. It appears to me that the book would have been improved had the listings been in standard BASIC, thus making it easier to use with other machines.

It is indicated that the book is self-contained and requires no reference to other tables. I consider this misleading since both the current Astronomical Almanac and Planetary Coordinates are required. The time system is ET, a fact that should have been clearly stated to avoid misunderstanding. I checked some listings selected at random. These appear to be free from error, although I did not check too many and there may be errors in those that I did not check.

In summary, I would state that this book can be used to advantage by both amateur and professional astronomers interested in cometary orbits. It is definitely not a book for the inexperienced. The various steps are logically presented but do involve a great deal of number punching with possible resultant errors. An experienced user of microcomputers, by disregarding the listings, should be able to write a programme for any computer.

I can recommend this book, despite my comments, to anyone interested in cometary orbits.

C.J.P.

THE HIDDEN UNIVERSE by Michael Disney, J.M. Dent & Sons Ltd., LONDON,
1984. 216pp. N.Z. Retail \$39.50.

If you are interested in cosmology then read this book; if you are not interested in this subject then still read the book but do so slowly and carefully with an ice pack on your head for you may find it heavy going in places.

The book is concerned with the missing mass, or in other words the cosmic density parameter, Σ . It was Einstein that stipulated that it was the density of the Universe that determined its future fate and geometry. If the present density exceeds a certain critical value, presently taken as one atom per cubic metre, then the Universe is finite. That implies that at some future stage it will recollapse on itself when the gravitational forces over power the current expansion. On the other hand if the present density is less than the critical value then the Universe will go on expanding for ever and it is infinite. That is what this book is all about.

The obvious assumption is made that if the Universe is closed then the missing mass must be hidden from our view in some way. It is pointed out that space appears to be largely empty and that low mass stars are much more numerous than high mass stars. The author accepts that the Big Bang Theory is generally accepted and shows that the observed cosmic background radiation supports this theory, whereas the Steady State Theory lacks observational evidence to support it and cannot stand up as a satisfactory alternative.

A host of objects ranging from red and black dwarfs to galaxies, clusters of galaxies, black holes and neutrinos are examined as possible sources of missing mass. In each case the argument for their holding at least some of the missing mass are presented along with any observations that might support these ideas. Then the difficulties inherent in such observations or theories are discussed. Along the way one learns much of both past and current research into the problem. The reader is also introduced to Newton's law of gravitation and Einstein's improvements to this theory. The evolution of stars and Eddington's work are also discussed.

At the end of chapter 7 there is a table that summarises the arguments about cosmic density as derived from various objects and chemical abundances. The broad conclusions from the evidence so far discussed are summed up in four concise statements in which it is suggested that if Σ is 1 then the range of values for it lies somewhere between .03 and 10 although many of the observations indicate that the hidden mass may be as much as a hundred times that which we can account for.

Chapters 8 and 9 return to galaxies, first as individuals and then as clusters. The discussion centres on how the mass of galaxies can be estimated. It is shown that much of the mass of galaxies lies beyond the visible extent of their structures as we currently photograph them. Computer produced models of spiral galaxies are reproduced and discussed. These experimental models appear to support the idea that a spherical halo of hidden matter is required to stabilise the galaxies. Much the same applies to some elliptical galaxies. It is also pointed out that hidden mass can also be regarded as hidden luminosity. The mass to light estimates are summarised on page 142 followed by concise conclusions on what has been found.

The following three chapters deal with a wide variety of objects including some unusual views on illusions and assumptions. Finally a look into future research concludes the book, apart from a brief two page explanation of the technical terms and a full bibliography. In the latter the more technical papers are clearly marked so that those who wish to read further can avoid the more advanced papers if they so desire.

This book is well written, stimulating and thought provoking. I can recommend it to anyone wishing to get a good grasp of cosmology and the problem of the missing mass. The latter is left unresolved.

F.M.B.

1985 YEARBOOK OF ASTRONOMY by Patrick Moore (ed). Sidgwick & Jackson Ltd., London.
1984. 216pp.

The layout of this book follows the same style as previous Yearbooks, edited by Patrick Moore. There are two parts, of which the first contains the star charts and lists of phenomena visible in 1985 with short descriptive notes. The star charts are in two parts. One drawn for latitude 52°N and the other for 35°S . Each chart is headed with the date and local time for which it is designed. The charts are a model of clarity. A short chapter precedes the actual charts and makes the use of the charts clear to even the most ignorant star watcher.

Monthly notes explain which planets are visible and where they can be found. These notes also give details of some of the main stellar objects that are visible, as well as some unusual bits of information such as a reminder of the centenaries of several distinguished astronomers. It is amazing just how much information has been so concisely given.

The second half of the book is devoted to articles. Here we have that gifted writer, David Allen, explaining how "An Infrared Astronomer looks at Cloud-covered Planets." Another very topical article that deserves careful reading is by Ron Arbour on "Photographing Comet Halley." Other articles deal with the Solar Atmosphere; Active Galaxies; Observing at the Very Large Array and on Variable Stars of the Southern Sky (written by our own Frank Bateson). All these articles are interesting and informative.

This book is well produced and shows the usual careful editing that is the hallmark of Patrick Moore. The plates and diagrams are excellent and illustrate what is contained in the articles. The book is highly recommended.

A.J.W.

THE HISTORY OF ASTRONOMY FROM HERSCHEL TO HERTZSPRUNG. by Dieter B. Herrmann, translated & revised by Kevin Krisciunas. Cambridge University Press, U.K. 1984. 220pp.

There is considerable interest to-day in historical perspectives. Earlier works on this subject such as Shapley & Howarth's "A Source Book in Astronomy"; Abetti's "The History of Astronomy" and Agnes Clerke's "Popular History of Astronomy", whilst invaluable reference works, fail to convey any impression of how astronomy has developed into its current golden age.

The original German edition of this book was first published in 1973, since when it has gone through three editions in that language. Essentially it is concerned with developments in astronomical research and equipment between 1780 and 1930. The aim of the original edition was to trace the history of these developments to show the changing direction of astronomical research rather than provide detailed studies of individual astronomers. This presents a more logical understanding of how the direction of research changed and why.

The translator has done a good job and appears to have largely refrained from attempting to give a strictly literal translation and from attempting to render the translation too far from the original. The result is that the book flows, and is instructive and informative. The few footnotes by the translator are brief and to the point.

This book achieves its aim of tracing the developments in astronomical research during a period that brought great changes. It is well produced in the style that one associates with works from the Cambridge Press. It is well illustrated and includes some unusual diagrams that certainly add to the value of the book. Any reader will profit from this work, which I can certainly recommend.

F.M.B.

RECENT LIGHT CURVES OF VW HYDRI

Frank M. Bateson

Figures 1, 2 and 3 on the following pages show the visual light curves for recent outbursts of VW Hydri during the interval when the Section was engaged in an intense cooperative programme on this well known dwarf nova.

FIGURE 1. 1984 September showing two normal outbursts. The first on 2,445,949 and the second on 2,445,965.

The first of these two outbursts was observed on the rise and decline, but bright moonlight and cloudy skies hindered most observers with the result that close to maximum brightness there were few observations.

The second outburst was very well observed at all phases. In both curves not all the negative observations have been shown. Allowance has also been made for poor observations, which an observer reported was hindered by clouds, etc.

FIGURE 2. 1984 October. This shows the normal outburst on 2,445,981. This outburst was again very well observed. A mean curve has been drawn through the plotted points at minimum although these appear to indicate oscillations. However, some of these magnitudes were at the threshold of the observer's instrument and must be regarded with caution.

FIGURE 3. The 1984 October-November super outburst, which reached its peak on 2,445,999. In this figure the horizontal scale is larger than in Figures 1 and 2. This was necessary because of the large number of observations. The plotted points are means at intervals of $^d.1$ where possible. Most means at from $0^d.8$ through 0.2 of each Julian Day contained from 5 to 11 observations; those from 0.3 to 0.6 of each Julian Day were derived from 1 to 4 observations whilst there is generally no observations, or only single estimates at 0.7 .

VW Hydri rose in $1^d.1$ from $13^m.6$ to $9^m.2$, which was the top of the initial rise. It required another $2^d.5$ to reach maximum brightness of $8^m.5$. An enlarged plot of the individual observations clearly show superhumps. In Figure 3 because it was plotted from means the superhumps are partly obscured as mini-maxima. Following maximum on 2,445,999 the star oscillated just below maximum brightness for two days before remaining close to $9^m.0$ for just over 4 days. Then there was a slow, steady decline for 3 days after which VW Hydri decline more steeply to minimum.

This super outburst was very well observed at all phases, although there was a tendency for the volume of observations to decrease once the decline entered its final stage.

Once again I must remind all observers that it is essential that in reporting their observations of a dwarf nova in outburst that they give the Julian Date to at least three decimals of a day, making sure that their observations have been very accurately timed. This is to assist in determining the period of the small amplitude variations be they due to superhumps or eclipses.

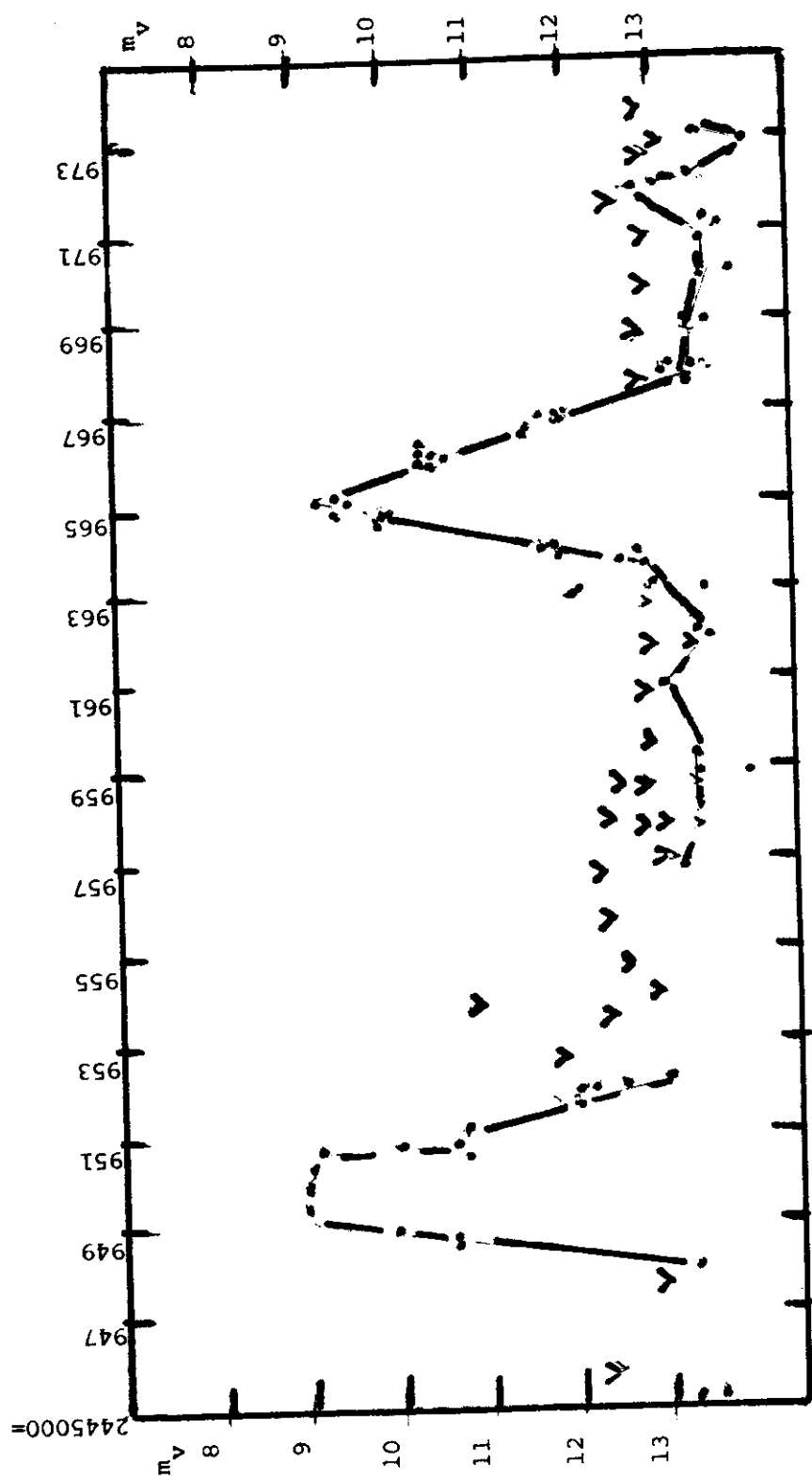


FIGURE 1. VW HYDRI---Two Normal Outbursts 1984 September.

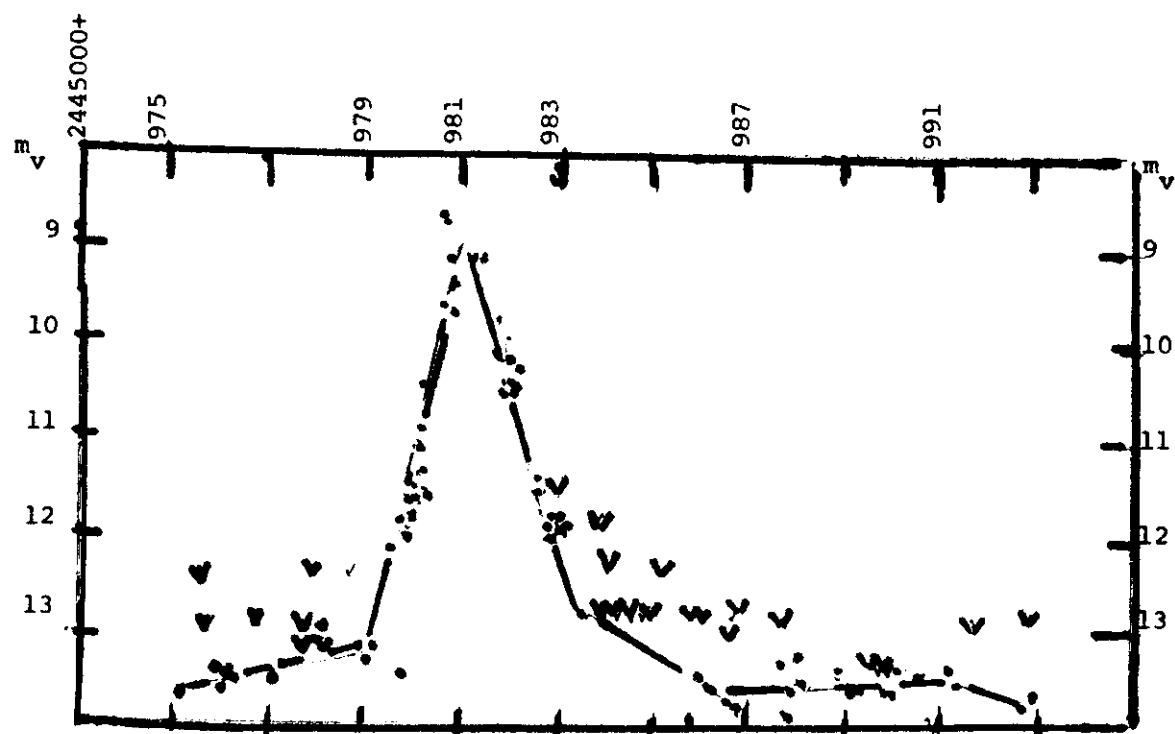


FIGURE 2. VW Hydrus--Normal Outburst 1984 October.

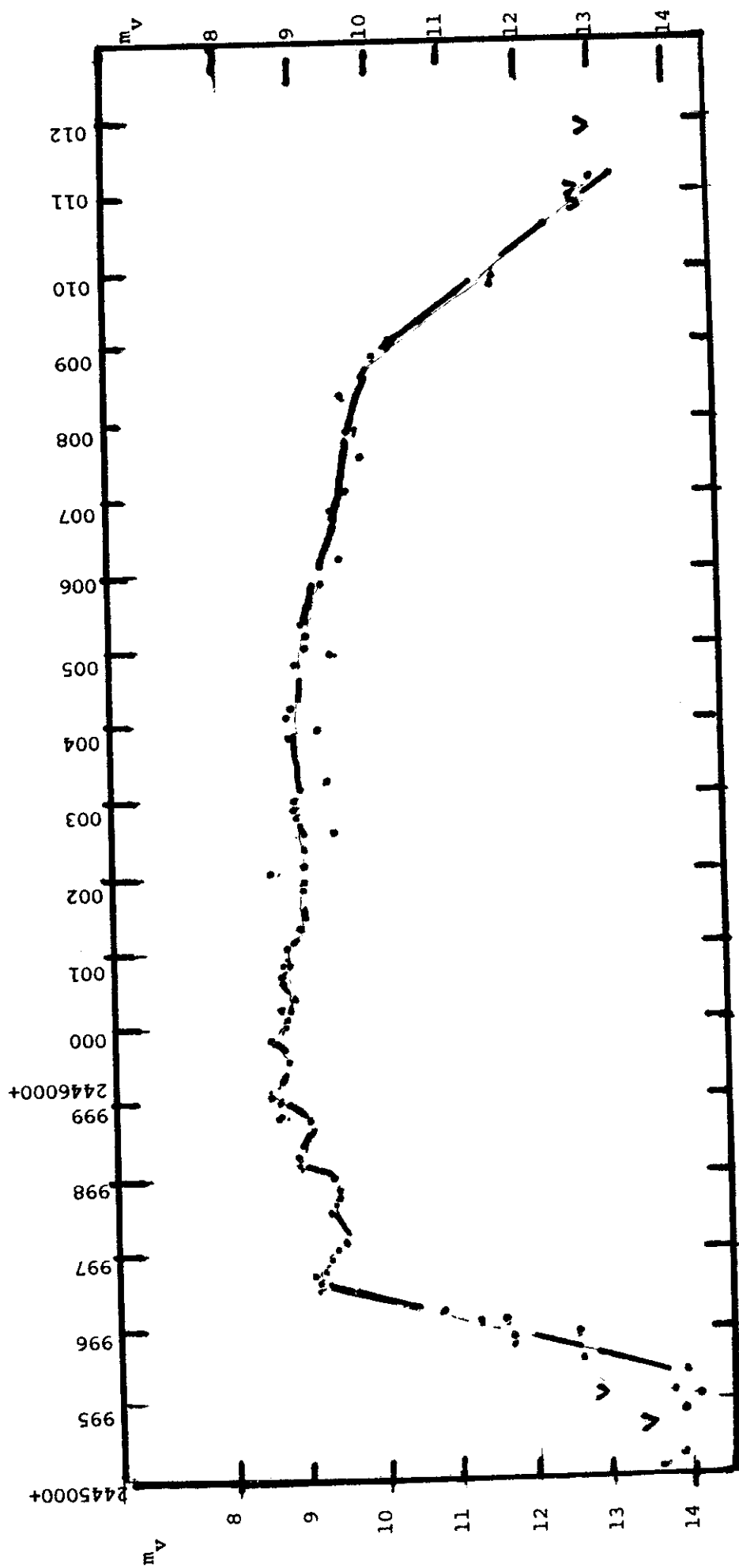


FIGURE 3. VW Hydri. The Super maximum of 1984 October-November.

REPORT OF THE VARIABLE STAR SECTION, ROYAL ASTRONOMICAL SOCIETY OF NEW ZEALAND
FOR THE YEAR ENDED 1984 DECEMBER 31.

This report marks the 57th year of activity of the Section. In presenting this report it will be necessary for me to refer to many matters because a number of changes in direction have occurred during the year with the objective of providing a better basis for future operations. I trust, therefore, that members will excuse the length of the report, but, at the same time, I hope they will find it interesting and informative.

DATA REDUCTION

The availability of microcomputers has enabled a start to be made with the production of computer light curves. The first stage was accomplished through the cooperation of Ranauld McIntosh, Director, Computer Section, R.A.S.N.Z. He kindly wrote a programme in BASIC for the reduction of observations of Mira variables. Dr. B.J. Poppleton, Director of the Computing Section, Astronomical Society of Victoria kindly offered the services of his members in providing these curves. Another member, of the V.S.S., has also undertaken the same work.

The first task in the programme is to have all the observations of Miras listed in a form that makes punching into a computer easier. I am extremely grateful to W. Goltz, a very skilled member of the Section, for his providing computer read outs of ten day means for a number of Miras. C.W. Venimore and myself have also produced listings for other stars in typescript.

The first computer produced light curve is published in this issue. This result from Ranauld McIntosh's work in writing the original programme. The speed at which these curves can be produced depends entirely on the time that volunteer assistants can give to this work. Should a number become available in a fairly short time of each other then it will be possible to publish them in a separate issue but it is probable that they will appear at least for a year or two as a growing number in the usual issues of these Publications.

The ultimate aim is for the Section to have its own adequate computer facilities installed at Headquarters. I am indebted to Dr. Janet A. Mattei for supplying very full details of the computer set up at the A.A.V.S.O. It is obvious that we shall not be able to provide such a complete arrangement but the objective is to ultimately have a set up that is compatible with that of the A.A.V.S.O. This will require the accumulation of the necessary funds, which will largely come from myself. It is also obvious that such funds as are built up must be sufficient to also provide for the salaries of a small paid staff. Investments that fall due within the next two years will provide the nucleus of that fund and these will in due course be transferred to Astronomical Research Ltd for this purpose.

It is unfortunate that shortly after the date of this report and before it was in its final form advice came that C. Potter, Manager, Computer Services at the University of Waikato had been attracted away by private industry. We rely very much on his advice and he was maintaining a programme for us in connection with the search for secondary and tertiary periods in Miras. We are hopefully that, after he has settled down in his new position, he will continue to assist the Section as he has done in the past.

ARCHIVAL DATA.

Once computer listing of observations on Miras, Semi-Regular and Irregular variables is completed the old records are being deposited in the archives of the A.A.V.S.O. This is in line with current recommendations that archival records be kept at one centre in much the same manner as photoelectric records can be deposited at a single centre for consultation and use by future researches. Some such records

have already been despatched and others are now ready for sending. This policy is also a sound one from the viewpoint that complete records will be available at two centres should fire, or other accident, destroy one set.

COOPERATION WITH OTHER VARIABLE STAR ORGANISATIONS.

I have referred in past reports to the fact that for certain stars in the equatorial zone the Variable Star Section, British Astronomical Association and ourselves have an arrangement whereby the final reduction of the combined observations for stars north of the equator are carried out by the B.A.A. and for those south of the equator by ourselves. The B.A.A. have already published the results of some of these combined observations (e.g. RU Peg, J. Brit. astr. Assoc. 93,2,pp 70-74). For our part we publish the combined results on CN Ori in a paper in this issue of our Publications. Excellent cooperation has been established with D.R.G. Saw, the Director of the B.A.A. Section.

A good exchange of observations continues with the A.A.V.S.O. whereby both organisations benefit by being able to use, when they desire, observations of the other group. Gordon Smith, our Recorder, compiles monthly lists of all our observations of Miras for use by the A.A.V.S.O. in their predictions and light curves. Those predictions are also based on the observations from many other national Variable Star Organisations and it makes sound sense to have one centre responsible for such predictions. Additionally a number of members of the A.A.V.S.O., whose location permits them to observe southern variables kindly communicate their observations to us as copies of their reports to the A.A.V.S.O. These have proved of particular use in our work on dwarf novae and other unusual objects.

The various National Variable Star Organisations in Australia, South Africa and Argentina cooperate very closely with us and we wish to extend our appreciation to their respective Directors for their cooperation.

SPECIAL PROGRAMMES

Throughout the year the Section has taken part in many special programmes, of which members received advice in either the Monthly Circulars or by way of Special Circulars. There is therefore no need to detail them all here. Most of these programmes called for our very close monitoring, especially of dwarf novae, in order to provide prompt alert notices of outbursts so that these could be studied with advanced techniques by both large ground based telescopes and from space.

Our Newsletter, Changing Trends No 10, kept members informed on how valuable their reports proved to be. Possibly the most successful of these programmes was that on the normal and superoutbursts of VW Hyi. There is little doubt that there has now been accumulated much greater knowledge of this system so that the observations at different wave lengths is building up a picture of how these outbursts proceed through the different parts of the system. The emphasis in the future appears as if it will be on observations in X-rays from EXOSAT as well as at I.R. and U.V. wavelengths. This may possibly make UVB observations less important but will not lessen the dependency on visual monitoring to provide advice of outbursts and for a subsequent visual light curve for comparison with the other results.

Special programmes also embrace a number of other types of variables ranging from transient X-ray sources, such as A0538-66, to RV type variables and irregular variables with rapid variations. There is still a growing demand for visual results.

PUBLICATIONS

Monthly Circulars have appeared each month. The growing number of observers and the fact that reports from our more distant members take some weeks to reach us has meant that the publication of these Circulars is usually not possible to late in each month.

Special Circulars have been issued as necessary. The NEWSLETTER, Changing Trends, has appeared quarterly. I must stress to members that whether this is issued at regular intervals depends entirely on the contributions from members.

Publication No. 11 was distributed early in the year. No 12 is under preparation at the time this report was written and will include this report. Several members have made suggestions that they would like to see in the Publications references to overseas papers in which the work of the Section has been used, whilst others have requested the inclusion of Book Reviews. Both requests have stressed that if possible these should be additional to the material that is normally published. An attempt has been made in the current issue to satisfy these requests. Comments of their value are welcome.

Another suggestion has come from Stan Walker. He suggests that the Publications should appear quarterly. That would, of course, be ideal. However, it is not a practical suggestion since it disregards the enormous amount of work that is done at Headquarters without any paid staff. It also ignores the simple fact that costs would rise considerably on account of the extra postage charges. The present economic climate is not the time to do this. Normally as soon as one edition is distributed work starts on the next. Our aim is to keep increasing the number of pages as has been done in the current issue. There is an alternative in producing the Publications in a reduced size and type as is done with SOUTHERN STARS. We wish to avoid this if possible and have noticed in several recent reviews that there appears to be some adverse comment on publications issued in this small format.

HEADQUARTERS

The routine work at Headquarters has been greatly aided by the work of our valued Recorder, Gordon Smith, who solely on a voluntary basis shoulders the time consuming task of checking and entering into the permanent records all the observations, once they have been used for the Monthly Circulars. This task Gordon performs with the great care and attention to detail that has for so long being a hallmark of all he does. The Section owes a great deal to Gordon's devoted efforts.

I am also most thankful to the voluntary assistance given so willingly in the preparation of papers and other work by Colin Venimore, Tony Dodson, Bill Goltz, David Lee, Mati Morel, George Stephanopoulos and A. Walsh. Dick Hull again produced the Julian Date Calendar distributed to members for which I am grateful.

During the year outward correspondence, exclusive of Circulars, Publications, etc., totalled just over 3,500 items. This included supplying data in advance of publications, correspondence with observers, requests for advice and guidance on observing (not all on variable stars), and equipment; considerable correspondence on historical matters; papers for publication; help to students and graduates; comments on various proposals for new installations and many other subjects. This is merely quoted to show the work that passes across my desk in addition to what might be termed the normal routine.

Good progress has been made in the preparation of a complete list of magnitudes for comparison stars, especially for those charts which originally had all the sequence stars designated by chart letters when no reliable magnitudes were available. This list has become increasingly important because of the large number of new observers who joined the Section in recent years and did not have access to the old style Circulars and earlier issues of the Publications in which sequence magnitudes have been published.

Several members have visited Headquarters during the year. Overseas visitors have included: Professor Forest Boley (McGraw Hill Observatory); D.J. Costanzo (A.A.V.S.O.) T.R. Williams (Vice-President A.A.V.S.O.); Professor Z. Kopal (Manchester). Dr. L.G. Glasser (Mt. Cuba Astronomical Observatory) did not include the North Island on his visit to N.Z. We were, however, able to arrange for him to meet with Albert Jones. Dr. Patrick Moore's visit to N.Z. did not include Tauranga, but

we were able to have most pleasant discussions with him in Whakatane. In addition, due to the courtesy of Jim Duthie, we shared with Patrick Moore and Jim a very enjoyable and exciting flight over White Island.

SEQUENCES

There is still a sad lack of reliable magnitudes for comparison stars in many southern variable star fields. We are indebted to the Director, Mt. Stromlo Observatory for allocating time on the 76cm reflector and associated equipment to enable members to work on sequence magnitudes. L.J. Williamson has already been able to use this instrument for this purpose. C. Bembrick, and members of the B.A.A. (N.S.W.) have also had time allocated to them in 1985 for sequence work. Other members have made use of this instrument in other programmes, with the result that, at times, a number of variables have been observed at limits normally beyond the threshold of their own telescopes.

I am also indebted to David Kilkenny for supplying sequence magnitudes as his own observing permitted. Jan van Paradijs has most kindly sent some sequence magnitudes for AR Pav,

CHARTS

Charts for Southern Variables, Series 17 was published and distributed by ASTRONOMICAL RESEARCH Ltd. Series 18 is currently under preparation. These charts are published under an original personal grant from the I.A.U. and have been in demand. I owe a great debt of appreciation to Mati Morel, whose skilled draughtmanship and careful attention to detail maintains the high standards that he has set in the past. It is always a pleasure to have his cooperation and to work so closely with him. His own "Visual Atlas of the Large Magellanic Cloud" is now in demand by overseas astronomers.

NOVA PATROL

Several requests for guidance in carrying out Nova Patrols, both visually and photographically, were made during the year. Despite every encouragement most of those interested in this work apparently gave it up after a short time and reports on searches carried out have dropped off.

OBSERVATIONS

The observations contributed by members are listed on a following page. As usual the totals are for the 12 months ending 31 August, 1984 in order that there is a strict comparison with previous years before the Society changed its financial year to December 31.

There was a slight increase on the previous 12 months, despite generally poor weather conditions during much of the year at many sites. The totals do not include the contributions received from the British Astronomical Association for stars south of the equator since these have been listed in their own publications. They will also be shown in the papers to appear in this and subsequent issues as papers on the combined results are published. Several members of the A.A.V.S.O. kindly send either their original lists of observations or duplicates to us. Since there is now such a complete interchange of observations between the two organisations no attempt has been made to show in the following list exactly how many observations were made specially for us and how many for the AAVSO. The very large increase in both members and contributions in the latter months of 1984 are not reflected in the totals presented in this report.

The observations, especially of the experienced observers, have maintained the high degree of accuracy of past years. I would like to thank each, and every, observer, no matter whether his or her contribution has been large or small for their excellent work. The fullest use is being made of all results and the ever increasing demand for visual results shows that they are worth while.

ACKNOWLEDGEMENTS

It is my great pleasure to express my most sincere thanks to all members for their support and cooperation throughout the year. Above all it is their observations that make the Section possible since without these there would be no Section. I also take this opportunity of expressing a warm welcome to the many new members who have joined the Section in recent months. I hope that they will find that they are part of a happy band, united in the modest desire to do something useful and constructive rather than indulge in mere star gazing. The long serving members have set a very high standard in their observations and I am sure that many of the new members will reach the same level of scientific accuracy in due course.

My thanks are also due to those members who have contributed papers to the Publications, or assisted in their preparation. Most of these have already been mentioned in this report and I trust that I have overlooked nobody. If so I humbly apologies in advance. There is always work to be done by those who have a preference for desk work.

Our thanks are extended to the subscribers to the various publications for their financial support. We are indebted to many professional astronomers for their interest in our work and for supporting our activities. We hope that those who have requested data, often in advance of publication, are satisfied with the results. We thank so many who have given small grants or paid for the costs of extended data.

My personal thanks are extended to the Directors of Local Sections for their work in collecting the observations from their members. In this regard I wish to mention in particular Jim Park; Jan Hers; Dick Hull and Juan Carlos Marioni. Special thanks are due to Doug Saw, Director, Variable Star Section, B.A.A., for the interchange of observations.

Dr. Janet Mattei, Director, A.A.V.S.O. has been of wonderful help in our future plans by supplying complete details of the computer set up at her headquarters and in other directions as well. We were delighted to have visits during the year from two members of the A.A.V.S.O. and look forward to other members visiting us during the coming year.

Lastly I wish to record my personal thanks to my wife, Doris, for her contributions to the work of the Section and for her constant encouragement.

1985 January 20.

Frank M. Bateson
DIRECTOR.

OBSERVATIONS RECEIVED FOR YEAR ENDED 31 AUGUST 1984.

<u>OBSERVER</u>	<u>TOTAL OBS</u>	<u>STARS</u>	<u>OBSERVER</u>	<u>TOTAL Obs</u>	<u>STARS</u>
ADCOCK, B	15	2	MARTIN, D.	409	29
ALBRECHT, W.M.B.	164	24	MENZ, A.R.	18	7
BEGG, D.L.	64	8	MENZIES, B.	1,191	42
BEMBRICK, C.	3	1	MEYERS, P.	56	9
BLANE, D.L.	42	7	MORISBY,, A.G.F.	20	17
BROWN, N.J.	139	30	NELSON, P.	35	17
BRYANT, K.	7	4	O'KANE, J.	153	29
COULING, G.G.	379	25	ORCHISTON, W.	524	26
CRAGG, T.A.	1,202	480	OVERBEEK, M.D.	11,847	313
CURNICK, C.L.	16	4	PARK, J.L.	405	43
DEBONO, I.	7	3	PAZZI, L.	674	72
DIETERS, S.	6	5	PEARCE, CA.	31	14
DINGLEY, A.	82	12	PEMBLE, H.	5	1
DODSON, A.W.	312	47	PROSSER, G.L.	68	28
DURHAM, D.	1,066	84	ROST, F.	8	1
EMMERSON, R.	197	14	ROWE, G.H.	313	56
FRASER, B,	44	16	ROWLANDS, S.J.	20	8
GOLTZ, W.	312	77	SAUNDERS, S.	170	37
HARRIES-HARRIS, E.	585	56	St. GEORGE, L.E.	73	17
HERDMAN, G.	254	37	SRINIVASAN, S.	208	9
HENSHAW, C.	66	4	STABENOW, R.	460	38
HERS, J.	1,065	43	SHINKFIELD, R.C.	19	11
HULL, (Mrs) O.A.	11	6	STEPHANOPOULOS, G.	1,164	170
HULL, O.R.	3,319	247	TAYLOR, N.W.	1,416	125
IVES, F.	629	91	THOMAS, R.	168	21
IZZO, J.	2	1	TREGASKIS, T.B.	583	118
JONES, A.F.	3,961	110	Turle, Mrs. L.	63	7
JOZSA, A.	275	34	TURK, C.	29	20
LANHAM, L.	64	15	VENIMORE, C.W.	523	35
LEE, D.	55	20	VINCENT, J.V.	384	18
LESLIE, Mrs. A.	293	15	WILLIAMS, P.	1,446	140
LUMLEY, E.	366	32	WILLIAMSON, L.J.	827	36
MARINO, B.F.	40	34	WINNETT, R.D.	448	63

TOTAL OBSERVATIONS 38,800.

Compared to the previous twelve months there was a slight increase in the total observations, despite unusual bad weather over many sites and the bush fires that hindered observations by a number of our Australian observers. Unfortunately a few of our very keen members who made substantial contributions last year have had to cease observing, temporarily, as they have lost their jobs and are seeking work.

The above totals, as mentioned in the Annual Report, do not included those from the B.A.A. Also those who also contribute to the A.A.V.S.O. are not marked simply because to keep track on the observations they make specially for the V.S.S. and those they make specially for the A.A.V.S.O. would place an additional burden on our over worked Recorder.

Ten observers made more than 1,000 observations and their contributions accounted for just over 68% of the total. Only observations received up to 31 August have been included in the above totals.

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