PHOTOGRAPHIC PHOTOMETRY OF MAGELLANIC CLOUD CEPHEIDS

by

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TABLE OF CONTENTS

TABLE OF CONTENTS (ctd)

TABLE OF CONTENTS (ctd)

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Declaration

I declare that, except where specified by references in the script, this thesis is, to the best of my knowledge, my own work.

Signed:- W.K. Martin

Date:- 1-5-80

ABSTRACT

Photographic (B,V) light curves of 213 LMC and 180 SMC cepheids (and W Virginis stars) have been obtained and the relevant light-curve parameters derived. Comparison of this work with stars in common with photoelectric data indicate that the $\langle V \rangle$ and $(\langle B \rangle - \langle V \rangle)$ magnitudes differ from their photoelectric counterparts by $\pm 0^{m}.09$ and $\pm 0^{m}.12$ respectively for the fainter cepheids (log P <0.8) and by $\pm 0^{m}.06$ and $\pm 0^{m}.07$ respectively for the brighter cepheids (log P >0.8).

Analyses of a selected sample of these cepheids (156 in the LMC and 135 in the SMC) combined with existing photoelectric data show that:-

(1) The mean P-L relationships (from least square solutions) are:-

$$\langle V \rangle = \underset{\pm 0.03}{17.61} - \underset{\pm 0.02}{2.70} \log P \qquad \langle B \rangle = \underset{\pm 0.05}{17.78} - \underset{\pm 0.05}{2.29} \log P \quad \text{for the SMC}$$

$$\langle V \rangle = \underset{\pm 0.03}{17.33} - \underset{\pm 0.03}{2.70} \log P \qquad \langle B \rangle = \underset{\pm 0.04}{17.71} - \underset{\pm 0.05}{2.35} \log P \quad \text{for the LMC}$$

(2) The mean P-C relationships (from least square solutions) are:-

$$\langle B \rangle - \langle V \rangle = \underset{\pm 0.02}{0.40} \log P + \underset{\pm 0.02}{0.17} \text{ (SMC)} \qquad \langle B \rangle - \langle V \rangle = \underset{\pm 0.02}{0.35} \log P + \underset{\pm 0.02}{0.39} \text{ (LMC)}$$

(3) The intrinsic width of the instability strip (from each P-C diagram) is betweeon $0^{m}.3$ and $0^{m}.4$ for each Magellanic Cloud.

(4) The LMC and SMC cepheids are intrinsically $\sim 0^{m}.04$ and $0^{m}.17$ bluer respectively than those in the Galaxy, which can be interpreted as representing an under-abundance in metals in the LMC and SMC of factors of $\sim$1.4 and 4.0 respectively, compared with the Galaxy.

(5) The combined least squares and maximum likelihood, P-L-C solutions are:-

$$\langle V\rangle = 16.34 - 3.59 \log P + 2.55 (\langle B\rangle - \langle V\rangle) \quad \text{for the LMC}$$

$$\langle V\rangle = 17.05 - 3.92 \log P + 3.02 (\langle B\rangle - \langle V\rangle) \quad \text{for the SMC,}$$

whose colour coefficients are in agreement with those theoretically derived by Sandage and Tammann (1968), Gascoigne (1974) and others. There is an indication that the fainter cepheids (in both Clouds) obey P-L-C relationships whose colour coefficients are smaller than those suggested above, but this effect may be due to errors in the photographic observations.

(6) The SMC cepheids (at least) tend to follow the predicted P-L-A and P-C-A relationships derived by Sandage and Tammann (1971).

(7) Another method of distance determination may be used by fitting Iben and Tuggle's (1975) theoretical blue edge of the instability strip in the P-L plane to the observational data.

(8) The true distance moduli (corrected for metal abundance) of the LMC and the SMC are 18.66 ± 0.10 and 19.00 ± 0.15 respectively.

(9) The helium and metal abundances, derived by fitting Iben & Tuggle's theoretical blue edge of the instability strip in the P-C plane to the data, are, for the LMC: $Y \sim 0.28$, $Z \sim 0.015$; for the SMC: $Y \sim 0.38$, $Z \sim 0.005$.

Finally, a comparison of the properties of cepheids in the Magellanic Clouds has been made with those in other systems (M31, NGC 6822, IC1613 and the Galaxy) and approximate distance moduli derived.

Overall it is concluded that: (a) cepheids in the Magellanic Clouds and as far as can be determined, those in other systems, appear to share the same properties and obey similar laws, provided that effects of chemical composition have been taken into consideration: (b) distances to cepheids in each galaxy may be derived with reasonable accuracy by applying either a P-L-C relationship and correcting for abundance effects or a P-L relationship and correcting for reddening effects.

INTRODUCTION

The resurgence of interest in the cepheid variable in recent years has barely been equalled since Miss Leavitt's historic discovery of the period - luminosity law some seventy years ago.

The present interest has tended to follow two main avenues of research. The first concerns the physical and chemical properties of the variable itself and its rôle in the instability strip. Owing to the theoretical difficulties at this stage of stellar evolution, observation has played almost as important a part as the construction of theoretical models. A second application, and one which might be considered to be of wider interest, is whether cepheids, because of their intrinsic brightness, large amplitude variation and stable period, can be used to set up a distance scale to external galaxies.

Clearly, for a universal distance scale to be applicable, it must be satisfactorily demonstrated that cepheids everywhere share the same properties and obey the same laws. If this were true, then given an absolute calibration for our own galaxy, an extragalactic scale could be established. There are still quite large differences of opinion on the exact form of the absolute calibration and even the foundation stone on which this calibration is laid - the distance to the Hyades cluster - is not as secure as one might have wished! (see e.g. Hanson 1975).

It might be thought that one of the simplest methods of determining whether all cepheids share the same properties in different galaxies would be to compare the slopes of the respective period-luminosity (P-L) relationships. The galaxies from which such a comparison could be made include our own, the Magellanic Clouds, M31, NGC 6822 and IC 1613.

Observational tests along these lines in these galaxies by Arp (1960), Woolley et al (1962), Baade and Swope (1963),Kayser (1967), van Genderen

(1969), Hodge and Wright (1969), Gascoigne (1969), Sandage (1971), Connolly (1975), Butler (1976, 1978) and others have indicated that not only are the P-L slopes different between these galaxies, but differ among observers for the same galaxy! These differences could be explained by chance selection effects or by poor photometry or they may be real. If the P-L law has an intrinsic scatter, selection effects might well produce different slopes. In addition, Iben and Tuggle (1972) suggest that the slope of the P-L relationship depends on the mode of pulsation of each cepheid. This situation alone suggests the need for more observational material.

As the cepheid instability strip has a finite width it seems not unreasonable to suppose that scatter in the P-L relationship might be reduced if a third parameter were introduced. Candidates for this parameter include (B-V) colour (C), amplitude (A) and chemical composition. Sandage and Tammann (1969), Iben and Tuggle (1972), Stobie (1969) and others have derived semi-empirical P-L-C relationships against which observational tests may be made. Gascoigne (1969) found that the colour coefficient derived by Sandage and Tammann for the galactic cepheids, fitted his photoelectric data for Magellanic Cloud cepheids quite well. Butler (1976), from the photographic photometry of Small Magellanic Cloud (SMC) cepheids, found similar agreement, but Connolly (1975), investigating the Large Magellanic Cloud (LMC) photographically, found that a colour term was relevant only for the long period cepheids.

The rôle of the colour term is further confused by problems of differential reddening and chemical composition. Gascoigne (1974) has shown that the (B-V) coefficient in the P-L-C relationship increases as the metal abundance (Z) decreases. This effect tends to make a P-L-C law in this form less useful as a distance indicator to external galaxies unless Z is known. Conversely it implies that an estimate of Z may be made once the distance (or, more specifically, the coefficients in a

P-L-C law) is known. Indeed Butler (1978), from the photographic photometry of Magellanic Cloud cepheids, has made use of this last point to compare values of Z in the LMC and SMC. It would appear, then, that a P-L-C law where the colour is expressed as (B-V), may not be entirely sufficient to determine the 'universal law' for cepheids. Other colour indices such as (R-I) and (V-I) may prove to be more viable parameters in this respect.

An alternative to colour as a third parameter is the cepheid amplitude of light variation (A). Unfortunately the theory relating to, for example a P-L-A relationship, is not as well developed as its P-L-C equivalent and we must rely more heavily on observational results. Sandage and Tammann(1971) working with observational data for cepheids in four galaxies (SMC, LMC, M31 and our galaxy) showed that, within specific period ranges, large amplitude cepheids occupied discreet and different positions in the instability strip compared with those of small amplitude. In addition they derived P-L-A relationships, within these period ranges, from the observations. Butler's (1976) work on the SMC cepheids indicated that his derived P-L-A correlations were of the same general character as those found by Sandage and Tammann. However both Connolly's (1975) and Butler's (1978) observations of LMC cepheids showed no agreement with the amplitude coefficients derived by Sandage and Tammann, and Madore (1976), using Fernie's (1970) data for nearby cepheids, showed that the distribution of amplitudes in the instability strip appeared to be exactly opposite to that suggested by Sandage and Tammann. Theoretical models and further observation are urgently required to clarify the situation.

Whilst Sandage and Tammann's work has added much to the construction of a distance scale using cepheids, one criticism that can be made is that cepheid data from at least four galaxies have been combined in the derivation of the various P-L-C-A relationships. It should perhaps be emphasized that the cepheid data in each galaxy should be studied separately and the results intercompared for homogeneity. To do this effectively it is essential to have data on a significant sample of cepheids in each galaxy.

Although photoelectric photometry exists for several hundred galactic cepheids, they lie at different distances and suffer different (and in some cases unreliable) reddenings. These facts tend to reduce the usefulness of such data. In each of the Magellanic Clouds and in some external galaxies the cepheids are all nearly at the same distance and have small and reasonably uniform reddenings. On the other hand, photoelectric work on these objects is not yet plentiful enough to escape the inevitable selection effects.

It is for these reasons that photographic photometry methods are still viable especially in the Magellanic Clouds (and external galaxies) where large numbers of cepheids of all period ranges may be secured on one photographic plate. With the possible exception of Butler's work, no reliable photometry of a significant sample of cepheids in both Clouds exists. This work, therefore, presents B and V light curves of 181 cepheids in the SMC and 213 in the LMC. It is hoped that the derived parameters will be accurate enough and the sample large enough to be able to decide whether or not the cepheids in these two galaxies share the same properties as those in other systems.

CHAPTER 1

OBSERVATIONAL TECHNIQUE

1.1 The Telescope

The telescope, situated at Sutherland (an outstation of the SAAO), consists of two refractors mounted on the same side of the pier. This arrangement enables simultaneous observations in B and V colours to be made. The relevant data for each telescope (tube) are given in Table 1.11 together with typical exposure times for the given limiting magnitudes in conditions of average seeing.

Table 1.11

Telescope data

Tube	Diam (ins)	F/ratio	Plate scale (arcsec/mm)	Sky area (deg sq)	Emulsion	Filter	Col.	Lim. Mag.	Exp (mins)
Blue	10	9	88	4.0	IIaO	-	B	18.5	90
Yellow	8	10	100	4.2	Io3aD	OMAG301	V	17.5	90

The 'yellow' tube consists of a four component Taylor-Taylor-Hobson astrometric lens and the 'blue' tube is a Cooke triplet. The advantages of being able to make simultaneous (B,V) observations are:-

(a) For variable star work, the observations are obtained at the same phase.

(b) The extinction in colour with altitude is minimized.

(c) The observing time is halved.

(d) Each plate pair experiences the same conditions of seeing, telescope guiding, exposure time etc.

Of course the effects of air mass and problems of zero point remain, but are taken out in the calibration procedure in the usual way.

The main disadvantages of the system are the inherently small plate scales and the relatively long exposure times required to reach the fainter stars.

1.2 Iris Diaphragm Photometer

The plates were measured with an (Askania) iris diaphragm photometer of a type similar to that described by Stock and Williams (1960). Briefly, two light beams, one of which passes through the iris diaphragm and the plate and the other which passes through a continuously variable wedge and a "chopper" blade, are intercompared with the aid of a photometer. A balance between these beams may be reached in two ways:-

(i) The wedge may be kept fixed and the diaphragm varied. In this case the diaphragm measures effectively the diameter of the stellar image.

(ii) The diaphragm may be kept fixed and the wedge varied. In this case the diaphragm measures the transparency of a given constant area round and including the image.

In method (ii), recommended by Dixon (1970), the diaphragm must be slightly larger than the brightest image measured which means that for Magellanic Cloud photometry the chances of being able to measure a faint (small diameter) image without contamination are very small. It was for this reason that method (i) was chosen.

1.3 Photoelectric standards

The classical requirement for photographic photometry is a photoelectric sequence of stars for calibration purposes. Ideally there should be hundreds of such stars of all magnitudes and colours covering the area to be photographed. Such ideals are seldom attained but it is essential to specify the sequences used and their reliability as, clearly, the photographic photometry can only be as accurate (and go as faint) as the calibrating sequence of stars. For LMC I the procedure adopted was somewhat different from that used in the remaining areas. This was partly due to an increasing awareness of the problem and partly due to limited (photoelectric) observing time. For LMC I one central sequence was used (Olowin et al. 1974) together with the sequences OK and OM by Butler (1972) which lie in the southern areas of LMC 1. For the northern areas photographic subsequences, corrected for background fog, were established in the manner, described by Woolley et al.(1962). The subsequences were transferred from the central photoelectric sequence.

However, the (B,V) sequences in the remaining regions (LMC II, LMC III and SMC I) of the Clouds were especially chosen to lie in the corners and centres of each region covered by the Blue plate. (The B tube covers slightly less area than the V due to its slightly different focal length).

The photoelectric observations for these new sequences were made in October and December 1975 and February 1976 with the St. Andrews photometer(Kelly & van Breda, 1975) attached to the (SAAO) one-metre reflector. Standard stars by Cousins (1970) and Olowin et al. (1974) were observed together with the sequence stars at hourly intervals (or less if the conditions warranted it) throughout the night. Table 1.31 lists the standards used with source references. The standards were 'tied in' with Harvard E and F region standards (Cousins 1973) and comparisons between these and the standards in Table 1.31 showed differences in zero point of not more than $0^{m}.02$. The reductions were made with the aid of the NOVA computer at SAAO and a program written

Table 1.31

Standard Stars for SMC and LMC Fields

HD	RA	(1975.0)	dec	Spec.	V	B-V	Source
3689	00	37.4	-74 06	F2	7.415	0.484	Cousins
6172	01	00.1	-72 50	K0	7.674	1.339	Cousins
6536	01	03.6	-72 23	K0	8.404	1.010	Cousins
6655	01	04.5	-72 41	G0	8.043	0.562	Cousins
32933	05	01.4	-67 28	-	9.104	0.499	Olowin
33031	05	01.7	-69 32	A3	8.130	0.258	Cousins
35230	05	17.7	-68 37	K0	7.575	0.879	Cousins
36062	05	22.8	-71 32	A3	7.435	0.192	Cousins
37195	05	31.6	-66 42	G0	8.88	0.545	Cousins

Table 1.32

Photoelectric Magnitudes of the Sequence Stars
Small Magellanic Cloud

Sequence I

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	11.17	01	1.32	01	11,22
2	13.33	03	0.48	03	11,15
3	14.06	02	-0.11	02	11,15
4	14.96	03	0.29	03	11,15
5	15.15	03	-0.01	02	22,15
6	15.29	06	0.22	06	22
7	16.43	05	0.71	05	15

Sequence II

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	10.30	01	0.20	02	22
2*	10.61	01	1.21	01	22,15
3	12.14	02	0.98	02	22
4	13.50	03	0.46	03	22
5	15.42	04	0.57	04	22
6	16.01	03	0.60	04	15
7	16.77	04	1.42	05	15

(* Butler V = 10.61, B-V = 1.17)

Sequence III

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1*	11.01	01	0.93	01	11
2	12.54	01	0.96	01	11,15
3	13.62	01	0.70	01	11,15
4	14.62	02	0.09	02	15,22
5	15.01	01	-0.16	01	15,22
6	15.42	04	0.92	04	11
7†	16.35	05	-0.25	05	15.22
8	(17.63)	20	(2.0)	50	15

(*Butler V = 11.03, B-V = 0.92)
(†Butler V = 16.16, B-V = -0.35)

Sequence IV

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	10.45	01	0.53	01	11
2*	11.24	01	0.48	01	11,22
3	11.53	01	1.06	01	11,11
4	11.75	01	0.52	01	22,11
5	11.91	01	0.72	01	15,15
6	11.96	02	0.48	02	22
7	12.12	01	1.17	02	11,11,15
8	12.76	01	0.68	01	11,22
9†	12.85	03	1.07	03	11
10	13.69	02	0.76	02	11
11	14.09	01	0.03	01	11,11
12	14.17	02	0.93	02	11
13	14.44	02	0.76	02	11
14	14.51	02	0.03	02	11
15	14.91	03	0.13	03	11
16	15.20	02	0.50	05	11,15
17	15.47	02	0.52	01	11,15
18	15.79	03	0.83	03	11
19	15.88	03	0.33	03	11
20	16.42	04	0.80	04	15
21	16.54	04	0.88	05	15
22	16.62	04	0.17	05	11
23	17.08	05	1.63	06	15

(*Butler V = 11.26, B-V = 0.47)
(†Butler V = 12.91, B-V = 1.01)

Table 1.32 - continued

Large Magellanic Cloud

Sequence I (LMC II)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	12.36	01	0.65	01	11,15
2	14.02	02	0.69	05	15,15
3	15.10	05	1.03	05	15
4	15.44	10	-0.30	05	15
5	(16.10)	10	(0.5)	50	15
6	16.26	10	1.44	10	15

Sequence II (LMC II)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	12.17	01	0.58	01	15,22
2	13.26	03	0.55	01	15,22
3	13.50	03	0.69	03	22
4	14.37	03	1.45	03	15
5	15.53	04	0.69	04	22
6	15.63	04	1.39	05	15
7	16.96	06	1.55	08	22

Sequence III (LMC II)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	11.84	01	0.77	01	22,15
2	12.43	03	0.69	03	30
3	14.98	03	0.87	03	22
4	15.15	04	0.16	04	15
5	15.82	04	0.93	04	15
6	16.74	05	0.66	05	15
7	(17.51)	10	(0.97)	15	15

Sequence IV (LMC II,III)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	12.51	01	0.78	02	22,15
2	13.53	03	0.69	02	22,15
3	14.64	02	0.77	02	22,15,15
4	15.46	04	0.46	05	22,15,15
5	16.34	04	0.21	02	22,15
6	16.80	05	(1.52)	30	15

Sequence V (LMC III)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	11.73	01	0.56	01	22,15
2	13.17	03	0.84	01	22,15
3	13.72	01	0.57	03	22,15,15
4	14.58	02	-0.20	01	22,15,15
5	14.87	03	0.06	03	22
6	15.07	04	-0.06	04	15
7	15.59	04	0.53	04	15
8	15.83	04	-0.13	04	15
9	16.02	05	0.95	05	15

Sequence VI (LMC II)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	11.73	02	1.06	03	30
2	13.94	02	0.54	03	30
3	14.69	02	0.79	03	15
4	15.01	04	0.95	05	30
5	15.43	07	2.13	08	30
6	16.62	05	1.36	06	15
7	(17.01)	15	(0.79)	50	15

Sequence VII (LMC III)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	10.09	01	1.11	01	15
2	12.26	01	0.59	01	11,22
3	12.86	01	0.53	01	11
4	13.57	01	1.27	02	11
5	13.97	01	0.78	01	15,15
6	15.05	03	0.14	03	15
7	15.30	03	-0.20	03	22,15
8	16.36	04	1.78	05	15
9	16.37	04	1.19	05	15

Sequence VIII (LMC III)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	10.56	01	0.32	01	15,11
2	11.50	01	0.62	01	15
3	12.62	02	0.60	01	15,15,11
4	13.66	01	1.11	01	15,11
5	13.95	02	0.84	02	15
6	14.67	02	0.67	02	15,11
7	15.41	04	0.63	02	15,11
8	16.78	05	0.83	05	15
9	16.80	05	0.85	05	15

Sequence IX (LMC III)

Star	V	pe (±)	B-V	pe (±)	Ap (arcsec)
1	9.78	01	1.30	01	15,15
2	10.61	02	0.32	02	30
3	11.55	01	0.88	01	30,15
4	12.57	05	0.77	01	15,15
5	12.59	02	0.51	02	30
6	12.75	01	1.30	01	15,15
7	14.05	02	0.97	02	30
8	14.48	03	0.78	03	30,15
9	15.57	05	0.79	01	30,15
10	(15.70)	15	(0.78)	05	30
11	(16.88)	10	(1.40)	30	15
12	17.59	10	0.98	10	15

Table 1.33

Approximate Positions of the Sequences

Sequence	Star	RA (1975.0) ($\pm 0^m.2$)	dec (1975.0) ($\pm 2'$)
SMC I	2	00 41.7	-73 43
SMC II	2	00 46.2	-72 21
SMC III	3	00 56.4	-71 59
SMC IV	5	00 57.1	-73 11
LMC I	1	05 00.0	-68 40
LMC II	3	05 03.0	-71 16
LMC III	2	05 15.2	-70 12
LMC IV	3	05 23.1	-68 39
LMC V	1	05 24.3	-66 56
LMC VI	1	05 27.4	-71 11
LMC VII	1	05 34.6	-68 01
LMC VIII	1	05 48.4	-66 34
LMC IX	1	05 53.9	-69 02

Notes:

Finding charts (in B) for the sequences are shown in the following Plates as follows:

Plate I: location of all SMC sequences.
Plate II: detailed location of SMC sequences I - III.
Plate III: detailed location of SMC sequence IV.
Plate IV: location of all LMC sequences
Plate V: detailed location of LMC sequences I - V.
Plate VI: detailed location of LMC sequences VI - IX.

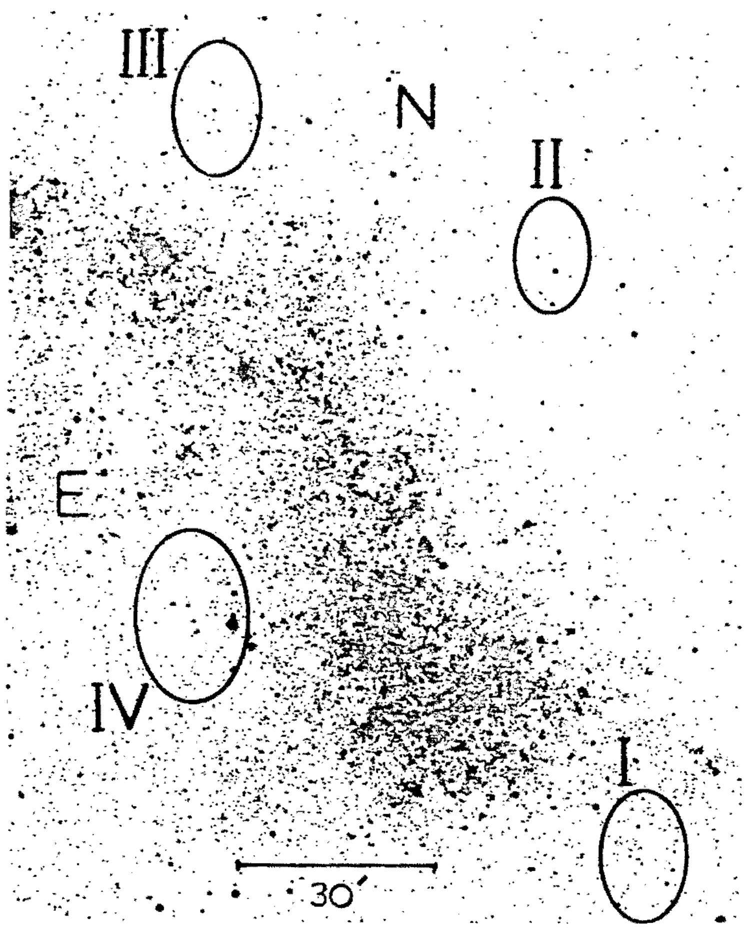


PLATE I. *General location of SMC sequences.*

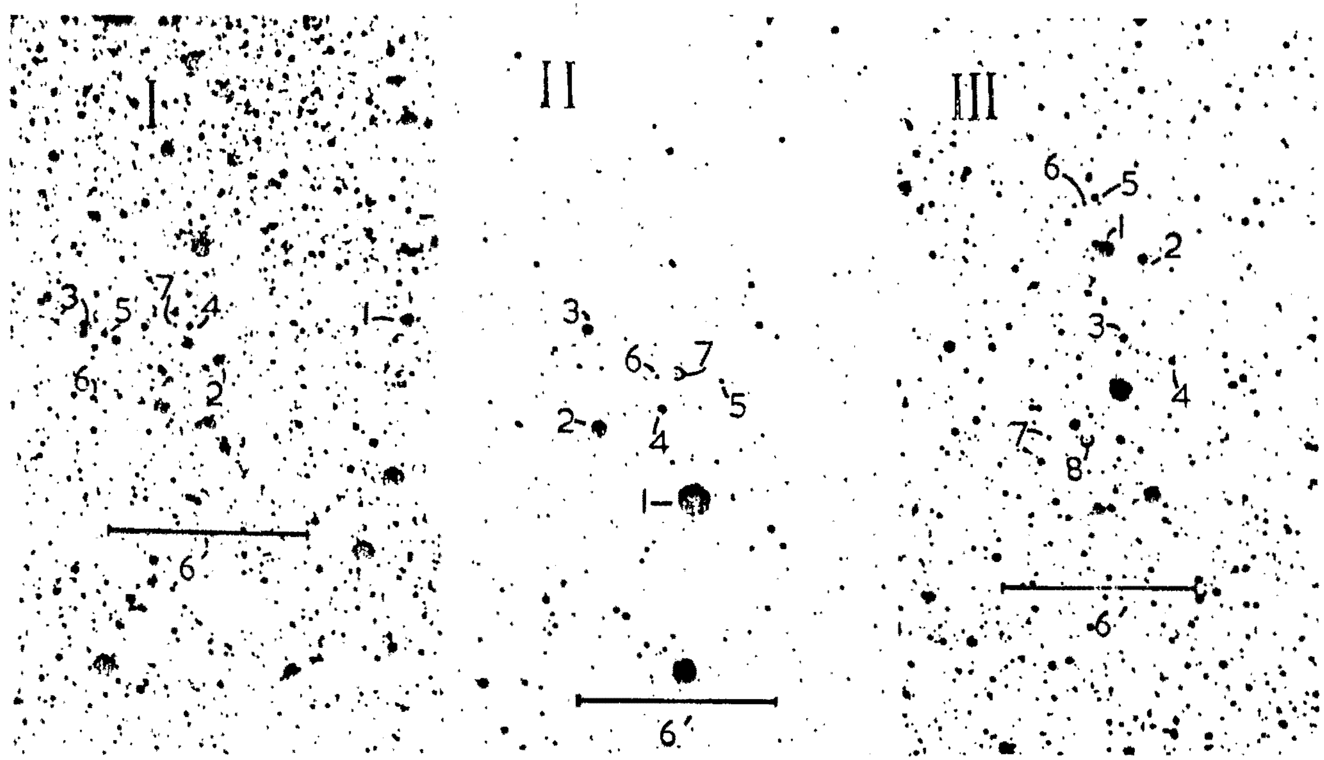


Plate II. *Detailed location of SMC sequences I–III.*

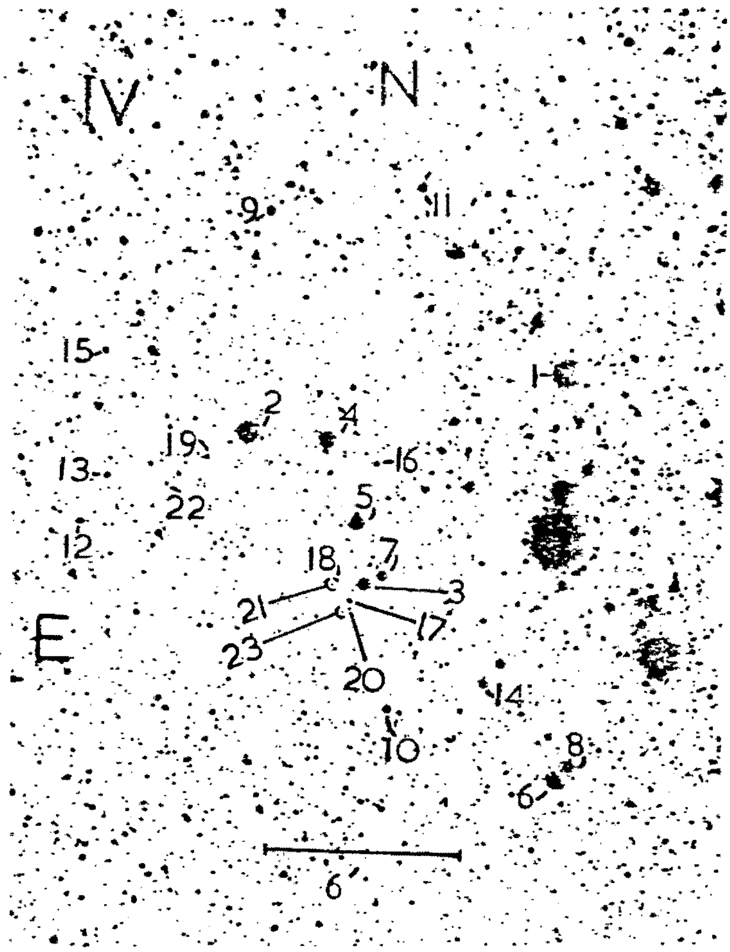


PLATE III. *Detailed location of SMC sequence IV.*

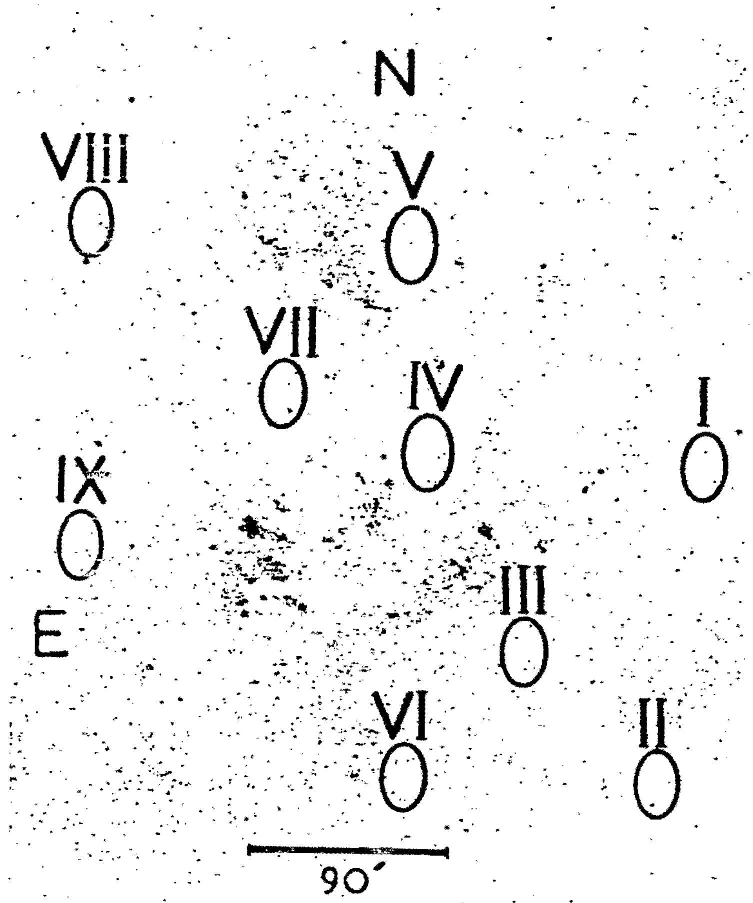


PLATE IV. *General location of LMC sequences.*

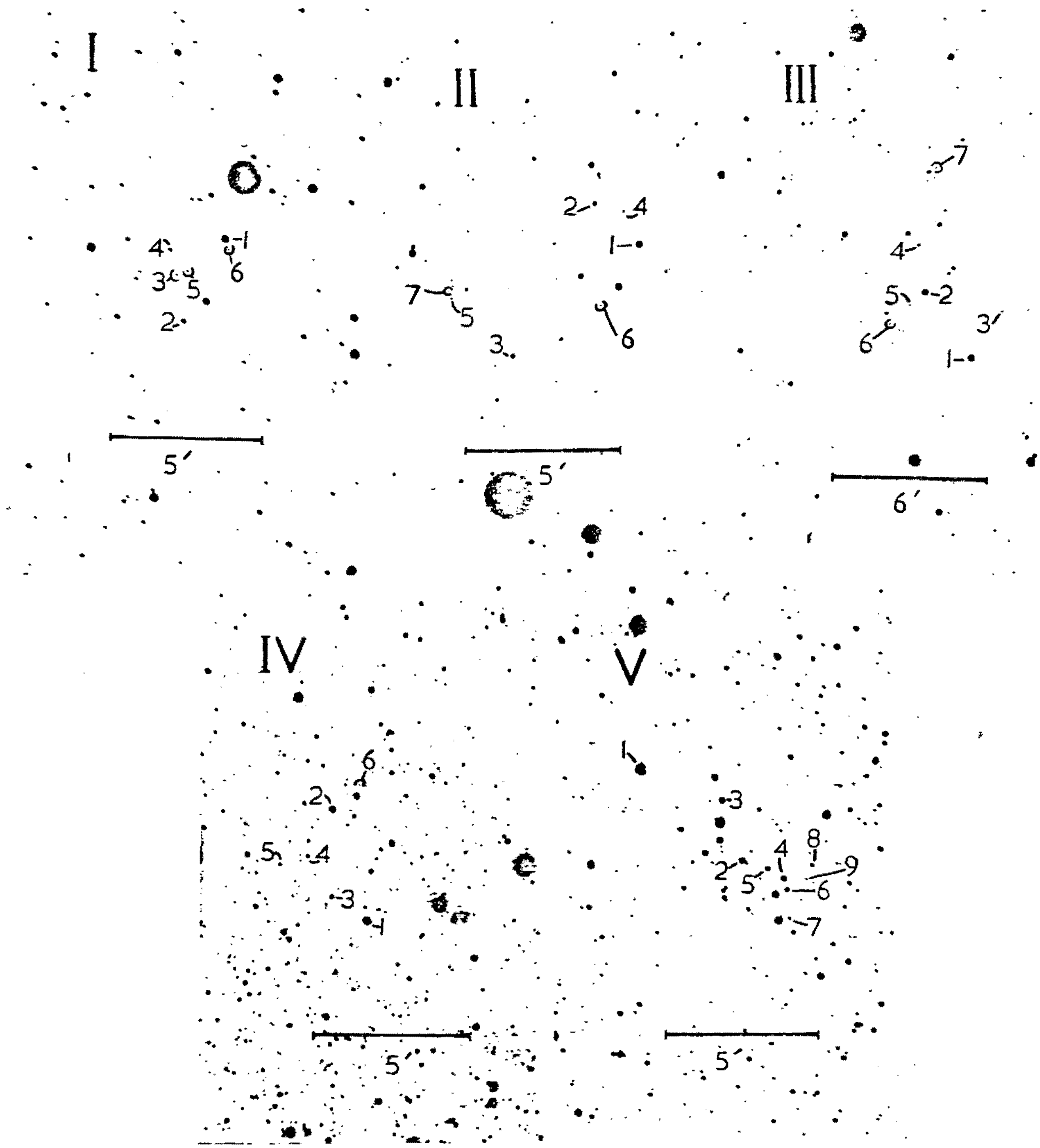


PLATE V. *Detailed location of LMC sequences I–V.*

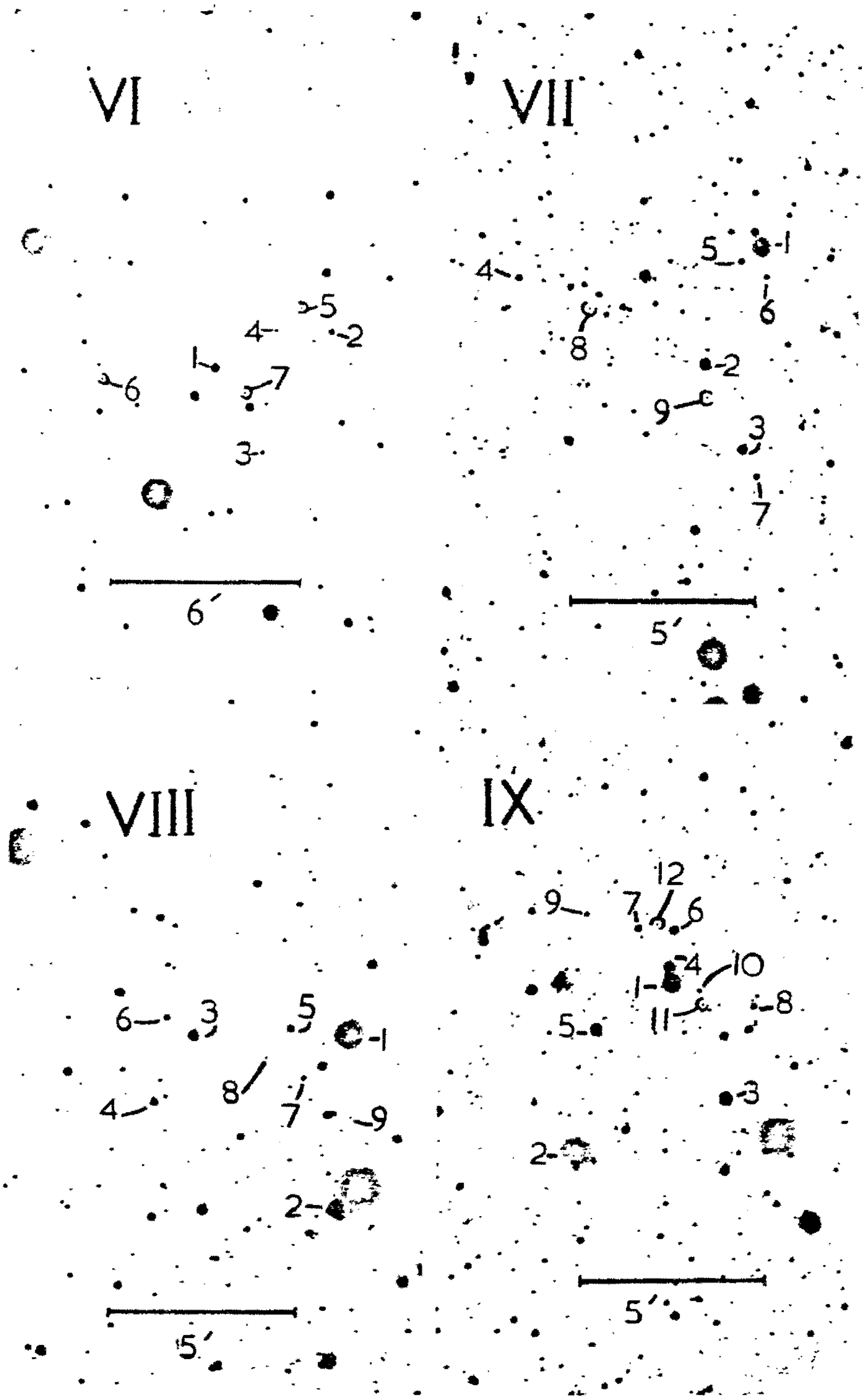


PLATE VI. *Detailed location of LMC sequences VI–IX.*

by Dr A.J. Penny. It should be noted that the colour equations and extinction coefficients for Sutherland are well established.

In Table 1.32 the mean values of the magnitudes of the new sequence stars are given together with the aperture sizes used (in arcseconds) for each night and photoelectric magnitudes of stars in common with Butler (1972). Magnitudes given in brackets indicate unreliable values either due to poor seeing where a large aperture had to be used (and hence background contamination became important) or to apparently large differences in sky background. Also shown in the Table are the probable errors of the magnitudes estimated for the internal standard errors (where more than one nights observation was available) and from variations in sky background near the star.

Table 1.33 lists the approximate RA and Dec. (1975) for a specified star in each sequence. These coordinates have been estimated from photographic plates by measuring the distances of the specified stars from the nearest stars in the Smithsonian Astrophysical Observatory Star Catalogue.

Finding charts for the sequences are shown in plates I - VI.

1.4 Reduction Procedure

The main considerations in the reduction of photographic images to magnitudes are:-

(a) Non linearity of the photographic response.

(b) The colour dependence.

(c) Transfer and field errors across the plate.

(d) Plate background.

(e) Iris photometer drift.

(f) Uncertainties in the photoelectric sequence magnitudes.

(g) The B,V system adopted.

(h) Emulsion variations across the plate.

(i) Chemical processing methods.

(j) Contamination of stellar images by companions.

(k) Wrongly identified stars.

Let us consider each of these in turn with particular reference to the twin refractor for the observations and an Askania iris diaphragm photometer for the plate reductions.

(a) Non-linearity

As the photographic plate emulsion has a non-linear light response a separate calibration is essential. Fig. 1.41 shows a typical V calibration curve (photoelectric (pe) magnitude versus Askania reading) for the five sequences in LMC III. This particular plate was a 90 minute exposure taken in conditions of average seeing. An indication of the accuracy of the photographic (pg) magnitudes can be obtained by plotting the residuals from a smoothed curve (hand drawn) against pe magnitude.

These residual plots are shown in Fig. 1.42 where $V_{pg}-V_{pe}$, $B_{pg}-B_{pe}$ against V_{pe} and B_{pe} respectively have been derived from fifteen (B,V) plate pairs in the areas LMC II, III and SMC I. As expected the scatter tends to increase towards fainter magnitudes. For stars brighter than $\sim 15^m$ the probable error is $\sim \pm 0^m.05$ and $\sim \pm 0^m.15$ for stars fainter than this.

These errors are approximate as the inherent problems associated with photometry in the Clouds (plate background, etc - which will be dealt with later) do not warrant a strictly accurate statistical analysis. Although tests have been carried out in regions of sky where crowding and plate bacground are less, the number of photoelectric stars available in these areas has unfortunately been much

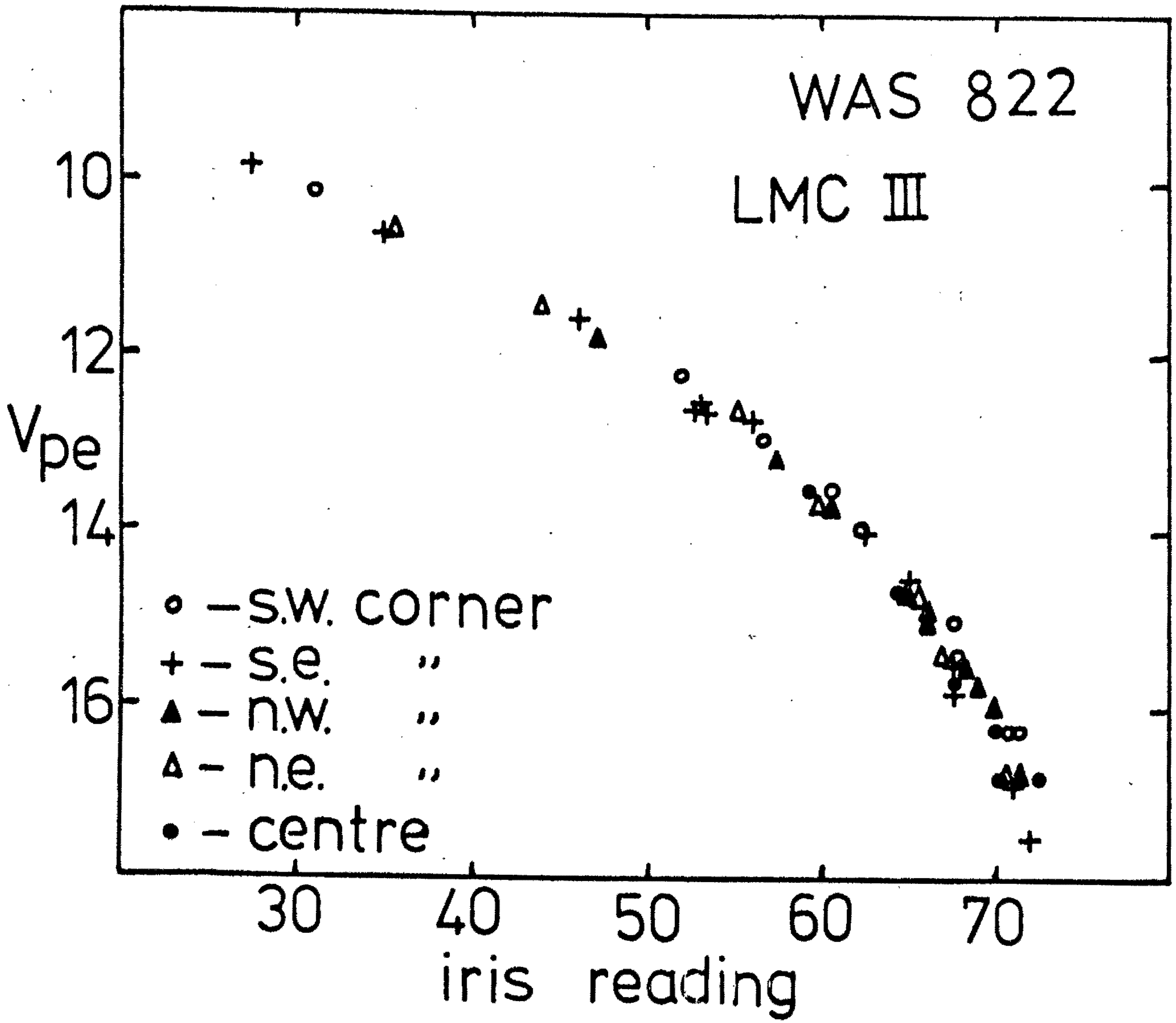
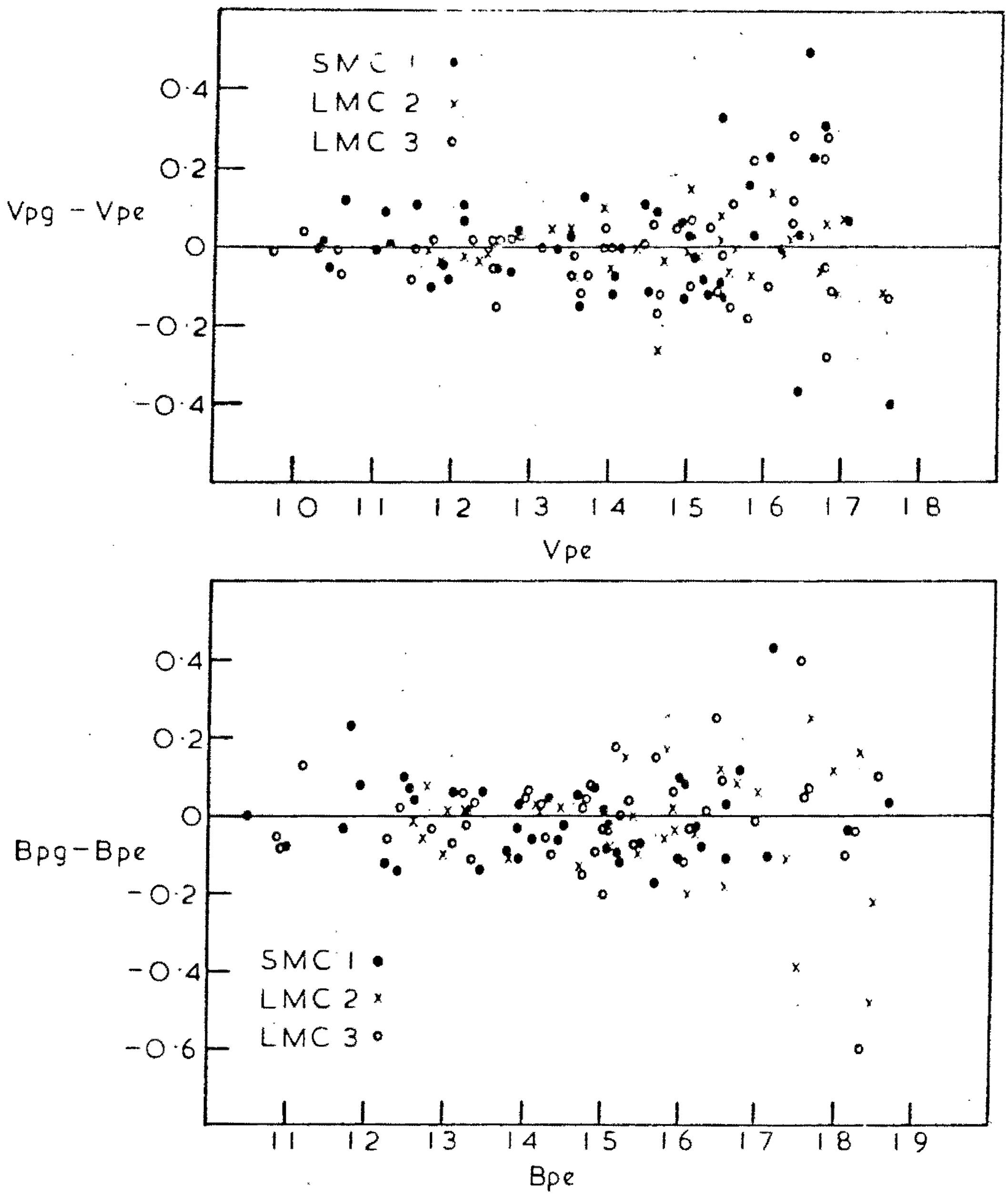

WAS 822
LMC III
V_{pe}
10
12
14
16
30
40
50
60
70
iris reading
○ – s.w. corner
+ – s.e. ,,
▲ – n.w. ,,
△ – n.e. ,,
● – centre

Fig 1.41

Fig 1.42



SMC 1
LMC 2
LMC 3
0·4
0·2
0
-0·2
-0·4
Vpg - Vpe
10
11
12
13
14
15
16
17
18
Vpe
0·4
0·2
0
-0·2
-0·4
-0·6
Bpg-Bpe
SMC 1
LMC 2
LMC 3
11
12
13
14
15
16
17
18
19
Bpe

smaller with the consequence that the resulting residual differences have been much the same as for the Cloud studies.

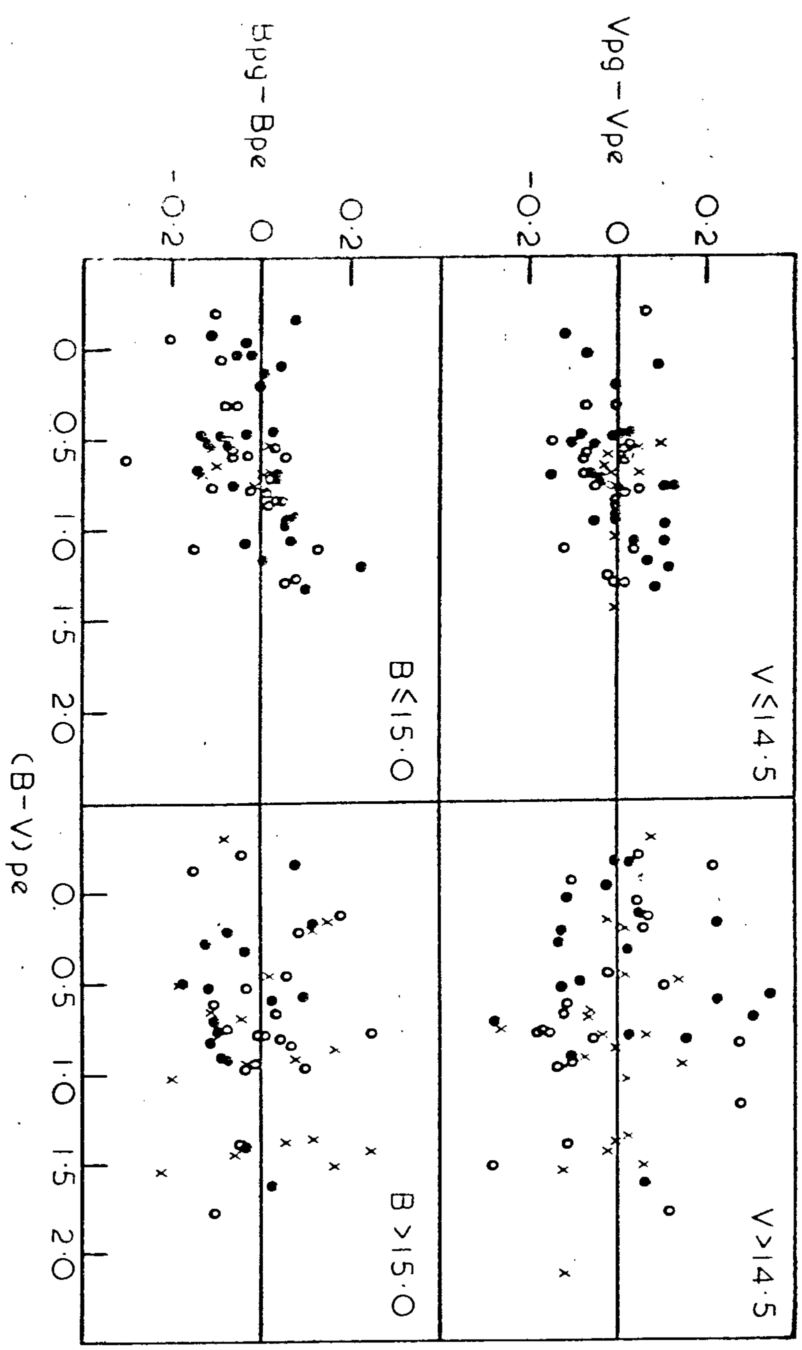
It is felt that probably the only 'proof of the pudding' test is an intercomparison of the final photographic light curves obtained here and those derived from previous photoelectric work. Even then the photoelectric magnitudes cannot be assumed to be perfect (as crowding and sky background problems are just as relevant) and indeed the amplitudes and brightnesses of the cepheids may have changed during the period between comparisons. Partly to overcome this, spot checks were made photoelectrically for a few cepheids at the same time as the plates were being taken. In addition Martin & Warren (1979) have obtained photoelectric (B,V) light curves of cepheids in the LMC at much the same epoch as the plate-taking. These checks and comparisons together with those from other sources are discussed more fully in Chapter 2.

(b) The colour dependence

The dependence of pg magnitude upon (B-V) colour can be investigated by plotting residuals (derived in the same fashion as above) against colour. At the same time the colour effects within certain specified magnitude ranges can be studied. Fig. 1.43 shows the residual plots against $(B-V)_{pe}$ for the sample of stars derived (at V = $14\overset{m}{.}5$ and B = $15\overset{m}{.}0$) into two nearly equal groups. The decision to include only two groups was made purely to retain a sufficient number of points in each group.

There appears to be no detectable colour equation in V in either magnitude group over the whole colour range considered. For B < $15\overset{m}{.}0$ there is no clear colour correlation for (B-V) < $0\overset{m}{.}8$, but for (B-V) > $0\overset{m}{.}8$ there may be a weak dependence in the sense that photographic B magnitudes are measured too faint by up to $0\overset{m}{.}15$ at (B-V)

Fig 1.43



$\sim 1\overset{m}{.}4$. For B > $15\overset{m}{.}0$ the scatter of points makes any conclusion uncertain.

No colour equation in B or V were applied to the cepheid data and it will be shown in Chapter 2 that the redder (brighter) cepheid observations are in good agreement with photoelectric work.

(c) Transfer and field errors

If a pe sequence were situated at the centre of a photographic plate it is possible that errors might be introduced into the pg magnitudes of stars situated at significant distances away from the central calibration, because:-

(i) the plate was not quite squared-on to the telescope axis.

(ii) the telescope optics were misaligned or the incoming beam was being vignetted.

In Fig. 1.41 the different symbols represent pe sequences situated at the centre and the four corners of the plate. If transfer errors were present then one or more of the sequences would lie consistently away from a line representing the mean calibration curve, providing effects due to local sky background had first been eliminated. For the areas SMC I, LMC II and LMC III some forty (B,V) calibration curves (corrected for sky background) have been inspected and no consistent departures from the mean curve by any of the sequences have been found. On a few of the curves some points from a particular sequence did lie off the mean curve (by $\sim 0\overset{m}{.}1$) but this is more likely to be due to variations in sky background which have not been completely eliminated or to variations in plate emulsion sensitivity.

As a further check on transfer error problems, short (1-2 minute) exposure B and V plate pairs were obtained of an established pe sequence area(E5, Cousins (1973)) which was free from local sky background variations. The exposures were taken with the telescope both east and west of the pier and such that the sequence appeared five times (centre and four corners) on each plate. All plates were then processed at the same time. Points (from three plate pairs) on the resulting mean calibration curves from the respective corners referred to the central sequence again showed no deviation in either (B or V) colour.

Positional errors can also arise from coma, and field curvature, etc symmetrically about the plate centre. Whilst the above tests do to some extent confirm the absence of such errors a more stringent test may be made in the following manner. Plates of an established pe sequence are secured such that it lies on different corners of each plate. Then the magnitudes of a selection of stars in common on each plate are derived (calibrated according to their own sequence) and the differences in magnitude are plotted against distance from the sequence.

This procedure was followed for a low sky background E region area (E8, Cousins (1973)) for eight (B,V) plate pairs, half of which were centred on the sequence and half such that the sequence lay in each plate corner. For all but one of the (corner-centre) plate sets the differences in magnitude were within $0^{m}.2$ and showed no correlation with distance. One set however showed differences of up to $0^{m}.6$ which appeared to increase linearly with distance. It was subsequently discovered that those particular plates were obtained from another source and were much thinner than usual. The reason for these large differences is not clear but it is suggested that because the plates were thinner the emulsion was able to distort the plates. The results from all these plates (about one dozen) have, for this reason, been discarded.

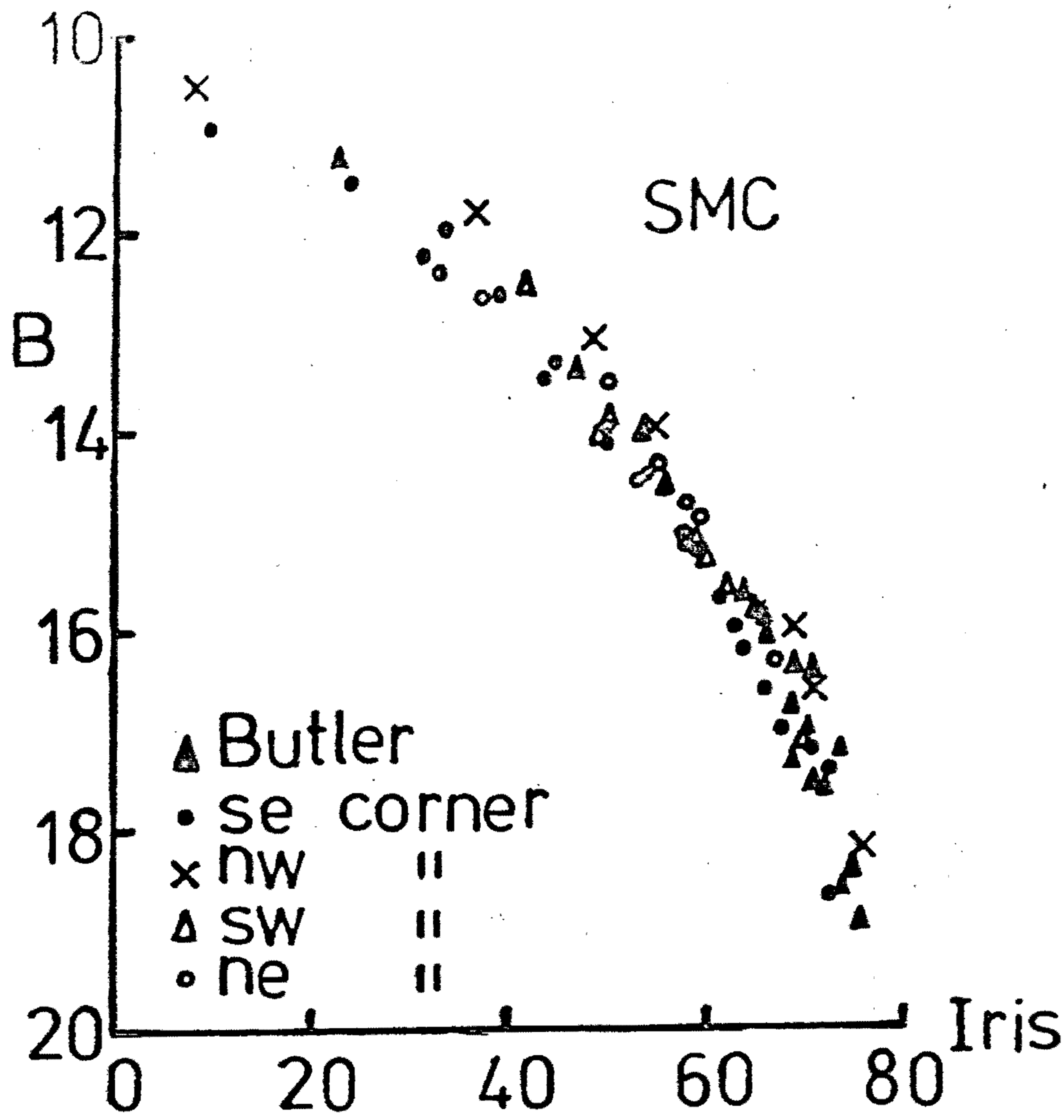
(d) Plate background

Every photographic plate suffers from some background fogging either intrinsic or from other sources (moonlight, faint stars, etc.). Some allowance for this must be made, particularly in more crowded areas of sky. This may be done by using either the fixed or variable iris diaphragm modes of the Askania measuring machine. In § 1.2 it was shown that the variable iris method was more relevant for studies in the Clouds.

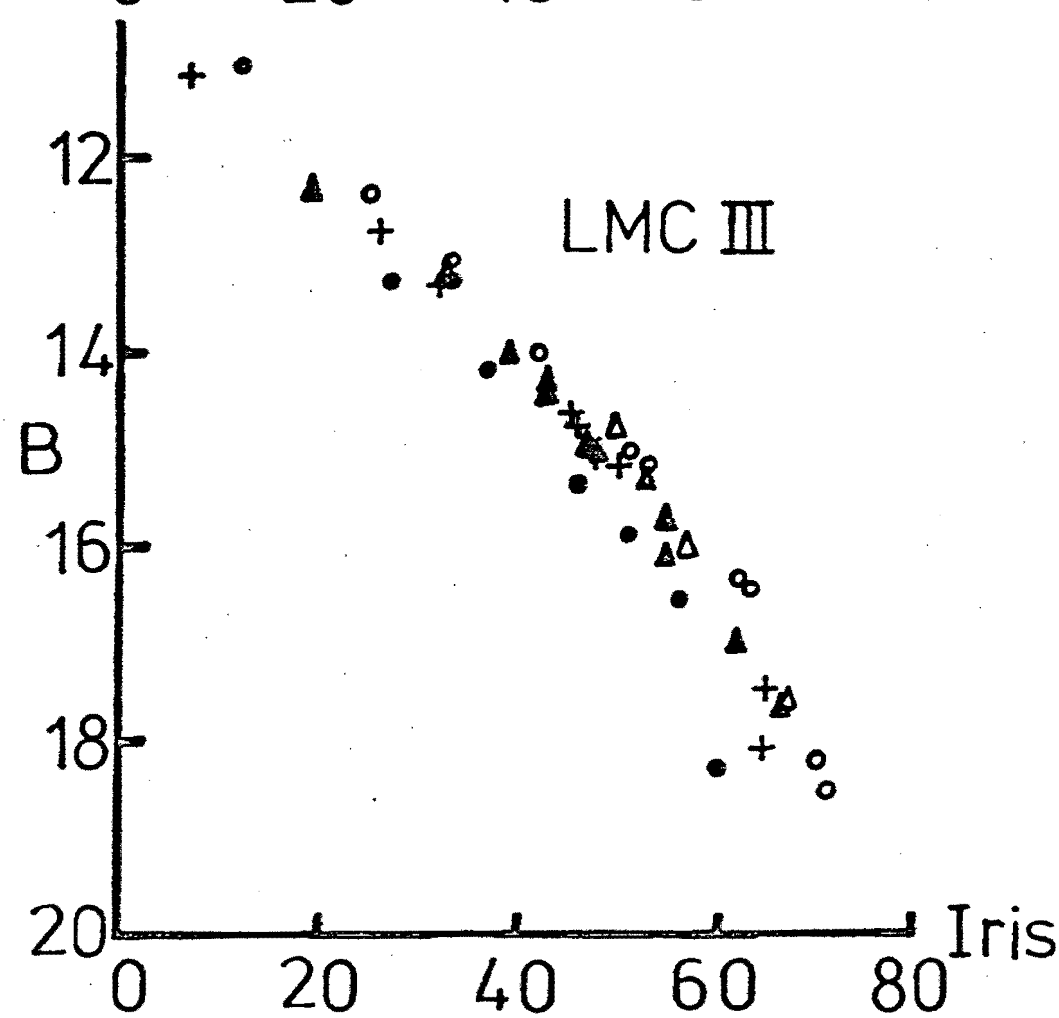
Plate sky readings were first obtained in the areas of the pe sequences and averaged for each sequence. Referring to one sequence the star readings for the remaining sequences were corrected according to their mean sky values and a 'sky corrected' calibration curve for that plate could then be plotted. The sky corrected values for each cepheid could then be found in the same way. This method assumes a linear relationship between iris reading and sky background magnitude which the calibration curve shows it clearly is not. However as the differences between sky readings are generally quite small ($\sim$ 0.2) over the plate, linearity is quite a good assumption especially at the faint end of the calibration curve.

Some proof of the success of this method can be seen from Fig. 1.44 where typical (B) plate calibration curves have in (a) had no sky corrections whatever and in (b) had the corrections applied. It should be emphasized that the method works only for small differences in sky background and it was for this reason and for reasons of crowding that studies of cepheids in the bars of the Clouds were not, in general, attempted. However, in order to obtain data for some of the longer period cepheids which did lie near such regions of higher obscuration, shorter exposure plates were taken with the result that the sky background was reduced to tolerable levels.

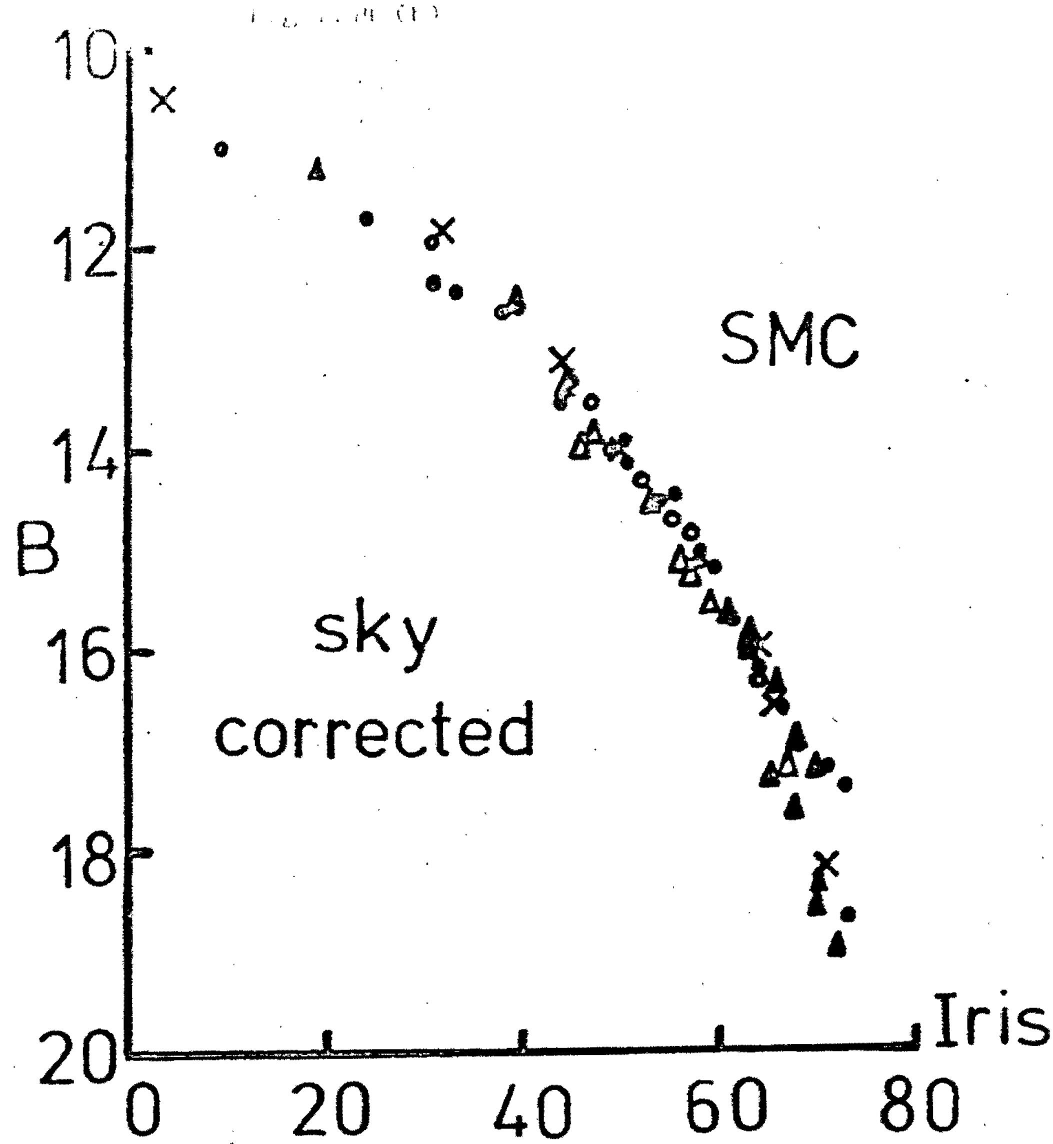
Fig 1.44 (a)

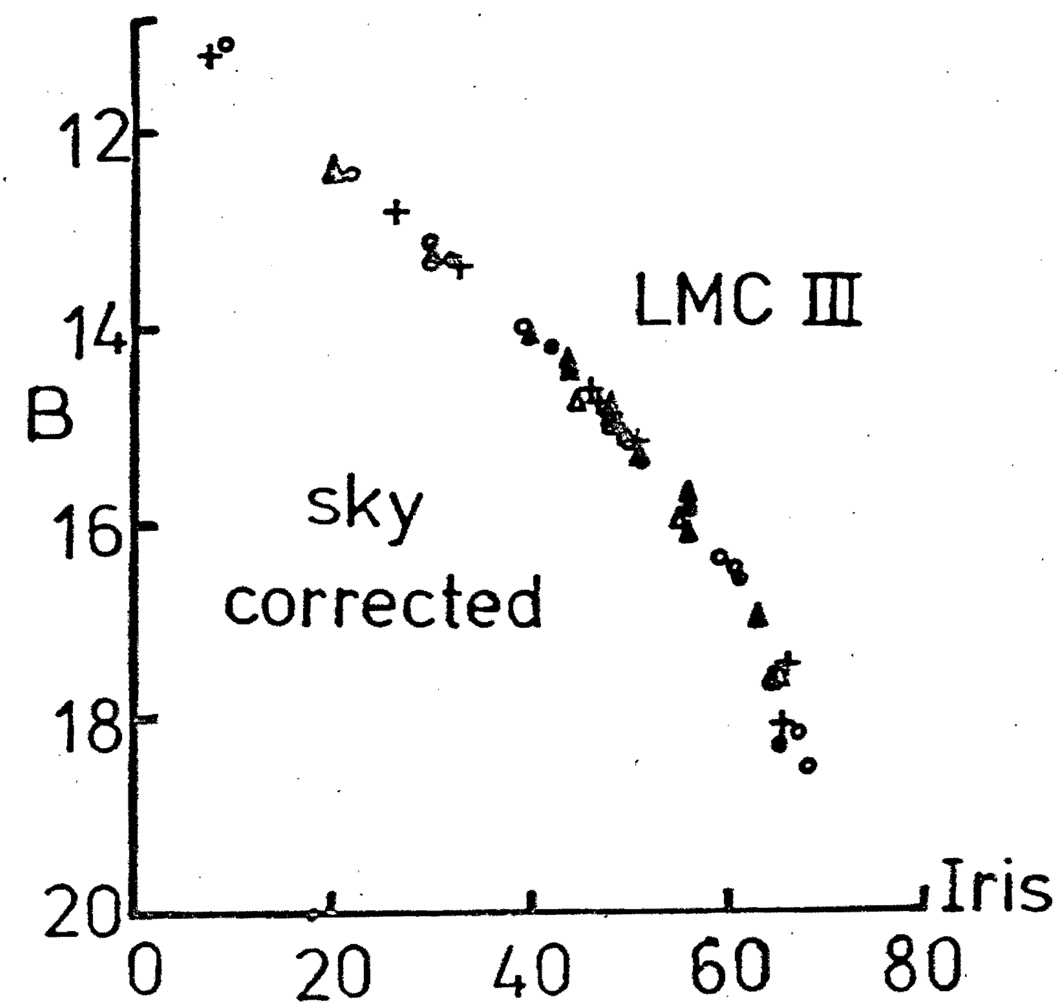


SMC
B
Iris
Butler
se corner
nw "
sw "
ne "
10
12
14
16
18
20
0
20
40
60
80



LMC III
B
Iris
12
14
16
18
20
0
20
40
60
80


10
12
14
16
18
20
B
SMC
sky
corrected
Iris
0
20
40
60
80


12
14
16
18
20
B
LMC III
sky
corrected
Iris
0
20
40
60
80

The policy of taking long and short exposure plates was followed for all Cloud regions.

(e) Iris-photometer drift

The Askania iris photometer at SAAO like most photometers takes time to 'warm up' and is subject to some drift in the readings which may be due to temperature or voltage fluctuations. There is no certain cure for these fluctuations as they tend to be random for the most part. As one SMC I plate took some three hours to measure a check on drift was made by measuring the same few stars every half hour or so. If those varied by more than $0\overset{m}{.}1$ during successive measurements then the entire plate was remeasured at a later date. However this happened only very rarely and in general readings reproduced to $\sim 0\overset{m}{.}03$ during measurement.

(f) Photoelectric sequence errors

These have been adequately discussed in § 1.3. It is clear from Table 1.32 of § 1.3 that the magnitudes of the faint stars could be improved upon. Until observing time becomes available to check these magnitudes we have used in addition to the present sequences the faint pe stars of Butler (1972), where available, and these appear to fit quite well on the present calibration curves. A typical calibration curve is shown in Fig. 1.44 for SMC I where the sequences OJ and OH of Butler have been included.

(g) The B,V system

It is unusual to find a plate-filter combination in photographic work that exactly matches the Johnson UBV system. The photoelectric calibration ties the photographic magnitudes to the UBV system used in the pe observations and this has been well established. Consequently any serious mis-match between $(B,V)_{pg}$ and (B,V) Johnson should appear in the colour equation or zero point. A colour equation has been shown to be absent save for a possible weak dependence in B as the colour becomes very red. It was shown in Table 1.11 that no filter was used with the IIaO emulsion to reproduce B as it was assumed that the Cooke triplet of lenses effectively removed any ultra-violet contribution. To test this a GG13 (ultra-violet excluding) filter was used in combination with three B plate exposures. Intercomparison of pe sequence stars read off calibration curves with and without this filter showed no discernible difference in magnitude. It would seem then that within the detectable limits of photographic photometry there appears to be no serious deviation from the Johnson UBV system.

(h) Emulsion variations

There is little that can be done about possible variations of emulsion sensitivity across the plate. If such variations did exist they were not specifically detected. Reliance was placed in the theory that provided a sufficient number of plates are taken then the effects of these variations will be minimised.

(i) Chemical processing

Much has been written about the 'best' way to process photographic plates. Suggestions, for example, for development include:- plate rocking, bubble burst, plate brushing and the spraying of developer at the plate. Research into this subject has not been undertaken here but nitrogen bubble burst has been favoured. It is probably important that some agitation process be adopted in order to reduce 'adjacency' and Eberhard effects. The developer used was Kodak D19 and development time was 5 ± 1 minutes at 20∓ 1°C. After a water rinse the plates were immersed in Amfix fixer for twice the time that they took to 'clear'. After another water rinse they were agitated in Thiolim fixer-remover for two minutes and then left to wash for $\sim$15 minutes. Finally, the plates were 'scrubbed' with wet cotton wool to remove any residual plate 'backing' and rinsed in wetting agent for uniform drying.

The effects on photometry of different processing methods are not known but the errors are likely to be less than factors already considered. Again if a sufficient number of plates are employed these errors will be minimized.

(j) Companions

Apart from the possibility that some 15 - 25% of cepheids have physical companions (see, e.g. Madore, 1977; Lloyd Evans, 1968) too close to be detected on photographic plates, there is the usual problem, particularly in the Clouds, of line-of-sight companions. This problem is aggravated as the plate scale decreases. The plate scales for the B and V plates are 88 and 100 arcsec/mm respectively so that, clearly, care must be taken in the initial cepheid selection.

Consequently, each cepheid was examined carefully on long exposure B and V plates ($\sim$2 hour exposures) and only those that could be measured without obvious contamination by nearby companions, chosen. In addition some plates (of the SMC and LMC I) were taken with the one-metre reflector telescope at SAAO in combination with a reflector-corrector lens situated at prime focus. These plates have a scale of $\sim$60 arcsec/mm and inspection of them aided the selection process. (The inner regions of these few plates (see Table 2.21) were measured in the same way as described above and included in the cepheid program. The outer regions could not be used as the one-metre mirror suffers some astigmatism.)

However careful the selection is made there will still exist cepheids which have (line-of-sight) companions that have been overlooked. It is hoped that by including a sufficient number of cepheids in both Clouds that these effects will be correspondingly reduced.

(k) Wrongly identified stars

Errors in identification of cepheids which appeared in the Hodge & Wright (1967) and Payne -Gaposchkin (1966) charts were usually obvious as the final light 'curves' appeared as straight lines. There were also errors in identification on our part where the star was (a) occasionally or (b) consistently measured in error. In (b) a straight line of points usually resulted and in (a) the wrongly measured points would tend to stand off from the mean light curve. Unless those points occurred at important phase gaps in the curve for a particular cepheid they were ignored. Otherwise the plate was remeasured. About 5% of the original cepheids selected were lost by the identification errors mentioned above.

1.5 Summary

The technique of reducing photographic star image readings to some meaningful magnitude is clearly an arduous one and calls for both patience and care. Systematic effects are particularly to be guarded against. It would appear at this stage however that this system yields magnitudes accurate to about $\pm 0\overset{m}{.}1$ (on average) provided that the stellar image is free from contamination and sky background effects have been taken into consideration. In addition the resulting magnitudes seem to be free from any serious systematic effects, but more objective checks and intercomparisons are required and will be provided in the following chapter.

CHAPTER 2

OBSERVATIONAL DATA

2.1 Selection of Variables

As the shorter period Cloud cepheids tend to be more plentiful, the areas were chosen so as to include as many of those of longer period as possible. Table 2.11 lists the plate centres for these areas and Fig. 2.11 shows the extent of each area in the LMC superimposed on a map of the Hodge & Wright (1967) atlas. For the SMC virtually all cepheids were available for study. (See Plate I).

Table 2.11

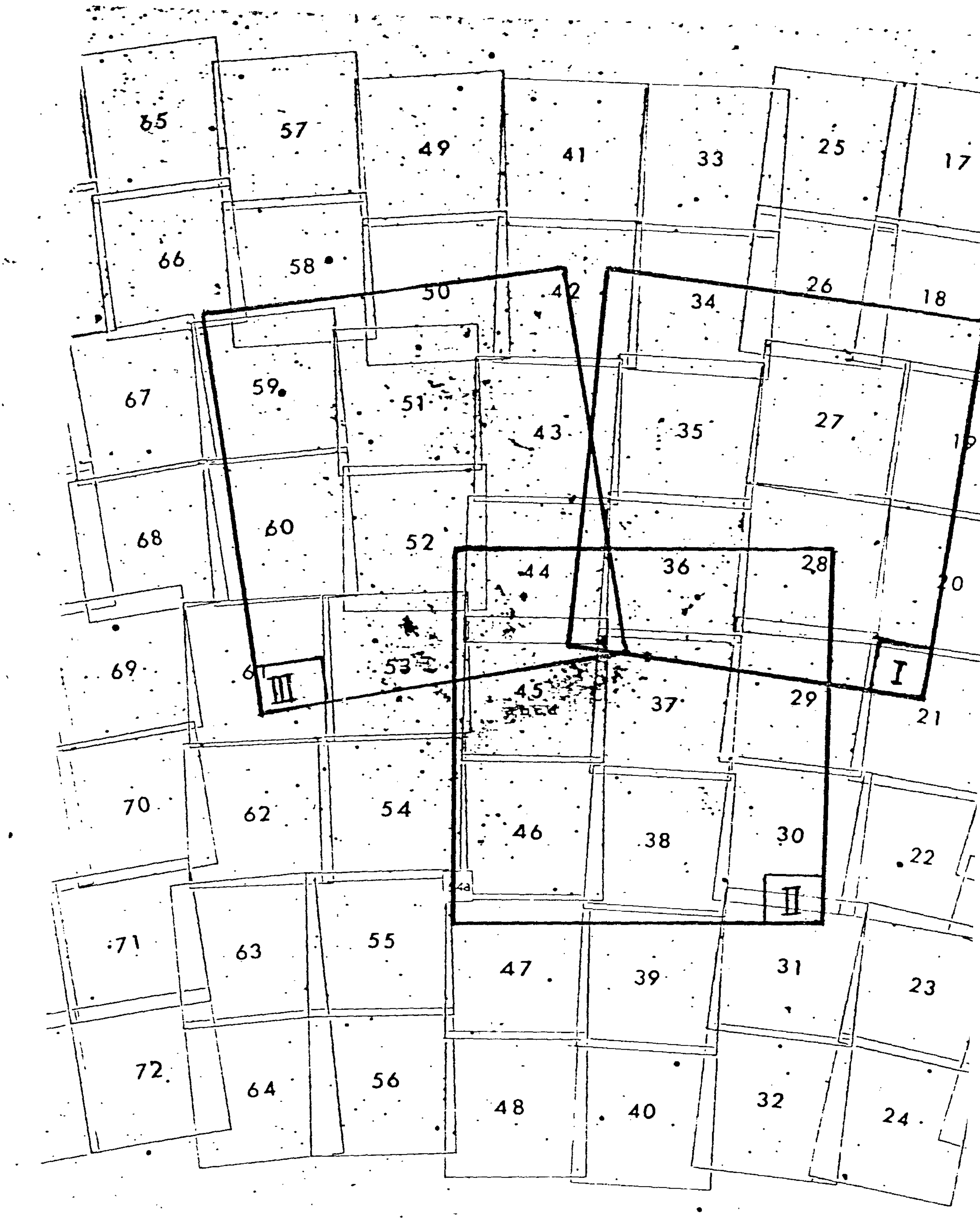
The Cloud Area Positions

Area	RA (1975)	Dec. (1975)
LMC I	05 01.6	-67 38
LMC II	05 14.6	-70 02
LMC III	05 37.5	-67 51
SMC	00 53.0	-72 40

The cepheids for each area were initially selected from the lists of Payne-Gaposchkin & Gaposchkin (1966) for the SMC and Gaposchkin (1970) for the LMC. Whilst many of the longer period cepheids were included it was considered sufficient to choose only a sample of those of short period. The variables were, in general, selected away from regions of high obscuration. Apart from the general rule that cepheids were rejected if they showed obvious contamination (close companions etc) on long exposure plates, no other restriction (such as, e.g. amplitude size) was placed upon them. One area (LMC I) is at present being 'blinked' (by SAAO staff members) for new variables, but it was not considered necessary to initiate a special blink programme for this work.

Fig 2.11

Extent of each LMC area (I, II, III) photographed (in B)



2.2 Photographic Data

The photographic (B,V) plate pairs were taken by Messrs B.S. Carter, H.E. Davies, A. Harrison, T.W. Russo and myself during the period January 1974 - February 1977. In Table 2.21 the Julian Date of mid-point of exposure, plate number, exposure time, observer and some remarks on observing conditions (high plate background (HPB), poor seeing (PS), stopped by cloud (SBC)) are given for each plate pair measured. This represents ~75% of the plates taken, the remainder being rejected for various reasons (trailed, fogged, broken etc). The plates were measured by Miss Y.Z.R. Thomas (SMC, LMC I, LMC III) and myself (LMC II) and reduced in the manner described in Chapter 1.

The individual B and V magnitudes and phases($\emptyset$) for each cepheid in each area (in order of increasing period) are given in Appendix A. Magnitudes in brackets indicate uncertain values as the plate limit was approached. Once the distribution of points with (light-curve) phase had been examined, additional plates were secured in an attempt to cover gaps in phase, but it was not necessary to measure all the cepheids on these plates.

2.3 Photoelectric Data

Photoelectric (B,V) observations of mainly ten day cepheids in both Clouds have also been made by Dr P.J. Warren and myself (Martin & Warren 1979) at epochs coinciding with, or not much later than, the photographic observations. The individual cepheid magnitudes in order of period, are tabulated in Appendix C. Most of these cepheids were chosen to coincide with those obtained photographically so that a useful comparison with this work can be made, (see Section 2.5). The telescope used, method of observation, reduction, etc was the same

TABLE 2.21

Photographic Plate Data

LMC I

JD 244	WAS (V)	WAB (B)	Exp Time Mins	Obs	Remarks	JD 244	WAS (V)	WAB (B)	Exp time Mins	Obs	Remarks
2071.337	147	5	90	AH	HPB(V)	2393.417	560	373	90	WLM	
2073.377	152	10	90	AH		2394.481	564	377	90	WLM	
2073.560	154	12	90	AH		2395.498	568	381	90	WLM	
2076.447	158	16	105	AH		2396.485	572	385	90	WLM	
2077.318	159	17	90	R		2397.392	575	388	90	WLM	
2078.517	163	21	91	R		2400.432	578	391	90	HED	
2097.305	167	26	90	AH		2401.435	582	395	90	HED	
2098.444	173	32	90	WLM		2402.448	586	399	90	HED	
2102.300	177	36	90	AH		2403.448	590	403	90	HED	
2103.295	180	39	90	WLM		2404.395	593	406	80	HED	
2104.300	185	44	90	AH	PS	2427.360	597	410	120	WLM	
2126.342	188	48	85	AH		2428.353	600	413	120	WLM	
2128.346	192	50	90	AH		2429.351	603	416	120	WLM	
2129.349	198	56	90	AH		2431.318	606	419	105	WLM	HPB(B)
2134.289	214	70	90	WLM		2432.465	610	421	90	WLM	
2135.272	221	77	90	WLM	HPB(B,V)	2433.421	613	424	120	WLM	
2138.248	229	86	25	WLM		2511.240	640	449	25	WLM	
2304.542	516	336	100	WLM		2517.327	658	469	30	WLM	
2305.538	519	339	100	WLM		2543.212	633	474	30	HED	
2306.575	522	342	115	WLM		2544.216	672	483	30	HED	
2307.514	526	346	50	WLM	SBC	2714.495	830	656	40	HED	
2309.533	530	350	110	HED		2715.437	836	662	40	HED	PS
2310.581	533	353	143	HED	HPB(V)	2717.460	842	668	30	HED	
2311.584	539	359	120	HED		2719.424	848	674	30	HED	
2392.428	556	369	90	WLM		2720.401	854	680	30	HED	

LMC II

JD 244	WAS (V)	WAB (B)	Exp time mins	Obs	Remarks	JD 244	WAS (V)	WAB (B)	Exp time mins	Obs	Remarks
2633.608	787	588	85	HED		2840.306	942	775	90	HED	
2715.492	837	663	95	HED		2842.309	948	781	100	HED	
2719.542	850	676	90	HED		2872.273	959	792	90	BSC	
2720.449	855	681	90	HED		3017.616	1092	925	100	BSC	
2744.412	860	686	90	WLM		3018.611	1100	934	20	BSC	
2745.408	866	692	90	WLM		3044.538	1136	969	90	BSC	
2748.401	873	699	90	WLM		3049.537	1161	995	90	BSC	
2749.470	878	704	90	BSC		3071.573	1169	1003	30	BSC	PS
2751.437	885	711	105	BSC		3099.462	1177	1011	14	BSC	SBC
2752.455	891	717	90	BSC		3102.406	1187	1021	20	BSC	
2754.411	896	723	90	BSC		3103.408	1194	1028	20	BSC	
2755.456	902	729	90	BSC		3104.404	1200	1034	20	BSC	
2777.399	905	734	90	HED		3128.417	1208	1042	80	HED	
2779.396	910	740	90	HED		3128.455	1209	1042A	20	HED	
2781.487	914	745	90	HED		3168.380	1258	1091	20	HED	
2782.415	917	748	105	HED		3169.380	1264	1096	20	HED	
2783.418	920	751	92	HED		3192.278	1273	1106	20	WLM	
2809.333	926	758	90	HED		3192.322	1274	1107	90	WLM	
2810.319	930	762	90	HED		3195.330	1280	1113	90	WLM	
2811.326	935	768	110	HED	PS	3196.278	1283	1116	20	WLM	
2836.308	938	771	90	HED		3196.322	1284	1117	90	WLM	

LMC III

JD 244	WAS (V)	WAB (B)	Exp time mins	Obs	Remarks	JD 244	WAS (V)	WAB (B)	Exp time mins	Obs	Remarks
2634.622	798	599	90	HED		2809.401	927	759	90	HED	
2659.624	822	624	90	BSC		2809.447	928	760	30	HED	
2661.612	827	641	90	BSC		2810.393	931	763	100	HED	
2715.560	838	664	70	HED	SBC	2810.443	932	764	30	HED	
2720.528	856	682	90	HED		2836.379	939	772	90	HED	
2720.574	857	683	30	HED		2836.426	940	773	30	HED	
2744.497	861	687	90	WLM		2842.429	950	783	35	HED	
2744.544	862	688	30	WLM		3016.638	1086	919	20	BSC	
2745.510	868	694	90	WLM		3019.604	1111	944	90	BSC	
2745.557	869	695	30	WLM		3021.612	1128	961	90	BSC	
2749.538	879	705	90	BSC		3045.523	1146	979	20	BSC	
2750.505	882	708	120	BSC	PS	3045.565	1147	980	90	BSC	
2754.502	898	725	90	BSC		3075.536	1175	1009	110	HED	PS
2754.547	899	726	30	BSC		3104.510	1202	1036	90	BSC	
2755.522	903	730	90	BSC		3128.496	1210	1043	90	HED	
2777.472	906	735	105	HED		3129.503	1216	1049	100	HED	
2779.497	912	742	105	HED		3132.500	1220	1054	98	HED	
2779.552	913	743	40	HED		3133.493	1226	1060	90	HED	
2781.555	915	746	90	HED		3190.406	1269	1102	90	WLM	
2782.465	918	749	25	HED		3192.392	1275	1108	90	WLM	
2783.487	921	752	90	HED		3195.402	1281	1114	90	WLM	
2808.480	923	754	90	HED		3196.394	1285	1118	90	WLM	

SMC

JD 244	WAS (V)	WAB (B)	Exp time mins	Obs	Remarks	JD 244	WAS (V)	WAB (B)	Exp time mins	Obs	Remarks
2397.319	574	387	90	WLM	HPB(V)	2750.351	880	706	105	BSC	
2403.383	589	402	80	HED		2753.292	893	720	20	BSC	PS
2603.635	720	522	90	WLM		2754.362	895	722	30	BSC	
2604.654	729	531	90	WLM		2779.326	909	739	90	HED	
2605.617	736	538	60	WLM	SBC	2782.331	916	747	120	HED	
2607.644	753	555	90	WLM		2783.334	919	750	120	HED	
2631.594	768	569	90	HED		2952.667	1009	843	30	WLM	
2633.535	786	587	90	HED		2956.647	1031	866	20	WLM	
2634.548	797	598	90	HED		2957.640	1039	874	20	WLM	
2635.585	808	609	100	HED		2980.650	1048	883	20	HED	
2635.634	809	610	30	HED		2981.653	1056	891	20	HED	
2636.552	813	614	90	HED		2982.656	1064	899	20	HED	
2636.605	814	615	30	HED		3015.618	1074	909	20	BSC	
2659.478	820	622	90	BSC		3016.619	1085	918B	20	BSC	
2659.556	45	46	30	WLM	*	3017.557	1091	924	25	BSC	
2661.470	825	639	90	BSC		3018.567	1099	933	20	BSC	
2662.476	828	648	90	BSC		3019.556	1110	943	20	BSC	
2694.464	59	60	30	WLM	*	3021.487	1125	958	20	BSC	
2715.313	834	660	37	HED		3045.443	1143	976	90	BSC	
2715.373	835	661	120	HED	PS	3045.485	1144	977	20	BSC	
2717.406	841	667	90	HED		3071.478	1167	1001	20	HED	
2719.353	846	672	90	HED		3075.365	1173	1007	25	HED	
2719.397	847	673	30	HED		3100.280	1178	1012	20	BSC	
2720.353	853	679	90	HED		3102.274	1184	1018	20	BSC	
2744.288	858	684	30	WLM		3102.315	1185	1019	90	BSC	
2744.335	859	685	90	WLM		3103.274	1191	1025	20	BSC	
2745.289	864	690	30	WLM		3127.362	1204	1038	20	HED	
2747.292	870	696	30	WLM		3128.340	1207	1041	90	HED	
2747.350	871	697	120	WLM		3132.337	1218	1051	25	HED	
2749.321	876	702	105	BSC		3133.326	1223	1057	90	HED	

* Taken with the 1-metre and reflector corrector.

as that described in Chapter 1, for the photoelectric standards.

2.4 B,V Light Curves and Parameters

The B and V magnitudes were plotted against phase (Ø) which is defined as the fractional part of the expression:-

$$\emptyset = \frac{(JD)_i - (JD)_o}{P}$$

where $(JD)_o$ is the Julian Date of the first plate pair in each region, $(JD)_i$ the Julian Date of subsequent plate-dates and P the period in days. The periods were taken initially from the lists of the Gaposchkins and only redetermined if the scatter in the light-curve points suggested that it was necessary. In these (few) cases new periods were found using a computer program (written by Dr L.A. Balona) and a 1210 NOVA Computer at SAAO. They are listed in Table 2.41 together with the Gaposchkin periods. It should be emphasized that the data fitted these new periods only marginally better than before and that not too much significance should be attached to the period changes.

From the final B,V light curves (fitting a smoothed, hand drawn curve through the points) the following parameters were derived:-

(i) Amplitude of light variation A_V, A_B in V and B respectively.

(ii) Asymmetry AS_B. This is defined as the phase at minimum (blue) light minus that at maximum and is always taken as a positive value. A sinusoidal light curve therefore has a lower value of AS_B than one that is asymmetric. The B curve defines the symmetry rather better than the V curve as the B amplitudes are usually larger.

(iii) <B> and <V>. The mean magnitudes were derived as follows:-

TABLE 2.41

Cepheids with recomputed periods

LMC

HV	Period (Martin) (days)	Period (Gaposchkin) (days)
2332	8.909	8.899
2260*	12.987	12.587 } 12.987 }
2580†	16.945	16.929
1023†	26.588	26.539
883	134	133.583

SMC

HV	Period (Martin) (days)	Period (Gaposchkin) (days)
1695	14.59	14.51
1967	28.936	29.052
1636	32.6	32.746
2064	33.6	33.663
837	42.6	42.680
834	77	73.589
1956	218	209.995

* 2 periods given by Gaposchkin, one in his Table and one in his light curves.

† Photelectric determinations.

TABLE 2.42

Light Curve Parameters (pg)

LMC I

HV	log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
W 41	0.218	0.70	16.15	0.60	16.49	15.90	0.40	16.09	0.40	
12512	0.368	0.78	15.60	1.55	16.41	15.50	1.00	16.03	0.38	
12520	0.380	0.76	16.20	1.15	16.80	15.75	0.85	16.19	0.61	
W 38	0.380	0.70	15.70	0.70	16.11	15.45	0.40	15.67	0.44	
W 44	0.408	0.77	16.15	1.15	16.79	15.87	0.73	16.30	0.49	0.46
(W 24)	0.429	0.74	15.73	1.39	16.54	15.35	0.98	15.85	0.69	
(12528)	0.432	0.78	16.15	1.05	16.73	15.80	0.80	16.34	0.39	0.44
5536	0.433	0.69	16.10	1.00	16.69	15.70	0.75	16.14	0.55	0.42
12527	0.444	0.80	15.85	1.15	16.60	15.62	0.78	16.01	0.59	0.48
5684	0.445	0.53	15.90	0.69	16.12	15.40	0.47	15.60	0.52	
5567	0.446	0.76	15.55	1.35	16.33	15.45	0.75	15.88	0.45	0.59
5514	0.461	0.74	15.65	1.45	16.40	15.40	1.00	15.93	0.47	0.65
12491	0.470	0.74	16.05	1.18	16.77	15.60	0.95	16.12	0.65	0.51
5533	0.477	0.72	16.00	0.85	16.47	15.55	0.65	15.91	0.56	0.38
W 33	0.478	0.69	16.20	1.00	16.74	15.90	0.60	16.23	0.51	0.44
12504	0.488	0.74	16.00	1.10	16.57	15.50	0.90	15.96	0.61	0.48
W 48	0.493	0.76	15.95	1.10	16.58	15.45	0.85	15.94	0.64	0.48
W 32	0.495	0.71	16.00	1.10	16.48	15.70	0.65	16.02	0.46	0.49
5522	0.497	0.76	15.53	1.07	16.14	15.05	1.00	15.60	0.54	0.47
W 47	0.504	0.77	15.70	1.30	16.43	15.40	0.80	15.84	0.59	0.59
2368	0.508	0.71	15.85	1.05	16.44	15.65	0.55	15.94	0.50	0.47
2361	0.512	0.82	16.15	1.20	16.82	15.65	0.70	16.06	0.76	0.54
W 25	0.529	0.66	16.15	0.82	16.62	15.60	0.60	15.92	0.70	0.38
12518	0.532	0.82	15.95	1.12	16.57	15.52	0.85	15.96	0.61	0.51
5530	0.534	0.78	15.55	1.40	16.32	15.35	0.85	15.79	0.53	0.66
2287	0.578	0.78	15.15	1.20	15.84	14.90	0.95	15.41	0.43	0.58
2317	0.582	0.78	15.68	0.97	16.16	15.27	0.63	15.63	0.53	0.47
W 42	0.584	0.83	15.52	1.23	16.18	15.25	0.70	15.66	0.52	0.59
12325	0.596	0.69	16.10	1.10	16.68	15.63	0.47	15.88	0.80	0.53
12530	0.622	0.73	15.90	1.00	16.39	15.30	0.80	15.74	0.65	0.50
12532	0.640	0.75	15.50	1.20	16.17	15.10	0.75	15.49	0.68	0.60
2334	0.671	0.79	15.75	1.10	16.28	15.30	0.70	15.67	0.61	0.57
2325	0.691	0.73	15.75	1.00	16.29	15.25	0.65	15.67	0.62	0.52
2263	0.703	0.74	14.92	0.88	15.40	14.65	0.75	15.06	0.34	
5595	0.715	0.78	15.50	1.10	16.11	15.15	0.65	15.46	0.65	0.58
(2358)	0.825	0.80	15.20	1.05	15.66	14.75	0.85	15.15	0.51	0.62
2335	0.899	0.76	14.57	1.23	15.21	14.20	0.87	14.66	0.55	0.79
2332	0.950	0.62	14.77	1.03	15.25	14.35	0.75	14.71	0.54	0.68
5543	0.956	0.67	15.00	0.82	15.36	14.35	0.55	14.60	0.76	0.82
(2297)	0.957	0.76	14.85	1.48	15.45	14.50	0.75	14.86	0.59	1.04
2432	1.039	0.78	14.45	0.68	14.76	13.90	0.70	14.22	0.54	0.46
880	1.067	0.68	13.97	1.20	14.69	13.65	0.75	14.06	0.63	0.70
2299	1.081	0.60	14.08	1.29	14.78	13.72	0.88	14.18	0.60	0.76
12519	1.086	0.63	14.70	1.00	15.19	14.20	0.63	14.46	0.73	0.58
2260	1.115	0.63	15.05	1.35	15.69	14.35	0.95	14.81	0.88	0.76
2324	1.160	0.64	14.40	1.45	15.03	13.85	0.85	14.27	0.76	0.76
5598	1.169	0.75	16.20	1.15	16.74	15.90	0.75	16.22	0.52	
2356	1.180	0.66	13.90	1.45	14.63	13.32	0.93	13.79	0.84	0.76
2249	1.182	0.68	13.65	1.72	14.54	13.25	1.15	13.85	0.69	0.96

HV	Log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_v	<V>	<B>-<V>	f_B
2273	1.226	0.68	14.58	1.42	15.25	14.00	0.85	14.43	0.82	0.73
5594	1.236	0.71	14.40	1.50	15.15	13.75	1.10	14.33	0.82	0.78
12499	1.268	0.82	14.34	0.72	14.66	13.70	0.55	13.94	0.72	0.33
(12446)	1.347	0.81	13.40	1.38	14.12	13.00	0.92	13.49	0.63	
886	1.380	0.78	13.05	1.80	14.02	12.70	1.20	13.35	0.67	0.75
2251	1.447	0.82	13.00	1.67	13.90	12.65	1.15	13.22	0.68	0.60
2294	1.563	0.84	12.63	1.67	13.50	12.00	1.37	12.67	0.83	0.64
877	1.655	0.68	13.87	1.08	14.43	12.97	0.66	13.31	1.12	0.41
2369	1.684	0.79	12.75	1.55	13.53	12.00	1.25	12.55	0.98	0.65
(5497)	1.996	0.70	12.50	1.15	13.06	11.45	0.75	11.91	1.15	0.62
(883)	2.127	0.72	12.57	1.41	13.33	11.60	1.25	12.25	1.08	0.96

LMC II

HV	Log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
12575	0.296	0.68	15.95	0.95	16.37	15.75	0.65	16.06	0.31	
(5615)	0.395	0.81	15.90	1.70	16.81	15.82	1.33	16.53	0.28	
12426	0.407	0.72	15.75	1.30	16.46	15.60	1.00	16.14	0.32	0.53
2473	0.411	0.63	16.17	1.67	16.98	15.77	1.18	16.42	0.56	0.75
12500	0.420	0.74	15.95	1.90	16.90	15.70	1.32	16.40	0.50	0.95
(12964)	0.430	0.73	16.00	1.70	16.80	15.45	1.15	16.03	0.77	
(12572)	0.444	0.74	15.95	1.13	16.55	15.50	0.85	15.89	0.66	0.47
(2557)	0.448	0.72	16.05	1.38	16.81	15.90	1.05	16.44	0.37	0.60
12547	0.448	0.70	16.45	1.15	17.01	15.95	0.80	16.32	0.69	0.77
12585	0.454	0.76	15.95	1.65	16.70	15.70	1.05	16.21	0.49	0.77
(2395)	0.465	0.69	15.97	1.28	16.59	15.40	0.90	15.89	0.70	0.55
(12551)	0.474	0.74	16.05	1.45	16.68	15.85	0.95	16.38	0.30	
2353	0.492	0.52	15.70	0.60	15.97	15.09	0.51	15.33	0.64	
12594	0.527	0.75	16.10	1.48	16.83	15.80	1.00	16.27	0.56	0.70
(12423)	0.528	0.63	15.90	1.50	16.68	15.90	0.97	16.38	0.30	
12765	0.535	0.48	15.45	0.68	15.80	15.25	0.50	15.50	0.30	
(12574)	0.537	0.50	16.00	0.76	16.38	15.77	0.73	16.16	0.22	
(926)	0.541	0.67	15.75	1.21	16.41	15.10	0.79	15.48	0.93	
12508	0.552	0.69	15.96	1.09	16.55	15.59	0.81	15.99	0.56	0.51
2290	0.568	0.78	15.27	1.83	16.20	15.25	1.09	15.78	0.42	1.01
12424	0.620	0.78	15.90	1.20	16.54	15.43	0.97	15.98	0.56	0.60
12432	0.630	0.82	15.94	0.96	16.41	15.45	0.56	15.80	0.61	0.48
(2366)	0.631	0.63	15.78	1.09	16.29	15.15	0.70	15.52	0.77	0.54
(2421)	0.632	0.73	15.65	1.25	16.25	15.15	0.75	15.49	0.76	0.63
(12422)	0.633	0.79	15.69	1.43	16.44	15.53	0.87	15.98	0.46	0.74
2384	0.634	0.73	15.95	1.35	16.58	15.45	0.88	15.91	0.67	0.69
2431	0.642	0.60	15.55	0.65	15.91	14.80	0.57	15.11	0.80	
12561	0.648	0.72	16.10	1.05	16.57	15.40	0.80	15.83	0.74	0.53
(2486)	0.666	0.76	15.90	1.12	16.48	15.60	0.90	16.00	0.48	0.58
(12430)	0.670	0.72	15.15	1.65	15.99	15.20	1.05	15.69	0.30	
(5840)	0.671	0.72	16.00	1.15	16.50	15.50	0.93	15.97	0.53	0.60
5526	0.671	0.80	15.85	1.35	16.47	15.39	0.86	15.81	0.66	0.72
2387	0.691	0.73	15.70	0.97	16.18	15.20	0.73	15.55	0.63	0.51
2283	0.698	0.63	15.05	0.65	15.41	14.55	0.40	14.74	0.67	
12568	0.705	0.74	15.35	1.50	16.05	14.95	1.00	15.39	0.66	0.84
12555	0.705	0.78	15.50	1.15	16.07	15.05	0.85	15.44	0.63	0.61
2381	0.708	0.75	15.45	1.40	16.08	14.95	0.95	15.38	0.70	0.98
931	0.714	0.78	15.40	1.50	16.09	15.05	1.10	15.58	0.51	0.86
(12427)	0.719	0.76	15.37	1.18	15.93	15.05	0.88	15.50	0.43	0.64
8040	0.719	0.78	15.05	1.70	15.96	14.95	0.95	15.43	0.53	1.03
(12421)	0.730	0.73	15.50	1.38	16.16	15.15	0.95	15.66	0.50	0.77
(2523)	0.831	0.64	15.34	0.51	15.60	14.55	0.50	14.83	0.77	0.38
2405	0.840	0.62	15.50	0.85	15.95	14.75	0.70	15.09	0.86	0.52
12531	0.842	0.55	15.65	0.95	16.10	15.00	0.83	15.37	0.73	0.58
(12428)	0.849	0.75	15.15	1.35	15.77	15.00	0.80	15.35	0.42	
919	0.849	0.68	14.85	1.27	15.49	14.42	0.84	14.81	0.68	0.78
2386	0.867	0.65	15.45	1.25	15.98	14.80	0.95	15.18	0.80	0.78
12433	0.874	0.66	15.25	0.95	15.71	14.80	0.75	15.16	0.55	0.59
(12823)	0.919	0.66	14.34	1.21	14.88	14.10	0.85	14.52	0.36	
(2267)	0.923	0.72	14.85	1.35	15.42	14.45	1.00	14.92	0.50	0.89
(2301)	0.978	0.65	14.45	0.70	14.80	13.70	0.51	13.98	0.82	0.52
2248	0.979	0.64	14.30	1.30	14.95	13.93	0.87	14.33	0.62	0.90
2296	0.987	0.63	14.98	0.82	15.34	14.19	0.77	14.51	0.83	0.58
5551	1.021	0.48	15.45	0.75	15.76	14.70	0.50	14.93	0.83	0.51
(2285)	1.101	0.50	14.74	1.06	15.17	13.80	0.68	14.12	1.05	
874	1.103	0.69	14.45	1.40	15.13	14.00	0.95	14.44	0.69	0.82

HV	Log P	AS_B	B_{max}	A_B	$\langle B\rangle$	V_{max}	A_v	$\langle V\rangle$	$\langle B\rangle-\langle V\rangle$	f_B
(2527)	1.112	0.63	14.76	1.42	15.43	14.25	0.98	14.74	0.69	0.82
2270	1.134	0.57	14.99	1.36	15.67	14.25	0.92	14.69	0.98	0.76
2352	1.134	0.58	14.44	0.92	14.92	13.75	0.66	14.11	0.81	0.50
5655	1.153	0.65	14.75	1.35	15.38	14.10	0.95	14.51	0.87	0.71
887	1.161	0.63	14.42	1.33	15.07	13.60	1.03	14.15	0.92	0.69
2282	1.166	0.68	14.50	1.25	15.13	13.85	0.90	14.29	0.84	0.64
2262	1.200	0.75	14.30	1.45	14.93	13.65	1.00	14.14	0.79	0.72
2549	1.209	0.63	13.75	1.35	14.38	13.30	1.00	13.79	0.59	0.66
2261	1.237	0.68	13.66	1.63	14.50	13.05	1.10	13.62	0.88	0.80
878	1.367	0.84	13.37	1.89	14.35	12.95	1.35	13.62	0.73	0.84
902	1.421	0.76	12.97	1.94	14.07	12.65	1.15	13.25	0.82	0.80
5829	1.499	0.79	15.20	1.50	15.85	14.76	1.16	15.23	0.62	
2281	1.500	0.75	15.35	1.40	16.08	15.00	0.90	15.42	0.66	
(882)	1.503	0.81	13.05	2.12	14.14	12.75	1.25	13.33	0.81	0.90
(873)	1.536	0.79	12.75	1.85	13.76	12.45	1.30	13.09	0.67	
881	1.553	0.83	13.10	1.76	13.97	12.55	1.15	13.09	0.88	0.68
909	1.575	0.78	12.79	1.56	13.50	12.15	0.95	12.59	0.91	0.59
2257	1.594	0.81	13.22	1.63	14.04	12.55	1.05	13.08	0.96	0.64
2338	1.625	0.80	12.90	1.80	13.73	12.27	1.28	12.88	0.85	0.76
900	1.677	0.77	13.10	1.60	13.84	12.30	1.00	12.81	1.03	0.67
2622	1.718	0.74	13.25	1.31	13.85	12.30	0.90	12.75	1.10	0.54

HV	Log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_v	<V>	<B>-<V>	f_B
2661	0.206	0.74	16.25	1.35	16.93	16.10	0.75	16.49	0.44	
12906	0.242	0.70	17.25	0.85	17.66	16.72	0.69	17.00	0.66	
2837	0.250	0.56	16.05	0.80	16.40	15.58	0.68	15.86	0.54	
12676	0.364	0.60	15.62	0.78	16.01	15.25	0.55	15.52	0.49	
12688	0.368	0.75	16.10	1.35	16.79	15.70	1.12	16.22	0.57	
2809	0.399	0.72	15.90	1.47	16.61	15.45	1.01	16.01	0.60	
12999	0.466	0.72	15.85	1.30	16.51	15.35	1.05	15.94	0.57	0.57
12682	0.469	0.76	16.05	1.10	16.62	15.50	0.95	16.05	0.57	0.47
(2813)	0.493	0.80	15.45	1.70	16.28	15.00	1.20	15.62	0.66	0.83
2863	0.501	0.81	15.80	1.45	16.58	15.49	0.87	15.91	0.67	0.67
(2682)	0.505	0.70	16.40	1.25	16.99	15.80	0.70	16.12	0.87	
6067	0.530	0.86	15.75	1.45	16.47	15.50	0.70	15.94	0.53	0.68
2803	0.531	0.78	15.75	1.40	16.49	15.25	1.00	15.81	0.68	0.65
5776	0.536	0.76	16.24	1.11	16.80	15.75	0.80	16.17	0.63	0.51
2807	0.538	0.70	15.55	1.25	16.20	15.05	0.91	15.58	0.62	0.58
980	0.554	0.78	15.40	1.35	16.13	15.00	1.10	15.58	0.55	0.64
6064	0.562	0.76	15.30	1.78	16.19	14.95	1.15	15.59	0.60	0.96
2867	0.594	0.75	15.25	1.31	15.94	14.95	1.08	15.44	0.50	0.65
2802	0.619	0.78	15.40	1.20	16.04	14.95	1.00	15.43	0.61	0.59
2832	0.620	0.67	15.30	1.20	15.94	14.85	1.05	15.36	0.58	0.59
6015	0.627	0.68	15.20	0.69	15.60	14.65	0.62	15.00	0.60	
12791	0.631	0.78	15.30	1.50	16.08	15.15	0.88	15.61	0.47	0.79
6085	0.632	0.76	15.40	1.30	16.01	15.00	0.86	15.45	0.56	0.66
12681	0.639	0.82	15.60	1.25	16.17	15.10	1.00	15.65	0.52	0.64
12660	0.640	0.78	15.60	1.25	16.19	15.15	1.00	15.59	0.60	0.64
6051	0.643	0.73	15.76	0.81	16.14	15.05	0.75	15.44	0.70	0.42
2821	0.648	0.70	16.05	1.05	16.51	15.40	0.65	15.72	0.79	0.53
(6059)	0.655	0.80	15.50	1.10	16.01	15.15	0.95	15.57	0.44	0.56
6025	0.670	0.76	15.45	1.15	16.10	15.00	0.85	15.46	0.64	0.60
2826	0.673	0.66	15.65	1.20	16.32	15.20	0.97	15.65	0.67	0.62
(2794)	0.727	0.73	15.85	1.15	16.47	15.05	0.80	15.52	0.95	
2871	0.729	0.74	15.10	1.20	15.74	14.75	0.81	15.13	0.61	0.65
2869	0.741	0.74	15.45	1.21	15.98	14.85	0.91	15.29	0.69	0.67
2855	0.754	0.77	15.30	1.26	15.93	14.75	0.87	15.24	0.69	0.71
12067	0.767	0.76	15.60	1.05	16.10	15.02	0.83	15.49	0.61	0.59
935	0.849	0.74	15.05	1.22	15.65	14.65	0.89	14.97	0.68	0.74
1000	0.859	0.72	15.30	1.02	15.80	14.65	0.65	15.00	0.80	0.62
5730	0.897	0.70	15.25	0.80	15.61	14.65	0.62	14.96	0.65	0.52
6104	0.902	0.70	14.85	1.30	15.40	14.35	0.85	14.72	0.68	0.83
12581	0.904	0.70	15.35	1.25	15.85	14.70	0.75	15.09	0.76	0.79
2738	0.920	0.58	14.90	1.30	15.42	14.25	0.87	14.70	0.72	0.85
2854	0.936	0.67	14.90	1.00	15.35	14.35	0.85	14.78	0.57	0.65
2733	0.941	0.50	15.03	0.67	15.34	14.35	0.51	14.63	0.71	0.48
2461	0.941	0.62	14.70	1.20	15.26	14.20	0.90	14.58	0.68	0.79
12589	0.951	0.60	15.10	0.90	15.53	14.55	0.60	14.82	0.71	0.60
971	0.968	0.63	14.65	1.15	15.13	14.00	0.95	14.45	0.68	0.77
2510	0.973	0.58	15.00	1.25	15.57	14.54	0.79	14.91	0.66	0.85
969	0.988	0.57	15.10	0.85	15.50	14.35	0.60	14.65	0.85	0.58
2816	1.017	0.53	14.85	1.12	15.36	14.15	0.95	14.56	0.80	0.72
6105	1.019	0.57	14.95	1.15	15.48	14.40	0.90	14.82	0.66	0.74
2864	1.041	0.56	14.85	1.15	15.39	14.15	0.90	14.61	0.78	0.71
2662	1.082	0.56	14.80	0.85	15.20	14.15	0.55	14.37	0.83	0.50
(997)	1.119	0.64	14.85	1.40	15.48	14.01	0.96	14.48	1.00	
2579	1.128	0.59	14.20	1.30	14.78	13.60	0.86	14.04	0.74	0.71

HV	Log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
955	1.138	0.59	14.15	1.40	14.84	13.43	1.17	13.99	0.85	0.76
2538	1.142	0.52	15.00	0.80	15.34	14.12	0.68	14.44	0.90	0.44
2647	1.152	0.62	15.55	1.12	16.08	14.55	0.76	14.94	1.14	
2667	1.210	0.72	13.50	1.85	14.46	13.30	1.13	13.83	0.63	1.04
2580	1.229	0.67	14.01	1.34	14.68	13.39	1.01	13.89	0.79	0.62
2836	1.244	0.68	15.20	1.30	15.83	14.24	0.91	14.69	1.14	
1005	1.272	0.73	14.15	1.55	14.89	13.50	1.05	14.00	0.89	0.70
(2793)	1.283	0.67	14.40	1.55	15.09	13.50	1.00	14.01	1.08	
2454	1.316	0.70	14.60	1.30	15.20	13.70	0.95	14.18	1.02	0.52
(2749)	1.364	0.65	15.25	1.40	15.98	14.12	0.93	14.66	1.32	
938	1.372	0.72	13.65	1.70	14.45	13.02	1.08	13.53	0.92	0.70
1013	1.383	0.70	14.05	1.80	14.94	13.30	1.18	13.91	1.03	0.75
1003	1.387	0.75	13.15	1.80	14.05	12.65	1.30	13.26	0.79	0.73
1023	1.424	0.71	14.00	1.45	14.80	13.25	1.01	13.82	0.98	0.51
929	1.445	0.76	14.09	1.36	14.76	13.40	0.80	13.83	0.93	0.45
(934)	1.450	0.74	14.51	1.34	15.13	13.45	1.00	14.00	1.13	
1002	1.484	0.82	12.55	2.20	13.69	12.22	1.53	12.98	0.71	0.95
12625	1.571	0.56	15.85	1.00	16.20	15.39	0.96	15.73	0.47	
6070	1.575	0.70	15.40	0.70	15.74	15.00	0.65	15.40	0.34	
953	1.681	0.82	12.39	1.61	13.15	11.77	1.04	12.24	0.91	0.68
(2827)	1.902	0.80	13.20	1.05	13.68	11.95	0.75	12.32	1.36	
(2447)	2.074	0.72	12.85	1.13	13.36	11.66	0.72	12.07	1.29	0.66

TABLE 2.42

SMC

HV	Log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
(1968)	0.164	0.80	16.45	1.45	17.20	16.05	1.40	16.71	0.49	
1755	0.178	0.76	16.50	1.00	17.00	16.65	0.50	16.91	0.09	
(1436)	0.219	0.72	16.80	1.30	17.36	16.40	1.15	16.96	0.40	
1344	0.238	0.70	16.20	2.00	17.12	16.25	1.25	16.92	0.20	
2093	0.262	0.64	16.15	0.85	16.57	15.75	1.25	16.37	0.20	
2057	0.281	0.64	16.20	1.50	16.82	16.16	0.84	16.62	0.20	
(1590)	0.298	0.76	16.60	1.16	17.17	16.00	1.00	16.58	0.59	
11234	0.305	0.68	16.80	1.10	17.32	16.67	0.88	17.12	0.20	
2186	0.315	0.54	16.10	1.20	16.64	15.80	1.15	16.33	0.31	
2014	0.343	0.80	15.89	1.69	16.78	15.85	1.40	16.62	0.16	
1727	0.346	0.78	16.00	1.40	16.83	15.75	1.15	16.44	0.39	
2061	0.351	0.67	15.75	0.83	16.20	15.49	0.78	15.93	0.27	
(2156)	0.362	0.75	16.12	1.68	17.07	16.27	1.13	16.90	0.17	
2056	0.363	0.75	15.95	1.40	16.74	15.80	1.43	16.58	0.16	
1332	0.383	0.84	16.00	1.52	16.87	16.10	1.30	16.65	0.22	
(1571)	0.415	0.77	16.52	1.40	17.24	16.01	1.04	16.61	0.63	
2042	0.418	0.80	15.95	1.62	16.83	15.75	1.40	16.53	0.30	0.72
1600	0.429	0.63	15.65	0.77	16.00	15.45	0.50	15.69	0.31	
2082	0.433	0.80	15.75	1.40	16.51	15.85	1.16	16.42	0.09	0.60
2104	0.433	0.75	15.85	1.95	16.81	15.76	1.34	16.56	0.25	0.99
1360	0.439	0.56	16.30	0.95	16.83	15.80	1.15	16.43	0.40	0.40
2045	0.454	0.76	16.00	1.25	16.67	15.80	0.75	16.33	0.34	0.52
2015	0.459	0.74	16.35	1.00	16.90	16.10	0.80	16.49	0.41	0.42
(1974)	0.461	0.80	15.90	1.88	16.71	15.65	1.39	16.54	0.17	0.95
2118	0.475	0.78	16.15	1.40	16.72	15.89	0.97	16.38	0.34	0.62
2192	0.478	0.79	16.04	1.16	16.60	15.75	1.11	16.33	0.27	0.50
1898	0.480	0.60	15.89	0.69	16.31	15.68	0.72	16.07	0.24	
(2173)	0.482	0.81	15.55	1.57	16.31	15.50	1.18	16.18	0.13	
2168	0.484	0.77	16.02	1.23	16.75	15.45	1.35	16.28	0.47	0.37
1662	0.484	0.59	16.44	0.82	16.88	16.01	0.92	16.51	0.37	0.53
(11233)	0.488	0.75	16.35	1.45	17.04	16.30	0.96	16.80	0.24	0.66
852	0.505	0.84	15.65	1.55	16.45	15.67	0.95	16.19	0.26	0.72
2037	0.527	0.58	15.45	0.65	15.79	15.09	0.57	15.39	0.40	
11206	0.531	0.60	16.17	0.79	16.57	15.82	0.61	16.17	0.40	0.37
1788	0.541	0.56	15.50	0.55	15.83	15.21	0.51	15.51	0.32	
1339	0.543	0.76	16.20	1.16	16.95	15.87	1.02	16.41	0.54	0.52
2055	0.550	0.80	16.00	1.20	16.69	15.84	0.96	16.33	0.36	0.55
(1502)	0.550	0.75	16.00	1.00	16.49	15.50	0.69	15.89	0.60	0.46
1901	0.553	0.77	16.32	0.98	16.83	16.15	0.61	16.46	0.37	0.45
(1331)	0.554	0.82	15.50	1.70	16.42	15.60	1.15	16.27	0.15	
2058	0.565	0.88	15.68	1.47	16.52	15.66	0.94	16.18	0.34	0.72
2028	0.567	0.70	15.85	1.25	16.50	15.60	0.77	16.00	0.50	0.59
2070	0.569	0.68	15.80	1.20	16.40	15.50	0.95	15.92	0.48	0.56
(2188)	0.570	0.77	16.21	1.19	16.84	16.15	0.67	16.56	0.28	0.55
1691	0.591	0.75	15.93	0.97	16.50	15.55	1.00	16.07	0.43	0.47
1718	0.607	0.78	15.70	1.33	16.40	15.08	1.32	15.92	0.48	0.65
1807	0.612	0.76	15.87	1.36	16.59	15.63	1.02	16.13	0.46	0.67
2175	0.624	0.80	15.35	1.40	16.03	15.20	1.00	15.79	0.24	0.70
1944	0.631	0.76	16.30	1.10	16.81	15.95	0.56	16.28	0.53	0.54
2026	0.638	0.80	15.70	1.45	16.46	15.40	1.23	16.02	0.44	0.75
(1619)	0.641	0.69	15.70	1.20	16.27	15.07	0.98	15.64	0.63	0.60

HV	log P	AS_B	B_{max}	A_B	$\langle B\rangle$	V_{max}	A_V	$\langle V\rangle$	$\langle B\rangle - \langle V\rangle$	f_B
1961	0.646	0.74	15.45	1.40	16.07	15.30	0.76	15.69	0.38	0.72
1425	0.658	0.74	15.50	1.25	16.11	15.16	1.09	15.85	0.26	0.64
2129	0.675	0.78	15.78	1.37	16.41	15.26	1.06	15.93	0.48	0.72
1343	0.692	0.78	15.55	1.25	16.25	15.29	0.96	15.82	0.43	0.65
2145	0.694	0.77	15.89	1.24	16.46	15.35	1.45	16.05	0.41	0.65
1555	0.694	0.72	15.18	1.47	15.95	14.85	0.90	15.43	0.52	0.80
(1995)	0.700	0.80	16.25	1.25	16.82	15.70	0.84	16.15	0.67	
1699	0.704	0.74	15.05	1.03	15.62	14.67	0.84	15.24	0.38	0.54
1951	0.706	0.76	15.15	1.48	15.83	15.00	1.08	15.49	0.34	0.82
(1927)	0.706	0.75	15.90	1.30	16.66	15.50	0.75	15.90	0.76	
2211	0.707	0.77	15.85	0.91	16.27	15.49	0.66	15.83	0.44	0.49
1531	0.709	0.80	15.55	1.10	16.18	15.30	0.80	15.73	0.45	0.58
1457	0.709	0.70	16.00	0.90	16.46	15.45	1.04	15.95	0.51	0.48
1752	0.710	0.76	15.80	1.40	16.48	15.46	0.89	15.90	0.58	0.77
11170	0.711	0.72	15.95	0.70	16.32	15.39	0.75	15.82	0.50	0.40
(1701)	0.714	0.76	15.35	1.15	15.98	14.95	1.01	15.41	0.57	0.61
1633	0.716	0.72	15.20	1.15	15.82	14.80	0.90	15.30	0.52	0.61
2031	0.720	0.86	15.09	1.45	15.77	14.85	1.10	15.49	0.28	0.81
1649	0.726	0.80	15.18	1.42	15.76	14.89	0.76	15.28	0.48	0.79
1818	0.737	0.65	16.15	1.07	16.74	15.69	0.85	16.11	0.63	0.58
(1811)	0.738	0.74	15.45	1.17	16.07	14.95	0.85	15.48	0.59	0.64
1878	0.744	0.80	15.30	1.20	15.90	14.95	0.94	15.45	0.45	0.65
2162	0.751	0.65	15.90	1.08	16.37	15.46	0.90	15.91	0.46	0.59
1618	0.752	0.73	14.95	1.61	15.75	14.67	1.18	15.28	0.47	0.96
1892	0.752	0.79	15.75	1.10	16.29	15.27	1.07	15.82	0.47	0.60
(2161)	0.759	0.78	15.54	1.34	16.15	15.15	1.19	15.82	0.33	0.76
1794	0.762	0.77	15.60	1.20	16.22	15.30	0.70	15.68	0.54	0.67
862	0.763	0.82	15.02	1.25	15.73	14.88	1.07	15.37	0.36	0.70
(1503)	0.764	0.86	15.25	1.56	16.01	14.77	1.03	15.36	0.65	0.93
1537	0.767	0.76	15.50	1.00	15.90	15.20	0.81	15.60	0.30	0.56
10375	0.774	0.70	15.85	0.85	16.25	15.49	0.60	15.80	0.45	0.49
2144	0.774	0.75	15.55	1.20	16.02	15.29	0.81	15.68	0.34	0.67
1500	0.774	0.70	15.80	1.00	16.33	15.45	0.70	15.80	0.53	0.56
2203	0.775	0.80	15.56	1.29	16.06	15.17	0.96	15.70	0.36	0.74
2198	0.783	0.81	15.47	1.33	16.10	15.00	1.15	15.61	0.49	0.77
2124	0.783	0.77	15.35	1.07	15.91	15.12	0.73	15.47	0.44	0.60
2040	0.786	0.81	15.25	1.20	15.81	14.85	1.00	15.35	0.46	0.68
1612	0.791	0.76	15.20	1.45	15.90	14.88	0.87	15.33	0.57	0.86
1492	0.799	0.67	14.95	1.15	15.54	14.61	0.89	15.10	0.44	0.66
(1979)	0.799	0.71	15.45	0.75	15.78	14.87	0.48	15.12	0.66	0.46
1676	0.805	0.75	15.55	1.20	16.18	15.30	0.75	15.67	0.51	0.69
(11193)	0.808	0.73	15.88	0.72	16.18	15.25	0.85	15.77	0.41	0.44
(2174)	0.808	0.73	15.30	0.88	15.69	14.73	0.66	15.04	0.65	0.52
1412	0.810	0.70	15.87	0.98	16.42	15.55	0.61	15.84	0.58	0.56
2142	0.812	0.74	15.25	1.45	15.91	15.12	0.90	15.52	0.39	0.88
1862	0.812	0.68	15.40	1.25	16.09	15.01	1.11	15.60	0.49	0.73
1988	0.817	0.75	15.40	1.12	15.89	14.95	0.95	15.40	0.49	0.65
1400	0.823	0.80	15.50	0.99	15.95	14.88	0.92	15.38	0.57	0.58
2163	0.826	0.67	15.42	1.09	16.00	15.15	0.89	15.58	0.42	0.64
1855	0.835	0.68	15.40	1.05	15.91	15.05	0.85	15.45	0.46	0.62
2054	0.855	0.60	15.32	0.98	15.83	14.94	0.64	15.30	0.53	0.60
2119	0.862	0.78	15.55	1.00	16.02	14.90	1.00	15.44	0.58	0.61
(853)	0.865	0.68	14.50	1.35	15.14	14.33	1.00	14.86	0.28	
1548	0.866	0.61	15.47	0.91	15.91	14.93	0.77	15.31	0.60	0.56
1973	0.874	0.72	15.44	0.96	15.86	15.00	0.84	15.37	0.49	0.59
1355	0.874	0.72	14.95	1.20	15.56	14.60	0.85	15.08	0.48	0.74

HV	log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
1758	0.875	0.70	15.14	1.21	15.65	14.77	0.67	15.08	0.57	0.75
(2081)	0.881	0.69	15.15	0.66	15.54	14.44	0.56	14.78	0.76	
1582	0.885	0.69	14.55	1.45	15.23	14.40	0.95	14.83	0.40	0.94
1666	0.890	0.62	15.00	1.26	15.58	14.55	0.95	14.98	0.60	0.79
1709	0.897	0.71	14.95	1.26	15.52	14.60	0.95	15.10	0.42	0.80
1764	0.900	0.58	15.40	0.89	15.84	14.95	0.67	15.28	0.56	0.57
845	0.900	0.70	14.75	1.30	15.35	14.37	0.93	14.86	0.49	0.83
1396	0.906	0.74	14.80	1.45	15.52	14.50	0.80	14.93	0.59	0.96
(1632)	0.910	0.52	15.65	0.58	15.90	14.85	0.65	15.16	0.74	0.43
1783	0.911	0.61	15.12	0.88	15.48	14.63	0.70	14.89	0.59	0.57
(1437)	0.923	0.60	14.90	0.76	15.24	14.21	0.74	14.59	0.65	0.51
(1338)	0.929	0.72	14.80	1.40	15.46	14.72	0.99	15.20	0.26	
1784	0.938	0.57	15.28	1.12	15.77	14.86	0.71	15.18	0.59	0.73
1790	0.948	0.75	15.05	1.15	15.52	14.54	0.85	14.90	0.62	0.76
2103	0.953	0.60	15.30	1.00	15.71	14.90	0.60	15.25	0.46	0.66
2087	0.962	0.76	15.36	0.87	15.76	15.03	0.57	15.26	0.50	0.59
836	0.973	0.68	14.82	1.16	15.30	14.52	0.78	14.83	0.47	0.77
1334	0.975	0.60	14.65	1.35	15.31	14.50	0.87	14.94	0.37	0.93
(1487)	0.980	0.65	14.95	1.25	15.52	14.45	0.85	14.83	0.69	0.85
2060	1.008	0.55	14.40	0.90	14.84	13.90	0.75	14.33	0.51	0.62
818	1.014	0.60	14.75	1.10	15.27	14.47	0.73	14.78	0.49	0.74
1705	1.032	0.53	15.45	0.95	15.83	14.83	0.59	15.08	0.75	0.61
2063	1.048	0.64	14.90	0.99	15.37	14.19	1.03	14.78	0.59	0.62
2201	1.051	0.64	14.40	1.13	14.91	13.87	0.98	14.38	0.53	0.71
(1630)	1.057	0.55	14.80	1.09	15.37	14.20	0.85	14.61	0.76	0.67
2017	1.057	0.63	14.75	1.07	15.26	14.30	0.75	14.70	0.56	0.66
(857)	1.075	0.65	14.30	1.30	14.92	14.15	0.95	14.59	0.33	
1682	1.084	0.56	14.53	1.27	15.14	14.20	0.90	14.62	0.52	0.77
856	1.085	0.66	14.85	1.39	15.48	14.30	1.00	14.89	0.59	0.86
1365	1.094	0.58	15.10	0.90	15.56	14.65	0.68	14.94	0.62	0.54
2052	1.100	0.64	14.15	1.25	14.72	13.80	0.95	14.22	0.50	0.73
1744	1.101	0.60	14.54	1.06	15.11	14.06	0.95	14.48	0.63	0.61
1873	1.112	0.66	14.89	1.19	15.52	14.29	0.86	14.87	0.65	0.67
1351	1.117	0.60	14.60	1.15	15.19	14.10	1.15	14.68	0.51	0.64
2202	1.120	0.56	14.50	1.20	15.04	14.08	0.98	14.53	0.51	0.67
2189	1.129	0.70	14.53	0.93	15.05	14.20	0.65	14.50	0.55	0.52
827	1.129	0.68	14.30	1.35	14.97	13.82	1.06	14.39	0.58	0.77
1345	1.130	0.65	14.50	1.20	15.19	14.15	0.65	14.58	0.61	0.67
1373	1.137	0.52	14.95	1.25	15.56	14.50	0.73	14.90	0.66	0.68
1326	1.138	0.60	14.85	1.20	15.50	14.60	0.68	14.92	0.58	0.65
1933	1.139	0.60	14.30	1.05	14.81	13.70	0.95	14.23	0.58	0.57
1996	1.154	0.70	15.10	1.05	15.68	14.50	0.90	14.99	0.69	0.55
2088	1.164	0.67	14.90	1.05	15.40	14.25	0.95	14.71	0.69	0.55
1695	1.164	0.70	14.83	1.22	15.44	14.14	0.86	14.65	0.79	0.64
843	1.168	0.61	15.32	1.28	15.82	14.38	1.02	14.91	0.91	
(1372)	1.198	0.68	15.20	1.22	15.82	14.60	0.72	14.94	0.88	
854	1.203	0.75	13.85	1.55	14.67	13.65	1.10	14.23	0.44	0.82
1954	1.223	0.57	13.90	1.14	14.46	13.30	0.92	13.86	0.60	0.54
1828	1.235	0.76	16.60	1.12	17.18	16.05	0.90	16.47	0.71	
1342	1.254	0.69	14.25	0.85	14.67	13.92	0.55	14.20	0.47	0.40
1884	1.258	0.60	14.55	1.46	15.24	13.95	0.85	14.40	0.84	0.68
1543	1.311	0.70	14.55	1.22	15.20	14.02	0.78	14.39	0.81	0.51
2209	1.355	0.73	13.60	1.00	14.01	13.20	0.69	13.58	0.43	0.38
1430	1.380	0.72	14.35	1.45	14.98	13.70	0.85	14.13	0.85	0.56
11129	1.389	0.66	14.90	1.25	15.55	14.00	1.05	14.53	1.02	
(2205)	1.405	0.76	13.80	1.70	14.62	13.60	1.00	14.06	0.56	0.68

HV	log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
847	1.432	0.76	14.15	1.20	14.74	13.33	1.02	13.86	0.88	0.41
1967	1.463	0.80	13.50	1.70	14.20	13.00	1.15	13.62	0.58	0.62
(1369)	1.492	0.67	14.55	0.90	14.96	13.75	1.03	14.22	0.74	0.29
823	1.504	0.78	13.75	1.50	14.47	13.29	1.11	13.80	0.67	0.51
1636	1.515	0.80	13.75	1.01	14.30	13.20	0.95	13.62	0.68	0.33
855	1.518	0.79	13.85	1.30	14.51	13.37	0.93	13.77	0.74	0.43
840	1.519	0.76	13.55	1.60	14.37	12.93	1.17	13.56	0.81	0.56
2064	1.526	0.79	13.80	1.50	14.48	13.28	0.97	13.75	0.73	0.52
(11182)	1.593	0.72	14.30	0.90	14.80	13.30	0.90	13.73	1.07	
2195	1.621	0.84	12.85	1.70	13.77	12.51	1.14	13.03	0.74	0.69
837	1.629	0.70	13.50	1.45	14.20	12.90	0.90	13.34	0.86	0.55
824	1.818	0.78	12.45	1.65	13.18	11.95	0.95	12.33	0.85	0.82
11157	1.838	0.66	13.70	0.83	14.11	12.73	0.55	13.06	1.05	0.39
834	1.886	0.84	12.35	1.38	13.04	11.80	0.81	12.22	0.82	0.68
829	1.943	0.75	12.25	1.25	12.81	11.50	0.86	11.92	0.89	0.64
(821)	2.106	0.64	12.50	1.25	13.02	11.60	0.90	11.98	1.04	0.77
(1956)	2.338	0.56	12.85	1.20	13.46	11.80	0.95	12.18	1.28	0.93

TABLE 2.43

Light Curve Parameters (pe)

HV	LMC Period	log P	AS_B	B_{max}	A_B	$\langle B \rangle$	V_{max}	A_v	$\langle V \rangle$	$\langle B \rangle - \langle V \rangle$	f_B
2353	3.108	0.492	0.60	15.47	0.87	15.90	15.05	0.67	15.37	0.53	
12765	3.429	0.535	0.44	15.58	0.68	15.86	15.04	0.52	15.29	0.57	
12700	8.153	0.911	0.69	15.26	0.87	15.58	14.62	0.54	14.85	0.73	0.63
12823	8.302	0.919	0.78	14.60	1.13	15.12	14.20	0.81	14.57	0.55	0.81
2854	8.635	0.936	0.69	14.97	0.88	15.36	14.38	0.60	14.64	0.72	0.65
2733	8.722	0.941	0.64	15.08	0.62	15.31	14.50	0.48	14.69	0.62	
12816	9.114	0.960	0.58	14.56	1.04	15.08	14.15	0.74	14.51	0.57	0.76
971	9.297	0.968	0.69	14.65	1.05	15.11	14.15	0.68	14.43	0.68	0.76
2301	9.499	0.978	0.63	14.40	0.84	14.78	13.70	0.50	13.94	0.84	
6105	10.440	1.019	0.54	15.24	1.00	15.73	14.55	0.71	14.91	0.82	0.67
2864	10.984	1.041	0.60	14.83	1.22	15.49	14.23	0.79	14.70	0.79	0.80
2260	12.987	1.114	0.58	15.07	1.36	15.75	14.45	0.90	14.86	0.89	0.82
2527	12.948	1.112	0.71	14.60	1.51	15.39	14.05	1.02	14.59	0.80	0.94
997	13.147	1.119	0.69	14.68	1.47	15.37	14.12	0.88	14.52	0.85	0.90
2579	13.431	1.128	0.58	13.90	1.45	14.61	13.40	1.05	13.95	0.66	0.87
2352	13.626	1.134	0.56	14.35	1.12	14.92	13.80	0.72	14.17	0.75	0.64
955	13.732	1.138	0.63	14.15	1.31	14.80	13.64	0.86	14.07	0.73	0.75
2324	14.466	1.160	0.65	14.45	1.45	15.20	13.83	0.95	14.35	0.85	0.83
2549	16.197	1.209	0.60	13.60	1.65	14.42	13.16	1.04	13.70	0.72	0.93
2580	16.945	1.229	0.68	14.03	1.29	14.71	13.48	0.92	13.96	0.75	0.65
2836	17.526	1.244	0.66	14.93	1.59	15.63	14.15	1.00	14.62	1.01	0.83
1005	18.710	1.272	0.75	13.97	1.66	14.78	13.42	1.11	13.96	0.82	0.86
2793	19.184	1.283	0.69	14.30	1.60	15.10	13.60	0.96	14.09	1.01	0.79
12815	26.169	1.418	0.78	13.50	1.80	14.41	12.92	1.13	13.46	0.95	0.79
1023	26.588	1.425	0.76	14.05	1.39	14.78	13.28	0.87	13.74	1.04	0.53

New cepheid data from Martin (1980)

935	7.067	0.849	0.77	15.35	0.85	15.73	14.70	0.68	15.02	0.71	0.60
1000	7.224	0.859	0.75	15.35	1.02	15.80	14.70	0.78	15.04	0.76	0.71
5730	7.895	0.897	0.60	15.57	1.00	15.97	14.85	0.65	15.12	0.85	0.71
6104	7.989	0.902	0.73	14.95	1.30	15.55	14.52	0.80	14.85	0.70	0.94
12581	8.019	0.904	0.70	15.55	0.90	15.98	14.85	0.60	15.15	0.83	0.65
2738	8.327	0.920	0.66	15.10	1.05	15.52	14.30	0.85	14.66	0.86	0.75
2510	9.39	0.973	0.64	15.00	1.35	15.56	14.48	0.85	14.85	0.71	0.91
5551	10.485	1.021	0.44	15.43	0.83	15.76	14.70	0.65	15.00	0.76	0.58
2662	12.076	1.082	0.54	15.00	0.85	15.34	14.25	0.50	14.46	0.88	0.53
874	12.682	1.103	0.68	14.30	1.70	15.16	13.85	1.10	14.45	0.71	1.14

TABLE 2.43

SMC

HV	Period	log P	AS_B	B_{max}	A_B	<B>	V_{max}	A_V	<V>	<B>-<V>	f_B
1338	8.4934	0.929	0.68	15.02	1.18	15.54	14.70	0.90	15.09	0.45	0.85
2103	8.9841	0.953	0.62	15.33	1.00	15.73	14.80	0.70	15.11	0.62	0.73
2087	9.1592	0.962	0.64	15.57	0.83	15.98	14.98	0.57	15.23	0.75	0.63
836	9.4034	0.973	0.72	14.75	1.13	15.22	14.40	0.80	14.77	0.45	0.81
1334	9.4514	0.975	0.70	14.80	1.28	15.45	14.45	0.86	14.88	0.57	0.93
2063	11.1662	1.048	0.61	14.90	1.00	15.42	14.38	0.69	14.74	0.68	0.64
2017	11.4074	1.057	0.50	14.75	1.05	15.25	14.25	0.73	14.58	0.67	0.67
857	11.9829	1.079	0.58	14.55	1.10	15.04	14.09	0.81	14.45	0.59	0.68
856	12.1553	1.085	0.66	15.00	1.08	15.58	14.50	0.77	14.90	0.68	0.66
1365	12.4133	1.094	0.56	15.17	0.98	15.68	14.60	0.70	14.99	0.69	0.59
2052	12.5750	1.100	0.60	14.12	1.28	14.77	13.77	0.85	14.21	0.56	0.77
2202	13.1823	1.120	0.62	14.52	1.08	15.06	13.97	0.73	14.37	0.69	0.63
2189	13.4591	1.129	0.55	14.60	1.10	15.14	14.10	0.75	14.49	0.65	0.63
1326	13.7274	1.138	0.64	14.87	1.43	15.51	14.36	1.03	14.82	0.69	0.84
2088	14.5788	1.163	0.68	14.75	1.42	15.45	14.20	0.90	14.68	0.77	0.80
854	15.9530	1.203	0.84	14.02	1.43	14.76	13.65	1.05	14.19	0.57	0.77

The magnitudes from 20 equally spaced points along the light curve were converted to intensities. The mean intensity was found and this value converted back to magnitude. All the above mentioned parameters are presented for the photographic and photoelectric work in Tables 2.42 and 2.43 respectively. Values in brackets indicate uncertainty due to incomplete phase coverage of the light curve or possible faint-star contamination.

2.5 Comparison with Others (Magnitudes)

As there are several cepheids in the present study which are in common with those of others, a comparison of <B> and <V> magnitudes may be made. These are depicted in Fig. 2.51 where ΔB etc. is the difference in the sense Martin-Others. Comparisons are made with the photoelectric data of Gascoigne & Kron (1965), Gascoigne (1969), Madore (1975) and Martin & Warren(1979) and with the photographic data of Butler (1976, 1978), Woolley et al. (1962), Hodge & Wright (1969), Wright & Hodge (1971), van Genderen (1969), Arp (1960) and Connolly (1975). We shall discuss each comparison in turn:

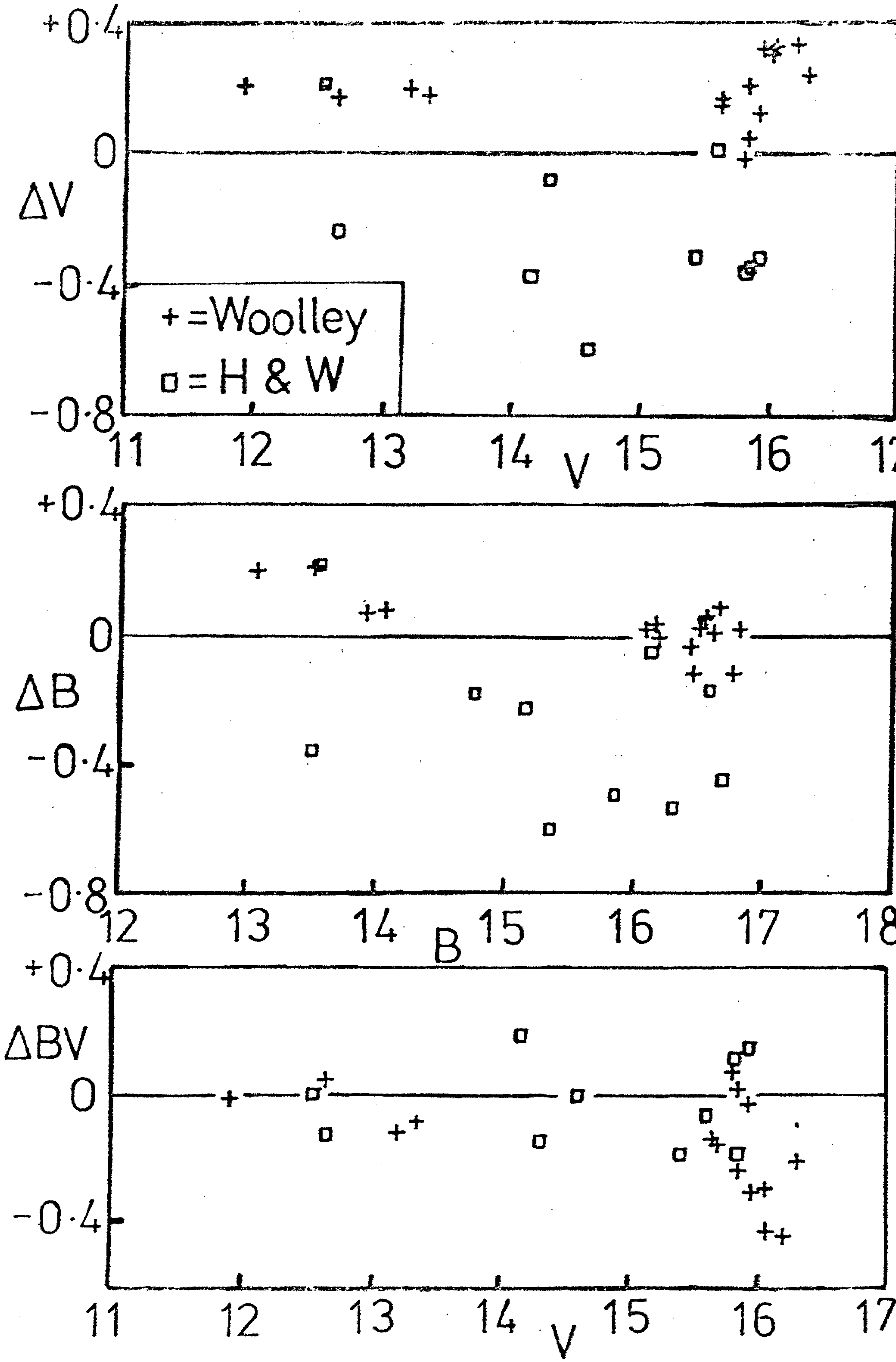
Photographic

(a) Hodge & Wright (LMC). Their data (Fig. 2.51a) tends to be ~ 0.3 and ~ 0.4 fainter than ours in <V> and <B> respectively. Butler (1972), who finds a similar trend, suggests that the fainter standards used by Hodge & Wright were measured, by them, between 0^m and $0^m.8$ fainter than Butler's scale would imply.

(b) Woolley et al. (LMC). For the four brighter cepheids in common (Fig. 2.51a) there seems to be a systematic difference (in the sense that they measure brighter) of $\sim 0^m.15$ in both <B> and <V>. For the eleven fainter cepheids a similar trend is

Fig 2.5?

Comparison of magnitudes with Woolley, Hodge & Wright



seen but only in <V> which shows up as differences in their colours of $\sim 0^{m}.20$ in the sense that they measure too red. In their paper, Woolley et al. (1958) compare their photographic magnitudes with eleven photoelectric standards ($V > 13^{m}.6$) and they find a similar trend ($V(pe) - V(pg) = 0.17 \pm 0.06$) which they suggest may be due to transfer errors across the visual plates.

(c) Connolly (LMC). As Connolly obtained his material on two different systems (Uppsala Schmidt and CTIO Schmidt) the comparison (Fig. 2.51b) has been divided accordingly, for each of his regions I, II, and III. The main discrepancies lie in the Uppsala II and CTIO II data. Connolly himself finds very poor agreement between these two data sources and suspecting photometric errors in the Uppsala II work he has eliminated it from his final analyses. This does not however explain the differences of $\sim 0^{m}.2$ in <B> and <V>, for the CTIO II data, in the sense that he measures fainter ($V \geqslant 14^{m}$). The problem is further confused as his B,V period-luminosity relationships for this region give flatter slopes than ours, a result we discuss further in Chapter 3.

(d) Butler (LMC + SMC). As there are a sufficient number of variables in common, the comparisons have been made for the SMC and LMC separately (Figs. 2.51c and d). Within the limits of photographic photometry the agreement is quite good, but in the range $14 < B < 16$ our (LMC) B values appear to be too bright by $\sim 0^{m}.1$.

(e) Van Genderen (SMC). With the exception of 3 stars (HV1372, 1437, 1457) the agreement is reasonably good (Fig. 2.51e). These 3 stars may suffer a certain amount of background contamination which may make our magnitudes a little too bright but the corresponding colour agreement is good.

Fig 2.51b

Comparison of magnitudes with Connolly

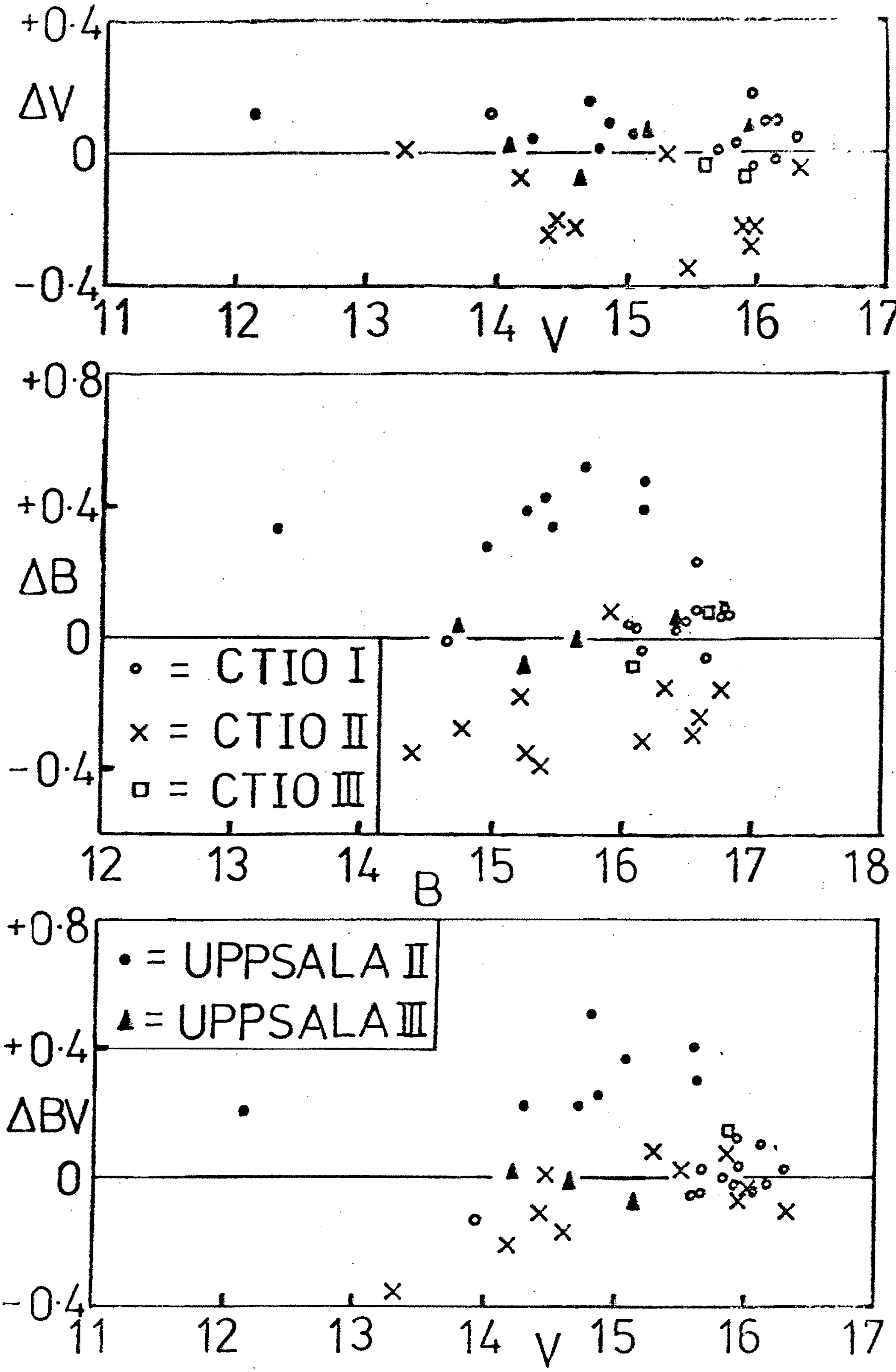


Fig 2.51c

Comparison of LMC magnitudes with Butler

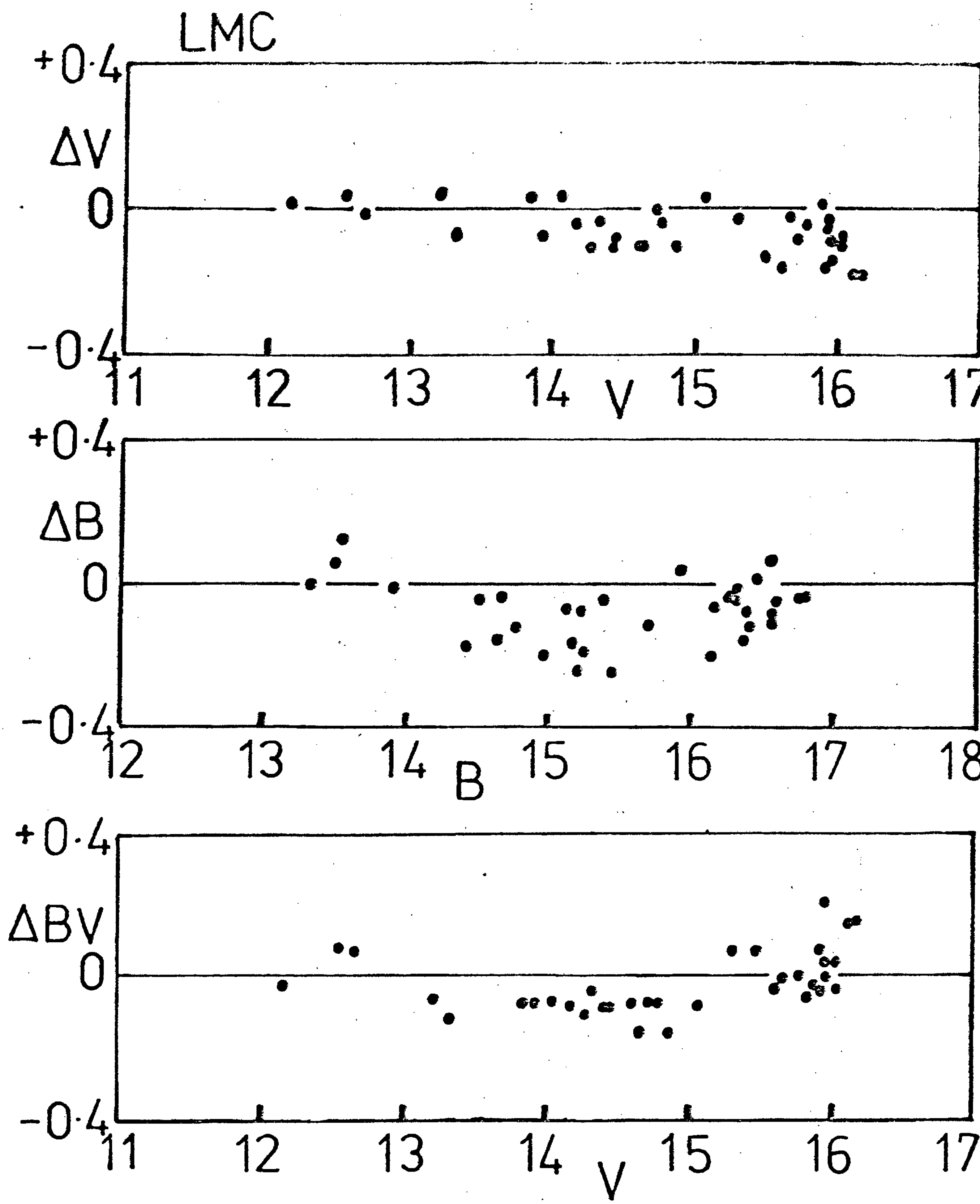


Fig 2.51d

Comparison of SMC magnitudes with Butler

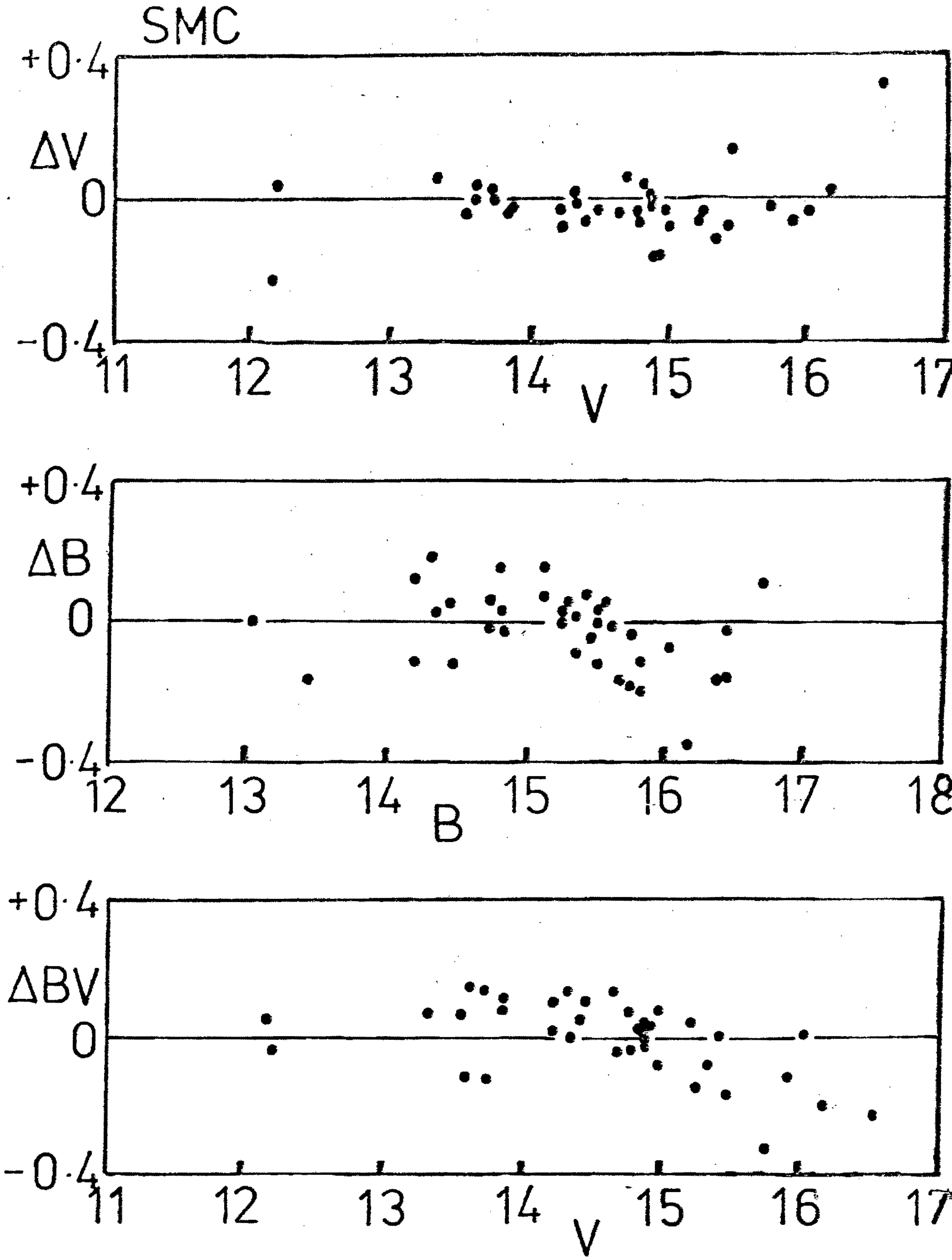
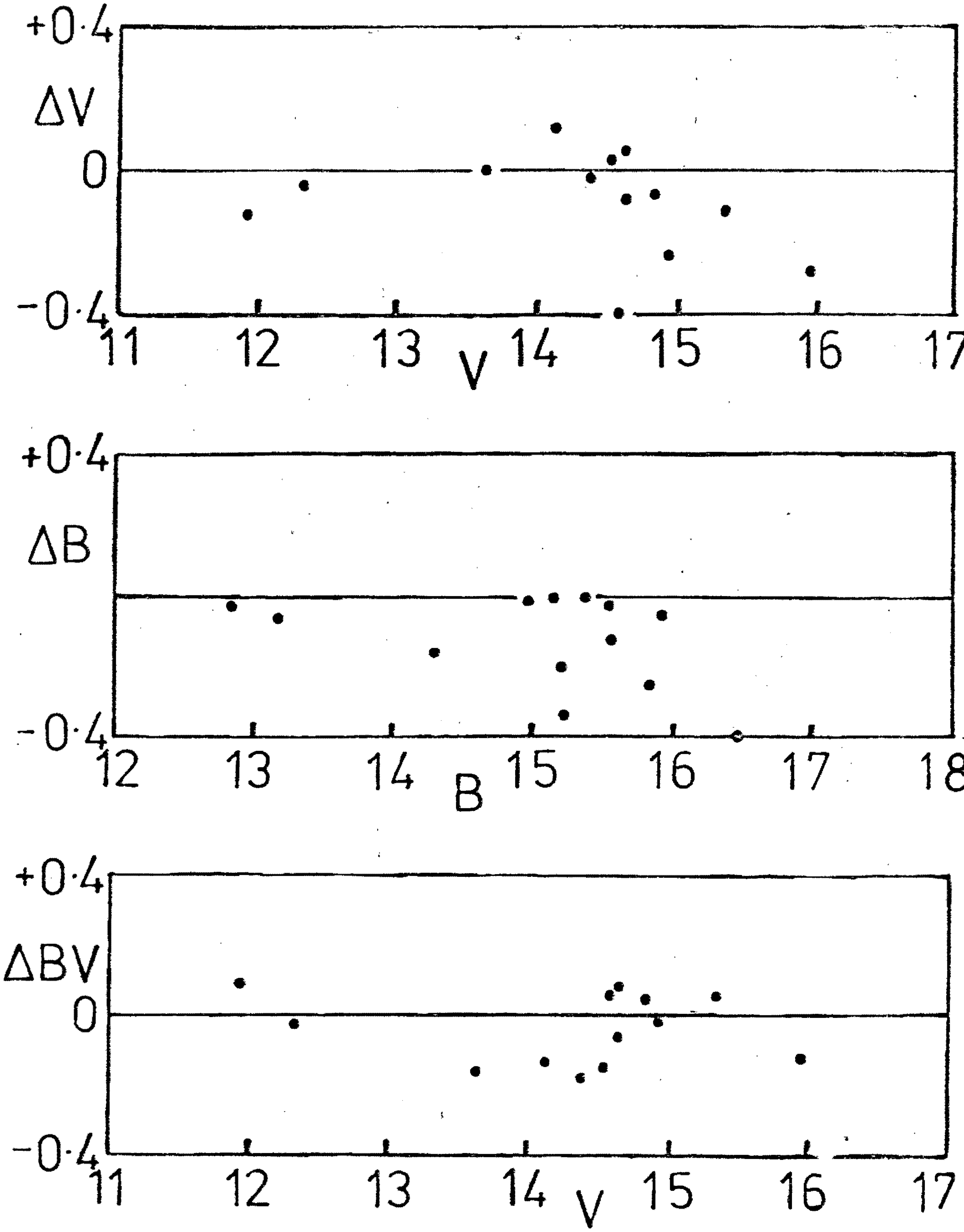


Fig 2.51e

Comparison of magnitudes with van Genderen



(f) Arp (SMC). It is now fairly well established that Arp's pioneering work on the SMC cepheids show systematic errors at the fainter magnitudes. Butler (1976) finds that Arp's short period cepheids are $\sim 0^m.2$ redder than his. We find a similar trend (Fig. 2.51f), for, in the range <V> = $14^m.5 - 16^m.5$, Arp measures (the 13 stars in common) between 0 and $0^m.5$ redder in (<B> - <V>) than we do.

Photoelectric. (LMC + SMC)

(g) Madore, Gascoigne, Martin et al. In Fig. 2.51g we compare all the available photoelectric data with our own (pg). Overall the agreement is good but there is a tendency for the scatter in ΔB (and hence ΔBV) to be greater than in ΔV. There are three stars for which the agreement is very poor (SMC: HV 847, LMC: HV 873 and W 24). HV 847 and W 24, comparedhere with Madore and Gascoigne respectively have also been observed (photographically) by Butler and Woolley et al. respectively and <B> and <V> values are given in Table 2.51.

Table 2.51

Magnitude Comparisons for Two Cepheids

HV 847	<B>	<V>	<B>-<V>	W 24	<B>	<V>	<B>-<V>
(log P = 1.43)				(log P = 0.43)			
Madore	15.20	14.20	1.00	Gascoigne	16.73	16.22	0.51
Butler	14.67	13.91	0.76	Woolley	16.48	15.81	0.67
Martin	14.74	13.86	0.88	Martin	16.54	15.85	0.69

For HV 847 it would appear that as the photographic values agree rather well that either (a) a companion star has been included in both photographic studies (b) the star has a variable light curve or (c) there is an error in the photoelectric work.

Fig 2.51f

Comparison of magnitudes with Arp

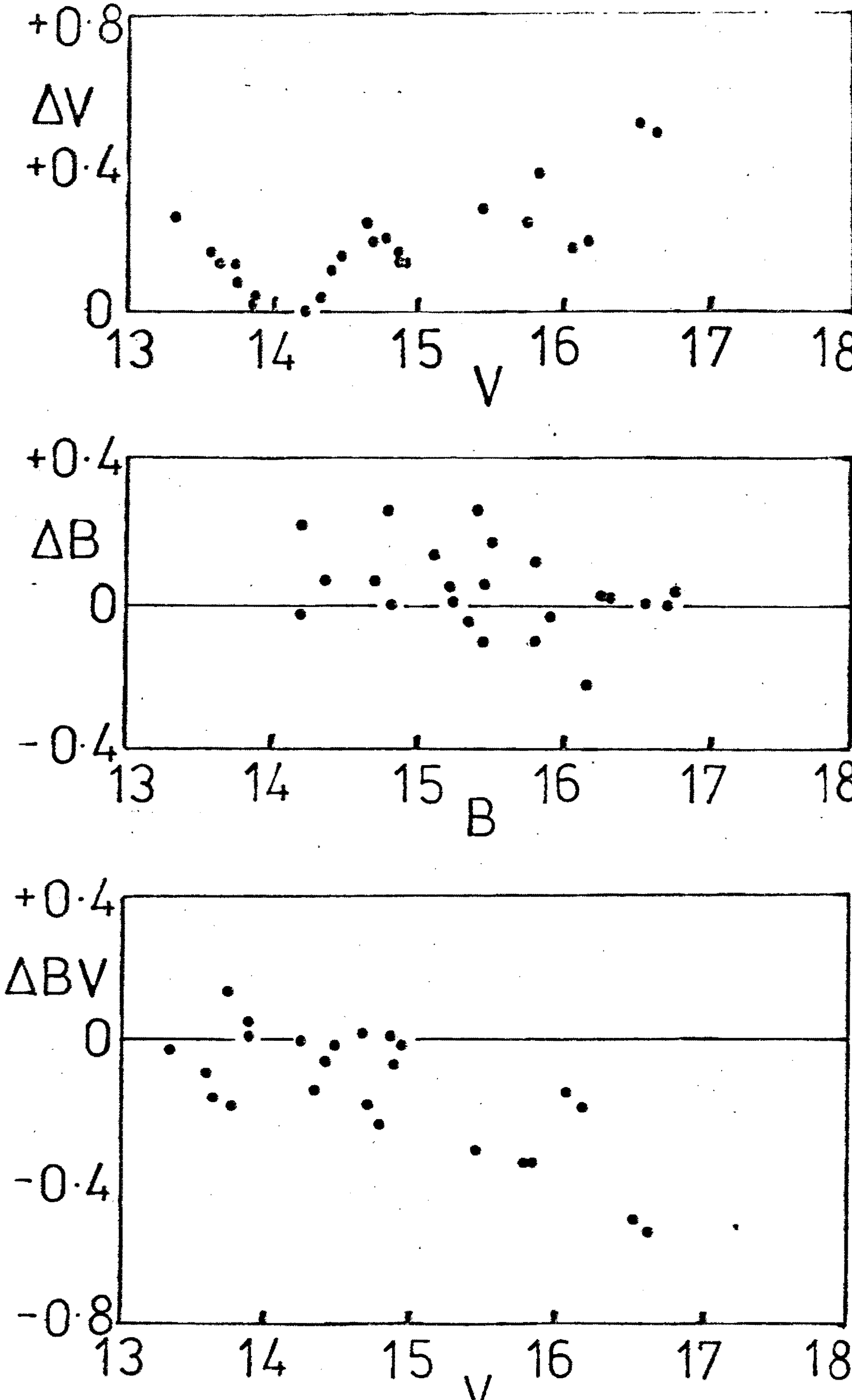
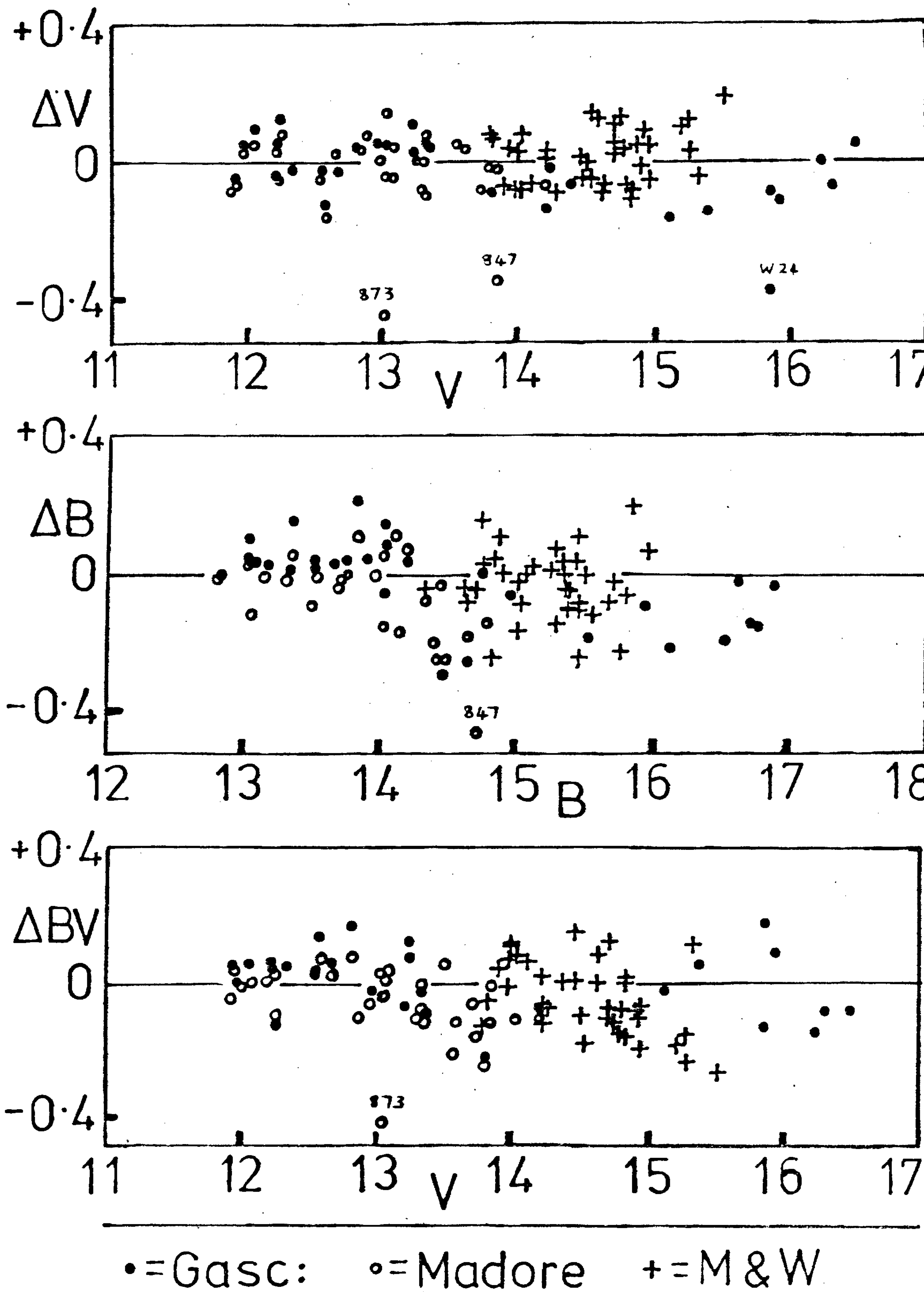


Fig 2.51g

Comparison of magnitudes with Gascoigne, Madore, Martin & Warren.



Similar arguments could be applied to W 24 but Gascoigne has shown that this cepheid has a variable light curve.

For HV 873 the situation is even less clear as there exists no other data with which to compare with that of Madore. No obvious companion can be seen on the photographic plate and the plate background is not unusually high in this region.

2.6 Comparison with Others (Amplitudes)

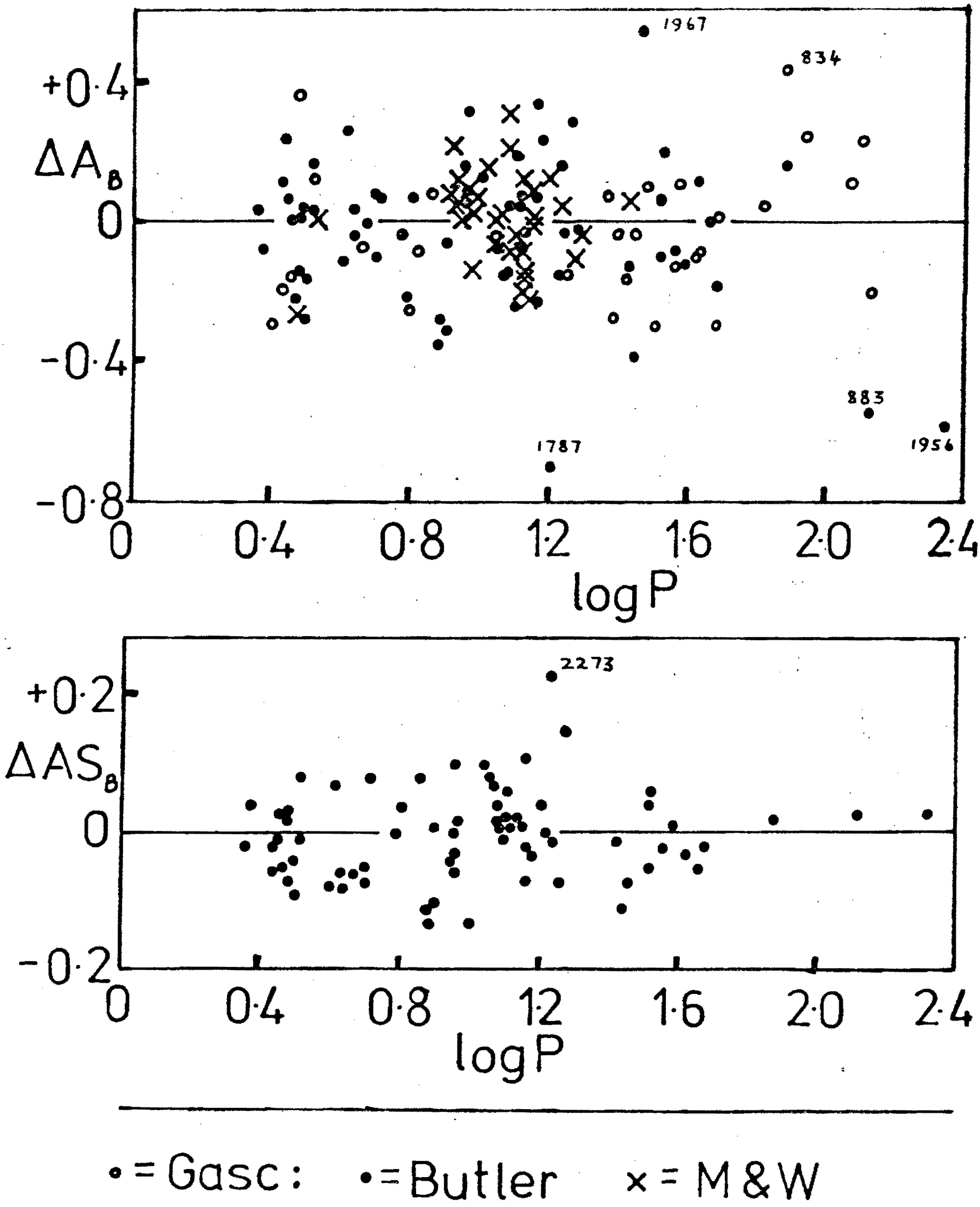
A further useful comparison may be made with the amplitudes and asymmetries of cepheids in common with the present work. In Fig. 2.61 we plot the differences in A_B (Martin-Others) against log P for Butler's (1976, 1978), Gascoigne's (1969) and Martin & Warren's (1979) data and in Fig. 2.62 we compare the values of AS_B with those of Butler. For both sets of comparisons there appear to be no systematic differences but there are a few notable exceptions, namely:-

SMC: HV 1967 and HV 834; our amplitudes are considerably larger than Butler's and Gascoigne's respectively. Gascoigne's value of A_B for HV 834 is given as uncertain but Butler's value for the same star is much closer to ours. For HV 1787 and 1956, the values of A_B are much smaller than Butler's, but HV 1787 is quite badly contaminated on our plates and we have excluded it from the final analysis. HV 1956 is a long period cepheid and our phase coverage at minimum and maximum light is probably not quite adequate to define the parameters accurately.

LMC: HV 883; Our (B) amplitude is smaller than that of Butler or Gascoigne which is probably due to our light curve having a shallower minimum than the others. HV 2273; Butler's value of AS_B implies a much more sinusoidal curve than does our data, but the asymmetries for the remaining stars are in quite good agreement.

Fig 2.61

. Comparison of amplitudes with Gascoigne, Butler, Martin & Warren.



2.7 Comparison With Others (Light Curves)

Whilst some idea of the reliability of our data can be obtained by comparing the <B> and <V> magnitudes, amplitudes, etc, it is important to stress that in some cases the distribution of points with phase defining a light curve is not always sufficient to derive meaningful values of the light curve parameters. The coverage at minimum and maximum light is, of course, particularly important. In spite of our efforts to cover all phases of the light curve some cepheids had curves that were not completely covered at maximum and/ or minimum. They are:-

LMC: HV 5497, 883, 882, 2827, 2447

SMC: HV 2088, 829, 821, 1956.

From Madore's (1975) photometry Cepheid light curves that were also inadequately covered include:-

LMC: HV 883, 2447, 2883, 877, 881, 873, 875, 889.

SMC: HV 11157, 1877, 11182, 847, 2209.

For Martin & Warren (1979) they are:-

LMC: HV 2353, 2579, 2549, 2793

SMC: HV 1338

For Gascoigne (1969) and Gascoigne & Kron (1965) they are:-

LMC: HV 909

SMC: HV 1425, 834, 1871.

The light curves for cepheids in common with photoelectric work are shown in Appendix B. Open circles represent the present work, crosses are observations by Madore, closed circles are by Gascoigne and 'vees' are Martin et al. For W 24 open circles with central dots are second epoch observations by Gascoigne (1969). The magnitude scales are marked in $0^m.5$ intervals and the (arbitrarily zeroed) phases in units of 0.2. Curves from the various authors have been shifted horizontally to obtain the best fit.

In general the photoelectric points lie within the photographic ones over all phases of the light curves. The agreement amongst the V curves is particularly good. For the B curves there are some discrepancies at minimum or maximum. For the following cepheids, our points at minimum are a little ($\sim 0^{m}.1 - 0^{m}.2$) brighter than the photoelectric ones:-

SMC: HV 1492, 2189, 1326, 2088 and 823.

LMC: W 44, HV 2324, 886, 873 and 883.

To compensate, the following cepheids have minima which are correspondingly fainter than the photoelectric data:-

LMC: HV 997, 2580, 2836, 1003, 953 and 2447.

A few show both maximum and minimum which are brighter than the photoelectric work, which may represent light-curve variability:-

SMC: HV 1425, 1334

LMC: HV 12823, 6105

One, HV 902, appears to be more asymmetric than its photoelectric counterpart.

2.8 Summary

The overall picture that presents itself is that the present data are as good and perhaps in some cases rather better than previous photographic work, however our B magnitudes fainter than $\sim 14^{m}$ do show a slight tendency to be brighter than their photoelectric counterparts by $\sim 0^{m}.05$ on average. The V magnitudes on the other hand agree well with the photoelectric data.

CHAPTER 3

RELATIONSHIPS BETWEEN PERIOD, LUMINOSITY, COLOUR AND AMPLITUDE

3.1 Selection of variables for analysis

Before an attempt is made to investigate the various P-L-C-A relationships, a decision must be made as to which cepheids, if any, should be excluded from the final analyses.

It has been suggested that short period cepheids with small amplitudes and nearly sinusoidal light curves are pulsating in the first overtone. They tend to be $\sim 0^m.5$ brighter than 'normal' cepheids of the same period. Such stars were first recognized as a sub-group by Arp (1960) and while we have found cepheids that fall into this category, it is not clear whether this is a function of the mode of pulsation or whether it is due to the presence of an unresolved companion star, which would show the same effect. In figs 3.11 and 3.12 plots of A_B/log P and AS_B/log P are made for each Magellanic Cloud. From these diagrams, cepheids which are members of the sub-group described above are easily recognized and have been excluded from the final analyses. They are:

SMC: HV 2093, 2186, 2061, 1600, 1898, 2037 and 1788. Three other stars (HV 1360, 1662 and 11206) which have low asymmetries or quite small amplitudes but do not seem to be brighter than normal have not been excluded.

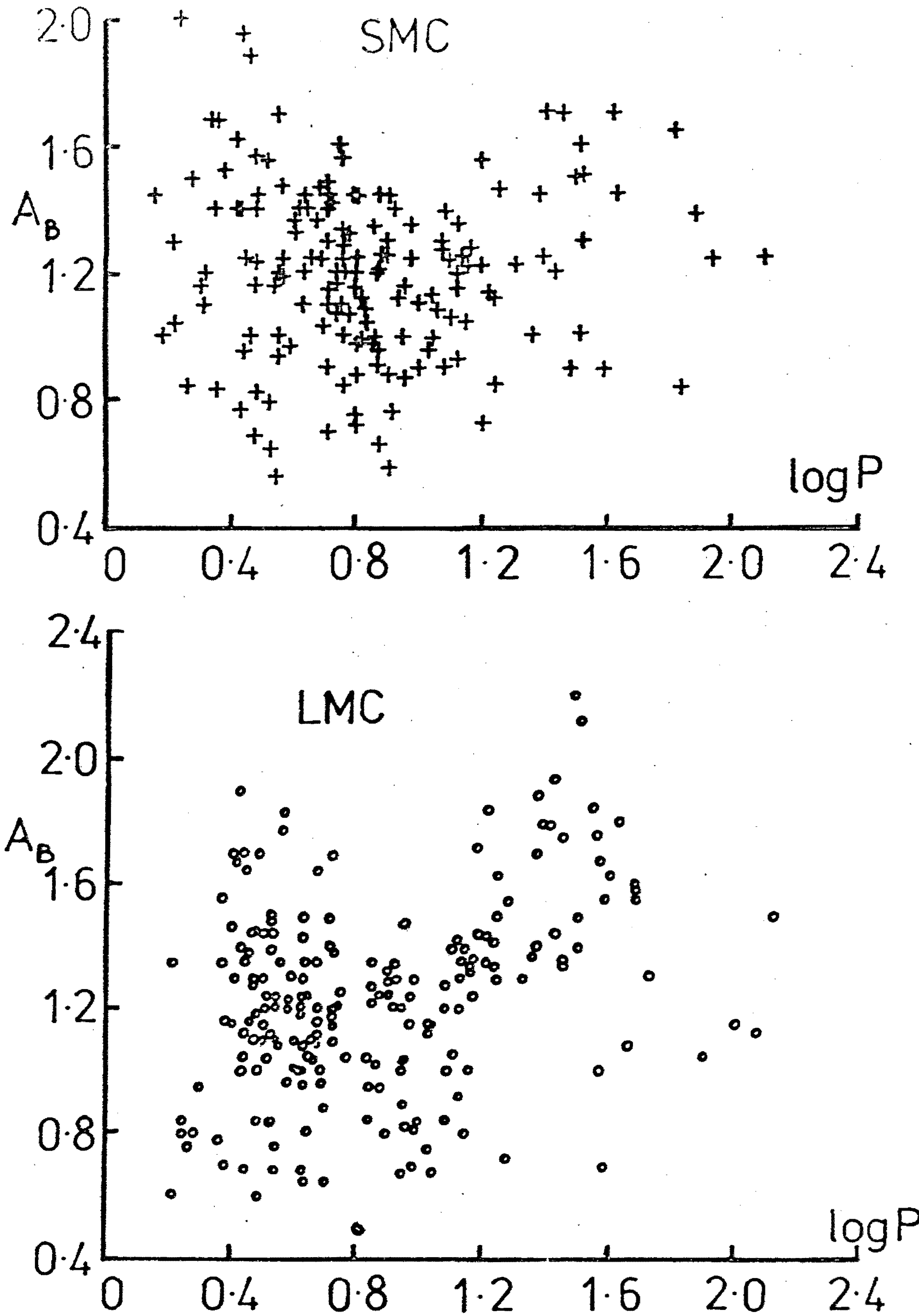
LMC I. W41, W38, HV 5684 and 2263, but have retained W25 and HV 5533. W24 was also removed as it has a variable light curve (Gascoigne, 1969).

LMC II. HV 12575, 2353, 12765, 2431 and 2283.

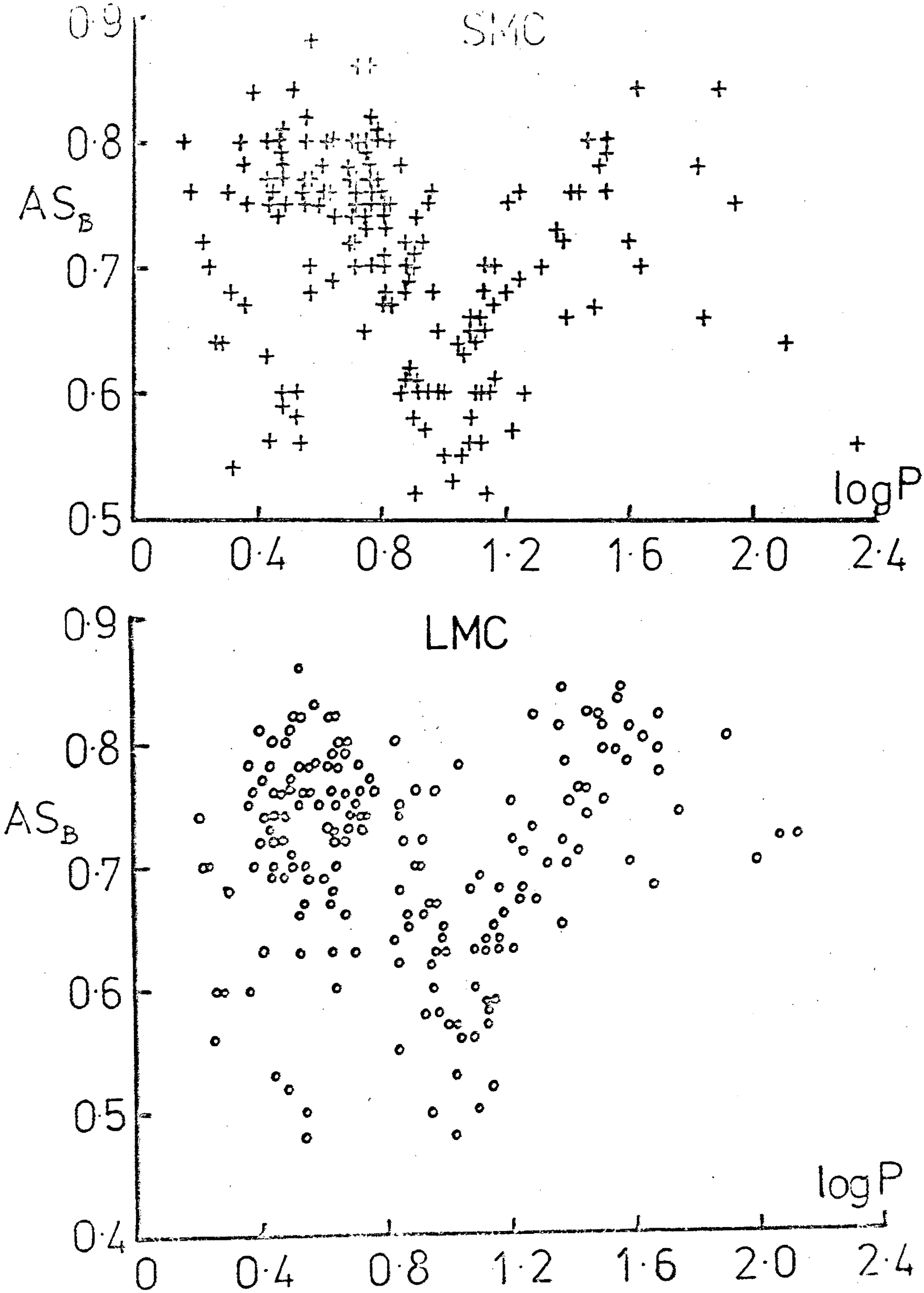
LMC III. HV 2837, 12676 and 6015, but have retained HV 6051, and 12906.

In addition we have excluded variables which are thought to be Type II (W Virginis) stars and those which are > $0^m.5$ fainter than 'normal'

Fig 3.11
Amplitude-period plots for SMC, LMC (photographic data)



Asymmetry-period plots for SMC, LMC (photographic data)



which appear to belong to an intermediate (Type I-II) group, or are heavily reddened. The W Virginis types are usually $\sim 2^{m}.0$ fainter than the classical cepheids and are easily recognizable, but the intermediate group (which seem to lie in the region log P $\sim$ 1.0) are not so easy to recognize; however we feel they are special cases and not merely a part of the scatter of the period-luminosity relationship. They are:

SMC. HV 1828 (W Vir), 11129, 843, 1372 (Intermediate).

LMC I. HV 5598 (W Vir).

LMC II. HV 5829, 2281 (W Vir).

LMC III. HV 12625, 6070 (W Vir), 2647, 2836 (Intermediate).

We also exclude HV 2749 which is near 30 Doradus and is heavily obscured (Gascoigne, 1969).

We have also excluded cepheids with periods greater than 100 days. Gascoigne (1969) describes such stars as being very red and falling well below any reasonable period-luminosity line. In addition, Feast (1974) has suggested that the long period Cloud cepheids are too red for their spectral types and that those with periods $\sim$ 100 days would then be > 1 magnitude brighter than previously supposed. Consequently we have removed:

SMC. HV 821, 1956

LMC I. HV 883.

LMC III. HV 2447.

Finally we have excluded cepheids which appeared, from the plates, to be badly contaminated (faint companions or high sky background) or showed very poor light curves to which no improvement could be made by changing the period. They are:

SMC. HV 1968, 1590, 1571, 2173, 1331, 1995, 1927, 853, 2081, 1338, 857, 11182, 1369, 2205, 1630, 1974, 11193, 1502, 1619, 1632, 1437, 1436, 2156, 2161, 1503, 1979, 2174, 1487, 1701, 1811, 11233, 2188.

LMC I. HV 12446, 12528, 2358, 2297, 5497.

LMC II. HV 5615, 12964, 12551, 12423, 12574, 926, 12430, 12428, 12823, 2285, 873, 12572, 2557, 2395, 2366, 2421, 12422, 2486, 5840, 12427, 12421, 2523, 2267, 2301, 2527, 882.

LMC III. HV 2682, 2794, 997, 2793, 934, 2827, 2813, 6059.

The number of stars used in the final analyses are as follows:

SMC, 135; LMC I, 49; LMC II, 45; LMC III, 59.

3.2 Period-luminosity, the anomalous cepheids

In Figs. 3.21 (a) and (b) we have plotted <V> and <B> against log P for the SMC and LMC respectively (LMC I = crosses, LMC II = open circles, LMC III = filled circles) for <u>all</u> the data in Table 2.42. In Figs. 3.22 (a) and (b) similar plots have been made but this time with the selection criteria (described above) enforced. The least squares regression lines calculated from the selected data appear in Table 3.41 and are superimposed on these P-L diagrams.

Cepheids which lie well away from the regression lines we shall describe as anomalous and divide them into three groups:

(a) those with short periods and having small values of A_B and AS_B.

(b) W-Virginis-type stars.

(c) long-period cepheids.

(a) As we have seen, this group of cepheids is thought to be pulsating in the first overtone. To test whether they appear brighter than normal (normal is defined by the least squares line) we have, in Table 3.21, listed all stars that lie in the ranges $AS_B \leqslant 0.74$, $A_B \leqslant 0.95$ and $\log P < 0.705$, together with the observed-computed <V> and <B> differences. It can be seen from these results that, on average, these cepheids appear $\sim 0^m.4$ brighter than normal. From the P-L results in Table 3.41 we adopt

Fig 3.21 (a)

<V> and <B> - log P plots for all photographic data (SMC)

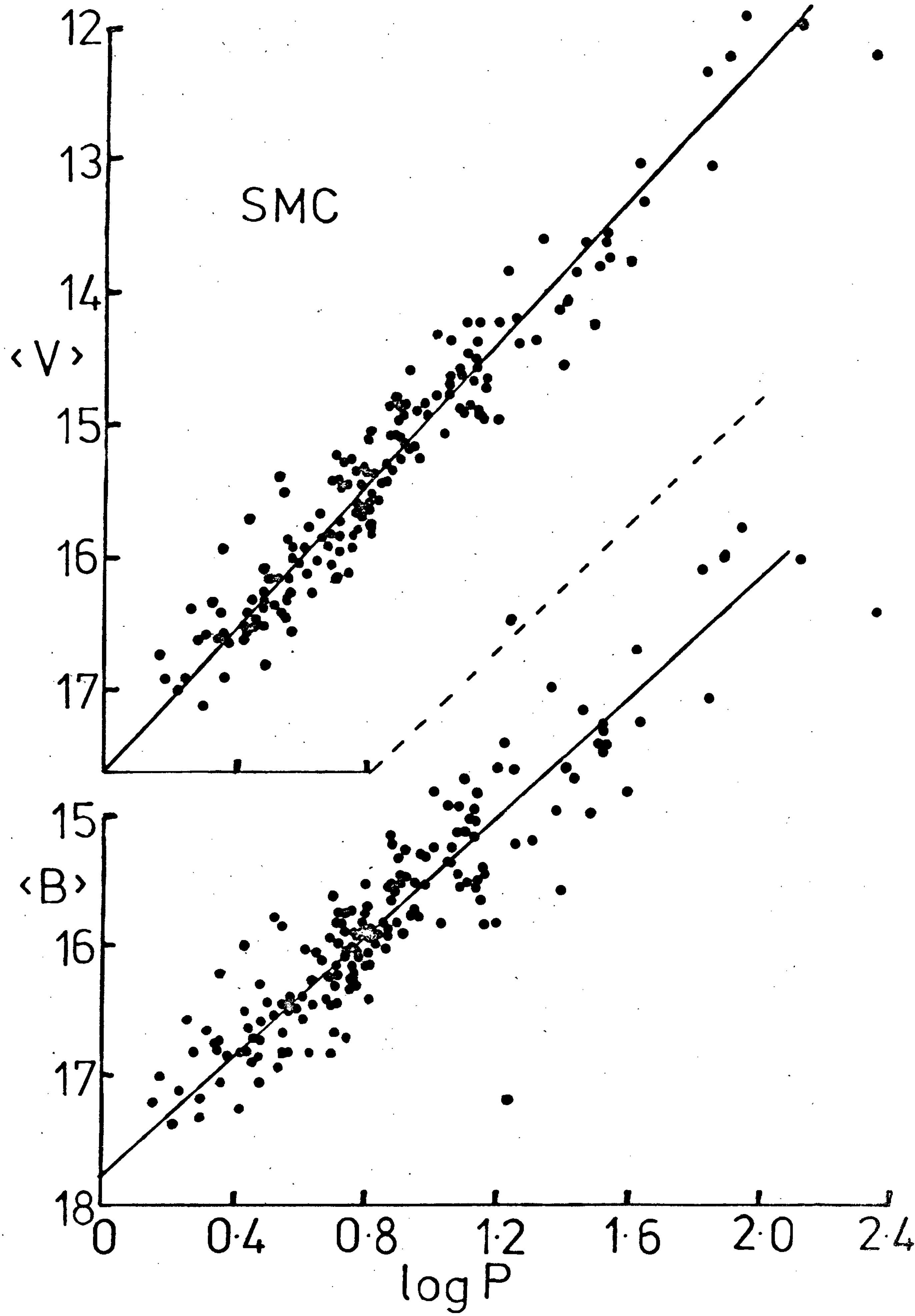


Fig 3.21 (b)

<V> and <B> - log P plots for all photographic data (LMC)

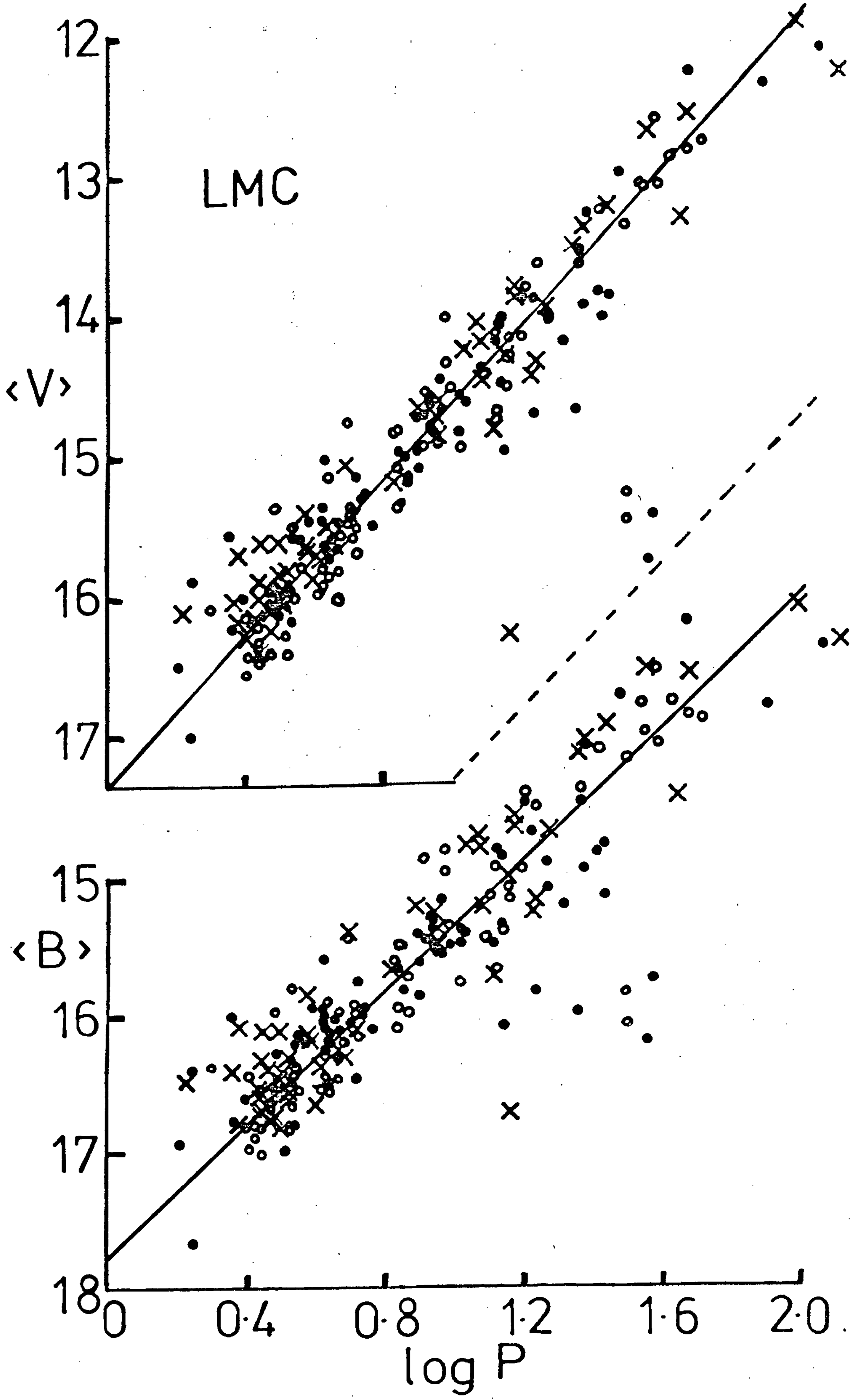


Fig 3.22 (a)

<V> and <B> - log P plots for selected data (SMC).

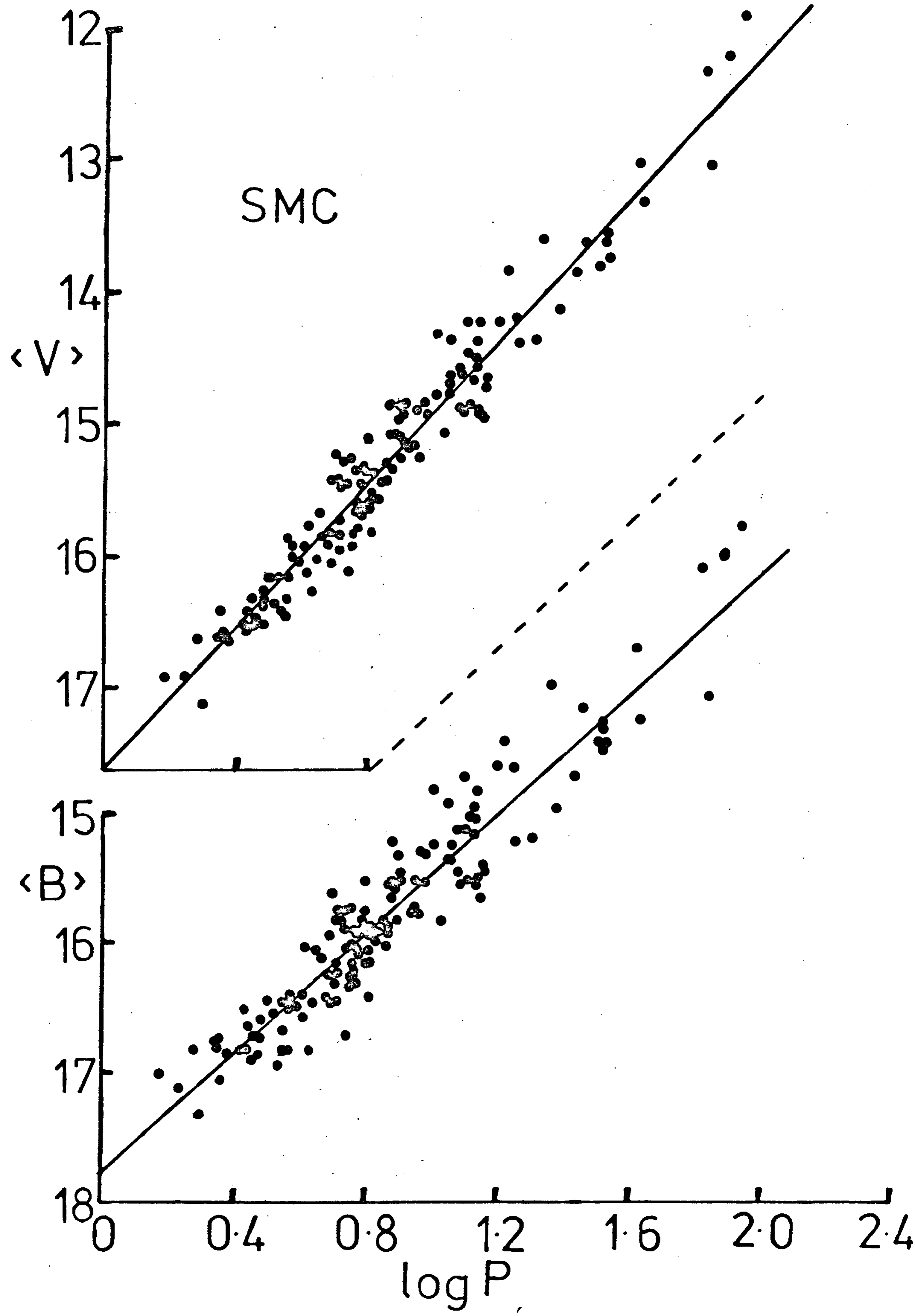


Fig 3.22 (b)

<V> and <B> - log P plots for selected data (LMC)

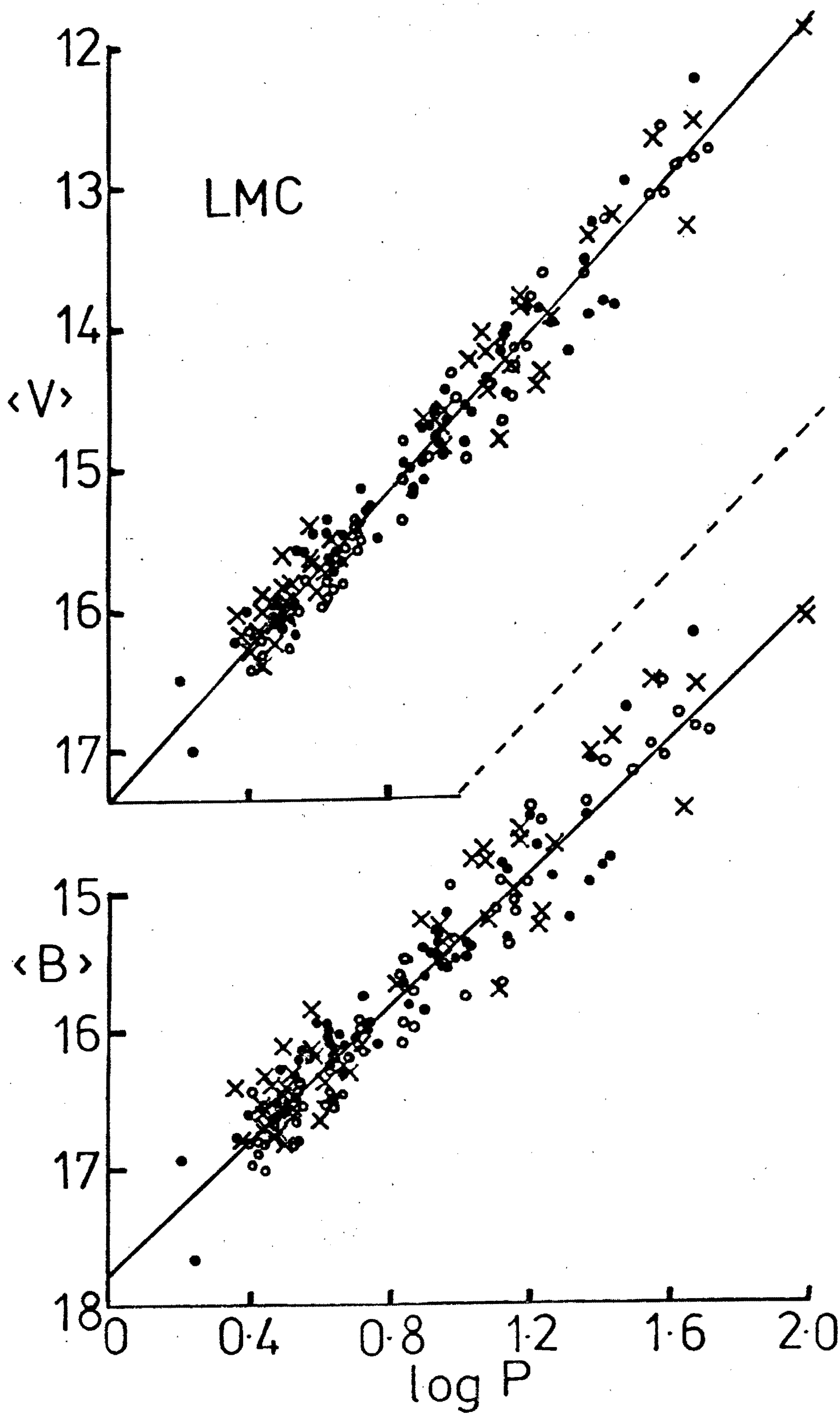


TABLE 3.21

O-C differences for short period cepheids

SMC	HV	log P	AS_B	A_B	$\langle V\rangle_o - \langle V\rangle_c$	$\langle B\rangle_o - \langle B\rangle_c$
	2093	0.262	0.64	0.85	-0.53	-0.61
	2186	0.315	0.54	0.90	-0.53	-0.51
	2061	0.351	0.67	0.83	-0.73	-0.78
	1600	0.429	0.63	0.77	-0.76	-0.80
	1360	0.439	0.56	0.95	0.00	+0.05
	1898	0.480	0.60	0.69	-0.25	-0.37
	1662	0.484	0.59	0.82	+0.20	+0.21
	2037	0.527	0.58	0.65	-0.80	-0.78
	11206	0.531	0.60	0.79	-0.01	+0.01
	1788	0.541	0.56	0.55	-0.64	-0.71
LMC I	W41	0.218	0.70	0.60	-0.67	-0.72
	W38	0.380	0.70	0.70	-0.65	-0.72
	5684	0.445	0.53	0.69	-0.55	-0.55
	5533	0.477	0.72	0.85	-0.15	-0.12
	W25	0.529	0.66	0.82	0.00	+0.15
	2263	0.703	0.74	0.88	-0.38	-0.66
LMC II	12575	0.296	0.68	0.95	-0.49	-0.66
	2353	0.492	0.52	0.60	-0.69	-0.59
	12765	0.535	0.48	0.68	-0.40	-0.66
	12574	0.537	0.50	0.76	+0.27	-0.07
	2431	0.642	0.60	0.65	-0.50	-0.29
	2283	0.698	0.63	0.65	-0.71	-0.66
LMC III	12906	0.242	0.70	0.85	+0.30	+0.51
	2837	0.250	0.56	0.80	-0.82	-0.73
	12676	0.364	0.60	0.78	-0.85	-0.85
	6015	0.627	0.68	0.69	-0.65	-0.64
	6051	0.643	0.73	0.81	-0.16	-0.06
Mean					-0.41	-0.43
					±0.07	±0.07

$\langle V \rangle$ and $\langle B \rangle$ slopes of 2.70 and 2.31 respectively and write:

$$\langle V \rangle_o = C - 2.70 \log P_o \qquad (1)$$

$$\langle V \rangle_c = C' - 2.70 \log P_1 \qquad (2)$$

where C is a constant and P_o and P_1 are the fundamental and first harmonic periods respectively. According to Iben and Tuggle (1972) the ratio $^{P_1}/_{P_o} \sim 0.74$. Substituting this ratio in (1) and subtracting (2) from (1) we find:

$$\langle V \rangle_o - \langle V \rangle_c = -0.35$$

with the corresponding exptression in $\langle B \rangle$ as:

$$\langle B \rangle_o - \langle B \rangle_c = -0.30$$

i.e. that first harmonic pulsators are in this case brighter (in V) than fundamental pulsators by 0.35. The observed (O-C) values could of course be due to companion stars as we explained earlier but what we have shown here is that the predicted differences are at least consistent (in magnitude and sign) with the theory that these cepheids are first harmonic pulsators.

(b) The O-C differences for the W Virginis and intermediate-type cepheids are given in Table 3.22.

Stars identified as W Virginis by the Gaposchkins (1966, 1970) are marked with an asterisk in the Table and are, in the mean $2^m.22 \pm 0.10$ (V) and $1^m.93 \pm 0.10$ (B) fainter than classical cepheids. The intermediate group (excluding HV 2749) lie $0^m.61$ (V) $\pm$ 0.06 and $0^m.92$ (B) $\pm$ 0.08 below the least squares line. Whilst the W Virginis stars are well known, it

TABLE 3.22

O-C differences for the W Virginis and long period variables

		HV	log P	$\langle V\rangle_o - \langle V\rangle_c$	$\langle B\rangle_o - \langle B\rangle_c$
SMC	W VIR	843	1.168	+0.43	+0.71
		1372	1.198	+0.54	+0.78
		1828*	1.235	+2.17	+2.23
		11129	1.389	+0.64	+0.95
	L.P	824	1.818	-0.42	-0.44
		11157	1.838	+0.37	+0.54
		834	1.886	-0.34	-0.42
		829	1.943	-0.49	-0.52
		821	2.106	0.00	+0.06
		1956	2.338	+0.82	+1.03
LMC I	W VIR	5598*	1.169	+2.05	+1.79
	L.P	5497	1.996	0.00	+0.08
		883	2.127	+0.70	+0.66
LMC II	W VIR	5829*	1.499	+1.96	+1.69
		2281*	1.500	+2.16	+1.92
LMC III	W VIR	2647	1.152	+0.72	+1.09
		2836	1.244	+0.73	+1.06
		2749	1.364	+1.06	+1.50
		12625*	1.571	+2.66	+2.21
		6070*	1.575	+2.34	+1.76
	L.P	2827	1.902	+0.15	+0.48
		2447	2.074	+0.37	+0.57

is not clear whether the intermediate group is truly anomalous or whether these stars are heavily reddened as in the case of HV 2749.

(c) Table 3.22 also shows the O-C differences for the long period cepheids (beginning at log P ~1.8 to increase the sample). It appears that these cepheids only begin to depart significantly from the least squares line for values of log P > 2.0. The four cepheids with log P > 2.0 lie on average $0\overset{m}{.}47 \pm 0.18$ (V) and $0\overset{m}{.}58 \pm 0.20$ (B) below the least squares lines. Selection effects become important at this end of the P-L relationship since there are very few stars available, however it seems likely that the very long period cepheids are either intrinsically underluminous for their period or are reddened in some way.

3.3 The 3 LMC regions (Period, Luminosity, Colour)

As the three LMC regions have been photographed separately, it is worthwhile making a comparison of the period, luminosity and colour relationships for the cepheids in each region. In Table 3.31 the least squares solutions for the P-L relationships are shown for each of the regions LMC I, II and III, together with the number of cepheids (N) in each sample and in Table 3.32 the least squares and maximum likihood solutions for the P-L-C relationshps are given. Details of the errors assumed, etc for the maximum likihood solutions are given in § 3.7.

TABLE 3.31

P-L relationships for each LMC region (log P < 2.0)

	$\langle V \rangle = a - b \log P$			$\langle B \rangle = c - d \log P$	
Region	a (se)	b (se)	N	c (se)	d (se)
I	17.27 ± 0.07	2.69 ± 0.08	49	17.67 ± 0.09	2.38 ± 0.10
II	17.59 ± 0.08	2.92 ± 0.08	45	17.98 ± 0.10	2.57 ± 0.10
III	17.24 ± 0.08	2.64 ± 0.08	59	17.66 ± 0.09	2.33 ± 0.10

TABLE 3.32

P-L-C relationships for each LMC region ($\log P < 2.0$)

$$\langle V\rangle = \alpha \log P + \beta(\langle B\rangle - \langle V\rangle) + \gamma$$

Region	α se	β se	γ se	N
I	-3.05 ± 0.10	1.19 ± 0.26	16.79 ± 0.12	49
	-3.79	3.59	15.83	49
II	-3.17 ± 0.12	0.70 ± 0.27	17.33 ± 0.13	45
	-4.53	4.57	15.85	45
III	-3.02 ± 0.12	1.19 ± 0.30	16.73 ± 0.14	59
	-4.24	5.01	15.10	59

The results from Table 3.31 indicate that the cepheids in region II of the LMC (which lies predominently to the south-west of the main LMC Bar) may follow a different P-L relationship to those in the other two regions (situated as shown in Fig. 2.11). This difference appears to be supported by the least squares P-L-C solutions shown in Table 3.32, where a smaller colour coefficient is preferred for the LMC II cepheids compared with those in regions I and III.

However, the maximum likihood solutions (which take into account the errors for each parameter and are therefore more reliable) do not suggest that the cepheids in region II obey a different P-L-C law compared with the remaining two regions. It is therefore concluded that as far as the data will allow (i.e. taking into account sample size and errors in photometry) there is no marked inhomogeneity in the properties of LMC cepheids considered separately in these three regions.

3.4 Period — Luminosity, comparison with others

Table 3.41 shows the P-L relationships (both B and V) derived by least squares techniques from the following sources:-

1. Gascoigne (1969)
2. Butler (1976, 1978)
3. Butler and Gascoigne combined (see Butler 1976, 1978)
4. Arp (1960)
5. Arp revised by van Genderen (1969)
6. van Genderen (1969)
7. All available photoelectric photometry - Gascoigne (1969), Madore (1975) and Martin & Warren (1979). For cepheids in common, a mean is taken.
8. Photographic data presented here.
9. Data from 7 and 8 combined. Where cepheids are in common, the photoelectric data is preferred.
10. As for 1 above.
11. As for 2 above.
12. As for 3 above.
13. Hodge and Wright (1969).
14. Woolley et al (1962).
15. Connolly (1975).
16. As for 7 - data from Martin et al (1979) and also new observations of ten LMC cepheids, Martin (in preparation).
17. and 18. As in 8 and 9 above.

TABLE 3.41

P-L solutions (uncorrected for reddening)

<V> = a - b log P			SMC		<B> = c - d log P	
Source	a	b	log P	N	c	d
	se	se			se	se
1. Gasc.	17.73	2.88	< 2.0	25	17.99	2.57
2. But.	17.57±0.08	2.66±0.08			17.92±0.09	2.40±0.10
3. B + G	17.60	2.72		76	17.93±0.08	2.45±0.08
4. Arp	17.24±0.08	2.48±0.10		∿69	17.70±0.09	2.25±0.12
5. Arp (R)	17.60	2.74		∿69		
6. Van G	17.90±0.10	2.74±0.10		∿105	18.10±0.10	2.25±0.10
7. PE	17.58±0.09	2.69±0.08	< 2.0	52	17.80±0.12	2.30±0.11
8. WLM	17.64±0.05	2.72±0.05	< 2.0	135	17.79±0.06	2.32±0.07
9. WLM+PE	17.61±0.05	2.68±0.05	< 2.0	156	17.75±0.06	2.25±0.06
			LMC			
10. Gasc.	17.58	3.07	< 2.0	18	18.07	2.88
11. But.	17.36±0.07	2.70±0.08	< 2.0	60	17.69±0.09	2.28±0.11
12. B + G	17.46±0.06	2.87±0.07	< 2.0	75	17.85±0.08	2.54±0.09
13. H & W	17.82	3.05		19	18.28	2.80
14. W	17.22±0.06	2.94±0.07	< 2.0	13	17.86±0.06	2.85±0.07
15. C	17.17±0.04	2.58±0.05		∿100	17.57±0.05	2.19±0.06
16. PE	17.35±0.09	2.71±0.08	< 2.0	83	17.73±0.12	2.35±0.10
17. WLM	17.34±0.04	2.73±0.05	< 2.0	153	17.74±0.06	2.40±0.06
18. WLM+PE	17.29±0.04	2.66±0.04	< 2.0	190	17.68±0.05	2.30±0.06

An examination of Table 3.41 shows that if we consider only the work of Butler, Butler & Gascoigne, Arp (revised), van Genderen, the combined p.e. data and our photographic data, the respective V and B slopes of the P-L relationships are very much the same for each Magellanic Cloud and have values $\sim$ 2.7 and $\sim$ 2.3 respectively. The exceptions are the results by Gascoigne, Arp, Hodge and Wright, Woolley and Connolly.

The results by Gascoigne, Hodge and Wright and Woolley are clearly subject to considerable selection effects when the small number (N) of cepheids used in each sample is taken into account. To illustrate this point we plot in Fig. 3.41 the (LMC) values of $\langle V \rangle$ and log P according to Gascoigne's photometry. Superimposed on this plot are the outer limits (straight lines) of the equivalent plot taken from our data [see Fig. 3.22 (b)]. With the exception of two points all of Gascoigne's data are contained within these limits but appear to yield a much steeper P-L slope. Hence we feel justified in ignoring these data.

Arp's results have been shown here and elsewhere to be subject to considerable systematic error so we will henceforth eliminate these data from further discussion.

Connolly's results are (like our own) made up from three different regions (we shall call LMC I, II and III) and are all shown in Table 3.42.

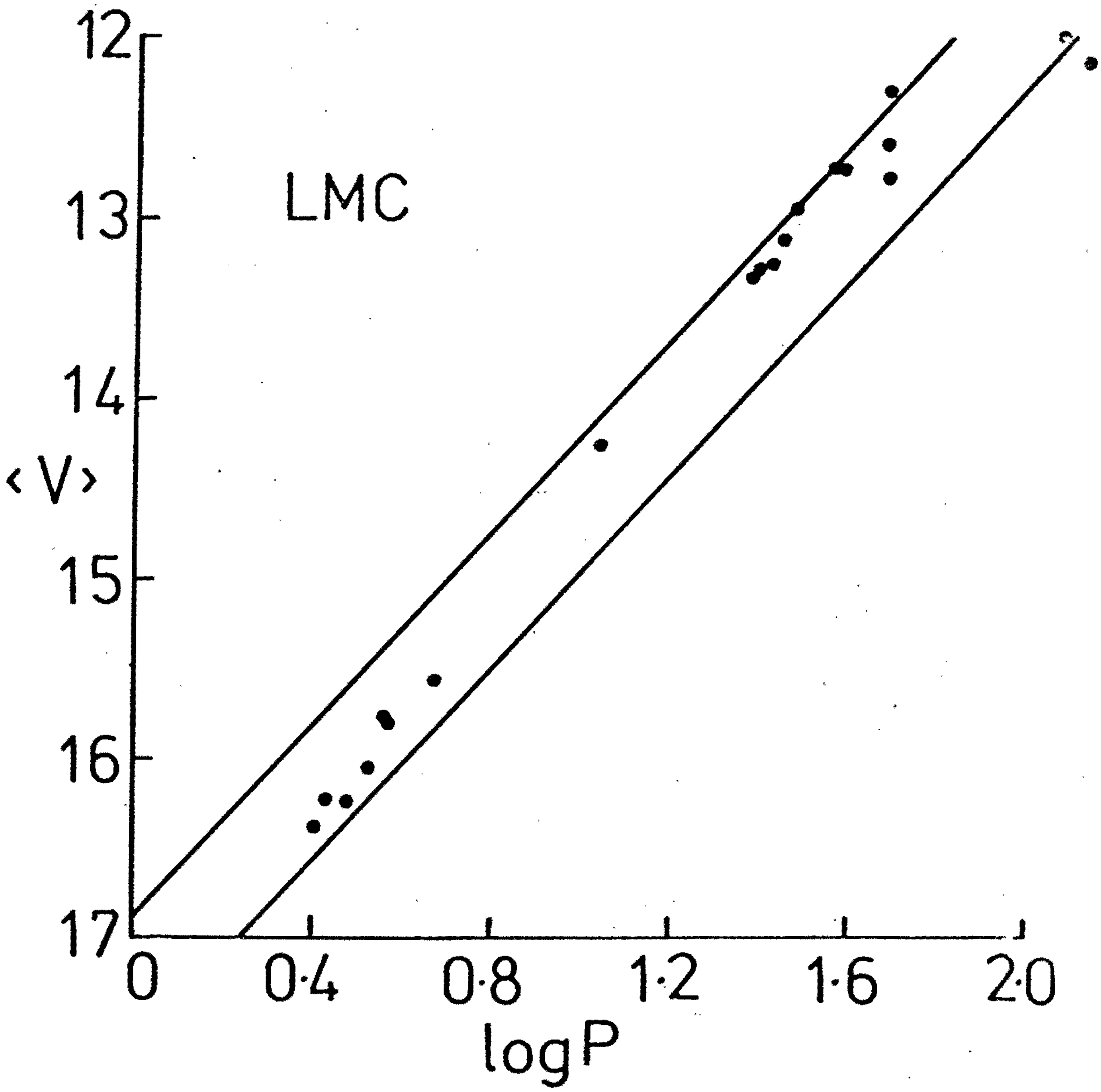
TABLE 3.42

Connolly's 3 LMC regions (P-L results)

	$\langle V \rangle$ = a-b log P				$\langle B \rangle$ = c-d log P			
Region	a	s.e (±)	b	s.e (±)	c	s.e (±)	d	s.e (±)
LMC I	17.18	0.05	2.65	0.08	17.63	0.06	2.35	0.09
LMC II	17.28	0.07	2.39	0.08	17.57	0.09	1.79	0.11
LMC III	17.18	0.09	2.68	0.10	17.57	0.10	2.30	0.11

Fig 3.41

Plot of <V> - log P for Gascoigne's photometry



It can be seen that both the <V> and <B> slopes of Connolly's LMC II P-L relationships are much flatter than his other two regions. In fact the results from regions I and III are in good agreement with each other and with our data. We saw in § 2.5 how Connolly's mean <V> and <B> magnitudes from his CT10 II data differed from ours (for stars in common) in the sense that he measured too faint by $\sim 0\overset{m}{.}2$ for $<V> \gtrsim 14^m$. This seems to be in the wrong sense to account for the flatter P-L slope he derives. It is probable however that with only 24 cepheids in his region II the discrepancies can be put down to selection effects.

If, for the reasons given above, we disregard the P-L solutions of Gascoigne, Arp, Hodge & Wright and Woolley, then from Table 3.41, the mean P-L relationships for each Magellanic Cloud become:

SMC $<\overline{V}> = 17.66 - 2.71 \log P$ $\quad$ $<\overline{B}> = 17.90 - 2.32 \log P$

$\pm 0.08, \pm 0.02$ $\quad$ $\pm 0.09, \pm 0.04$

(from solutions 2, 5, 6, 7, 8) $\quad$ (from solutions 2, 6, 7, 8)

LMC $<\overline{V}> = 17.31 - 2.68 \log P$ $\quad$ $<\overline{B}> = 17.68 - 2.31 \log P$

$\pm 0.04, \pm 0.03$ $\quad$ $\pm 0.05, \pm 0.06$

(from solutions 12, 15, 16, 17) $\quad$ (from solutions 12, 15, 16, 17)

The close agreement between the values of the respective B and V slopes suggests that, at least for these two galaxies, cepheids do indeed share the same properties in that they obey very similar P-L laws.

3.5 Period-colour, least squares results.

Butler (1976) has suggested that inspection of the coefficients in the relationship,

$$<B> - <V> = m(\log P - 1) + n$$

enables differences of zero point and slope between authors to be adjudged more easily. Hence, in Table 3.51 the least squares P-C relationship for the present data is compared with that from some of the work listed in Table 3.41.

TABLE 3.51

Least-squares P-C relationships (uncorrected for reddening)

$$\langle B\rangle - \langle V\rangle = m\,(\log P - 1) + n$$

Source	m	s.e (±)	n	s.e (±)	m	s.e (±)	n	s.e (±)
1. Gasc.	0.19		0.68		0.31		0.57	
2. But.	0.39	0.03	0.73	0.03	0.26	0.03	0.61	0.03
3. B & G	0.31	0.03	0.70	0.03	0.27	0.02	0.60	0.03
4. H & W	0.25		0.71					
5. W	0.09		0.73					
6. Arp					0.25		0.71	
7. Van G.					0.49		0.69	
8. PE	0.36	0.03	0.74	0.04	0.38	0.03	0.60	0.03
9. WLM	0.33	0.02	0.73	0.02	0.40	0.02	0.55	0.02
10. WLM+PE	0.36	0.02	0.74	0.02	0.43	0.02	0.58	0.02

If, as before, only those sources with a significant number of cepheids are considered, we can calculate mean P-C relationships as follows:

$$\text{LMC} \qquad \overline{\langle B\rangle - \langle V\rangle} = \underset{\pm 0.02}{0.36}\,(\log P - 1) + \underset{\pm 0.02}{0.73}$$

$$\text{SMC} \qquad \overline{\langle B\rangle - \langle V\rangle} = \underset{\pm 0.05}{0.38}\,(\log P - 1) + \underset{\pm 0.02}{0.61}$$

where the standard errors represent the differences between solutions. As in the case of the P - L relationships the slopes of these mean P - C relationships are very nearly the same for each Cloud. The zero points however indicate that, provided the reddening is much the same for each Cloud, the SMC cepehids are intrinsically bluer than those in the LMC by $\sim 0^{m}.1$.

3.6 Period-colour, abundance

In order to investigate this apparent colour difference between the Cloud cepheids, we plot in Fig.s 3.61 and 3.62, <B>-<V> against log P for the LMC and SMC cepheids respectively. It would appear at first sight that the spread in colour at any given period is $\sim 0^{m}.4$, i.e. that the instability strip is $\sim 0^{m}.4$ wide for cepheids in both Magellanic Clouds.

However, before proceding it is important to establish whether this spread in colour is genunine or whether it is due purely to errors in photometry. This may be done by comparing the standard deviation of (<B>-<V>) for a single cepheid from the least squares solution with the 'true' errors in photometry. These 'true' errors are difficult to ascertain, but we will define them as being the differences in (<B>-<V>) between the photographic data presented here and the photoelectric data from all other sources (see § 3.4 for references).

In Table 3.61 the cepheid standard deviations (derived from the P-C relationships given in Table 3.51, solution 9) for each Cloud are shown together with their respective standard errors, for two sets of data divided at log P = 0.8. The column marked E gives the 'true' error estimates for each group (a mean of the absolute value of the difference (pg-pe)) and N is the number of cepheids in common which led to this estimate. Also shown in this Table are the equivalent error estimates and standard deviations in the P-L plane using the V-log P relationships in Table 3.41 (solutions 8 and 17).

Fig 3.61

Period-colour plot for photographic and photoelectric LMC data

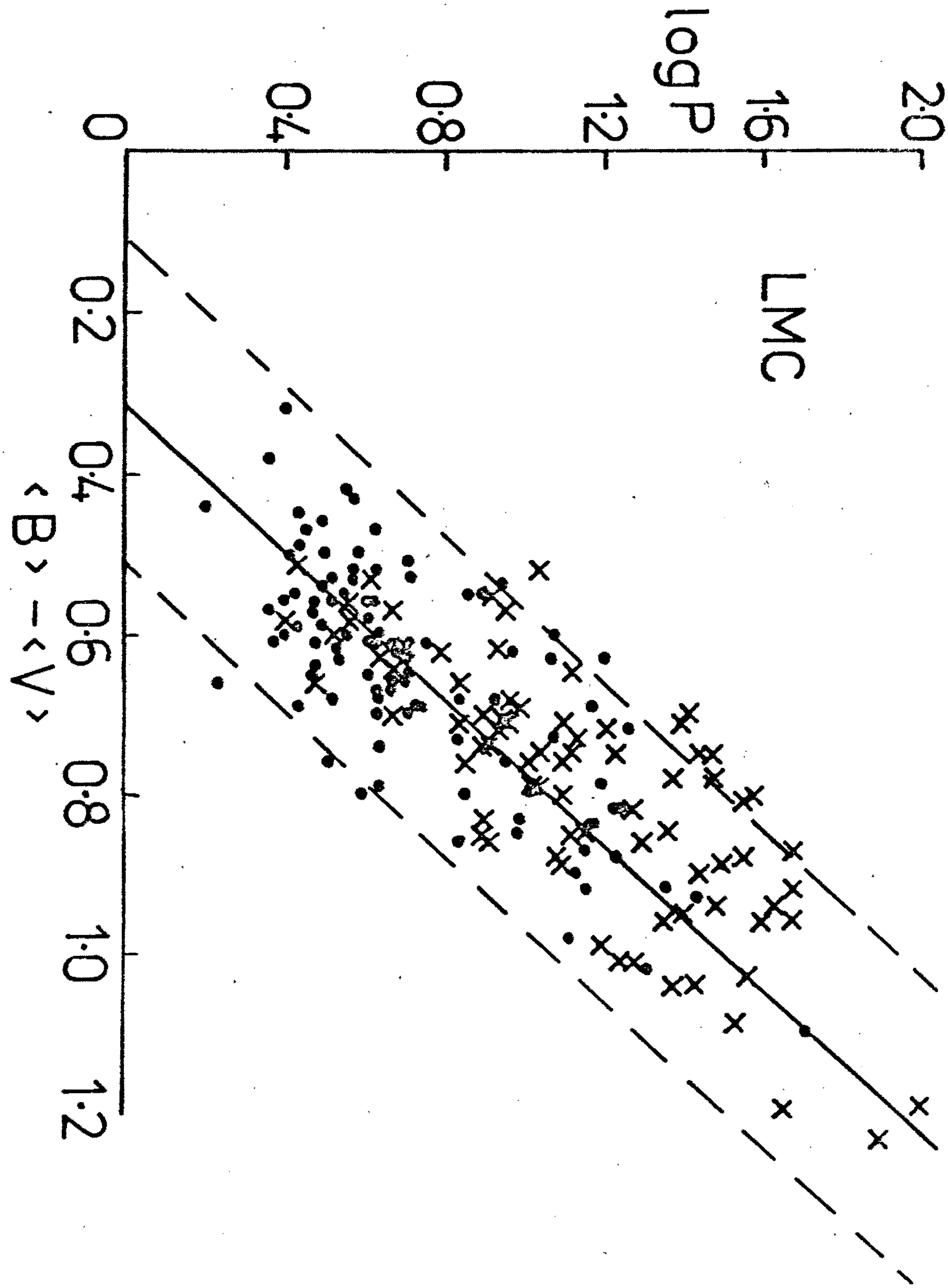


Fig 3.62

Period-colour plot for photographic and photoelectric SMC data

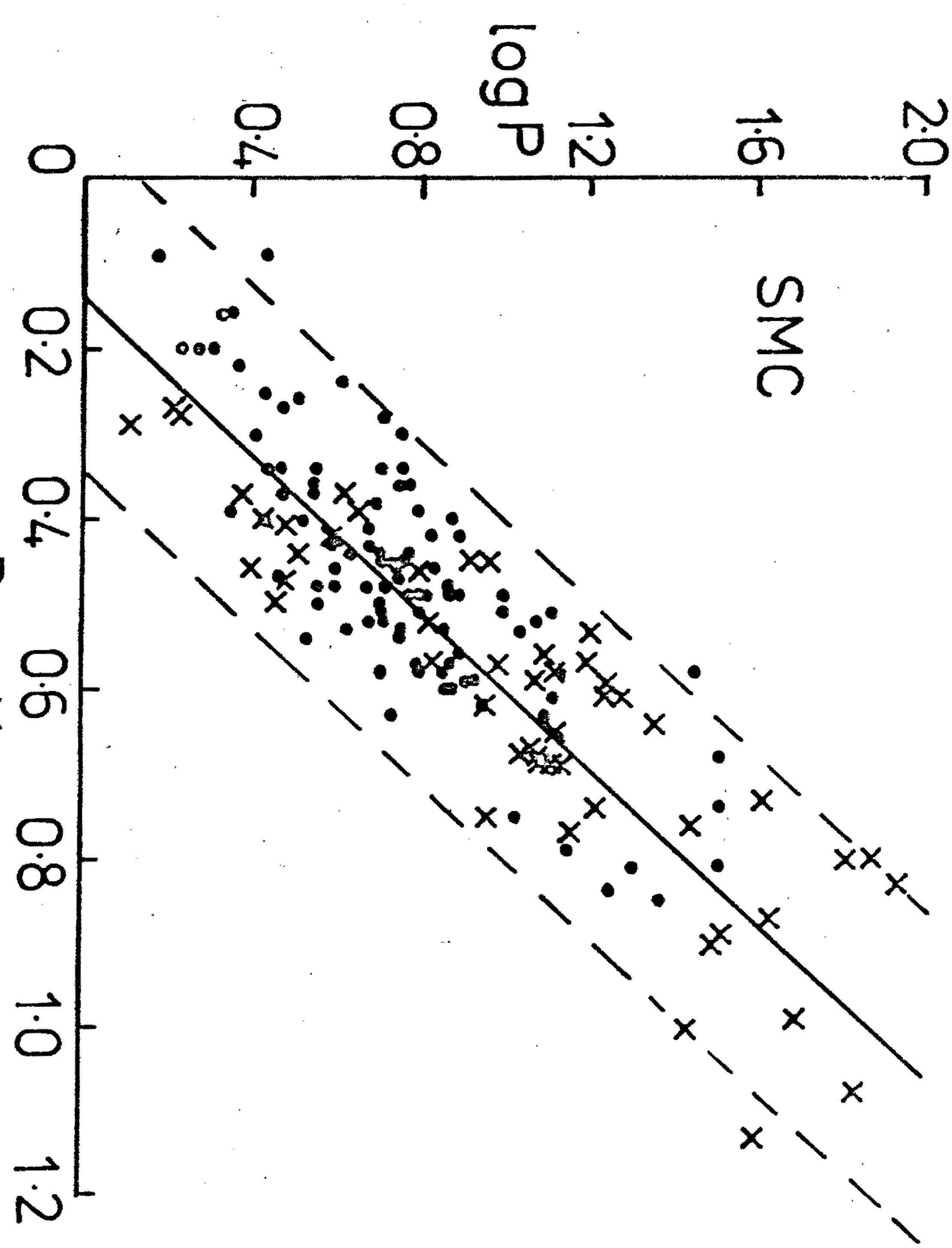


TABLE 3.61

A comparison of standard deviations and errors

P-C Plane

	log P < 0.8 S.D	E	N	log P > 0.8 S.D	E	N
SMC	0.09 ± 0.01	0.12 ± 0.02	9	0.09 ± 0.01	0.07 ± 0.01	27
LMC	0.08 ± 0.01	0.12 ± 0.02		0.10 ± 0.01	0.06 ± 0.01	48

P-L Plane

	S.D	E	N	S.D	E	N
SMC	0.21 ± 0.02	0.09 ± 0.02	9	0.24 ± 0.02	0.06 ± 0.01	27
LMC	0.18 ± 0.02	0.09 ± 0.02		0.25 ± 0.03	0.06 ± 0.01	48

As there are only nine (LMC and SMC) cepheids with common photographic and photoelectric photometry in the range log P < 0.8, any conclusions pertaining to this period range will be somewhat tentative. It is evident, however, that in the P-L plane the errors in photometry (for cepheids in both Magellanic Clouds) are much less than their respective standard deviations for both ranges in period. This suggests that the total spread in <V> in the P-L plane which is about $0^m.5$ for each Cloud (or ∿ 2 standard deviations) is genuine. In the P-C plane (for both SMC and LMC cepheids) the results suggest that the spread in <B>-<V> colour in the range log P < 0.8 is not genuine and represents random scatter in the observations. In the range log P > 0.8 however the spread in colour seems to be genuine although the results for the SMC are barely significant.

To clarify the problem we have superimposed on the log P - (<B>-<V>) plots in Figs. 3.61 and 3.62 the equivalent photoelectric data (crosses) obtained from all sources (see § 3.4). It can be seen from these plots that the larger photographic sample tends to fill in the gaps left by the photoelectric data and whilst the width of the instability strip may be a little less than that suggested by the photographic data, a value of $\sim 0^m.35$ is a reasonably good estimate for the spread in colour at any given period.

In addition Martin et al (1979) have shown from BVI photometry of LMC cepheids that only a small fraction ($\sim 0^m.04$) of the total colour spread ($\sim 0^m.35$) that they found was attributable to differential reddening so that most of the spread was intrinsic. Consequently we have assumed that cepheids in both Magellanic Clouds propulate an instability strip of between $0^m.3$ and $0^m.4$.

Returning to Figs. 3.61 and 3.62 we further note that:-

(a) There is a bunching of the short period cepheids which gives rise to an apparent discontinuity at log P $\sim$ 0.8, at least for the LMC data. This effect has also been noted by Butler (1976, 1978) for both LMC and SMC cepheids and is thought to be due to the limited penetration into the instability strip of the evolutionary tracks of the shorter period cepheids.

(b) A band of width $\sim 0^m.4$ in (<B>-<V>) centred on the intrinsic P-C relationship for cepheids in the galaxy:

$$(\langle B\rangle - \langle V\rangle)_o = 0.46 \log P + 0.27$$ - from Dean et al (1978)

would fit the LMC data rather well.

If however a similar procedure were followed for the SMC data, the band would be found to lie $\sim 0^m.13$ too far towards the blue. Since the data in Figs. 3.61 and 3.62 have not been corrected for reddening, both the LMC and SMC cepheids must be intrinsically bluer than those in the galaxy. In Figs 3.61 and 3.62 the galactic relationship (solid line) and bands $0^m.4$ wide (dashed lines) are shown shifted by $0^m.04$ to the red and $0^m.13$ to the blue for the LMC and SMC respectively.

Bell and Parsons (1974) have made theoretical calculations of the effect of changes in (B - V) with abundance for stars that may be compared with cepheids. They predict that a star which is four times more metal deficient than normal is likely to have a value of (B - V) which is $\sim 0^m.17$

bluer than one with normal composition [at $(B - V) \sim 0^m.8$].

If we assume a value of $0^m.04$ for the (E_{B-V}) reddening of LMC cepheids (see Martin et al, 1979) and for convenience adopt the same value for SMC cepheids, the LMC and SMC cepheids become intrinsically $0^m.04$ and $0^m.17$ bluer, respectively, than those in the galaxy. Using Bell and Parsons' calculations these differences in (B - V) correspond to metal deficiences (compared with the galaxy) of factors of 1.4 and 4.0 for the LMC and SMC cepheids respectively; values which agree well with results by Pagel et al (1978) and Butler (1978).

Another parameter which has been used (see e.g. van den Bergh, 1967) to define metal abundance is Q, which is defined as:-

$$Q = (U - B) - \phi\ (B - V).$$

Q was devised to be independent of reddening and consequently ϕ was chosen to be 0.72. Racine (1973) however has shown from the integrated colours of globular clusters that Q is <u>not</u> completely free from reddening and that ϕ increases with increasing intrinsic (B - V) colour.

We have, nevertheless, computed mean values of Q for cepheids in the galaxy and the Magellanic Clouds where Q in this case is defined by the relationship:-

$$Q = (\langle U\rangle - \langle B\rangle) - \phi\ (\langle B\rangle - \langle V\rangle)$$

and $\phi = 0.72$

Using the collected photoelectric data of Schaltenbrand and Tammann (1971) for galactic cepheids and data by Madore (1975) and Martin and Warren (1979) for Magellanic Cloud cepheids we find:-

$$Q_{GAL} = +0.002 \pm 0.001 \text{ (s.e.) (207 cepheids)}$$

Q_{LMC} = -0.01 ±0.02 (23 cepheids)

Q_{SMC} = -0.08 ±0.02 (16 cepheids)

Whilst the Magellanic Cloud data are rather sparse the results indicate that at least for the SMC cepheids, the metal deficiency compared with that of the Galaxy, is in the same sense (and roughly the same magnitude as that found from the <B> - <V> colours alone. It should be noted that the effect of using a higher value of ϕ for the intrinsically redder (longer period) cepheids (as would be required by Racine) would make the values of Q smaller for the LMC and SMC cepheids where the proportion of longer period cepheids, in these samples, is larger. Hence, compared with the galaxy, the Magellanic Cloud cepheids would appear even more metal deficient than the values given here.

3.7 Period-luminosity-colour

Sandage and Tammann (1968, 1969) using the combined data from cepheids in four galaxies derived a semi-empirical P-L-C relationship:-

$$M^{\circ}_{<V>} = -3.425 \log P + 2.52 \, (B - V)_o - 2.459 \tag{3.71}$$

based on the transformations:-

$$M_{bol} = M_v + 0.145 - 0.322 \, (B - V)$$
$$\log T_e = 3.886 - 0.175 \, (B - V)$$
$$\log L/_{L\odot} = 0.4 \, (4.77 - M_{bol})$$

Expression 3.71 was slightly changed in a rediscussion by Tammann (1970) to:-

$$M^{\circ}_{v} = -3.534 \log P + 2.647 \, (B - V)_o - 2.469 \tag{3,72}$$

Gascoigne (1974) using models derived by Iben and Tuggle (1970) and Bell and Parsons (1972) showed how the P-L-C relationship was dependent on metal abundance (Z):-

$$\text{for } Z = 0.02 \quad M_v = -3.64 \log P + 2.55\,(B - V)_o - 2.60 \qquad (3.73)$$

$$\text{for } Z = 0.005 \quad M_v = -3.64 \log P + 3.14\,(B - V)_o - 2.51 \qquad (3.74)$$

using the transformations:-

$$\text{for } Z = 0.02, \ \log T_e = 3.886 - 0.175\,(B - V) \qquad (3.75)$$

$$\text{for } Z = 0.005, \log T_e = 3.887 - 0.222\,(B - V) \qquad (3.76)$$

Iben and Tuggle (1975), again employing semi-empirical arguments find :-

$$\text{for } Z = 0.02 \quad Y = 0.28 \quad M_v = -3.64 \log P + 2.63(\langle B\rangle-\langle V\rangle)-2.77 \qquad (3.77)$$

$$Z = 0.01 \quad Y = 0.29 \quad M_v = -3.71 \log P + 2.70(\langle B\rangle-\langle V\rangle)-2.50 \qquad (3.78)$$

$$Z = 0.005 \quad Y \sim 0.29 \quad M_v = -3.76 \log P + 2.75(\langle B\rangle-\langle V\rangle)-2.37 \qquad (3.79)$$

using the transformation given in 3.75.

From these results, it would appear that the colour coefficient in a P-L-C relationship for cepheids takes on values of $\sim$ 2.6 for Z = 0.02, $\sim$2.7 for Z = 0.01 and $\sim$ 3.1 for Z = 0.005. As we have seen in the previous section these abundances are appropriate for cepheids in the galaxy, the LMC and the SMC respectively.

On the observational side, however, the evidence is somewhat conflicting. Table 3.71 summarizes the P-L-C relationships in the Magellanic Clouds derived from the photoelectric work of Gascoigne (1969) (= G), all available pe data (= PE) and the photographic work of Butler (1976, 1978) (= B), Connolly (1975) (= C), this work (= WLM) and this work plus all pe data (= WLM + PE). The results are presented in the form:-

TABLE 3.71

P-L-C Solutions

$$\langle V\rangle = \alpha \log P + \beta(\langle B\rangle - \langle V\rangle) + \gamma$$

	LMC					SMC			
Source	α	β	γ	N	Range log P	α	β	γ	N
1. G(a)*	-3.609	2.52	16.40	18	<2	-3.609	2.52	17.03	25
2. B(a)	-3.39	1.82	16.71	57	<2	-3.18	1.76	17.02	59
	±0.11	±0.24	±0.10			±0.12	±0.34	±0.13	
3. C(a)	-2.80	0.55	16.94	∿100	<2				
	±0.06	±0.13	±0.07						
4. C(a)	-2.24	-0.22	17.17	∿70	<0.8				
	±0.21	±0.16	±0.12						
5. C(a)	-2.98	0.96	16.68	∿30	>0.8				
	±0.12	±0.19	±0.15						
6. PE(a)	-3.42	1.98	16.59	83	<2	-3.46	2.01	17.14	52
	±0.08	±0.17	±0.08			±0.11	±0.26	±0.09	
7. PE(b)	-3.79	3.03	16.19	83	<2	-4.05	3.54	16.80	52
8. PE(a)	-3.09	1.39	16.70	40	<1.1	-3.20	1.54	17.19	25
	±0.15	±0.29	±0.16			±0.23	±0.55	±0.16	
9. PE(b)	-3.72	3.45	15.82	40	<1.1	-4.70	5.64	16.23	25
10. PE(a)	-3.85	2.28	16.95	43	>1.1	-3.65	2.20	17.27	27
	±0.11	±0.17	±0.15			±0.18	±0.29	±0.19	
11. PE(b)	-4.04	2.76	16.79	43	>1.1	-4.02	3.05	17.15	27
12. WLM(a)	-3.05	0.98	16.94	153	<2	-3.06	0.84	17.52	135
	±0.07	±0.17	±0.08			±0.09	±0.20	±0.06	
13. WLM(b)	-4.31	4.84	15.38	153	<2	-5.45	6.75	16.65	135
14. WLM(a)	-2.90	0.67	17.04	108	<1.1	-3.01	0.58	17.59	101
	±0.10	±0.19	±0.10			±0.15	±0.25	±0.08	
15. WLM(b)	-4.37	5.88	14.79	108	<1.1	-7.25	9.94	16.52	101
16. WLM(a)	-3.41	1.51	16.98	45	>1.1	-3.43	1.29	17.75	34
	±0.19	±0.31	±0.26			±0.21	±0.35	±0.22	
17. WLM(b)	-4.23	4.05	15.93	45	>1.1	-4.45	3.93	17.32	34
18. WLM+PE(a)	-3.14	1.35	16.77	190	<2	-3.17	1.12	17.44	156
	±0.06	±0.14	±0.06			±0.09	±0.18	±0.05	
19. WLM+PE(b)	-4.02	3.82	15.82	190	<2	-5.01	5.39	16.82	156
20. WLM+PE(a)	-2.95	0.85	16.95			-3.03	0.69	17.53	115
	±0.09	±0.17	±0.09	130	<1.1	±0.14	±0.23	±0.07	
21. WLM+PE(b)	-4.13	4.78	15.29	130	<1.1	-6.57	8.66	16.44	115
22. WLM+PE(a)	-3.67	2.02	16.91	60	>1.1	-3.50	1.76	17.45	41
	±0.14	±0.21	±0.18			±0.17	±0.28	±0.19	
23. WLM+PE(b)	-4.09	3.19	16.46	60	>1.1	-4.09	3.25	17.16	41

* Gascoigne contrained the coefficient of β to Sandage & Tammann's value of 2.52.

$$\langle V \rangle = \alpha \log P + \beta(\langle B \rangle - \langle V \rangle) + \gamma$$

Also shown in the Table are the standard errors for each solution, the ranges in P used and the number of cepheids (N) in each sample. Solutions marked (a) and (b) are those determined by least squares and maximum likelihood techniques respectively. It should be noted here that the method of maximum likelihood (as described, eg by Kendall and Stuart, 1967) should in principle give more meaningful results since, unlike the method of least squares, the errors of all of the observable parameters are taken into account.

In this case we have taken the errors in $\langle V \rangle$, log P and $(\langle B \rangle - \langle V \rangle)$ as 0.1, 0.001 and 0.14 respectively. The errors in B and V have been taken from the comparisons with photoelectric photometry made in Chapter 2 and the error in log P is a nominal value, the exact value of which is not vital as it is in any case so much smaller than the remaining errors. It is because the error in log P is relatively so small that the P-L and P-C solutions derived by least squares techniques are the same as those derived by maximum liklihood methods. The equivalent errors for the photo-electric data alone (solutions 8-11) have been assumed to be 0.03, 0.001 and 0.04 respectively which correspond to differences in photometry of cepheids measured in common by various authors.

To show how the coefficients in a P-L-C relationship change with the errors adopted, we have in Table 3.72 recomputed the (photographic) SMC solutions with different errors in $V(e_1)$ and $(\langle B \rangle - \langle V \rangle)$ (e_3) but kept the error in log P (e_2) the same at 0.001.

As Table 3.72 shows, there is very little difference between these three solutions. However, the fourth solution shows the effect of taking 6 cepheids (2 short, 2 intermediate and 2 long period) at random out of the total sample and it is clear that the coefficients (especially in β) have

TABLE 3.72

Maximum liklihood solutions with different values of e_1, e_2, e_3

e_1	e_2	e_3	α	β	γ	N
0.05	0.001	0.07	-5.45	6.74	16.65	135
0.10	0.001	0.14	-5.45	6.75	16.65	135
0.15	0.001	0.20	-5.42	6.69	16.66	135
0.10	0.001	0.14	-5.36	6.40	16.76	129

changed quite significantly. These tests and others that have been done for both P-L-C and P-L-A relationships indicate that whilst maximum liklihood methods are in general to be preferred over least squares techniques, if the correlation between say P, L and C is a weak one (either because the correlation is genuinely not a strong one or because the correlation appears to be weak through inaccurate photometry or small sample size) then the coefficients so derived become less reliable. In fact is has been discovered (empirically) that as the correlation becomes weaker so the absolute values of the coefficients become larger in log P and (B-V) and smaller in V until a point is reached where the coefficients cease to have meaning, ie there is no correlation between all 3 parameters.

Bearing this in mind we now examine the results in Table 3.71 and find:-

(a) For the whole period range (log P <2), all least squares solutions for both LMC and SMC cepheids yield much smaller values of the colour coefficient (β) than the theoretically predicted values of $\sim$ 2.7 for the LMC and $\sim$ 3.0 for the SMC. [See solutions 2,3,6,12,18.]

(b) In addition, when the various samples are divided into two groups at log P $\sim$ 1, all the least squares solutions consistently show that the shorter period cepheids prefer a smaller value of β than the longer period cepheids. Connolly (1975) and Butler (1978) found a similar trend.

(c) The maximum liklihood solutions, however, paint a very different picture. For the whole period range (log P <2) the values of β are in general <u>higher</u> than those predicted theoretically (and are higher for the SMC cepheids than for those in the LMC, as required by theory - see solutions 7, 13 and 19) and also there is now no suggestion that the values of β for the shorter period cepheids are any different from those of longer period.

In view of what we stated earlier about the limitations of both types of solution it would seem that the 'true' solution lies somewhere between a least squares and a maximum liklihood solution. Consequently in Table 3.73 we have calculated mean values of α, β and γ for each Magellanic Cloud from what we have deemed to be the 'best' least squares and maximum liklihood solutions, ie (i) all photoelectric data (chosen for accuracy of photometry-solutions 6,7) and (ii) the combined photoelectric and photographic data (chosen for largest sample size - solutions 18 and 19).

TABLE 3.73

Mean P-L-C coefficients from least squares and maximum liklihood solutions in the range log P <2.

	LMC				SMC			
Source	α	β	γ	N	α	β	γ	N
PE(a)	-3.42	1.98	16.59	83	-3.46	2.01	17.14	52
PE(b)	-3.79	3.03	16.19	83	-4.05	3.54	16.80	52
Mean	-3.61	2.51	16.39		-3.76	2.78	16.97	
WLM+PE(a)	-3.14	1.35	16.77	190	-3.17	1.12	17.44	156
WLM+PE(b)	-4.02	3.82	15.82	190	-5.01	5.39	16.82	156
Mean	-3.58	2.58	16.30		-4.09	3.25	17.13	
Overall Mean	-3.59	2.55	16.34		-3.92	3.02	17.05	

Table 3.73 shows that the overall mean values of β for the LMC (2.55) and the SMC (3.02) are very close (perhaps fortuitously) to the predicted theoretical values of $\sim$ 2.7 and $\sim$3.0 respectively.

Although it now seems likely that a P-L-C relationship in some form, exists for the Magellanic Cloud cepheids, a final test may be made by seeing how well the various P-L and P-L-C relationships fit the observational data. In Table 3.74 the standard deviations of $\langle V \rangle$ for a single cepheid from each of the P-L and P-L-C solutions given below have been calculated.

<u>Photoelectric data alone</u>

Solution (a)	LMC	$\langle V \rangle = 17.35 - 2.71 \log P$;
	SMC	$\langle V \rangle = 17.58 - 2.69 \log P$
Solution (b)	LMC	$\langle V \rangle = 16.59 - 3.42 \log P + 1.98\,(B-V)$;
	SMC	$\langle V \rangle = 17.14 - 3.46 \log P + 2.01\,(B-V)$
Solution (c)	LMC	$\langle V \rangle = 16.19 - 3.79 \log P + 3.03\,(B-V)$;
	SMC	$\langle V \rangle = 16.80 - 4.05 \log P + 3.54\,(B-V)$

<u>Photographic + photoelectric data</u>

Solution (d),	LMC	$\langle V \rangle = 17.29 - 2.66 \log P$
(e), (f)	SMC	$\langle V \rangle = 17.61 - 2.68 \log P$
Solution (g),	LMC	$\langle V \rangle = 16.34 - 3.59 \log P + 2.55\,(B-V)$;
(h), (i)	SMC	$\langle V \rangle = 17.05 - 3.92 \log P + 3.02\,(B-V)$

Table 3.74 shows that, for the photoelectric data alone, a P-L-C relationship provides a much better fit to the observational data (over all periods) then a simple P-L relationship, for both LMC and SMC cepheids. In addition it would appear that the (P-L-C) least squares fit is as good as the maximum liklihood fit.

From the combined (WLM+PE) data it would at first appear that for

TABLE 3.74

Standard deviation (σ) of $\langle V \rangle$ for a single cepheid

	Soln.	From Table	LMC σ	LMC s.e ($\pm$)	Range log P	SMC σ	SMC s.e ($\pm$)
PE	(a) P-L	3.41	0.25	0.02	<2	0.26	0.02
PE	(b) P-L-C	3.71	0.14	0.01	<2	0.17	0.01
PE	(c) P-L-C	3.71	0.15	0.02	<2	0.20	0.02
WLM +PE	(d) P-L	3.41	0.22	0.02	<2	0.23	0.02
WLM +PE	(e) P-L	3.41	0.18	0.02	<1.1	0.21	0.02
WLM +PE	(f) P-L	3.41	0.29	0.02	>1.1	0.28	0.02
WLM +PE	(g) P-L-C	3.73	0.21	0.02	<2	0.29	0.03
WLM +PE	(h) P-L-C	3.73	0.22	0.02	<1.1	0.29	0.03
WLM +PE	(i) P-L-C	3.73	0.18	0.02	>1.1	0.22	0.02

the whole range (log P <2) there is little to choose between a P-L and a P-L-C relationship for the LMC cepheids and for those of the SMC, a P-L relationship provides the better fit to the data. If however the sample is divided into two groups at log P = 1.1, it is clear that the shorter period LMC and SMC cepheids (which constitutes $\sim$ 70% of the data) prefer a P-L relationship whereas the longer period cepheids are best satisfied with the (mean) P-L-C relationship.

These results suggest that either (a) the shorter period cepheids obey quite a different P-L-C relationship (i.e. one in which β is small) from those of longer period (where β = 2.7 -3.0) or (b) there is a smoothly varying colour correlation which becomes stronger with increasing period or (c) the photographic photometry is not sufficiently accurate to detect a colour correlation in the fainter (shorter period) cepheids. From a theoretical point of view it might prove difficult to construct models which would account for points (a) and (b) mentioned above and it also seems unlikely, in view of the conclusions reached by Martin et al (1979), that differential reddening plays any part in explaining these points.

It was seen in § 3.6 that the spread in colour for the shorter period cepheids was probably not genuine and this together with the arguments presented above lead us to conclude that the photographic colours of these cepheids (particularly in the SMC) have not been determined with sufficient accuracy. The problem concerning the existence or otherwise of a P-L-C relationship for the short period cepheids can not therefore be definitively resolved until a lot more photoelectric data become available.

3.8. Period, luminosity, colour and amplitude relationships

Sandage and Tammann (1971), using the combined data from four galaxies (M31, SMC, LMC and our galaxy) have suggested that for cepheids in the ranges $0.4 < \log P < 0.86$ and $\log P > 1.3$, those with largest amplitudes tend to fall towards the blue edge of the instability strip. For cepheids in the range $0.86 < \log P < 1.3$ the trend may be reversed. Madore (1976) on the other hand has shown how, using Fernie's (1970) galactic cepheid results, an exactly opposite conclusion may be reached, namely, that cepheids of large amplitude fall towards the red side of the strip.

In the absence of any definitive theoretical or semi-empirical models predicting the position of cepheids with different amplitudes in the instability strip, we have, following Sandage and Tammann (1971), used Kraft's (1960) amplitude parameter in order to compare our results with those of Sandage and Tammann.

Kraft's amplitude parameter, f_B, is defined as:-

$$f_B = 10^{0.4\Delta A_B},$$

where ΔA_B is the amplitude deficiency $A_B - A_B$ (max) measured from the upper envelope of the log P - A_B diagram defined originally by Schaltenbrand and Tammann (1970). The period ranges used by Sandage and Tammann were chosen to be periods at which this envelope has discontinuities in slope. Since we have a more complete sample of Magellanic Cloud cepheids we have redefined this envelope and the period ranges to fit both the SMC and LMC data. Figures 3.81 and 3.82 show the log P - A_B plots (for the combined photographic and photoelectric data) together with the newly defined envelopes. The new period ranges are 0.4 $<$log P $<$0.96, 0.96 $<$log P $<$ 1.48 and log P $>$ 1.48. Although these ranges are slightly different from those used by Sandage and Tammann, the predicted trend, if present, should be evident in the results.

Values of f_B for each cepheid were determined and are listed with the rest of the light curve parameters in Tables 2.42 and 2.43. Least squares (a) and maximum likelihood (b) solutions for the P-L-A relationships determined from all photoelectric data (PE), photographic combined with all photoelectric (WLM+PE), photographic alone (WLM) and Bulter's (1976) SMC data (B) are given in Table 3.81, for each of the three period ranges. The solutions each take the form:-

$$\langle B \rangle = a \log P + b f_B + c$$

and the errors for the maximum liklihood solutions have, for the photographic work, been taken as 0.1, 0.001 and 0.1 in $\langle B \rangle$, log P and f_B respectively and for the photoelectric data; 0.03, 0.001 and 0.03 respectively.

The results from Table 3.81 indicate that for the LMC cepheids, with the possible exception of the intermediate group, there is no discernable correlation of amplitude with period and luminosity for any of the three period ranges considered. Butler (1978) and Connolly (1975) arrive at a similar conclusion.

Fig 3.81

log P - A_B plot for combined photographic and photoelectric data (SMC)

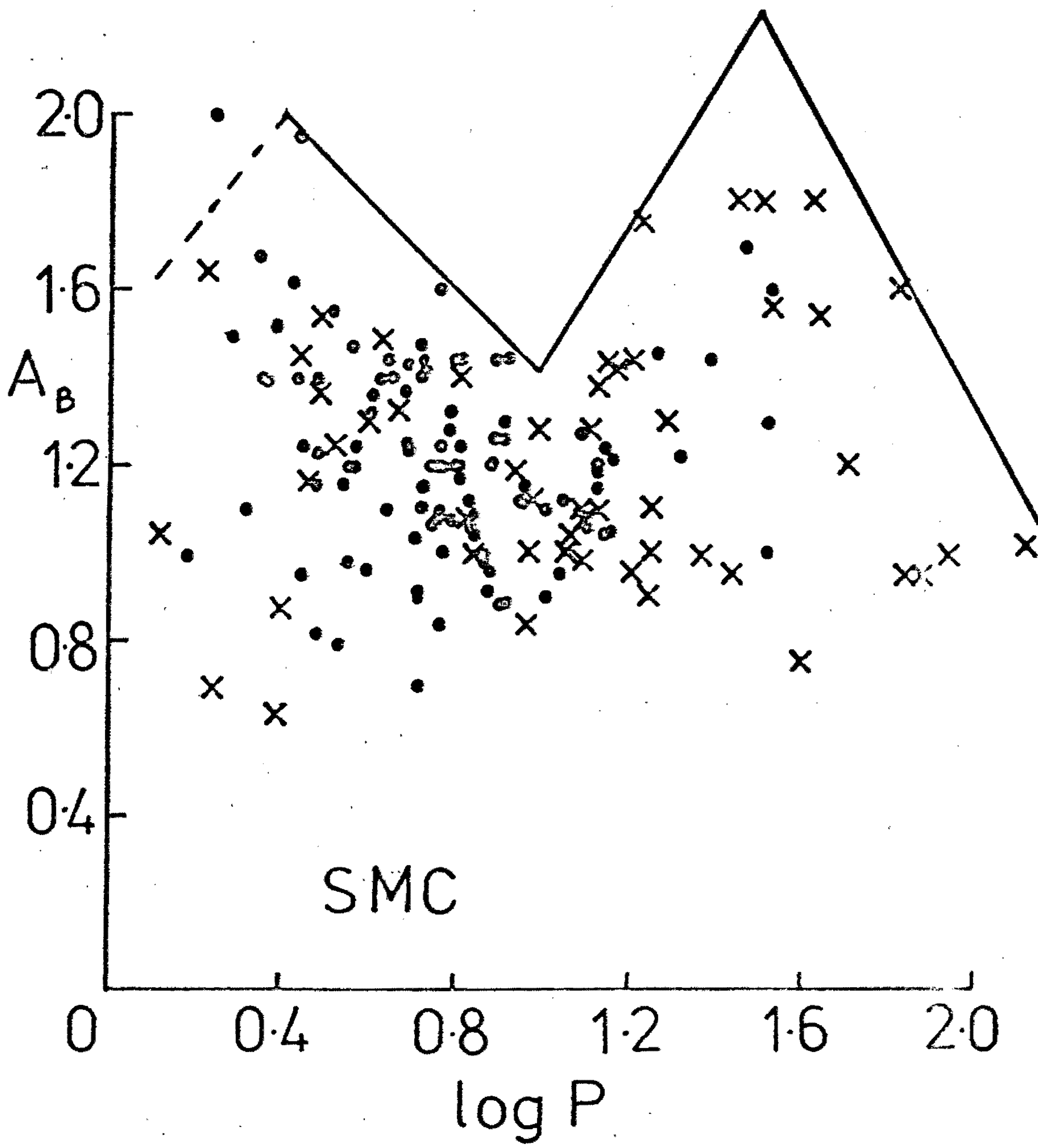


Fig 3.82

log P - A_B plot for combined photographic and photoelectric data (LMC)

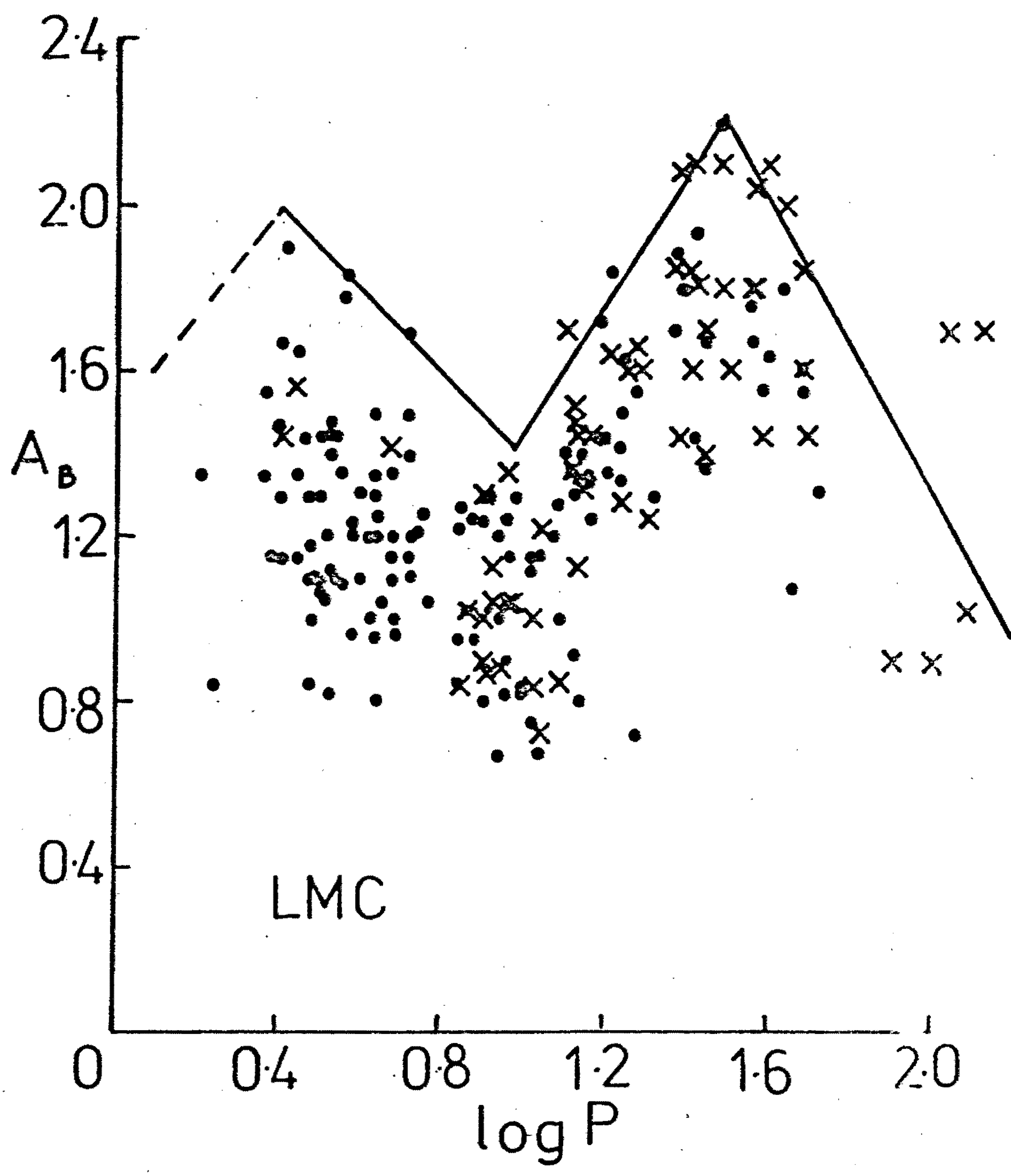


TABLE 3.81

P-L-A relationships for Cloud cepheids

$$\langle B \rangle = a \log P + b f_B + c$$

	Source	LMC a	LMC b	LMC c	LMC N	SMC a	SMC b	SMC c	SMC N
				$0.4 < \log P \leqslant 0.9$					
1.	B (a)	-	-	-	-	-2.37	-0.81	18.49	31
						±0.26	±0.26	±0.26	
2.	B* (a)	-	-	-	-	-2.46	-1.406	18.97	31
						±0.27		±0.18	
3.	PE (a)	-2.38	0.13	17.65	13	-2.52	-1.50	19.20	13
		±0.43	±0.60	±0.67		±0.22	±0.39	±0.37	
4.	PE (b)	3.4	20.0	-1.8	13	-2.56	-2.30	19.88	13
5.	WLM (a)	-2.35	-0.15	17.81	88	-2.21	-0.79	18.24	81
		±0.15	±0.16	±0.12		±0.18	±0.19	±0.14	
6.	WLM (b)	0.2	-9.0	21.8	88	-1.31	-3.42	19.31	81
7.	WLM+PE (a)	-2.31	-0.08	17.74	90	-2.34	-0.64	18.26	89
		±0.15	±0.16	±0.13		±0.16	±0.16	±0.14	
8.	WLM+PE (b)	1.5	-17.2	26.3	90	-1.88	-2.94	19.49	89
				$0.96 < \log P < 1.48$					
9.	PE (a)	-2.64	-0.45	18.47	30	-2.20	0.60	17.22	20
		±0.45	±0.42	±0.63		±0.64	±0.56	±0.87	
10.	PE (b)	-2.24	-8.90	24.56	30	-1.4	8.3	10.8	20
11.	WLM (a)	-2.29	-0.66	18.08	46	-2.13	-0.27	17.74	35
		±0.35	±0.35	±0.50		±0.57	±0.58	±0.91	
12.	WLM (b)	-2.76	-7.19	23.14	46	-22	-36	63	35
13.	WLM+PE (a)	-2.24	-0.64	18.10	53	-1.72	0.19	17.00	41
		±0.34	±0.28	±0.46		±0.48	±0.47	±0.74	
14.	WLM+PE (b)	-2.26	-5.59	21.78	53	15	38	-27	41
				$\log P > 1.48$					
15.	B (a)	-	-	-	-	-3.77	-0.36	20.39	11
						±0.58	±0.50	±0.83	
16.	PE (a)	-1.25	0.34	15.56	17	-3.30	-1.37	20.46	10
		±0.36	±0.32	±0.62		±0.59	±0.86	±1.20	
17.	PE (b)	-1.78	2.13	14.95	17	-3.32	-4.64	22.73	10
18.	WLM (a)	-2.07	-1.16	17.90	13	-2.61	-1.63	19.18	11
		±0.83	±0.76	±1.66		±0.49	±0.58	±0.71	
19.	WLM (b)	-4.24	-5.50	24.37	13	-2.05	-2.98	19.01	11
20.	WLM+PE (a)	-1.76	-0.10	16.72	15	-3.55	-1.02	20.53	13
		±0.68	±0.50	±1.33		±0.63	±0.55	±1.02	
21.	WLM+PE (b)	-15	-22	55	15	-2.84	-3.33	20.72	13

* coefficient of f_B constrained to -1.406.

The P-L-A relationship derived by Sandage and Tammann for the range $0.4 < \log P < 0.86$ is:-

$$M_B^O = -2.386 \log P - 1.406 f_B - 0.205$$

(where the constant term is derived from Galactic cepheids)

and Butler (1976) constraining the coefficient of f_B to Sandage and Tammann's value of -1.406 found for cepheids in the SMC:-

$$\langle B \rangle = \underset{\pm 0.27}{-2.46} \log P - 1.406 f_B + \underset{\pm 0.18}{18.97} \quad (0.4 < \log P < 0.9)$$

If we again take a mean value of the least squares and maximum likelihood solutions (solutions 3,4,7,8 in Table 3.81) we find for the SMC:-

$$\langle B \rangle = \underset{\pm 0.16}{-2.33} \log P \underset{\pm 0.50}{-1.84} f_B + \underset{\pm 0.35}{19.20} \quad (0.4 < \log P < 0.96)$$

(where the standard errors quoted represent the scatter about the mean solution).

which confirms the trend found by Sandage and Tammann and by Butler, i.e. that for the short period group, there is a tendency for the largest amplitude cepheids to be brighter than average for their period.

For the intermediate group ($0.96 < \log P < 1.48$) there appears to be no correlation of amplitude with period and luminosity, for the SMC cepheids.

The long period group ($\log P > 1.48$) yield a mean P-L-A relationship (from solutions 16,17,20,21) for the SMC:-

$$\langle B \rangle = -3.25 \log P - 2.59\, f_B + 21.11$$
$$\pm 0.15 \qquad \pm 0.85 \qquad \pm 0.54$$

where the standard errors tend to be larger due to the fact that there are very few ($\sim$12) cepheids in this period range.

The equivalent relationships by Butler are:-

$$\langle B \rangle = -3.77 \log P - 0.36\, f_B + 20.39 \qquad (1.4 < \log P < 2.0)$$
$$\pm 0.58 \qquad \pm 0.50 \qquad \pm 0.83$$

and
$$\langle B \rangle = -3.46 \log P - 0.91\, f_B + 20.22$$
$$\pm 0.51 \qquad\qquad \pm 0.83$$

(where the second expression has the coefficient in f_B constrained to a value determined from a study of the residuals from a P-L relationship and f_B).

The most that can be said about the long period group of SMC cepheids is that it appears to follow a similar P-L-A relationship to the short period group, but with so little data this conclusion should be treated with caution.

We now turn to the P-C-A relationships which we have compared with those of Butler (1976) in the same way in Table 3.82, where the abbreviations are the same as for Table 3.81. The solutions take the form:-

$$\langle B \rangle - \langle V \rangle = a \log P + b f_B + c$$

and the maximum liklihood errors in ($\langle B \rangle - \langle V \rangle$), log P and f_B are 0.14, 0.001 and 0.1 respectively for the photographic data and 0.04, 0.001 and 0.03 for the photoelectric data.

From this Table the following results emerge:-

(a) $0.4 < \log P < 0.96$

TABLE 3.82

P-C-A relationships for Cloud cepheids

$$\langle B\rangle - \langle V\rangle = a \log P + b f_B + c$$

	Source	LMC a	LMC b	LMC c	LMC N	SMC a	SMC b	SMC c	SMC N
					$0.4 < \log P < 0.9$				
1.	B (a)	-	-	-	-	0.24	-0.18	0.49	31
						±0.11	±0.11	±0.11	
2.	B*(a)	-	-	-	-	0.22	-0.311	0.59	31
						±0.11		±0.08	
3.	PE(a)	0.43	-0.00	0.36	13	0.21	-0.37	0.63	13
		±0.16	±0.22	±0.24		±0.08	±0.14	±0.14	
4.	PE(b)	2.2	4.4	-4.3	13	0.20	-0.86	1.03	13
5.	WLM(a)	0.35	-0.12	0.46	88	0.50	-0.19	0.22	81
		±0.06	±0.07	±0.05		±0.07	±0.07	±0.05	
6.	WLM(b)	1.21	-1.76	0.94	88	1.21	-1.25	0.40	81
7.	WLM+PE(a)	0.39	-0.11	0.44	90	0.41	-0.10	0.23	89
		±0.06	±0.06	±0.05		±0.06	±0.06	±0.05	
8.	WLM+PE(b)	1.17	-1.73	0.98	90	1.09	-1.35	0.59	89
					$0.96 < \log P < 1.48$				
9.	PE (a)	0.38	-0.17	0.49	30	0.20	0.05	0.38	20
		±0.13	±0.12	±0.18		±0.17	±0.15	±0.23	
10.	PE (b)	1.02	-1.50	0.75	30	2.0	4.0	-4.5	20
11.	WLM (a)	0.29	-0.20	0.59	46	0.40	-0.15	0.24	35
		±0.12	±0.11	±0.16		±0.19	±0.19	±0.30	
12.	WLM (b)	0.18	-2.89	2.56	46	-455	-608	908	35
13.	WLM+PE(a)	0.38	-0.20	0.51	53	0.38	-0.06	0.25	41
		±0.10	±0.08	±0.14		±0.14	±0.13	±0.21	
14.	WLM+PE(b)	0.98	-1.21	0.53	53	7	10	-14	41
					$\log P > 1.48$				
15.	PE (a)	0.69	-0.03	-0.16	17	0.18	-0.46	0.90	10
		±0.09	±0.08	±0.15		±0.17	±0.24	±0.34	
16.	PE (b)	0.87	-0.10	-0.42	17	0.20	-1.32	1.43	10
17.	WLM (a)	0.55	-0.52	0.38	13	0.57	-0.25	-0.01	11
		±0.13	±0.12	±0.26		±0.16	±0.19	±0.23	
18.	WLM (b)	0.55	-0.66	0.47	13	0.99	-0.88	-0.35	11
19.	WLM+PE(a)	0.80	0.01	-0.37	15	0.22	-0.27	0.65	13
		±0.18	±0.13	±0.35		±0.26	±0.23	±0.42	
20.	WLM+PE(b)	1.33	0.28	-1.44	15	1.37	-1.87	-0.30	13

* coefficient of f_B constrained to -0.311.

Both the LMC and SMC short period cepheids appear to follow the form of the P-C-A relationships derived by Sandage and Tammann and by Butler. Taking mean values of the least squares and maximum liklihood solutions as before we find:-

LMC (solutions 7,8)

$$\langle B\rangle - \langle V\rangle = \underset{\pm 0.40}{0.78} \log P \underset{\pm 0.80}{-0.92} f_B \underset{\pm 0.27}{+0.71}$$

SMC (solutions 3,4,7,8)

$$\langle B\rangle - \langle V\rangle = \underset{\pm 0.21}{0.48} \log P \underset{\pm 0.28}{-0.67} f_B \underset{\pm 0.16}{+0.62}$$

(where the standard errors quoted represent the scatter about the mean)

The equivalent relationships by Sandage & Tammann and Butler are:-

S&T $\quad (\langle B\rangle - \langle V\rangle)_o = 0.227 \log P - 0.311 f_B + 0.584 \qquad 0.4 < \log P < 0.86$

B $\quad \langle B\rangle - \langle V\rangle = \underset{\pm 0.11}{0.24} \log P \underset{\pm 0.11}{-0.18} f_B \underset{\pm 0.11}{+0.49} \qquad 0.4 < \log P < 0.9$

B $\quad \langle B\rangle - \langle V\rangle = \underset{\pm 0.11}{0.22} \log P - 0.311 f_B \underset{\pm 0.08}{+0.59} \qquad 0.4 < \log P < 0.9$

where Butler's second equation has the coefficient of f_B constrained to S & T's value.

From these various P-C-A relationships we confirm the findings of S & T and Butler for the short period cepheids; namely that the large amplitude cepheids tend to be bluer.

(b) $0.96 < \log P < 1.48$

There seems to be no P-C-A relationship for the SMC cepheids in the intermediate period group but for the LMC cepheids a mean value gives:-

$$\langle B\rangle - \langle V\rangle = \underset{\pm 0.18}{0.69} \log P \underset{\pm 0.34}{-0.77} f_B \underset{\pm 0.06}{+ 0.57} \qquad \text{(solutions 9,10,13,14)}$$

which follows the same trend as in the short period groups.

(c) $\log P > 1.48$

In this group there is no obvious P-C-A correlation for the LMC cepheids but for those of the SMC the mean relationship:-

$$\langle B\rangle - \langle V\rangle = \underset{\pm 0.30}{0.49} \log P \underset{\pm 0.37}{-0.98} f_B + \underset{\pm 0.36}{0.67}$$

may be derived, which again follows the trend found earlier although selection effects become important again with such small samples.

To summarize, it appears that in the approximate period ranges $0.4 < \log P < 0.9$ and $\log P > 1.4$, the SMC cepheids which have large amplitudes tend to be brighter and bluer than average for their period - results which are in agreement with those of Sandage and Tammann (1971) and Butler (1976). For the LMC there is some indication that in the short and intermediate period groups the large amplitude cepheids may be bluer than average.

In making comparisons of P-L-A and P-C-A relationships with other authors in this fashion it should be remembered that since each author finds it necessary to redefine the amplitude envelopes and period ranges, only <u>trends</u> in the relationships for each period group can be expected to be found. Perhaps a simpler method of checking the results found above is to examine the distribution of the higher amplitude cepheids in the P-L and P-C planes. In Figs. 3.83 and 3.84 we have plotted $\langle V\rangle$ - log P and log P - ($\langle B\rangle - \langle V\rangle$) respectively for the cepheids in both Magellanic Clouds whose values of A_B exceed 1.4. On each diagram the mean (WLM+PE) least sqaures regression line is superimposed and on the P-C diagrams an instability strip of $0^m.4$ has also be drawn. Figures on each of the three

Fig 3.8c

<V> - log P plots for values of A_B >1.4

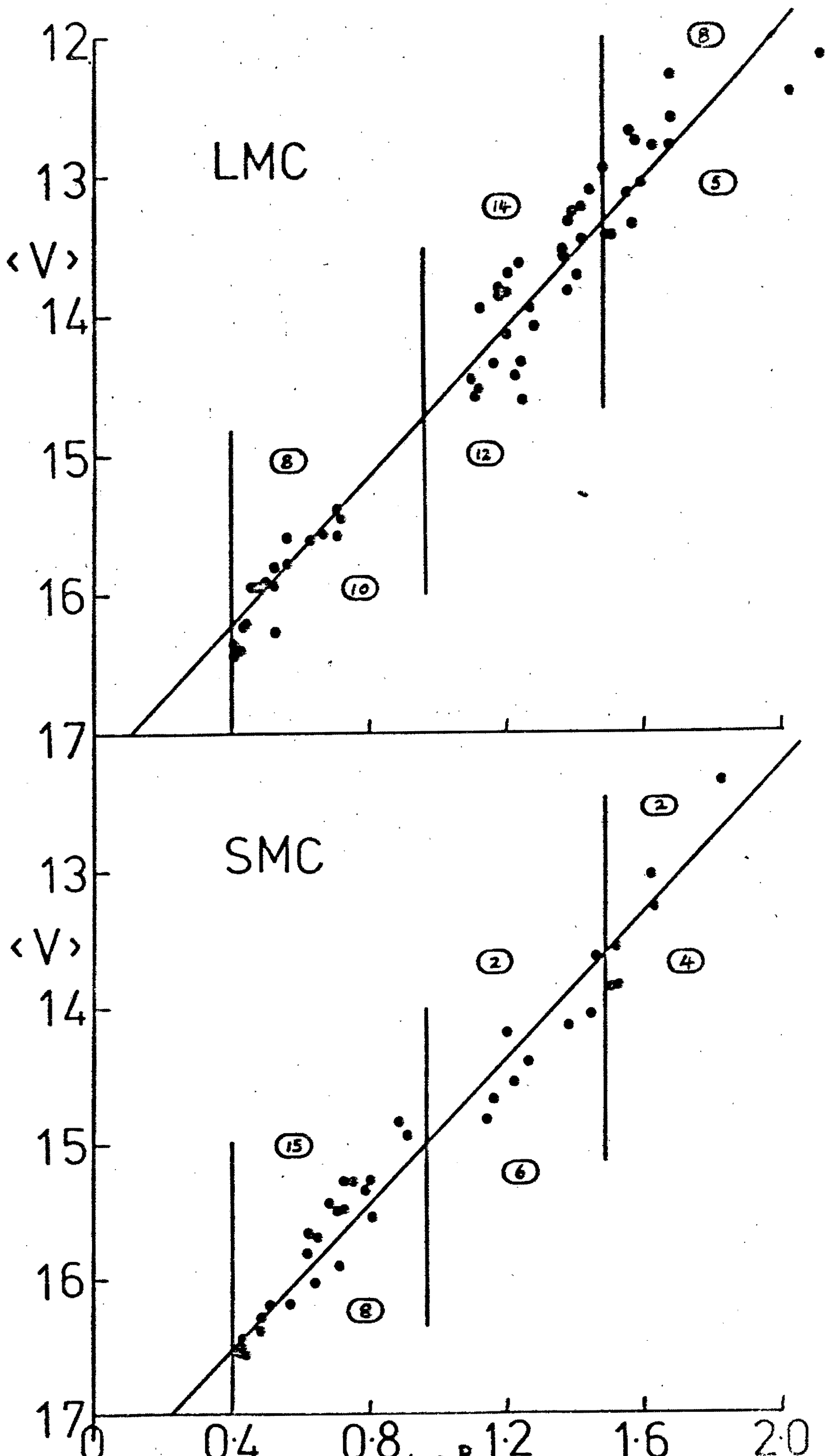
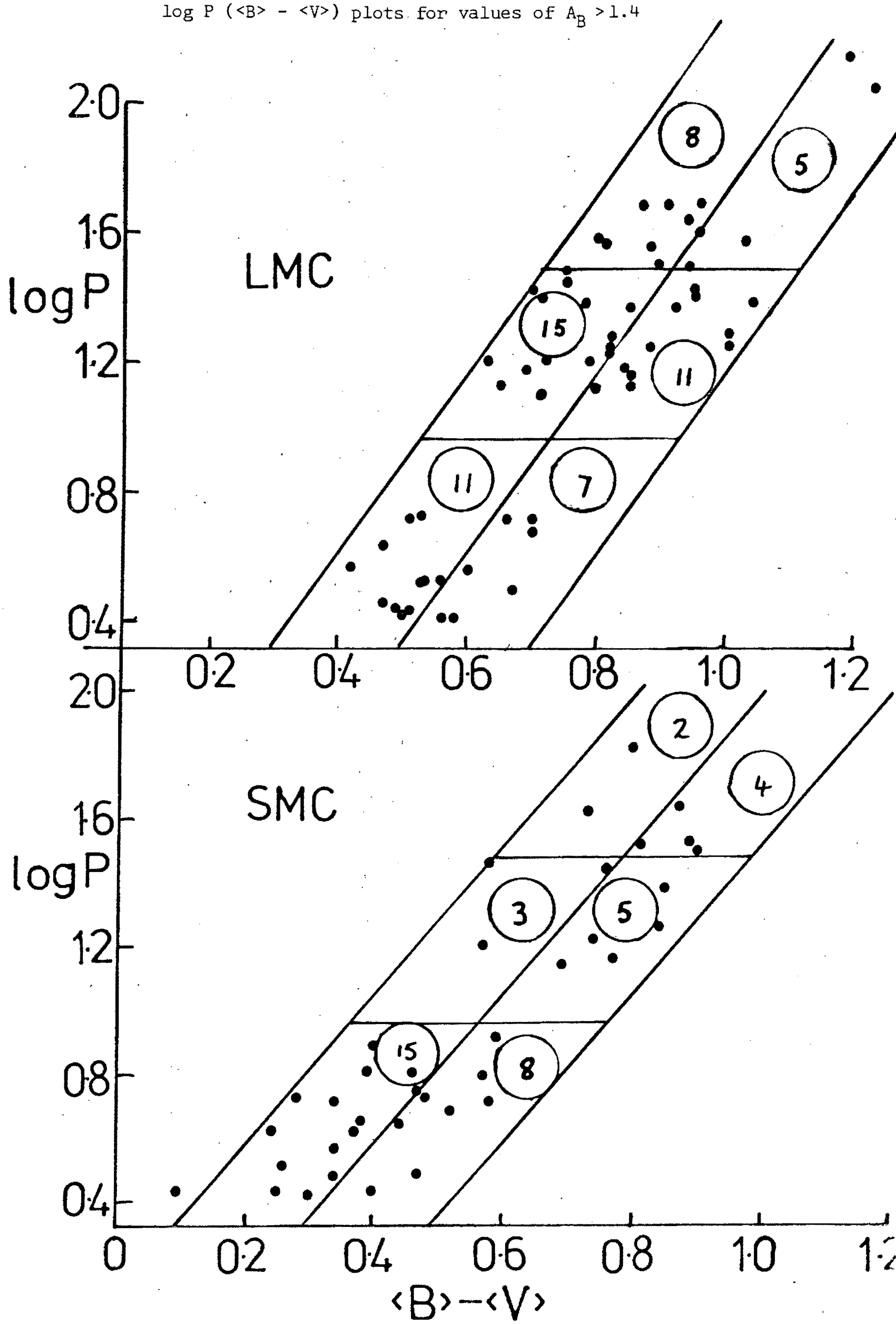


Fig 3.84

log P (<B> - <V>) plots for values of $A_B > 1.4$



period groups indicate the number of high amplitude cepheids on either side of the mean lines. From these plots it appears that in general the conclusions reached above are endorsed but it would be a mistake to put too much emphasis on results which have been obtained from such small samples.

3.9. Distance moduli of the Clouds

There are two main disadvantages of using cepheid P-L-A or P-C-A relationships for deriving distance moduli to the Magellanic Clouds (or indeed any other galaxy); they are:-

(1) Three distinct period ranges need to be considered.

(2) These period ranges depend on the author's definition of the amplitude envelopes.

In view of these limitations and the fact that only the shorter period cepheids show the strongest correlations between P, L, A and C, it was decided that distance derivations should be confined to relationships between period, luminosity and colour only. Consequently distance moduli to the Magellanic Clouds will now be derived using (a) P-L and (b) P-L-C relationships.

(a) P-L

The procedure in this case is quite straightforward. A mean P-L slope is adopted from the Magellanic Cloud data and this slope is fitted to the galactic cepheid data in order to establish a zero point.

From Table 3.41 a mean <V>/log P slope of 2.70 (±0.01) fits both the Large and Small Magellanic Cloud data very well. The galactic 'calibrating' cepheids (i.e. those thought to be members of clusters) we have chosen are seven of those used by Sandage and Tammann (1969), namely: EV Sct, CE Cas b, CF Cas, CE Cas a, U Sgr, DL Cas and S Nor and seven additional cepheids (CV Mon, CS Vel, V367 Sct, TW Nor, VY Car, T Mon and SV Vul) suggested by van den Bergh (1977). These cepheids have been plotted on a M_V/log P diagram shown in Fig. 3.91 (open circles = S & T, filled circles = v.d.B) onto which has been fitted (by eye) the mean Magellanic Cloud slope of 2.70 (solid line). It can be seen that our adopted slope may be a little shallow for the best fit to the galactic data, but with a sample of only 14 cepheids this slight divergence is not significant.

The zero point fit yields the expression:-

$$M_V = 2.70 \log P - 1.42 \tag{3.91}$$

The mean (solutions 16 and 18 in Table 3.41) LMC P-L relationship is given by:

$$\langle V \rangle = -2.70 \log P + 17.32 \tag{3.92}$$

and for the SMC (solutions 7, 9):

$$\langle V \rangle = -2.70 \log P + 17.60 \tag{3.93}$$

Subtracting expression (3.91) from expressions (3.92) and (3.93) in turn we find:-

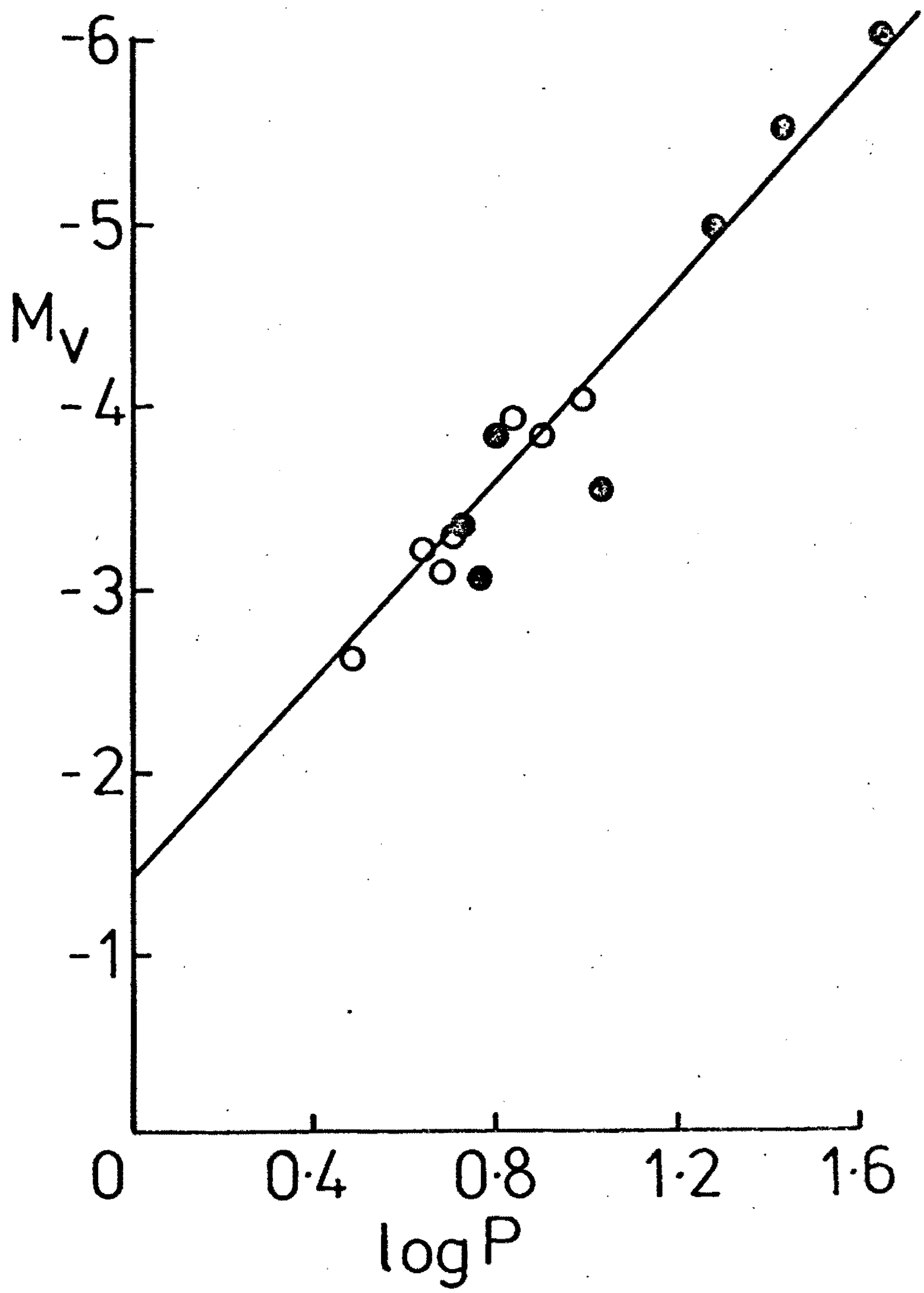
$$\langle V \rangle - M_V = 18.74 \qquad \text{LMC}$$

$$\langle V \rangle - M_V = 19.02 \qquad \text{SMC}$$

Assuming abundance effects do not affect the P-L relationship (see e.g. Iben and Tuggle (1975) and Gascoigne, 1974) and adopting reddening values, E_{B-V}, of $0^m.04$ for each Cloud (see § 3.6) we find, with $A_V = 3.3\ E_{B-V}$

Fig 3.91

Mean Cloud P-L relationship fitted to Galactic cepheids



(see Martin et al, 1979), true distance moduli;-

$$\underline{(\langle V\rangle - M_V)_o = 18.61} \qquad \text{for the LMC}$$

$$\underline{(\langle V\rangle - M_V)_o = 18.89} \qquad \text{for the SMC}$$

(b) P-L-C

In § 3.7 we derived mean P-L-C relationships for cepheids in the Magellanic Clouds:-

$$\text{LMC: } \langle V\rangle = 16.34 - 3.59 \log P + 2.55 (\langle B\rangle - \langle V\rangle) \qquad (3.94)$$

$$\text{SMC: } \langle V\rangle = 17.05 - 3.92 \log P + 3.02 (\langle B\rangle - \langle V\rangle) \qquad (3.95)$$

These expressions may now be compared directly with the theoretical P-L-C relationship derived by Sandage and Tammann (1969) for the cepheids in the Galaxy. In fact we have chosen to use the up-dated expression by Tammann (1970):-

$$M_V^o = -2.47 - 3.53 \log P + 2.65 (\langle B\rangle - \langle V\rangle) \qquad (3.96)$$

Subtracting (3.96) from (3.94) and (3.95) in turn, then:

$$\text{LMC: } \langle V\rangle - M_V^o = 18.81 - 0.06 \log P - 0.10 (\langle B\rangle - \langle V\rangle) \qquad (3.97)$$

$$\text{SMC: } \langle V\rangle - M_V^o = 19.52 - 0.39 \log P + 0.37 (\langle B\rangle - \langle V\rangle) \qquad (3.98)$$

As these expressions are functions of period and colour we shall need to derive moduli at a representative point in the data, i.e. log P = 1.0. From the P-C relationships in Table 3.51; at log P = 1, $(\langle B\rangle - \langle V\rangle)_{LMC} = 0.74$ and $(\langle B\rangle - \langle V\rangle)_{SMC} = 0.58$. Hence expressions (3.97) and (3.98) become:-

LMC: $\langle V\rangle - M_V^{\,o} = 18.68$

SMC: $\langle V\rangle - M_V^{\,o} = 19.34$

Adopting $E_{B-V} = 0\overset{m}{.}04$ for each Cloud as before the correction for reddening is:-

$$(\langle V\rangle - M_V)_o = (\langle V\rangle - M_V) - E_{B-V} \quad (3.3 - \beta)$$

where β is the colour coefficient given in (3.94) and (3.95)

Hence $(\langle V\rangle - M_V)_o = 18.65$ LMC

$(\langle V\rangle - M_V)_o = 19.33$ SMC

An allowance for abundance effects must now be made.

In § 3.6 it was seen that a band $0\overset{m}{.}4$ wide centred on the galactic P-C relationship fitted the LMC data well, when no correction for reddening was made. If $\Delta(B-V)$ is the intrinsic (B-V) colour excess due to metallicity and E_{B-V} is the mean reddening, then for the LMC cepheids compared with those of the galaxy we can write:-

$$\Delta(B-V) - E_{B-V} \simeq 0 \qquad (3.99)$$

Also, it was shown by Martin et al (1979) that the total observed reddening for LMC cepheids was $\sim 0\overset{m}{.}086$. This total is made up from the absolute reddening, E_{B-V} and a contribution due to metal deficiency, $\Delta(B-V)$. Hence:-

$$\Delta(B-V) + E_{B-V} \simeq 0\overset{m}{.}086 \qquad (3.100)$$

Adding (3.99) and (3.100) we have:-

$$\Delta(B-V) \simeq E_{B-V} \simeq 0\overset{m}{.}04$$

From Martin et al the correction to the LMC modulus due to metals is:-

$$\Delta M = (3.3 - \beta)\,\Delta E - \beta\;\Delta(B-V)\;.$$

Assuming from their work that $\Delta E \simeq \Delta(B-V)$ we have:-

$$\Delta M = \Delta(B-V)(3.3 - 2\beta) = -0\overset{m}{.}07$$

The true LMC modulus corrected for metals is therefore :-

$$\underline{(\langle V\rangle - M_V)_T = 18.58}$$

In § 3.6 we also saw that the LMC and SMC cepheids were a factor of 1.4 and 4 (respectively) underabundant than those in the galaxy. This implies that the SMC cepheids are a factor 2.86 underabundant compared with those in the LMC. Assuming linearity, the corresponding correction to the SMC modulus is therefore:-

$$\Delta M = -0\overset{m}{.}20$$

and the true SMC modulus becomes:

$$\underline{(\langle V\rangle - M_V)_T = 19.13}$$

The final moduli that we shall adopt will be the mean of the values derived in (a) and (b) namely:-

$$(\langle V\rangle - M_V)_T = 18.60 \pm 0.02 \qquad \text{LMC}$$
$$(\langle V\rangle - M_V)_T = 19.01 \pm 0.12 \qquad \text{SMC}$$

where the standard errors quoted represent only the differences between the two evaluations. These distance moduli correspond the distances of 53 ± 1 kpc and 64 ± 3 kpc for the LMC and SMC respectively.

It should be noted here that these distance estimates are based on van Bueren's (1952) distance modulus for the Hyades of $3^{m}.03$. More recent determinations summarized by de Vaucouleurs (1978a) suggest a value of $\sim$3.29 which would mean that we have underestimated the distances to the Magellanic Clouds. However, as van den Bergh (1977) points out, this proposed increase in the Hyades distance may well be compensated for by a decrease in the distance scale that results from taking into account the fact that the stars in the Hyades have an above-average metal abundance.

3.10. Blue edge of the instability strip (P-L)

Iben and Tuggle (1975) have calculated linear non-adiabatic pulsation parameters for cepheids covering ranges in mass, luminosity and composition. These models define the blue edges of the instability strip either in the period-luminosity or colour-magnitude diagrams and can therefore be compared directly with the equivalent diagrams from this work.

Iben and Tuggle's equation (10) gives the general approximation for the relationship between fundamental period (P_{FBE}) of the blue edge, luminosity (L) and composition (Y,Z) as:-

$$\begin{aligned}\log P_{FBE} \simeq\ & 0.555 + (0.96 - 0.40\,\alpha\beta - 0.60\beta)\,\Delta\log L \\ & + (0.06 - 0.20\beta^2)(\Delta\log L)^2 - 0.60\alpha - 0.20\alpha^2 \\ & + (-0.35 + \Delta Y - 0.15\,\Delta\log L)\ \Delta Y + 2.0\,\Delta Z \qquad (3.101)\end{aligned}$$

where

$$\begin{aligned}\Delta\log L &= \log L - 3.25 \\ \Delta Y &= Y - 0.28 \\ \Delta Z &= Z - 0.02 \\ \alpha &\simeq 0.032 - \Delta Y + 3\,\Delta Z\end{aligned}$$

and β is the slope of the mass-luminosity relationship given by:-

$$\Delta \log M = \log M - 0.7 = \alpha + \beta \, \Delta \log L$$

It was found from Iben and Tuggle's work that the blue edge defined in this way was not very sensitive to composition changes. Hence we have approximated expression (3.101) by putting $\Delta Y = \Delta Z = 0$ and calculated log P_{FBE} for $\beta = {}^1/_3$, ${}^1/_4$ and ${}^1/_5$.

Hence we have from (3.101):-

$$\log P_{FBE} \simeq 0.5356 + 0.756 \, \Delta \log L + 0.0378 \, (\Delta \log L)^2 \qquad \beta = {}^1/_3$$
$$\log P_{FBE} \simeq 0.5356 + 0.807 \, \Delta \log L + 0.0475 \, (\Delta \log L)^2 \qquad \beta = {}^1/_4$$
$$\log P_{FBE} \simeq 0.5356 + 0.837 \, \Delta \log L + 0.0520 \, (\Delta \log L)^2 \qquad \beta = {}^1/_5$$

which on substituting for $\Delta \log L$ become:-

$$\log P_{FBE} \simeq -1.521 + 0.510 \log L + 0.0378 \, (\log L)^2 \qquad \beta = {}^1/_3 \qquad (3.102)$$
$$\log P_{FBE} \simeq -1.585 + 0.4983 \log L + 0.0475 \, (\log L)^2 \qquad \beta = {}^1/_4 \qquad (3.103)$$
$$\log P_{FBE} \simeq -1.637 + 0.4994 \log L + 0.0520 \, (\log L)^2 \qquad \beta = {}^1/_5 \qquad (3.104)$$

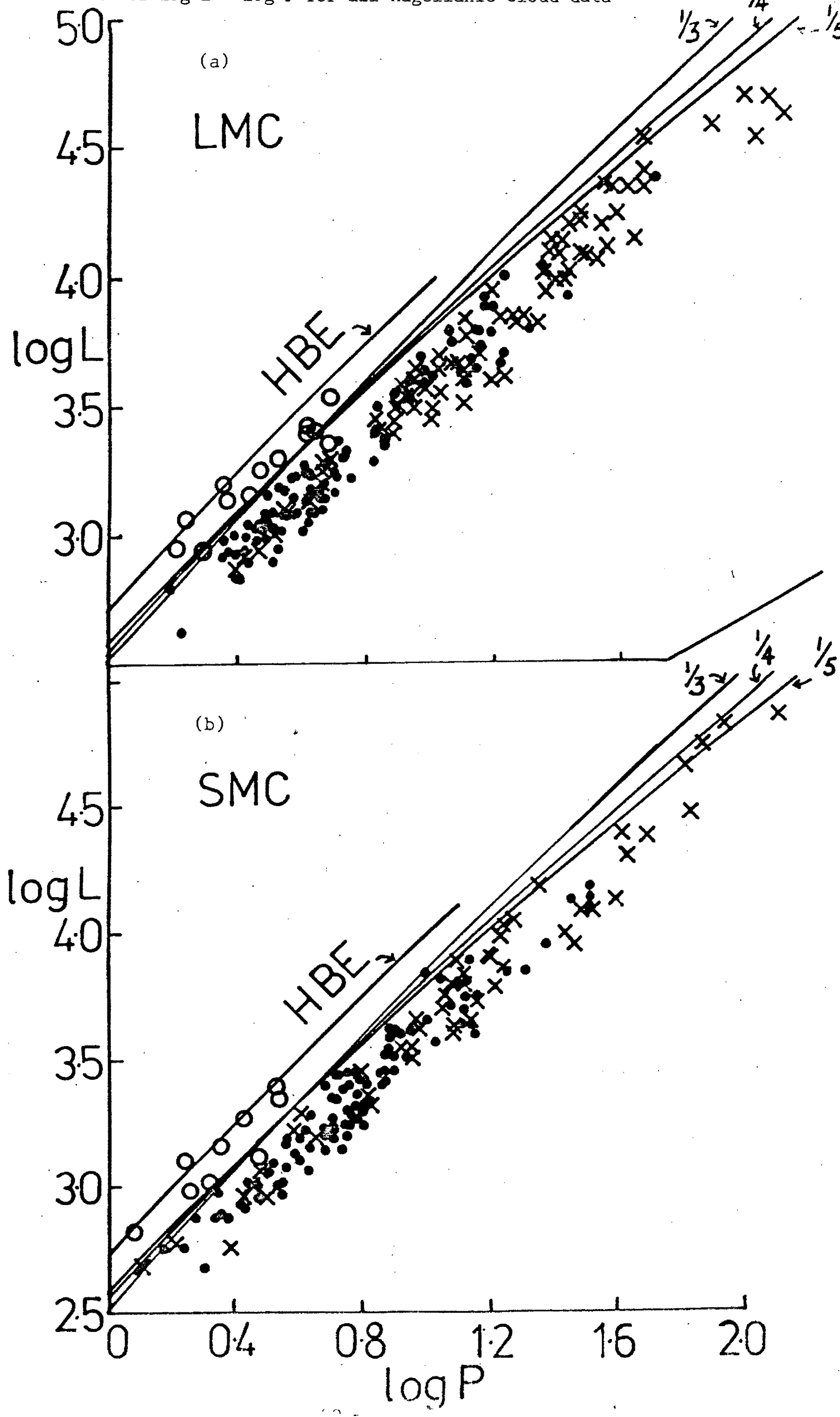
These three lines appear on the plots of period against luminosity for each Magellanic Cloud in Figs. 3.101a and 3.101b. The transformations from <V> magnitude to luminosity (L) for the cepheid data (photographic = dots, photoelectric = crosses) were made with the aid of the standard relationships:-

$$\log L/L_\odot = 0.4 \, (4.77 - M_{bol}) \qquad (3.105)$$

$$M_{bol} = m_{bol} - m_d \qquad (3.106)$$

$$m_{bol} = \langle V \rangle_o + 0.145 - 0.322 \, \langle B - V \rangle_o \qquad (3.107)$$

Figs 3.101 (a) and (b)
Plots of log L - log P for all Magellanic Cloud data



where m_d is the true distance modulus.

$<B - V>$ is used in preference to $<B>-<V>$ according to the reasoning by Kraft (1961). We use the transformation given by Iben and Tuggle (1975):-

$$<B - V>_o \simeq (<B>_o - <V>_o) + 0.04$$

and since $\quad <B>_o - <V>_o = (<B>-<V>) - E_{B-V}$

and the adopted reddening for each Cloud is $0^m\!.04$, we have:-

$$<B - V>_o \simeq <B>-<V> \qquad (3.108)$$

Finally we use $A_v = 3.3\ E_{B-V}$ and 18.60 and 19.01 as the true distance moduli for the LMC and SMC respectively.

Also shown in Figs. 3.101a and 3.101b are the theoretical lines marking the blue limits of the instability strip for harmonic pulsators which have been calculated form Iben and Tuggle's (1975) relationship:-

$$\log P_{HBE} \sim \log P_{FBE} \ -0.131 - 0.024\ \Delta \log L$$

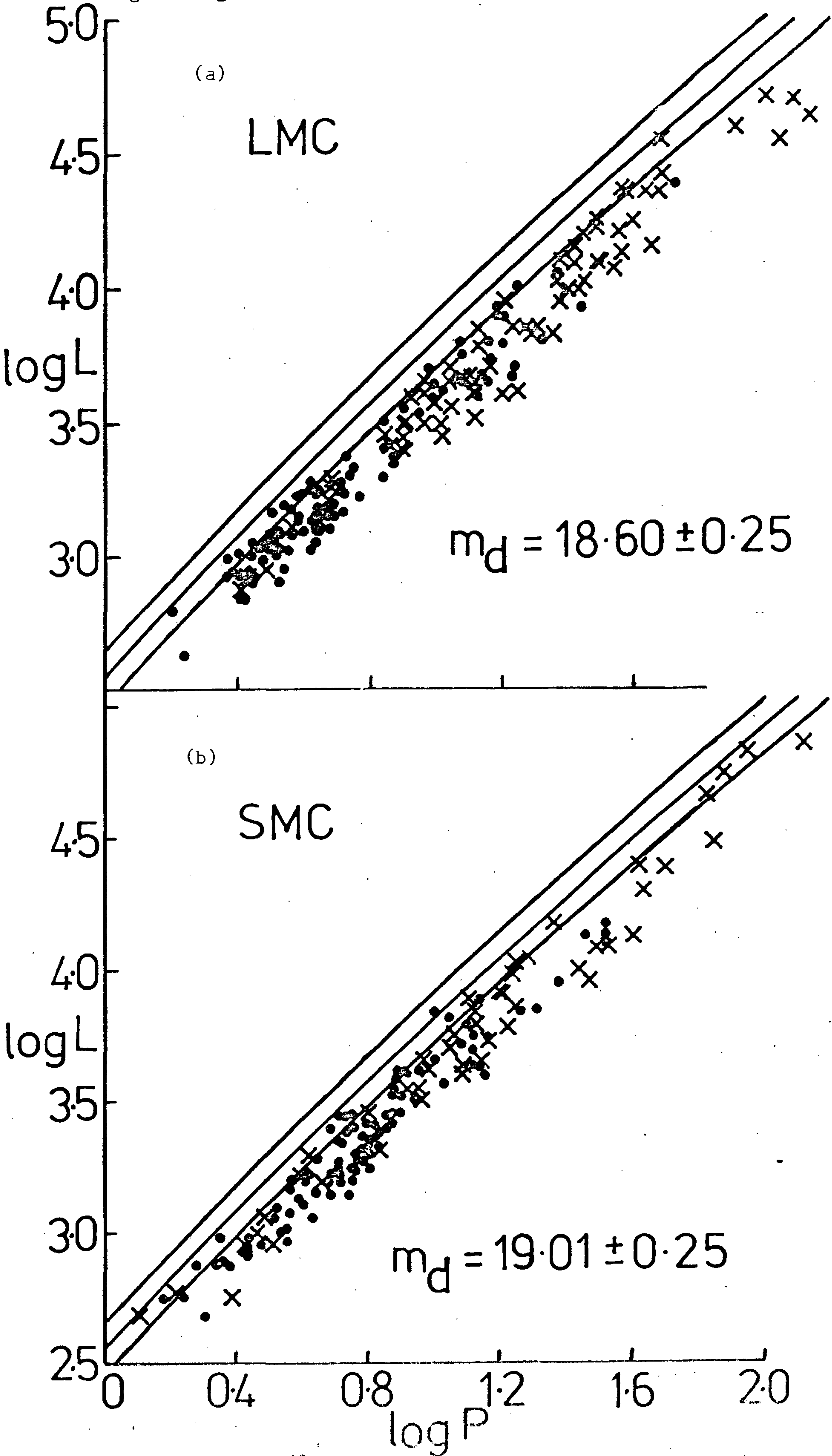
or $\quad \log P_{HBE} \sim \log P_{FBE} \ -0.024 \log L - 0.053$

which is valid only for relatively low luminosities where the fundamental and first harmonic blue edges are nearly parallel.

From Fig 3.101 b it can be seen that the best fit to the blue edge of the SMC data in the (log L - log P) plane is provided by the $\beta = \frac{1}{4}$ curve. This implies that a value of $19^m\!.01$ ($E_{B-V} = 0.04$) is a good estimate for the distance modulus. For the LMC data (Fig 3.101 a) the $\beta = \frac{1}{4}$ curve appears to lie systematically above the optimum position for the blue edge limit, so we have in Figs 3.102 a and b replotted the data for both Magellanic Clouds (without the suspected harmonic pulsators).

The centre curves on each of these plots represents the adopted moduli (and reddening) used, namely:- $19^m\!.01$ and $18^m\!.60$ for the SMC and LMC

Figs 3.102 (a) and (b)
Plots of log L - log P for different distance moduli



respectively and the outer curves represent moduli of $19^{m}.01 \pm 0^{m}.25$ and $18^{m}.60 \pm 0^{m}.25$ respectively (although it should be remembered that it is in fact the data points that are affected and not the theoretical curves). From Figs 3.102 a and b, it can be seen that the best blue edge fits are provided by the centre curve in the case of the SMC cepheids and for the LMC cepheids, by a curve lying somewhere between the centre and lower curves. These results are consistent therefore with a value of $\beta = \frac{1}{4}$ and distance moduli of $19^{m}.01$ and $\sim 18^{m}.72$ for the SMC and LMC respectively.

Inspection of Figs.3.101a and 3.101b also shows that most of the cepheids suspected of being first harmonic pulsators, namely:-

LMC: W41, W38, HV 5684, HV 2263, HV 12575, HV 2431, HV 2283, HV 2837, HV 12676, HV 6015, HV 2353 (pe data), HV 12765 (pe data) HV 12869 (pe data.)

SMC: HV 2093, HV 2186, HV 2061, HV 1600, HV 1898, HV 2037, HV 1788, HV 1897 (pe data), HV 1779 (pe data).

do indeed lie between the first harmonic and fundamental mode blue limits.

Since composition differences do not play an important part in defining the blue edge of the P-L relationship, this method provides a useful way of determining distances to cepheids in external galaxies, providing:-

(a) β, the mass-luminosity slope can be determined.

(b) the reddening is known.

(c) the laws given by expressions (3.105), (3.106) and (3.107) hold true. Considering each of these points in reverse order:-

(c) Laws

We shall assume the laws hold true.

(b) Reddening.

Clearly this is a parameter which needs to be known quite well. For LMC cepheids the method of determining individual cepheid reddenings from BVI photometry (see Martin et al, 1979) seems to lead to a reasonably reliable reddening determination. For the SMC cepheids a value of E_{B-V} =

$0^m.04$ was assumed. If the value were in fact $0^m.10$, then with $A_V = 3.3\ E_{B-V}$ the value of A_V would be 0.33 instead of 0.13 and all values of $\log L/L_\odot$ would increase by 0.08. This would mean that to keep the same theoretical blue edge fit, the distance modulus would have to be reduced by $0^m.20$ - a not insignificant amount. It seems unlikely however that the SMC modulus would be as small as 18.80, but the problem will not be resolved until accurate BVI photometry becomes available for the SMC cepheids.

(a) β determination

The determination of β and the blue edge fitting procedure depends upon there being enough data points to define the blue edge and the photometric observations being accurate. We saw in § 3.6 that the errors in the photographic determinations of <V> were much less than the standard deviations from a mean line. This, plus the fact that we have included the photoelectric data gives us confidence that we have been able to define the blue edge of the instability strip in the P-L plane to about ± 0.025 units in $\log L/L_\odot$, which is equivalent to $\sim \pm\ 0^m.06$ in the distance modulus.

3.11. Blue edge of the instability strip (V, B-V)

According to Iben and Tuggle (1975) the blue edge of the instability strip in the colour-magnitude plane <u>is</u> sensitive to chemical composition. Hence we will attempt to compare these theoretical blue edges with observation, for various mixtures of composition. Iben and Tuggle's (1975) equation (9) defines the relationship between $\log T_e$, luminosity (L), metal and helium abundance (Z,Y) and mass-luminosity slope (β) as follows:-

$$\log T_{FBE} \sim 3.796 + 0.012\ (\alpha + \beta \Delta \log L) + \left[-0.046 - 0.012\ \Delta \log L + 0.035\ (\alpha + \beta \Delta \log L)\right] \Delta \log L + (0.110 - 0.325\ \Delta Y + 0.050\ \Delta \log L)\ \Delta Y - 0.55\ \Delta Z \quad (3.111)$$

where the expressions for $\Delta \log L$, ΔY, ΔZ, β, etc are the same as those given in § 3.10.

In this case we will transform the theoretical parameters (T_e, L, etc) into observational ones (<B-V>, <V>) using the temperature-colour relationships:-

$$\log T_e \sim 3.886 - 0.175 \langle B-V \rangle_o \quad \text{for } Z = 0.02 \qquad (3.112)$$

$$\log T_e \sim 3.8865 - 0.1985 \langle B-V \rangle_o \quad \text{for } Z = 0.01 \qquad (3.113)$$

$$\log T_e \sim 3.887 - 0.222 \langle B-V \rangle_o \quad \text{for } Z = 0.005 \qquad (3.114)$$

Equations (3.112) and (3.114) are estimates by Kraft (1961) and Bell and Parsons (1972) respectively and (3.113) is an arithmetic mean of (3.112) and (3.114).

Adopting $\beta = {}^1\!/_4$ for reasons given in § 3.10, the following ($\log T_e$, $\log L$) relationships may be derived from (3.111) for various compositions:-

($Z \sim 0.005$, $Y \sim 0.28$

$$\log T_e \simeq 3.910995 - 0.02233 \log L - 0.00325 (\log L)^2 \qquad (3.115)$$

($Z \sim 0.005$, $Y \sim 0.48$)

$$\log T_e \simeq 3.907845 - 0.01933 \log L - 0.00325 (\log L)^2 \qquad (3.116)$$

($Z \sim 0.01$, $Y \sim 0.28$)

$$\log T_e \simeq 3.906922 - 0.021875 \log L - 0.00325 (\log L)^2 \qquad (3.117)$$

($Z \sim 0.02$, $Y \sim 0.28$)

$$\log T_e \simeq 3.898166 - 0.020755 \log L - 0.00325 (\log L)^2 \qquad (3.118)$$

(a) LMC

For the LMC we shall derive blue-edge limits for the compositions $Y \sim 0.28$; $Z \sim 0.02$, $Z \sim 0.01$ and $Z \sim 0.005$. Hence, substituting the transformations (3.112), (3.113) and (3.114) into equations (3.118), (3.117) and (3.115) respectively and using the expressions for log L given by (3.105) - (3.107), we find:-

($Y \sim 0.28$, $Z \sim 0.02$)

$$0.461136 - 0.032456\ V + 0.00052\ V^2 - 0.000335\ V(B-V) - 0.164549\ (B-V)$$
$$+0.000054\ (B-V)^2 = 0 \quad (3.119)$$

($Y = 0.28$, $Z \sim 0.01$)

$$0.463285 - 0.032904\ V + 0.00052\ V^2 - 0.000335\ V(B-V) - 0.187905\ (B-V)$$
$$+0.000054\ (B-V)^2 = 0 \quad (3.120)$$

($Y = 0.28$, $Z \sim 0.005$)

$$0.463939 - 0.033086\ V + 0.00052\ V^2 - 0.000335\ V(B-V) - 0.211346\ (B-V)$$
$$+0.000054\ (B-V)^2 = 0 \quad (3.121)$$

where $V = \langle V \rangle_o$ and $(B-V) = \langle B-V \rangle_o$.

In Fig.3.111a we plot $\langle V \rangle_o$ against $\langle B-V \rangle_o$ for the LMC data (photographic = dots, photoelectric = croses, $E_{B-V} = 0.04$) and superimposed on these plots are the three theoretical curves described by equations (3.119), (3.120) and (3.121). The best blue edge fit for the combined data would seem to be provided by the ($Y = 0.28$, $Z \sim 0.01$) curve. In § 3.6 it was shown that the photographic colours of the fainter cepheids may be unreliable so that if we attach less weight to the photographic points in the range $\langle V \rangle_o > 15^m$, the blue edge might be a little better defined by the dashed curve in Fig.3.111a which is equivalent to $Y = 0.28$, $Z \sim 0.015$. This result implies that LMC cepheids have normal helium abundance and a small metal underabundance compared with cepheids in the Galaxy, which is consistent with the results found in previous sections.

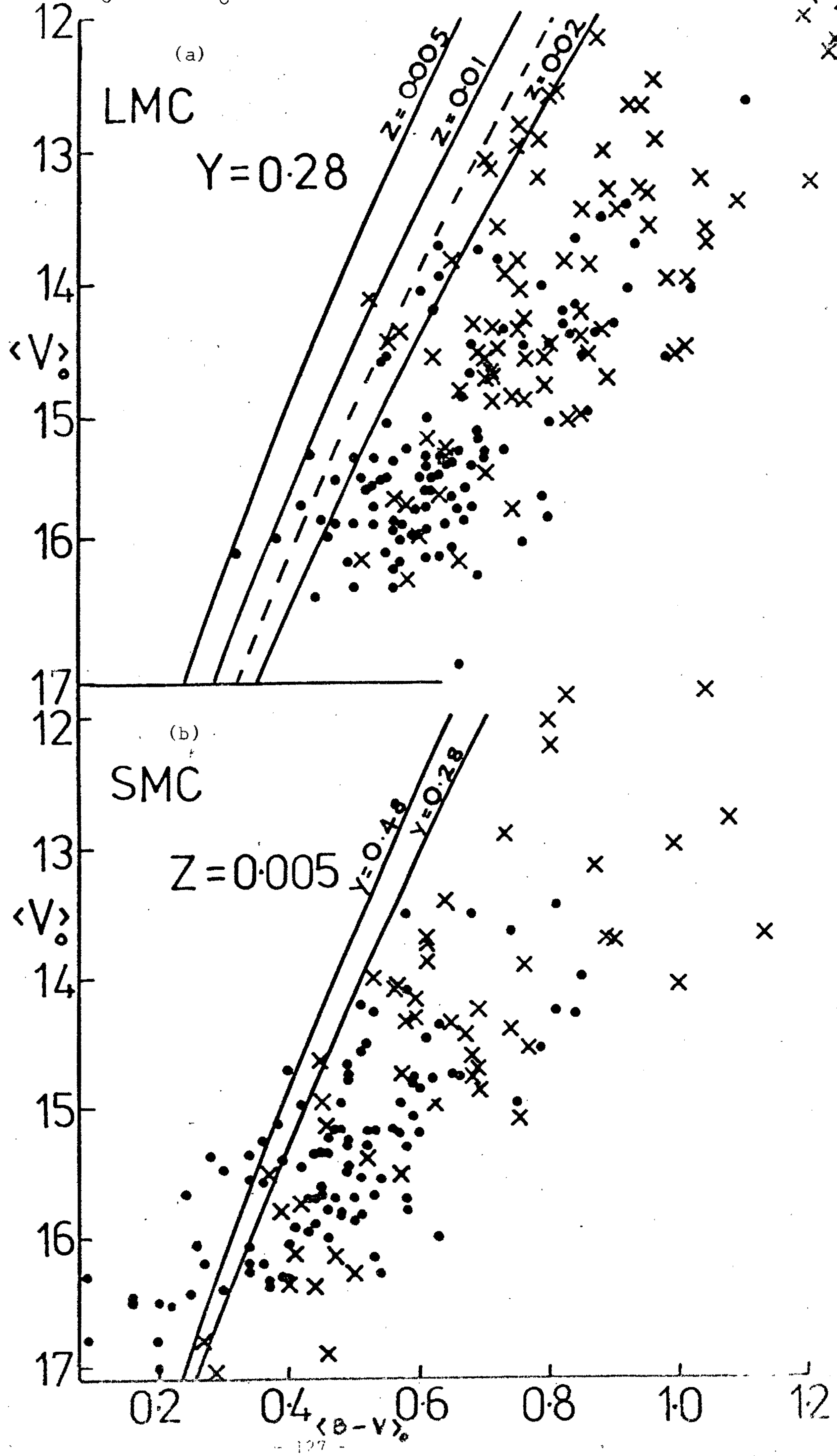
(b) SMC

For the SMC we derive fundamental blue edges for the compositions $Y \sim 0.28$, $Y \sim 0.48$; $Z \sim 0.005$. Substituting in the same way as before we have:-

[$Y \sim 0.28$, $Z \sim 0.005$; $\log T = 3.887 - 0.222\ (B-V)$]

$$0.477257 - 0.033502\ V + 0.00052\ V^2 - 0.000335\ V(B-V) - 0.211212\ (B-V)$$

Figs 3.111 (a) and (b)
<V>$_o$ - <B - V>$_o$ plots for Magellanic Cloud data



$$+0.000054\ (B-V)^2 = 0 \qquad (3.122)$$

$[Y \sim 0.48,\ Z \sim 0.005;\ \log T = 3.887 - 0.222\ (B-V)]$

$$0.452057 - 0.032302\ V + 0.00052\ V^2 - 0.000335\ V(B-V) - 0.211599\ (B-V)$$
$$+0.000054(B-V)^2 = 0 \qquad (3.123)$$

The two curves (3.122) and (3.123) are superimposed onto the $\langle V\rangle_o$, $\langle B-V\rangle_o$ plots for the SMC cepheids in Fig. 3.111b.

At first sight it would appear that neither of the theoretical curves provide a good fit to the observed blue edge of the instability strip. Poor blue edge fits were also encountered by Iben and Tuggle (1975) and Butler (1978) in their studies of SMC cepheids. Iben and Tuggle (1975) got round the problem by adopting a different form of the colour-temperature relationship, namely:-

$$\log T_e \simeq 3.869 - 0.175\ \langle B-V\rangle$$

which appeared to provide them with a consistent set of data for SMC cepheids with nearly normal helium abundance ($Y \sim 0.31$). It seems to us however that there is no real justification for (somewhat arbitrarily) changing the form of the colour-temperature relationship. Butler's solution to the problem was that either the heavy element abundance (Z) was < 0.005 or the cepheid reddening (E_{B-V}) was as low as ~ 0.02.

However, if we re-examine Fig.3.111b more carefully and consider only the photoelectric data for cepheids in the range $\langle V\rangle_o > 15^m$ (for the same reasons as those given earlier) then a theoretical curve corresponding to values of $Y \sim 0.38$ and $Z = 0.005$ fits the observed blue edge very well up to $\langle V\rangle_o \sim 13^m.5$. For cepheids brighter than $\langle V\rangle \sim 13^m.5$ the fit is poor but in this region of the diagram there are very few cepheids and the blue edge is poorly defined. We conclude, somewhat tentatively, therefore that the SMC cepheids have a slightly enhanced helium abundance and are metal poor compared with galactic cepheids, which is consistent with the results in § 3.6. However, further photoelectric observations of SMC cepheids, particularly the fainter ones, are required to clarify the situation.

CHAPTER 4

CEPHEIDS IN OTHER SYSTEMS

4.1 Introduction

The aim of this Chapter is to examine some of the properties of cepheids in the galaxies M31, NGC 6822 and IC 1613 and to compare them with those in the Galaxy and the Magellanic Clouds. In addition an attempt will be made to derive distance moduli for these galaxies incorporating some of the results from the preceding Chapter. The data sources are as follows: the Galaxy, Schaltenbrand and Tammann (1971); NGC 6822, Kayser (1967): IC 1613, Sandage (1971); M31, Baade and Swope (1963, 1965); LMC, SMC, this study, plus all photoelectric data.

4.2 Period-colour diagram

We saw in Chapter 3 how the intrinsic colours of cepheids could be tied to metal abundance using the models of Bell and Parsons (1974). Since both NGC 6822 and M31 have B and V cepheid photometry we are able to plot log P against $\langle B \rangle - \langle V \rangle$ which we have done in Figures 4.21 and 4.22. Superimposed on these diagrams is the galactic relationship by Dean et al (1978):-

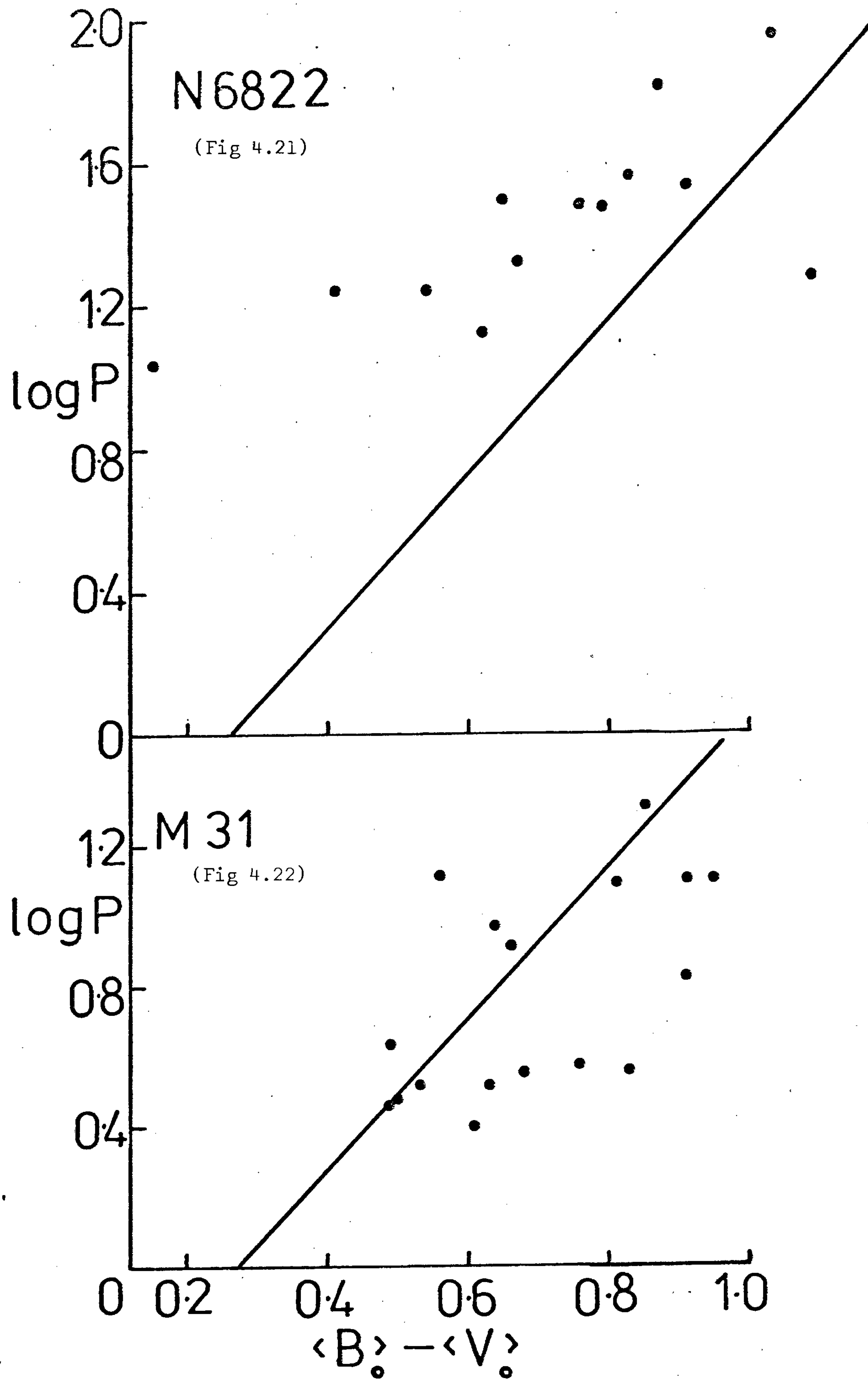
$$\langle B \rangle_o - \langle V \rangle_o \quad = \quad 0.46 \log P + 0.27$$

Although the number of cepheids in each case is rather small it would appear that:-

(a) For M31, the cepheids are slightly redder intrinsically than those in the galaxy, assuming $E_{B-V} = 0.10$. Applying the theory of Bell and

Fig. 4.21 and 4.22

Log P - (<B>$_o$ - <V>$_o$) for cepheids in NGC 6822 and IC 1613



Parsons (1974) as before this would imply that cepheids in M31 are slightly more metal abundant than those in the Galaxy, a result which is in agreement with that of van den Bergh (1969) from his study of globular clusters in M31.

(b) For NGC 6822, the cepheids appear to lie well to the blue side of the intrinsic galaxy line by $\sim 0^m.2$, assuming $E_{B-V} = 0^m.27$. The inference from this is that these cepheids are about as metal weak as those in the SMC.

4.3 Amplitude - amplitude diagram

Since amplitude of light variation is, to a first approximation, independent of reddening, a useful comparison should in principle be possible between cepheids in different systems. Van Genderen (1974) found from the lists of parameters of (Population I) galactic cepheids by Schaltenbrand and Tammann (1971) that a plot of A_v (amplitude in V light) against A_B (blue light) yielded the result:

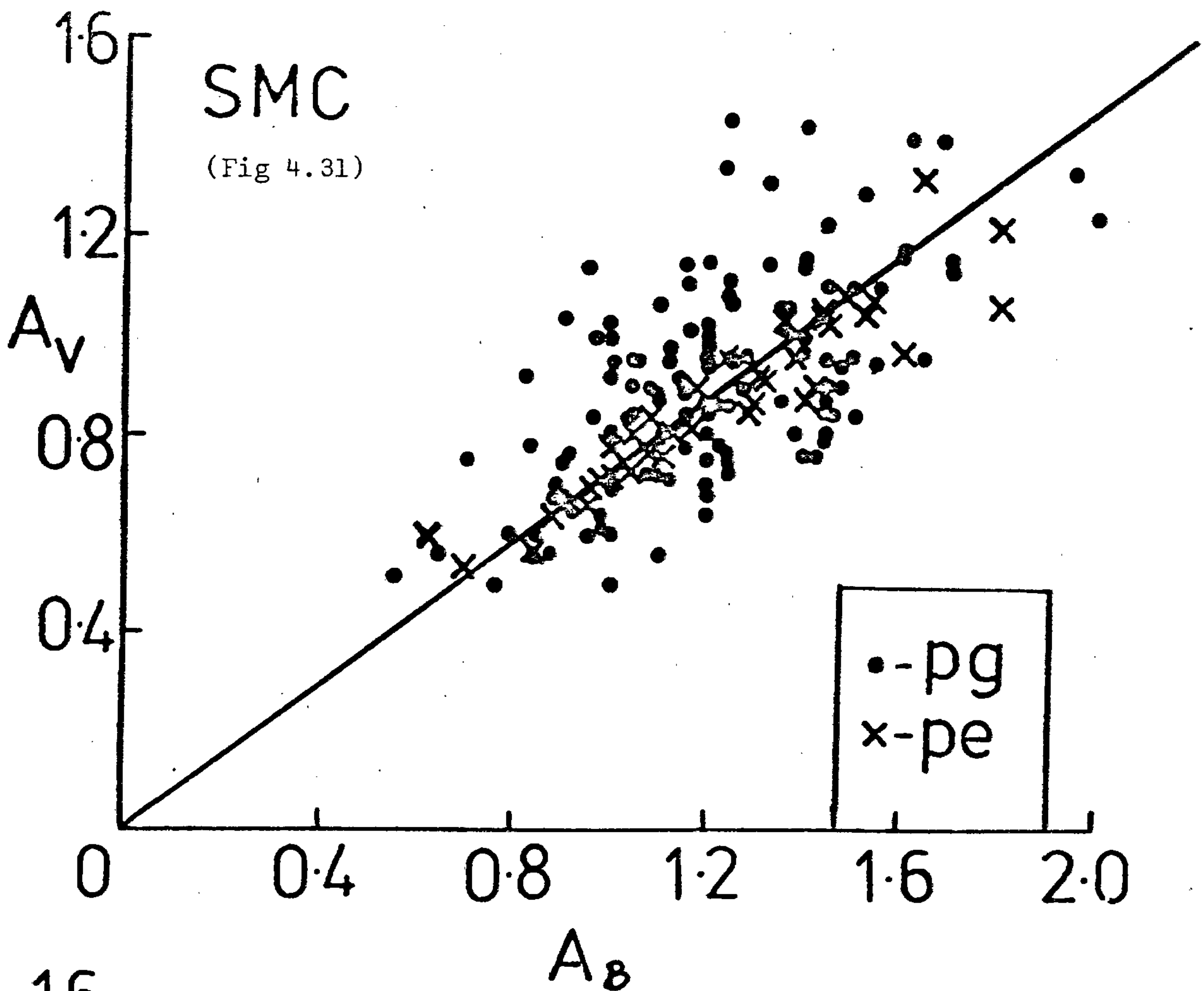
(> 250 cepheids)
$$A_v = 0.67\ A_B \qquad A_B \leqslant 1.5$$
$$A_v = 0.64\ A_B \qquad A_B > 1.5,\ \log P > 1.05$$

for straight lines drawn through the origin. It was not clear from van Genderen's work whether the slightly different slope for the high amplitude, long period cepheids was real or due to systematic errors introduced into the Fourier techniques used by Schaltenbrand and Tammann to determine the amplitudes.

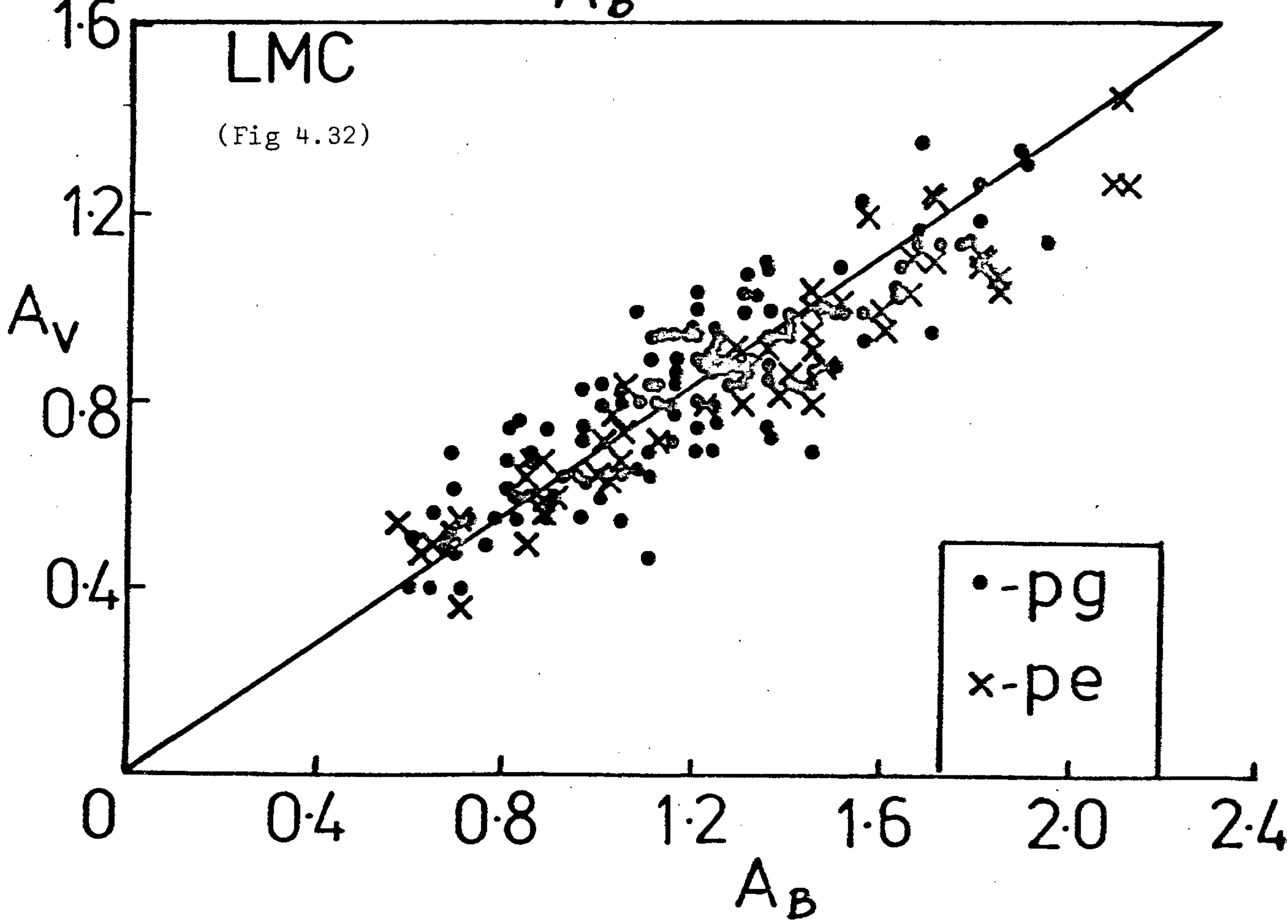
In Figures 4.31, 4.32, 4.33 and 4.34 plots of A_v versus A_B have been made for the SMC, LMC, NGC 6822 and M31 respectively. Straight lines, contrained to pass through the origin, have been superimposed on these plots and represent (eye-estimate) best fits to the data. The following

Figs 4.31 and 4.32

A_V - A_B plots for Cloud data (dots = photographic, crosses = photoelectric)



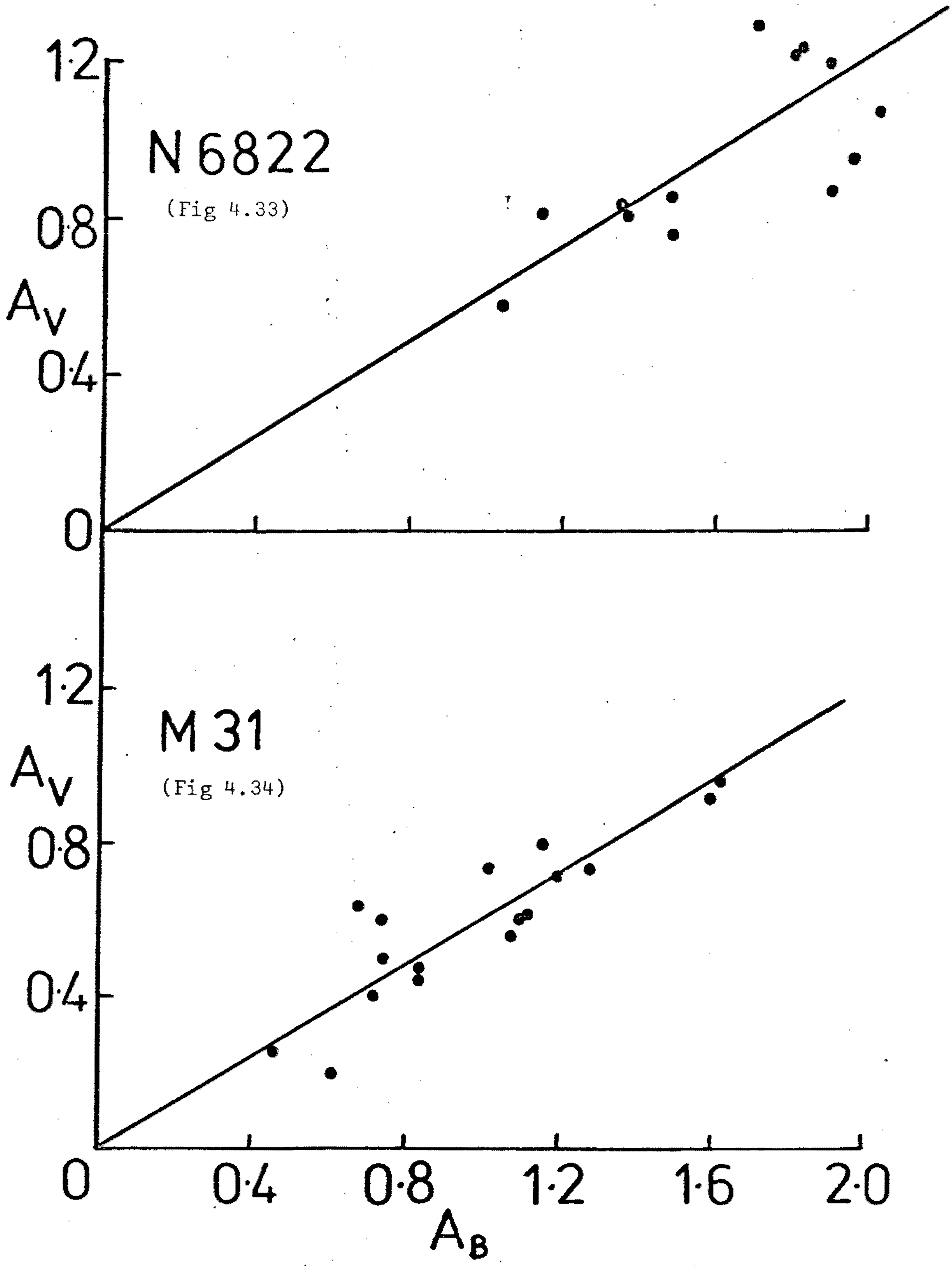
(Fig 4.31)



(Fig 4.32)

Figs 4.33 and 4.34

A_V - A_B plots for cepheids in NGC 6822 and M 31



slopes were derived:-

SMC	$A_v = 0.73\ A_B$	156 cepheids
LMC	$A_v = 0.70\ A_B$	190 cepheids
NGC 6822	$A_v = 0.61\ A_B$	13 cepheids
M31	$A_v = 0.61\ A_B$	17 cepheids

A least squares solution for the LMC cepheids gives:-

$$A_v = \underset{\pm 0.05}{0.64}\ A_B + \underset{\pm 0.02}{0.07}$$

which gives a 'feel' for the errors involved. Although the number of (B,V) observations in NGC 6822 and M31 are rather small, a mean slope of $\sim 0.67 \pm 0.06$ would appear to fit all the data reasonably well.

4.4 Amplitude - period diagram

In a similar way we can compare (Population I) cepheids in an amplitude-period diagram. In Figures 4.41, 4.42, 4.43, 4.44 and 4.45 we have plotted A_B - log P for cepheids in the Galaxy, SMC, LMC, M31 and NGC 6822 and IC 1613 respectively, from which we note:-

(a) The A_B - log P diagrams for our galaxy and M31 are remarkably alike. In § 4.2 it was seen that both our Galaxy and M31 were comparatively metal rich galaxies.

(b) There appear to be many more short period (log P $\lesssim$ 0.5) cepheids in the Magellanic Clouds than in our Galaxy, M31, NGC 6822 or IC 1613. According to Christy (1971) and Sandange and Tammann (1971) the penetration into the cepheid instability strip by stellar evolutionary tracks may differ

Fig 4.41

Amplitude-period plot for galactic cepheids

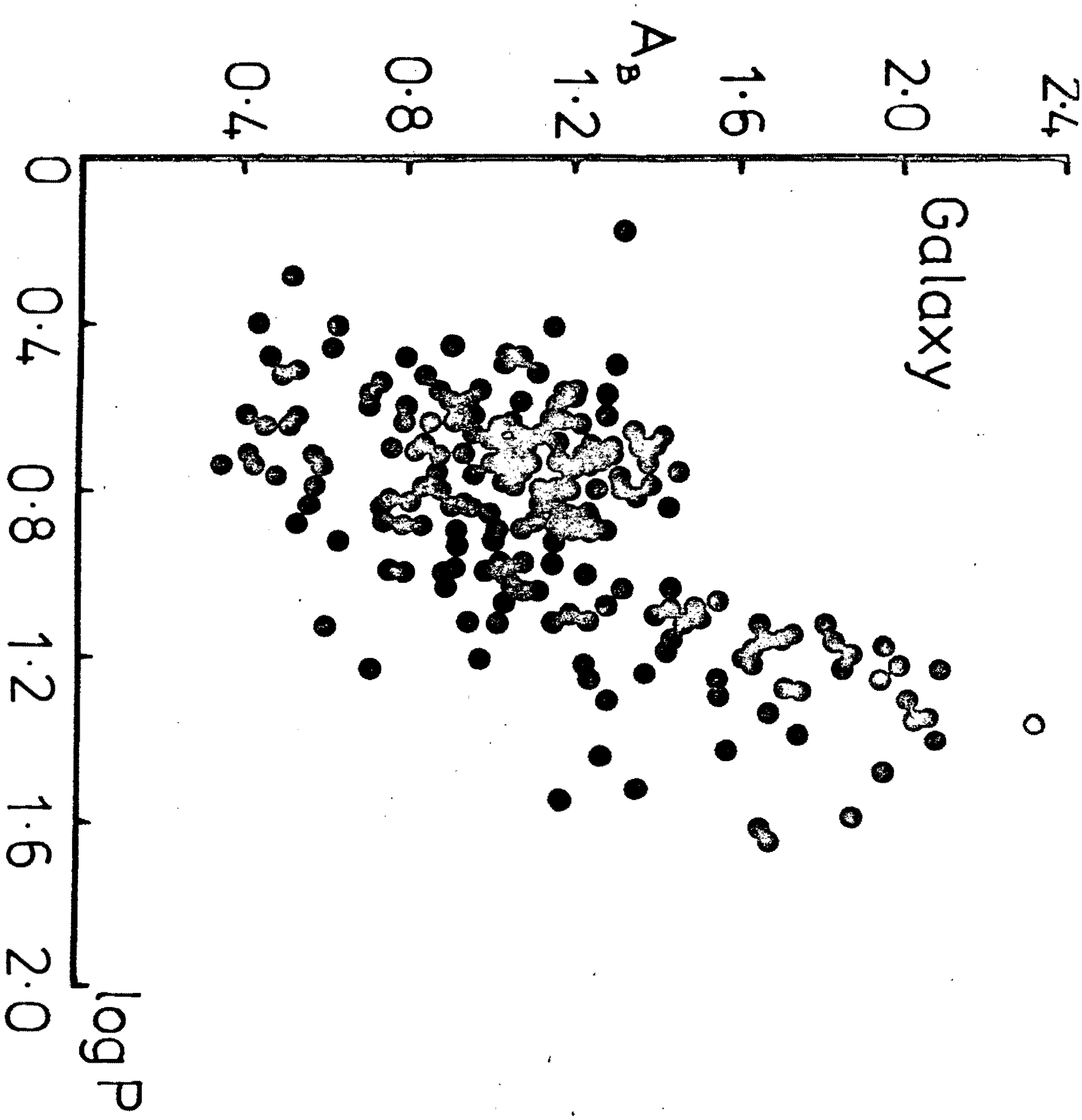


Fig 4.42

Amplitude-period plot for SMC cepheids
(dots = photographic data, crosses = photoelectric data)

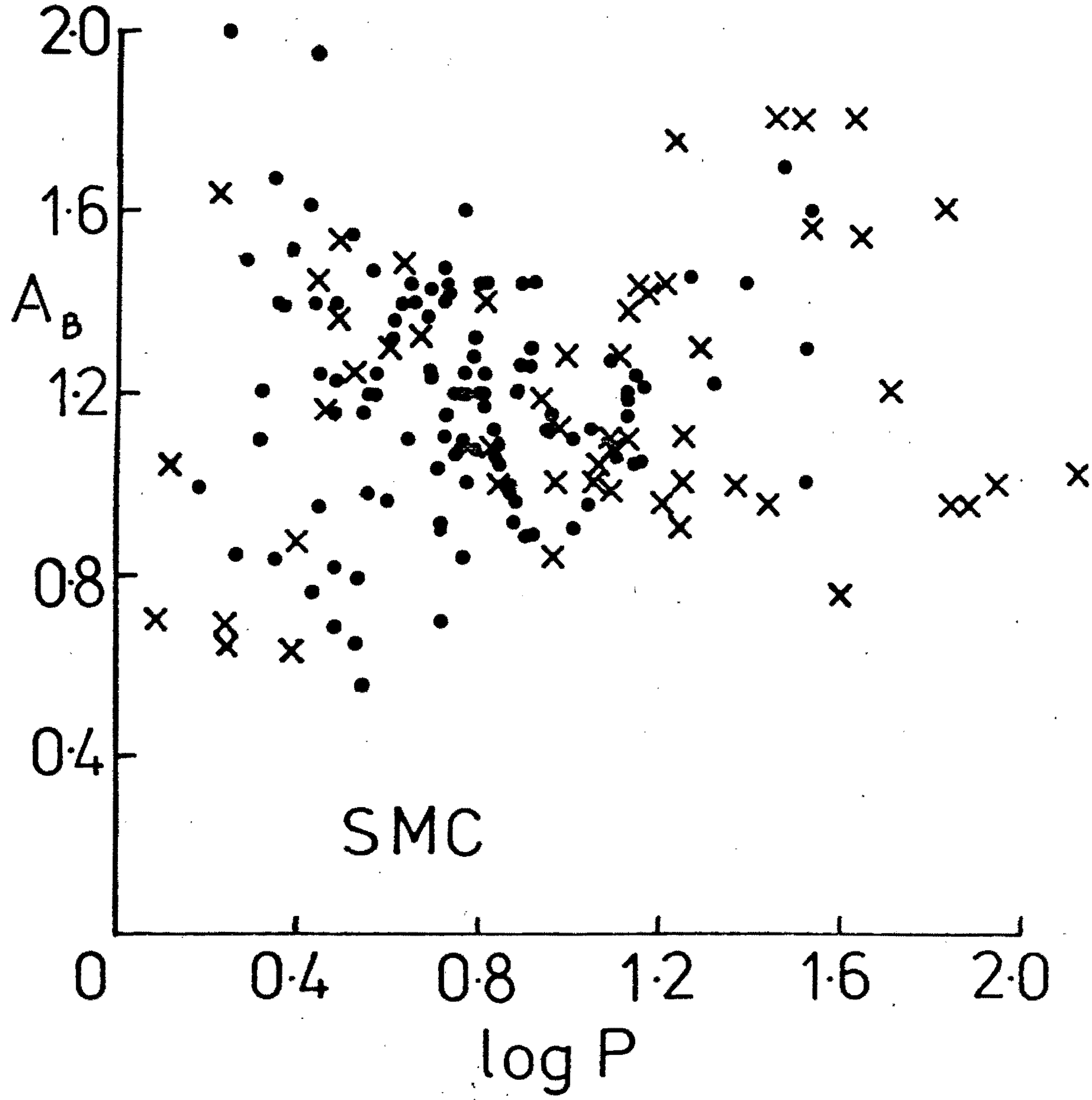


Fig 4.43

Amplitude-period plot for LMC cepheids
(dots = photographic data, crosses = photoelectric data)

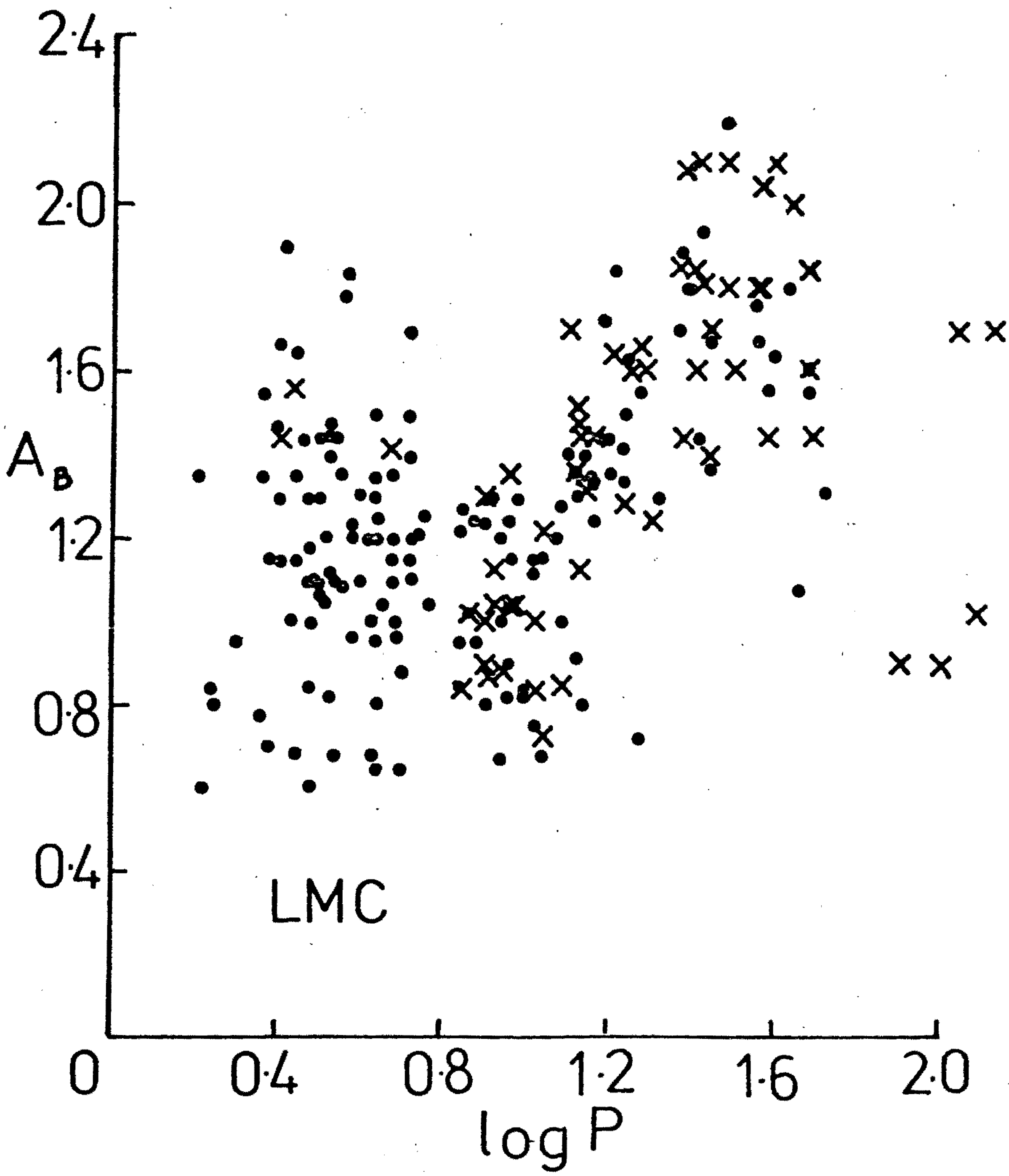


Fig 4.44

Amplitude-period plot for M31 cepheids

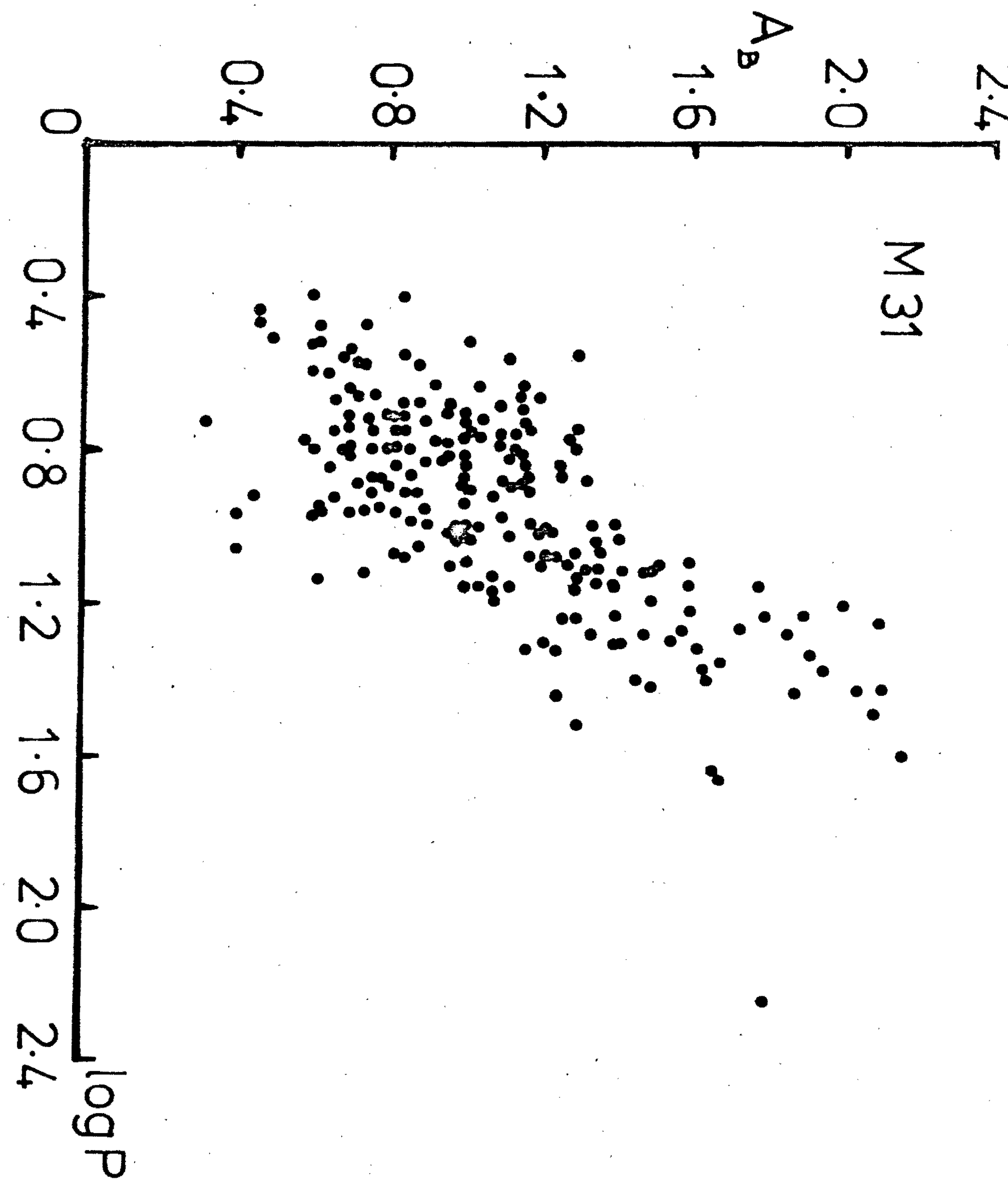
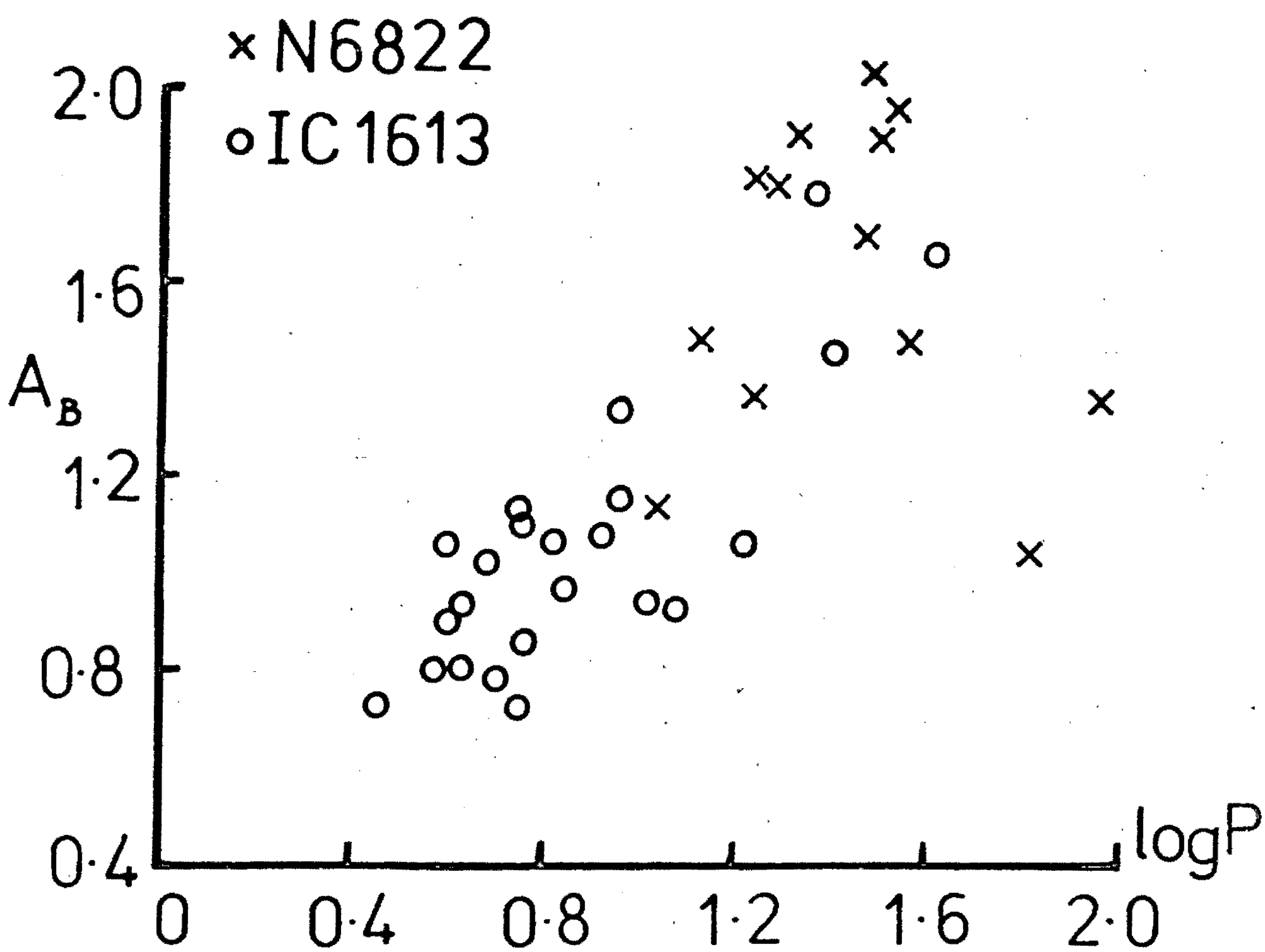


Fig 4.45

Amplitude-period plots for NGC 6822 and IC 1613 cepheids



from galaxy to galaxy depending on variations in helium and metal content. Where these tracks penetrate most deeply into the strip, the cepheids will have intrinsically bluer colours. This would explain why the SMC ($Z \lesssim 0.005$, $Y \sim 0.38$) appears to have the greatest number of short period cepheids, followed by the LMC ($Z \sim 0.01$, $Y \sim 0.28$) with correspondingly fewer cepheids. For NGC 6822, which we inferred in § 4.2 to be as metal weak as the SMC (and should therefore have a relatively large number of short period cepheids) the data reach only as faint as log P $\sim$ 1.0, so that for this galaxy (and IC 1613) further observations are required.

(c) The SMC and LMC both have their largest amplitude, short period cepheids at log P $\sim$ 0.4. Since there is a cut-off at log P $\sim$ 0.5 for the cepeheids in the remaining galaxies, either because of the abundance effects or observational selection discussed above, it is not possible to make the corresponding comparison.

(d) There appears to be a separate subgroup of short period, small amplitude cepheids in our Galaxy, M31 and the Magellanic Clouds, which, as we saw in § 3.1, are probably cepheids that are either pulsating in the first overtone or that possess companions. Again due to the limited data for NGC 6822 and IC 1613, it is not possible to disclose the existence of such a subgroup.

(e) The upper envelopes in the A_B - log P diagrams for the Galaxy, SMC, LMC and M31 all appear to dip at log P $\sim$ 0.95 ±0.05. Cepheids whose periods are $\sim$ ten days, tend to have smaller amplitudes (causing the 'dip') and sinusoidal light curves. These phenomena are thought by some (see eg van Genderen, 1974) to be associated with the change over of 'bumps' from one side of the light curve to the other. Investigations of cepheid bumps and their inter-comparison amongst different galaxies require accurate phase determinations of such bumps which was not possible with the present (photographic) data.

(f) In the period range log P > 1.0, all A_B - log P diagrams show that the maximum amplitude is reached at log P $\sim$ 1.5 and in all cases except for the SMC, A_B attains values of $\sim 2^{m}.2$.

4.5 Asymmetry - period diagram

The asymmetry of cepheid light curves should also prove to be a useful parameter in the comparison of cepheids in different systems since, like amplitude, it should be free from reddening effects and also is not expected to be sensitive to metal abundance effects. We have in the cases of NGC 6822, IC 1613 and M31 derived AS_B from the published light curves. In Figures 4.51, 4.52, 4.53, 4.54, 4.55 we have plotted AS_B - log P for our galaxy, SMC, LMC, M31 and NGC 6822 and IC 1613 respectively. Inspection of these diagrams reveals:-

(a) The shapes of the upper envelopes closely resemble those of the A_B - log P plots.

(b) The existence of a subgroup of cepheids with short period and nearly sinusoidal light curves. We have discussed these in 4.4 (d).

(c) In all cases AS_B peaks at log P $\sim$ 0.6 for the short period cepheids.

(d) In all cases the upper envelopes reach a minimum AS_B at log P $\sim$ 1.0 [See 4.4 (e)].

(e) In all cases the upper envelope for the longer period cepheids reaches a maximum value of AS_B at log P $\sim$ 1.4.

These results indicate that the asymmetries and amplitudes of cepheids in the galaxies considered exhibit very similar properties and that abundance differences appear to affect only the amplitude distributions at short period.

Fig 4.51

Asymmetry-period plot for galactic cepheids

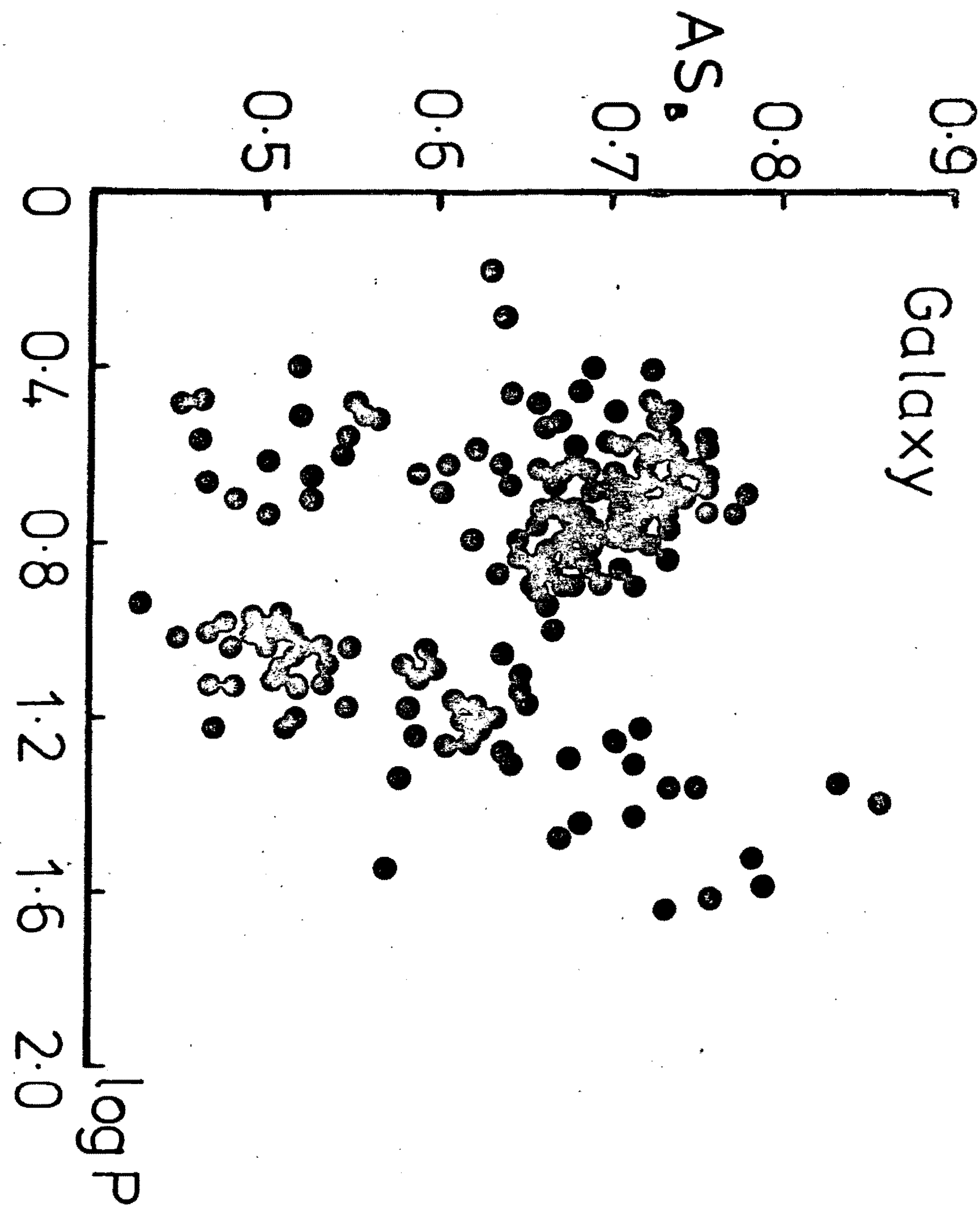


Fig 4.52

Asymmetry-period plot for SMC cepheids
(dots = photographic data, crosses = photoelectric data)

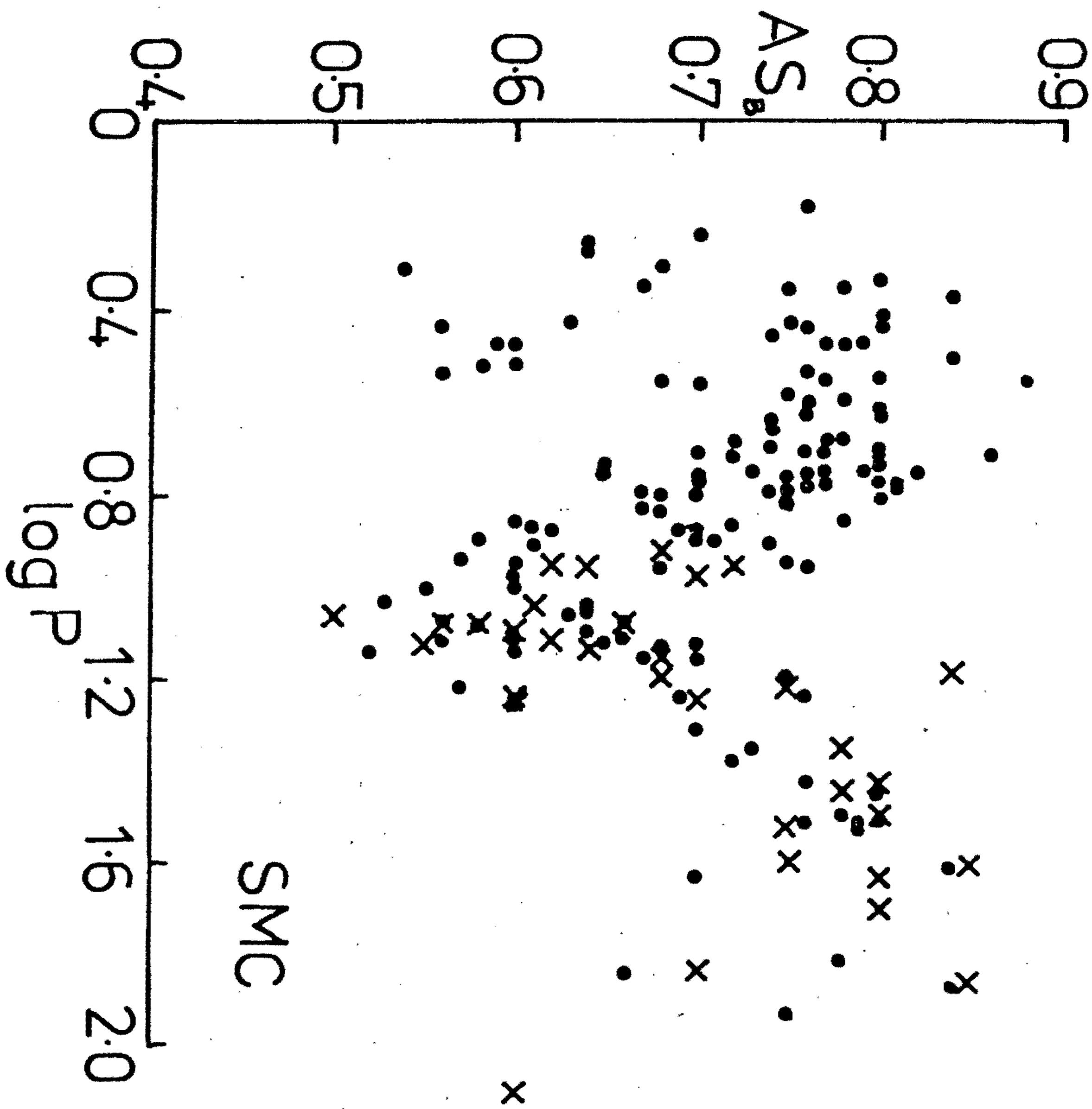


Fig 4.53

Asymmetry-period plot for LMC cepheids
(dots = photographic data, crosses = photoelectric data)

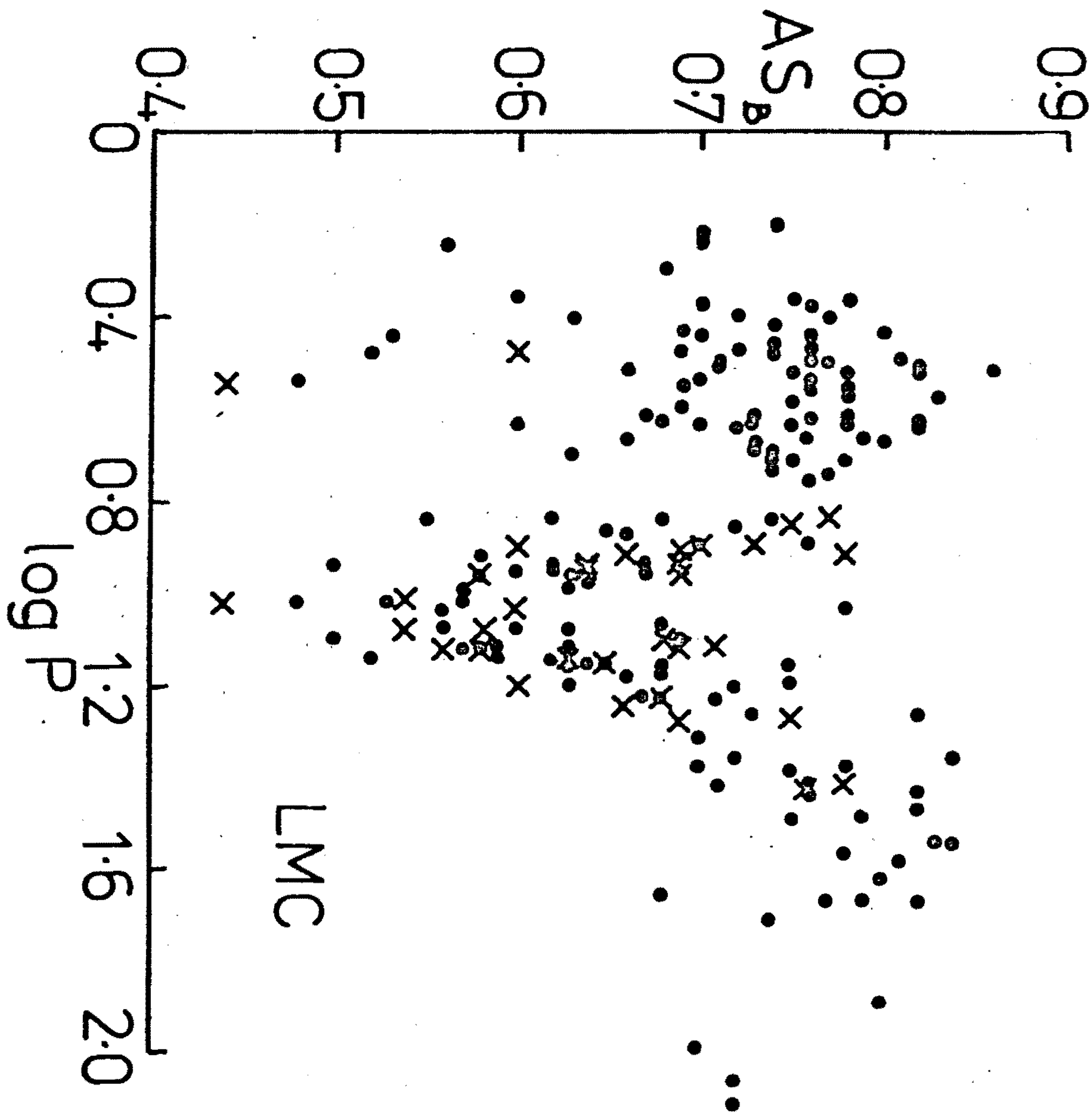


Fig 4.54

Asymmetry-period plot for M31 cepheids

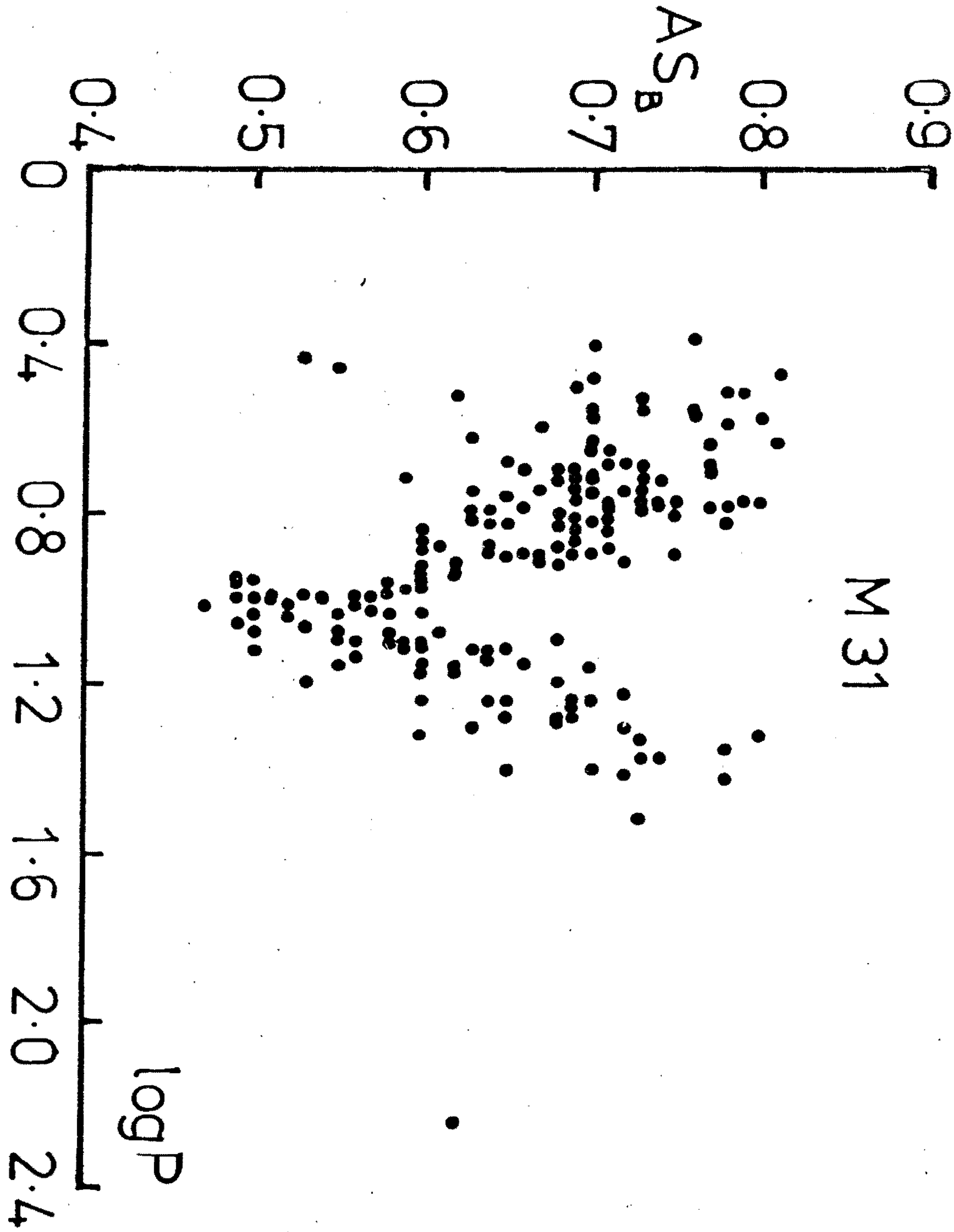
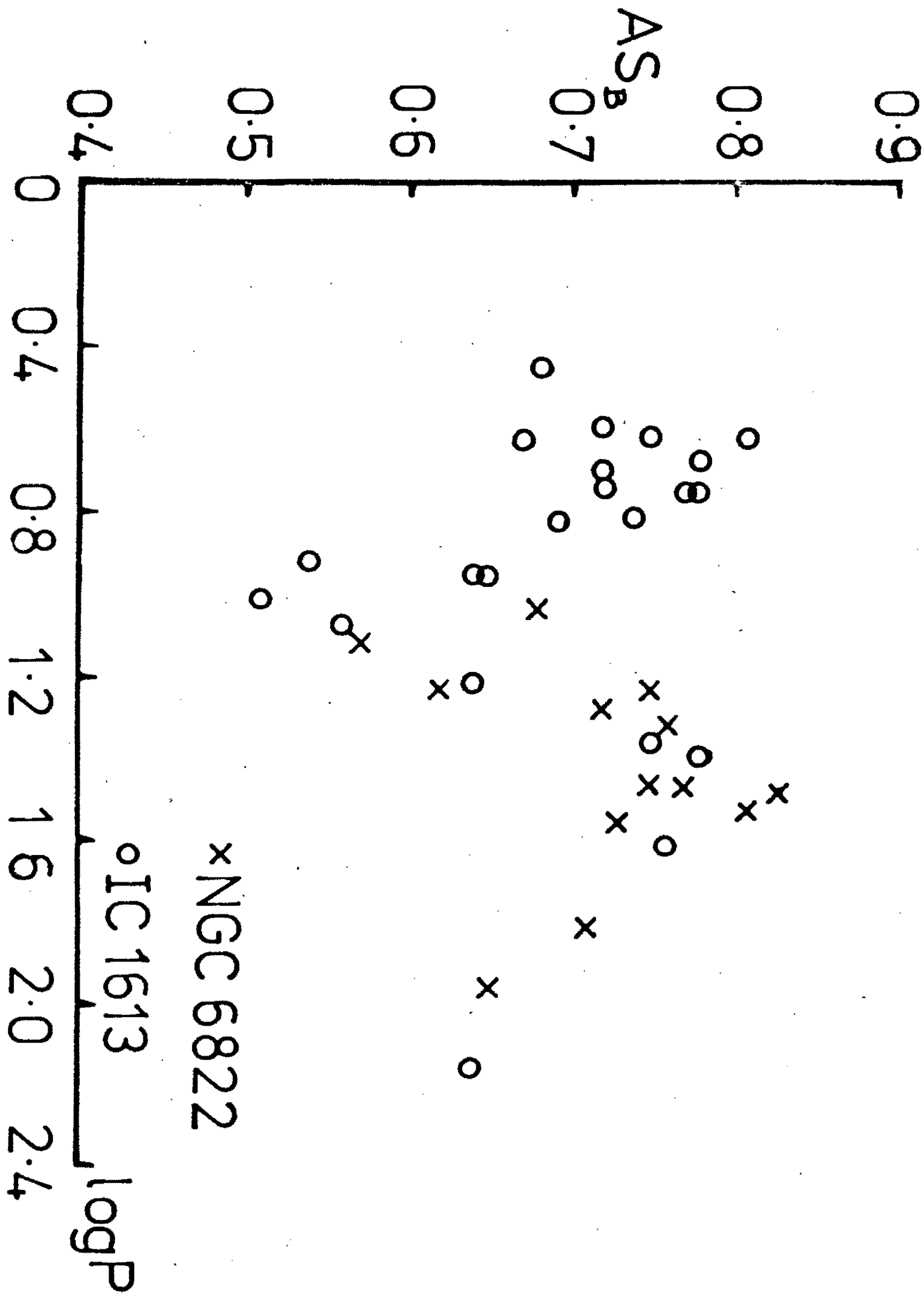


Fig 4.55

Asymmetry-period plot for NGC 6822 and IC 1613 cepheids



4.6 Distance moduli

In § 3.10 it was suggested that distances to cepheids in other galaxies might be obtained by comparing Iben and Tuggle's (1975) theoretical blue edge for fundamental-mode pulsators with observational data. This method has the advantage that (unlike the P-L-C derivation) it is not sensitive to differences in composition amongst cepheids; however the method is dependent on reddening. We shall, therefore, attempt to derive distance moduli for M31, NGC 6822 and IC 1613 using this method and compare the results with those derived from P-L relationships to which a mean slope has been fitted.

(1) NGC 6822

(a) Blue-edge fit

In Fig 4.61 we have plotted log L - log P for the 13 cepheids by Kayser (1967). Log L is given by:

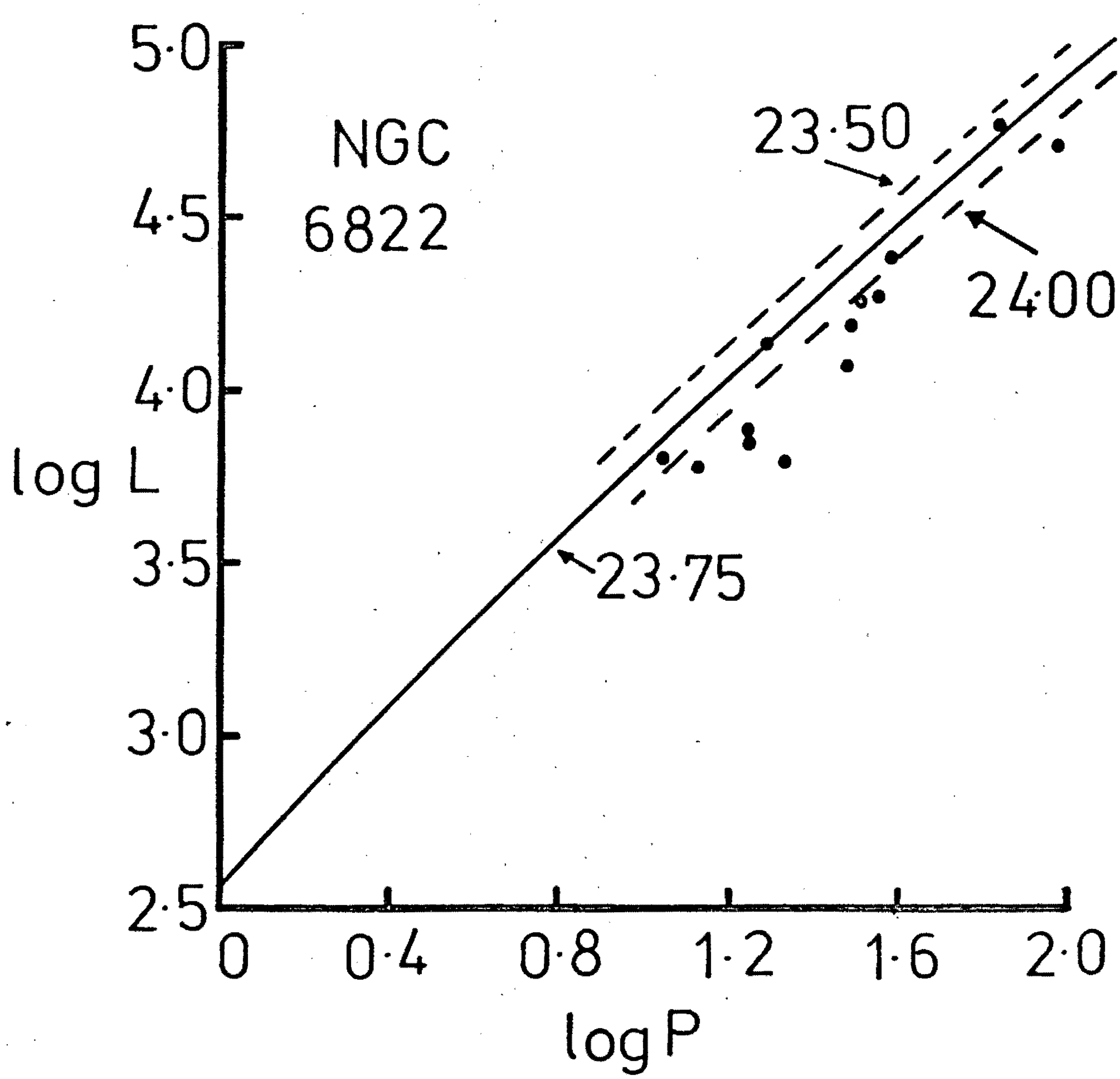
$$\log L = 0.4\,(4.625 - \langle V\rangle_o + 0.322\,\langle B-V\rangle_o + m_d)$$

which is merely equations (3.105), (3.106) and (3.107) combined together. We start with a guess at the value of the true distance modulus (m_d) of 23.75 taken from Kayser's work and then derive log L for each cepheid adopting $E_{B-V} = 0.27$.

Also shown in Fig. 4.61 is Iben and Tuggle's blue-edge line derived from equation (3.103) assuming $\beta = {}^1/_4$, which we saw in § 3.10 provided the best fit to the Magellanic Cloud data. In fact in Fig 4.61, three blue-edge lines are drawn corresponding to true distance moduli of 23.50, 23.75 and 24.00 (although, of course, it is the individual points that change with different values of m_d and not the theoretical blue-edges). The best 'blue-edge' fit to the data appears to lie somewhere between the lines

Fig 4.61

log L - log P plot for NGC 6822 cepheids



represented by $m_d = 23.50$ and $m_d = 23.75$. Consequently we have adopted a true distance modulus of 23.63.

(b) P-L relationship

Following the method described in § 3.9 we fit a slope of 2.70 (by eye) to the $\langle V\rangle/\log P$ data shown in Fig. 4.62. Thence:-

$$\langle V\rangle = -2.70 \log P + 23.02$$

For the galactic cepheids we found; equation (3.91) :-

$$M_V = -2.70 \log P - 1.42$$

Subtracting these two equations we have:-

$$\langle V\rangle - M_V = 24.44$$

Assuming $E_{B-V} = 0.27$ and $A_V = 3.3\ E_{B-V}$ we find a true distance modulus of:

$$\langle V\rangle - M_{V\,o} = 23.55,$$

which is in quite good agreement with the modulus derived in (a) in spite of the different method of derivation.

(2) M31

(a) Blue-edge fit

The same procedure is followed as for NGC 6822. In this case we adopt $E_{B-V} = 0.10$ and $m_d = 24.50$ and plot log L versus log P (Fig. 4.63) for

Fig 4.62

NGC 6822 data fitted with a slope of 2.70 in the P-L plane

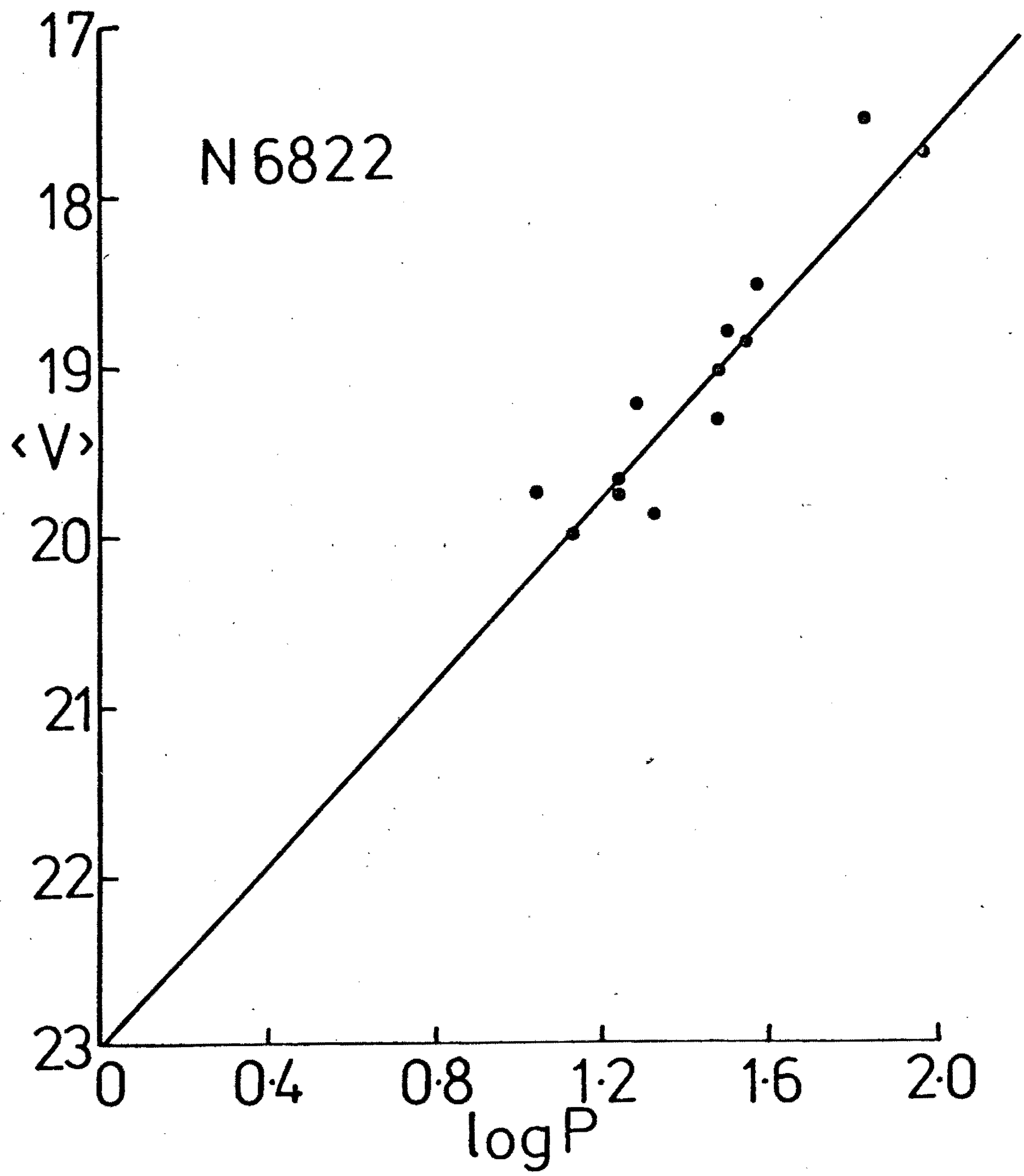
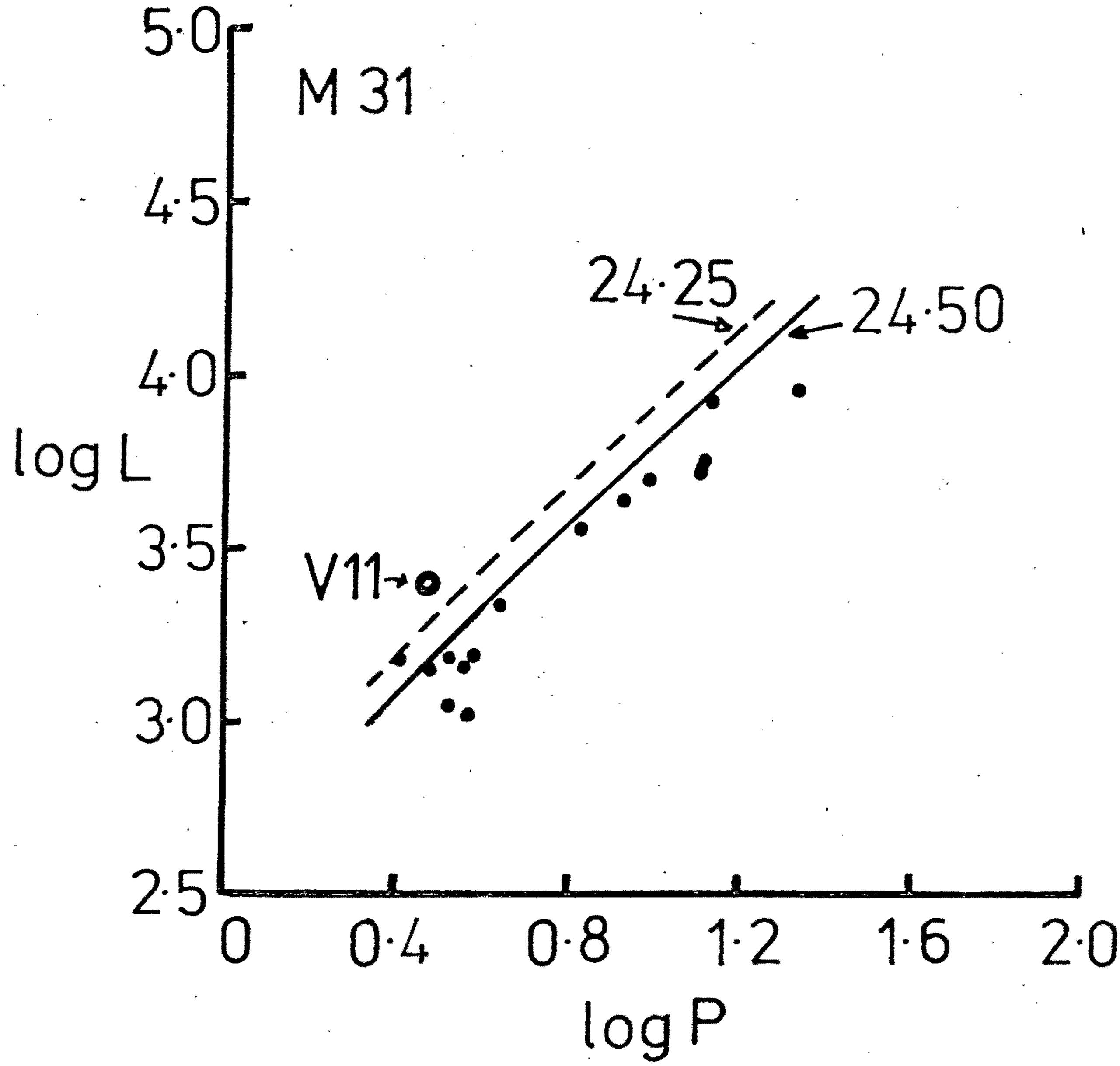


Fig 4.63

log L - log P plot for M 31 data



the 17 cepheids observed by Baade and Swope (1963). Two blue-edge lines (β = $^1/_4$) are superimposed on the data in Fig. 4.63 representing true moduli of 24.25 and 24.50. If the cepheid, VII, in Baade and Swope's list is ignored due to its very small amplitude (A_B = 0.46) and therefore its probable membership of the subgroup described in § 4.4, then the best fit to the data is provided by a value of $m_d \sim 24.40$.

(b) P-L relationship

Fitting the mean Magellanic Clound <V>/log P slope of 2.70 to the data in M31 gives:-

$$\langle V \rangle = -2.70 \log P + 23.12$$

which we show in Fig. 4.64.

Combining this expression with that for the Galaxy and applying the reddening correction we arrive at a true distance modulus of 24.21 - a value somewhat smaller than that derived in (a).

(3) IC 1613

Since Sandage (1971) made B observations only for the cepheids in this galaxy, the distance modulus will be derived from the <B>/log P relationship alone. In Fig. 4.65 we plot <B> against log P for the 23 cepheids in the range log P < 2.0. The mean <B>/log P slope for the Magellanic Clouds is 2.31 which we have fitted (by eye) to the data. It can be seen from Fig. 4.65 that the slope defined by Sandage's cepheids is much flatter than that for the Clouds. Van den Bergh (1977) who noticed the same phenomenon concluded that (a) either the period-luminosity law for IC 1613 was intrinsically different from that in the Galaxy or (b) the observations were affected by a magnitude scale error which probably has its greatest effect amongst the fainter cepheids. As a result van den Bergh chose only the six

Fig 4.64

M31 data fitted with a slope of 2.70 in the P-L plane

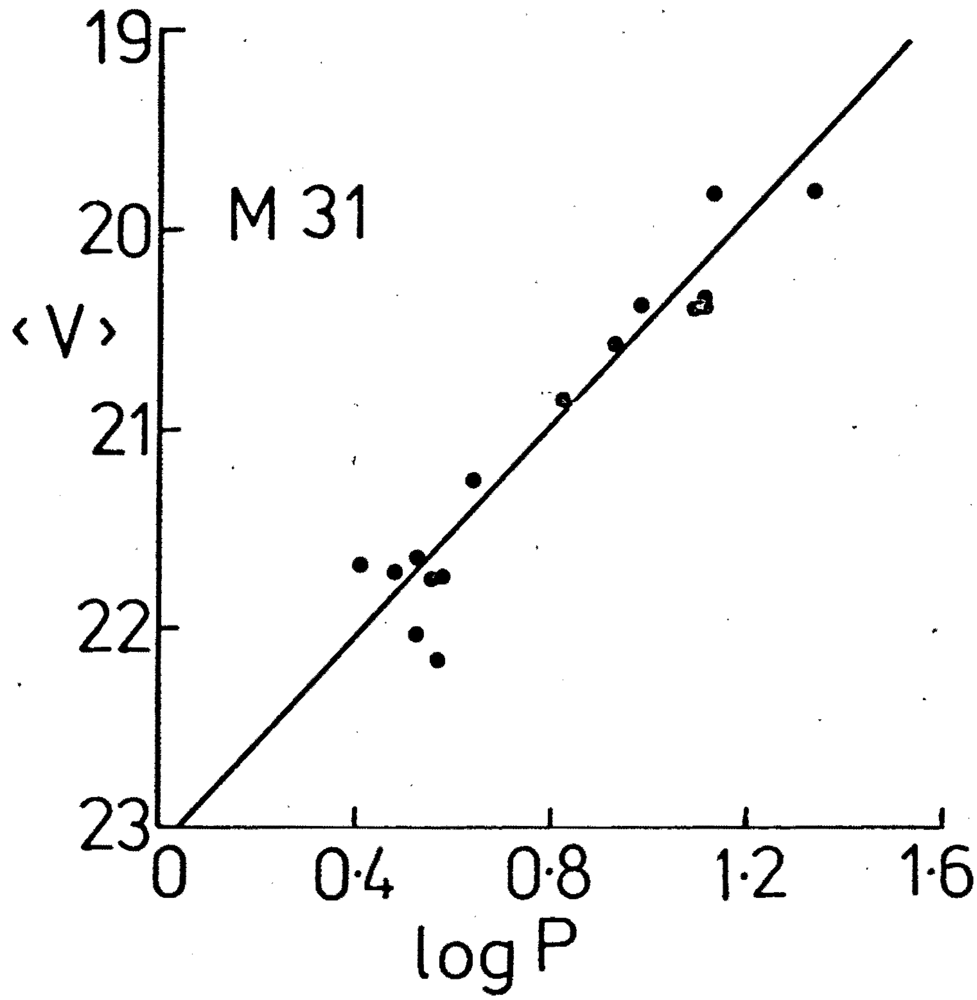
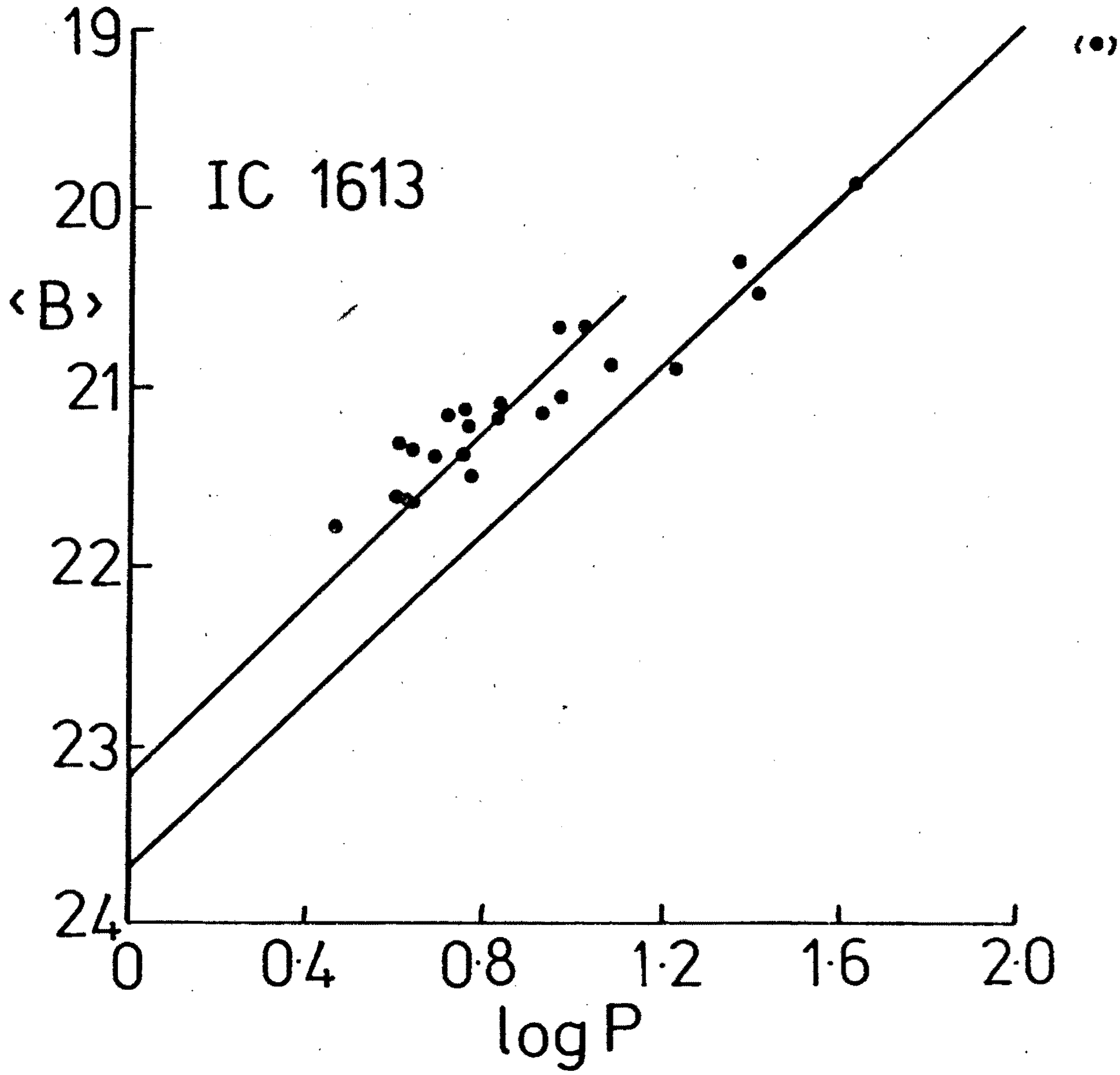


Fig 4.65

IC 1613 data fitted with a slope of 2.31 in the P-L plane
(Two separate fits are made with the data divided at log P = 1.1)



cepheids in the range $1 < \log P < 1.7$ to determine the distance modulus.

We have fitted two lines with the same slope of 2.31 to the IC 1613 data, one for the short and one for the long period cepheids, divided at $\log P = 1.1$. The $\langle B \rangle - \log P$ relationship for galactic cepheids (specified in § 3.9) is shown in Fig. 4.66, from which the best (eye) fit with a slope of 2.31 is given by :-

$$M_B = -2.31 \log P - 1.08$$

The equivalent relationships for IC 1613 are:-

$$\langle B \rangle = -2.31 \log P + 23.68 \qquad \log P > 1.1$$

$$\langle B \rangle = -2.31 \log P + 23.17 \qquad \log P < 1.1$$

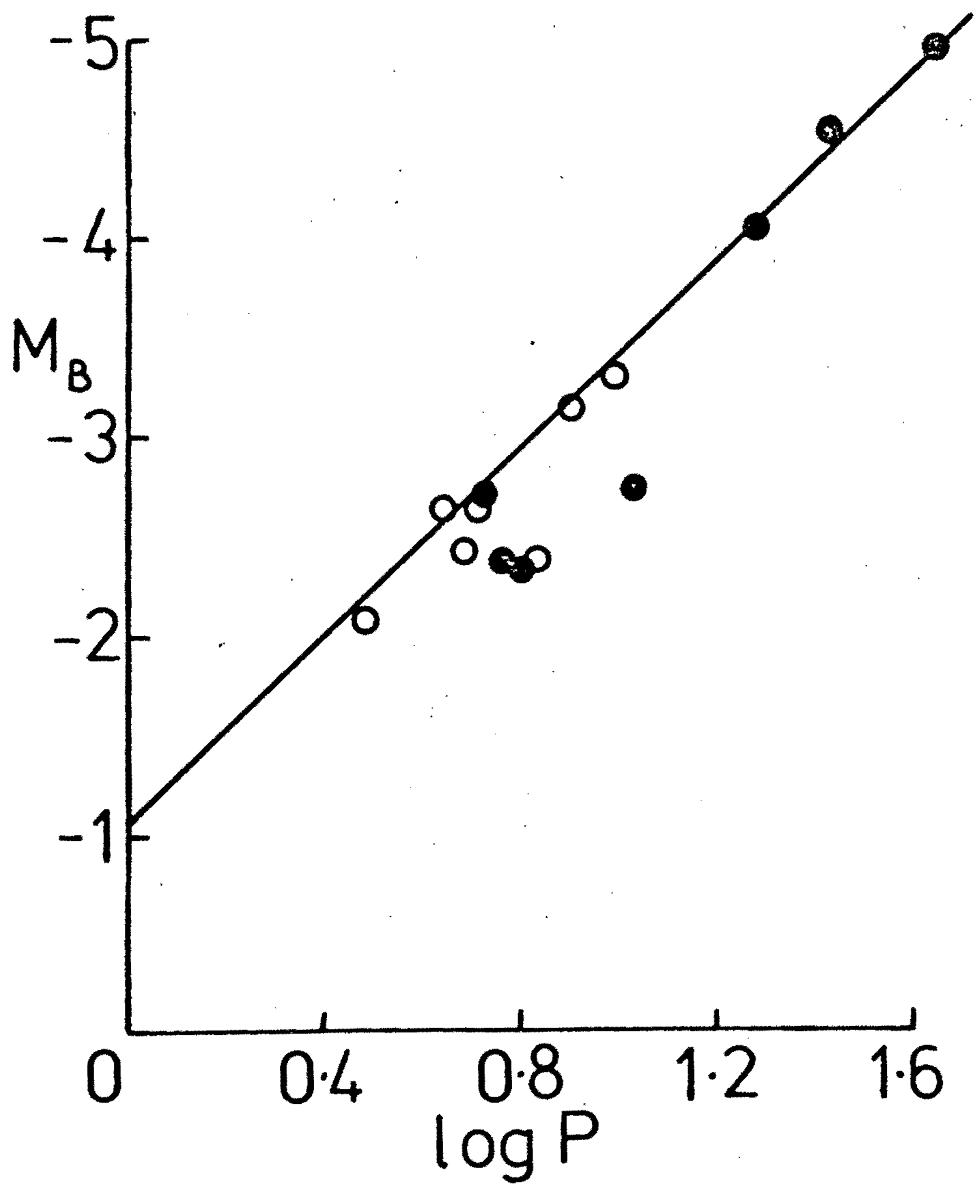
Subtracting the galactic relationship from these and applying a value of $E_{B-V} = 0.03$ (van den Bergh, 1977) yields distance moduli of 24.63 and 24.12 for the long and short period cepheids respectively. We have therefore adopted a modulus of 24.38.

4.7 Comparison of distance moduli

One of the problems with comparing distance moduli amongst different authors is that each author uses a different value of reddening. In order to go some way towards standardization we have used the same reddening for each galaxy. In Table 4.71 we present a sample of the many distance derivations that have been made from the following sources:-

Fig 4.66

M_B - log P plot for galactic cepheids onto which has been superimposed the mean Magellanic Cloud (P-L) slope of 2.31



(1) de Vaucouleurs' (1978b) general review of distance moduli of nearby galaxies (= deV).

(2) Crampton's (1979) distance modulus of the LMC from spectral classification and Hγ equivalent widths of 25 OB stars (= C).

(3) Martin et al's (1979) LMC modulus from BVI photometry of cepheids (= MWF).

(4) Gascoigne's (1974) summary of the SMC modulus (= Gasc).

(5) The results from this work (= WLM).

Table 4.71

Comparison of various distance moduli

Source	Galaxy	$(V-M_V)_o$	E_{B-V}	Indicators
de V	LMC	18.57 ± 0.15	0.04	All available
C		18.70 ± 0.2		OB stars
MWF		18.69 ± 0.15		Cepheids
WLM		18.66 ± 0.06		Cepheids
de V	SMC	18.76 ± 0.15	0.04	All
Gasc		19.05(± 0.15)		'best'
WLM		19.01 ± 0.15		Cepheids
de V	M31	24.04 ± 0.16	0.10	All
WLM		24.30 ± 0.2		Cepheids
de V	N6822	23.44 ± 0.25	0.27	'All'
WLM		23.60 ± 0.2		Cepheids
de V	IC1613	24.10 ± 0.25	0.03	'All'
WLM		24.4 ± 0.3		Cepheids

LMC

From the more recent determinations, it would appear from Table 4.71, that the distance to the LMC can now be given with some confidence.

A mean of the four estimates listed gives:-

$$(V - M_V)_o = 18.66 \pm 0.10$$

SMC

Gascoigne's 'best' estimate of the SMC modulus agrees well with our value, but de Vaucouleurs' mean value is low compared with ours (even with the smaller reddening applied). An overall assessment of distance determinations from different types of indicator (eg. RR Lyraes, eclipsing binaries, etc) depends to a certain extent on the weight attached to each method. Without going into lengthy discussion on the subject, we feel the 'best' estimate of the SMC modulus is:-

$$(V - M_V)_o = 19.00 \pm 0.15$$

M31, NGC 6822, IC 1613

The moduli derived from this work depend upon fitting theoretical models and empirical results to the few cepheid data points that are available. Consequently the distances so obtained are less reliable. Methods of determining distance moduli from other types of indicator (eg Novae, brightest stars, etc) encounter similar difficulties; however, for what they are worth the mean of the moduli given in Table 4.71 are:-

$(V - M_V)_o = 24.17 \pm 0.2$ for M31, 23.52 ± 0.2 for N6822 and 24.25 ± 0.3 for IC 1613

Clearly a lot more work (especially in obtaining cepheid data) needs to be done.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

5.1. Overall conclusions

The main purpose of this work has been to compare the properties of a large number of cepheids in the Magellanic Clouds with those in other galaxies in order to ascertain whether or not cepheids at least in these systems obey the same laws and which of these laws, if any, may be used to determine the distances to these galaxies. The overall conclusions we have reached may be summarized as follows:-

(1) Homogeneity. The cepheids in the Magellanic Clouds and as far as can be determined those in other galaxies, appear to share the same properties and obey similar laws, once effects of chemical composition have been taken into account.

(2) Chemical composition. The chemical composition of cepheids in each galaxy (compared to those in the Galaxy) may be derived by applying theoretical models to the observed period-colour and colour-magnitude diagrams.

(3) Distance scale. The distances to cepheids in each galaxy may be derived by applying either a period-luminosity-colour relationship and correcting for abundance effects or a period-luminosity relationship and correcting for reddening effects.

Let us examine each of these conclusions in a little more detail:

5.2. Homogeneity

The following observations led to the conclusions of homogeneity amongst cepheids in the galaxies considered:-

(i) The slopes of the P-L relationships for the Magellanic Cloud cepheids were found to be very much the same in both B and V colours. The actual values of the slopes (2.70 ± 0.02 in V and 2.31 ± 0.05 in B) are somewhat smaller than those derived by other investigators (Gascoigne (1969), Woolley et al (1962), Hodge and Wright (1969), etc) and this is due mainly to observational selection effects introduced by the smaller cepheid samples that these authors had at their disposal. Because of the sparseness of the data it was not possible to make a critical examination of the slopes of the P-L relationships for cepheids in galaxies such as the Galaxy, M31, NGC 6822 and IC 1613, although the adopted slope from the Magellanic Cloud data fitted observations of cepheids in the Galaxy, M31 and NGC 6822 very well.

(ii) The distribution of cepheids in the asymmetry-period diagrams for each of the galaxies LMC, SMC, M31, NGC 6822, IC 1613 and the Galaxy are very similar.

(iii) The distribution of cepheids in the amplitude-period diagrams for each of these galaxies are similar only for those cepheids of longer period ($\log P > 1$). In the shorter period regions of these diagrams there appears to be a definite lack of cepheids in, for example, the Galaxy as compared with the SMC, which can be accounted for by differences in chemical composition between the galaxies.

(iv) By inspecting the amplitude-period and asymmetry-period diagrams of cepheids in different galaxies it is clear that, where the samples are large enough, there exists a sub-group of cepheids in each galaxy which exhibit nearly sinusoidal light curves and small amplitudes. It is thought that these cepheids are pulsating in the first overtone and indeed comparison with the theoretical models of Iben and Tuggle (1975) show that the observations are consistent with theory. However there is still further work to be done to distinguish between cepheids that are genuine overtone pulsators and those that give overtone characteristics, but are in fact cepheids whose light curves are distorted by companion stars. Other possible anomolous cepheid subgroups such as the intermediate-type W Virginis stars (as seen in the LMC and SMC) and the apparently subluminous long period cepheids, also require further investigation.

(v) For both the LMC and the SMC, the observed P-L-C relationships, at least for the longer period cepheids, follow the form of the P-L-C relationships predicted theoretically. For the shorter period cepheids there is some indication that a smaller colour coefficient is preferred, but this effect may be due to inaccuracies in the photographic photometry.

5.3. Chemical composition

From the period-colour relationship it was demonstrated that the cepheids in the SMC and LMC were intrinsically bluer than those in the Galaxy by $0^{m}.17$ and $0^{m}.04$ respectively. Applying the theoretical models of Bell and Parsons (1974) these differences were shown to correspond to under-abundances (in Z) in the SMC and LMC (compared with the galaxy) of factors of 4.0 and 1.4 respectively. Other methods of determining the metal abundance from this work (using the parameter Q and from the P-L-C relationship) and independent observations of HII regions, etc, in the Magellanic Clouds, tend to support these conclusions. Approximate abundance determinations, from plots of log P - (B - V), were also made for the cepheids in NGC 6822 and M31 but as the data in these cases are rather sparse the results are less well defined.

A method of deriving both helium (Y) and metal (Z) abundances simultaneously is provided by comparing observations (in the colour-magnitude plane) with the theoretical models of Iben & Tuggle (1975) which predict the position of the blue edge of the instability strip as a function of chemical composition. This method confirms the metal abundance of the LMC cepheids ($Z \sim 0.015$) and yields a helium abundance that is normal ($Y \sim 0.28$). For the SMC cepheids the situation is less clear, but if the photographic colours of the shorter period cepheids are discounted (due to errors in photometry), a reasonably good fit to the data can be made corresponding to helium and metal abundances of $\sim$0.38 and $\sim$0.005 respectively.

5.4. Distance scale

Whilst there is some evidence that the shorter period SMC cepheids follow the form of the P-L-A and P-C-A relationships derived by Sandage and Tammann (1971), we decided not to use these relationships for distance determinations because of the problems in defining the amplitude parameter (f_B), the need to consider three separate period ranges and also because it is the longer period (i.e. brighter) cepheids that are more readily accessible in external galaxies.

As a result the P-L and P-L-C relationships were used to determine distances to the Small and Large Magellanic Cloud.

The (mean) P-L-C relationship adopted for each Cloud has (B - V) colour coefficients which are in satisfactory agreement with the theoretical values of Sandage and Tammann (1969), Gascoigne (1974), Iben and Tuggle (1975), etc., (i.e. β = 2.5 - 3.1). Consequently, since the ratio of total to selective absorption is ∿3.3, the correction for reddening using the P-L-C method is very small. Martin et al. (1979) have shown however that a correction for metal abundance to the final LMC distance modulus is necessary. An estimate of the equivalent correction for the SMC modulus was made in this study, but in order to determine this correction accurately, photoelectric BVI observations of SMC cepheids are required so that individual cepheid reddenings may be obtained. Since the SMC cepheids appear to be considerably under-abundant in metals compared with those in the Galaxy (and the LMC), this modulus correction is likely to be quite large, as indeed our estimate suggested.

The P-L method on the other hand is, according to Iben and Tuggle (1975), free from metal abundance effects. However the limitation on this method is that values for the reddening need to be determined accurately. As a result the Magellanic Cloud moduli were derived using both the P-L and P-L-C methods from which mean values were taken.

For the other galaxies considered, the shortage of cepheid data precludes accurate distance determinations and the methods of P-L slope and blue edge fitting should be treated more in the nature of a pilot study. However it is interesting to note that the distance moduli so derived are in quite good agreement with those found by other authors.

5.5. Work for the future

(a) Theoretical work

The form of the theoretical period-luminosity-colour relationship derived by Sandage and Tammann (1969), Iben & Tuggle (1975), Gascoigne (1974) and others seems now to hold true for cepheids in the Magellanic Clouds. The exact nature of the relationships between colour and effective temperature, colour and chemical composition, etc. do however require further refinement. There is also a need for some theory relating to the amplitude of light variation. An exact prediction of the expected behaviour of amplitude with colour, magnitude and period of a cepheid would enable direct comparisons with observation to be made.

(b) Observational data

(1) The Galaxy. In our Galaxy the problem remains that only a few cepheids, which are associated with clusters, have known distances. With so many cepheids near at hand the first priority is to establish a method which enables distances and reddenings to be accurately determined.

(2) Magellanic Clouds. Both clouds require many more photoelectric (UBVRI) observations of short and intermediate period cepheids in order to clarify the situation regarding the P-L-C relationship. Further (BVI) observations are also required for cepheids (and W Virginis stars) of all periods in order to determine individual reddenings and hence intrinsic P-L-C-A relationships. In addition, observations of the brighter cepheids need to be made in a narrow band system such as the Strömgren or DDO systems in order to provide further information on cepheid gravities, temperatures

and abundances. It would also be very useful (for independent mass determinations, etc) to find and study short period cepheids which are pulsating in both the fundamental and first harmonic modes.

(3) Other stellar systems. Clearly, there is a dire need for more (good quality) observational data of cepheids in nearby galaxies such as M31, M33, NGC 6822 and IC 1613, in order to make detailed studies of their P-L and P-L-C relationships from which reliable distance moduli can be derived. Although the short period cepheids in these systems are likely to be rather faint ($\sim 22^m$), the fact that these galaxies appear to occupy only a small area of sky means that they would be perfect candidates for observation with the McMullan (1972) electronographic camera where exposure times, at least in broad band colours, would not be particularly long, even for moderately small (i.e. 1-m) telescopes.

Finally, perhaps the most exciting prospect for the future is the possibility of securing observations of cepheids with the Space Telescope in even more distant systems such as the Virgo cluster of galaxies. Distances to these galaxies derived from an established cepheid period-luminosity or period-luminosity-colour law could then be directly combined with observed galaxy red shifts to make an independent determination of the Hubble Constant.

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APPENDIX A

INDIVIDUAL B, V MAGNITUDES OF SMC AND LMC CEPHEIDS

LARGE MAGELLANIC CLOUD - LMC I

	W41			12512			12520		
J.D. 244	Φ	V	B	Φ	V	B	Φ	V	B
2071.337	25	16.41	16.55	50	15.77	16.21	21	15.90	16.69
2073.377	48	16.41	16.54	38	15.69	15.73	06	15.94	16.47
2073.560	60	16.09	16.89	46	15.52	15.96	13	15.89	16.63
2076.447	34	16.16	16.65	69	16.14	16.55	34	16.38	16.77
2077.318	87	15.89	16.17	07	16.51	16.62	70	16.58	17.01
2078.517	59	16.28	16.71	58	16.00	16.20	20	16.30	16.53
2097.305	96	15.71	16.33	63	16.10	16.41	04	15.99	16.42
2098.444	65	16.19	16.83	11	16.04	16.62	52	16.57	17.01
2102.300	98	15.93	16.11	77	16.04	16.50	12	16.02	16.40
2103.295	58	16.01	16.64	19	16.18	16.66	54	16.31	16.95
2104.300	19	15.96	16.69	66	16.02	16.54	96	15.79	16.35
2126.342	52	16.31	16.68	06	16.30	16.54	16	16.30	16.50
2128.346	74	16.22	16.41	92	16.34	16.80	99	15.85	16.37
2129.349	34	16.16	16.50	35	15.29	15.58	41	16.37	16.90
2134.289	33	16.00	16.67	46	15.70	15.98	47	16.43	17.50
2135.272	93	15.80	16.30	89	16.30	16.68	88	15.65	16.25
2138.248	73	15.86	16.79	16	15.92	16.70	12	16.48	16.60
2304.542	32	16.10	16.65	38	15.60	15.79	50	16.51	
2305.538	90	16.00	16.40	79	16.20	16.58	90	15.76	16.20
2306.575	55	16.25	16.91	25	16.01	16.21	35	16.22	17.05
2307.514	12	16.01	16.45	65	16.03	16.51	74	16.45	16.95
2309.533	34	16.11	16.58	52	15.89	16.17	58	16.54	(18.00)
2310.581	97	15.91	16.26	97	16.30	16.78	02	15.68	16.50
2311.584	58	16.20	16.60	40	15.76	15.78	44	16.67	17.30
2392.428	48	16.45	16.65	02	16.34	17.09	16	16.20	17.00
2393.417	08	15.91	16.50	44	15.60	15.94	58	16.80	17.35
2394.481	73	16.08	16.40	90	16.10	16.94	02	15.92	16.45
2395.498	34	16.50	16.69	33	15.44	15.64	45	16.30	17.20
2396.485	94	15.96	16.17	76	16.40	16.59	86	15.90	16.28
2397.392	49	16.14	16.76	14		17.10	23	16.38	16.88
2400.432	33	16.59	16.59	45	15.70	15.90	50	16.54	17.35
2401.435	93	16.18	16.27	88	16.08	16.83	92	16.00	16.16
2402.448	55		16.80	31	16.21	15.71	34	16.44	17.05
2403.448	15	16.05	16.45	74	16.06	16.76	76	16.57	17.25
2404.395	72	15.95	16.50	14	16.44	17.01	16	16.25	16.90
2427.360	62	16.10	16.64	98	16.18	16.99	74	16.39	17.30
2428.353	22	16.03	16.50	40	15.53	15.72	15	16.28	16.82
2429.351	82	15.95	16.24	83	16.25	16.61	57	16.44	17.25
2431.318	01	15.93	16.26	67	16.01	16.68	39	16.33	17.30
2432.465	70	16.01	16.54	16	15.20	16.94	87	15.89	16.23
2433.421	28	16.30	16.53	58	16.08	16.44	26	16.24	17.03
2511.240									
2517.327									
2543.212	70	15.99	16.35	60	15.83	16.24	07	17.04	17.03
2544.216	30	15.20	16.59	02	16.43	17.14	48		
2714.495									
2715.437									
2717.460									
2719.424									
2720.401									

	W38			W44			W24			12528	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
19	15.54	(16.61)	51	16.50	17.16	01	15.05	16.11	93	16.78	16.92
04	15.60	16.14	30	16.68	17.08	77	15.78	17.12	69	16.44	
11	15.57	16.08	38	16.60	16.88	84	15.30	16.67	75	16.56	17.15
32	15.60	16.34	50	16.51	17.08	92	15.66	16.17	82	16.40	17.21
68	15.72	16.20	84	15.99	16.17	24	16.09	16.24	14	16.59	17.10
18	15.59	16.13	31	16.46	16.95	69	16.08	16.91	59	16.22	16.89
00	15.58	15.64	66	16.50	17.11	69	16.04	16.89	53	16.01	16.35
48	15.76		11	16.14	16.85	12	15.68	(17.28)	95	16.19	17.13
08	15.37	(16.47)	62	16.61	16.98	55	16.00		38	15.90	16.35
50	15.77	16.18	00	16.08	16.60	92	15.48	15.70	74	16.60	16.99
92	15.60	15.86	40	16.53	16.90	30	16.04	16.40	12	16.59	17.24
10	15.78	16.13	02	16.10	16.50	51	16.34	16.88	27	16.39	16.63
93	15.48	15.55	80	16.01	16.31	26	16.19	16.64	01	16.39	16.89
35	15.80	16.02	19	16.46	16.84	64	16.35	16.42	38	15.96	16.05
41	15.80	16.38	13	16.40	15.72	48	16.02	16.70	20	16.39	16.72
82	15.67	15.80	51	16.31		84	15.92	17.00	57	16.38	16.50
06	15.20	15.83	67	16.61		95	15.38	15.24	67		16.75
32	16.06	16.18	71	16.38	16.93	93	15.33	15.89	14	16.48	17.26
71	15.95	(16.85)	08	16.40	16.87	29	15.86	17.25	50	16.00	16.40
16	15.86	15.81	50	16.60	17.31	69	16.37	16.72	90	16.39	17.00
55	15.78	16.25	87	16.00	16.23	04	15.52	15.73	24	16.37	17.07
40	16.10	16.31	66	(16.83)	17.24	79	16.08	17.45	99	16.11	17.02
83	16.00	16.21	07	16.27	16.74	18	15.52	16.80	38	15.82	16.14
25	15.72	15.86	46	16.40	17.33	56	16.20	16.62	75	16.41	16.92
92	15.60	15.99	08	16.32	16.79	69	16.32	16.95	64	16.18	16.62
33	15.62	16.20	46	16.28	17.10	06	15.43	16.20	00	16.29	16.83
78	15.77	15.93	88	15.84	16.20	46	16.06	16.79	76	16.02	16.20
20	15.38	16.08	28	16.53	16.90	83	15.79	16.78	77	16.20	16.85
61	15.87	16.26	66	16.52	16.97	20	15.69	16.48	14		17.10
99	15.23	15.68	02	15.85	16.74	54	16.10	17.13	47	16.42	16.90
25	15.40	16.17	21	16.47	17.02	67		17.23	59	16.38	16.50
67	15.76	16.40	60	(16.90)	17.34	05	15.78	15.95	96	16.76	17.00
09	15.45	15.84	00	16.35	16.60	42		16.92	34	16.22	16.29
51	15.84	16.33	39	16.45	17.02	80	16.36	17.06	71	16.10	16.72
90	15.60	15.88	76	15.85	16.54	15	15.66	16.37	06	16.40	16.95
47	15.87	16.20	74	15.97	16.63	71	16.22	17.05	55	16.23	16.40
88	15.67	15.92	13	16.23	16.90	08	15.60	16.08	92	16.40	17.14
30	15.93	16.10	52	16.38	17.30	45	16.10	16.49	29	16.22	16.63
12	15.82	16.00	29	16.30	17.16	18	15.85	16.55	01	16.28	16.88
60	15.68	16.33	74	16.42	16.77	61	16.42	17.12	44	15.82	16.30
99	15.52	15.81	11	16.20	16.91	97	15.33	15.85	79	16.36	17.00
72	15.80	15.82	05	15.99	16.82	89	15.46	15.98	38	15.95	16.28
14	15.30	16.12	44	16.35	17.20	26	16.18	16.59	75	16.02	17.00

5536			12527			5684			5567		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
91	16.10	16.68	67	15.90	16.70	64	15.54	16.50	62	15.90	16.31
66	16.12	16.50	41	16.20	16.70	37	15.98	15.92	34	15.52	15.70
72	16.13	16.70	47	16.03	16.66	43	15.74	16.14	41	15.54	15.81
79	16.11	16.88	51	16.16	16.78	47	15.48	16.10	44	15.60	15.87
11	16.28	16.83	83	16.23	16.92	78	15.66	16.58	76	16.09	16.63
55	15.83	16.19	26	16.00	16.45	21	15.22	15.92	18	16.18	16.62
48	15.60	16.15	02	15.74	16.00	95	15.77	16.06	91	16.20	16.73
90	16.26	17.03	43	16.30	16.75	36	15.44	16.04	32	15.70	15.88
32	16.20	16.78	82	16.25	16.67	74	15.65	16.60	70	15.98	16.27
69	15.83	16.57	18	15.82	16.50	10	15.29	15.82	05	16.06	16.76
06	16.20	17.37	54	16.22	16.79	46	15.80	16.10	41	15.62	15.75
19	16.31	17.00	48	16.05	16.90	36	15.70	15.79	30	15.76	16.16
93	16.45	17.10	20	15.93	16.53	08	15.59	16.20	02	16.06	16.80
30	16.20	17.01	56	16.18	16.80	44	15.82	16.20	38	15.46	15.50
12	16.20	16.97	34	16.18	16.75	22	15.57	16.24	15	16.31	16.65
48	15.70	16.13	70	16.58	17.25	57	15.62	16.60	50	15.45	17.30
58	15.70	16.20	77	16.47	16.70	64	15.80	16.33	56	15.96	16.22
90	16.39	16.96	65	16.28	16.73	28	15.40	15.89	08	16.37	16.65
25	16.31	17.06	99	15.85	15.80	62	15.90	16.34	42	15.53	15.65
64	16.16	16.68	38	16.10	16.80	01	15.45	16.32	81	15.66	16.70
99	16.42	16.99	72	16.46	16.95	35	15.44	16.00	14	16.00	16.70
74	16.00	16.76	45	16.04	17.15	07	15.46	16.02	87	16.20	17.10
12	16.34	17.04	83	16.31	(17.45)	45	15.46	16.04	24	15.84	16.60
49	15.70	16.20	19	15.95	16.50	81	15.81	16.18	60	15.92	16.40
30	16.21	16.90	30	15.82	16.75	80	15.70	16.30	54	15.75	16.45
67	16.11	16.69	66	16.23	17.05	16	15.62	16.04	89	16.03	16.80
06	16.32	16.95	04	15.50	16.06	54	15.85	16.38	27	15.69	16.27
43	15.81	16.25	40	16.05	16.80	91		16.00	64	15.80	16.50
80	16.23	16.77	76	16.19	17.15	26	15.38	16.02	99	15.86	16.95
13	16.42	17.09	09	15.84	16.15	58	15.50	16.51	31	15.82	15.73
25	16.35	17.09	18	15.87	16.50	68	15.93	16.40	40	15.87	15.70
62	16.08	16.60	54	16.10	16.80	04	15.42	15.88	76	16.22	16.75
00		17.28	91	16.18	16.63	40	15.70	16.00	12	16.02	16.95
36	16.61	16.62	27	16.10	16.70	76	15.79	16.30	48	15.70	15.93
71	16.14	16.87	61	16.14	16.90	10	15.52	15.84	82	16.00	16.65
18	16.28	17.06	88	16.09	16.70	33	15.30	15.91	04	16.09	16.09
55	15.84	16.26	24	15.90	16.63	69	15.80	16.36	39	15.39	15.74
92	15.99	16.88	59	16.32	16.90	05	15.52	15.95	75	15.99	16.40
64	15.85	16.54	30	15.90	17.00	75	16.50	16.35	46	15.58	16.15
06	16.58	17.07	72	16.55	17.23	16	15.49	15.95	87	16.18	16.85
42	16.00	16.34	06	15.63	16.00	51	15.79	16.15	21	16.03	16.85
90	16.23	16.70	60	16.20		89	15.68	16.00	50	16.00	16.26
27		17.35	96	15.82	16.71	25	15.41	15.78	86		

5514			12491			5533			W33		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
29	15.65	15.80	11	15.92	16.68	96	15.65	16.01	93	16.25	
99	16.20	16.91	80	15.64	16.27	64	16.23	16.70	61	16.28	17.50
05	16.21	16.78	87	16.07	16.40	70	15.89	16.66	67		17.30
05	16.27	17.02	85	15.93	16.47	66	16.25	16.68	63	16.24	17.04
35	15.51	15.84	14	16.30	17.00	96	15.75	16.15	92	16.30	17.17
77	16.19	16.85	55	16.53	16.92	36	16.20	16.54	32	16.11	16.73
26	15.52	15.60	92	15.91	16.40	62	16.36	16.90	57	16.68	16.97
66	16.12	16.69	31	16.30	(17.59)	00	15.56	16.17	95	16.38	
99	16.19	16.70	61	16.51	16.87	29	15.98	16.40	23	15.90	(17.28)
33	15.62	16.00	95	16.06	16.63	62	16.05	16.77	56	16.00	16.78
68	16.09	16.74	29	16.40	16.92	00	15.70	16.21	90	16.34	16.94
30	15.30	15.74	77	15.67	16.21	31	16.19	16.68	23	15.82	16.50
99	16.50	17.27	45	16.58	17.30	98	15.80	16.00	89	16.39	16.73
33	15.42	15.80	79	15.80	16.08	31	15.98	16.60	23	16.00	16.15
04	16.44	17.02	47	16.70	17.19	96	15.63	15.90	87	16.12	17.01
38	15.50	15.96	80	15.51	16.25	29	15.85	16.55	20	16.10	16.29
41	15.95	16.09	81	15.95	16.11	28	16.48	16.60	19	16.03	16.08
89	16.27	16.79	22	16.31	17.00	75	16.00	16.37	49	16.40	17.00
22	15.50	15.80	54	16.58	17.18	07	15.85	16.66	80	16.47	
60	16.10	16.60	91	15.98	16.60	43	15.99	16.90	16	16.23	16.06
92	16.24	16.62	23	16.48	17.02	74	15.75	16.58	48	16.02	16.57
62	15.69	16.61	91	15.78	16.51	41	16.18	17.00	15		16.56
98	16.10	17.04	27	15.96	17.10	76	15.80	16.60	50	16.71	17.48
33	15.50	15.93	61	16.56	17.01	10	15.95	16.35	83	16.82	16.79
27	15.50	15.60	03	15.95	16.62	06	15.73	16.25	72	16.49	17.09
61	16.24	16.47	36	16.42	17.20	39	16.00	16.80	04	16.04	16.73
98	16.25	17.20	73	15.92	16.02	75	15.94	16.55	40	16.10	16.78
33	15.48	15.80	07	16.43	16.90	09	15.68	16.45	74	16.10	17.20
67	16.05	17.07	41	16.42	17.27	42	16.20	16.77	06	16.02	16.59
99	16.37	17.08	71	15.66	16.23	72	16.06	16.70	37	15.94	16.60
04	16.09	17.03	75	15.60	16.10	73	16.29	16.60	38	16.02	16.55
39	15.58	15.89	09	16.00	16.70	07	16.00	16.20	71	16.18	17.20
74	16.09	16.92	43	16.20	17.68	40	16.23	16.54	05	16.10	17.00
08	16.43	17.26	77	15.70	16.20	74	16.07	16.62	38	16.25	16.69
41	15.54	16.20	09	16.09	16.87	05	15.63	16.30	70	16.50	16.93
34	15.44	15.90	88	15.97	16.31	72	16.09	16.80	33	16.30	16.47
69	16.00	16.64	22	16.30	17.09	05	15.84	16.40	66	16.40	17.02
03	15.90	17.11	55	16.18	17.28	38	16.00	16.70	00	16.45	16.91
71	16.19	16.80	22	16.22	17.12	04	15.64	16.35	65	16.80	16.84
11	16.27	16.97	61	16.26	16.95	42	16.03	16.90	03	16.02	17.00
44	15.87	16.22	94	15.90	16.50	74	15.99	16.50	35	15.91	16.55
39	15.71	16.07	18	15.30	17.08	36	16.44	16.99	86	16.65	17.30
74	15.63	15.27	52	15.65	16.55	69			19	15.31	16.35

12504			W48			W32			5522		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
73	15.93	16.62	63	15.75	16.53	59	15.78	16.56	55	15.66	16.20
40	15.60	16.12	28	16.12	16.48	24	16.05		20	15.84	16.51
46	15.90	16.25	34	15.52	16.19	30		17.10	26	15.60	16.30
40	15.80	15.95	27	15.91	16.60	22	16.02	16.95	18	15.88	16.50
68	15.99	16.79	55	16.01	16.23	50	15.98	16.58	46	16.09	16.35
07	16.30	16.74	94	16.05	16.94	88	15.92	16.39	84	15.73	15.96
18	16.08	16.92	97	16.19	16.98	89	16.20	16.32	82	15.68	15.80
55	15.79	16.50	30	15.58	16.22	25	15.98		19	15.90	16.42
80	16.10	16.68	58	15.74	16.44	49	16.00		42	15.98	16.30
12	16.30	17.00	90	16.00	16.82	80	15.70	16.18	73	15.20	15.60
45	15.78	16.39	22	16.10	16.71	13	16.00	16.57	05	15.68	16.39
62	15.78	16.76	30	16.00	16.35	17	16.03	16.92	07	15.64	16.29
27	15.70	16.28	94	16.43	17.10	81	15.80	16.02	71		15.50
59	16.00	16.55	26	15.94	16.39	13	16.21	16.37	03	15.75	15.76
20	16.05	16.69	85	15.94	16.80	71	15.70	16.27	60	15.43	15.64
52	15.70	16.48	17	16.10	17.04	03	16.29	16.31	92	16.01	15.74
49	15.93	16.17	12	16.10	16.88	98	15.98	16.23	86	15.62	16.20
55	15.79	16.50	54	15.80	16.20	14	16.24	16.88	82	15.40	16.08
86	16.30	16.94	85	16.27	16.85	45	16.20		13	15.71	16.09
21	16.10	16.69	20	16.37	16.99	79	16.00	16.03	47	15.84	16.38
52	15.90	16.50	50	15.70	16.28	09	16.00	16.60	77	15.42	15.95
17	16.20	16.98	14	16.40	16.90	74	16.06	16.44	41	15.91	16.48
51	15.79	16.44	48	15.47	16.30	07	16.12	17.00	75	15.17	15.81
84	16.08	16.67	80	16.10	16.91	39	(16.60)	16.65	07	15.98	16.50
12	16.32	16.80	77	16.04	16.50	24	16.37	17.10	81	15.43	15.74
44	15.69	16.11	09	16.19	17.01	55	15.59	15.97	13	15.87	16.38
79	16.03	16.69	43	15.53	15.90	89	15.99	16.44	47	15.95	16.68
12	16.38	17.08	76	16.08	16.60	22		17.02	79	15.60	15.71
44	15.82	16.27	08	15.96	16.91	54	15.87	16.18	10	16.10	16.42
73	16.07	16.88	37	15.61	15.96	82	15.79	16.31	39	16.10	16.65
72	15.60	16.70	34	15.68	16.18	80	15.70	16.39	36	16.05	16.64
05	16.08	17.00	67	16.07	16.92	12	16.01	17.18	68	15.05	15.55
38	15.50	16.13	99	16.21	16.85	44	16.10	17.10	00	16.03	16.21
70	16.00	16.61	31	16.02	16.26	76	15.95	16.30	32	16.00	16.59
01	16.09	17.19	62	15.70	16.38	06	15.86	16.87	62	15.19	15.73
48	15.83	16.30	94	16.08	16.99	40	16.32	16.74	94	15.45	16.08
80	16.18	16.79	31	15.74	16.09	72	15.90	16.23	25	15.75	16.73
12	15.98	17.06	63	15.77	16.41	04	16.18	16.71	57	15.66	15.70
76	16.19	16.64	27	16.14	16.64	67	15.90	16.00	20	15.64	16.43
14	16.24	16.98	64	16.10	16.67	04	16.00	16.72	56		16.42
45	15.66	16.35	94	16.20	16.90	34	16.00	16.93	87	15.49	15.97
14	15.28	(17.45)	21	16.39	16.82	44	16.10	16.70	83	15.32	15.95
47	15.60	15.96	53	15.68	16.25	76	15.30	16.89	15		16.50

W47			2368			2361			W25		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
41	15.58	15.85	34	15.68	16.24	26	16.12	17.00	95	15.45	17.17
05	16.37	16.86	97		16.84	89	16.20	16.30	56	15.50	16.51
11	15.84	17.00	02	16.35	16.70	95	16.30	16.20	61	14.90	16.33
01	16.24	16.79	92	16.25	16.63	84	16.00	16.18	46	16.06	16.66
28	15.67	15.83	19	16.30	16.80	10	15.95	17.22	72	16.10	16.30
66	15.83	16.48	56	16.13	16.83	47	16.30	17.50	08	16.06	16.86
54	15.60	16.25	39		16.14	25	16.01	16.90	64	15.58	16.25
90	15.96	16.84	75	16.24	16.93	60	16.35	17.33	98	15.80	
10	16.20	16.80	94	16.40	16.76	79	15.43	16.33	12	15.90	
42	15.40	15.80	25	15.88	15.83	09	16.10	16.90	41	16.20	16.60
73	15.75	16.51	56	15.98	16.66	40	16.40	17.00	71	15.83	16.20
63	15.78	16.40	43	15.63	15.98	18	16.20	16.70	24	16.20	16.96
26	15.70	16.41	02	16.21	16.90	80	16.00	16.10	83	16.18	16.54
57	15.49	16.35	33	15.60	15.85	11	16.30	16.80	13	16.29	16.50
12	16.15	16.67	87	16.02	16.80	63	15.90	16.98	59	15.80	16.20
43		16.00	17		16.38	93	15.91	16.65	88	15.80	16.81
36	15.54	15.76	10	15.70	16.50	84	15.33	16.26	76	15.38	16.09
42	15.59	15.91	69	16.33	16.83	00		16.72	99	16.00	16.98
72	15.82	16.67	99	16.29	16.92	29	16.12	17.17	27	16.07	
06	16.20	16.99	32	15.80	15.93	62		17.46	59	15.63	15.99
36	15.28	15.65	61	15.90	16.66	91	15.96	16.55	87	15.84	16.48
99	16.18	16.90	24	15.85	15.97	53		15.63	47	15.96	16.89
32	15.47	15.88	56	16.16	16.41	86	16.20	16.21	78	15.65	16.83
63	15.90	16.60	88	16.32	16.80	16	16.40	16.91	07	16.08	16.55
94	16.40		96	16.08	16.80	03	16.00	16.69	00	16.09	16.75
25	15.66	16.37	27	15.40	15.84	34	15.91	17.18	30	16.22	17.14
58	15.70	16.28	60	15.79	16.67	66	16.06	17.13	61	15.73	16.20
90	16.10	16.78	91	16.00	16.99	98	15.79	16.87	91	15.92	16.70
21	16.05	16.53	22	15.40	16.21	28	16.06	17.12	21	16.32	16.82
50	15.55	16.17	50	15.48	16.53	56	15.92	17.30	48	16.10	16.68
45	15.68	15.97	44	15.79	16.20	49	16.38	17.19	37		16.97
76	16.25	16.74	75	15.86	16.82	80	15.61	16.30	67	15.92	16.86
08		17.07	07	16.00	16.67	11	15.14	17.10	97	16.20	16.98
39	15.61	15.76	38	15.68	16.07	42	16.10	17.28	27	16.23	16.86
69	15.85	16.44	67	15.95	16.45	71	15.84	16.40	55	15.66	16.37
88	16.00	16.82	80	15.83	16.63	78	15.60	16.15	35	16.30	16.87
19	15.87	16.79	11	16.04	16.88	08	15.92	16.83	64	15.65	16.14
50	15.64	16.19	42	15.62	16.18	39	16.25	17.00	94	16.10	16.70
12	16.21	16.87	02	16.29	16.83	99	15.95	16.77	52	15.90	16.42
48	15.76	16.25	38	15.78	16.08	35	16.12	17.12	86	15.95	16.79
78	16.04	16.76	68	15.86	16.70	64	16.02	17.09	14	16.18	16.99

15	16.20	16.82	74	15.85	16.45	41	16.08	16.80	64	15.84	16.45
46	15.55	16.10	06		16.80	72	15.79	16.59	94	16.24	16.77

12518			5530			2287			2317		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
89	15.68	16.32	86	15.77	16.39	10	15.52	16.28	04	15.73	16.33
49	16.23	16.81	45	15.86	16.00	64	15.31	15.63	58	15.66	16.30
54	15.92	16.66	50	15.40	15.72	69	15.44	15.91	62	15.68	16.40
39	16.40	16.84	35	16.12	16.70	45	15.08	15.23	38	15.28	16.10
65	15.84	16.30	60	15.53	15.83	68	15.30	15.63	61	15.58	16.20
00	15.98	16.45	95	15.89	16.44	00	15.63	16.04	92	15.85	16.58
52	16.17	17.10	45	15.80	16.11	96	15.61	16.10	85	15.90	16.58
85	15.80	16.27	78	15.55	16.34	26	15.83	16.34	15	15.40	15.72
98	15.90	16.40	91	15.89	16.40	28	15.80	16.18	16	15.40	15.68
28	16.30	16.60	20	16.05	16.60	54	15.08	15.34	42	15.62	15.93
57	16.02	16.80	49	15.47	15.88	81	15.60	15.96	68	15.68	16.42
04	15.90	16.50	94	15.83	16.40	64	15.03	15.72	46	15.79	16.04
63	15.93	16.42	52	15.75	15.53	16	15.84	16.20	98	15.80	16.63
93	15.90	16.42	82	15.88	16.21	43	14.93	15.00	25	15.69	15.84
38	16.20	17.10	26	16.18	16.96	74	15.26	15.23	54	15.80	16.23
67	15.78	16.05	55	15.22	15.60	00	15.48	15.90	80	15.70	16.58
54	16.30	16.40	42	16.01	15.90	78	15.35	16.06	58		16.30
38	16.19	16.62	04	16.15	16.45	73	15.30	15.80	17	15.37	15.83
66	15.72	16.00	32	16.30	16.40	98	15.70	16.00	42	15.55	16.25
98	15.99	16.78	64	15.47	15.95	27	15.72	16.20	70	15.78	16.40
25	16.10	16.73	91	15.90	16.40	51	14.95	15.16	95	15.88	16.56
84	15.62	16.35	50	15.10	15.55	05	15.51	16.25	48	15.77	16.18
15	15.99	17.27	81	15.70	16.50	32	15.55	16.05	75	15.80	16.54
45	16.20	16.92	10	15.98	16.65	59	15.25	15.55	02	15.81	16.80
19	16.00	16.85	74	15.73	16.22	95	15.50	16.15	21	15.35	15.97
48	16.40	17.35	03	16.29	16.60	22	15.48	16.35	46	15.65	16.24
79	15.60	16.25	34	16.02	16.90	50	15.03	15.15	74	15.82	16.57
10	16.21	16.80	64	16.04	16.10	76	15.51	15.80	01	15.94	16.40
38	16.19	17.00	93	15.74	16.70	03	15.57	16.30	27		15.75
65	16.06	16.30	19	15.82	16.87	27	15.96	16.25	51	15.78	16.26
54	16.22	17.20	08	16.01	16.80	07	15.99	16.04	30	15.32	15.85
84	15.81	16.15	38	16.26	16.88	33	15.60	15.90	57	15.71	16.44
13	16.22	17.05	67	15.85	16.04	60	15.39	15.60	83	15.79	16.58
43	16.57	17.00	96	16.00	16.60	87	15.41	15.87	09	15.76	16.08
70	15.74	16.00	24	16.12	17.07	12	15.60	16.30	34	15.42	16.03
45	16.20	17.11	96	15.80	16.52	19	15.64	16.24	36	15.58	15.70
74	15.53	16.16	25	16.10	17.02	45	14.91	15.13	62	15.60	16.26
04	15.80	16.74	54	15.39	15.60	71	15.28	15.66	88	15.91	16.70
61	15.90	16.71	11	15.90	16.85	23	15.58	16.43	40	15.49	16.11
95	16.03	16.71	45	15.50	16.20	54	14.89	15.45	70	15.60	16.45
23	16.19	16.72	73	15.50	16.05	79	15.47	15.80	95	15.77	16.53

48	16.39	17.90	83	15.63	16.49	80	15.63	15.90	73	16.18	16.44
77	15.58	16.50	12	16.21	16.90	07	15.60	16.68	99	16.36	16.83

W42			12325			12530			12532		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
01	15.92	16.70	82	16.03	17.23	42	15.44	16.22	16	15.75	16.75
54	15.78	16.19	34	15.98	16.47	91	16.29	17.04	62	15.03	16.18
59		16.49	38	15.77	16.65	95	15.78	16.91	67	15.05	16.03
34	15.41	15.91	12	15.61	16.10	64	15.90	16.93	33	15.82	16.42
57	15.73	16.22	34	15.74	17.17	85	16.18	17.22	53	15.34	15.50
88	15.93	16.69	64	15.90	17.10	14	15.60	16.50	80	15.53	16.15
78	15.80	16.63	41	15.90	16.87	62	15.93	16.40	11	15.74	16.40
08	15.83	16.41	70	16.18	17.08	90	15.99	16.74	37	15.40	16.90
09	15.77	16.44	68	15.98	17.04	82	15.91	16.90	25	15.89	17.05
35	15.40	15.80	93	16.00	16.70	06	16.20	16.92	48	15.12	
61	15.80	16.54	18	15.82	16.48	30	15.30	16.25	71	15.58	
36	15.45	15.86	78	16.18	(16.38)	56	16.02	16.40	76	15.67	
88	15.95	16.80	29	15.90	16.70	04	15.65	16.80	22	15.70	
14	15.21	15.91	54	15.85	16.79	28	15.66	15.80	45	15.28	
43	15.49	15.94	80	16.04	17.30	46	15.67	16.44	59	15.16	
69	15.82	16.63	05	15.54	16.42	70	(14.73)	16.55	81	15.51	
46	15.40	16.08	80		16.80	41	(16.10)	16.30	49	15.02	
85	15.94	16.74	01	15.82	16.63	14	15.63	16.46	61	15.22	
10	15.79	16.23	25	15.80	16.38	37	15.60	16.20	83	15.56	
38	15.52	15.82	52	16.28	17.10	63	15.90	16.42	07	15.61	
62	15.83	16.53	76	15.88	16.88	85	15.85	16.90	29	15.65	
15	15.52	15.85	28	15.74	16.49	34	15.72	16.16	75	15.00	
42	15.54	16.07	54	16.10	17.08	59	15.52	16.50	99	15.40	
69	15.69	16.57	80	16.18	17.30	83	15.90	16.66	22	15.84	
78	16.09	16.41	31	15.80	16.62	14	15.60	16.15	75	15.44	16.00
04	15.88	16.57	56	16.15	17.18	38	15.68	15.90	98	15.69	16.48
31	15.32	15.87	84	16.04	17.00	63	15.95	16.42	22	15.90	16.80
58	16.00	16.37	09	15.79	16.15	88	15.88	16.75	45	15.38	15.50
84	15.94	16.52	34	15.60	16.50	11	15.92	16.41	68	15.57	16.05
07	15.66	16.41	57	15.87	16.99	33		16.20	89	15.84	16.24
87	16.01	16.58	35	15.90	16.70	06	16.00	16.50	59	15.53	15.80
13	15.92	16.17	60	15.98	16.63	30	15.66	15.95	82	16.00	16.18
39	15.59	16.03	86	16.04	17.10	54	15.93	16.33	05	16.00	16.45
65	15.78	16.22	11	15.70	16.12	78	15.83	16.50	28	15.92	16.55
90	15.95	16.83	35	15.70	16.44	00	16.02	16.44	49	15.26	15.60
89	15.95	16.68	18	15.61	16.15	49	15.92	16.20	76	15.17	16.25
15	15.37	15.63	43	15.73	16.91	73	15.64	16.53	98	15.68	16.61
41	15.46	16.09	69	15.92		97	16.18	16.47	21	15.90	16.70
92	15.88	16.58	18	15.59	16.02	44	15.57	16.15	66	15.22	16.10
22	15.27	15.50	48	16.00	16.74	71	15.90	16.35	93	15.67	16.50
47	15.60	16.13	72	15.97	16.95	94	16.34	16.80	15	15.71	16.60

12	15.96	16.18	58	16.02	16.62	17	15.62	16.15	31	(16.10)	16.70
38	15.55	15.94	84		16.90	41	(16.02)	16.26	54	15.20	15.80

	2334			2325			2263			5595	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
73		16.42	47	15.24	15.86	32	14.95	14.96	18	15.32	15.82
16		15.75	89	15.55	16.45	72	15.20	15.60	57	15.47	16.52
20	15.63	15.80	93	15.87	16.68	76	15.13	15.73	60	15.75	16.43
82	16.00	16.63	52	15.33	15.96	33	14.80	15.25	16	15.05	15.92
00	16.00	16.84	69	15.68	16.17	50	15.02	15.29	33	15.29	16.00
26		15.94	94	15.73	16.56	74	15.19	15.73	56	15.52	16.28
26	15.11	15.71	76	15.73	16.42	46	(14.79)	15.35	18	15.32	15.85
50	15.50	16.32	00	15.96	16.85	68	15.38	15.45	40	15.50	16.30
33	15.21	15.81	78	15.67	16.39	45	14.99	15.40	14	15.09	15.93
54	15.89	16.59	98	15.90	16.32	65	15.23	15.48	33	15.54	15.88
75	15.82	16.85	19	15.85	16.84	84	15.30	15.68	52	15.60	16.28
45	15.63	16.39	68	15.65	16.11	21	14.80	15.00	77	15.77	16.38
88	15.95	16.85	09	15.93	16.35	60	14.95	15.63	16	15.16	15.67
09	15.74	16.75	29	15.92	16.21	80	15.42	15.48	35	15.43	16.13
15	15.51	16.25	30	15.67	16.33	78	15.20	15.63	30	15.42	16.03
36	15.30	15.68	50	15.25	15.68	98	15.42	15.75	49	15.35	16.13
99	15.60	17.00	11	15.73	16.25	57	15.22	15.43	06	14.88	15.70
44	16.00	16.21	99	15.74	16.70	49	15.05	15.33	10	15.30	15.56
64	15.94	16.82	18	15.75	16.58	68	15.18	15.53	28	15.37	15.96
87	16.22	16.98	40	15.27	15.87	89	15.19	15.75	49	15.40	16.42
07	15.92	16.45	60	15.55	16.03	08	15.19	15.57	67	15.53	16.52
50	15.85	16.58	00	16.00	16.43	48	15.08	15.29	06	15.33	15.48
73	16.03	16.60	22	15.97	16.65	68	15.24	15.53	26	15.40	15.83
94	16.14	(17.30)	42	15.29	15.95	88	15.28	15.92	46	15.58	16.23
17	15.50	15.74	90	15.78	16.58	89	15.11	15.51	03	15.30	15.60
38	15.56	15.99	10	15.87	16.67	08	14.90	15.38	22	15.47	15.99
61	15.68	16.11	31	15.67	16.05	29	14.79	15.05	43	15.70	16.19
83	15.80	16.45	52	15.42	15.85	50	14.93	15.46	63	15.73	16.40
04	15.89	16.71	72	15.47	16.44	69	15.08	15.49	81	15.89	16.64
23	15.12	15.87	91	15.43	16.49	87	15.79	15.82	99	15.27	15.90
88	15.78	16.77	53	15.51	16.02	47	15.10	15.40	57	15.57	16.32
09	15.58	16.56	73	15.58	16.19	67	15.30	15.60	76	15.53	16.60
31		15.65	94	15.92	16.35	87	15.59	15.61	96	15.48	15.90
52	15.66	16.31	14	15.94	16.85	07	15.20	15.49	15	15.04	15.72
72	15.70	16.71	33	15.76	16.18	26	14.62	14.89	34	15.67	16.07
62	15.71	16.25	01	15.73	16.56	80	15.41	15.55	76	15.61	16.38
83	15.80	16.81	22	15.73	16.63	00	15.26	15.60	95	15.34	15.90
04	15.82	16.50	42	15.35	15.75	20	14.68	15.02	14	15.27	15.60
46	15.45	16.46	82	15.61	16.50	59	15.10	15.45	52	15.25	16.13
71	15.67	16.40	05	15.75	16.67	82	15.20	15.75	74	15.69	16.66
91	15.72	16.46	25	15.63	16.48	00	15.40	15.59	93	15.42	16.00
49		16.34									
78		16.72									
32	15.39	16.20	62	15.68	16.00	74	15.20	15.54	08	15.48	15.53
53	15.62	16.28	82	15.71	16.23	94	15.38	15.85	27	15.72	16.11
81		16.55									
01		16.39									
44		15.93									
86		16.60									
07		16.16									

2358			2335			2332			5543		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
02	15.23	15.97	39	14.50	14.79	02	14.55	14.59	97	15.11	15.85
33	15.38	15.66	65	14.12	14.64	25	14.75	14.70	20	14.74	15.32
36	15.14	15.55	67	14.41	15.10	27	14.36	14.99	22	14.64	15.17
79	15.10	15.68	03	14.90	15.68	59	15.01	15.62	53	14.40	15.30
92	15.10	15.82	14	14.97	16.02	69	15.20	15.98	63	14.74	15.31
10	15.47	15.90	30	14.81	15.91	83	15.01	15.46	76	14.78	15.67
91	15.08	15.70	66	14.37	14.80	94	14.70	15.10	84	14.80	15.50
08	15.48	16.34	81	14.88	15.35	06	14.61	14.85	96	14.73	15.83
66	14.95	15.61	30	14.99	15.91	50	14.60	15.60	39	14.52	15.70
81	15.30	15.47	42	14.70	14.65	61	15.18	15.71	50	14.40	15.16
96	15.40	15.86	55	14.30	14.59	72	15.00	16.00	61	14.58	15.40
26	15.38	15.80	33	14.95	15.64	20	14.40	15.02	05	14.75	15.62
56	14.90	15.44	58	14.56	15.10	42	14.88	15.84	27	14.41	15.08
71	15.16	15.53	71	14.71	15.16	54	14.99	16.00	38	14.41	14.90
45	14.76	14.97	33	14.80	15.68	09	14.57	15.04	93	14.85	15.90
60	14.74	15.23	45	14.17	14.60	20	14.27	15.14	04	15.00	15.55
04	15.28	16.27	83	14.90	15.52	54	14.70	15.41	36	14.48	15.35
95	15.52	16.08	81	14.79	14.83	22	14.58	14.71	74	14.63	15.55
09	15.30	16.04	93	14.84	15.11	33	14.85	15.14	85	14.81	15.65
26	15.44	16.08	06	14.99	15.37	45	14.90	15.25	97	14.83	15.70
40	15.00	15.44	18	15.10	15.92	56	14.80	15.60	07	14.70	15.65
70	15.00		44	14.48	14.98	78	15.05	15.78	30	14.31	15.07
86	15.16	15.84	57	14.25	14.77	90	14.96	15.54	41	14.46	15.10
00	15.20	15.91	70	14.46	15.08	02	14.46	14.81	52	14.40	15.15
11	15.50	16.46	89	14.80	15.32	10	14.69	15.04	46	14.49	15.20
26	15.30	16.23	02	15.00	15.58	21	14.30	14.85	57	14.48	15.30
42	14.81	15.20	15	15.13	15.70	33	14.52	14.97	69	14.84	15.44
57	14.90	15.30	28	14.82	15.78	44	14.60	15.35	80	15.20	15.50
72	14.77	15.70	41	14.86	14.89	56	14.99	15.68	91	15.01	15.62
86	14.97	15.77	52	14.32	14.62	66	14.88	15.45	01	14.90	15.59
31	15.30	15.71	90	14.65	15.47	00	14.69	15.27	35	14.30	14.99
46	14.81	15.28	03	14.63	15.68	11	14.37	15.04	46	14.60	15.08
61	16.04	15.36	16	15.09	15.62	23	14.32	14.90	57	14.50	15.10
76	15.05	15.47	28	15.02	15.89	34	14.69	15.43	68	14.57	15.20
91	15.25	15.97	40	14.64	15.12	44	14.77	15.30	78	14.81	15.65
34	14.82	15.47	30	15.12	15.62	02	14.45	14.84	32	14.35	15.13
49	14.70	15.19	43	14.40	14.60	14	14.45	15.04	43	14.50	15.20
64	14.79	15.34	55	14.38	14.92	25	14.45	15.17	54	14.61	15.25
94	15.10	15.73	80	14.78	15.15	47	14.69	15.49	76	14.79	15.46
11	15.18	16.08	94	14.65	15.34	60	14.74	15.64	88	14.66	15.80
25	15.37	16.10	07	14.86	15.58	71	14.88	15.71	99	14.84	15.78
			88		15.56	39		15.40			
			65		15.05	08		14.93			
70	15.01	15.53	92	14.77	15.40	04	14.52	14.76	13	14.86	15.32
85	15.21	15.96	04	15.30	15.90	16	14.60	14.88	24	14.62	15.09
			52		14.57	21		14.92			
			64		15.02	32		15.14			
			90		15.30	54		15.52			
			14		15.70	76		15.34			
			27		15.68	87		15.09			

2297			2432			880			2299		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
97	14.90		46	14.50	15.16	30	14.06	14.70	23	14.24	14.86
19		16.37	65	14.60	14.73	48	14.20	14.94	40	14.44	15.24
21	15.30	16.42	66	14.36	14.74	49	14.30	14.96	41	14.54	15.30
53	14.61	14.70	93	14.10	14.51	74	14.24	15.14	65	14.41	15.24
63	14.70	15.31	01	13.98	14.68	82	14.14	14.74	72	14.24	14.81
76	14.80	15.11	12	14.13	14.70	92	14.14	14.54	82	14.00	14.65
84	14.80	15.10	84	14.01	14.60	53	14.21	15.10	38	14.34	15.23
96	15.10	15.74	94	14.05	14.52	62	14.44	15.12	48	14.51	15.38
39	14.60	15.16	29	14.21	14.86	96	13.94	14.33	80	14.10	14.50
50	14.59	14.91	39	14.51	15.00	04	13.59	13.95	88	14.02	14.58
61	14.51	15.19	48	14.61	14.91	13	13.84	14.30	96	13.75	14.22
00	15.20	16.47	49	14.60	14.99	02	13.63	14.10	79	14.00	14.60
26	15.14	16.26	68	14.21	14.87	19	13.82	14.49	96	13.76	14.03
38	15.00	15.69	77	14.12	14.54	27	14.10	14.55	04	13.96	14.28
92	15.01	15.90	22	14.00	14.88	70	14.60	15.06	45	14.50	15.36
03	15.06	15.74	31	14.10	14.98	78	14.36	14.84	53	14.80	15.26
36	15.01	15.70	58	14.38	15.16	04	13.73	14.00	78	14.05	14.65
73	14.80	15.02	80	13.85	14.46	29	14.09	14.67	56	14.61	15.40
84	15.01	15.52	89	13.96	14.50	37	14.10	14.67	64	14.50	15.00
95		15.70	99	13.74	14.50	46	14.20	14.90	73	14.29	14.80
06	15.17	15.90	08	13.75	14.53	54	14.36	15.22	81	14.03	14.60
28	15.00	16.21	26	14.06	14.84	72	14.20	15.04	98	13.71	14.17
40	14.96	15.38	36	14.56	15.20	80	13.99	14.83	06	14.14	14.58
51	14.68	15.01	45	14.53	15.05	89	14.01	14.62	15	14.12	14.75
44	14.58	15.05	85	14.17	14.73	82	14.07	14.78	85	14.12	14.63
55	14.58	15.01	94	13.92	14.44	90	14.10	14.60	93	13.72	14.20
66	14.65	15.22	04	13.94	14.51	00	13.56	14.27	02	13.77	14.33
78	14.89	15.19	13	14.39	14.89	08	13.82	14.10	11	14.45	14.56
89	14.72	15.61	22	14.03	14.97	17	13.85	14.36	19	14.02	14.70
99	14.78	15.87	30	14.16	14.93	24	13.94	14.55	26	14.29	14.89
32	14.85	15.85	58	14.65	14.98	51	14.20	15.11	52	14.60	15.34
43	14.68	15.30	67	13.87	14.65	59	14.06	15.10	60	14.80	15.35
54	14.54	14.98	76	13.90	14.49	68	14.38	15.09	68	14.50	15.07
66	14.77	15.24	86	14.09	14.56	76	14.30	15.12	77	14.10	14.61
76	14.76	15.36	94	13.80	14.35	84	14.04	14.80	84	14.14	14.59
30	15.24	15.77	05	13.81	14.58	81	14.20	14.95	75	14.11	14.61
41	14.57	15.04	14	14.10	14.70	90	14.20	14.64	83	14.12	14.75
52	14.57	15.14	23	14.30	14.80	98	13.58	14.14	91	13.90	14.50
74	14.66	15.04	41	14.63	15.02	15	13.79	14.30	08	13.93	14.50
86	14.66	15.37	51	14.63	15.01	25	13.94	14.70	17	13.93	14.75
97	14.88	15.58	60	14.40	14.93	33	14.08	14.77	25	14.28	14.93
58	15.20	15.45									
25		16.13									
10		16.10	65	14.15	14.62	74	14.34	15.15	36	14.39	14.91
21		16.48	74	13.88	14.50	83	14.12	14.90	44	14.48	15.25
04		15.77									
14		16.00									
36		15.37									
58		14.85									
69		15.25									

12519			2260			2324			5598		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
20	14.33	14.98	08	15.06	15.65	86	14.02	14.33	82		17.28
37	14.34	15.44	23	14.60	15.06	00	14.10	14.96	96	16.45	17.45
38	14.65	15.53	25	14.46	15.24	01	14.20	15.46	97	16.68	17.17
62	14.80	15.87	47	14.66	15.45	21	14.41	15.47	17	16.06	16.48
69	14.70	15.67	54	14.77	15.81	27	14.60	15.82	23	15.90	16.33
79	14.63	15.50	63	14.99	15.83	35	14.60	15.76	31	15.90	16.29
33	14.40	15.24	08	14.86	15.87	65	13.90	14.40	58	15.85	17.09
43	14.38	15.55	17	15.01	15.74	73	13.92	14.40	66	15.99	16.87
74	14.60	15.53	47	14.91	15.61	00	14.21	14.99	92	16.62	17.26
82	14.55	15.20	55	14.74	15.70	07	14.40	15.16	99	16.62	17.20
91		15.50	62	14.62	15.66	14	14.46	15.50	06	16.46	17.40
71	14.64	15.40	33	14.34	15.20	66	13.90	14.59	55	16.26	16.30
88	14.22	15.05	48	14.61	15.41	80	14.18	14.69	69	16.38	17.04
96	14.33	14.95	56	14.77	15.87	87	14.16		75	16.15	17.20
36	14.50	15.47	94	15.18	16.87	21	14.44	15.53	09	16.60	17.20
45	14.67	15.40	02	15.00	15.80	28	14.69	15.60	16	16.10	17.27
69	14.64	15.45	25	14.59	15.30	48	14.15	15.40	36	16.00	16.32
33	14.45	15.32	10	15.09	15.75	98	14.29	14.76	63	16.22	16.90
40	14.49	15.40	18	15.10	15.95	04	14.43	14.94	70	16.34	16.90
49	14.70	15.62	26	14.96	15.75	12	14.53	15.40	77	16.42	17.07
57	14.70	15.65	33	14.37	15.01	18	14.53	15.60	83	16.42	17.20
74	14.58	15.45	49	14.66	15.62	32		15.70	97	16.70	17.00
82	14.51	15.26	57	14.80	15.80	40	14.67	15.98	04	16.69	17.27
90	14.40	15.07	65	14.71	15.83	46	14.36	15.28	11	16.40	16.84
53	14.75	15.55	90	15.09	15.97	05	14.50	15.20	59	16.00	16.78
61	14.80	15.60	97	15.30	16.30	12	14.48	15.50	64		
70	14.83	15.53	06	15.37	16.25	20	14.70	15.33	73	16.30	16.91
78		15.30	14	15.05	15.93	27	14.70	15.45	80	16.22	17.14
86	14.60	15.20	21	15.10	16.12	34	14.81	15.50	86	16.32	17.17
94	14.44	15.04	28	15.27	15.60	40	14.42	15.57	92	16.23	
19	14.43	14.80	52	14.68	15.40	61	14.35	15.12	13	16.19	16.84
27	14.61	14.85	59	14.87	15.69	68	13.85	14.72	20	16.01	16.30
35	14.60	15.30	67	14.96	15.91	75	13.80	14.47	27	15.95	16.08
44	14.58	15.35	75	14.90	15.69	82	14.02	14.90	34	16.12	16.50
51	14.76	15.63	82	15.02	15.99	88	14.19	15.00	40	16.00	16.79
40	14.55	15.43	60	14.46	15.36	47	14.59	15.20	96		17.09
48	14.54	15.63	68	14.63	15.52	54	14.40	15.00	02	16.33	17.40
56	14.84	15.70	75	14.70	16.04	61	14.34	15.25	09	16.31	16.89
72	14.60	15.50	90	15.12	16.30	74	13.95	14.37	22	15.66	16.20
82	14.41	15.30	99	15.17	16.30	82	14.02	14.65	30	15.84	16.21
89	14.60	15.20	07	15.22	16.33	89	14.02	14.96	37	15.86	16.40
28	14.40	15.15	08		16.34	27		15.92	64		
77	14.56	15.50	55		15.26	69		14.47	06		
90	14.50	14.99	55	14.50	14.88	48	14.50	15.07	81	16.03	16.81
98	14.33	14.91	63	14.90	15.88	55	14.45	15.48	89	16.30	17.34
94	14.53	15.32	80		15.63	32		15.91	43	16.00	16.56
02	14.29	14.76	87		15.73	38		15.40	50	16.10	16.29
18	14.52	15.06	02		16.24	52		15.00	63	16.34	
35	14.23	15.38	18		16.00	66		14.30			
43	14.90	15.51	25		15.85	73		14.45			

2356			2249			2273			5594		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
78	13.94	15.08	77	14.08	15.01	60	14.25	14.33	56	14.57	15.63
91	13.99	15.35	90	13.28	13.60	72	14.01	14.49	68	14.84	15.73
92	13.90	15.71	91	13.04	13.68	73	14.15	14.78	69	14.69	15.91
11	13.99	15.27	10	13.50	14.21	90	14.23	14.96	86	14.62	15.84
17	14.07	14.59	16	13.64	14.35	95	14.40	15.16	91	14.60	15.53
25	14.12	15.01	24	13.71	14.52	02	14.38	15.18	98	14.78	15.65
49	13.58	13.74	47	14.04	15.03	14	14.63	15.41	07	13.93	14.44
57	13.70	14.29	55	14.18	15.28	21	14.64	14.86	14	13.83	14.44
82	13.96	15.15	80	14.22	14.90	44	14.74	15.56	35	14.31	15.03
89	14.23	14.85	87	13.46	13.91	49	14.88	15.57	42	14.56	15.20
96	14.14	15.17	93	13.33	13.65	55	14.53	15.14	48	14.53	15.22
41	13.55	13.95	38	14.10	15.02	86	14.15	15.41	76	14.79	15.90
55	13.70	14.35	51	14.29	15.40	98	14.23	15.30	88	14.85	15.60
61	13.88	14.32	58	14.28	15.05	04	14.45	15.90	93	14.91	15.60
94	13.87	14.86	90	13.34	13.80	34	14.73	16.18	22	13.98	14.70
00	14.17	15.05	97	13.50	14.00	39	14.75	16.00	28	14.10	14.80
20	14.25	15.36	16	13.73	14.27	57	14.30	15.08	45	14.14	15.23
20	13.85	14.62	09	13.68	14.21	45	14.70	15.80	12	13.68	14.40
26	13.96	14.45	15	13.76	14.51	50	14.97	16.00	17	13.84	14.40
33	13.59	14.04	22	13.84	14.56	57	14.36	14.88	24	13.94	14.65
40	13.45	14.04	29	13.74	14.74	63	14.25	14.68	29	14.00	14.80
53	13.67	14.05	42	14.04	15.08	74	13.99	15.00	41	14.18	15.08
60	13.68	14.34	49	14.06	15.38	81	14.30	14.97	47	14.30	15.10
66	13.75	14.86	56	14.22	15.35	87	14.24	15.30	53	14.41	15.08
01	14.22	15.30	87	13.46	14.10	67	14.08	14.68	23	14.05	14.76
08	14.15	15.35	93	13.30	13.76	73	13.99	14.74	28	14.09	14.78
15	13.97	14.95	00	13.45	14.12	79	14.04	14.82	35	14.23	14.98
21	14.33	14.84	07	13.61	14.24	85	14.30	15.15	40	14.25	15.05
28	13.95	14.98	13	13.64	14.28	91	14.47	15.18	46	14.45	15.35
34	13.88	14.75	19	13.63	14.50	96	14.47	15.23	52	14.70	15.33
54	13.53	14.48	40	14.08	15.00	14	14.60	15.53	69	14.65	15.77
61	13.43	14.48	46	14.06	15.22	20	15.03	15.85	75	14.81	15.78
67	13.57	14.75	53	14.00	15.22	26	14.80	15.85	81	15.01	15.85
74	13.81	14.90	59	14.19	15.14	32	14.70	16.13	87	14.72	15.50
80	13.88	15.15	66	14.05	15.15	38	14.78	15.92	92	14.78	15.40
32	13.51	14.55	16	13.52	14.51	74	14.22	14.71	26	13.92	14.90
39	13.05	13.75	23	13.76	14.47	80	14.14	15.10	32	14.15	14.85
45	13.25	14.10	29	13.80	14.71	86	14.22	15.25	37	14.24	15.07
58	13.38	14.35	42	13.88	15.07	98	14.50	15.47	49	14.40	15.60
66	13.48	14.70	50	14.22	15.36	05	14.30	15.51	55	14.32	15.45
72	13.65	14.62	56	14.30	15.43	10	14.66	15.72	61	14.66	15.64
						73	14.10	14.80			
						09	14.58	15.60			
98	14.25	15.55	78	14.20	15.21	62	13.97	14.60	99	14.78	15.45
05	14.56	15.64	84	13.81	14.44	68	13.95	14.86	05	13.80	14.42
						80	14.42	15.00			
						86	14.28	15.33			
						98	14.50	15.20			
						09	14.40	15.46			
						15	14.65	15.86			

12499			12446			886			2251		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
45	13.70	14.39	21	13.40	14.01	12	13.34	14.01	96	12.86	13.58
56	13.66	14.34	30	13.77	14.19	21	13.34	14.31	03	12.94	13.70
57	13.59	14.40	31	13.63	14.76	21	13.21	14.31	04	12.86	13.71
73	13.80	14.50	44	13.80		33	13.58	14.52	14	13.01	13.87
77	13.90	14.65	48	13.83	14.50	37	13.81	14.60	17	13.10	14.12
84	13.90	14.65	53	13.82	14.70	42	13.76	14.75	22	13.19	14.09
85	13.99	14.70	38	13.74	14.29	20	13.40	14.36	89	12.55	13.21
91	14.00	14.93	43	13.83	14.52	25	13.42	14.44	93	12.74	13.31
12	14.25	14.88	60	14.09	14.60	41	13.99	14.80	07	12.99	13.69
18	14.10	14.83	64	13.80	14.74	46	13.93	14.74	10	12.96	13.88
23	14.21	14.99	69	13.80	14.67	50	14.02	14.79	14	13.11	13.88
42	13.76	14.43	68	13.90	14.66	42	13.95	14.70	92	12.71	13.30
53	13.83	14.39	77	13.93	14.61	50	13.89	14.79	00	12.71	13.45
58	13.79	14.40	82	13.74	14.40	54	13.85	14.78	03	12.83	13.60
85	14.10	14.84	04	13.27	13.65	75	13.44	13.83	21	13.29	14.28
90	14.12	14.78	08	13.34	13.77	79	12.81	12.90	24	13.41	14.32
06	14.22	15.00	22	13.46	14.01	91	13.06	13.29	35	13.50	14.35
04	14.09	14.91	69	13.88	14.63	85	12.65	13.12	29	13.51	14.40
09	14.12	15.01	73	13.83	14.31	89	12.40	13.29	33	13.51	14.46
15	14.12	15.08	78	13.93	14.56	94	12.84	13.33	36	13.55	14.55
20	14.06	15.02	82	13.71	14.21	98	13.07	13.67	40	13.53	14.61
31	13.90	14.73	91	13.02	13.20	06	13.02	13.85	47	13.70	14.53
36	13.80	14.40	96	13.10	13.43	10	13.11	13.80	51	13.70	14.63
42	13.76	14.43	01	13.03	13.48	15	13.28	14.09	54	13.65	14.62
78	14.00	14.78	04	13.90	14.56	52	14.00	14.80	43	13.92	14.70
84	13.92	14.77	68	13.98	14.65	56	13.79	14.91	47	13.82	14.65
89	14.08	14.78	73	13.82	14.83	61	13.79	14.73	51	13.85	14.63
95	14.13	14.90	78	13.95	14.72	65	13.82	14.97	54	13.37	14.88
00	14.00	14.93	82	13.57	14.23	69	13.75	14.63	58	13.85	14.74
05	14.15	14.97	86	13.30	13.85	73	13.73	14.54	61	13.64	14.55
21	14.10	14.82	00	12.97	13.48	85	13.02	13.08	72	13.75	14.36
27	14.06	14.88	04	13.32	13.64	90	12.98	13.32	75	13.00	13.40
33	13.79	14.48	09	13.03	13.80	94	12.86	13.41	79	12.57	13.00
38	13.90	14.34	14	13.35	13.89	98	13.05	13.50	83	12.79	13.00
43	13.70	14.34	18	13.34	14.02	02	13.17	13.78	86	12.95	13.16
67	13.84	14.60	21	13.50	14.17	98		13.51	68		14.59
72	13.87	14.56	26	13.57	14.19	02		13.71	72	13.58	14.39
78	13.83	14.73	30	13.62	14.23	06	13.37	13.94	75	13.08	13.32
88	13.95	14.95	39	13.63	14.44	14	13.34	14.13	82	12.58	13.01
94	14.18	14.93	44	13.65	14.38	19	13.41	14.21	86	12.97	13.08
00	14.30	15.04	48	13.53	14.34	23	13.43	14.45	90	12.82	13.23
			98	13.19	13.55	48	13.65	14.73	68	13.65	14.60
			26	13.52	14.15	73	13.70	14.64	90	12.40	13.30
92	14.10	15.00	42	13.67	14.56	81	12.73	13.13	82	12.64	12.98
98	14.15	14.92	46	13.35	14.70	85	12.72	12.40	86	12.62	13.13
			12	13.23	14.14	96	13.02	13.54	94	12.70	13.47
			16	13.40	13.87	00	13.13	13.83	97	12.74	13.66
			25	13.67	14.20	08	13.16	13.89	04	12.98	13.80
			34	13.59	14.40	16	13.30	13.84	12	13.06	13.98
			38	13.60	14.69	21	13.31	14.22	15	13.29	14.27

2294			877			2369			5497		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
74	13.17	14.01	60	13.40	14.45	06			27	11.69	13.01
79	13.21	14.19	64	13.63	14.81	60	12.95	14.09	29	11.76	13.06
80	13.00	14.10	64	13.54	14.79	60	12.84	14.20	29		12.86
88	13.43	14.31	71	13.61	14.73	66	13.18	14.15	32	11.59	12.88
90	13.30	14.34	73	13.60	14.55	68	13.06	14.30	33	11.76	13.14
93	13.32	14.29	75	13.68	14.66	70	13.15	14.23	34	11.63	12.85
45	12.51	13.65	17	13.02	14.16	10	12.17	13.20	53	12.01	13.40
48	12.59	13.65	20	13.17	14.11	12	12.25	13.17	54	11.89	13.30
58	12.90	14.05	28	13.23	14.28	20	12.39	13.35	58	12.02	13.37
61	12.88	13.88	30	13.22	14.62	22	12.35	13.30	59	12.15	13.52
64	12.99	13.88	32	13.31	14.45	24	12.41	13.27	60	12.09	13.42
24	12.25	13.00	81	13.48	14.68	70	13.13	14.35	83	12.19	13.58
30	12.39	13.25	86	13.36	14.33	74	13.30	14.27	85	12.03	13.41
32	12.40	13.18	88	13.35	14.65	76	13.21	14.40	86	12.15	13.48
46	12.52	13.61	99	13.03	14.09	86	12.78	14.00	91	12.13	13.45
48	12.79	13.80	01	13.01	13.96	88	12.80	13.65	92	12.08	13.21
57	12.90	14.03	08	13.00	14.32	94	12.15	12.85	95	12.02	13.21
12	11.86	12.59	76	13.58	14.84	39	12.54	13.57	63	11.89	13.53
14	12.01	12.68	78	13.51	15.21	41	12.52	13.60	64	12.00	13.60
17	12.00	12.71	80	13.59	14.82	43	12.50	13.74	65	12.05	13.81
20	12.24	12.80	82	13.53	14.73	45	12.64	13.80	66	12.12	13.61
25	12.23	12.99	87	13.19	14.38	49	12.64	13.70	68	12.06	13.25
28	12.24	12.97	89	13.20	14.40	51	12.75	13.72	69	12.02	13.45
31	12.36	13.23	91	13.26	14.30	53	12.84	13.90	70	12.01	13.54
52	12.85	13.79	70	13.68	14.93	21	12.33	13.47	51	12.20	13.38
55	12.94	13.98	73	13.70	14.87	23	12.50	13.35	52	12.14	13.27
58	12.76	14.09	75	13.58	14.89	25	12.30	13.53	54	12.32	13.33
61	12.88	14.10	77	13.69	15.00	27	12.40	13.57	54	12.00	13.40
63	12.86	14.00	79	13.50	14.80	29	12.16	13.60	56	12.03	13.37
66	13.00	13.95	81	13.25	14.39	31	12.47	13.62	56	11.98	13.38
74	13.17	14.17	88	13.18	14.44	38	12.57	13.85	60		13.43
77	13.13	14.00	90	13.30	14.24	40	12.66	13.80	60	12.20	13.43
80	12.96	14.36	93	13.03	14.20	42	12.70	13.85	62	12.15	13.60
82	13.22	14.14	95	13.10	14.27	44	12.60	13.85	63	12.21	13.43
85	13.33	14.05	97	13.12	14.10	46	12.50	13.95	64	12.43	13.51
48	12.82	13.76	48	13.55	14.93	93	12.10	12.90	87	12.48	13.42
51	12.84	13.71	50	13.54	14.74	95	11.98	12.80	88	12.19	13.31
54	13.02	13.88	52	13.48	14.98	98	12.00	12.74	89	12.22	13.29
59	12.92	13.86	56	13.63	14.93	02	11.57	12.82	91	12.12	13.26
62	12.98	14.07	59	13.33	14.98	04	12.20	12.95	92	12.17	13.07
65	13.10	14.16	61	13.34	14.84	06	12.17	13.00	93	12.08	13.03
78	13.14	14.10	33	13.60	14.60	67	13.05	14.15	71	12.30	13.65
94	13.33	14.54	47	13.63	14.84	80	13.16	14.44	78	12.18	13.67
65	12.98	14.16	04	13.05	13.88	33	12.53	13.57	04	11.78	12.95
68	12.96	14.24	06	12.92	14.07	36	12.51	13.61	05	11.64	12.63
34	12.56	13.38	83	13.49	14.53	88	12.89	13.98	77	12.20	13.79
36	12.50	13.40	86	13.35	14.37	90	12.63	13.60	78	12.31	13.69
42	12.70	13.50	90	13.30	14.12	94	12.12	12.83	80	12.17	13.68
47	12.59	13.72	94	13.18	13.93	98	12.02	12.81	82	12.09	13.71
50	12.71	13.80	96	13.10	14.19	00	11.91	12.66	83	12.13	13.55

	883	
Φ	V	B
20	12.23	13.38
22	12.54	13.59
22	12.24	13.64
24	12.44	13.70
25	12.80	13.71
26	12.45	13.72
40	12.75	13.94
40	12.70	13.87
43	12.71	13.91
44	12.74	14.00
45	12.82	13.97
61	12.40	13.55
63	12.30	13.55
64	12.24	13.51
67	12.18	13.35
68	12.36	13.04
70	11.80	12.84
95	12.00	13.02
96	12.11	13.10
96	12.05	13.09
97	11.95	13.12
98	11.97	13.28
99	12.00	13.35
00	12.06	13.21
61	12.44	13.60
61	12.46	13.32
62		13.37
63	12.40	13.15
64	12.34	13.35
64	12.28	13.17
67	12.36	13.04
67	12.18	12.97
68	12.08	12.97
69	12.02	12.91
70	12.10	12.90
87	12.09	12.96
88	11.92	13.05
88	11.86	13.12
90	11.98	12.91
91	12.01	13.02
91	11.97	13.06
50	12.80	13.90
54	12.40	13.61
74	11.92	12.50
74	11.92	12.55
02	12.12	13.51
03	11.85	13.30
04	12.05	13.42
06	12.02	13.42
06	12.01	13.71

		12575			5615			12426	
J.D. 244	Φ	V	B	Φ	V	B	Φ	V	B
2633.608	00	15.88	16.64	00	17.00	17.37	00	16.17	17.15
2715.492	44	16.22	16.55	98	17.07	17.14	11	16.32	16.82
2719.542	49	16.02	16.20	61	16.76	17.30	70	16.04	16.28
2720.449	95	16.19	16.42	97	16.80	17.50	06	16.55	16.64
2744.412	08	16.30	16.66	62	16.90	17.30	45	15.85	16.12
2745.408	58	15.80	16.13	03	16.70	16.80	84	16.10	16.70
2748.401	09	16.30	16.58	23	16.15	16.31	02	16.50	17.00
2749.470	63	15.81	(15.98)	66	17.05	17.17	44	15.92	16.30
2751.437	63	15.60	16.13	45	16.59	17.13	21		17.07
2752.455	14	16.31	16.87	86	17.39	17.48	61	15.88	16.13
2754.411	14	16.15	16.49	65	16.80	17.35	37	16.41	16.66
2755.456	66	15.72	15.88	07	15.91	16.15	78	16.22	16.50
2777.399	77	15.96	16.09	91	16.97	17.53	39	16.33	16.67
2779.396	78	16.04	15.21	72	17.15	17.64	17	16.58	16.93
2781.487	84	16.04	16.17	56	16.86	17.09	99	16.45	16.74
2782.415	31	16.40	16.95	93	16.91	17.69	36	16.38	16.90
2783.418	81	15.89	16.14	33	16.69	16.60	75	16.12	16.50
2809.333	93	15.80	16.25	77	16.88	17.42	91	16.45	16.39
2810.319	44	16.39	16.40	17	15.89	16.09	30	16.62	16.60
2811.326	94	16.20	16.48	57	17.01	17.24	69	16.15	16.40
2836.308	58	15.89	16.05	64	16.70	17.45	49	15.55	15.75
2840.306	60	16.00	16.15	25	16.41	16.48	06	16.21	17.07
2842.309	62	15.99	16.23	05	16.22	16.39	84	16.08	16.54
2872.273	78	15.91	15.86	12	15.86	15.86	60	15.61	15.98
3017.616	34	16.29	16.74	66	16.72	17.22	59	15.73	16.15
3018.611	84		16.13	06	15.91	16.15	98	16.49	16.82
3044.538	96	15.90	16.04	50		17.22	15	16.30	17.08
3049.537	49	15.89	16.32	53	16.90	17.10	11	16.28	16.75
3071.573									
3099.462									
3102.406									
3103.408									
3104.404									
3128.417									
3128.455									
3168.380									
3169.380									
3192.278									
3192.322									
3195.330									
3196.278									
3196.322									

2473			12500			12964			12572		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.31	17.80	00	16.60	17.27	00	16.46	17.50	00	15.93	17.15
75	16.05	16.54	15	16.86	17.31	40	15.34	16.03	49	15.70	16.04
32	16.92	17.63	69	15.84	16.16	90	16.60	17.40	94	16.03	16.80
67	16.12	16.35	03	17.08	17.14	24	16.36	17.28	27	16.10	16.98
96	16.70	17.45	15	16.68	17.70	13	16.36	17.88	90	16.00	16.85
35	(17.30)	17.48	53	16.61	16.70	50	15.75	16.16	26	15.94	16.88
51	16.60	17.23	66	15.70	16.17	61	15.98	16.73	34	16.15	17.14
92	16.82	17.17	07	17.11	17.50	01		17.24	72	15.65	16.30
69	15.75	16.30	82	16.28	16.80	74	16.11	16.95	43	15.62	16.50
08	16.62	17.40	21	(17.41)	17.46	12	(16.90)	17.50	80	15.85	16.58
84	16.49	16.80	96	16.60	17.10	84	16.12	17.30	50	15.42	15.77
25	16.80	17.61	35	17.10	17.93	23	16.49	17.12	88	16.08	16.86
76	16.11	16.49	69	15.98	16.23	38	15.62	16.10	78	15.95	16.64
53	16.41	16.70	45	16.92	17.55	12	16.60	17.40	50	15.57	15.94
34	16.91	17.51	25	16.92	17.45	89	16.45	17.30	25	16.45	16.90
70	15.73	16.25	60	15.61	16.05	24	16.25	17.14	58	15.61	16.30
09	16.39	17.30	98	16.70	17.47	61	15.73	16.75	95	16.11	16.70
14	16.50	17.25	84	16.47	16.72	23	16.47	17.42	28	16.21	16.90
52	16.60	16.68	22	16.61	17.33	60	16.08	16.60	63	15.69	16.18
91	16.62	17.03	60	15.73	16.03	97	16.84	17.63	00	16.13	16.62
60	15.60	15.87	10	16.73	17.34	24	16.50	17.26	99	16.08	16.65
15	16.84	17.90	62	15.71	15.70	73	15.86	16.95	43	15.90	16.35
92	16.45	17.00	38	16.98	17.60	47	15.50	16.00	15	16.37	16.90
54	16.19	16.70	78	16.18	16.65	59	15.79	16.78	94	16.00	16.75
90	16.30	16.98	06	(17.26)	17.40	54		16.85	28	16.20	17.06
28		17.72	44	17.07	17.57	91	16.10	17.30	64	15.68	16.14
34		18.10	30	(17.35)	17.85	54	15.86	16.48	98	15.99	16.50
28	17.15	17.80	21	16.61	17.69	39	15.38	15.95	78	15.88	16.55

2557			12547			12585			2395		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.90	16.38	00	16.17	17.40	00	16.31	17.45	00	16.30	17.20
19	16.25	16.45	16	16.46	17.26	78	16.08	16.95	09	15.62	16.85
64	16.65	17.25	60	16.40	16.60	20	16.70	17.23	48	16.01	16.43
96	16.30	16.60	93	16.31	17.06	52	15.80	15.92	79	16.20	16.95
50	16.45	17.30	46	16.70	17.63	95	16.70	17.38	01	16.10	17.15
86	16.98	17.05	82	16.00	16.64	30	16.80	17.62	35	15.50	16.25
92	16.48	17.02	88	16.19	17.10	35	16.95	17.48	38	15.70	16.41
30	16.70	16.90	26	16.60	17.40	72	15.99	16.30	75	16.02	16.88
01	15.75	16.03	96	16.12	17.02	42	16.30	16.91	42	15.61	16.30
37	16.20	17.02	32	16.80	17.33	77	16.20	16.86	77	16.00	16.90
07	16.30	16.17	02	16.29	17.30	46	15.97	16.23	44	15.71	16.50
44	16.44	17.10	39	16.80	17.50	83	16.27	17.03	80	16.20	17.10
26	16.33	17.00	21	16.47	17.50	54	15.70	15.99	33	15.68	15.99
98	15.99	16.35	92	16.22	16.85	24	16.92	17.70	01	16.01	16.85
72	16.63	17.15	66	15.86	16.33	98	16.45	17.00	73	16.03	17.00
05	16.06	16.25	99	16.37	17.00	30	16.82	17.65	05	16.20	16.70
41	16.39		35	16.60	17.65	66	15.58	16.17	39	15.70	16.33
65	16.50	17.23	58	16.06	16.80	77	15.89	16.50	28	15.41	15.96
00	15.70	15.81	93	15.92	16.80	11	16.61	17.08	62	16.10	16.60
36	16.48	16.90	29	16.60	(17.90)	47	16.01	16.08	97	16.33	17.17
26	16.29	16.68	19		17.16	25	16.94	17.33	54	15.91	16.55
69	16.91	17.60	61	16.03	16.71	65	15.81	16.50	91	16.04	17.32
40	16.60	16.95	32	16.43	17.50	36	16.63	17.33	60	16.10	16.74
09	16.19	16.16	99	16.41	17.15	89	16.69	16.95	87	16.32	17.10
90	16.71	16.90	75	16.25	16.60	98	16.70	17.10	73	16.28	16.85
26	16.29	16.84	11	16.15	17.20	32	16.40	17.20	08	16.12	16.88
50	16.95	17.40	34	16.98	17.31	44	15.83	16.32	97		16.87
28	16.02	16.94	12	16.73	17.25	20	16.60	17.50	68	16.15	16.74
									24	15.57	16.25
									81		
									82		
									16	15.47	16.31

12551			2353			12594			12423		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		17.15	00	15.59	16.38	00	16.40	17.62	00	16.12	17.20
51	15.92	16.08	35	15.45	16.13	33	16.09	16.57	26	16.76	17.42
87	16.63	16.72	65	15.05	15.73	54	16.60	17.03	46	16.95	17.30
17	16.82	17.30	94	15.50	16.02	81	16.83	17.63	73	15.93	16.15
22	16.81	17.75	65	15.17	15.69	93	16.92	17.45	83	16.31	16.58
55	15.91	16.07	97	15.38	16.05	22	16.10	16.05	13	16.65	17.28
56	15.82	16.12	94	15.36	16.03	11	16.30	16.78	01	16.50	17.30
92	16.31	16.80	28	15.42	16.07	43	15.99	16.62	33	17.00	17.25
58	15.88	16.22	91	15.36	15.90	02	16.69	17.40	91	16.08	16.70
92	16.40	17.02	24	15.54	16.20	32	15.85	16.51	21	16.80	17.27
58	16.10	16.04	87	15.20	15.81	90	16.78	17.60	79	16.12	16.38
93	16.65	17.10	20	15.51	16.28	21	15.79	16.24	10	16.60	17.03
30	16.70	17.35	26	15.51	15.99	73	16.54	17.43	60	15.97	16.06
97	16.60	17.18	91	15.60	15.93	33	16.20	16.40	20	16.62	17.25
67	16.21	16.20	58	15.25	15.80	95	16.71	17.25	82	16.02	16.38
99	16.52	17.33	88	15.20	15.84	22	15.86	16.03	09	16.27	17.49
32	16.49	17.10	20	15.35	16.18	52	16.40	16.67	39	16.90	17.15
03	16.40	16.96	54	15.28	15.97	22	15.81	15.90	07	16.50	16.90
36	16.65	16.82	86	15.16	15.95	52	15.91	16.60	36		17.20
70	16.35	16.53	18	15.45	16.28	81	16.67	17.30	66	15.88	15.74
09	16.75	17.16	22	15.63	16.15	24	16.11	16.15	06	16.47	16.90
43	16.47	16.54	50	15.12	16.05	43	16.04	16.70	24	16.70	17.34
10	16.62	17.35	15	15.51	16.32	02	16.63	17.50	84	16.10	16.54
17	16.70	17.34	79	15.16	15.78	93	16.91		72	15.91	16.14
99	16.75	17.06	56	15.29	15.70	12	16.00	16.50	78	16.00	16.25
33	16.99	17.40	88	15.41	15.88	42	16.26	16.80	08	16.60	17.08
04		17.20	22	15.70	16.21	12	16.10	16.55	76	16.09	16.37
72	16.10	16.40	82	15.19	15.83	61	16.30	16.95	24	17.00	17.46

12765			12574			926			12508		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.63	16.25	00	16.12	16.22	00	15.45	16.43	00	16.04	16.90
88	15.90	16.09	77	16.41	16.70	54	15.91	16.94	95	15.93	16.55
06	15.70	16.18	94	16.65		71	15.65	16.17	08	16.22	16.73
32	15.63	15.90	21	15.94	15.80	97	15.17	16.60	34	16.17	16.88
31	15.62	15.97	16	15.85	16.23	86	15.30	15.98	06	16.30	16.90
60	15.31	15.76	45	15.90	16.30	14	15.36	16.63	33	16.36	16.98
48	15.30	15.52	32	16.07	16.35	00	15.35	16.30	17	16.47	17.12
79	15.55	15.91	63	16.46	16.70	31	15.45	16.63	47	15.82	16.50
36	15.38	15.73	20	16.12		88	15.12	15.93	02	16.09	16.83
66	15.40	15.85	50	16.31	16.45	17	15.59	16.58	31	16.38	16.90
23	15.70	15.85	07	16.00	16.27	73	15.20	16.00	86	15.83	16.50
54	15.30	(15.70)	37	16.08	16.35	03	15.50	16.20	15	16.23	17.00
93	15.81	16.05	74	16.19	16.50	34	15.63	16.64	30	16.38	16.84
52	15.31	15.40	32	15.87	16.01	92	15.38	16.10	86	15.82	16.41
13	15.70	15.84	93	16.67		52	15.69	16.75	45	16.29	16.60
40	15.40	15.94	20	15.60	16.17	78	15.10	15.79	71	15.73	16.13
69	15.32	15.50	49	16.38	16.75	07	15.32	16.29	98	16.17	17.20
25	15.70	15.82	01	16.00	15.98	52	15.82	16.70	25	16.43	
53	15.16	15.40	30	16.09	16.40	81	14.98	15.75	53	15.58	15.98
83	15.61	15.70	59	16.51	16.70	10	15.39	16.45	81		16.64
11	15.61	15.94	84	16.31	16.57	28	15.60	16.42	81	15.93	16.15
28	15.70	15.85	00			43	15.55	17.08	93	15.83	16.80
86	15.68	16.03	58	16.41	16.80	01	15.48	16.30	49	15.96	16.36
60	15.41	15.40	28	16.20	16.40	62	15.90	16.75	89	16.01	16.69
99	15.67	15.91	47	15.86	16.26	41	15.43	16.90	63	15.60	16.12
28	15.51	15.80	76	16.64		70	15.61	16.21	90	16.10	16.89
84	15.32	15.48	28	15.73	15.69	15	15.46	16.19	17	16.22	16.68
30	15.37	15.73	74		16.59	59	16.10	16.73	57	15.80	15.95

2290			12424			12432			2366		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.76	16.63	00	16.30	16.97	00	15.75	16.30	00	15.46	16.14
15	16.15	16.83	63	16.07	16.46	19	15.92	16.44	14	15.48	16.17
24	16.45	16.94	60	16.02	16.40	14	16.01	16.20	08	15.40	16.27
49	16.31	16.70	82	16.35	16.88	35	16.10	16.70	30	15.55	16.65
97	15.95	16.45	56	15.94	16.58	97	16.00	16.33	90	15.30	15.80
24	16.10	17.15	80	16.10	16.90	20	15.90	16.70	13	15.55	16.20
05	15.90	16.58	52	15.70	16.32	90	15.61	16.02	83	14.99	15.80
34	16.31	(16.95)	78	16.31	16.77	15	15.79	16.50	08	15.30	15.97
87	15.62	16.18	25	15.89	16.50	61	15.98	17.02	54	15.64	16.98
15	16.18	16.73	49	15.80	16.24	85	15.43	16.08	77	15.20	16.13
68	15.30	15.36	96	16.44	17.02	31	16.00	16.44	23	15.41	16.37
96	15.90	16.42	21	16.11	16.90	56	15.96	16.70	48	15.79	16.57
89	15.81	16.31	47	15.68	16.20	70	16.00	16.28	60	15.82	16.85
43	16.25	17.04	95	16.37	17.02	17	15.89	16.46	07	15.56	16.14
00	15.83	16.47	45	15.71	16.02	66	15.88	16.62	56	16.01	16.95
25	16.27	17.03	68	16.04	16.70	87	15.49	16.11	78	15.28	15.89
52	16.20	16.42	92	16.17	17.25	11		16.64	01	15.23	16.00
53	15.97	16.04	13	16.31	17.10	18	15.80	16.39	07	15.50	16.15
80	15.38	15.82	37	15.41	16.00	41	15.90	16.50	30	15.91	16.47
07	16.17	16.70	61	16.15	16.61	65	16.00	16.91	53	15.80	16.78
83	15.55	15.98	60	15.88	16.20	50	15.87	16.70	37	15.73	16.75
91	15.80	16.35	56	15.85	16.70	44	15.90	17.10	30	15.74	16.85
45	16.29	16.95	04	16.25	16.84	91	15.39	15.92	77	15.48	16.12
56	15.40	15.55	22	16.20	16.65	93	15.63	16.13	78	15.59	16.15
87	15.89	16.15	07	16.40	16.95	00	15.91	16.13	74	15.67	16.16
14	16.00	16.68	30	15.49	15.90	23	15.83	16.56	98	15.40	15.70
15	16.08	16.85	52	15.73	16.22	31	15.88	17.25	03	15.58	16.14
50	15.84	16.32	72	16.09	16.61	48	16.00	16.93	20	15.49	16.32

2421			12422			2384			2431		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.98	16.87	00	15.99	16.57	00	15.60	16.08	00	14.92	15.80
09	15.75	17.04	05	16.14	16.61	03	15.46	16.03	66	15.30	16.09
03	15.71	16.94	99	16.04	16.57	97	15.83	16.31	59	15.41	16.10
24	15.60	16.35	20	16.55	16.98	18	15.63		80	15.47	16.13
83	15.79	16.68	77	15.94	16.07	75	16.47	17.45	26	15.15	15.91
06	15.81	16.63	01	15.99	16.55	98	15.81	16.25	48	15.30	16.07
76	15.69	16.62	70	15.60	15.83	68	16.20	17.14	17	15.00	15.75
01	15.59	16.55	95	15.99	(16.36)	93	15.98	16.70	41	15.21	16.07
47	15.25	15.73	41	16.21	17.13	38	15.93	16.80	86	15.11	15.93
70	15.39	16.58	64	15.50	15.73	62	16.16	17.14	09	14.89	15.55
16	15.97	16.50	10	16.11	16.81	07	15.51	16.00	54	15.20	16.10
40	15.21	15.75	34	16.40	16.90	32	15.94	16.40	78	15.22	16.20
52	15.21	15.81	45	16.19	17.15	42	15.79	16.64	78	15.21	15.99
98	15.82	17.09	91	15.89	16.43	88	16.22	17.00	23	15.03	15.90
47	15.38	15.94	40	16.45	16.80	37	15.90	16.62	71	15.40	16.17
69	15.40	16.33	61	15.59	15.69	58	16.21	16.81	92	15.07	(15.48)
92	15.89	16.67	85	15.68	16.30	82	16.38	17.10	15	14.82	15.79
96	15.70	16.66	88	16.00	16.03	84	16.08	17.43	06	14.72	15.50
19	15.53	16.37	10		16.37	07	15.16	15.90	28	15.02	15.73
43	15.02	15.93	34	16.50	17.20	30	15.80	16.60	51	15.25	16.17
25	15.33	15.85	15	16.10	16.54	11	15.55	15.97	20	15.06	15.61
18	15.71	16.70	08	15.99	16.77	04	15.48	16.42	12	15.08	15.92
65	15.48	16.39	55	15.93	16.26	50	16.09	16.82	57	15.26	16.28
63	15.59	16.40	52	16.21	16.65	47	16.02	16.80	40	15.28	16.19
51	15.21	16.07	32	16.28	17.08	24	15.89	16.13	54		16.19
74	15.51	16.44	56	15.80	16.09	48	16.29	16.83	76	15.30	15.99
79	15.71	16.50	59	15.59	15.94	50	16.08	16.95	67	15.30	15.92
95	15.83	16.72	75	15.59	15.93	66	16.25	16.85	81	15.48	15.93

	12561			2486			12430			5840	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.90	16.43	00	16.11	17.33	00	15.02	15.15	00	16.13	17.29
40	16.06	16.50	67	15.87	16.50	50	15.98	16.36	46	15.83	16.24
31	15.80	16.45	54	15.69	16.00	37	15.83	16.50	32	15.69	16.00
51	16.09	17.10	74	16.08	16.65	56	16.10	16.80	52	15.93	16.40
89	15.96	16.75	91	16.11	16.82	69	16.14	16.83	63	15.81	16.45
12	15.65	16.14	12	16.38	16.77	90	15.60	15.86	84	16.35	16.90
79	16.17	17.14	77	16.17	16.66	54	16.17	16.60	48	15.71	16.33
03	15.41	16.11	00	15.99	16.73	77	16.30	16.58	70	16.09	16.59
47	15.80	16.70	42	15.52	16.10	19	15.45	15.82	12	16.30	17.30
70	16.00	16.84	64	15.70	16.32	41		16.32	34	15.41	16.00
14	15.59	16.16	06	16.27	16.85	82	16.13	16.62	76	16.13	16.82
38	16.08	16.79	29	15.93	16.95	05	15.30	15.45	98	16.11	17.12
31	15.81	16.35	02	16.14	17.03	74	16.28	16.70	66	15.68	16.37
75	16.28	17.15	45	15.60	15.94	16	15.59	15.53	08	16.22	17.15
22	15.69	16.19	90	16.02	16.68	61	15.85	16.45	53	15.72	16.05
43	15.90	16.86	10	16.22	16.98	81	16.20	16.92	73	16.20	16.61
66	16.21	16.86	32	16.21	16.58	02	15.05	15.27	94	16.17	16.70
48	16.00	16.70	91	16.11	16.40	56	15.91	16.55	47	15.55	15.98
70	15.91	16.74	12	16.33	16.75	78	15.93	16.64	68	15.73	16.34
93	15.86	16.60	34	16.16	16.24	99	15.26	15.15	89	16.29	17.02
54	15.95	16.75	73	16.22	16.30	33	15.74	16.03	22	16.13	16.55
44		16.80	60	16.10	16.32	19	15.69	15.90	07	16.44	16.90
89	16.11	16.66	03	16.41	16.80	61	15.98	16.60	50	15.97	16.39
62	16.06	17.00	49	15.80	15.78	02	15.30	15.25	89	16.23	16.80
28	15.67	16.30	85	15.88	16.75	09	15.31	15.39	88	16.40	16.70
50	15.69	16.92	06	15.97	17.00	30	15.70	15.97	09	16.49	17.03
32	15.73	16.45	66	15.98	16.24	84	15.86	16.59	62	15.72	16.50
45	15.98	16.70	74	15.80	16.43	91	15.38	15.63	68	15.86	16.43

5526			2387			2283			12568		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.39	15.95	00	15.70	16.46	00	14.80	15.58	00	15.20	15.95
45		16.62	67	15.85	16.53	40	14.62	15.50	15	15.05	15.43
32	15.85	16.77	50	15.60	16.30	21	14.80	15.63	95	15.85	16.38
51	16.50	16.65	68	15.90	16.55	40	14.81	15.49	12	15.08	15.28
62	16.14	17.28	56	15.61	16.32	20	14.98	15.51	85	16.10	
83	15.80	16.83	76	15.90	16.60	40	14.86	15.50	05	15.01	15.35
47	15.98	16.81	38	15.36	16.21	00	14.78	15.37	64	15.71	16.58
69	16.13	17.64	59	15.42	16.40	21	14.82	15.52	85	15.90	16.80
11	15.46	16.23	99	15.52	16.30	60	14.52	15.20	24	15.01	15.62
33	16.00	16.45	20	15.40	15.83	81	14.68	15.19	44	15.39	16.30
75	15.98	17.02	60	15.59	16.27	20	14.78	15.53	82		16.93
97	14.90	15.81	81	15.80	16.70	41	14.74	15.67	03	14.86	15.40
65	16.19	17.03	28	15.33	15.80	80	14.59	15.10	36	15.32	16.00
07	15.42	15.93	68	15.70	16.60	20	14.82	15.70	75	15.82	16.90
52	16.01	16.90	11	15.22	15.70	62	14.69	15.24	16	14.98	15.55
72	15.92	17.38	30	15.40	15.95	81	14.59	15.14	34	15.17	16.10
93	15.55	15.92	50	15.70	16.37	01	14.89	15.73	54	15.41	16.37
45	16.10	16.72	78	16.00	16.55	20	14.70	15.72	65	15.50	16.55
66	16.38	16.85	98	15.57	16.30	40	14.99	15.70	85	16.08	16.62
88	15.58	16.33	19	15.36	15.71	60	14.62	15.42	05	15.02	15.30
20	15.78	16.27	27	15.31	15.84	60	14.79	15.25	97	15.48	15.92
05	15.18	16.07	09	15.33	15.97	41	14.79	15.74	76	15.91	16.76
48	15.96	16.70	50	15.60	16.23	81	14.40	15.04	16	15.02	15.40
87	15.89	16.75	60	15.62	16.45	81	14.58	15.28	06	15.02	15.46
84	16.29	16.85	19	15.20	15.70	92	14.95	15.68	73	15.91	16.62
06	15.62	15.85	39	15.50	16.02	12	14.87	15.45	92	15.91	16.40
58	16.60	17.17	67	15.58	16.54	32	15.18	16.00	04	15.15	15.32
65	16.40	16.90	69	15.61	16.30	32	14.98	15.64	02	15.28	15.41

12555			2381			931			12427		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.85	16.88	00	15.46	17.00	00	15.73	16.95	00	15.35	15.90
14	15.40	15.77	02	15.62	16.67	82	16.08	16.78	66	15.19	15.45
94	16.00	16.60	82	15.59	16.30	61	15.70	16.32	43	16.04	16.45
12	15.29	15.70	99	15.80	16.78	78	16.30	16.67	60	15.61	15.92
84	16.00	16.52	68	15.50	16.18	41	15.51	16.22	19	15.90	16.33
03	15.79	16.41	88	15.74	16.38	60	15.81	16.37	38	15.60	16.48
62	15.49	16.47	46	15.19	15.78	18	15.00	15.47	95	15.37	15.88
83	15.71	16.35	67	15.43	16.15	39	15.40	16.00	15	15.79	16.06
22	14.89	15.48	06	15.91	16.70	77	15.77	16.80	53	15.62	16.45
42	15.28	16.02	26	15.31	15.96	97	16.19	16.95	72	15.20	15.42
81	15.69	16.40	64	15.33	15.87	34	15.31	15.79	10	15.50	16.01
01	15.80	16.52	84	15.80	16.28	55	15.59	16.36	30	15.80	16.24
34	15.30	15.65	14	15.84	16.53	79	15.81	16.74	49	15.83	16.23
73	15.56	16.45	53	15.03	16.01	17	15.06	15.38	88	15.41	15.73
14	15.13	15.83	94	15.55	16.46	58	15.72	16.30	27	15.82	16.20
33	15.30	15.77	12	15.92	17.02	76	16.02	16.69	45	15.70	16.71
52	15.20	16.12	32	15.07	15.64	95	15.99	16.69	64	15.18	15.69
63	15.65	16.28	39	14.85	15.50	96	16.00	16.75	60	15.50	15.75
83	15.72	16.55	58	15.13	15.95	15	15.09	15.50	79	15.13	15.42
02	15.89	16.60	78	15.48	16.38	34	15.46	15.83	98	15.46	
95	15.89	16.70	67	15.15	16.10	17	15.17	15.40	76	14.91	15.30
74	15.68	16.59	45	15.13	15.85	94	16.44	16.95	52	15.83	16.65
13	15.16	15.84	84	15.60	16.46	33	15.60	16.04	90	15.35	15.73
04	16.19	16.70	70	15.50	16.18	12	15.40	15.65	63	15.38	15.60
68	16.00	16.13	15	(16.28)	16.70	21	15.12	15.25	42	16.06	16.33
88	15.78	16.54	34	15.00	15.40	40	15.11	15.83	61	15.49	15.58
99	16.00	16.63	42	15.18	15.60	41	15.44	15.68	57	15.59	16.22
97	15.80	16.62	39	15.16	15.51	37	15.56	15.80	53	15.72	16.30

8040			12421			2523			2405		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.25	15.88	00	15.59	16.13	00	14.89	15.70	00	15.22	16.32
63	15.97	16.70	26	15.90	16.36	07	14.97	15.83	83	15.20	15.98
40	15.70	16.40	02	15.65	16.13	67	14.71	15.47	41	14.80	15.60
58	16.08	16.80	19	15.83	16.42	80	14.81	15.58	54	15.04	15.57
15	15.50	16.11	65	15.68	16.03	33	15.09	15.82	00	15.61	16.12
34	15.75	16.37	84	15.32	15.62	48	14.90	15.55	15	15.38	16.14
91	14.92	15.47	40	15.85	16.77	92	14.80	15.48	58	15.00	15.68
12	15.42	16.06	60	15.95	16.57	08	14.82	15.59	73	15.28	15.80
49	15.72	16.72	96	15.50	15.90	37	14.96	15.86	02	15.35	16.26
68	15.70	16.28	15	15.78	16.40	52	14.78	15.65	16	15.21	16.40
06	15.31	15.76	52	16.30	16.66	81	14.87	15.41	45	14.80	15.50
26	15.50	16.34	71	15.73	15.82	96	14.91	15.64	60	14.88	15.71
45	15.81	16.33	80	15.49	15.55	20	14.96	15.63	77	14.97	15.76
83	15.02	14.98	17	15.89	16.27	49	14.92	15.70	06	15.27	16.26
23	15.69	16.03	56	16.04	16.60	80	14.70	15.23	36	14.96	15.63
40	15.77	16.40	74	15.21	15.59	94	14.92	15.66	49	14.86	15.70
60	15.90	16.84	92	15.25	15.90	08	14.96	15.63	64	14.89	15.78
54	15.69	16.40	75	15.20	15.45	90	14.70	15.43	38	14.73	15.60
73	15.40	15.96	94	15.38	15.85	05	14.88	15.55	52	14.99	15.53
92	15.22	15.33	12	15.60	16.14	20	15.04	15.67	67	15.00	15.84
69	15.55	16.20	78	15.15	15.52	88	14.79	15.67	28	15.05	15.85
45	15.57	16.90	53	16.21	16.73	47	15.00	15.63	85	15.20	16.20
84	14.86	15.12	90	15.35	15.60	76		15.58	14	15.51	16.53
56	16.01	16.63	48	16.06	17.00	18	15.02	15.64	47	15.07	15.54
30	15.39	16.53	58	16.09	16.76	61	14.58	15.23	46	14.93	15.50
49	15.61	16.41	76	15.27	15.50	75	14.70	15.30	61	14.99	15.60
44	15.59	16.36	59	16.04	16.38	58	14.50	15.33	35	14.84	15.31
39	15.68	16.04	52	15.98	16.87	31	14.92	15.65	07	15.39	16.15

12531			12428			919			2386		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.12	16.00	00	15.60	16.78	00	14.71	15.27	00	15.47	16.52
77	15.28	16.13	59	15.44	15.62	58	14.96	16.00	11	15.55	16.70
36	15.59	16.28	16	15.81	16.13	16	14.45	15.06	66	14.96	15.85
49	15.80	16.70	29	15.15	15.03	28	14.66	15.48	78	15.20	16.02
93	15.27	15.77	69	15.39	16.00	68	15.29	16.10	04	15.61	16.58
08	15.19	15.88	83	15.61	16.16	82	15.18	16.11	17	15.74	16.62
50	15.68	16.52	25	15.20	15.48	24	14.70	15.30	58	15.02	15.75
66	15.69	16.40	40	15.02	15.29	39	14.69	15.57	72	15.07	15.80
94	15.20	15.77	68	15.25	15.85	67	15.13	16.00	99	15.50	16.50
09	15.29	15.95	82	15.80	16.23	81	15.29	16.08	13	15.41	16.65
37	15.52	16.38	10	15.80	16.40	09	14.46	14.70	39	14.88	15.59
52	15.63	16.70	25	15.20	15.56	24	14.60	15.27	54	14.99	15.61
67	15.62	16.20	36	15.06	15.23	34	14.74	15.30	51	14.84	15.54
96	15.06	15.70	64	15.17	15.53	62	15.29	16.10	78	15.12	15.74
26	15.38	16.10	93	15.68	16.26	92	14.91	15.60	07	15.55	16.35
40	15.47	16.21	06	15.91	16.81	05	14.44	14.90	19	15.79	16.57
54	15.88	16.66	21	15.11	15.72	19	14.52	14.98	33	15.05	16.05
27	15.55	16.37	88	15.50	16.28	86	14.85	15.93	85	15.26	16.10
41	15.53	16.20	02	15.53	16.40	00	14.56	15.12	98	15.38	16.14
55	15.80	16.40	16	15.61	16.03	14	14.46	15.10	12	15.38	16.62
14	15.15	15.70	69	15.29	15.70	67	15.01	15.94	51	14.81	15.44
72	15.46	16.18	26	15.30	15.40	24	14.75	15.40	05	15.53	16.76
01	15.00	15.60	54	15.21	15.55	52	15.00	15.78	32	15.21	16.08
32	15.41	16.22	79	15.50	16.03	76	15.38	16.00	39	15.20	15.76
21	15.60	16.10	36	14.93	15.27	32	14.71	15.40	11	15.72	16.58
36	15.69	16.34	50	15.03	15.55	46	14.89	15.43	24	15.70	16.40
08	15.30	16.14	17	15.41	16.13	13	14.51	14.78	76	15.00	15.80
80	15.19	15.80	88	15.59	16.14	84	15.16	15.92	44	14.82	15.31

	12433			12823			2267			2301	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.82	15.26	00	14.52	14.63	00	14.41	14.83	00	14.15	14.83
93	14.85	15.30	86	14.31	14.95	78	15.44	16.06	62	13.85	14.50
48	15.59	15.96	35	15.05	15.66	26	14.82	15.13	05	14.09	14.83
60	15.62	16.15	46	15.08	15.40	37	14.94	15.28	14	13.99	15.02
80	15.40	15.86	35	15.17	15.52	23	14.82	15.15	66	13.81	14.39
93	14.86	15.33	47	14.81	15.20	35	14.74	15.40	77	13.88	14.50
33	15.03	15.83	83	14.30	14.65	71	15.30	16.18	08	13.88	14.78
47	15.32	15.94	96	14.21	14.65	84	15.41	15.80	20	14.21	15.04
73	15.40	16.01	19	14.83	15.33	07	14.48	14.87	40	14.20	15.27
87	15.04	15.65	32	14.98	15.73	19	14.85	15.31	51	14.22	15.10
13	15.01	15.53	55	14.59	14.78	43	15.02	15.51	72	13.82	14.46
27	15.11	15.63	68	14.09	14.51	55	14.90	15.83	83	13.90	14.50
20	15.06	15.60	32	14.96	15.43	17	14.74	15.07	14	14.08	14.84
47	15.29	15.96	56	14.50	14.54	41	14.90	15.45	35	14.21	15.10
75	15.55	15.93	81	14.41	14.51	66	15.13	15.85	57	14.11	14.78
87	14.92	15.59	92	14.35	14.75	77	15.50	16.12	66	13.70	(14.52)
00	15.05	15.26	04	14.69	14.63	89	14.93	15.64	77	13.72	14.50
46	15.20	16.00	17	14.70	15.20	98	14.62	14.84	50	14.09	15.00
60	15.40	16.06	28	14.75	15.16	10	14.67	15.10	60	14.08	14.58
73	15.48	16.17	41	14.91	15.26	22	14.73	15.20	71	13.80	14.45
07	14.95	15.45	42	15.06	15.29	21	14.71	15.02	34	14.12	15.03
60	15.55	16.30	90	14.58	14.61	68	15.53	16.32	76	13.98	
87	15.10	15.60	14	15.01	15.27	92	14.78	15.20	97	13.82	14.60
87	15.19	15.53	75	14.27	14.22	50	15.10	15.74	12	14.19	15.00
28	15.06	15.60	25	14.75	15.45	86	15.19	15.82	42	14.29	15.10
41	15.27	15.66	37	14.76	15.57	98	14.38	14.84	53	13.99	14.90
87	14.86	15.52	50	14.63	14.93	07	14.40	14.91	26	14.10	15.11
54	15.29	15.94	10	14.52	15.10	67	15.16	15.94	78	13.74	14.33

2248			2296			5551			2285		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.79	15.43	00	14.99	15.77	00	14.93	15.70	00	14.41	15.50
59	14.03	14.87	43	14.05	14.95	81	14.86	15.88	48	13.86	14.95
02	14.81	15.60	85	14.60	15.40	20	14.80	15.50	80	14.48	15.77
11	14.79	15.42	94	14.34	15.48	28	15.02	15.62	87	14.39	15.68
63	14.40	14.73	41	14.39	15.00	57	15.19	16.23	77	14.52	15.69
73	14.21	14.97	51	14.31	15.15	66	15.19	16.15	85	14.52	15.60
05	14.61	15.65	82	14.61	15.42	95	14.81	15.70	09	14.20	15.40
16	14.73	15.62	93	14.63	15.60	05	14.72	15.60	17	14.21	14.81
37	14.05	14.40	13	14.86	15.53	24	14.89	15.49	33	13.76	14.76
47	14.10	14.60	24	14.68	15.55	35	14.93	15.73	41	14.08	14.83
68	14.47	14.87	44	14.38	15.18	52	15.10	15.83	56	14.10	15.19
79	14.35	15.04	55	14.23	15.07	62	15.21	16.24	64	14.17	15.19
09	14.62	15.55	81	14.50	15.55	71	15.05	15.90	38	13.81	14.80
30	14.30	14.85	01	14.81	15.62	90	14.90	15.60	54	14.01	15.03
52	13.96	14.31	23	14.49	15.47	10	14.69	15.28	71	14.29	15.55
62	14.42	14.88	32	14.42	15.38	19	14.82	15.67	78	14.38	15.74
72	14.31	15.10	43	14.40	15.10	29	14.90	15.67	86	14.31	15.73
44	13.88	14.38	10	15.11	15.93	76	15.15	15.88	91	14.47	15.91
55	14.40	14.73	20	14.90	15.66	85	15.01	15.79	99	14.30	15.45
65	14.37	15.00	30	14.53	15.23	95	14.92	15.84	07	14.29	15.24
27	14.41	14.94	87	14.47	15.33	33	14.80	15.41	04	14.10	15.07
69	14.45	15.03	29	14.56	15.15	71	15.20	16.32	36	13.89	14.70
90	14.41	14.94	49	14.01	14.95	90	14.78	15.72	52		14.84
05	14.78	15.50	58	14.19	14.98	76	15.03	15.87	89	14.43	15.87
30	14.38	15.00	54	14.52	15.20	62	15.19	16.20	40	14.19	14.95
41	13.91	14.21	65	14.38	14.99	72	15.30	16.05	48	13.96	15.02
13	14.82	15.60	32	14.59	15.50	19	14.93	15.45	53	14.21	15.47
65	14.27	15.04	83	14.71	15.59	67	15.18	16.06	92	14.60	15.93

874			2527			2270			2352		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.61	15.43	00	14.05	14.64	00	14.79	15.98	00	13.82	14.48
46	14.40	15.35	32	14.68	15.60	01	14.72	15.84	01	13.68	14.43
78	15.03	15.85	64	15.29	16.14	31	15.40	16.38	31	14.18	15.15
85	14.90	15.73	71	15.33	16.24	37	14.91	15.98	37	14.15	15.10
74	15.16	15.82	56	15.17	16.22	13	15.16	16.30	13	14.01	14.70
82	14.83	15.60	64	15.21	16.10	21	15.09	16.24	20	14.08	14.80
05	14.02	14.40	87	14.92	15.57	42		15.90	42	14.19	15.21
14	14.11	14.65	95	14.68	15.12	50	15.10	15.82	50	14.42	15.36
29	14.20	15.05	10	14.29	14.83	65	14.20	14.97	65	14.20	15.33
37	14.37	15.10	18	14.57	15.20	72	14.38	15.15	72	14.22	15.18
53	14.80	15.44	33	14.80	15.41	87	14.58	15.50	87	14.01	14.69
61	14.75	15.88	41	14.73	15.70	94	14.54	15.63	94	13.80	14.39
34	14.20	14.92	10	14.30	14.88	55	14.62	15.58	55	14.37	15.23
50	14.59	15.31	26	14.48	15.28	70	14.40	15.07	70	14.30	15.05
66	14.76	15.50	42	14.77	15.55	85	14.50	15.25	85	14.04	14.84
73	14.85	15.89	49	14.98	15.90	92	14.46	15.84	92	13.81	14.60
81	14.90	15.85	57	15.19	15.96	00	14.59	15.90	00	13.72	14.50
86	14.72	15.53	57	14.98	16.07	90	14.58	15.59	90	13.89	14.65
93	14.79	15.50	65	15.10	16.09	97	14.66	15.78	97	13.67	14.37
01	14.63	15.19	72	15.16	16.02	04	14.91	15.91	04	13.79	14.50
98	14.56	15.34	66	15.07	16.30	88	14.47	15.33	88	14.02	14.66
30	14.33	15.06	96	14.49	15.00	17	14.89	16.36	17	14.08	14.90
46	14.40	15.03	12	14.65	15.15	32	15.00	16.05	32	14.02	15.04
82	15.03	15.72	43	15.02	15.64	52	14.99	15.75	52	14.43	15.35
28	14.29	15.06	66	15.06	16.18	18	15.07	16.33	18	14.17	14.70
36	14.31	15.03	73	15.11	15.85	26	15.28	16.27	26	14.31	14.90
40	14.39	15.21	74	15.12	16.05	16	15.09	16.35	16	14.00	14.84
80	14.85	15.75	12	14.33	14.82	52	15.08	15.82	52	14.33	15.30

5655			887			2282			2262		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.80	15.94	00	14.10	14.84	00	13.88	14.45	00	13.68	14.51
76	14.40	15.46	65	14.42	15.63	58	14.68	15.60	17	13.85	14.78
05	14.93	16.04	93	14.38	15.14	86	14.58	15.37	42	14.48	15.43
11	15.18	16.10	99	13.90	14.78	92	14.28	15.20	48	14.31	15.20
80	14.51	15.45	65	14.70	15.86	56	14.63	15.69	99	13.70	14.30
87	14.65	15.67	72	14.60	15.73	62	14.62	15.68	06	13.81	14.42
08	14.91	16.02	92	14.29	15.19	83	14.31	15.25	24	14.11	14.91
15	14.95	16.07	00	14.08	14.97	90	14.43	15.30	31	14.21	15.15
29	14.61	15.70	13	13.70	14.56	03	13.79	14.56	44	14.40	15.28
36	14.55	15.65	20	13.98	14.77	10	13.92	14.58	50	14.48	15.64
50	14.08	14.61	34	14.18	15.02	24	14.10	14.90	62	14.59	15.55
57	14.23	14.94	41	14.12	15.24	31	14.08	15.18	69	14.62	15.58
12	15.10	16.10	92	14.17	15.07	80	14.48	15.18	08	13.71	14.40
26	14.70	15.49	06	13.47	14.14	94	14.21	15.09	20	14.02	14.77
41	14.30	14.97	21	13.88	14.67	08	13.88	14.66	33	14.18	14.97
47	14.22	14.81	27	13.87	14.96	15	13.95	14.88	39	14.30	15.25
54	14.07	14.87	34	14.04	14.98	21	14.04	14.95	46	14.36	15.50
37	14.70	15.60	13	13.62	14.44	98	13.98	14.58	09	13.78	14.55
44	14.10	14.58	20	13.86	14.78	05	13.85	14.58	15	13.89	14.80
51	14.12	14.80	27	13.96	14.87	12	14.02	14.72	22	13.96	14.91
26	14.70	15.42	99	14.02	14.74	82		15.20	79	14.05	15.00
54	14.37	15.06	27	13.96	14.82	09	13.89	14.72	04	13.91	14.60
69	14.19	15.20	40		14.93	23	13.90	14.74	17	13.83	14.58
80	14.54	15.53	47	14.32	15.20	27	14.16	14.95	06	13.82	14.54
02	15.18	15.95	50	14.60	15.40	18	14.27	14.84	24	14.27	14.90
09	14.91	16.07	57	14.50	15.42	25	14.12	14.80	30	14.19	14.99
92	14.71	15.92	36	14.21	15.13	02	14.11	14.30	93	14.10	14.54
27	14.74	15.53	71	14.60	15.67	36	14.37	15.20	25	14.10	14.96
						86			64		
						76	14.58	16.11	40		
						96			59		
						03			65		
						10			71		
						74	14.94	15.76	23		
						74	14.80	15.34	23		
									75	14.57	15.70
									81	14.91	15.47

2549			2261			878			902		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.22	15.17	00	13.65	14.66	00	12.97	13.43	00	13.09	14.04
06	14.29	15.25	74	13.10	13.85	52	13.70	14.92	10	13.07	14.35
31	13.48	13.88	98	13.70	14.68	69	14.21	15.23	26	13.50	14.60
36	13.19	13.60	03	13.59	14.70	73	14.19	15.10	29	13.52	14.72
84	14.30	14.97	42	14.10	15.20	76	14.31	15.15	20	13.38	14.43
90	14.30	14.97	48	13.90	14.98	80	14.31	15.22	24	13.46	14.66
09	14.12	14.86	65	12.97	13.44	93	14.10	15.10	35	13.55	14.90
15	13.98	14.65	71	13.22	13.91	97	13.34	13.69	39	13.66	14.90
28	13.86	14.32	83	13.34	14.16	06	12.93	13.39	47	13.69	14.79
34	13.37	13.67	89	13.53	14.38	10	13.20	13.73	51	13.81	14.80
46	13.65	14.00	00	13.61	14.56	19	13.31	13.81	58	13.73	14.86
52	13.50	14.40	06	13.72	14.94	23	13.37	14.14	62	13.88	14.90
88	14.10	14.90	33	14.05	15.23	17	13.28	13.80	45	13.62	14.72
00	14.50	14.93	45	13.96	14.88	26	13.47	14.16	53	13.68	14.69
13	14.09	14.48	57	13.82	14.68	35	13.51	14.35	61	13.84	14.86
19	13.95	14.56	62	13.30	13.87	39	13.56	14.63	64	13.62	14.73
25	13.96	14.20	68	13.09	13.77	43	13.67	14.80	68	13.49	14.47
85	14.09	14.98	18	14.08	15.10	54	13.93	14.95	66	13.69	14.68
91	14.29	14.88	24	13.98	15.22	58	14.00	15.00	70	13.21	13.80
97	14.37	14.90	30	14.18	15.29	63	14.20	15.19	74	12.57	12.95
52	13.65	14.19	74	13.16	13.78	70	13.99	15.08	69	13.23	14.08
76	14.15	14.60	98	13.70	14.78	87	14.25	15.24	84	12.90	13.37
88	14.39	15.10	09	13.59	14.74	96	13.50	14.13	91	12.91	13.50
74	13.97	14.40	83	13.45	14.16	24	13.52	14.14	05	13.31	14.05
71	13.64	14.30	25	14.19	15.15	48	13.80	14.86	56		14.90
77	13.79	14.55	31	14.12	15.22	52	13.88	14.90	60	13.78	14.78
37			81	13.35	14.09	64	14.21	15.09	58	14.05	14.92
68	13.74	14.08	10	13.74	14.86	85	14.19	15.19	77	12.49	12.91
									61		
									66		
									78	12.72	13.04
									82		
									85		
									76	12.55	13.00
									76	12.69	12.97

5829			2281			882			873		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.89	15.73	00	15.60	15.95	00	13.90	14.93	00	12.49	12.83
59	15.89		59	15.90	16.62	57	13.06	14.05	38	13.02	14.10
72	15.06	15.58	72	15.85	16.80	70	13.39	14.50	50	13.39	14.40
75	15.20	15.31	75	15.45	16.42	73	13.29	14.40	53	13.37	14.38
51	15.97	17.05	50	15.65	16.33	48	13.08	13.68	23	12.90	13.51
54	15.89	16.70	54		16.37	51	12.96	13.82	26	12.78	13.70
64	15.90	16.51	63		16.34	61	13.24	14.20	34	13.00	13.90
67	15.58	16.20	66		16.38	64	13.40	14.28	37	13.17	14.08
73	15.25	15.76	73	15.50	16.00	70	13.22	14.33	43	13.13	14.27
76	15.19	15.55	76	15.31	15.98	74	13.38	14.53	46	13.26	14.22
82	14.79	15.20	82	15.30	15.51	80	13.52	14.60	52	13.39	14.24
86	15.00	15.30	85	15.01	15.31	83	13.42	14.75	55	13.28	14.40
55	15.93	16.56	55	15.83	17.00	52	12.99	13.83	19	12.79	13.33
62	15.87	16.80	61	15.70	16.73	58	13.09	13.91	24	12.82	13.40
68	15.59	16.17	68	16.05	16.60	65	13.13	14.17	30	12.93	13.55
71	15.57	16.13	71	15.88	16.49	68	13.19	14.19	33	12.99	13.80
74	15.50	15.47	74	15.70	16.60	71	13.33	14.45	36	13.08	13.98
56	15.50		56			52	13.10	14.03	12	12.65	13.00
60	15.71		59			55	13.09	14.02	14	12.68	13.07
63	15.69	16.16	62			59	13.26	14.17	17	12.81	13.40
42	15.48	16.30	41			37	12.79	13.08	90	13.65	14.51
54	15.55	16.65	54		16.50	50	13.19	13.80	02	12.58	12.83
61	16.29	16.80	60	15.93	17.00	56	12.97	13.73	08	12.49	12.73
56	16.05	16.63	55			50	13.01	13.86	95	13.52	14.37
16	15.14	15.43	15	15.45	16.29	07	13.99	15.20	18	12.65	13.33
19	14.92	15.65	12	15.48	16.08	10	13.96	15.05	21	12.58	13.31
01	14.73	15.32	00	15.20	15.80	92	13.83	14.92	96	13.49	14.35
17	14.84	15.33	16	15.08	15.93	07	13.91	15.00	11	12.42	12.92
									75	13.72	14.43
									56		
									65		
									68		
									70	13.49	14.52

881			909			2257			2338		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	13.61	14.90	00	12.96	14.13	00	12.70	13.50	00	13.47	14.63
29	12.60	13.20	18	13.09	14.20	08	12.73	13.82	94	13.34	14.55
40	12.65	13.41	29	13.05	13.90	19	13.05	14.13	04	13.74	14.67
43	12.70	13.40	31	12.69	13.70	21	12.96	14.12	06	13.59	14.72
10	13.75	14.82	95	12.80	13.98	82	13.20	14.10	63	12.91	13.92
13	13.71	14.92	97			85	12.90	13.59	65	12.96	14.00
21	13.50	14.53	05			92	12.59	13.27	72	13.10	14.07
24	13.29	14.10	08	13.03	14.30	95	12.70	13.28	75	13.13	14.15
30	12.52	13.09	14	12.95	14.15	00	12.52	13.41	79	13.09	14.28
32	12.68	13.12	16	13.04	14.40	03	12.71	13.60	82	13.20	14.34
38	12.69	13.10	21	13.20	14.17	08	12.86	13.62	86	13.27	14.18
41	12.58	13.33	24	12.99	14.26	10	12.81	13.83	89	13.35	14.42
02	13.54	14.70	82	12.70	13.70	66	13.55	14.63	41	12.50	13.17
08	13.68	14.76	88	12.69	13.78	71	13.60	14.80	46	12.65	13.27
14	13.59	14.79	93	12.79	14.02	76	13.61	14.72	51	12.69	13.51
16	13.71	14.80	96	12.95	14.04	79	13.47	14.63	53	12.76	13.67
19	13.70	14.88	98	12.88	13.98	81	13.31	14.40	55	12.85	13.67
91	13.38	14.50	67	12.41	13.46	47	13.31	14.60	17	13.36	14.37
94	13.40	14.56	70	12.45	13.43	50	13.49	14.57	19	13.01	13.91
97	13.61	14.73	73	12.44	13.66	52	13.50	14.67	21	12.81	13.25
67	13.02	14.00	39	12.14	12.58	16	12.81	13.73	81	13.12	14.21
78	13.42	14.45	50	12.29	13.05	26	13.08	14.21	90	13.39	14.55
84	13.20	14.30	55	12.30	13.03	31	13.02	14.14	95	13.31	14.50
67	13.19	14.20	35	12.38	13.06	08	12.80	13.60	66	13.00	13.93
74	13.19	14.38	22	13.30	14.34	78	13.81	14.85	10	13.51	14.56
76	13.19	14.29	24	13.08	14.13	80	13.71	14.55	13	13.50	14.44
49	12.91	13.70	93	12.87	13.94	46	13.42	14.52	74	13.04	14.04
63	13.08	14.11	06	12.96	14.08	59	13.52	14.70	86	13.09	14.04
									38		
									05		
									12		
									14		
									16		
									73		
									73		
									68		
									70		
									25	12.38	12.72
									25	12.31	12.88
									32	12.36	13.01
									34	12.17	13.09
									34	12.68	13.14

900			2622		
Φ	V	B	Φ	V	B
00	12.42	13.16	00	12.50	13.28
72	13.27	14.69	57	13.08	14.60
81	13.20	14.53	64	13.12	14.45
83	13.14	14.40	66	13.22	14.58
33	12.80	13.92	12	12.29	13.30
35	12.81	14.00	14	12.36	13.54
42	12.90	14.02	20	12.50	13.48
44	12.98	14.17	22	12.53	13.55
48	12.85	14.15	25	12.51	13.88
50	12.92	14.31	27	12.62	13.95
54	13.05	14.24	31	12.79	13.82
56	13.11	14.33	33	12.91	14.04
02	12.30	13.10	75	13.19	14.50
07	12.48	13.39	79	13.21	14.40
11	12.41	13.42	83	13.04	14.15
13	12.50	13.42	85	12.99	14.33
15	12.60	13.60	87	13.07	14.04
70	13.29	14.62	36	12.66	13.87
72	13.19	14.66	38	12.71	13.81
74	13.40	14.75	40	12.69	14.13
26	12.68	13.65	88	12.95	14.38
35	12.86	14.18	95	12.71	13.64
39	12.89	13.97	99	12.55	13.22
02	12.37	13.10	57	13.10	14.19
08	12.50	13.38	35	12.50	13.70
10	12.45	13.24	36	12.63	13.73
65	13.30	14.51	86	13.03	14.18
75	13.40	14.58	96	12.50	13.22
22					
80					
86					
88	12.81	13.44			
91	12.88	13.49			

J.D. 244	φ	2661 V	2661 B	φ	12906 V	12906 B	φ	2837 V	2837 B
2634.622	00	16.91	16.91	00		17.72	00	15.80	16.40
2659.624	54	16.48	16.26	32	16.59	16.13	07	15.70	16.24
2661.612	77	16.35		46	16.74	(18.40)	19	15.70	16.30
2715.560	30	16.50	17.10	36	16.70	17.89	55	15.93	16.38
2720.528	39		17.13	20	17.20	17.50	34	15.70	16.48
2720.574	42	16.20	17.10	23		17.92	37		16.02
2744.497	29	16.68	17.41	93	17.40		83	16.30	16.88
2744.544	32			96			86	16.44	
2745.510	92		16.72	51	16.94	17.78	40	15.70	16.40
2745.557	95		17.05	54		17.30	43	15.44	16.24
2749.538	42	16.41	16.58	82	16.70	17.48	67	15.95	16.75
2750.505	02	16.77	17.23	37	17.02	17.68	21	15.92	16.08
2754.502	50	16.00	16.27	66	16.66	17.50	46	16.14	16.48
2754.547	53		16.59	69		17.10	49	15.62	16.20
2755.522	14		17.50	24	17.13	18.20	04	15.83	16.52
2777.472	78	16.35	16.85	82	16.73	17.50	39	15.71	16.05
2779.497	04			98	17.58	17.70	53	16.41	16.60
2779.552	07			01			56	16.20	16.53
2781.555	32	16.83	17.60	15	(17.7)	17.73	69	(16.68)	16.86
2782.465	88			68			20	15.58	16.08
2783.487	52	16.18	16.30	26	17.03		77	16.05	16.72
2808.480	05		17.40	58	17.17	17.50	84	16.12	16.75
2809.401	62	16.10	16.58	10	(17.3)	17.60	36	15.88	16.40
2809.447	65	16.30	16.59	13			38		16.32
2810.393	24	16.57	17.30	67	16.88	17.50	92	15.91	16.89
2810.443	27			70		17.10	94		16.72
2836.379	39	16.70	17.39	55	16.82	17.60	54	16.11	16.68
2836.426	42		(17.90)	58			56	15.60	16.25
2842.429	15			02			94		16.43
3016.638	42			80			98	16.00	16.82
3019.604	27	16.62	17.66	50	16.70	18.02	65	15.81	16.69
3021.612	51	16.20	16.60	64	16.88	17.55	78		16.80
3045.523	38			34			23	15.55	16.30
3045.565	40	16.52	17.30	36	17.17	17.65	26	15.70	15.81
3075.536	03	16.52	17.30	53	16.90	17.70	12	15.89	16.68
3104.510	04	16.38	(17.88)	12		18.20	43	15.80	16.45
3128.496	94		17.73	86	17.21		93	16.37	16.60
3129.503	57	16.29	16.24	44		17.89	49	15.59	16.23
3132.500	43	16.06	(18.02)	16		18.20	18	16.00	16.21
3133.493	05	16.73	17.55	72	16.88	17.65	74	16.30	16.75
3190.406	42	16.43	(17.87)	32	16.90		77		17.09
3192.392	65	16.30	16.48	46	16.93	17.81	88	16.24	16.81
3195.402	52	16.12	16.49	18	17.08		58	15.59	16.42
3196.394	14	16.50	17.66	75	16.50	17.30	14	16.18	16.61

12676			12688			2809			12999		
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	15.51	16.19	00	15.73	15.88	00	15.60	16.62	00	15.55	15.81
81	15.70	15.95	70	(17.33)	17.38	98	16.20	16.60	55		16.97
67	15.60	16.21	55	16.99	17.08	77	15.53	15.91	23	15.82	16.65
99	15.47	16.35	65		17.29	30	16.40	17.28	61	16.64	
14	15.70	16.04	78	16.73	17.30	28	16.31	16.91	37	16.09	16.45
16	15.20	16.03	79	16.20	(17.63)	30		17.36	38	16.15	17.40
50	15.38	15.98	04	15.67	15.94	84	15.68	16.35	56	16.13	17.25
52	15.28	15.80	06	15.79	16.55	86	15.65	16.15	58		
94	15.78	16.03	47	16.50	17.12	25	15.99	16.85	91	15.78	16.22
96	15.58		49		17.04	27			93	15.48	16.25
68	15.87	16.17	19	16.15	16.50	86	15.93	16.19	62	16.17	16.58
10	15.34	15.86	61	16.73	17.33	24	16.38	16.99	62	16.27	
83	15.83	16.14	32	16.12	16.93	84	15.85	16.40	98	15.35	15.85
85	15.80		34		16.92	86		16.42	00		
27	15.35	15.75	76	(17.20)	17.79	24	16.30	17.00	33	16.17	17.00
76	15.70	16.04	15	15.96	16.48	00	15.97	16.58	84	16.20	17.20
62	15.94	16.20	02	16.05	16.09	81	15.73	16.30	53		17.13
66	15.55	16.10	04	15.80	15.98	83	15.61	16.19	55	16.00	17.08
52	15.56	16.34	90	16.64	17.37	63	16.30	16.91	23	16.07	16.77
92			29		16.60	00			54		
36	15.31	15.50	73	16.38	17.26	40	16.52	17.63	89	15.96	16.55
17	15.53	15.70	42	16.44	16.79	38	16.10		44	16.25	16.83
56	15.70	16.21	82	16.52	17.20	74	15.58	15.92	75	16.50	17.02
58	15.40	16.17	84		(17.69)	76	15.40	16.00	77		16.95
99	15.80	16.15	24	15.84	16.85	14	15.88	16.93	09	15.99	16.04
01	15.45	16.22	26		16.47	16		17.25	11	15.46	16.17
23	15.30	15.82	37	16.10	17.01	51	16.53	17.20	98	15.52	16.10
25	15.20	15.47	39	16.31		53	16.40	16.54	99	15.32	15.79
84		16.44	96	15.89	16.44	92	15.60		04	15.68	15.90
16	15.50	15.95	53			44			60	16.10	16.50
44	15.47	15.88	80	16.41	(17.74)	62	15.49	16.40	62	16.07	
31	15.50	15.72	66		17.20	42	16.20	17.68	30	16.08	16.40
65	15.30	16.20	90		16.90	97	15.80	17.06	48	15.98	17.30
67	15.62	16.04	92	16.47	16.30	98	16.20	16.70	49	16.21	17.02
62	15.63	16.58	75	16.83	17.40	94	15.85	16.65	74	16.20	17.10
15	15.69	16.10	15	15.86	16.70	50	16.45	17.14	64	16.26	17.80
52	15.48	16.38	42	16.40		08	16.20	16.60	85		17.30
96	15.79	16.15	85	16.60	17.50	48	16.50	16.94	19	15.68	16.26
25	15.53	15.70	13		16.84	67	15.41	15.69	21	15.81	16.62
68	15.39	16.00	56	16.34	17.29	07	16.30	16.70	55	16.17	17.28
29	15.55	15.78	92	16.05	16.75	78	15.63	16.24	01	15.30	15.85
15	15.30	16.10	77	16.65	(17.70)	57	16.44	17.40	69	16.32	17.13
45	15.48	15.64	06	15.73	16.24	77	15.72	16.24	72	16.19	16.83
88	16.10	16.73	48	16.80	16.82	17	15.93	17.35	06	15.50	16.41

	12682			2813			2863			2682	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	16.40	16.90	00	15.16	15.56	00	15.74	16.66	00	16.14	17.22
50		16.47	03	15.26	15.53	88	15.80	16.80	81	16.68	17.23
17	16.20	16.58	67	16.15		51	(16.70)	17.10	43	16.05	17.20
51	15.80	15.61	99	15.15	15.58	52	15.80	16.91	29	15.89	16.68
20	15.73	15.88	59	15.82		08	16.00	16.87	85	16.60	
22	15.60	15.98	60	15.88	17.30	10	15.87	16.70	86	16.50	
35	16.12	16.35	28	15.83	16.27	64	15.40	15.94	34	16.13	17.08
36	15.64	16.48	30	15.67	16.89	65	15.46	15.68	35	15.71	16.73
69	16.13	16.74	61	16.20		96	15.85	16.32	65	16.07	17.28
71		16.73	62			97	15.70	16.52	67		
06	16.23	17.00	90	15.14	15.46	23	16.15	16.94	91	16.36	17.30
39	16.02	16.30	21	15.70	16.07	53	16.15	16.57	21	15.90	16.26
75	16.28	16.88	50	16.28		79	15.43	16.55	46	16.00	16.91
76		16.93	51	16.17	16.74	81		16.26	48	15.85	16.90
09	16.50	16.90	82	16.27	16.95	12	16.08	(17.39)	78	16.73	17.27
56	16.18	16.55	87	15.79	16.55	04	15.71	16.83	64	16.17	17.50
24		16.25	52		16.80	67	15.62	16.09	27		16.80
26	15.62	15.98	54	15.70	16.78	69	15.70	16.13	29	16.17	16.70
94	16.70	17.33	18		16.50	32	(16.70)	17.20	92		17.80
25		16.08	48			61		15.80	20		16.20
60	16.13	16.55	80	15.98	16.70	93	15.94	16.32	52		17.28
09	16.43	16.67	83	16.14	16.40	81	16.10	16.30	33		16.55
41	16.08	16.24	13	15.53	16.03	10	16.10	17.00	62	16.08	17.39
42	15.82		14	15.34	16.00	12	16.40	16.95	63	15.91	17.30
74	16.05	16.61	44	15.89	16.63	41	16.50	17.23	93	16.44	17.54
76		17.00	46	15.56	16.90	43			94		17.20
58	16.16	16.80	79	16.10	16.62	61	15.65	16.20	05	16.53	16.88
59	16.20	16.60	80	16.22	16.62	62	15.30	15.92	06	16.11	16.69
63		16.94	73			51	15.90	16.62	94	16.08	
85			68			43			38		17.05
86	16.17	16.97	63	15.87		37	16.07	17.21	31	15.78	16.50
54	16.19	16.82	27	15.82	16.70	00	16.20	16.76	93	16.37	17.74
66		16.84	95	15.10	15.50	54	15.50	16.82	41	16.00	16.81
68	16.27	16.60	97	14.86		55	16.20	16.50	42	15.83	16.72
88	16.08	17.13	59		16.89	00	15.99	16.88	79	16.40	17.30
72	16.17	17.13	90	15.38	16.20	14	16.00	(17.40)	84	16.27	17.80
87	16.63	17.30	60		17.18	70	15.78	15.90	34		16.80
21	15.40	16.28	92	15.29	15.40	02	15.92	16.70	65	16.41	17.40
23	15.39	16.28	88	14.96	15.90	96	15.83		59	15.82	16.88
57	16.20	16.72	20	15.43	16.45	27	15.89	16.98	90	16.32	17.31
91	16.30	17.40	48	15.73	17.17	22	15.93	16.70	68		17.60
59	16.20	16.73	12	15.60	16.35	84	15.71	16.29	30	16.20	16.84
61	16.04	16.72	08	15.35	16.17	79	15.42	16.15	24	15.89	16.40
95	16.04	16.83	40	15.70	(17.35)	10	16.04	17.00	55		17.05

	6067			2803			5776			2807	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	16.17	17.00	00	15.15	15.77	00	16.23	17.17	00	15.80	16.63
38	16.08	15.98	37	15.83	16.89	27	16.40		24	15.98	16.29
97	16.44	17.02	95	15.85	16.41	85	16.03	16.86	81	15.85	16.30
90	16.07	16.93	85	16.30	16.68	54	16.00	16.50	43	15.17	16.03
37	15.83	16.03	32	15.68	16.71	99	16.60	17.20	86	15.58	16.19
38		16.50	33		16.68	00		16.97	88	15.70	16.70
45	15.82	16.28	38	16.10	(17.30)	96	16.53	16.85	80		16.69
46		16.10	40	15.68	16.66	97	16.19	16.91	82	15.10	16.66
75	16.20	16.50	68	15.98	16.86	25	16.20		10	15.79	
76		16.60	70		17.17	27		17.13	11	15.80	
95	16.00	16.82	87	16.18	17.25	43	16.41	16.70	26	15.97	16.70
22	15.55	15.74	15	15.59	16.11	71	15.98	16.22	54	15.50	15.70
40	15.71	16.25	33	15.90	16.78	87	16.05	16.89	70	15.55	16.10
42	16.01	16.04	34	15.75	16.64	88	16.30	16.88	71	15.32	15.90
70	16.10	16.77	63	15.93	17.00	17	16.20	(17.69)	99	16.08	16.49
19	15.85	16.20	10	15.36	15.85	55	16.19	16.54	35	15.88	(17.00)
79	15.98	16.97	70		17.10	14	16.42	17.10	93		16.66
80	16.20	16.64	71	16.21		16	16.17		95	15.69	16.52
39	15.74	16.40	30	16.04	16.80	74	15.65	16.52	53	15.25	16.10
66		16.20	57			00			79		
96	16.17	16.82	87	16.32	17.04	30	16.35	17.38	09	15.94	16.90
34	15.54	15.83	24	15.80	16.27	57	15.79	16.25	32	15.84	16.50
62	16.02	16.39	51	16.51	16.53	84	16.43	17.05	59	15.15	15.90
63	16.21	17.00	52	16.00		85		16.71	60	15.41	15.74
91	16.07	17.00	80	16.19	(17.62)	13	16.20	17.27	88	15.80	16.58
92			82		16.90	14		17.01	89	15.48	16.32
58		16.70	46	16.21	16.80	68	15.86	16.17	40	15.70	16.34
60		16.42	48	15.87		70	16.18	16.45	41	15.55	16.15
37	15.72	16.50	24	15.78	16.25	44		16.92	15	15.91	16.70
82			59			12			57	15.35	15.50
70		17.10	46	15.93	16.89	98		17.00	43	14.99	15.74
29		15.80	05		15.88	56	15.71	17.03	01	15.88	16.64
35	15.98	15.92	10			52		17.00	93		16.70
36	15.37	16.05	11	15.78	15.89	53	16.03	16.71	94		16.81
22	15.50	16.21	95	15.90	16.24	25	16.14	17.12	62	15.13	15.60
77	16.25	16.88	48	16.01	16.98	68	16.01	16.22	00	15.45	17.04
86		17.18	56	15.85	17.73	65	15.92	16.31	95	15.60	16.61
15		16.80	85	16.17	17.00	95	16.03		24	15.90	16.77
04		17.10	74	16.25	17.05	82		16.28	11	15.88	(17.20)
33	15.60	16.00	03	15.08	15.80	11		16.69	39	15.50	16.40
14	16.02	17.08	80	16.02	17.29	66	15.77	16.70	87	15.65	(17.15)
73	16.03	16.74	39	16.18	16.94	24	16.17		44	15.10	15.90
62	16.42	16.71	27	15.56	16.45	11	16.17	16.79	31	16.20	16.51
91	15.83	17.35	56	16.17	17.20	40	16.70	17.35	60	15.70	15.95

	980			6064			2867			2802	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	15.82	16.31	00	16.00	16.41	00	15.17	15.99	00	15.40	15.92
98	16.03	16.13	85	15.70	16.60	36	15.80		02	15.27	16.10
54	15.22	15.63	40	15.70	15.55	87		15.67	50	16.02	16.59
60	15.07	15.37	19	16.30		60	15.40	15.83	48		16.37
98	15.55	16.64	55	15.30	15.93	86	15.40	15.76	68	14.90	
00	15.60	16.50	56	15.13	15.95	87	15.11	15.86	69	15.13	15.40
67	15.20	15.67	12	15.97	17.20	96	15.56	16.16	44	15.93	16.63
69	15.08	15.83	13		16.93	97	15.25	15.62	46		16.40
96	15.55	16.40	40	15.26	15.27	22	15.45	16.00	69	15.05	
97	15.40	16.74	41	15.00	15.40	23	15.43	16.35	70	15.27	15.26
08	15.89	16.38	50	15.08	15.17	24	15.68	16.04	66	15.01	15.58
35	15.85	(17.12)	77	15.65	16.36	49	16.00	16.21	89	15.56	15.94
47	15.55	16.29	86	15.98	16.50	50	16.04	16.42	85	15.08	15.92
48	15.29	16.00	87	15.33	16.70	52	15.80	16.17	86	15.04	15.69
75	15.32	16.17	14	16.07	17.01	76	15.14	15.38	10	15.30	16.49
88	15.50	16.22	16	16.00	16.80	35	16.04		38	15.70	16.33
44	15.95	16.79	71	15.48	16.12	86	15.40	15.86	87	15.31	15.94
46	15.65	16.22	73	15.58	16.23	88	15.29	15.88	88	15.10	15.92
02	15.88	16.52	28	16.06	16.95	39	16.02	16.84	36	15.90	16.78
27			53	15.05	15.19	62	14.97	16.03	58		16.04
56	15.07	15.33	81	15.69	16.14	88	15.39	15.81	83	14.95	15.75
54	15.00	15.86	66	15.72	16.01	24	15.82	16.10	84	15.55	15.60
79	15.59	16.04	91	16.05	16.58	47	16.02	16.04	06	15.40	16.31
81	15.50	16.04	92	15.97	16.65	48	16.22	16.55	08	15.30	16.42
07	15.95	16.72	18	16.07	17.15	72	15.16	15.20	30	15.73	16.50
08		16.73	20		17.25	74	14.97	15.28	32	15.55	16.30
32	16.13	16.85	31	16.32	16.62	34	16.03	16.50	56	16.03	16.45
34		16.70	32	15.82	16.48	35	15.71	16.20	57	15.63	16.20
01	15.78		96	15.90	16.50	88	15.36	15.73	01	15.52	16.05
65	15.40	15.57	72	15.52	16.20	20	15.73	16.50	94	15.50	15.74
48	15.61	16.23	53	15.09	15.46	96	15.27	15.94	65	15.02	15.49
04	15.95	16.50	08	15.82		47	15.68	16.60	14	15.68	16.50
71		15.65	64	15.30	15.88	55	15.40		89	15.13	15.95
72	15.17	15.98	65	15.12	16.00	56	16.00	16.17	90	15.40	15.92
09	16.00	16.51	86	15.79	16.41	19	15.53	16.04	12	15.60	16.02
18	15.91	(17.00)	81	15.90	16.40	56	15.84	16.20	09	15.45	16.39
88	15.49	16.07	38		15.69	67	15.17	15.50	86	15.52	15.85
16	15.91	16.31	66	15.40	16.05	92	15.28	15.65	10	15.45	16.17
99	15.82	16.20	48	14.67	15.40	68	15.11	15.27	82	15.10	15.70
27		16.69	75	15.72	16.23	94	15.15	16.35	06	15.30	16.40
16	15.60	(17.08)	35	15.32	16.30	42			76	15.13	15.85
71	15.12	15.59	90	15.88	16.31	92	15.21	15.70	24	15.50	16.46
55	14.99	15.48	72	15.32	15.83	69	14.93	15.28	96	15.28	15.93
83	15.37	16.35	99	15.70	16.72	94	15.17	15.93	20	15.53	16.50

	2832			6015			12791			6085	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	15.90	16.42	00		15.82	00	15.55	16.22	00	15.03	15.45
00	15.75	16.48	90	15.40	15.72	85		15.97	84	16.14	16.69
48	15.42	15.82	37	14.90	15.56	31	15.90	16.37	30	15.68	16.13
42	15.18	15.60	09		15.83	93	15.63	16.45	90	15.63	16.40
61	15.21	16.31	26	14.88	15.79	09	15.84	16.22	06	15.39	15.50
62	15.61	15.91	28	14.98	15.71	10	15.60	16.59	07		15.45
36	14.99	15.58	92	15.05	15.67	70	15.47		65	15.90	16.50
37	14.75	15.27	93	14.99		71	15.28	15.85	66	15.40	16.29
60	15.40	15.96	16	14.92	15.62	93	15.45	16.04	89	15.72	16.33
62	15.20	15.97	17	15.12		94	15.79	16.16	90	15.50	16.30
58	15.26	16.00	11	15.25	15.78	87	15.48	16.03	83	15.99	16.58
80	15.65	16.24	34	15.07	15.42	10	15.73	16.41	06	15.27	16.98
76	15.42	16.40	28	14.91	15.69	04	15.56	16.50	99	15.20	15.48
77	15.59	16.29	29	14.92	15.43	05	15.98		00	14.81	15.43
01	15.60	16.40	52	14.62	15.45	27	15.94	16.60	23	15.30	15.62
27	14.85	15.12	70	14.86	15.55	41	16.10	17.02	35	15.60	16.02
76	15.78	16.47	18	15.13	15.80	88	15.56	16.08	82	15.87	16.90
77	15.95	16.14	19	15.28	15.74	89	15.40	16.37	84		16.50
25	14.83	15.55	66	14.83	15.70	36	15.86	16.75	31	15.63	16.47
47	15.00	15.49	88		15.80	58	15.34	15.30	52		
72	15.52	16.00	12	15.20	15.72	81	15.10	15.80	76	15.73	16.35
71	15.50	16.40	01	15.30	15.73	66	15.15	15.40	59	15.62	16.14
93		16.17	23	15.18	15.87	87	15.50	16.15	81	15.85	16.45
94	16.17	16.43	24	15.40	15.71	88	15.78	16.20	82		16.89
17	15.66	16.00	46	14.74	15.31	11	15.50	16.50	04	15.15	15.48
18	15.30	15.90	48	14.50	15.28	12	15.84	16.42	05	14.84	15.28
41	15.52	16.00	59	14.97	15.42	18		16.50	11	15.37	15.74
42	15.05	15.65	61		15.48	19	16.12	16.70	12	15.08	15.70
86	15.82	16.39	02	15.22	15.75	60	15.10	15.26	52	15.50	
65	15.75	16.30	12	15.29	15.90	34	15.78	16.50	19	15.58	15.68
36	14.83	15.46	82	14.91	15.40	03		16.40	89	15.60	16.85
85	15.69	16.35	29	15.08	15.73	50		16.61	35	15.34	16.17
58	15.00	16.02	93	14.95	15.61	09	15.70	16.37	94	15.70	16.20
59	15.50	15.75	94	15.14	15.73	10	15.64	16.40	95	15.36	16.25
78	15.31	16.41	01		15.79	11	15.62		94	15.53	15.99
74	15.60	16.38	85	15.21	16.23	89	15.65	16.20	71	15.79	16.68
49		15.80	50	14.69	15.26	50	16.08	16.35	31	15.48	16.45
73	15.58	16.28	72	14.94	15.45	73	15.31	15.68	54	15.65	16.36
45	15.20	15.86	45	14.68	15.47	43		16.42	24		16.10
69	15.64	16.24	68	15.03	15.34	67		15.60	48	15.38	16.28
34	14.90	15.48	11	15.12	16.10	98		16.40	76	15.41	16.95
82	15.73	16.73	58	14.69	15.68	44	16.01	17.05	23	15.11	15.80
54	15.55	15.83	29	15.05	15.84	14		16.79	93	15.55	16.13
78	15.61	16.50	52	14.42	15.55	38		16.56	16	14.73	15.78

	12681			12660			6051			2821	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00		16.40	00	16.18	16.88	00	15.62	16.28	00	15.69	16.75
75	15.08	15.95	73	15.40	16.30	69	15.72	16.22	63	15.72	16.70
20	15.80	16.70	18	15.31	15.91	92			08	16.05	16.91
60	15.17	15.70	55	15.60	16.50	44	15.48	16.05	22	15.93	16.55
74	15.69	16.31	68	15.89	16.37	56	15.52	16.40	34	15.54	16.03
75	15.71	16.04	70	15.90	16.74	58	15.40	16.18	34	15.60	16.20
25	16.07	16.79	18	15.20	15.75	02	15.60	16.38	73	15.81	16.50
26		16.72	19	15.23	15.58	03	15.45	16.20	74	15.70	16.48
48	15.33	15.42	41	15.30	15.68	25	15.20	15.80	96	15.60	
50	15.15	15.68	42	15.35	15.90	26	14.97	15.88	97		
41	15.53	16.62	33	15.31	15.64	17	15.30	15.86	86	15.66	16.55
63	15.42	15.70	56	15.82	16.97	39	15.42	16.00	08	15.88	16.61
55	15.11	15.42	47	15.58	16.42	30	15.40	15.87	98	16.02	17.09
56	15.05	15.64	48	15.62	16.20	31	15.35	15.93	99		
79	15.62	16.00	70	15.93	16.59	53	15.28	16.24	21	16.07	16.30
83	15.83	15.95	73	15.78	16.47	53	15.59	16.20	15	15.96	16.75
30	16.38	17.10	20	15.33	15.64	99		16.14	61		16.70
31	15.97	16.68	21	15.40	15.68	01	15.63	16.21	62	15.63	16.26
77	15.78	16.38	67	15.55	16.46	46	15.58	16.15	07		17.17
98		16.20	88			67	15.50		28	15.49	16.07
21	16.08	16.20	11	15.99	15.77	90	15.80		50	15.45	16.03
96	15.92	16.71	84	15.90	16.45	59	15.37	15.87	13	16.20	16.50
17	16.02	16.24	05	16.20	16.82	80	15.62		34	15.55	16.15
18		16.80	06	15.61	16.60	82	15.62	16.70	35	15.40	16.03
40	15.72	16.41	28	15.13	15.86	03	15.35	15.91	56	15.36	16.30
41	15.46	16.89	29	15.27	15.70	04	15.36	16.20	57	15.28	16.27
37	16.19	16.74	23	15.41	15.79	95		16.38	41	15.63	16.17
38	15.99	17.8	24	15.17	15.72	96	16.03	17.13	42	15.50	16.21
76	15.43	15.90	62	15.68	16.20	33	15.10	15.73	77	15.90	16.79
80		15.95	54	15.58	16.10	00	15.30	16.70	98	15.86	16.80
48	15.48		22	15.18	15.71	68		16.27	65	15.71	16.16
94	15.78	16.24	68	15.92	16.61	13		15.65	10	15.70	16.61
44	15.59	16.30	16	15.28	16.00	58	15.50	16.10	48	15.40	16.04
45	15.59	15.85	17	15.12	15.63	59	15.63	16.05	49	15.38	
34	15.90	16.92	04	16.00	16.70	41	15.35	16.08	24	15.61	16.60
99	15.93	16.98	68	15.40	16.45	01	15.53	16.45	76	15.69	16.63
51	15.32	15.79	17	15.31	15.78	48		16.01	16	16.10	16.63
74	15.29	15.91	40	15.05		70	15.83	16.42	38	15.38	16.08
43	15.84	16.69	09		16.38	39		15.91	06	15.80	17.03
66	15.71	15.79	32	15.17	15.47	61	15.57	16.30	28	15.69	16.20
74	15.42	15.90	36	15.43	15.90	57	15.43	16.54	09	15.98	16.83
19	16.00	16.68	81	15.71	16.33	03	15.37	16.49	54	15.23	16.31
88	15.72	16.25	50	15.41	16.17	71	15.61	16.19	22	15.89	16.51
11	16.32	16.73	73	15.50	16.50	94	15.83	16.08	44	15.81	16.25

	6059			6025			2826			2794	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	15.22	15.76	00	15.90	16.27	00	15.84	16.67	00	15.49	16.38
53	15.83	16.17	34	15.28	16.40	31	16.28	16.70	69	15.35	16.22
97	15.32	16.10	77	15.50	16.07	73	15.45	15.98	06	15.60	17.07
90	15.89	16.50	30	15.62	16.50	18	15.68	16.72	18	15.93	16.75
00	15.52	15.58	36	15.39	16.35	24	16.12	16.83	11	15.58	16.75
01	15.15	15.71	37	15.38	16.26	25		16.70	12	15.40	17.10
30	15.42	15.99	49	15.05	15.52	33	16.00	16.78	61	15.30	16.05
31	15.23	15.87	50	14.99		34		16.48	62	14.99	
53	15.55	16.08	70	15.50	16.04	54	15.05	15.80	80	15.68	16.57
54		15.99	72		15.99	55	15.00	16.20	81		
42	15.73	16.00	57		15.68	40	15.95	16.54	55	15.10	15.74
63	15.88	16.37	77	15.45	16.13	60	15.57	15.50	73	15.45	16.40
52	15.60	16.50	63	15.31	16.05	45	15.50	16.35	48	15.48	16.27
53		16.32	64		15.97	46	15.70	16.26	49	15.02	16.10
74	15.80	16.45	84	15.70	16.13	67	15.32	16.00	68	15.27	16.36
60	15.69	16.20	54	15.30	15.55	33	16.10	16.75	79	15.50	16.30
04	15.29	15.53	97	15.84	16.50	76	15.62	16.07	17	16.00	16.97
06	15.40	15.54	98	15.63	16.40	77	15.40		18	15.89	
50	15.73		41	15.40	16.44	20	16.10	16.87	56	15.33	16.15
70			60		15.84	39			73		
93	15.50	16.04	82	15.44		61	15.22	15.41	92	15.38	16.30
46	15.85	16.10	17	15.72	16.30	91	15.62	16.17	61	15.50	15.84
66	15.88	16.22	36	15.62	16.22	11	15.92	16.75	78	15.50	16.62
67	16.10	16.20	37	15.61	16.60	12	16.20	16.68	79	15.40	16.31
88	16.03	16.40	58	15.48	15.69	32	16.20	16.85	97	15.70	16.83
89	15.32	16.28	58		15.53	33		17.10	98	15.38	
63	15.82	16.50	13	15.80	16.55	84	15.57	16.44	84	15.90	16.75
64	16.12	16.25	14	16.01	16.63	84	15.50	16.30	85		
96	15.60	15.84	42	15.38	16.10	12	15.77		97	15.56	16.70
50	15.49	15.92	66	15.30	15.74	11	15.86		65	15.16	16.10
15	15.18	15.74	30	15.53	16.85	74	15.10	16.08	20	15.71	17.28
60	15.58	16.30	73	15.33	16.10	16	15.93	16.80	58	15.29	16.10
89	15.71		84		16.23	24	16.18	17.19	06	15.70	
90	16.08	16.32	85	15.70	16.21	25	16.21	16.63	07	15.68	16.80
53	15.62	16.38	25	15.62	16.37	61	15.36	15.65	69	15.27	16.20
93	15.41	16.20	45	15.22	16.02	76	15.40	16.17	13	15.72	17.07
24	15.59	15.90	58	15.04	15.70	85	15.80	16.44	63		16.20
46	15.63	16.05	79	15.50	16.17	07	15.80	16.80	82	15.56	16.20
13	15.36	15.65	43	14.97	15.75	70	15.29	15.89	38	15.71	16.84
34	15.73	15.96	64	14.92	15.53	92	15.72	16.38	56	14.91	16.04
93	15.55	16.17	81	15.43	16.20	00	15.72	16.81	24	15.80	16.81
37	15.52	16.00	23	15.71	16.79	42	16.18	16.59	61	15.11	15.86
04	15.15	15.48	88	15.39	16.20	06	15.93	16.47	17	15.70	16.63
26	15.30	15.89	09	15.82	16.58	27		16.99	36	16.03	16.69

	2871			2869			2855			12067	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	14.79	15.32	00	15.58	16.63	00	15.28	16.47	00	15.36	16.10
66	15.46	15.85	54	15.68	15.95	40	15.18	15.35	28	16.13	16.58
03	14.80	15.17	90	15.78	16.70	75		16.19	62	15.09	15.68
09	14.76	15.30	70	15.40	16.21	26	15.30	15.83	84	15.30	15.98
02	14.74	15.20	60	15.50	16.53	13	15.54	16.25	70	14.90	15.74
03	14.73	15.00	61	15.15	16.40	14	15.50	16.58	70	15.39	
49	15.20	15.70	95	15.84	16.85	35	14.78	15.41	80	15.38	15.70
50	15.23	15.86	96	15.40	16.80	36	14.74		80		15.90
68			14	15.07	15.69	53	15.04	15.42	97	15.55	15.98
68	15.50	16.08	14	14.83	15.54	54	15.22		98	15.16	15.88
43	15.13	15.77	87	15.70	16.61	24	15.45	15.86	66	15.25	15.60
61	15.51	15.93	04	15.70	16.13	41	15.07	15.58	82	15.38	15.74
35	15.10	15.83	77	15.79	16.47	11	15.79	16.64	51	15.90	16.50
36	15.07	15.80	78	15.62	16.20	12	15.52	16.35	51		16.60
54	15.42	15.97	95	15.63	16.45	29	15.21	15.50	68	15.10	15.48
64	15.48	16.30	94	15.50	16.77	16	15.60	16.45	44	15.83	16.60
01	14.90	15.34	31	15.22	15.58	52	15.31	15.74	78	15.33	15.61
02	15.06	15.32	32	15.05	15.50	52	15.04	15.72	79	15.27	15.90
40	15.20	15.84	68	15.65	16.64	88	15.60	16.77	13	15.30	16.28
57	15.20		85		16.40	04			29		16.34
76	15.50		03	15.39	15.91	22	15.68	15.93	46	15.58	16.50
42	15.16	15.96	57	15.40	16.00	62	15.50	15.78	74		
59	15.43	16.09	74	15.48	16.16	78	15.08	15.95	90	15.54	15.60
60	15.70	16.24	75	15.40	16.60	79		16.17	91	15.10	16.17
77	15.42	16.30	92	15.50	16.35	96	15.79	16.40	07	15.38	15.93
78	15.46		93	15.59	16.63	97		16.58	08		16.40
62	15.57	16.25	64	15.40	16.00	53	15.28	15.84	51		16.39
63	15.56	16.10	65	15.59	16.08	54	15.13	15.70	52		16.40
75	15.42	16.30	74	15.42	16.08	60	14.97	15.71	55	15.30	16.12
23	15.30	15.66	37	15.19	15.73	28	15.08	15.71	35	15.75	16.60
78	15.50	16.06	91	15.53	16.49	80	15.28	16.00	86		16.12
16	14.81	15.32	27	15.06	15.54	16	15.58	16.95	20		16.35
62	15.25		62	15.10	15.80	37		15.40	29	15.88	16.40
62	15.50	16.10	62	15.55	16.28	38	14.77	15.55	30	15.48	16.53
21	15.07	15.35	07	15.37	16.50	65	15.25	15.89	42	15.89	16.65
62	15.58	16.20	33	15.04	15.80	76	15.40	16.19	38	15.69	
09	14.94	15.16	68	15.48	16.31	98			48		16.59
28	15.11	15.84	86	15.62	16.40	16	15.63	16.60	65		15.69
83	15.58	16.21	41	15.15	15.70	69	15.45	16.08	17		16.35
02	14.96	15.07	59	15.18	16.24	86	15.27	16.02	34	15.73	(16.95)
63	15.34	16.19	92	15.55	16.70	88	15.20	16.53	07	15.62	16.50
00	14.77	15.30	28	14.90	15.50	23	15.58	16.18	41	15.60	16.48
56	15.59	16.00	83	15.61	16.22	76	15.15	15.90	93	15.35	16.03
75	15.70	16.36	01	15.30	16.27	94	15.07	16.26	10	15.60	16.20

	935			1000			5730			6104	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	14.91	15.73	00	14.86	15.70	00	15.17	15.67	00	14.58	14.91
54	14.95	15.25	46	15.14	16.03	17	14.94	15.20	13	14.30	14.86
82	14.94	15.86	74	14.62	15.40	42	14.93	15.60	38	14.63	15.42
45	15.10	15.82	20	15.08	15.98	25	14.82		13		
16	15.24	16.20	89	14.87	15.53	88	15.23	16.07	75	15.11	15.91
16	15.30	16.17	90	14.75	15.39	89	15.10	16.19	76	15.08	16.04
55	14.83	15.28	21	15.10	15.92	92	15.18	15.97	75	15.52	16.14
55	14.62	15.06	22	15.05	15.94	92	15.23	15.77	76	15.00	15.97
69	14.83	15.17	35	15.20	16.19	04	14.99	15.60	88	14.77	15.15
70	14.80	15.42	36	15.22	16.13	05	14.68	15.68	89	14.80	15.27
26	15.45	16.22	91	14.91	15.52	56	14.90	15.52	38	14.90	15.51
40	15.42	16.11	04	14.92	15.58	68	15.11	15.88	50	15.22	16.17
96	15.05	15.69	60	15.23	16.05	18	14.65	15.40	00	14.50	14.78
97	14.82	15.70	60	15.40	16.01	19	15.05	15.42	01	14.32	15.13
11	15.14	16.50	74		15.52	31	14.85	15.78	13	14.63	15.19
21	15.55	16.03	78	14.75	15.26	09	14.86	15.30	88	14.75	15.30
50	14.95	15.41	06	15.28	15.71	35	15.17	15.40	13	14.50	15.20
51	14.80	15.20	06	14.79	15.76	36	14.85	15.53	14	14.60	15.20
79	14.68	15.48	34	15.41	16.47	61	14.83	15.64	39	14.47	15.34
92	14.88	15.54	47			73	14.73	15.80	51	14.85	15.78
06	15.20	15.91	61	15.11	15.63	86	15.40	16.10	63	14.95	16.11
60	14.68	15.09	07	14.88	15.68	02	15.13	15.52	76	15.19	16.20
73	15.05	15.29	20	15.12	15.97	14	14.84	15.29	88	14.70	15.05
74	14.63	15.40	20	15.37	15.90	14	15.17	15.41	88	14.85	15.20
87	15.03	15.82	33	15.18	16.14	26	14.54	15.45	00	14.28	14.82
88	14.85	15.48	34	15.11	16.20	27	15.10	15.52	01	14.40	15.00
55	14.63	15.19	93	15.05	15.55	56	15.07	15.58	25		15.04
56	14.80		94	14.80	15.60	56	14.80	15.70	26	14.30	14.84
40	15.40	15.90	77	14.78	15.58	32	15.06	15.71	01	14.58	14.92
06	14.93	15.99	88	14.76	15.32	39	14.93	15.59	82	15.07	15.71
48	14.92	15.69	29	15.03	15.95	76	14.82	15.93	19		15.27
76	14.92	15.20	57	15.28	16.34	02	15.02	15.68	44		16.18
14	15.30	15.89	88		15.63	04	15.10		43	14.93	15.93
15	15.62	15.84	89	14.59	15.77	05	14.95	15.57	44	15.07	15.82
39	15.48	16.20	04	15.05	15.68	85	15.27	16.12	19	14.39	
49	15.02	15.85	05	15.03	15.66	52		15.55	82	15.03	16.07
88	14.90	15.65	37	15.31	16.06	55	14.75	15.54	82	14.92	15.70
03	15.24	16.02	51	15.29	16.33	68	15.10	15.90	94	14.31	14.95
45	15.05	15.89	92	14.99	15.45	06	14.90	15.49	32		15.40
59	14.63	15.29	06	14.80	15.71	19		15.30	44		15.28
64	14.88		94	15.17	15.70	40	14.71	15.68	57		16.15
92	15.10	15.68	21	15.05	16.09	65	14.78	15.62	82	14.68	15.70
35	15.14	16.15	63	15.39	15.72	03	14.71	15.73	19		15.04
49	14.85	15.70	77	14.75		15	14.85	15.30	32		15.55

	12581			2738			2854			2733	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	14.79	15.58	00	14.45	14.99	00	14.95	15.95	00	14.79	15.50
12	14.61		00	14.69	14.88	90	15.17	15.72	87	14.48	15.20
37	15.19	15.72	24	14.51	15.43	13	15.23	15.59	09	14.75	15.46
09	15.10	15.81	72	15.07	16.15	37	14.38	15.08	28	14.80	15.60
71	15.51	15.81	32	14.70	15.42	95	15.23	15.71	85	14.54	15.41
72	15.50	16.03	32	14.74	15.10	95		15.87	85	14.74	15.23
70	15.40	16.61	20	14.60	15.05	72	14.80	15.40	60	14.41	15.08
71	15.28	15.93	20	14.50	15.14	73		15.29	60	14.60	15.14
83	15.04	15.40	32	14.63	15.15	84		15.57	71	14.51	15.32
83	14.68	15.50	32	14.80	15.44	85	14.68		72	14.53	15.02
33	15.30	15.62	80	15.08	15.72	31	14.70	15.49	18	14.91	15.49
45	15.40	16.20	92	14.86	15.28	42	14.79	15.09	29	14.74	15.48
95	14.93	15.73	40	14.70	15.54	88	15.00	15.73	74	14.50	15.31
96	14.90	15.60	40	14.79	15.71	89			75	14.74	15.08
08	14.55		52	15.03	16.17	00	14.88	15.65	86	14.45	15.38
81	15.08	15.87	16	14.69	15.12	54	14.68	15.00	38	14.68	15.25
07	15.22	15.69	40	14.90	16.07	78	14.98	15.74	61	14.48	15.13
07	15.02	15.85	40	15.07	15.75	78	14.97	15.73	62	14.53	15.28
32	14.83	15.90	64	14.98	16.13	02	14.83	15.90	85	14.53	15.44
44	15.39	16.13	75	15.20	15.86	12	15.31	15.55	95	14.73	15.48
56	15.20	16.40	88	15.07	15.30	24	14.68	15.04	07	14.74	15.38
68	15.15	16.02	88	15.25	15.50	13	14.88	15.89	93	14.53	15.37
80	15.20	15.68	99	14.32	15.05	24	15.03	15.28	04	14.71	15.62
80	14.88	15.67	00	14.50		25	14.60	15.40	04	15.15	15.70
92	14.68	15.33	11	14.30		36	14.34	15.10	15	14.75	15.67
92	15.13	15.60	11	14.34	15.00	36	14.47	15.02	16		15.72
16		15.50	23	14.63	15.18	36	14.55	15.20	13	15.05	15.79
16	14.82	15.80	24	14.58	15.05	37	14.50	14.96	14	14.93	15.50
91	15.14	15.32	96	14.60	14.94	07	15.08	15.92	82	14.76	15.25
64	15.40	16.30	88	14.91	15.90	24	14.61	15.20	80	14.91	15.10
01		15.55	23	14.38	15.10	58	14.54	15.21	14	14.78	15.55
26	15.10	15.98	47	15.19	15.79	82	14.76	15.79	37	14.61	15.30
24	15.23	15.58	34	14.60	15.31	59	14.53	15.32	11	14.92	15.90
24	15.40	15.84	35	14.39	15.75	59	14.50	15.41	12	14.98	15.62
98	15.09	15.59	95	14.27	15.00	06	15.11	15.88	55	14.45	15.25
60	15.41	16.66	43	15.22	16.30	42	14.60	15.10	87	15.02	15.38
59	15.52	16.60	31	14.68	15.24	20	15.00	15.45	62	14.50	15.01
71	15.32	16.12	43	14.65	15.48	31	14.32	14.96	74	14.58	15.17
09		15.55	79	14.88	15.70	66	14.71	15.33	08	14.58	15.35
21		15.75	91	14.55	15.35	77		15.50	20	14.79	15.54
31		16.10	74	14.93	16.17	36	14.61	14.91	72	14.86	15.15
55	15.21	16.50	98	14.15	15.20	60	14.47	15.20	95	14.55	15.45
93	14.41	15.33	34	14.42	15.33	94	15.05	15.60	29	14.55	15.29
05		15.55	46	14.75	15.65	06	15.00	15.73	41	14.31	15.28

	2461			12589			971			2510	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	14.98	15.81	00	14.55	15.35	00	14.28	14.80	00	14.80	16.12
86	14.65	15.54	80	14.65	15.54	69	15.00	15.34	66	14.90	15.82
09	15.05	16.02	02	14.52	15.02	90	13.90	14.58	87	15.30	16.22
27	14.82	15.52	06	14.85	15.33	71	14.90	15.37	62	15.08	15.70
84	15.23	15.46	62	15.30	16.18	24	14.66	14.95	15	14.54	15.47
84	14.73	15.60	63	14.99	16.01	24	14.29	15.14	15	14.50	15.30
58	14.50	15.01	30	14.95	15.68	82	14.27	14.70	70	15.07	16.07
59	14.40	14.76	31	14.57	15.20	82	14.23	14.68	71	14.96	15.80
66	14.79	15.20	42	14.98	15.57	93	14.18	14.57	81	15.22	16.00
70	14.50	15.42	42	14.67	15.50	93	14.38	14.78	82		16.08
16	15.00	15.74	87	14.93	15.28	36	14.34	15.30	24	14.70	15.00
27	14.57	15.24	98	14.87	15.03	46	14.75	15.62	34	14.53	15.17
73	14.44	15.33	42	14.85	15.88	89	14.07	14.75	77	15.00	16.04
73	14.68	15.50	43	15.06	15.50	90	14.27	14.84	77	15.05	15.98
84	14.70	15.60	54	14.93	16.00	00	14.10	14.95	88	15.31	16.20
36	14.27	14.72	00	14.70	15.10	36	14.45	15.44	21	14.50	15.14
59	14.20	14.68	22	14.88	15.35	58	14.72	15.60	43	15.06	15.48
60	14.31	14.92	23	14.83	15.47	59	15.00	15.58	44	14.85	15.41
83	14.55	15.20	46	14.79	15.40	80	14.28	14.74	65	14.98	15.82
93	15.30	15.80	56	15.30	15.78	90	13.80	14.69	74	15.21	15.84
05	15.08	15.77	67	15.10	15.73	01	14.43	14.96	85	15.05	16.13
91	14.60	15.58	47	14.94	15.40	70	14.68	15.60	52	14.90	15.58
02	15.00	15.60	57	14.97	15.90	80	14.62	14.95	61	15.02	15.50
02	14.97	15.70	58	15.03	16.03	80	14.34	15.08	62	15.39	15.99
13	15.24	15.85	68	15.22	15.89	91	14.14	14.71	72	15.17	15.94
14	15.28	16.00	69	14.93		91	14.03	14.81	72		15.93
10		15.85	60		15.83	70	14.85	15.60	49	14.84	15.63
11		15.70	60	15.08	15.78	71	14.54	15.41	49	14.80	15.35
80	14.73	15.65	27	15.00	15.27	35		15.11	13	14.73	15.38
75	14.93	15.48	78	15.25	15.73	09	14.30	14.95	68	15.12	16.09
09		(16.26)	11		15.47	41	14.52	15.50	00	15.10	15.75
32		15.04	34	14.91	15.32	62	14.92	15.80	21	14.62	15.13
06	14.78	(16.20)	02	14.48	15.21	20	14.29	14.84	76		16.29
06	15.07	15.83	02	14.62	15.38	20	14.35	15.08	76	15.27	16.40
49	14.21	15.11	38	15.09	15.88	42	14.85	15.70	96	15.20	16.08
81	14.81	15.78	62	15.23		54	15.00	15.80	04	15.17	15.80
56	14.24	14.69	31	14.50	15.44	12	14.42	14.93	60	15.11	15.70
67	14.51	15.15	42	14.85	15.53	23	14.49	15.17	70	14.97	16.20
02		15.68	76		15.75	55	14.89	15.55	02	15.10	15.76
13		15.54	87		15.32	66		15.68	13	14.55	15.50
65		14.97	24		15.66	78	14.39	15.11	19	14.71	15.55
88	14.57	15.65	46	14.68	15.75	99	14.23	14.89	40	14.71	15.27
22	14.52	15.45	80	14.83	15.74	32	14.38	15.26	72	15.28	15.98
33		14.81	91		15.43	42	14.43	15.42	83	15.42	

	969			2816			6105			2864	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	14.79	15.90	00	14.70	15.50	00	15.05	15.67	00	14.17	14.95
57	14.50	15.35	40	14.48	15.21	40	14.59	14.37	28	14.70	15.40
77	14.90	15.80	59	14.58	15.59	58	14.61	15.41	46	15.15	15.73
32	14.33	15.24	78	14.89	15.79	75	15.28	16.02	37	14.80	15.70
82	14.88	16.04	26	14.42	15.16	23	14.62	15.01	82	14.50	15.62
83	14.74	15.92	26	14.18	14.90	23	14.70	15.15	82	14.97	15.42
28	14.64	15.40	56	14.68	15.44	52	15.00	15.15	00	14.17	14.76
29	14.36		57	14.50	15.15	53	14.73	15.50	01	14.36	14.91
39	14.40	15.09	66	14.64	15.62	62	14.95	15.50	10	14.30	15.06
39	14.37	15.27	66	14.65	15.50	62	15.00	15.68	10	14.23	15.03
80	14.71	16.05	05	14.73	15.60	01	14.91	15.32	46	14.73	15.72
90	14.83	15.81	14	14.45	15.17	10	14.97	15.51	55	15.05	15.97
31	14.47	15.30	52	14.66	15.35	48	14.70	15.30	91	14.30	15.17
31	14.54	15.04	53	14.54	15.52	49		15.60	92	14.34	15.16
41	14.60	15.46	62	14.55	15.94	58	15.25		01	14.30	14.89
67	14.67	15.19	73	14.84	15.78	68	15.08	15.68	00	14.28	14.89
88	15.07	15.72	92	15.13	16.05	88	15.13	15.92	19	14.48	15.38
88	14.83	15.75	93	14.97	15.84	88	15.40	16.30	19	14.48	15.20
09	14.83	15.75	12	14.53	15.50	07	14.60	15.32	38	14.55	16.08
18	14.88	15.30	21	14.26	15.04	16	15.00	15.21	46	14.71	15.88
28	14.50	15.27	31	14.13	14.80	26	14.32	14.83	55	14.75	15.63
85	14.80	15.60	71	14.75	15.65	65	15.00	15.64	83	14.80	15.40
95	15.10	15.92	80	15.09	15.98	74	15.22	15.76	91	14.50	15.29
95	15.13	16.00	80	14.90	15.95	74	15.35	16.19	92	14.70	15.15
05	14.92	15.73	90	15.38	15.85	84	15.10	15.95	00	14.27	15.06
05	14.81		90	14.82	15.74	84	15.00		01	14.32	14.75
72	14.90	15.60	39		15.00	32		14.80	37	14.85	15.63
72	14.68		40	14.20	14.85	33	14.83	15.20	37	15.02	15.68
34	14.68	15.12	97	14.78	15.60	90	15.20	15.80	92	14.56	15.22
22	14.78	15.40	72	14.95		59	14.98	15.73	78	14.63	15.28
53	14.40	15.13	00	14.68	15.74	87		15.93	05	14.28	14.86
74	14.64	15.60	20	14.74	15.38	07		15.73	23	14.52	15.68
19	14.40	15.46	50	14.20	15.40	36	14.28	15.03	41	14.86	16.14
20	14.59	15.44	50	14.47	15.28	36	14.77	15.09	41	14.70	15.73
27	14.47	15.21	38	14.07	14.83	23	14.44	14.90	14	14.41	15.10
25	14.60	15.40	17	14.59	15.12	01	15.20	15.93	78	14.65	
71		15.36	47	14.49	15.29	30	14.48	14.95	96	14.40	14.80
81	14.79	15.70	57	14.43	15.50	40	14.28	15.20	05	14.17	15.05
12	14.87	15.87	86	15.11	16.00	69		15.75	33	14.30	15.28
22	14.63	15.50	95	14.76	15.75	78		16.05	42	14.40	15.65
07	14.71	16.20	42	14.53	15.15	23		14.97	60		15.92
27	14.59	15.37	61	14.31	15.38	42	14.35	15.30	78	14.56	15.50
58	14.73	15.36	90	15.01	15.88	71		15.73	05	13.95	14.93
68	14.68	15.60	00	14.85	15.65	81			14	14.06	15.14

	2662			997			2579			955	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	14.33	15.01	00	14.47	15.70	00	14.00	15.93	00	14.47	15.66
07	14.14	14.90	90	14.22	15.50	86	14.20	15.34	82	14.20	15.15
24	14.08	15.27	05	14.41	15.86	01	14.11	14.90	96	14.30	15.63
70	14.43	15.33	16	14.68	15.84	03	14.17	14.88	89	14.15	15.37
11	14.47	15.25	53		15.57	40	13.75	14.27	26	14.30	15.17
12	14.50	14.93	54	14.63	15.60	40	14.00	14.60	26	14.29	14.97
10	14.40	14.95	36	14.99	16.10	18	13.88	14.48	00	14.43	15.50
10	14.18	14.91	36	14.62	15.94	18	14.05	14.40	00	14.50	15.37
18	14.42	15.18	43	14.71	15.42	26	13.50	14.02	08	14.63	15.63
19	14.39	15.22	44	14.67	15.60	26	13.43	14.01	08	14.59	15.40
52	14.93	15.75	74	14.40	15.15	56	14.22	14.75	37	14.30	14.70
60	14.80	15.65	81	14.39	15.30	63	14.39	15.19	44	13.41	
93	14.27	15.17	12	14.62	16.00	92	14.20	15.48	73	14.09	14.89
93	14.30	14.83	12	14.80	15.90	93	14.49	15.40	73	14.05	14.85
01	14.17	14.86	20	14.89	16.17	00	14.37	15.13	80	14.18	15.17
83	14.28	15.13	86	14.31	15.25	64	14.31	15.06	40	14.00	14.35
00	14.09	14.80	02	14.70	15.58	79	14.55	15.37	55	13.84	14.54
00	14.11	14.93	02	14.69	15.71	79	14.54	15.31	55	13.86	14.38
17	14.17	15.17	18	14.83	16.35	94	14.23	15.35	70	13.92	14.65
24	14.20	14.89	24	14.88	16.07	01	14.31	14.86	77	14.00	14.90
33	14.52	15.26	32	14.95	16.02	08	14.30	14.71	84	14.30	15.10
40	14.54	15.33	22	14.75	15.96	94	14.48	15.02	66	13.92	14.64
47	14.63	16.02	29	15.02	16.24	01	14.30	14.94	73	14.23	14.88
48		15.86	30		16.33	02	13.88	14.83	73	13.82	14.70
56	14.75	15.85	37	15.03	16.07	09	13.95	14.82	80	14.15	15.15
56	14.55	15.80	37	14.68	16.29	09	14.02	14.50	80	13.84	14.89
71	14.55	15.32	35	14.87	16.15	02	14.30	14.91	69	14.26	14.65
71	14.28	15.20	35	15.05	15.85	02	14.11	14.76	70	13.87	14.50
21	14.29	15.20	81	14.49	15.17	47	13.89	14.70	13	14.60	15.30
64	14.50	15.43	06		15.61	44	14.13	14.41	82	14.17	14.98
88	14.28	14.84	28	14.81	16.06	66	14.17	15.17	03	14.68	15.48
05	14.25	14.91	43	14.60	15.67	81	14.60	15.58	18	14.58	15.40
03	14.10	14.80	25	14.90	16.44	59	13.96	14.73	92	14.04	15.20
03	14.37	15.00	26	14.85	16.04	60	14.06	15.07	92	14.35	15.38
51	14.57	15.76	54	14.65	15.68	83	14.44	15.47	11	14.60	15.48
91	14.55		74	14.32	15.21	98	14.24	15.22	22	14.41	15.17
90	14.20	14.99	56		15.10	77	14.30	15.17	96	14.18	15.43
98	14.13	14.95	64	13.99	14.81	84	14.32	15.40	04	14.40	15.52
23	14.33	15.06	87	14.37	15.50	07	14.08	14.65	26	14.19	14.80
31	14.25	15.33	94	14.40	15.65	14		14.50	33		15.04
02	13.98	14.85	27		16.51	38	13.85	14.81	47	13.36	14.04
19	14.37	15.18	42	14.62	15.88	53	14.08	15.03	62	13.63	14.55
44	14.35	15.38	65	14.23	14.86	75	14.36	15.28	84	13.85	14.95
52	14.52	15.43	73	14.24	15.40	82	14.37	15.55	91	14.05	15.38

	2538			2647			2667			2580	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00		15.35	00	14.57	15.39	00	13.32	13.89	00	13.92	14.72
80	14.58	15.58	76	15.03	16.22	54	14.17	14.97	48	14.01	14.82
95	14.61	15.35	90	14.50	16.17	66	14.64	15.28	59		15.03
84		15.55	70	15.10	16.50	99	13.24	13.50	78	14.66	15.38
19	14.25	15.02	06	14.65	15.58	30	13.80	14.50	07	13.46	13.82
20	14.20	15.03	06	14.60	15.73	30	13.70	14.59	08	13.36	14.18
92	14.48	15.53	74	15.30	16.82	78	14.39	15.00	49	14.17	14.87
92	14.50		75	15.20	16.08	78	14.24	15.01	49	14.06	14.76
00	14.50	15.22	82	14.86	16.02	84	14.37	15.00	55	14.30	14.93
00	14.52	15.25	82	15.20	16.08	84	13.93	14.93	55	14.23	15.08
28	14.09		10	14.71	16.20	09	13.50	13.84	79	14.53	14.97
36	14.28	15.15	17	14.62	16.20	14	13.70	14.10	84	14.11	14.97
64	14.40	15.65	45	15.14	16.50	39	14.06	15.00	08	13.47	13.95
65	14.68	15.50	45	15.27	16.40	39	14.07	14.94	08	13.69	14.10
72	14.41	15.95	52		16.68	46	14.28	14.89	14	13.62	14.15
30	14.18	15.13	07	14.90	15.78	81	14.29	15.07	44	13.80	14.78
44	14.32	15.23	21	14.78	15.86	93	13.50	13.97	56	14.02	14.92
45	14.47	15.26	22	15.00	16.00	94	13.46	13.63	56	14.04	15.29
59	14.63	15.63	36	15.42	16.35	06	13.40	13.94	68	14.12	
66	14.50	15.65	42			12	13.50	14.13	73	14.33	15.45
73	14.87	15.38	49	15.09	16.70	18	13.89	14.38	79	14.38	15.10
54	14.48	15.54	25	14.99	16.07	72	14.31	15.42	27	13.78	14.46
60	14.58	15.41	32	15.05	15.96	78	14.70	15.30	32	13.85	14.80
60	14.80	15.72	32	15.28	16.20	78	14.25	15.17	33	13.52	14.70
67	14.40	15.70	39	14.89	16.28	84	14.35	15.33	38	13.77	14.95
68	14.75	15.62	39	15.05	16.17	84	14.20	15.30	39	13.73	14.66
55	14.30	15.50	22	15.00	16.40	44	14.00	14.82	92		14.68
55	14.60	15.59	22	14.73	15.93	44	13.96	14.60	92	14.15	14.75
98	14.60	15.40	65	15.23	16.14	81	14.17	15.07	28	13.90	14.65
54	14.50	15.50	92	15.00	15.58	56	14.19	15.15	57	14.31	15.20
76	14.78	15.85	13	14.68	15.85	74	14.40	15.15	74		
90	14.61	15.40	28	14.92	16.28	86	14.29	15.23	86	14.19	14.93
63	14.48	15.50	96	14.40	15.50	34	13.68	14.42	27	13.80	14.36
63	14.46	15.58	96	14.65	15.97	34	14.01	14.69	27	13.69	14.73
79	14.62	15.70	08	14.37	16.10	19	13.70	14.28	04	13.28	13.88
88	14.51	15.51	12	14.95	16.08	97	13.30	13.50	76	14.38	15.50
61	14.49	15.50	81	15.01	16.50	45	14.04	14.82	17	13.67	14.33
68	14.79	15.60	88	15.11	16.00	51	14.21	15.04	23	13.43	14.40
90	14.71	15.40	09	14.80	15.80	70	14.43	15.06	41	13.91	14.74
97	14.32	15.78	16	14.80	16.20	76		15.32	47	13.74	14.24
07	14.59	15.48	17	14.94	15.84	27	13.62	14.71	83		14.90
22	14.34	15.03	31	15.11	16.20	39	13.70	14.93	95	13.86	14.80
43	14.39	15.20	52	15.61	16.51	58	14.17	15.06	12		13.83
50	14.50	15.60	59	15.14	16.90	64	14.17	15.38	18		14.17

	2836			1005			2793			2454	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	15.08	16.40	00	13.40	14.23	00	13.44	14.43	00	14.45	15.35
43	14.40	15.79	34	13.84	14.93	30	14.04	15,34	21	13.62	14.77
54	14.78	16.00	44	13.91	15.12	41	14.10	15.55	30	13.88	14.90
62	14.55	16.00	33	13.92	15.00	22	13.89	15.03	91	14.53	15.68
90		16.50	59	14.27	15.33	48	14.25	15.61	15	13.96	14.70
90		16.35	59	14.40	15.20	48	14.59	15.60	15	14.14	14.67
27	14.16	15.09	87	14.31	15.50	73	14.39	15.61	31	14.19	14.88
27	14.21	15.08	88	14.39	15.00	73	14.46	15.30	31	14.05	14.90
33	14.41	15.40	93	14.40	15.34	78	14.21	15.25	36	14.10	14.98
33	14.50	15.48	93	14.54	15.45	78	14.24	15.53	36	14.11	15.05
56	14.85	15.88	14	13.50	14.50	99	13.42	14.30	55	14.35	15.38
61	14.85	16.11	19	13.67	14.47	04	13.72	14.69	60	14.38	15.63
84	15.11	16.70	41	14.19	15.08	25	13.99	15.35	79	14.70	15.98
84	15.00	16.32	41	14.07	15.04	25	13.97	14.98	79	14.68	15.82
90	15.27	16.94	46	14.14	15.32	30	14.10	15.32	84	14.75	15.83
15	14.80	15.78	64	14.38	15.33	45	14.20	15.45	90	14.46	15.62
26	14.52	15.27	74	14.35	15.70	55	14.59	15.70	00	14.52	15.22
27	14.30	15.20	75	14.50	15.74	56	14.38	15.70	00	14.30	15.49
38	14.54	15.72	85	14.33	15.60	66	14.38	15.94	10	13.92	14.50
43	14.50	15.40	90	14.31	15.17	71	14.68	15.70	14	13.89	14.74
49	14.60	15.52	96	14.58	15.07	76	14.31	15.37	19	14.08	14.64
92	15.50	16.50	29	13.61	14.75	06	13.72	14.52	40	14.08	14.96
97	15.00	16.58	34	14.02	14.67	11	13.73	14.65	44	14.20	15.19
97	15.12	16.32	34	13.88	14.89	11	13.62	14.95	44	13.88	15.28
03	15.07	16.30	40	13.80	15.04	16	13.92	14.85	49	14.26	15.31
03	14.70	15.90	40	14.00	14.89	17	13.98	14.53	49	14.27	15.30
51	14.78	15.93	78		15.58	52	14.51	15.75	74	14.50	15.48
51	14.27	15.85	79	14.40	15.45	52	14.38	15.51	75	14.40	15.79
86	15.08	16.25	11	13.60	14.28	83	14.28	15.27	04	14.31	15.30
79	14.94	16.30	42	13.95	14.84	91		15.10	45	14.08	
96	14.91	16.39	58	14.25	15.38	07	13.81	14.51	60		15.49
08	14.90	16.10	68	14.48	15.60	17	13.75	14.87	69	14.63	15.60
44	14.26	15.22	96	14.15	15.07	42	14.21	15.27	85	14.21	15.62
44	14.42	15.68	96	14.31	15.45	42	14.05	15.20	85	14.62	15.95
15	14.55	15.88	57	14.19	15.52	98	13.62	14.60	30	14.17	15.20
81	15.15	16.35	12	13.82	14.17	50	14.19	15.55	70	14.72	15.93
18	14.75	15.33	40	14.06	15.02	75	14.52	15.65	85	14.49	
23	14.21	15.28	45	14.00	15.15	80	14.40	15.65	90	14.21	15.74
40	14.68	15.45	61	14.65	15.35	95		14.90	05	14.24	14.99
46	14.50	15.59	66	14.63	15.68	01	13.44	14.51	10		14.65
71	14.90	16.48	71		15.55	97	13.63	14.62	84	14.40	16.05
82	15.00	16.60	81	14.57	16.05	08	13.70	14.79	94	14.18	15.58
99	15.12	16.04	97	14.52	15.17	23	14.03	14.87	09	13.60	14.70
05	14.91	15.90	03	13.58	14.34	28	13.99	15.23	13	13.53	14.35

	2749			938			1013			1003	
ϕ	V	B	ϕ	V	B	ϕ	V	B	ϕ	V	B
00	14.46	16.10	00	13.70	14.94	00	13.95	15.18	00	13.62	15.02
08	14.86	16.16	06	13.63	14.73	04	13.88	15.20	02	13.60	14.91
17	14.78	16.40	14	12.77	13.40	12	14.20	15.60	11	13.80	15.12
50	14.92	16.49	43	13.45	14.49	35	14.22	15.42	32	13.68	14.40
72	14.72		64	13.88	15.31	56	13.80	14.06	52	12.71	13.30
72	14.41	15.62	65	13.60	14.92	56	13.17	14.35	52	12.63	13.27
76			66	13.59	14.93	55	13.50	14.14	50	12.62	13.30
76	14.19	15.20	66	14.05	14.85	56	13.50	14.14	51	12.75	13.27
80	14.24		70	13.78	15.12	60	13.27	14.03	55	12.78	13.72
80	14.07	15.32	71	13.78	15.10	60	13.35	14.30	55	12.86	13.52
97	14.64	16.17	88	14.28	15.25	76	13.58	14.50	71	13.23	13.90
02	14.85	16.13	92	13.98	15.15	80	13.72	14.57	75	13.39	14.25
19	14.93	16.60	09	13.07	13.85	97	14.06	15.06	92	13.36	14.94
19	14.68	16.52	09	13.47	14.19	97	14.01	15.22	92	13.73	14.46
23	15.13	16.40	13	13.21	13.72	01	13.88	15.23	96	13.92	14.97
18	15.09	16.40	06	13.86	14.58	92	13.79	14.93	86	13.59	14.45
27	15.03	16.38	15	13.09	13.69	00	14.08	15.09	94	13.53	14.67
27	14.93		15	13.35	13.41	01	13.91	15.17	94	13.53	14.40
36	14.97	16.53	23	13.09	13.72	09	14.13	15.55	02	13.82	14.97
40	15.00		27	13.31	13.77	13	14.60	15.49	06	13.62	14.60
44	14.85	16.20	32	13.55	14.41	17	14.32	15.47	10	13.65	15.00
52	15.00	16.10	38	13.27	14.33	20	14.52	15.44	13	13.90	14.83
56	15.02	16.60	42	13.33	14.35	24	14.39	15.70	17	13.74	15.05
57	14.73	16.31	42	13.74	14.45	24		15.86	17		14.92
61	15.02	16.09	46	13.43	14.85	28	14.27	15.73	21	13.82	14.94
61	14.70	15.92	46	13.39	14.28	29	14.59	15.58	21	14.06	14.50
73	14.49	15.63	56	13.60	14.60	36	14.40	15.48	27	13.96	14.93
73	14.28	15.32	56	13.74	14.62	36	14.30	15.30	27	13.70	15.60
99	14.60	15.80	82	13.90	15.08	61	13.25	14.22	52	12.83	13.27
53		16.40	21	13.12	13.65	83	13.95	14.90	66	13.12	13.84
66		15.69	34	13.41	14.38	95	13.85	15.09	78	13.35	14.20
75		15.53	42		14.45	04	14.28	15.55	87	13.50	14.60
78	14.30	15.32	44	13.30	14.60	03	14.19	15.34	85	13.55	14.25
79	14.19		44	13.31	14.90	03	14.07	15.80	85	13.40	14.50
08	14.60	16.59	71	13.76	15.41	27		16.41	08	13.55	15.02
34		16.88	94	14.10	15.38	47		15.40	26	14.10	14.94
38		16.80	96	13.97	15.19	47		15.31	25	13.93	14.53
42	14.85	16.50	00	13.86	15.19	51	13.86	15.04	29	13.60	14.71
55		16.30	12	13.07	13.76	63	13.48	14.30	41	12.94	12.97
59	15.17	16.36	17	12.97	13.72	67	13.37	14.41	45	12.86	13.26
05	14.79	16.29	58	13.36	15.15	03	14.01	15.59	79	13.34	14.55
14	14.73	16.29	67	13.92	15.24	11	14.38	15.82	87	13.64	14.80
27	15.14	16.42	79	14.00	15.02	24	14.50	15.75	99	13.78	15.08
31	14.76	16.58	84	13.93	15.19	28	14.56	15.82	03	13.78	14.90

	1023			929			934			1002	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00		15.32	00	14.14	15.45	00	13.65	14.86	00	13.50	14.73
94	14.08	15.27	90	14.20	15.35	89	13.46	14.60	82	13.09	14.30
02	14.31	15.42	97	14.00	15.42	96	13.68	14.80	89	13.28	14.50
05		15.25	90	14.38		87	13.73	14.54	66	13.02	13.90
24	14.24	15.52	08	14.47	15.52	05	14.04	15.16	82	13.38	14.24
24		15.23	08	14.09	15.43	05	14.01	15.30	82	13.35	14.28
14	14.21	15.41	94	14.40	15.70	90	13.67	14.66	61	12.91	13.77
14	14.20		94	14.16	15.29	90	13.53	14.50	61	12.74	13.58
18	14.21	15.27	98	14.13	15.45	93	13.74	14.72	64	12.92	13.80
18	14.17		98	14.21	15.67	94	13.61	14.70	64	12.88	13.71
33	14.28	15.20	12	14.18		08	14.10	15.03	77	13.06	14.21
37	14.02	14.80	16	14.04	15.42	11	14.02	15.04	81	13.30	14.20
52.	13.42	14.12	30	13.57		25	14.30	15.75	94	13.40	14.47
52	13.48	14.20	30	13.29		26	14.27	15.50	94	13.20	14.50
56	13.69	14.22	34	13.48		29	14.22	15.60	97	13.67	14.50
38	13.60	14.58	13	14.08	15.30	07	14.00	15.29	69	12.93	13.98
46	13.38	14.24	20	14.23	14.66	14	14.09	15.13	76	13.17	14.35
46	13.37	13.90	20	13.80	14.67	14	14.08	15.10	76	13.28	14.17
54		14.43	27	13.34	14.00	21	14.08	15.15	82	13.15	14.50
57	13.75	14.18	31	13.59	14.09	24	14.20	15.50	86	13.02	14.10
61	13.50	14.42	34	13.57	14.48	28	14.27	15.45	89	13.24	14.50
55	13.48	14.37	24	13.52	14.21	17	13.98	15.03	71	12.98	14.20
59	13.56	14.53	27	13.38	14.38	20	14.10	15.27	74	13.25	14.47
59	13.62	14.32	27	13.50	14.28	20	14.02	15.32	74	13.03	14.10
62	13.43	14.52	31	13.42	14.17	24	13.96	15.50	77	13.17	14.30
62	13.44	14.28	31	13.48		24	14.06	15.20	77	12.95	13.93
60	13.55	14.58	24	13.45	14.09	16	13.96	15.30	63	12.85	13.51
60	13.59	14.44	24	13.50	14.15	16	14.10	15.07	63	12.81	13.61
83	13.89	14.80	46	13.68	14.30	37	14.31	15.68	82	13.00	14.30
39	13.55	14.33	71	13.90	15.20	55	14.35		54	12.60	13.20
51	13.55	14.09	82	14.05	15.10	66	14.34	15.86	64	12.95	13.74
58	13.51	14.38	89	14.17	15.20	73	14.02	14.77	71	12.92	14.14
48	13.10	13.85	75	14.20	15.10	58	14.40	15.62	49	12.50	12.98
48	13.17	13.97	75	13.97	15.60	58	14.24	15.63	50	12.68	13.34
61	13.42	14.38	82	14.17	15.60	64	14.32	16.00	48	12.58	13.25
70	13.72	14.62	86	14.14	15.60	67		15.80	43	12.33	12.93
61	13.86	14.41	72	13.72	14.88	52	14.38	15.55	22	13.85	14.58
65	13.46	14.54	76	13.87	15.24	56	14.46	15.60	25	13.43	14.55
76	13.96	14.80	87	14.09	15.29	66	14.61	15.73	35	12.30	12.53
80	13.63	15.08	90		15.23	70		15.29	38	12.17	12.63
94	14.00	15.14	95	14.17	15.55	72	13.87	15.15	25	13.43	14.81
02	14.00	15.53	02	14.08	15.35	79	13.40	14.60	32	12.70	13.36
13	14.24	15.50	13	13.92	15.10	90	13.58	14.44	42	12.47	12.97
17	14.19	15.45	16	13.99	14.92	93	13.58	14.60	45	12.46	13.17

	12625			6070			953			2827	
φ	V	B	φ	V	B	φ	V	B	φ	V	B
00	15.74	16.20	00	14.95	15.52	00	11.76	12.42	00	12.16	13.29
67	15.82		66	15.38	16.11	52	12.51	13.80	31	12.17	13.70
72	16.50		72	15.72		56	12.50	13.90	34	12.29	13.81
18	15.41	15.99	15	15.17		69	12.68	13.94	01	12.17	13.23
31	15.54	15.80	28	15.50	15.84	79	12.78	14.02	08	12.17	13.16
31	15.30	16.05	28		15.51	79	12.70	13.93	08	12.16	13.32
95	15.80	16.28	92	15.43	16.02	29	12.34	13.35	38	12.40	13.97
96	15.68	15.78	92		15.93	29	12.25	13.33	38	12.38	13.74
98	15.73	16.02	95	15.64	15.83	31	12.30	13.43	39	12.35	13.91
98	15.50	15.85	95	15.22	15.60	31	12.18	13.44	39	12.43	13.85
09	15.40	15.74	06	15.17	15.50	40	12.26	13.62	44	12.33	
12	15.62	15.90	08	15.25	15.63	42	12.38	13.79	45	12.44	13.91
22	15.60	16.07	19		15.40	50	12.47	13.75	50	12.41	13.96
22	15.50	15.98	19	15.22	15.54	50	12.47	13.75	50	12.52	13.98
25	15.58	15.94	22	15.63	15.55	52	12.34	13.85	52	12.66	14.00
84	16.02	16.25	80	15.60	15.95	98	11.89		79	12.55	14.05
89	15.80	16.13	85	15.34	15.94	02	11.73	12.60	82	12.47	14.14
90	15.90	16.59	85	15.63	15.85	02	11.99	12.45	82	12.58	13.93
95	15.71	16.50	91	15.50	15.95	06	11.97	12.58	84	12.46	13.80
97		16.02	93		15.80	08	11.90	12.60	85	12.43	13.50
00	15.69	15.72	96	15.79	15.36	10	12.05	12.90	86	12.50	13.64
67	16.26		62	15.61	15.90	63	12.62	13.75	18	12.22	13.75
70	16.70	16.92	65	15.59	15.80	65	12.52	14.01	19	12.25	13.90
70			65	15.63	16.29	65	12.52	13.80	19	12.20	13.40
72	16.40	17.00	67		15.83	67	12.68	14.03	20	12.13	13.81
73		16.80	68		16.10	67	12.87	13.91	20	12.17	13.55
42	15.81	16.01	36		15.58	21	12.09	12.97	53	12.68	14.09
42	15.58	16.05	37	15.60	15.70	21	12.30	13.00	53	12.42	13.86
59	15.92	16.45	53	15.50	15.75	34	12.26	13.19	60	12.52	14.10
27	15.44	15.99	16	15.41	15.65	97	11.88	12.21	79	12.32	13.70
35	15.38	16.15	24		15.40	03	12.03	12.60	82	12.32	13.62
40	15.63	16.34	29		15.60	07	11.90	12.58	85	12.24	13.75
04	15.39	16.28	93	15.60	16.04	57	12.38	13.47	15	12.16	13.33
05	15.58	15.98	93	15.47	16.14	57	12.56	13.91	15	12.19	13.55
85	15.90	16.43	72	15.50	16.13	20	12.04	12.90	52	12.47	14.35
63	15.91	16.50	49	15.50	16.10	80	12.73	14.07	89	11.94	13.26
28	15.75	15.82	13		15.43	30	12.10	13.08	19	12.22	13.41
30	15.39	15.69	16		15.42	32	12.17	13.37	20	12.22	13.67
38	15.42	15.86	24		15.89	39	12.20	13.40	24	12.29	13.50
41	15.93	16.22	26		15.87	41		13.55	25	12.31	13.62
94	15.81	16.52	78	15.63	16.10	59	12.51	14.03	96	12.09	13.35
99	15.50	16.23	83	15.41	16.14	64	12.52	13.95	99	12.01	13.25
07	15.32	16.17	91	15.73	16.03	70	12.83	13.85	03	11.97	13.17
10	15.67	15.81	94	15.33	16.08	72	12.75	14.08	04	12.19	13.40

	2447	
ϕ	V	B
00	12.40	13.89
21	12.10	13.70
23	12.12	13.60
68	12.15	13.27
72	12.10	13.69
72	11.94	13.63
93	12.30	14.11
93	12.32	13.82
94	12.33	14.01
94	12.14	13.98
97	12.20	14.04
98	12.13	14.11
01.	12.32	14.07
01	12.17	13.82
02	12.43	14.13
20	12.40	13.72
22	12.40	13.50
22	12.30	13.04
24	12.37	13.27
25	12.25	13.17
26	12.23	13.60
47	11.81	13.09
47	11.75	13.05
47	11.78	12.88
48	11.79	13.00
48	11.83	12.90
70	11.96	13.41
70	11.98	13.29
75	12.07	13.20
22	12.27	13.42
24	12.25	13.79
26	12.20	13.69
46	11.65	12.98
46	11.82	13.17
72	12.20	13.75
96	12.19	14.05
16	12.20	13.81
17	12.14	13.72
20	12.25	13.63
20	12.17	13.65
68	12.04	13.55
70	11.95	13.31
73	12.24	13.38
74	11.99	13.39

SMALL MAGELLANIC CLOUD

		1968			1755			1436	
J.D. 244	Φ	V	B	Φ	V	B	Φ	V	B
2397.319	00		18.00	00	16.88	16.90	00	17.01	18.21
2403.383	16		17.60	03		16.61	66	16.68	17.20
2603.635	45	16.38	16.69	02	16.74	16.67	58	16.40	16.55
2604.654	15	16.39	17.90	70	(17.20)	17.49	20		18.35
2605.617	81	16.72		34		16.90	78		17.07
2607.644	20	16.81	17.69	68	(17.00)	17.65	00	17.59	
2631.594	62	16.55	17.32	59			46	16.80	18.1
2633.535	95		17.92	88		17.10	63	16.79	16.70
2634.548	64	16.42	17.50	55	16.61	17.09	24	17.47	18.11
2635.585	35	16.27	16.57	24	16.90	16.80	87	17.10	17.24
2635.634	39		16.79	27		16.79	90		17.20
2636.552	02			88	16.90	17.55	46	17.21	17.85
2636.605	05			92		16.91	49		
2659.478	73	17.21	17.40	11	16.80	16.29	30		17.95
2659.556	79	17.29	17.35	16	16.60		35	17.02	
2661.470	10			43	17.10		50	16.15	16.92
2662.476	79	16.67	17.32	10	16.57	16.83	11	(17.5)	
2694.464	72	17.18	17.69	35	16.80	16.85	42		17.14
2715.313	01			19		16.40	01		
2715.373	06	17.00	17.80	23	16.75	16.81	05	17.30	18.10
2717.406	45	16.15	17.12	58	17.28	17.13	28	17.22	18.06
2719.353	78	17.40	17.47	88	17.00	17.40	45		17.40
2719.397	81		17.24	90		17.00	48		17.32
2720.353	47	16.00	16.50	54	16.80	16.87	06	17.18	17.44
2744.288	88		17.57	44		16.77	51		17.23
2744.335	91	17.70	17.60	47	16.63	17.03	54		17.30
2745.289	56	16.95		10	16.73	16.90	12		17.34
2747.292	94			43		16.79	32		
2747.350	98	17.27	17.72	47	17.10	16.93	36		17.71
2749.321	33	16.57	16.41	78		17.13	55		17.67
2750.351	04	16.98	17.22	46	16.94	16.98	17	(17.6)	
2753.292	05			42		16.80	95		16.67
2754.362	78			13	16.45	16.52	59		17.29
2779.326	90	17.75	17.63	71	16.90	17.50	67	17.50	17.22
2782.331	96	17.40		70	17.10	17.23	48	17.27	17.43
2783.334	65	17.10	17.22	37	17.20		09		16.57
2952.667									
2956.647									
2957.640									
2980.650									
2981.653									
2982.656									
3015.618									
3016.619									
3017.557									
3018.567									
3019.556									
3021.487									
3045.443									
3045.485									
3071.478									
3075.365									
3100.280									
3102.274									
3102.315									
3103.274									
3127.362									
3128.340									
3132.337									
3133.326									

1344			2093			2057			1590		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.34	16.80	00	16.62	17.00	00	16.74	17.39	00		17.10
50			32	17.06	16.90	18	16.61		05		
19	17.00		84	(17.7)	16.35	07	16.62	17.40	91		17.89
78			40		16.80	61	16.99		42	16.50	17.30
33			92	17.00	16.50	11	16.82		90		
50		17.85	03	16.58	16.90	17	16.48	17.50	93	16.80	17.62
34		17.61	13	(17.18)	16.95	72	16.26	16.43	99	16.88	17.67
46		17.58	19		16.78	74	16.21	16.35	96	17.00	17.65
04	16.70	16.67	75	16.25		27	16.60	17.30	47	16.41	17.02
65	(17.5)		32		16.85	81	15.98	16.70	00	16.78	17.85
68			34		17.10	84		16.90	02		
20	17.10	17.24	84	16.12	16.60	32	16.72	17.58	48	16.54	17.78
24		17.19	87		16.50	34		17.50	51		17.40
45		(18.5)	38	(17.60)	16.85	33	16.70	17.50	03	16.50	17.95
49		18.17	42		16.60	37	17.20		07	16.82	17.19
60			47	17.00	(18.0)	37		17.22	03	16.91	17.55
18	16.80	17.20	02	16.67	16.50	90	16.29	17.20	54	16.72	16.97
66			52			65	16.78		65		17.68
70			92			58			15	16.16	16.60
74	17.40	18.3	95	16.78	16.84	61			18	16.32	16.60
91	16.26	16.28	06	16.80	16.70	67	16.02	16.47	20	15.88	16.80
04	16.65	16.80	13	16.91	16.82	69	16.50	15.95	19	16.22	
06		16.60	15	15.85	16.77	71		16.12	21		16.98
62	16.87	18.03	68	16.16	16.20	22	17.09		69	16.90	17.12
44			77	15.70	16.45	75	16.57	16.32	74		17.59
47		18.23	79	16.42	16.33	78	16.51	16.40	77	16.99	(18.3)
02	16.84	16.82	32	16.70	17.00	28			25	16.10	16.68
18	16.80	17.11	41	16.90	16.73	33		17.20	26	17.08	16.62
21	17.23	17.06	44	16.81	16.66	36	17.07	17.09	29	16.05	17.08
35	17.7	17.70	52		16.30	39	17.37	17.19	28	16.69	17.03
95	(16.30)	16.20	08	16.31	16.71	93	16.50	16.91	80	17.50	
65			69		16.16	47			28		16.98
26			28		16.93	03		16.90	82		
68	17.20		93	16.26	16.69	11	17.69	17.29	39	17.35	17.17
42			58	15.30	16.54	68	16.20	16.07	90		
00	16.12	16.47	12	17.38	16.82	21			41	16.45	17.32

11234			2186			2014			1727		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.75	16.89	00	16.97	17.48	00	17.01	17.47	00		17.40
00	16.45		93	16.93	16.95	75			73	16.52	17.60
24		17.02	78	16.08	16.60	62	17.18	17.30	91		17.47
75	(17.40)	(18.9)	27	16.24	16.70	08	15.84	15.89	36	16.48	16.62
23			74	16.53	16.30	52	17.14	16.79	80	16.71	
24	16.90	18.8	72	16.37	16.99	44	16.59	18.10	71	16.59	17.15
10	17.10	16.99	30	16.77	16.73	31	16.45	17.14	50	16.80	17.53
07	16.90	17.32	24		16.51	19	16.12	16.35	37	16.55	17.14
57		17.90	73	16.59	16.75	65	16.56	17.37	82	16.90	
08	16.90	17.25	23	16.49	16.64	12	15.95	15.90	29	16.18	16.63
11		17.08	26		16.47	14		16.15	32		16.40
56		17.7	70	16.22		56	16.60	17.30	73	16.90	
59			73		16.72	58		17.05	75		
92	17.30	17.33	79	16.43	17.01	96	17.40	17.32	05	16.70	16.84
96	16.63		83			00	16.74	16.53	09	16.25	16.04
91	16.75		75	16.40	16.90	87		17.70	95	16.59	17.20
41	(17.60)	18.6	24	16.48	16.68	32	16.68	16.73	40	16.21	16.55
26	17.60	18.0	71			84	17.28	17.68	81	16.95	
60			79	16.60	16.60	30		16.70	20	15.78	16.10
62		17.78	82	16.62	16.98	33	16.64	16.97	22	16.05	16.31
63	17.50	17.62	80	16.51	16.99	25	16.60	16.48	14	16.19	16.00
60			74	16.57	16.35	13	15.95	16.07	02		17.18
62			77		16.71	15		16.05	04	16.04	17.09
09	16.56	16.70	23	16.30	16.68	59	16.89	17.00	46	16.53	16.99
95		16.93	80	16.79	16.70	45		16.92	24	16.71	16.05
98	16.65	17.03	83	16.60	16.80	47	16.72	17.35	25	15.91	16.30
45		17.80	29	16.27	16.50	90	17.01	17.60	69	16.65	
44		17.90	26	16.48	16.60	81			60	16.26	
47		17.93	28	16.42	16.60	84	17.16	17.42	62	16.71	17.00
45	17.20	17.80	24	16.63	16.62	73	17.03	17.03	51	17.00	16.60
96	16.72	17.05	74	16.37	16.55	20	16.20	16.25	97	17.11	16.98
42			16		16.85	53		16.95	30		16.65
95			68	16.22	16.50	02	16.52	16.50	78		
32	17.5		75	16.27	16.80	35	17.13	17.08	02	17.08	17.27
81	16.90		20	16.35	16.69	71	17.22	17.10	38	16.38	17.00
30	17.25		69	16.45	16.61	17		16.03	83		17.03
			58	16.20	16.25						
			51	15.84	16.04						
			99								
			12		17.45						
			60		16.25						
			09		16.98						
			03								
			51	15.81							
			97								
			45		16.40						
			93		16.77						
			87								
			45	16.19	16.14						
			47								
			04								
			92								
			97								
			94		17.39						
			96		16.92						
			42		16.30						
			07								
			54	16.23							
			48	15.70							
			96	16.62							

2061			2156			2056			1332		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.37	16.33	00	16.29	16.63	00			00	(17.20)	17.10
70	15.92	16.16	64	17.10	17.47	63	16.28	16.22	51		17.40
01	15.60	15.90	73		17.60	35	16.89		36	16.60	17.34
45		16.42	18	17.08	17.17	80	16.80	16.80	78	16.21	16.50
88	15.38	16.00	60			21		15.49	18		
78	15.75	16.06	48	17.28	(18.20)	09	16.64	17.20	02	17.3	17.23
46	16.12	16.50	89	16.32	16.55	46	16.25	16.93	93	16.85	17.27
33	16.30	16.08	74	16.83	17.60	30	17.30		73	16.55	16.50
78		15.77	18	16.95	17.00	74	16.55	16.70	15	17.3	17.20
24	15.79	16.52	63	17.34	17.91	19	16.60		58	16.40	16.42
26		16.35	65			21			60	16.00	16.00
67	16.00	16.13	05	16.83		61	16.00	16.05	98	16.85	17.01
70		16.30	07		16.80	63		16.10	00		
89	15.72	15.95	02	16.53	16.69	54	15.75	15.97	47		17.31
93	15.91	16.10	06			57	16.22	16.25	50		
78		16.10	89	16.52	16.24	40	(16.70)	17.30	29		17.50
23	15.81	16.20	32	17.40	17.20	84	16.73	16.65	71		
49	16.25	16.55	24			69	16.56	16.42	94		
79		15.96	30			72	16.70	16.48	57	15.90	16.91
82	15.51	16.03	33		17.55	75	16.65	16.40	60	16.07	16.08
72	15.83	16.05	22	16.98	17.50	63	16.10	16.27	44		17.39
59	16.04	16.38	06	16.93	16.68	47	16.70	16.76	24	16.80	17.10
61		16.60	08		16.80	49	16.05	16.40	26		17.21
04	15.90	16.15	50	17.52	17.38	90	16.65	16.62	66	16.20	16.15
71	15.60	16.00	91		16.00	27			56		16.60
73	16.10	15.96	93	16.39	16.17	29	17.20		58	16.40	16.23
16	16.10	16.30	34		17.22	70	16.52	16.65	97	17.00	17.11
05	15.90	16.00	21		17.10	57	15.70	16.12	80	16.60	16.63
08	15.90	16.08	24	17.09	17.01	60	16.10	15.83	82	16.75	16.87
95	15.76	15.58	10	16.59	16.20	45	16.50	16.32	64	16.20	16.07
41	15.95	16.27	54	17.28		90	16.63	16.90	07		17.11
72		16.31	82			17			28		
20	15.88	16.08	29		17.24	63	16.00		73		16.35
33	16.10	16.50	15	16.68	17.07	44	16.70	17.18	06	17.35	17.34
67	16.20	16.31	45	17.01	17.19	74	16.30	16.51	30	17.25	17.30
12	15.71	16.28	89	16.58	16.10	18	(17.5)	17.33	71	16.20	16.31

1571			2042			1600			2082		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.40	18.02	00	16.89	17.40	00	15.55	16.33	00		16.80
33			32		17.35	26	15.80		24	16.45	16.60
30		(18.0)	80	15.80	16.55	86	15.63	16.00	06	15.75	16.54
69	16.60	16.95	19		17.23	24	16.03	16.30	44	16.50	17.11
06			82		16.79	60	15.76	16.00	79	16.05	15.90
84	16.45		34	(17.20)	17.62	36	15.80	16.37	54		17.00
04		(18.10)	48	16.60		28	15.75	16.47	37	16.70	17.00
79	16.24		22	16.64		00	15.80	15.92	08	16.46	16.22
18	16.95	17.65	61	16.55	16.70	38	16.02	16.00	46	17.13	16.98
58	17.00	17.85	01	16.30	17.20	77	15.50	15.75	84	15.72	15.97
60		17.60	03		17.08	79	15.60	15.75	86		15.93
95		17.22	38	17.05	17.50	13	15.93	16.20	20		16.84
97		16.90	40		17.33	15		16.33	22		16.62
76	16.26	16.80	13		17.59	67		15.83	65	16.80	16.95
79	16.16		16	16.93		70	15.46	15.60	68	17.10	16.82
53	16.90		90	16.40	16.90	41	16.00	16.10	38	16.60	16.98
91	16.64	17.20	28		17.11	79	15.44	15.70	75	16.20	16.02
21	16.82	17.68	50		17.87	70	15.40	15.58	54	17.30	17.29
22			46	(17.40)	17.10	47	15.75	16.08	23	16.90	16.66
24	16.85	17.20	48		17.75	49	15.73	15.90	25	16.90	16.60
02	16.53	16.93	26	17.20	17.40	25	16.10	16.28	00		16.21
77	16.27	16.59	00		16.82	98	15.62	16.20	72	16.55	16.25
79		16.65	02		17.24	99	15.90	16.18	74	15.80	16.10
16		17.25	39	17.07		35	15.75	16.23	09	16.30	16.40
36		17.87	53		17.18	27	16.00		91	16.20	16.15
38	16.95	17.89	55	17.20	17.45	28	15.90	16.30	93	16.12	16.25
74		16.90	91	16.67	17.00	64	15.60		28	16.20	16.90
51			68	15.70	16.07	39		16.10	02	16.20	16.47
53			70	15.90	16.25	41	15.82	16.42	04	16.42	16.40
29	17.00	17.38	45	17.37	17.37	14		16.05	77	15.56	15.60
69	16.35	17.00	84	16.55	16.73	53	15.60	15.92	15	16.40	16.51
82		16.80	97		16.93	62	15.63	15.75	23		16.60
23		17.61	38		17.30	02	15.70	15.97	63		16.91
82	16.25		91	16.80	17.20	32	16.00	16.45	83	16.05	16.30
98	16.44	17.31	06	16.88	16.92	44	15.70	16.20	94	16.16	16.48
36	17.10		44	17.15	17.19	81	15.45	15.90	31	17.00	16.80

2104			1360			2045			2015		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.31	17.12	00	15.80	15.98	00	16.20	16.30	00		17.39
24	17.20	17.60	21	16.48	16.20	13	16.20	16.38	11	16.41	16.65
06	16.30	17.01	09	15.90		46	16.52	17.05	78	16.70	17.40
43	17.20	17.59	46	16.60		82	16.11	16.88	14		16.44
79	16.04	16.17	81			16	16.21	16.20	47	16.21	17.29
53	17.10		55	16.81	(17.90)	87	15.80	16.15	18		16.60
36	17.23	18.30	26	16.48	17.70	28	16.40	17.07	51		17.10
08	16.85	16.93	97	15.57		96	15.91	16.10	18		16.63
45	17.10	17.59	34	16.68	16.44	32	16.41	16.79	54	16.41	16.87
83	16.16	16.20	72	16.90		68	16.52	16.98	90	16.44	17.06
85		16.09	74			70			92		
19	16.73	17.47	07	16.23	16.77	02	16.21	16.37	23	16.20	16.54
21		17.10	09			04		16.40	25		16.62
64	16.76	17.20	41	17.10	16.92	08	16.22	16.40	21	16.19	16.35
67	16.35	16.19	44	16.87		10	16.50	16.69	24	16.44	16.72
38	16.95	17.70	14	16.31	16.50	78	16.40	16.97	90	16.80	17.38
75	15.93	15.75	50	17.00	17.00	13	16.08	16.62	25	16.28	16.63
54	17.15	17.50	15	16.02		36	16.60	17.31	38		
22			73			69	16.42	17.20	64		17.10
25	17.10	17.08	76	16.70	17.10	71	16.68	17.09	66	16.90	17.10
00	16.65	16.94	50	16.54	17.43	42		16.90	36	16.23	16.90
72	15.85	15.80	20	16.50	16.52	10	16.58	16.41	04	16.97	16.91
73	15.60	15.93	22		16.65	12		16.50	06		16.71
08	16.50		57			46	16.43	16.80	39	16.09	16.50
91	16.30	17.10	28	16.31	16.95	86	16.30	16.07	72		17.31
92	16.30	16.51	30	16.20	17.10	88	15.90	15.95	73	17.00	17.12
28			64		17.07	21	16.53	16.40	07	16.70	16.90
01	16.80	17.20	37	16.22	17.20	92	16.00	15.95	76	16.90	17.10
04	16.75	16.80	39	16.30	17.02	94	16.05	16.07	78	16.90	17.00
76	16.09	16.50	11	16.14	16.19	63	16.80	16.92	47		17.00
14	16.60	17.46	49	16.41	16.98	99		16.25	83	16.70	
23		17.36	56			02		16.20	85		
62	16.15	17.46	95		16.92	40		16.79	22	15.82	16.27
82	16.26	16.60	03	15.90	16.05	17	16.55	16.82	91	17.38	17.46
93	16.14	16.53	12	15.83	16.47	22	16.51	16.83	96	17.12	17.05
30	16.95		49	17.00	17.10	58	16.52		30	16.20	16.45

1974			2118			2192			1898		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.45	16.33	00	15.97	17.39	00	15.57	16.24	00	16.55	16.64
10	16.26	16.40	03	16.15	16.60	02	15.80		01		
31	16.50	17.10	06	16.30	16.90	59		17.10	35	15.72	15.86
66	17.15	17.64	40	16.80	16.84	93	16.03	15.88	68	15.81	16.28
00		16.35	72	16.40	16.31	25		16.60	00	16.13	16.60
70	17.15	17.63	40	16.70	18.08	93	15.60	16.00	67	16.40	16.43
98		16.30	42	(16.96)	16.73	89	15.85	16.33	61	15.81	16.44
65		18.00	07	16.53	16.90	54	16.53	16.75	25	16.07	16.00
00	16.00	16.40	41	17.06	16.90	87	16.35	16.13	59	16.43	
36	16.50	16.85	76	15.80	16.33	22	16.37	16.82	93	16.40	16.48
37		17.25	77		16.55	23		16.90	95		
69	16.95	17.70	08	16.55		54	16.75		25	16.24	16.18
71		17.30	10		16.85	56		17.00	27		16.22
62		17.35	75	(16.26)	16.32	16	16.25	16.50	84	16.11	
64	16.96		78		16.04	19			87		15.75
30	16.93	17.20	42	15.87	17.53	82	16.15	17.20	50	15.77	16.16
65		17.40	76	16.26	16.23	16	16.38	16.57	84	16.48	
71	16.82	17.63	46	16.86	17.62	79			44	15.89	15.98
92	15.90	15.90	44	16.75	17.68	72			34	15.91	15.82
94	15.70	16.23	46		17.04	74	16.95	17.07	36	15.78	15.90
64	17.00		14	16.70	17.10	42	16.54	16.99	04	16.59	16.46
31	16.63	16.83	79	16.30	16.50	07	16.30	16.36	68	16.21	16.47
33		16.60	81		16.40	08		16.12	70	15.88	16.29
66	16.90		13	16.40	16.85	50	16.55	16.68	01	16.72	16.30
93	15.50		14		16.67	36	16.47	16.50	94		
95	16.10	16.30	16	16.28	17.30	37	16.57	16.58	96	16.12	16.55
28		17.08	48	16.67	17.22	69		17.30	27	15.51	16.20
97	15.75	15.97	15	16.40	16.99	36		16.90	94	16.50	16.44
99	16.20	16.60	17	16.33	16.88	38	16.58	16.83	96	16.32	16.37
67	16.90		83	16.12	16.30	03	16.15	16.03	61	16.00	
03	16.10	16.21	17	16.23	16.73	37	16.40	16.70	95	16.12	16.40
04		16.47	16		17.18	35		16.50	92		16.40
41		17.09	51		16.93	71			28	15.72	16.05
04	16.20	16.50	87	16.50	16.70	01	15.90	16.31	55	16.10	16.30
08	16.32	16.48	88		16.68	00	15.97	16.07	54	15.89	16.20
43	17.15	17.09	21		16.97	34	16.78	16.75	88	16.37	

2173			2168			1662			11233		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.10		00	16.12	16.91	00	16.88		00		17.80
00	16.08	16.30	99	16.30		99	16.33	16.80	97		
06		16.48	72	15.49	15.95	64	16.00	16.50	09	16.60	17.10
40	16.78	16.95	05	16.69	16.70	97	16.34	17.20	42	16.70	16.81
72	15.62	15.67	37	16.87	16.83	29	16.90	17.10	73		17.11
38			03	16.51	17.25	95	16.63		39	16.50	17.13
28	16.41	17.00	89	16.05		80	16.41	16.90	18	16.30	17.13
92	16.22	16.09	53			44	16.82	17.13	81	17.10	17.52
26		16.60	86	16.28	16.60	77	16.70	16.68	14	16.66	17.30
60	16.18	16.63	20	16.55	17.13	11	16.71	16.98	48	16.65	16.85
62		16.75	22		16.93	13		17.33	49		16.73
92	16.04		52	16.61		43	16.78	17.03	79	16.85	17.50
94		16.53	54		17.10	45		16.80	81		17.19
48	16.71	17.15	05	16.42	17.20	95	16.36	16.84	25	16.34	16.40
51			07			97	16.32		27	16.15	
14	16.38	16.63	70	15.92	16.12	60	16.28	16.69	89	17.15	18.01
47	(17.10)		03	15.99	16.95	93	16.40	17.17	22	16.60	16.95
02			53			42	16.81	16.99	62	17.00	17.41
90	16.21	16.35	37	16.92		25	16.50		40	16.70	16.70
92	16.30	16.58	39	16.80	17.18	27	16.92	17.32	42	16.90	17.04
59	16.40	16.81	06	16.50	16.88	94	16.60		08	17.10	17.61
24	16.40	16.90	70	16.00	16.03	58	16.09	16.57	72		17.15
25	16.60	16.80	71	15.54	16.23	59	15.89	16.60	73		17.09
57	16.60	16.63	03	16.01	17.05	90	16.53	17.04	04	16.50	
46	16.30		88	16.18	16.60	75	16.43	16.51	82	(17.00)	17.45
48	16.71	17.21	90	16.20	16.80	77	16.61	16.76	84	16.95	17.47
79	15.62	15.90	21	16.40		08	16.82	17.40	15	16.30	17.07
45	16.51		87	15.78	16.32	74	16.00	16.44	80	16.10	
47	16.60	16.74	89	16.18	16.46	75	16.50	16.90	82	17.40	17.20
12	16.53	16.40	53	(17.13)	17.15	40	16.95	16.85	46	16.60	16.83
46	16.80	17.01	87	16.19	16.50	74	16.40	16.55	80	16.80	17.08
43			84		16.50	70		16.60	75		17.37
78	15.77	15.97	19			05		17.05	10		17.00
02	16.08	16.88	38	16.50	17.17	24	17.08	17.20	22	16.32	16.50
01	16.58	16.35	37	16.58	16.90	22	16.85	17.30	19	16.35	16.87
34	16.81	16.60	70	16.36	15.95	55	16.25		52	16.75	16.93

852			2037			11206			1788		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		17.21	00	15.35	15.84	00	15.85		00	15.40	15.89
90			80	15.40	15.40	78	16.25		74	15.16	15.60
52	16.38	16.59	24		15.87	69	16.60	16.82	31	15.50	15.99
83	16.50	16.93	54	15.33	15.67	99		16.80	60	15.41	15.55
14	15.56	15.70	83	15.45	15.71	27	16.20	16.17	88	15.47	15.83
77		17.25	43	15.56	15.85	87	16.30	17.00	46	15.50	15.75
26	16.05	16.00	54	15.42	15.75	91	16.36	16.87	34	15.63	16.10
86		17.00	12	15.50	15.93	48	16.35	16.60	90	15.52	15.71
18	15.90	15.70	42	15.65	15.63	78			19	15.66	15.84
51	16.34	16.55	73	15.27	15.50	09	15.73	16.45	49	15.53	15.84
52		16.78	74	15.40	15.69	10			51	15.50	15.75
81	16.54	17.10	01	15.50	15.77	37	15.98	16.42	77	15.26	15.58
82		17.01	03	15.73		39		16.70	78	15.33	15.60
98	16.73	17.03	82	15.30	15.63	12	15.90	16.30	36		16.03
00	16.35	16.72	84		15.82	14	15.95		38	15.66	
60	16.35	16.95	41	15.50	15.69	70	16.13		93	15.50	15.80
92		17.03	71	15.30	15.48	00	16.23	16.65	22		16.00
92	16.53	17.10	20	15.73	16.28	41	16.08	16.73	42		
44	16.20	16.30	39		15.90	54		16.65	41	15.63	15.96
46	16.30	16.90	41	15.53	16.07	56	16.10	16.61	43	15.74	16.08
09	16.35	16.25	02	15.42	15.82	16	16.25	16.17	01	15.81	15.80
70	16.50	16.79	59	15.42	15.60	73	16.35	16.80	57	15.52	15.80
71	(16.45)		61	15.00	15.63	74			58	15.30	15.80
01	16.28	16.70	89	15.50	15.90	02	16.04	16.26	86	15.70	15.67
50	16.00	16.60	99	15.30	16.00	06	15.80	16.58	74	15.24	15.45
51	16.25	16.91	01	15.20	15.83	08	15.73	16.37	75	15.30	15.55
81	16.60	16.90	29	15.63		36	15.90	16.50	03	15.44	15.90
44	15.90	16.23	89	15.30	15.74	95	15.95	16.79	60	14.95	15.73
46	16.20	16.67	90	15.18	15.50	96		16.82	62	15.21	15.68
07	16.40	16.78	49	15.24	15.37	54	16.23	16.40	19	15.67	15.85
39	16.05	16.26	79	15.12	15.47	85	16.23	16.73	48	15.49	15.79
31		16.34	67	15.25	15.65	71			33		16.03
65	16.45	16.89	98	15.15	16.02	03	16.20	16.50	64	15.27	15.60
45	15.65	16.69	40	15.45	15.83	37	16.04	16.67	81	15.28	15.59
39	15.95	16.90	29	15.40	16.08	26	16.00	16.25	68		15.65
71	16.27	16.81	58	15.40	15.37	55	16.01	16.67	96	15.81	15.65

1339			2055			1502			1901		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.20	17.08	00	16.12	16.90	00	16.50	17.08	00	16.70	17.31
74	15.60	16.20	71	15.77	16.11	71	15.76	16.35	70	16.60	16.81
13	16.42		20	16.63	17.18	26	16.04	16.58	74	16.38	17.23
42	17.05		49	16.35	17.14	47	15.84	16.38	03	16.44	17.20
70	16.35		76	16.11	16.55	74		16.67	30	16.32	16.54
28			33	16.51	17.33	32	15.46	16.04	86	16.63	
14	16.62	17.52	09		17.08	07	16.30	16.74	57	16.41	17.23
70	16.10		64	16.13	16.35	62	16.08	16.40	11	16.09	16.69
99	16.50	16.80	92	15.99	16.64	90	16.10	16.70	39	16.10	16.64
29	16.90	(17.65)	22		17.06	20	15.60	16.40	68	16.55	16.93
30			23		16.98	21		16.60	70		16.80
56		17.12	49	16.48	16.98	47	15.79	16.23	95	17.03	17.30
58			50		16.85	48	15.65	16.35	97	15.54	16.92
14	16.55	17.09	96	16.22	16.70	93		16.89	37	16.10	16.84
16			98	16.58		96			39	16.41	16.52
71	16.20	16.80	52	16.20	16.50	50	15.64	16.54	93	16.62	17.25
99	16.50	17.00	80	16.10	16.41	78	16.10	16.73	21		16.24
16			82	16.28		80	16.05	16.78	16		16.44
14			71	16.18	16.37	68	16.10	16.42	00	16.62	16.81
15	16.62	17.08	72	16.50	16.50	70	15.90	16.80	01	16.72	16.80
74	15.92	16.23	30	16.38	16.97	27	15.80	16.27	58	16.54	17.23
30	16.50	17.27	85		16.58	82		16.59	13	16.41	16.35
31		17.48	86		16.80	83	16.15	16.72	14	16.52	16.40
58	16.60	17.31	13	16.40	16.65	10	16.25	16.73	41	16.19	16.80
44		17.29	88	16.63	16.47	85	16.00	16.88	11	16.18	16.40
46	16.70		89	16.42	16.60	86	16.20	16.80	12	16.21	16.53
73	15.75	16.40	16	16.75	16.90	13	15.90	16.70	39		16.52
30		17.00	73	15.80	16.13	70		16.73	95		17.00
32	16.80	17.27	74	16.27	16.50	72	15.93		96	16.94	16.89
88	15.95	16.55	30	16.90		27	15.52	16.10	52	16.92	16.81
18	16.65	17.20	59	15.81	16.21	56	15.75	16.72	80	16.57	17.03
02			42			39		16.20	63		17.03
33		17.10	72	16.02	16.38	69	15.80	16.64	93		17.20
48	16.63	17.30	76	16.23	16.68	73	16.05	16.62	91	16.58	17.13
34	16.60	17.12	61	15.99	15.91	58	15.70	16.75	75	16.85	16.85
63		17.17	90	16.27	16.50	86	16.29	16.60	03	16.37	16.83

1331			2058			2028			2070		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.80	17.23	00	16.40	16.20	00		17.40	00		16.65
69	16.30	16.60	65	16.30	16.80	64	15.85	16.08	63		16.65
64	16.45	16.53	99	15.90	16.18	94	16.30		60		16.13
92	17.00	17.30	27	16.45	16.75	20	16.07	16.43	87	16.69	17.23
19		16.94	53			46	16.10	16.50	13		16.70
76	16.10	17.00	08	16.33	16.50	02	16.62	16.80	68	15.96	16.54
45	15.86	16.14	58	16.40	17.00	51	16.12	16.45	13	16.27	17.23
99	16.60	16.93	11	16.38	16.55	03	16.22	17.15	66	16.09	16.48
27	16.53	16.15	38	16.76	16.75	31	15.90	15.62	93	16.30	16.79
56	15.95	16.23	66		17.14	59	16.20	16.50	21	15.70	16.13
58		16.30	68		17.08	60		16.80	22	15.70	16.21
83	16.90	16.80	92	15.98	16.17	85	16.20		47	15.91	16.41
85		16.91	94		16.22	87		16.75	48	15.42	16.40
24	16.50	17.04	15	16.50	16.37	07	16.33	16.90	65	16.09	16.65
26			17	16.55	16.40	09	16.30	16.50	67	15.92	16.30
79	16.30	17.12	69		17.20	61	16.37	16.60	18	15.68	16.10
07	16.74	17.13	96	15.63	16.27	88	16.48		46	15.61	16.02
01			64		17.12	55	15.83	16.36	08	16.31	17.13
84	16.75	16.53	30	16.32	16.60	20		16.26	69	16.16	16.69
85	16.72	16.70	32	16.43	16.62	22	15.75	16.10	71	16.13	16.70
42	15.60	15.65	87	15.80	15.72	77	16.40	16.60	26	15.20	15.64
96	16.70	16.93	40	16.75	16.68	30	15.45	15.73	78	16.16	16.25
98		17.24	41		16.90	31	15.40	15.92	79	15.95	16.80
24	16.60	16.73	67	16.30	16.90	57	15.65	16.22	05	16.09	16.24
93		16.91	16	16.40	16.60	06	16.50	17.00	50	16.00	16.23
94	16.31	(17.55)	18		16.52	07	16.18	16.85	51	16.00	15.90
21	16.45	17.10	44	16.55		33	15.60	16.04	77	16.00	16.75
77		16.60	98		16.26	87	16.27	16.86	31	15.80	15.87
78	16.40	16.80	00	16.15	16.11	89	16.46		33	15.30	15.98
34	15.90	15.66	53	16.50		42	15.78	16.20	86	16.40	16.84
62	16.25	16.25	81	15.70	15.61	70	16.42	16.50	14	16.21	16.63
44		16.05	61			50		16.36	93		16.80
74		16.65	90	15.70	16.11	79		17.07	22	16.20	16.02
72	16.20	16.65	67		16.94	55	15.83	16.61	94	(16.80)	17.13
56	15.90	16.31	49	16.54	16.97	37	15.85	16.13	75	15.98	16.92
84	16.60	16.75	76	16.05	16.00	64	16.13	16.60	02	16.20	16.70

	2188			1691			1718			1807	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.28	16.64	00	16.40	16.90	00	14.99	16.10	00		16.90
63			55	15.87	16.50	50	16.60	16.80	48		17.05
58	16.97	17.45	88	16.10	17.00	00	15.37	15.93	46		16.93
85	16.70	17.50	14	15.70	15.89	26	16.25	16.60	71	15.70	15.82
11	16.30	16.55	39	15.72	16.70	49	16.30	16.63	95	16.11	16.33
66	16.95	(17.80)	91	16.47		99	15.57	15.90	44	16.71	17.10
11	16.10	16.90	05	15.90	16.34	92	15.68	15.93	30	16.20	16.90
63	17.12	17.55	55	16.55	16.92	40	16.31	16.50	78	15.80	16.08
91		16.55	81	16.56	16.90	64	16.40	16.67	02	16.41	16.18
19	16.43	17.00	07	15.70	16.23	90	15.53	16.20	28	16.50	17.05
20		16.80	08	15.67	16.05	91	15.29	15.98	29		16.85
45	16.39		32	16.15	16.22	14	16.00	16.50	51	16.41	17.30
46		17.10	33		16.20	15		16.42	53		17.30
62	16.71	17.20	20		16.00	81	16.01	16.58	12	16.01	16.80
64			22	15.83	15.83	83	16.22	16.27	14	16.38	16.33
16	16.61	16.65	71		16.70	30	15.91	16.60	61	16.40	16.93
43	16.67		96	16.28	16.80	55	16.40	16.43	86	15.80	15.78
05			16	15.76	16.11	46		16.60	68	15.93	(16.21)
66	16.90		51	15.79	16.70	61	16.52	16.51	78		15.98
68	17.00	17.15	52		16.79	63	16.39	16.69	79	15.88	16.05
23	16.79	16.70	04	16.05	16.28	13	15.95	16.08	29	16.42	16.95
75	16.95		54	15.70	16.69	61	16.11	16.52	77	15.95	15.95
76			56	15.81	17.00	62		16.70	78	16.10	16.04
02	16.22	16.20	80			86	15.82	16.31	01	16.01	16.33
47		16.88	94			77	16.33	16.68	86	15.60	16.21
48	16.88	17.10	95	16.40	16.80	79	16.50		88	17.62	16.30
74		(17.68)	19	15.60	15.99	02		16.15	11	15.99	17.19
28		16.60	70		16.52	52		16.73	60	16.30	16.73
30	16.40	16.80	72	16.61	16.69	53	15.98	17.22	61		16.63
83	16.82	16.94	22	15.85	15.67	02	15.79	15.58	10	16.05	16.68
10	16.39	16.29	49	16.25	16.53	27	15.81	16.37	35	16.25	16.79
90			24		16.18	00	15.50	15.98	07		16.59
18	16.25	16.53	52		16.68	26	15.99	16.50	33		17.22
91	16.30	16.93	92	16.40	16.83	44	16.30	16.79	44	16.60	17.28
72	16.68	17.30	69	16.20	16.54	18	15.70	16.32	17	16.35	16.52
99	16.40	16.29	94	16.14	17.02	43	16.30	16.47	42	16.65	16.70

2175			1944			2026			1619		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.21	16.50	00		17.50	00			00		16.90
44	15.90	15.92	42	15.86	16.03	40	16.45	17.00	39	15.00	15.82
00	16.39	16.73	23	15.95	16.88	51	15.95	16.73	16	15.75	16.62
24	14.96	15.13	47	16.05	16.50	74	16.10	16.08	39	15.46	15.70
47	15.59	16.05	69		16.62	97	16.00	16.53	61	15.70	16.23
95	16.09	16.58	17	16.80	17.45	43	16.20	16.31	07		
64	15.80	16.30	76	16.35	17.30	95	15.82	16.40	55	15.65	16.32
10	15.92	16.40	22	16.42	17.00	40		17.19	99		
34	15.49	15.52	45	16.25		63	15.54	15.70	22	15.80	16.08
58	15.99	16.17	70	16.00	16.85	87	15.71	16.46	46	15.35	16.15
60	15.80	16.47	71		16.80	88		16.43	47	15.50	16.09
81	16.73		92	16.15	17.10	09	16.25	16.70	68	15.60	16.20
83		16.41	94		17.00	10		17.01	69	15.60	16.33
26	15.23	15.46	28	16.15	16.73	37	16.60	16.99	92	15.92	16.88
28			30	16.25		39	16.66		94	15.95	
73	15.89	16.10	75	16.40	16.95	83	15.82	16.55	37	15.03	15.68
97	16.11	16.30	98	16.50	17.37	06	16.23		60	15.70	16.29
57			46	16.00		43	16.80	16.80	92		16.60
52	16.04	16.13	33	16.33	16.24	23			68	15.90	16.40
53	15.71	16.00	35	15.97	16.55	24	16.57	17.20	69	15.56	16.45
01	16.00	16.70	82	16.50	17.13	71	15.73	16.08	16	16.10	16.70
48	15.60	15.90	28	16.35	16.40	16	16.40	17.03	60	15.50	16.20
49	15.40	16.00	29		16.50	17			61	15.60	16.28
71	16.21	16.17	51	16.11	16.40	46	16.45	16.70	83		
40	15.53	15.70	11	16.28		90	15.62	16.58	30	15.38	
41	15.70	15.70	12	16.58	17.35	91	16.30	16.54	31	15.35	15.59
64	16.20	16.50	35	15.90	16.60	13			53	15.45	16.25
11	16.28	16.33	81	16.20	16.90	59	15.40	15.98	99		
13		16.27	82	16.21	16.90	60	15.33	15.74	00	16.04	
59	15.84	15.76	28	16.10	16.48	06	16.26		45	15.13	15.60
84	16.30	16.21	52	15.92	16.53	30	16.42		69	15.62	16.27
54			21		16.93	97			36	15.50	15.80
79	16.07	16.35	46	16.20	16.41	22			61	15.70	16.28
72	15.95	16.47	30	16.05	16.65	98	15.88	16.80	31	15.30	15.83
43	15.73	15.93	00	16.50	16.95	66	15.50	15.96	00		16.68
67	16.10	15.94	24		16.80	89	16.03	16.31	23	15.60	16.24

1961			1425			2129			1343		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		16.50	00		15.59	00		15.84	00		16.60
37	15.74	16.80	33	15.85	16.38	28	15.80	16.21	23	14.77	
58	15.58	15.45	37	15.90	16.44	62		16.93	97	15.57	16.03
81	15.68	16.00	60	15.97		84	16.63	16.69	18	15.90	16.40
03	15.85	16.29	81	15.52	16.00	04	15.60	15.95	37	16.20	
48	15.90	16.73	25	15.91	16.34	47	16.05	16.70	79	15.47	15.60
89	15.70	16.17	52	16.30	16.73	53	16.35	16.98	66	15.65	15.59
33	16.00	17.20	95	15.52	15.83	94	16.00	16.37	05	16.08	16.24
56	15.63	15.90	17	15.98	16.25	15	15.95	15.89	26	15.82	16.58
79	15.57	15.70	40		16.60	37	16.25	16.60	47	16.23	16.80
80	15.30	15.83	41		16.40	38		16.38	48		16.90
01	15.79	16.17	61	16.21	16.69	58	16.19		67	15.31	15.77
02		16.33	62		16.80	59		17.25	68	15.60	15.65
19	16.00	16.65	65	16.24		43	15.88	16.57	33	16.15	16.60
20	15.68	16.25	67	16.20	16.54	44			35	16.04	
64	15.58	15.75	09	15.77	16.00	85	16.60	17.00	74	15.77	15.69
86	15.53	16.20	31	16.31	16.20	06	15.70	15.97	94	15.95	16.03
09	15.90	16.40	35	16.09		82			45	16.35	16.55
79	15.45	15.93	93	15.18	15.70	23	15.70	16.38	69	15.28	15.64
81	15.50	16.00	95	15.41	15.83	24	16.09	16.33	70	15.25	15.75
27	16.12	16.90	39	16.39	16.30	67	16.17	17.10	12	16.32	16.21
71		15.72	82	15.60	15.80	08	15.73	15.90	51	16.40	16.63
72		15.63	83	15.80	15.68	09	15.22	15.80	52	16.00	16.72
93	15.60	15.87	04	15.80	15.82	30	15.82	16.26	72	15.15	15.75
34	15.90	16.50	30	16.40	16.23	36	16.15	16.50	58	16.00	16.50
35	16.30	17.00	32	16.00	16.30	37	15.89	16.51	59	16.18	16.50
56	15.45	15.75	53	16.10	16.79	57	16.15	16.70	79	15.46	16.00
01	15.80	16.23	97	15.60	15.74	99	15.43	15.75	20	16.00	16.30
03	15.88	16.23	98	15.69	15.76	00	15.69	16.01	21	15.95	16.38
47	15.85	16.30	41	16.38	16.30	42	16.22	16.21	61	16.15	16.30
70	15.45	15.47	64	16.40	16.48	64	16.60	16.81	82	15.50	15.78
37		16.65	29		16.34	26		16.29	42		16.80
61	15.24	15.32	52	16.20	16.50	49		16.65	63	15.60	16.02
25	16.05	16.72	01	15.79	15.82	76	16.30	17.04	71	15.31	15.50
92	16.03	15.93	67	16.08	16.53	40	16.28	16.20	32	16.10	16.53
15	16.05	16.14	89	15.20	15.52	61	16.67	16.80	53	16.25	16.68

2145			1555			1995			1699		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.90		00			00		17.61	00	15.37	15.63
23	16.38	17.30	23	14.86	15.20	21	15.80	16.95	20	15.24	15.75
75	15.85	16.34	74	15.60	16.32	16	16.18	17.33	79	14.85	15.33
96	16.10	16.63	95	15.77	16.38	36	15.78	16.30	99	15.21	15.42
16	16.27	16.90	14	15.20	15.89	55	15.90	16.22	18	15.40	15.80
57	15.52	15.95	56	15.45	16.30	96	16.45	17.24	58	15.35	15.90
41	16.10	16.97	40		15.69	74	16.16	17.12	32	15.48	15.95
80		16.36	79	15.60	16.31	12		17.29	70	15.20	
01	16.67	16.62	00	15.94	16.50	32	15.65	16.26	90	15.07	15.42
22	16.65	17.21	21	15.00	15.30	53	16.10	16.87	10	15.49	15.70
23		16.88	22	15.09	15.33	54		16.89	12	15.38	15.75
42	16.50		40	15.26	15.48	72	16.02	17.00	30	15.51	15.78
43		16.80	42	15.00	15.65	74		16.75	31	15.38	15.90
06	15.90	16.90	04	15.70		30	15.95	16.50	83	14.88	15.30
07			06	15.55	15.83	31	15.57	16.00	84		15.05
46	16.10	16.40	45	15.44	16.02	70	16.36	16.90	29	15.60	15.80
66	16.05	16.08	65	15.80	16.15	90	16.26	17.60	42	15.39	
14			12	15.50	16.11	28	15.68	16.49	75	14.98	15.13
36	(17.00)	16.81	34	14.96	15.38	44	15.90	16.40	87	15.01	15.50
37	16.80	16.90	35	15.25	15.94	45	16.05	16.44	88	14.92	15.50
78	16.06	16.27	76	15.77	16.01	85	16.05	16.97	28	15.56	15.74
17	16.50		16	15.22	15.74	24	16.05	16.36	67	15.13	15.50
18		16.97	17		15.62	25		16.45	68	14.94	15.58
38	16.47	16.67	36	15.04	16.00	44	15.80	16.20	86	14.88	15.30
22	16.47	17.10	20		15.60	22	16.20	16.50	60	15.61	16.00
23	16.42	16.91	21	15.08	15.11	23	16.07	16.85	60		15.99
42	16.55	16.68	40	14.85	15.99	42		16.43	79		15.04
83	16.20	16.58	81	15.75	16.52	82	15.90	17.07	19		15.73
84	15.73	16.21	82	15.60	16.60	83	16.20	16.86	20	15.22	15.91
24	16.58		22	14.83	15.17	22	16.05	16.84	59	15.55	15.65
45	15.90	16.28	43	15.13	16.07	43	15.82	16.50	79		15.34
04			02		16.26	01		16.95	38		16.25
26		17.03	24	14.85	15.30	23	15.70	16.60	59	15.48	15.97
31		17.31	29	15.25	15.29	21	16.23	16.75	52	15.47	16.17
92	16.16	16.59	90	15.58	16.50	81	16.50	16.79	12	15.41	15.75
12	16.70	16.60	10	15.60	16.25	01	16.65	17.20	32	15.68	15.91
39											
20											
40											
05											
26											
46	15.71										
13											
33											
52	15.28										

1951			1927			2211			1531		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.36	16.50	00		17.19	00			00	15.45	16.15
19	15.50	15.90	19	16.25		19	16.00		19	15.35	15.83
59	15.35	15.70	58	15.22	16.08	50	15.39	15.82	36	15.90	16.01
79	15.72	16.20	78	16.16	16.70	69	15.68	16.10	56	15.65	16.40
98	16.25	16.35	97	16.10	16.90	88	16.00	16.22	74	15.90	16.38
38	15.00	15.25	36	15.80	17.30	28	16.15	16.90	14	15.66	16.00
09	16.00	16.52	08	15.85	17.28	98	15.98	16.60	83	15.95	16.50
47	15.27	15.55	46	15.82	16.40	36	16.06	16.35	21	15.82	16.21
67	15.75	15.62	66	15.67	16.34	56		15.86	40	15.90	15.84
87	15.85	16.25	86	15.85	17.30	76	15.84		61	15.73	16.03
88		16.18	87		16.68	77			62		16.23
06	16.15	16.76	05	16.30	17.00	95	15.85		80	15.93	16.64
07		16.33	06			96			81		16.50
57	15.45	15.80	56	15.70	15.95	45	15.75	16.20	28	15.60	16.35
59	15.15	15.34	57	15.78	15.82	47			30	15.63	
96		16.50	95	16.10	17.00	84	15.98	16.50	67	16.30	16.52
16	15.90	16.14	15		16.95	04	15.83		87	16.00	16.56
45	14.90	15.33	44		16.43	32			12	15.45	16.05
56	15.45	15.93	54	15.80	15.94	41	15.50	16.20	20	15.60	15.84
57	15.32	15.72	55	15.62	16.12	42	15.58	16.08	21	15.53	16.40
97	16.10	16.40	95	15.82	16.80	82	15.90	16.37	61	16.15	16.10
35	15.39	15.10	33		17.03	21	16.20	16.53	99	15.45	15.58
36	14.80	15.14	34		16.97	21	16.00	16.71	00		15.91
55		15.60	53	15.43	16.07	46	15.43	16.29	19	15.26	16.00
26	15.03	15.32	24	16.20	16.90	10	16.00	16.60	87	15.90	16.53
26	15.00	15.45	25		17.46	11	16.00	16.36	88	15.84	17.13
45	15.00	15.45	44		16.30	30	15.97	16.77	07	15.10	15.60
85	15.87	16.40	83	16.10	16.68	69	15.50	15.93	46	16.05	16.08
86		16.27	84	15.85	16.80	70	15.93	16.00	47	16.00	16.68
25	15.55	15.40	23	16.03	16.82	09	15.80	16.37	86	16.18	16.85
45	15.29	15.54	43	15.90	16.29	29	16.17	16.60	06	15.45	15.53
03		16.60	01		16.86	87		16.58	63		16.70
24	15.15	15.90	22	16.20	17.00	08		16.38	84	(16.70)	16.65
15	15.90	16.75	13	16.15	16.88	98	16.15	16.72	72	16.20	16.41
74	15.44	16.50	72	15.70	16.46	57	15.73	15.83	31	15.40	16.32
94	16.15	16.45	92	16.00	16.68	76	15.83	16.10	51	15.70	16.44

1457			1752			11170			1701		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		16.85	00	16.30	17.05	00		16.20	00	15.10	15.55
19	16.26	16.90	18	15.70	16.22	18	15.72	16.20	17	15.05	16.21
35	15.60	15.99	25	15.46	15.99	10	15.63	16.08	89	15.46	15.68
55	15.65	16.40	44	15.56	16.35	29	15.80	16.22	09	15.20	15.76
74	16.30	16.50	63	15.50	16.30	48	15.86	16.70	28	15.27	15.87
14	16.20	16.20	03	16.15	17.27	88	15.56	16.50	67	15.78	16.30
82	16.12	16.60	70	15.95	16.55	53	16.07	16.21	30	15.50	15.97
20	15.90	16.78	08	16.57	17.18	91	16.04	16.22	67	16.08	16.53
40	15.70	16.35	28	16.00	15.78	10		16.10	87	15.76	15.68
60	16.00	16.22	48	15.72	16.18	30	15.95	16.62	07	15.24	15.63
61		16.55	49	15.70	16.40	31	15.95		08	15.32	15.89
79	16.28	16.91	67	15.75	16.44	49	16.14	16.25	26	15.40	15.88
80		16.68	68	(15.90)	16.70	50	15.90	16.52	27	15.40	16.17
28	15.75	16.41	14	16.30	16.60	95	15.54	16.10	69		16.44
29	15.82		16		15.85	96	15.90	16.02	71	15.44	16.62
66	15.83	16.21	53	15.90	16.55	34			08	15.30	16.05
86	16.47	16.50	72	16.02	16.69	53		16.30	27	15.73	16.07
12		16.29	96	16.15		75	16.35		46		16.24
20	16.05	16.39	03	16.40		80	16.12	16.57	49	15.52	16.10
21	16.00	17.05	04	16.35	17.03	81	15.90	16.49	50	15.40	16.28
61	15.83	16.45	44	15.90	16.20	21	15.95	16.07	89	15.25	15.72
99	16.12	16.73	82	15.95	16.57	58		16.61	27	15.26	15.90
00		17.00	83	(16.15)	16.60	59		16.40	28		15.96
18	16.22	16.25	01	16.43		78	15.90	16.40	46	15.70	16.24
86	16.50	16.68	68		16.60	43	15.82	16.30	09	15.08	15.77
87	16.17	16.75	69	16.10	16.70	44	16.11	16.30	10	15.08	15.81
06	16.20	17.07	88		16.65	62		16.45	28	15.13	16.05
45	15.60	16.23	27	15.45	16.02	01	15.25	16.05	67	15.90	16.35
46	15.53	16.20	28	15.45	16.04	02		15.88	68		16.48
85		16.93	66	16.06	16.59	41		16.52	06	15.26	15.68
05	16.17	16.79	87	16.10	16.65	61	15.94	16.50	26	15.48	16.17
62		16.35	44	15.50	16.24	18		16.20	83	15.40	16.33
83	16.03	16.77	65	15.90	16.45	39		16.35	04	14.90	15.97
72	15.80	16.60	52	15.90	16.40	24	15.52	16.10	86	15.38	15.85
30	15.36	16.10	10	16.10	16.80	82	15.80	16.78	45	15.36	16.05
50	15.55	15.93	30	15.66	16.02	02	15.45	16.07	64	15.70	16.30
									38		
									15		
									34		
									79		
									99	15.08	
									18		
									55		
									75		
									93	15.32	

1633			2031			1649			1818		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.50	15.23	00	(16.25)	16.50	00	15.15	15.92	00	15.86	16.69
17	15.48	15.40	16	15.45	15.82	14	15.48	15.89	11	15.78	16.11
67		16.08	31	14.96	15.29	75	15.23	15.68	80	16.35	16.98
87	15.80	15.98	50	15.30	15.77	95	15.45	15.88	98	15.70	16.05
05	15.10		69		16.03	13	15.57	16.08	16	16.03	16.30
44	15.57	15.91	07	15.93	16.48	51	15.03	15.10	53	16.15	17.21
05	15.02	15.20	64	15.77	15.98	01	15.48	15.70	92	15.70	16.43
42	15.23	16.10	01	16.03		37	15.60	16.38	27	16.23	17.03
61	15.80	16.21	20	15.42	15.12	56	15.05	14.91	46	16.55	16.89
81	15.50	16.22	40	15.04	15.48	76	15.08		65		17.00
82		16.40	41	15.20	15.48	76	15.38	15.88	66		(17.3)
00	14.86	15.20	58	15.24	15.90	94	15.40	15.77	82	16.39	16.93
01	14.64	15.40	59	15.25	15.85	95	15.75	15.80	83		16.90
41	15.35	16.10	95	16.00	16.50	24	15.80	16.58	02	16.10	16.42
42	15.16	15.70	96			25	15.50	15.39	04	15.60	16.03
79	15.90	16.25	33	14.94	15.20	62	14.95	15.30	39	16.15	17.21
98	15.14	15.21	52	15.55	15.90	81	15.54	15.41	57	16.20	
14	15.24	15.58	62		15.53	82	15.45	15.51	43	16.23	16.94
14	15.30	15.70	59		15.89	73	15.18	15.75	25	16.20	16.28
15	14.90	15.85	60	15.53	15.92	74	15.30	15.44	26	15.90	16.50
55	15.70	16.05	99	16.02	16.42	12	15.34	15.93	64	16.42	17.20
92	15.10	15.58	36	15.30		49	14.59	15.12	99	15.90	16.24
93	14.65	15.35	36	15.00	15.39	50	15.18	15.32	00	16.00	16.30
11		15.33	55	15.34	15.43	68	14.90	15.15	18	15.75	16.50
72	15.90	16.50	11	15.86	16.37	18	15.63	16.20	56	16.60	
72	15.50	16.33	12	15.80	16.05	18	15.35	16.55	57		17.15
91	15.40	16.20	30	15.05	15.27	36	15.90	16.23	74		17.40
29	15.30	16.01	68	15.35	16.10	74	15.00		11	15.80	16.50
30	15.20	15.79	69	15.60	15.63	75	14.80	15.82	12	15.95	16.42
68	15.79	16.22	07	15.90	16.62	12	15.21	15.72	48	16.15	
88	15.30	15.82	26	14.90	15.17	31	15.45	16.10	67	16.40	17.33
45		16.22	82		16.20	87	15.52		21		16.80
65	15.66	16.19	03		16.40	07	15.85	16.30	41	16.13	17.10
45	15.29	16.50	78	15.72	16.71	76	14.96	15.76	98	15.85	16.35
03	14.80	15.21	36	15.35	15.49	32		16.34	53	16.15	17.01
22	15.00	15.68	55	15.55		51	14.86	15.21	71	(16.95)	17.04

	1811			1878			2162			1618	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.00	15.90	00	15.45	16.24	00			00	15.83	
11	15.62	16.12	09	15.66	15.95	08	16.15	16.60	07	15.72	16.41
72	15.89	16.37	18	15.70	16.38	63	15.66	16.08	52	15.20	15.80
90	14.94	15.60	36	15.70	16.30	81	16.10	16.55	70	15.36	15.68
08	15.47	16.30	54	14.90	15.47	98	16.09	16.60	87	15.47	16.25
45	15.67		90	15.23	16.10	34	16.10	16.79	23	15.14	15.60
83	14.90	15.70	22	15.60	16.69	60	16.05	16.12	47	14.85	15.21
18	15.50		57	15.15	15.22	95	16.06	16.95	81	15.68	16.31
37	15.80		75	15.58	15.69	12	16.40		99	15.88	16.50
56	15.75		94	15.60	16.17	30	16.35	16.83	18	15.35	16.20
57		16.63	95	15.32	16.17	31			18	15.70	15.98
74	15.52	16.00	11	15.80	16.13	48	15.70		35	14.53	15.20
75	15.60	16.02	12	15.80	16.17	48	15.45	15.90	36	14.60	15.15
93	15.45	16.05	24	(16.48)	16.72	55	15.48	16.15	40	15.02	15.00
94	15.20		26	15.80		56			42	15.45	15.15
29	15.46	16.25	60	15.40	15.60	90	16.04	16.90	76	15.35	15.83
48			78	15.46	16.00	08	16.40	17.10	94	15.90	16.44
32	15.83	16.45	55	14.85		76			60	15.60	15.59
14	15.55	15.99	31	16.00	16.40	46	15.60	15.95	29	14.87	14.99
15	15.45	16.12	32	16.03	16.50	47	15.62	16.03	30	14.70	15.15
52	15.79		68	15.40	15.67	83	15.90	16.07	66	15.30	15.89
87	15.10	15.40	03	15.50	16.07	18	16.25	16.67	00	15.75	16.50
88	15.20	15.36	04	15.70	16.17	18			01	16.20	16.40
06	15.44	15.79	21	15.66	16.36	36	16.12	16.13	18	15.66	15.90
43		16.50	53	15.08	15.54	60	15.57	15.76	42	15.20	15.30
44			54	14.90	15.43	61	15.70	16.20	42	15.08	15.60
62	15.87	16.67	71	15.25	15.60	78	15.60	16.14	59	14.90	15.99
98	15.07	15.92	07	15.70	16.32	14	16.24	16.80	95	15.50	16.60
99	15.10	15.81	08	15.75	16.21	15	15.95	17.02	96	15.65	16.40
35			43	15.60	15.90	50	15.70		31	14.82	14.90
54	15.43		62	15.04	15.48	68	15.50		49	15.15	15.40
08	15.30	16.03	15		16.31	20		16.80	01		16.50
28	15.40	16.43	34	15.75	16.61	39	15.64	16.10	20	15.20	15.96
84	14.94	15.69	84	15.46	15.95	82	15.90		62	15.40	15.95
39			38	15.85	16.29	36	15.91	16.47	15	15.60	16.22
57	15.60		56	14.85	15.39	54	15.60	15.75	33	14.89	15.19

1892			2161			1794			862		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.21	16.35	00	16.28	16.45	00	15.12	15.79	00	14.83	
07	15.23	15.62	06		16.31	05	15.30	15.71	05	15.18	
50	15.85	16.33	95	16.07	15.99	71	15.75	17.07	64	15.85	16.26
68	16.23	16.60	13	16.10	16.45	89	15.90	15.92	81	16.01	15.90
85	16.14	16.80	30		17.00	05	15.20	16.05	98	15.10	15.40
20	15.38	16.20	65		15.65	40		16.30	33	15.25	16.08
44	15.61	16.50	82	15.80	16.20	55	16.10	16.54	46	15.52	16.15
78	15.97	16.94	16	16.25	16.23	89	15.84	16.32	80	15.75	15.99
96	15.96	16.03	34	16.38	16.70	06	15.70	15.99	97	15.30	15.00
15	15.68	15.97	52	15.45	15.95	24	15.57	16.29	15	15.20	15.65
16	15.36	15.98	53		15.80	25		16.09	16	15.34	15.61
32	15.97	16.20	69	15.41		41	15.70	16.61	32	15.15	
33		16.30	70		15.88	42	15.54	16.51	33	15.35	
37	15.51	16.15	68	15.48	15.89	38	15.90	16.19	28	15.32	16.01
39	15.87	16.30	70			39	15.92	16.21	29		
73	16.53	16.69	03	16.01	16.16	72	16.30	16.90	62	16.11	16.05
90	16.17	16.12	20	16.06	16.30	90	15.40	16.11	80	15.71	16.09
56	16.25	16.45	78			43	16.00	16.91	32		
25	15.62	16.17	41		16.48	04	15.37	15.75	92	14.95	15.32
26	15.89	16.21	42	16.45	16.50	05	16.00	15.97	93	14.91	15.00
62	16.33	16.46	78	15.78	16.26	40	16.08	16.39	28	15.44	15.75
96	15.70	16.31	11	16.28	16.53	74	15.95	16.80	62	15.90	16.15
97	15.32	16.19	12		16.80	75	15.80	16.41	63	15.32	
14	15.40	16.07	29	16.22	16.71	91	15.57	16.08	79	15.63	16.00
38		16.21	46	15.60	16.30	06	15.40	16.10	93	15.05	15.18
38	15.65	16.50	47	15.82	16.10	06	15.60	15.83	94	14.98	15.07
55	15.99	16.50	63	15.13	15.47	23	15.38	16.20	10	15.20	15.60
91	15.60	16.60	98		16.31	58	15.90	16.60	45	15.58	15.74
92	15.93	16.46	99		16.25	59	15.70	16.53	46	15.48	15.92
27	15.51	16.05	34	16.30		93	15.57	15.52	80	15.88	15.69
45	15.98	16.50	52	15.60	15.68	11	15.50	16.10	98	14.83	15.10
97	15.52	16.22	03		16.52	62	(15.70)	16.82	48	15.45	16.22
16	15.53	15.98	22		16.61	80	15.80	16.68	67	15.78	16.24
57	15.92	16.38	56	15.30	15.50	12	15.68	15.83	98	14.98	15.29
10	15.60	16.08	09	15.81	16.45	64	16.05	16.50	50	(16.22)	16.22
28	15.61	16.07	26	16.25	16.50	82	15.86	16.50	67	15.82	16.08

1503			1537			10375			2144		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.79	16.61	00	16.05	16.17	00	15.57	16.49	00	15.80	16.80
04	15.59	16.50	04	15.55	15.83	02	15.79	16.44	02	15.70	16.12
55	15.39	15.84	32	16.00	16.30	74	15.37	15.80	72	15.50	15.75
73	15.56	16.44	49	15.77	15.80	92	15.70	15.98	89	15.60	16.00
89	15.73	16.95	65	15.40	15.60	08	16.02	16.23	05	16.00	16.60
24	15.19	15.25	00	15.75	15.93	42	15.86	16.82	39	15.62	16.20
37	15.01	15.83	10	15.80	15.97	45		16.50	42	15.65	15.82
70	15.39	16.04	43	16.00	16.21	78	15.64	15.89	75	15.53	15.88
88	15.70	16.40	61	15.45	15.43	95	15.80	15.98	92	16.10	16.02
06	15.83	16.92	78	15.50	15.98	12	15.80	16.47	09	16.38	16.34
06	16.00	16.19	79	15.40	15.55	13	(16.10)	16.48	10		16.45
22	15.10	15.21	95	15.60	16.22	29	15.87	16.40	26	16.00	
23	14.99	14.95	96	15.40	15.91	30		16.40	26		16.70
17	15.07	15.85	87	15.60	16.07	15	15.90	16.44	11	15.72	16.37
19	14.90	15.41	89			16			12		
52	15.21	16.22	22		16.50	48	16.10	16.33	45	15.49	15.55
69	15.30	16.19	39	16.21	16.27	65	15.82	16.05	62	15.35	15.52
20	14.86	16.83	86			04			00		
79	15.42	16.19	43	15.70	15.85	55	15.75	16.33	51	15.60	15.64
80	15.40	16.27	44	15.75	15.95	56	16.04	16.28	52	15.40	15.60
15	15.39	16.92	79	16.45	15.65	90	15.81	16.13	86	15.66	16.08
49		16.20	12	15.88	15.97	23	16.16	16.42	18	16.30	16.50
50	15.10	15.90	13			24	15.90	16.42	19		16.63
66	15.30	16.04	29	15.80	16.60	40	15.78	16.52	35	16.18	16.40
79	16.00	16.18	39		16.20	43	16.03		38		16.07
79	15.59	16.25	40	16.08	16.18	44	16.06	16.52	39	15.50	16.13
96	15.85	16.70	56		15.83	60	15.73	16.12	55	15.30	15.50
30	15.19	15.60	90	15.50	15.70	94	15.83	16.30	89	15.65	16.03
31	14.55	15.39	92	15.60	16.20	94	15.95	16.27	90	15.60	16.00
65	15.09	15.93	25	16.18	16.24	28	16.18	16.26	23		16.70
83	15.75	16.40	43	15.90	15.95	45	15.97	16.60	40	15.45	15.72
34	15.29	15.23	93	15.34	15.84	95			90	15.50	16.30
52	15.22	16.19	12	15.65	16.00	13	15.85	16.35	08	16.10	16.30
82	15.65	16.32	39	15.95	16.45	33	16.07	16.60	28	16.28	16.75
34	14.81	15.22	90	15.63	15.60	84	15.84	16.32	78	15.70	16.08
51	15.31	16.10	07	15.70	16.13	00	15.93	16.28	95	15.81	16.01
			06								
			74	15.57							

1500			2203			2198			2124		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		17.47	00	16.00		00	14.94		00	15.86	
02	15.95		02	15.77		00	15.07		00	15.60	16.38
68	16.00	16.37	60	15.13	15.60	02	15.38	15.47	02	15.43	16.08
85	16.02	16.61	77	15.80	16.05	19		15.75	19	15.06	15.43
01	15.90	16.54	94	15.69	16.12	35	15.70	15.82	35	15.41	15.68
35	15.63	16.14	28	15.90	16.84	68	15.95	16.69	68	15.63	16.19
38	15.52	15.71	29		16.81	63	15.90	16.71	63	15.55	16.40
71	16.04		62	15.57	15.75	95	15.26	15.60	95	16.00	16.23
87	15.90	16.36	79	15.83	15.82	12	15.80	15.70	12	15.40	15.33
04		16.95	96	15.73	16.13	29	15.50	16.05	29	15.23	15.70
05		16.62	97		16.60	30	15.50	16.40	30	15.48	15.83
21	15.70	16.57	12	15.85		45	16.03		45	15.06	
22		16.33	13			46			46	15.56	16.12
06	16.10	17.03	97	16.05	16.22	23	15.52	16.03	23	15.21	15.60
07	16.00		98			24			24		
40	15.35	15.80	30	16.00	16.89	56	16.27	16.33	56	15.52	15.83
63	15.65	16.07	47	15.21	15.62	72	15.97	16.90	72	15.68	15.80
94	16.14	16.60	84			00			00		
44	15.60	15.85	33		16.52	43		16.20	43	15.57	16.00
46	15.48	16.32	34	15.93	16.31	44	15.75	16.26	44	15.24	15.85
80	16.10	16.43	68	15.70	15.80	78	16.42	16.80	78	15.82	16.26
12	16.20	16.53	01	16.05	16.32	10	15.50	15.92	10	15.52	15.50
13			02		16.40	11	15.00	15.88	11	15.50	15.85
29	15.70	15.85	18	16.00	16.67	26	15.50	16.05	26	15.22	15.50
32		15.90	19	16.20	16.59	21	15.50	15.87	21	14.97	15.35
32	15.65	15.80	20	16.12	16.35	22	15.98	16.10	22	15.22	15.53
48	15.45	16.36	36		16.28	38	...	16.10	38	15.17	15.65
82		16.47	70	15.27	15.67	71	(16.6)	16.50	71		16.07
83	15.70	16.48	71	15.50	15.73	72	16.26	16.67	72	15.60	16.04
16	16.12	16.51	04	16.15	16.05	04	15.40	15.58	04	15.40	15.52
33	15.48	15.84	21	16.17		21	15.55	16.18	21	15.25	15.55
83		16.41	70	15.34		70		16.60	70	15.45	16.40
01	15.80		88	15.64	16.01	87	15.24	15.90	87	15.64	16.24
20	15.72	16.40	07	15.72	16.60	99	15.06	15.63	99	15.58	16.49
71	15.60	16.29	57	15.44	15.56	48	16.17	16.32	48	15.30	15.83
88	16.05	16.60	74	15.66	15.93	65	16.02	16.52	65	15.70	15.90

2040			1612			1492			1979		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		16.18	00	16.40	16.30	00		16.44	00	15.38	16.20
99	15.90	16.30	98		16.03	96	15.46	16.08	96	15.13	16.10
76	15.88	16.30	37	15.90	16.25	79	15.50		77	15.15	15.91
92	15.79	16.40	53	14.90	15.16	95	15.42	15.88	93	15.25	16.07
08	15.60	16.00	69	15.00	15.63	10	15.35	16.05	08	15.23	16.17
41	15.33	15.80	02	15.34	16.30	43	14.75	15.28	40	15.00	15.65
33	15.00	15.60	89	15.35	15.99	23	14.60	15.09	21	15.04	15.62
65	15.30	16.13	20	16.08	16.76	54	15.30	15.45	52	15.20	15.34
81	15.71		37	15.55	16.12	70	15.42		68	15.30	15.62
98	15.91	16.60	54	14.80	15.46	87	15.30	15.92	84	15.04	16.10
99	15.69	16.40	54	14.65	15.18	88	15.50	16.00	85	15.60	15.90
14	15.06	15.48	69	15.44	15.77	02	15.20	16.04	00	15.35	16.08
15	15.33	15.25	70	15.25	15.62	03	15.33	15.90	00		16.12
89	15.53	16.30	40	15.30	16.25	66	15.23	15.77	64	15.10	15.60
90	15.84	16.48	41	15.30	15.23	68	15.47	15.78	65	16.45	
22	14.76	15.20	72	15.35	15.83	98	15.44	16.05	95	15.30	16.04
38	15.18	15.62	88	15.30	15.93	14	15.12	15.52	11	15.45	15.80
62	15.26	16.05	06	15.58	16.60	22	14.76	14.83	19	14.95	15.70
03	15.42	16.33	43	15.00	15.73	54	15.10	15.80	50	15.16	15.62
04	15.89	16.20	44	15.10	15.90	55		15.52	51	14.90	15.62
37	15.05	15.50	77	15.48	15.94	87	15.39	15.94	84	15.05	15.85
69	15.69	15.97	08	15.60	16.50	18	14.64	15.25	14	(15.26)	15.70
70	15.41		09	15.40	16.33	19	14.66	15.30	15	15.20	15.78
85	15.68	16.13	24	15.43	16.44	34	14.70		30	14.63	15.33
77	15.90	16.02	12	15.55	16.53	14	15.18	16.05	11	(15.22)	16.02
78	16.00	16.26	12	15.54	16.70	15	14.96	15.58	11	14.97	16.03
93	16.04		28	15.60	16.40	30	14.63	15.10	26	15.10	15.56
26	14.98	15.23	60	14.80	15.40	62	15.40	15.85	58	15.10	15.80
27	14.91	15.55	61	14.90	15.50	63	15.40	15.83	59	(14.90)	
59	15.40	15.66	93	15.50	16.58	94		15.93	90		15.77
76	15.76	15.78	10	15.58	16.35	11		15.80	07		15.71
24		15.50	57	15.00	15.42	58	15.20	15.68	54	15.23	15.80
42	15.19	15.68	74	14.98	16.17	74		15.86	71	15.25	16.02
50	15.41	16.04	78	15.23	15.90	71	15.10	15.73	67	15.04	16.10
99	15.85	16.45	27	15.85	16.86	19	14.85	15.27	15	15.05	16.05
16	14.93	15.41	43	15.21	15.70	35	14.70	15.05	31	14.93	15.49

1676			11193			2174			1412		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.75	16.43	00	15.95	16.36	00	15.20	16.23	00	15.90	16.60
95	15.95	16.56	94		16.10	94	15.53		94	16.09	
30	15.26	15.83	10	15.50	15.88	09	15.15	15.97	92	15.72	16.35
45	15.70	16.04	26	15.70	15.97	25	14.87	15.69	08	15.90	16.79
60	15.62	16.17	41	15.84	16.12	40	14.82	15.42	23	16.20	16.80
92	15.75	16.70	72		16.60	71	15.02	15.70	54	15.48	16.03
66	15.80	16.60	45		16.20	44	14.80	15.30	24	16.03	17.60
97	16.11	16.65	75	16.18	16.62	74	14.93	15.49	54	15.65	16.23
13	15.40	15.49	91	16.15	16.30	90	15.40	15.68	70	15.93	16.60
29	15.33	15.97	07	15.77	15.90	06	15.40	15.93	86	15.90	16.62
30	15.32	15.75	08	(15.60)		07	15.47	16.21	87	15.55	16.40
44	15.50	16.13	22	15.52	16.00	21	14.90		01	16.00	16.65
45	15.90		23	15.54	15.95	22	15.24	15.63	02		16.60
03		16.07	79		16.70	78	15.23	15.82	56	15.40	15.99
04	15.50	15.90	80	16.00	16.35	79			57		15.62
34	15.29	16.23	10	15.58	16.03	09	15.26	16.03	87	15.80	16.67
50	15.57	16.72	26	15.35	15.85	24	15.44	15.41	02	15.90	16.74
50	15.55	16.30	23	15.60	16.20	22			97	16.04	16.73
77	15.80	16.40	48		16.20	46	14.87	15.50	20	16.20	16.50
78	16.00	16.57	49		16.24	47	14.87		21	16.20	17.77
09	15.70	15.60	80	16.00	16.70	79	15.16	15.91	52	15.70	16.10
40	15.50	16.33	10	15.75	15.93	09	15.45	16.09	82	15.85	16.80
40	15.40	15.99	11	15.44	15.80	10		16.18	83	15.45	16.44
56	15.58	16.40	26		16.00	24	15.12	15.44	98	16.07	16.68
30	15.20	15.95	98	15.86	16.23	97		15.93	68	15.65	16.00
31		16.34	99	15.84	16.29	98	15.35	16.04	69	15.64	16.30
46	15.48	16.50	14	15.30	15.95	12	15.17	15.95	83	15.90	16.31
77		16.62	45	15.70		43	14.63	15.28	14		16.49
78	16.10	16.40	46		16.20	44	14.73	15.20	15	15.90	16.87
09	15.68	15.77	77	16.05	16.39	75	15.02		46	16.00	15.99
25	15.26	15.61	93	15.82	16.23	91	15.23	15.96	62	15.75	16.25
71		16.59	39		16.20	37	14.93	15.34	07		16.47
88		16.70	55	15.86	16.25	53	14.77	15.50	24		16.91
78	16.11	16.53	44	15.73	16.31	42	14.73	15.39	10	16.05	16.80
25	15.50	16.05	90	16.12	16.34	88	15.40	15.75	56	15.40	15.89
41	15.60	16.33	06	15.70	16.08	04	15.12	15.93	72	15.60	16.31

2142			1862			1988			1400		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	16.15	16.62	00	15.14	15.95	00	15.70	16.17	00	14.82	16.08
93	16.00	16.28	93	15.80	15.84	92	15.30	15.90	91	15.10	15.85
79	15.60	16.27	79	15.25	15.67	44	15.23	15.54	03	15.30	15.70
95	15.87	16.30	94	15.17	16.13	60	15.05	15.38	19	15.31	15.95
10	15.35	15.90	09	15.90	16.30	75	15.60	15.90	33	15.70	16.38
41	15.23	15.80	40		16.62	06	15.44	16.18	64	15.11	15.70
10	15.40	15.70	10	15.79	16.31	71	15.50	15.70	24	15.56	15.96
40		15.61	39	16.38	16.50	00	15.80	16.08	53	15.75	16.21
55	15.65	15.73	55	15.90	15.97	16		16.40	68	15.31	15.59
71	15.85	15.99	71	15.03	15.40	31	15.95	16.33	84	15.27	15.75
72	(15.55)	16.21	72	15.30	15.70	32	15.98	16.52	85	15.07	15.70
86	15.50		86	15.50	15.79	46	15.00	15.64	98	15.22	15.91
87		16.40	87	15.75	15.87	47	15.30	15.52	99	15.39	15.77
39	15.30	16.05	39	16.20	16.60	96	15.48	16.50	43	15.90	16.42
40			40		16.02	97		15.98	45	15.47	
70	15.80	16.69	70	14.90	15.47	26	15.98	16.45	73	14.85	15.66
86	15.90	16.60	85	15.53	15.76	41	15.44	16.00	88	15.31	15.73
78			78	15.08	15.68	29	16.02	16.57	70	15.17	15.58
00	16.01	16.40	99	15.55	15.93	46	15.14	15.52	83	14.99	15.62
01	15.82	16.51	00	15.37	15.83	48	15.20	15.53	84	15.10	15.78
32	15.30	15.52	32	15.77	16.56	78	15.40	15.88	15		15.95
62	15.70	15.93	62	15.45	16.04	08	15.80	16.15	44	15.80	16.47
63	15.80	16.04	62	15.65	16.05	09	15.30	16.30	45	(15.7)	
77	16.00	16.20	77	14.95	15.60	23	15.82	16.26	59	15.46	16.07
46	15.20	15.75	46	15.85	16.70	88	15.20	15.83	19	15.59	16.20
47	15.54	15.76	46	16.10	16.52	89	15.42	16.17	20	15.34	16.11
62	15.44	16.30	61	15.60	15.86	03	15.50	16.30	34	15.67	16.40
92	16.20	16.58	92	15.50	15.68	34	16.05	16.17	64	15.41	15.78
93	16.16	16.81	93	15.18	15.90	35	15.68	16.22	65	15.30	15.95
24	14.90	15.05	23		16.20	65	15.05	15.48	95	15.38	15.77
40	15.40	15.59	39	15.80	16.56	81	15.25	15.50	10	15.29	15.77
85			84	15.50	16.04	25		16.40	54	15.49	16.32
01	15.60	16.50	01	15.45	15.85	42	15.25	15.71	71	14.85	15.58
86	15.85		86	15.50	16.00	22	15.56	16.46	46	15.79	16.47
32	15.44	15.60	32	15.84	16.63	68	15.20	15.50	91	15.11	15.92
48	15.61	15.73	48	16.10	16.80	83	15.40	15.60	06	15.38	15.65

2163			1855			2054			2119		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	17.10	15.73	00	15.40	16.13	00		16.21	00	14.96	15.82
91	15.09	15.40	89	15.48	15.80	85	15.68		83	15.36	15.75
83	15.66	15.82	16	15.73	16.10	79	15.30	15.90	37	15.35	16.15
98	15.50	15.54	31	16.04	16.30	94	15.58	16.23	51	15.46	16.20
12	15.65	15.77	45	15.85	15.90	07		16.07	64	16.00	16.38
42	15.73	16.50	75	15.06	15.65	35	15.00	15.33	92	15.22	15.52
00	15.40		25	15.90	16.40	70	15.00	16.28	21	15.48	15.97
29	16.00	16.00	54	15.30	15.74	97	15.40	16.31	48	15.86	16.09
44	16.05	16.35	68	15.47	15.45	11	15.53	16.10	62	16.04	16.65
60	16.13	16.50	83	15.40	16.05	25	15.25	15.70	76	15.90	16.19
61		16.48	84	15.34	15.50	26	15.20	15.70	77	(15.97)	16.08
74	15.65		98	15.10	15.85	39	14.80	15.40	90	15.24	
75		16.25	98	15.42	16.17	40	15.00	15.28	90	15.53	15.65
17	15.60	16.10	33	15.72	16.50	59	15.16	16.04	05	14.95	
18			34	16.00	16.10	60	15.45	15.60	06		15.70
47	16.00	16.60	62	15.58	15.78	86		16.29	32	15.41	16.08
62	15.80		77	15.24	15.60	00		15.99	46	15.83	
40			44	15.48	15.76	47	15.16	15.63	86	15.25	
51	16.10	16.40	49	15.73	15.86	38	14.98	15.60	72		16.45
52	15.75	16.23	50	15.23	15.90	39	15.03	15.40	73	15.74	16.50
82	15.70	16.14	80	15.50	15.85	67	15.20	15.71	01		15.71
12	15.52	16.20	08		15.96	94	15.55	16.13	28	15.60	16.01
12	15.20	15.59	09		16.04	95			29		16.00
26	15.60	16.07	23	15.70	16.23	08	15.72	16.00	42	15.30	16.08
84	15.57	15.80	73	15.44	15.60	42	15.00	15.55	71		16.60
85		16.20	73	15.23	15.85	43	15.28	15.49	72	15.93	16.56
99	15.10	15.65	87	15.34	15.68	56	15.17	15.60	85	15.45	15.97
29	15.50	16.03	17	15.55	16.26	84	15.54	16.00	12		15.73
30	15.60	16.02	18		16.11	85	15.40		13	15.20	15.90
59	16.12	16.42	46	15.67		12	15.27	15.93	40	15.50	16.12
75	15.62	16.07	61	15.27	15.48	27	15.20	15.74	54	15.88	16.21
19	15.45	15.88	04	15.47	15.86	68	15.40	15.97	95	14.83	15.51
35	15.45	16.17	20	15.45	16.28	83		16.10	09	15.07	15.90
08	15.35	15.84	85	15.26	16.20	31	15.18	15.70	53	15.80	16.53
52		16.44	29	15.78	16.40	73	15.45	16.20	94	15.40	15.81
67	15.89	16.33	44	15.60	15.93	87	15.80	16.05	08		15.72

853			1548			1973			1355		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.52	14.68	00	15.39	16.18	00	15.17	15.90	00	14.80	16.00
83	14.47	14.70	82	15.64	16.00	81	15.43	15.95	81	15.21	15.83
13	14.65	15.02	07	15.72	16.24	58	15.25	16.25	57	15.20	15.50
27	15.05	15.27	21	15.21	15.91	72	15.62	16.15	71	15.42	15.92
40	15.00	15.65	34	15.05	15.62	84	15.16	15.45	84	15.38	16.12
68	15.12	15.60	62	15.01	15.93	12	15.12	16.08	11	15.15	15.27
94	14.63	14.38	87	15.40	16.10	32	15.47	16.48	31	14.80	15.23
21	14.90	15.18	14	15.50	15.80	58	15.77	16.34	57	15.34	15.77
34	15.17	15.23	28	15.28	15.70	71	15.80	15.80	70	15.60	15.91
48	15.07	15.54	42	15.05	15.81	85	15.07	15.78	84	15.60	16.12
49	15.31	15.70	42	14.91	15.52	86	14.93	15.53	85	15.28	16.09
62	15.40	15.82	55	15.24	15.78	98	15.10	15.73	97	15.30	15.93
62		15.75	56	15.19	15.86	99	15.32	15.48	98	15.50	15.98
74	15.14		67	15.13	16.11	04	15.18		03	15.26	16.05
75	15.25	15.30	68	15.47		06	15.05	15.50	04	15.07	15.25
01	14.52		94	15.42	16.08	31	15.76	15.78	30	14.95	15.20
15	15.08	15.27	08	15.80	15.83	45	15.50	16.30	43	15.33	15.62
51	15.25	15.76	43	15.15	15.40	72	15.45	16.23	71	15.67	16.25
36	15.10	15.54	26	15.18	15.83	51	15.88	16.43	49	15.15	15.60
36	15.08	15.55	27	15.05	15.59	52	15.90	16.22	50	14.82	15.84
64	15.20	15.58	55	15.25	15.62	79	15.35	15.73	77	15.15	16.10
91	14.43	14.60	81	15.43	16.13	05		15.78	03	15.14	15.93
91	14.30	14.70	82		16.28	06	15.00	15.73	04		15.61
04	14.73	15.10	95	15.47	16.31	18	15.30	15.77	17	14.50	14.97
31	14.75	15.58	20	15.35	16.05	38	15.61	16.28	36	14.70	15.58
31	14.95	15.27	21	15.40	15.85	39	15.30	15.90	37	15.00	15.70
44	15.40	15.40	34	15.01	15.40	52	15.60	16.45	50	15.35	15.60
72	15.05	15.27	61	15.51	16.08	78	15.08	15.57	77	15.25	16.03
72	15.15	15.40	62	15.01	15.83	79	15.28	15.55	78	15.30	16.30
99	14.48	14.47	89		16.32	06		15.73	04	15.50	15.83
13	14.65	14.83	03	15.67	16.10	19	15.20	16.06	18	14.61	15.00
53	15.30	15.85	43	15.07	15.60	59	15.60	16.31	57	15.06	15.76
68		15.54	58		15.79	73	15.40	16.23	71	15.15	15.95
08	14.80	14.90	97	15.61	16.13	07	15.45	15.91	05	15.30	15.58
49	15.28	15.68	38	14.78	15.42	47	15.63	16.08	45	14.93	15.39
63	15.27	15.71	52	15.09	15.90	60	15.80	16.49	58	15.13	15.52

1758			2081			1582			1666		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.40	16.55	00	14.66	15.74	00	14.61	14.94	00	14.78	15.13
81	15.25	15.95	80	14.63	15.37	79		14.69	85	15.31	16.40
51	15.18	15.41	12	14.69	15.60	86	14.56	14.73	55	14.98	16.08
65	15.17	15.80	25	14.98	15.71	99	14.70	15.00	68	15.37	16.30
77	15.40	16.08	38	14.90	15.68	12	14.99	15.26	80	15.35	16.38
04	15.50	15.91	65	14.53	15.14	38	14.99	15.65	06	14.69	14.88
24	14.63	15.15	80	14.63	15.30	50	15.11	15.69	14	14.81	15.24
50	15.20	15.12	05	14.97		75	14.57		39	15.10	
63		15.48	18	15.04	15.68	88	14.57	14.70	52	15.20	
77	15.28	15.78	32	15.00	16.41	02	14.89	15.24	66	15.19	15.97
78	15.35	15.93	33	15.00	15.49	02	14.89	15.23	66		
90	15.30		45	14.63	15.60	14	15.10	15.37	78	15.37	16.14
91	15.80	16.20	45	15.13	15.35	15	15.21	15.33	79	15.44	16.40
96	15.82	16.21	46	14.78	15.65	13	15.19	15.29	73	15.35	
97	15.34	15.58	47	14.63	15.70	14	14.99	15.37	74	15.32	
22	14.80	14.91	72	14.80	15.41	39	15.04	15.55	99	14.47	15.79
36	15.00	15.27	86	14.85	15.47	52	15.37		12	14.64	15.23
62	14.92	15.83	06	14.77	15.77	68		15.19	23	14.80	15.06
40	15.00	15.48	80	14.98	15.30	40	15.09	15.60	92	15.00	15.70
41	14.70	15.38	81	14.73	15.35	40		15.57	92	14.85	15.58
68	15.15	15.65	08	14.78	15.74	67	14.65	15.10	19	15.37	14.94
94	15.40		33		15.95	92	14.41	14.73	44	15.05	15.50
95	(16.25)	16.35	34	14.77	15.72	93	14.50	15.20	44	15.05	15.88
07	14.93	15.63	46	14.70	15.68	05	14.90	14.84	56	15.12	15.84
26	14.83	15.53	61	14.35	15.25	17	14.91	15.34	64	15.40	16.20
27	14.92	15.22	62	14.50	15.30	17	14.74	15.78	65	15.50	16.10
40	14.80	15.58	74	14.85	15.17	30	15.30	15.83	77	15.40	16.22
66	15.05	15.87	00	14.77	15.55	56	15.40	15.91	03	14.79	14.90
67	14.95	15.84	01	14.87	15.60	57	15.12	15.64	04		15.21
94	15.35	16.08	27	14.98	15.60	82		14.67	29	14.70	15.50
07	15.35	16.10	41	14.90	15.75	96	14.50	15.09	42	14.89	15.93
46	15.07	15.83	79	14.72	15.51	34	15.35	16.03	80	15.47	16.35
61	15.03	15.72	93	14.82	15.54	48	15.10	16.09	94	14.84	15.59
94	15.28	16.50	22	14.87	15.88	73	14.50	14.93	15	14.61	15.31
34	14.85	15.50	61	14.59	15.31	12	14.60	15.38	54	15.20	15.81
47	15.00	15.71	74	14.79	15.20	25	14.79	15.46	67	15.70	16.12

	1709			1764			845			1396	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		15.89	00	15.45	16.40	00	14.45	14.80	00	14.53	15.18
77	15.10	15.70	76	15.27	15.70	76	14.75	15.63	75	15.00	15.70
13	15.70	16.24	00	15.23	16.35	95	14.48	14.68	59	15.18	
26	15.20	15.62	13	15.55	16.08	08	14.64	14.97	72	15.28	15.83
38	14.40	15.02	25	15.33	16.10	20	14.65		84	14.85	15.17
64	15.03	15.53	50	15.00		45	14.85	15.75	09	14.80	15.46
68	15.00		52	15.05		46	15.10	15.70	06	14.84	15.27
92	15.65	15.75	77	15.42		71	15.26	15.83	30	15.16	
05	15.50	15.81	90	15.60		84	14.92	15.15	43	15.27	15.75
18	15.57	16.11	03	15.65	16.00	97	14.52	14.82	56	15.36	16.00
19	15.65	16.24	03	15.32	16.20	97	14.33	14.78	56	15.32	16.10
30	15.00	15.37	15	15.46	16.08	09	14.76	15.00	68	15.25	15.95
31	15.13	15.65	16		16.08	10	14.80	14.99	68		16.00
21	15.70	16.10	04	15.40	16.21	97	14.40	14.79	52	14.95	
22	15.21	15.44	05		16.30	98	14.53	14.93	53	15.08	16.15
46	14.97	15.07	29	15.58		22	14.40	15.28	77	15.14	15.72
59	14.98	15.68	42	15.24	15.30	35	15.07	15.63	89	14.64	15.00
64	14.81	15.13	45	15.13	15.50	37	15.00	15.68	86	14.43	15.30
28	15.10	15.50	07	15.55	16.13	99	14.40	14.90	45	15.18	15.75
29	15.20	15.72	08	15.45	16.12	00	14.32	14.92	46	15.05	16.03
54	14.90	15.23	34	15.20	15.66	26	14.80	15.16	71	15.20	16.30
79	14.96	15.59	58	15.00	15.70	50	15.06	15.90	95	14.45	15.10
80	14.80	15.58	59	15.10	15.83	51		15.72	95		14.95
92	15.13	16.07	71	14.96	15.44	63	15.34	15.98	07	14.70	15.40
95	15.20	16.09	72	15.30	15.85	64	15.16	16.03	04	14.60	15.26
96	15.35	16.10	73	15.20		64	15.35	16.10	05	14.70	15.34
08	15.74	16.38	85		15.90	76	15.00	15.48	17	14.85	15.48
33	14.90	15.53	10	15.50	16.46	02	14.27	14.97	41	15.15	15.88
34	14.84	15.38	11	15.45	15.99	02	14.39	14.95	42	15.09	
59	14.90	15.17	36			27	14.70	15.52	67	15.40	16.35
72	15.06	15.50	49	15.03	15.45	40	15.01	15.73	79	14.98	15.43
09	15.53	16.31	87	15.35	16.05	77	15.25	15.80	16	15.07	15.60
23	15.06	15.86	00	15.70	16.63	90	14.60	14.89	29	14.88	15.70
39	14.60	14.91	14	15.56	16.29	04	14.63	15.00	39	15.13	15.95
77	15.25	15.50	52	14.77	15.60	42	15.03	15.72	76	15.10	15.58
90	15.54	15.98	65	15.37	15.62	55	15.30	15.97	88	14.50	14.72

1632			1783			1437			1338		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00			00	14.73	15.55	00	14.41	15.35	00	14.70	14.85
75		15.70	74	14.77	15.20	72	14.15	14.85	71	16.12	15.99
39	14.78		32	15.10	15.80	63	14.50	15.06	29	15.12	15.28
51	14.81	15.74	44	15.40	15.93	75	14.33	15.00	41	15.30	15.60
63	14.87	15.98	56	14.87	15.55	87	14.62	15.27	52	15.50	16.07
88	15.09	15.73	81	14.77	15.35	11	14.79	15.38	76	15.58	15.90
83	15.25	15.97	75	14.78	15.26	97	14.50	15.20	58	15.52	15.83
07	15.43		99	14.70	15.25	20	14.87	15.14	81	15.90	15.77
19	15.31		11	14.95		32	14.93	15.30	93	15.17	15.21
32	15.00		24	15.07	15.90	44	14.82	15.50	05	14.84	14.94
32	15.18	15.75	25	15.29	16.00	45	14.94	15.65	06	14.82	14.90
44	14.90		36	15.10	15.75	56	14.66	15.20	17	14.88	15.18
44	15.40	15.91	36	15.42	16.05	57	14.86	15.27	17	15.00	15.45
26	15.25	15.98	17	14.95	15.60	30	14.73	15.40	87	15.48	15.60
27	15.20	15.99	18	15.09		31	14.85	14.84	88		
50	15.00	15.90	42	15.30	15.78	54	14.48	15.20	10	14.98	14.95
63	14.81	15.68	54	14.83	15.24	65	14.38	15.03	22	14.90	15.27
56	14.99	15.62	47	15.12	15.52	47	14.96	15.48	99		
13	15.38	16.07	02	14.67	15.60	96	14.67	15.24	44	15.45	15.83
14	15.12	15.97	03	14.76	15.60	97	14.63	15.34	45	15.60	15.73
39	15.00	16.00	28	15.20	15.93	21	15.00	15.30	69	15.78	16.08
63	14.79	15.74	52	14.82	15.58	44	14.73	15.60	92	15.10	15.46
63	14.95	15.80	52	15.10	15.40	45	14.70	15.35	92	14.85	15.40
75	15.12	15.60	64	14.52	15.11	56	14.40	15.45	03	14.95	15.17
70	15.35	15.80	58	14.75	15.30	42	14.79	15.65	85	15.02	15.53
70	14.97	15.85	59	14.56	15.20	43	14.97	15.42	86	15.46	15.70
82	15.30	16.07	70		15.18	54	14.68	15.40	97	14.64	14.95
06	15.59	16.22	95		15.37	78	14.45	15.13	21	14.88	15.12
07	15.19	16.02	96	14.85	15.30	79	(14.28)	15.20	21	15.02	15.25
31	14.76	15.72	20	14.95		02	14.35	15.07	44	15.52	15.65
44	15.05	15.78	32	15.12		14	14.61	15.50	57	15.25	15.75
80	15.41	16.01	68	14.74	15.31	50		15.85	91	15.32	15.40
93	15.70	16.02	82	14.72	15.40	62	14.40	15.05	04	14.77	15.03
01	15.19	16.32	89	14.64	15.45	60	14.50	15.20	98	14.70	14.73
38	14.90	15.75	25	14.94	15.80	96	14.35	14.99	33		15.28
50	14.89	15.60	37	15.16	15.91	08	14.47	15.70	45	15.45	15.77

1784			1790			2103			2087		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00		16.00	00	14.64	15.07	00	14.95	15.62	00	15.19	15.93
70	14.95	15.23	68	15.25	15.85	68	15.34	16.00	66	14.94	15.95
76	14.82	15.31	25	14.80	15.30	96	15.00	15.29	53	15.09	15.60
88	15.10	15.67	37	14.83	15.38	08	15.10	15.31	64	15.30	15.53
99	15.18	16.05	48	15.00	15.73	19	15.40	15.75	74		15.60
22	15.45	16.40	70	15.33	16.11	41	15.32	16.07	96	15.04	16.05
98	15.30	15.90	40	14.80	15.43	08	14.90	15.07	58	15.18	15.70
20	15.80	16.22	62	15.40	15.91	29	15.28	15.72	79	15.03	15.69
32	15.40	16.14	74		16.03	41	15.50	15.90	90	15.20	15.55
44	15.25	15.63	85	15.23	15.93	52	15.52	16.32	01	15.15	16.03
45	14.92	16.08	86	15.02	15.98	53	15.40	15.95	02	15.35	15.70
55	14.80	15.20	96	14.75	15.30	63	15.65	16.21	12	15.21	15.90
56	15.10	15.35	97	14.74	15.15	64		16.10	12		16.20
19	15.65	16.23	55	14.95	16.05	18	15.23	15.60	62	15.13	15.75
20	15.62		55	15.32	15.73	19	15.54	15.70	63	15.25	15.65
42	15.27	15.80	77	15.20	16.28	40	15.20	16.10	84	15.26	15.82
54	15.04	15.48	88	15.08	15.78	52	15.60	16.28	95	15.31	15.99
22	15.43	16.29	49	15.25	15.91	08	15.20	15.40	44	15.12	15.63
62	14.97	15.43	84	15.10	15.98	40	15.46	15.90	72	15.04	15.68
63	15.02	15.59	84	15.16	16.05	40	15.30	15.96	73		15.60
86	15.05	15.62	07	14.55	15.10	63		16.23	95	15.17	15.85
09	15.62	15.82	29	14.70	15.30	85	15.20	15.50	16	15.80	16.20
09		16.20	30	14.68	15.20	85	14.90	15.50	16		16.05
20	15.39	16.13	41	15.00	15.55	96	15.20	15.72	27	15.60	16.21
96	15.20	15.75	10	14.60	15.17	62	15.58	16.10	88	15.15	15.58
97	15.20	15.90	11	14.57	15.27	63		16.12	89		15.76
08		16.26	22	14.67	15.38	73	15.30	15.86	99	15.17	15.84
31	15.52	16.10	44	15.00	15.90	96	15.20	15.50	21	15.60	16.13
31	15.18	16.42	45	14.90	15.89	96	15.13	15.55	22	15.48	16.25
54	15.20	15.68	67	15.30	15.77	18	15.32	15.37	43	15.32	15.40
66	14.92	15.30	79	15.10	16.20	30	15.10	15.66	54	15.13	15.40
00	15.10	15.80	12	14.91	15.10	62	(15.48)	16.28	86	15.14	15.70
12	15.20	16.40	24	14.72	15.26	74	15.10	15.95	98	14.98	
00	15.45	16.04	05	14.53	15.10	52	15.50	16.17	71	15.03	15.57
34	15.33	16.20	39	14.96	15.53	86	15.27	15.50	04	15.48	16.02
46	15.15	15.60	50	15.20	15.70	97	15.30	15.38	14	15.56	16.00

	836			1334			1487			2060	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.40	15.82	00	15.17	15.15	00	15.26	16.10	00	14.00	14.77
64	14.98	15.79	64	14.47	14.67	63	14.85	15.27	60	14.74	15.26
94	15.20	15.65	83	14.90	14.99	58	14.98	15.17	26	14.20	14.60
05	14.95	15.75	94	14.64	15.02	68	14.90	15.28	36	14.40	15.05
15	14.68	15.22	04	14.77	15.55	79	14.90	15.60	45	14.30	15.19
37	14.53	14.80	25	15.62	16.20	00	15.15	15.87	65	14.66	15.07
91	15.25	15.72	79	14.74	15.07	50	14.64	15.21	00	13.97	14.41
12	14.81	15.40	99		15.22	71	14.76	15.13	20	14.35	14.45
23	14.55	14.70	10	15.17	15.87	81	15.14	15.97	29	14.34	14.70
34	14.69	14.90	21	15.02	15.90	92	14.90	15.89	40	14.40	15.05
34		14.88	21	15.15	15.70	92	14.97	15.68	40	14.45	15.10
44	14.58	14.88	31	15.52	15.73	02	15.20	16.13	49	14.40	15.23
45	14.55	14.88	32		16.00	03	15.35	16.15	50	14.60	15.33
88	15.09	15.79	74	14.52	14.90	42	14.64	15.08	74	14.65	15.10
89	15.00		74			43	14.55	14.68	75	14.70	
09	15.11	15.48	95	14.70	14.94	63	14.60	15.03	94	14.05	14.45
20	14.61	14.86	05	14.85	15.52	73	14.62	15.70	04	14.16	14.53
60	14.80	15.20	44			08	15.24	15.86	18	14.09	14.48
82	15.01	15.75	64	14.50	15.00	26	14.83	15.87	22	14.20	14.60
82	15.05	15.89	65	14.63	14.59	26	14.97	15.95	23	14.18	14.70
04	15.12	15.81	86	14.60	14.84	48	14.36	15.25	43	14.41	15.17
24	14.65	14.89	07	14.98	15.93	68	14.90	15.45	62	14.58	15.25
25	14.61	14.96	08	14.90	15.74	69	14.60	15.40	62	14.42	
35	14.67	15.00	18	15.30	15.80	79	14.53	15.65	72	14.52	15.21
90	15.18	15.70	71	14.55		29	14.77	15.72	07	14.06	14.42
90	15.34	15.95	71	14.70		29	14.70	15.72	07	14.07	14.44
00	15.27	15.70	82		14.93	39	14.50	15.28	17	14.17	14.55
22	14.42	14.98	03	14.78	15.58	60	14.56		36	14.45	14.99
22	14.41	14.98	03	14.83	15.70	61	14.60	15.02	37	14.30	14.95
43	14.52	14.80	24	15.40	16.21	82	14.78	15.32	56	14.44	15.21
54	14.89	15.32	35	15.35	15.88	92	14.90	16.00	66	14.61	15.20
85	15.15	16.05	66	14.72	14.85	23	15.20	15.90	95	14.15	14.52
97	15.30	15.98	78		15.02	34	14.60	15.13	06	14.00	14.50
62	15.05		42	15.30	15.82	95	14.95	15.85	51	14.62	15.22
94	15.31	15.80	73	14.57	14.53	27	14.73	15.52	80	14.46	
05	15.50	15.52	84	14.68	14.92	37	14.40	15.70	90	14.60	14.55

	818			1705			2063			2201	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.50	14.98	00	14.75	15.72	00	14.11	14.95	00		
59	15.06	15.62	56	15.10	15.95	54	15.10	15.78	54	13.98	
96	14.53	15.08	18	14.90	15.45	48	15.00	15.47	34	14.73	15.20
06	14.50	15.07	27	14.90	15.38	57	15.07	15.75	43	14.39	14.73
16	14.55	15.45	36	15.18	15.60	66	14.90	15.89	51	14.10	14.51
35	14.97	15.70	55		16.08	84	14.82	15.50	69	14.15	14.32
67		15.47	78	15.01	16.40	98	14.55	15.05	82	14.38	14.92
86	14.65	14.72	96	15.45	15.69	16	14.80	15.07	99	14.66	14.87
95	14.80	15.36	05	15.13	15.41	25	14.67	15.07	08	14.89	15.29
06	14.60	14.93	15	14.88	15.60	34	14.68	15.59	18	14.81	
06	14.54	14.90	15	15.02	15.38	34	14.68	15.41	18	14.73	15.52
15	14.80	15.27	24	14.78	15.39	43	14.70	15.39	26	14.76	
15	14.85	15.32	24	14.90	15.48	43		15.70	26	14.70	
37	14.92	15.83	37	15.15	15.50	48	15.25	15.78	30	15.00	15.42
37	15.55	15.71	38	15.32		49	15.23	15.75	30		
56	15.20	15.80	55	15.35	15.99	66	15.13	15.87	48	14.06	14.71
66	15.13	15.54	65	15.13		75	15.06	15.27	56	14.40	14.60
75	14.80	15.12	62	15.50	16.17	61	15.12	15.89	41		
77	14.54	14.82	56	15.40	16.10	48	15.03	15.85	26	14.84	15.50
78	14.50	14.91	56	15.16	15.92	48	15.00	16.12	26	14.97	15.52
97	14.70	14.93	75	15.00	16.10	67	15.22	15.71	45	14.40	14.60
16	14.68	15.50	93	14.85	15.73	84	14.93	15.31	62	14.25	14.40
16	14.70	15.60	94	14.90	15.95	84	14.65	15.68	62	13.80	14.52
26	14.95	15.65	03	15.00	15.60	93	14.63	15.20	71	14.07	14.48
57	15.45	15.65	25	15.10	15.85	07	14.40	15.18	84	14.20	14.91
58	15.20	15.71	26	14.88	15.70	08	14.60	15.04	84	14.53	15.00
67		15.34	34	14.80	16.05	16	14.87	15.20	92	14.50	14.98
86	14.45	14.90	53	15.60	16.05	35	14.80	15.70	10	14.60	15.33
87	14.55		54	15.10	16.35	35	14.70	15.56	11	14.80	15.41
06	14.52	14.97	72	15.20	16.22	52	15.15	15.69	28	14.70	15.31
16	14.80	15.32	81	14.98	15.86	62	15.22	15.96	37	14.63	15.11
44	15.01	15.86	09	15.13	15.40	88	14.91	15.52	64	13.94	14.50
55	15.25	16.00	19	15.02	15.50	98	14.35	14.82	73	14.07	14.41
96	14.60		51		16.18	21	14.60	15.27	95	14.42	15.25
25	14.94	15.40	79	15.00	15.93	48	15.06	15.75	22		15.53
35	14.85	15.60	88	15.10	15.72	57	15.40	15.93	30		15.21

1630			2017			857			1682		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.65	15.97	00		15.26	00	14.55	15.42	00	14.50	15.24
53	14.40	14.95	53	14.70		51	14.20	14.45	50	14.94	15.37
10	14.80	15.78	09	14.80	15.20	22	14.39	14.74	98	14.65	14.94
18	14.87	15.31	18	14.95	15.45	30	14.30	14.58	06	14.38	14.81
27	14.77	15.50	26	14.66	15.60	38	14.05	14.48	14	14.08	14.50
45	14.52	14.80	44	15.02	15.92	55	14.36	14.85	31	14.44	15.42
55	14.42	14.97	54	14.95	15.30	55	14.54	14.93	28	14.56	14.90
72	14.35	15.89	71		14.90	71	14.88	15.10	44	14.82	15.00
81	14.90	14.88	80	14.23	14.83	80	15.05	15.40	52	14.80	15.12
90	14.75	15.65	89	14.60	15.02	88	14.82	15.63	61	15.03	15.97
90	15.02	15.68	89		15.03	89		15.23	61	15.00	15.37
98	14.87	15.70	97	14.40	15.20	96	15.06	15.60	69	15.00	15.73
99	15.15	15.93	98	14.56	15.14	97	15.23	15.68	69	15.26	15.80
99	15.06	15.99	98	14.70	15.41	88	15.00	15.44	58	15.04	15.34
00	15.34		99	14.50	15.09	88			58		15.96
17	14.59	15.67	16	14.90	15.54	04	15.05	15.44	74	15.15	
26	14.80	15.72	24	14.95	15.55	13	14.83	15.48	82	15.23	15.60
06	15.10	16.02	05	14.88	15.30	80			46	14.63	15.63
89	14.67	15.43	88	14.50		54	14.30	14.85	17	14.26	14.52
90	14.70	15.95	88	14.57	15.10	54	14.40	14.75	18	14.00	14.63
08	14.95	15.62	06	14.87	15.19	71	14.72	15.20	34	14.65	15.13
25	14.50	15.25	23	14.77	15.69	87	14.90	15.72	50	14.80	15.59
25	14.80	15.47	23	14.90	15.65	88		15.42	50	(15.45)	15.50
33	14.59	15.40	32	15.15	15.75	96	15.30	15.83	59	14.92	15.61
43	14.35	14.90	42	14.80	15.52	96		15.43	56	14.93	15.50
44	14.09	14.97	42	15.00	15.80	96	15.15	15.40	56	14.80	15.38
52	14.40	14.93	50	14.73	15.60	04	14.80	15.45	64		15.69
70	14.30	15.44	68	14.31		20	14.47	14.62	80	15.20	16.05
70	14.50	15.22	68		14.82	21	14.52	15.15	81	14.90	15.72
87	14.70		86	14.65	14.92	38	14.19	14.35	97	14.58	15.10
96	14.80	15.55	95	14.70	15.23	46	13.95	14.44	05	14.50	14.98
22	14.85	15.63	20	15.06	15.70	71	14.50	15.15	30	14.45	15.04
32	14.63	15.19	30	14.98	15.60	80		15.25	38	14.30	15.24
51	14.29	15.17	49	14.95	15.60	88	14.72	15.28	44	14.65	15.20
77	14.44	16.10	75		14.84	13	14.80	14.98	69		15.72
86	14.50	16.00	84	14.70	14.85	21	14.52	14.73	77	14.95	15.54

	856			1365			2052			1744	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.83	15.99	00	15.17	15.85	00	13.83	14.29	00	14.00	14.60
50	14.83	15.40	49			48	14.37	15.00	48		15.40
97	14.92	15.42	62	14.65	15.30	41	14.35	15.10	34	14.66	15.30
06	15.02	15.83	70	14.74	15.35	49	14.64	14.93	42	14.67	15.35
14	15.13	15.88	78	14.82	15.62	56	14.36	15.30	50	14.66	15.48
30	15.23	16.10	94	14.90	15.74	72	14.58	15.20	66	14.74	15.50
27	15.25	16.15	87	14.74	15.50	63	14.60	15.44	56	14.82	
43	(15.30)	15.88	03	15.32	15.89	78	14.47	15.18	71	15.14	
52	15.10	15.18	11	15.60	15.99	86	14.16	14.70	79	14.60	15.05
60	14.50	14.93	20	15.39	16.20	95	13.95	14.60	87	14.52	14.90
61	14.46	15.09	20	15.32	16.22	95	14.00	14.55	88	14.35	15.10
68	14.50	15.09	27	15.05	15.79	02	13.92	14.24	95	14.40	15.05
69	14.73	15.21	28	15.30	15.87	03	13.88	14.15	95	14.23	14.58
57	14.45	15.09	121	15.27	15.94	85	14.26	14.65	77	15.09	15.60
57		15.04	13		15.81	85	14.50	14.76	77		15.40
73	14.36	15.41	28	15.20	15.75	00	13.94	14.30	92		15.20
81	14.73	15.19	36	14.98	15.70	08	13.80	14.31	00	14.13	14.50
45	15.40	15.98	94	15.13	16.04	63	14.75	15.30	54	14.95	15.82
16	15.27	16.05	62	14.73	15.21	29	14.28	14.83	19	14.42	14.82
17	15.30	16.15	62	14.65	15.37	29	14.20	15.12	19	14.35	14.78
33	15.47	15.71	79	14.90	15.51	45	14.50	15.18	35	14.73	15.37
49	15.10	15.70	94	15.03	15.62	61	14.45	15.24	51	14.58	15.58
50	14.80	15.40	95	14.90	15.87	61	14.70	15.20	51		15.70
58	14.73	14.88	02	15.08	16.12	69	14.60	15.24	59		
54	14.51	15.00	95	15.20	15.84	59	14.60	15.00	48		15.34
55	14.59	15.42	96	15.10	15.82	60	14.46	15.43	49	14.75	15.57
63	14.58	14.95	03	15.00	15.70	67		15.40	56	14.70	
79	14.84	15.33	19	15.30	15.85	83	14.24	14.80	72	14.84	15.55
80	14.73	15.27	20	15.07	15.98	83	14.45	14.90	73	14.60	
96	14.81	15.45	36	15.10	15.51	99	13.90	14.14	88	14.34	15.14
04	15.13	15.72	44	14.80	15.55	07	13.75	14.02	96	14.58	14.93
29	15.20		68	14.90	15.40	31	14.25	14.95	20	14.40	15.17
37	15.13	15.72	76	14.95	15.48	39	14.22	14.83	28	14.32	15.05
43	15.10	15.78	77	14.80	15.56	38	14.25	14.97	26	14.24	15.06
68	14.76	15.11	02	15.10	15.41	62	14.70	15.23	50	14.67	15.55
76	15.02	15.13	10	15.24	16.10	70	14.90		58	15.07	15.73
						16	13.91				

1873			1351			2202			2189		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.96	16.00	00		15.70	00			00	14.14	15.10
47	14.46	14.96	46	14.00	14.58	46	14.20		45	14.60	15.00
94	15.00	15.80	77	14.64	15.24	65	14.37	14.77	33	14.77	15.45
02	15.34	15.75	85	14.74	15.35	73	14.26	14.80	40	14.80	15.25
10	15.10	15.95	92	15.00	15.59	80	14.45	14.97	48	14.62	15.43
25	15.21	15.71	08	15.07	15.72	96	14.58	15.30	63	14.15	14.62
10		15.92	91	14.82	15.40	77	14.45	14.96	41	14.63	15.36
25		15.73	05	15.10	15.77	92	14.76	15.00	55		15.15
33	14.93	15.68	13	15.22	15.62	00	14.82	15.35	63	14.34	14.55
41	14.20	14.96	21	15.07	15.52	08	14.70	15.60	70	14.20	14.87
42	14.57	14.88	21	14.76	15.31	08	14.75	15.46	71	14.14	14.70
49	14.63	15.07	28	14.78	15.10	15	14.80		78	14.15	
49	14.68	14.92	29	14.93	15.17	15	14.86		78	14.50	14.88
26	15.06	15.85	04	15.45	15.80	89	14.63	15.30	48	14.57	15.15
26		15.66	04	15.30	15.85	89			48		
41	14.40	14.95	19	14.85	15.25	04	14.80	15.55	63	14.17	14.58
49	14.58	15.13	27	14.75	15.36	12	15.00	15.40	70	14.37	14.60
96	15.25	15.90	71	14.80	15.41	54			08		
57	14.42	15.10	30	14.65	15.02	12	14.83	15.50	63	14.27	14.89
58	14.45	15.40	31	14.55	15.02	13	15.00	15.70	63	14.18	14.41
73	15.00	15.50	46	14.24	14.67	28	14.98	15.30	78	14.34	14.73
88	14.92	15.68	61	14.68	15.17	43	14.73	14.91	93	14.56	14.80
89		15.98	62	14.35	15.21	43	14.52	15.11	93	14.40	15.20
96	15.03	15.88	69	14.75	15.47	50	14.16		00	14.58	15.00
81		15.52	52	14.42	14.80	32	14.37	14.85	78	14.20	14.88
81	14.81	15.75	52	14.18	15.00	32	14.80	15.15	78	14.42	14.74
89	14.85	15.70	60	14.42	14.93	40	14.70	15.10	85	14.30	15.03
04		16.07	75	14.52	15.37	55	14.05	14.48	00	14.35	15.04
05	15.20	(16.39)	75	14.45	15.48	55	14.20	14.64	01	14.40	15.25
20	14.97	15.67	90	15.00	15.59	70	14.53	14.68	15	14.73	14.93
28	15.08	15.73	98	15.10	15.50	78	14.47	14.94	23	14.86	15.31
51	14.52	15.07	21	14.73	15.53	00	14.60	15.52	45	14.67	15.32
62		15.25	29	14.72	15.49	08	14.97	15.45	53	14.42	15.46
52	14.70	15.18	20	14.85	15.38	98	14.67	15.45	38	14.65	15.59
75	14.96	15.49	43	14.05	14.61	21	14.96	15.31	61	14.53	14.68
83	15.27	15.68	50	14.15	14.75	28	15.07	15.05	68	14.35	14.31

827			1345			1373			1326		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	13.80	14.30	00		15.39	00	14.85	15.26	00	14.80	15.62
45	14.49	15.34	45	14.52	15.20	44	14.86	15.70	44		15.29
32	14.42	14.97	31	14.18	14.72	05	14.70	14.95	03	15.01	15.58
40	14.60	15.23	38	14.30	14.79	12	14.52	15.00	10	14.80	15.15
47	14.53	15.31	46	14.51	14.90	19	14.62	15.33	18	14.45	14.83
62	14.81	15.62	61	14.46	15.45	34	14.77	15.60	32	14.75	15.20
40	14.41	15.42	38	14.33	14.90	09	14.40	15.06	07	14.90	15.31
54	15.04	15.34	53	14.60	15.24	23	14.90	15.75	21	14.84	14.91
62	14.88	15.44	60	14.59	15.40	30	14.80	15.50	28	14.83	15.30
69	14.68	15.68	68	14.90	15.60	38	14.92	15.68	36	14.87	15.32
70	14.79	15.27	68	14.51	15.32	38	14.70	15.72	36	14.66	15.30
76	14.78	15.20	75	14.78	15.50	45	14.80	15.87	42	14.90	15.40
77	14.53	15.10	76	14.99	15.35	45	15.05	15.77	43	15.00	15.47
47	14.40	15.44	45	14.58	14.97	12	14.63	15.30	10	14.85	15.18
47	14.73	15.23	46		14.62	13	14.50	14.77	10		
62	14.62	15.53	60	14.49	15.20	27	14.80	15.40	24	14.60	15.07
69	14.81	15.60	68	14.77	15.47	34	14.85	15.80	32	14.60	15.28
07	14.10	14.47	05	14.59	15.44	67	15.12	16.22	65		
61		15.53	60	14.47	15.22	19	14.72	15.40	17	14.50	14.90
62	14.80	15.70	60	14.43	15.30	20	14.60	15.43	17	14.45	14.83
77	14.53	15.30	75	14.75	15.40	35	14.94	15.73	32	14.85	15.17
91	14.22	15.03	89	14.80	15.65	49	15.20	16.11	46	15.00	15.70
92	14.20	14.70	90	14.60	15.73	49	14.70	16.05	46	14.80	15.70
99	13.90		97	14.85	15.82	56	15.04	16.00	53	15.00	15.82
77	14.48	15.30	74	14.85	15.70	29	14.70	15.50	28	14.70	15.24
77	14.58	15.35	75	14.72	15.68	31	14.90	15.70	28	14.65	15.20
84	14.27	15.08	82	15.00	15.48	38	14.70	15.90	35	14.60	15.31
99	13.99		97	14.70	14.73	53	14.82	16.10	50	15.20	15.58
99	14.12	14.44	97	14.75	15.95	53	15.19	16.10	50	15.06	15.61
14	14.41		12		15.33	68	15.50	16.04	64	15.25	15.65
22	14.59		20	14.69	15.17	75	15.23	15.90	72	15.20	15.98
44	14.59	15.40	41	14.38	14.96	96	15.12	15.53	93	15.00	15.90
51		15.49	49	14.60	15.03	04	14.60	15.00	01	14.92	15.50
37	14.61	15.07	34	14.37	14.41	86	14.85	15.70	83	15.05	15.95
59	14.91	15.62	57	14.41	15.00	08	14.54	15.10	05	14.90	15.25
66	14.90	15.49	64	14.45	15.29	16	14.52	15.10	12	14.42	15.04

1933			1996			2088			1695		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	14.66	15.25	00	15.14	15.90	00	14.45	15.43	00	14.84	15.47
44	13.78	14.25	43	15.48	15.87	42	14.65	15.50	42	14.33	15.32
97	14.66	15.28	49	15.00	15.67	15	14.84	15.80	14	14.44	14.88
04	14.60	15.17	56	14.57	15.07	22	14.98	15.75	20	14.48	15.08
11	14.44	15.22	63	14.65	15.10	29	15.09	16.00	27	14.33	15.24
26	14.24	14.78	77	14.80	15.70	43	14.80	15.50	41	14.63	15.52
00	14.45	15.14	45	15.21	15.62	07	15.12	15.70	05	14.70	15.04
14	14.50	15.05	59	14.52	15.06	20	15.32	16.00	18	14.45	14.60
21	14.62		66	14.97	15.27	27	15.23	15.80	25	14.62	15.13
29	14.30	14.53	73	14.60	15.40	34	15.03	15.70	32	14.57	15.70
29	14.30	14.67	73	14.92	15.30	35	14.92	15.89	33	14.67	15.32
36	14.22	14.75	80	14.70	15.58	41	14.88	15.60	39	14.54	15.63
36	14.12	14.50	80	14.90	15.45	41	14.70	15.58	39	14.68	15.40
02	14.50	15.45	41	15.15	15.75	98	14.71	15.55	96	14.76	
03	14.63	15.20	41	14.90	15.99	99		15.73	97	14.70	15.36
17	14.47	15.22	55	14.50	15.20	12	15.13	15.80	10	14.10	(15.52)
24	14.40	14.75	62	14.73	15.20	19	15.12	15.68	17	14.60	15.00
56	13.95	14.60	87	14.85	15.80	38	15.03	15.80	36	14.77	15.70
07	14.45	15.32	33	15.25	15.95	81	14.35	15.28	79	14.85	15.92
08	14.60	15.40	33	15.15	16.07	82	14.53	15.21	79	14.95	
23	14.31	15.09	48	15.00	15.70	96	14.70	15.50	93		15.85
37	14.07	14.41	61	14.52	15.40	09	14.78	15.72	06	14.23	15.29
37	14.08	14.64	62	14.90	15.10	09	14.86	15.89	07	14.27	15.14
44	13.65		68	14.78	15.50	16	15.02	15.82	13	14.47	14.97
18	14.34	14.95	36	15.00	16.20	80	14.54	15.00	77		
18	14.73	14.98	37	15.30	16.09	80	14.63	15.19	77		
25	14.12	15.00	43	14.76	16.10	87	14.60	15.29	84	14.80	15.89
39	13.90	14.45	58	14.62	15.21	00		15.62	98	14.55	15.58
40	14.22	14.62	58	14.67	15.17	01	14.70	15.50	98	14.73	15.42
54	13.80	14.34	72	14.92	15.17	14	15.06	15.58	12	14.32	15.22
62	14.15	14.88	79	14.80	15.40	21	14.99	15.76	19	14.47	15.00
83	14.35	15.10	00	14.93	16.10	42	14.92	15.84	39	14.50	15.38
91	14.43	15.15	07	14.97	16.00	49	14.67	15.50	46	14.44	15.57
72	14.30	14.90	82	14.87	15.79	20	15.12	15.95	17	14.45	15.20
94	14.55	15.40	04	15.33	16.03	41	14.96	15.56	38	14.67	15.70
01	14.70	15.39	11	15.42	16.12	48	15.06	15.53	45	14.77	15.29
						09					
						36					
						43					
						01					
						08					
						15					
						41					
						48					
						54	14.52				
						61	14.28				
						68	14.34				

843			1372			854			1787		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.35	16.08	00	14.90	15.50	00	14.18	14.69	00		
41	15.20	15.84	38		16.13	38	14.20	14.45	37	14.13	14.75
02	15.00	15.97	08	14.80	15.87	93	14.40	15.20	74	14.45	
09	15.30	16.30	14	14.95	15.93	00	14.53	15.03	80		
16		16.22	21	15.10	16.10	06	13.62	14.05	86		
29	15.61		34	15.40	16.23	18	13.92	14.31	98	14.77	
92	14.73	15.95	85	14.56	15.30	68	14.70	15.30	46	14.00	14.85
05	15.52	16.15	98	14.65	15.70	81	14.70	15.20	58	14.34	15.10
12	15.40	16.50	04	14.72	15.82	87	14.90	15.17	65	14.47	15.24
19	15.68	16.65	11	14.80	15.73	94	14.68	15.18	71	14.50	15.40
20		16.40	11	14.94	15.90	94	14.88	15.37	71	14.33	15.20
26	15.22	16.65	17	15.00	15.70	00	14.38	14.81	77	14.30	15.42
26	15.35	16.32	17	15.05	16.00	00	14.43	14.92	77	14.33	
82	14.84	15.89	62	15.23	16.30	43	14.20	14.85	19	14.45	14.81
82	14.77	15.63	63	15.22	16.03	44	14.50	14.82	19	14.39	14.85
95	15.25	15.99	75	15.20	16.02	56	14.50	15.11	31	13.90	14.80
02	15.20	16.29	81	14.63	14.97	62	14.70	15.53	37	14.11	14.70
22	15.54	16.73	84	14.55	15.39	62	14.35	15.15	35	14.17	15.00
61	14.50	15.20	16	14.72	15.80	93	14.70	15.10	63	14.14	
62	14.45	15.13	16	14.81	15.90	94	14.76	14.75	64	14.25	
75	14.60	15.60	29	14.93	15.93	06	13.74	14.20	76	14.62	
88	14.95	15.90	42	15.32	16.42	18	13.87	14.03	88	14.70	
89	14.80		42		16.35	19	13.80	14.20	89	14.84	
95		15.88	48		16.24	25	13.90	14.37	94	14.45	
58	14.55	15.40	00	14.68	15.85	75	14.59	15.41	42		14.98
58	14.35	15.37	00	14.63	15.70	75	14.63	15.32	42	14.30	14.81
65		15.38	06	14.67	15.93	81	14.70	15.32	48		14.90
78		15.52	19	14.90	16.02	94		15.12	61		15.05
79		16.02	19	14.82	16.00	94		15.22	61	14.12	
92	14.80	16.24	32	15.16	15.86	06	13.63	13.84	73	14.58	
99	15.25		38		16.10	13	13.65	13.85	80	14.70	
19	15.30	16.27	57	15.00	16.20	31	14.03	14.40	98	14.72	
26	15.30	16.51	64	15.10	16.06	38	14.30	14.63	04	14.42	
96	14.98	16.14	22	15.00	15.78	94	14.50	15.27	58	14.30	14.95
16		16.53	41	14.90	16.60	13	13.71	13.90	77	14.60	
23		16.50	47	15.00	16.33	20	13.80	14.05	83		14.97

1954			1828			1342			1884		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	13.33	14.02	00	16.58	17.17	00	14.24	14.61	00	14.27	15.70
36	14.05	14.70	35	16.92		34	14.28	14.74	34	14.77	15.45
35	14.03	14.70	00	16.30	17.08	50	14.21	14.73	39	14.50	15.45
42	14.11	14.64	06	16.10	17.18	56	14.15	14.47	44	14.45	15.18
47	14.02	14.90	11	16.32		61	14.01	14.63	50	14.23	14.90
59	(14.47)	14.92	23	16.60	17.47	73	13.90	14.44	61	14.10	14.75
03	13.36	13.91	62	16.62	(18.0)	06	14.23	14.91	93	14.64	15.43
14	13.78	14.10	74		16.32	17	14.35	15.23	04	14.58	15.80
20	14.06	14.46	80		16.70	22	14.70	14.95	10	14.90	15.95
27	13.85	14.69	86	16.25	16.43	28	14.50	15.10	15	14.98	15.95
27	13.80	14.44	86		16.70	29	14.28	15.16	16		15.95
32	13.86	14.60	91	16.40	16.80	34	14.45	14.81	21		15.90
33	14.00	14.70	91		16.90	34	14.60	15.10	21	14.70	15.60
70	14.05	14.86	24	16.55	17.47	62	14.10	14.53	47	14.15	15.10
70	14.00		25			62			48	14.39	14.93
82	14.05	14.42	36	16.60	17.80	73	13.85	14.33	58	14.00	14.60
88	14.21	14.53	42	17.3	(18.1)	78	13.97	14.63	64	14.20	14.70
79		14.42	28			57			40	14.77	15.40
04	13.27	13.80	49			73	13.78	14.40	55	14.12	14.68
04	13.42	13.95	50			73	14.00	14.36	56	14.20	14.70
17	13.80	14.60	61	16.65	17.60	84	14.35	14.30	67		14.95
28	13.72	14.50	73	16.60	17.17	95	14.10	14.92	78	14.27	15.24
29	13.73	14.41	73		17.24	96	14.22	14.88	78	14.08	15.17
34	14.03	14.70	78	16.18	16.63	01	14.16	14.99	83	14.49	15.22
78	14.00	14.77	18		17.30	34	14.40	15.27	15		16.03
78	14.02	14.69	18	16.73	17.35	35	14.62	14.84	16	14.92	15.87
84	13.95	14.58	23		17.27	40	14.30	15.01	21		15.97
96	13.51	13.95	35		17.45	51	14.47	14.60	32	14.48	15.70
96	13.52	14.12	35	16.35	17.35	51	14.29	14.74	32	14.60	
08	13.40	14.09	47		16.11	62	14.25	14.22	43	14.65	
14	13.55	14.43	53		17.55	68	13.90	14.35	49	14.18	14.94
32	13.80	14.63	70			84	14.10	14.40	65	13.90	14.81
38	13.90	14.70	76	15.85	17.11	90	14.18	14.68	71	14.00	15.05
88	13.94	14.72	21	16.47	17.40	30	14.52	14.93	09	14.70	15.84
05	13.52		39	16.45	17.10	46	14.23	14.40	25	14.90	15.91
12	13.60	14.40	45	17.4		52	14.04	14.47	31	14.77	15.51

1543			2209			1430			11129		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	15.02	15.63	00	13.50		00	14.60	15.51	00	14.97	15.72
30	14.20	14.65	27	13.72		25	13.68	14.40	25	14.25	15.00
09	14.57	15.46	11	13.65	14.34	61	14.15	15.22	43	14.55	15.38
14	14.48	15.05	15	13.86	14.30	65	14.45	14.85	47	14.66	15.63
18	14.10	14.86	20	13.63	14.45	69	14.09	15.30	51	14.45	15.89
28	14.10	14.80	29	13.85	14.50	77	14.11	15.50	59	14.63	16.07
45	14.23	15.38	34	13.88	14.47	77	14.17	15.10	57	14.60	15.50
55	14.20	15.35	43	13.90	14.30	85	14.43	15.56	65	14.90	15.94
60	14.62	15.26	47	13.85	14.35	90	14.77	15.63	69	14.83	15.82
65	14.52	15.42	52	13.43		94	14.45	15.40	74	15.03	16.31
65	14.40	15.19	52	13.33		94	14.57	15.41	74	14.93	16.08
70	14.60	15.38	56	13.25		98	14.47	15.54	78	14.70	15.83
70	14.55	15.63	56	13.22		98	14.52	15.88	78	14.80	16.02
82	14.70	15.67	57	13.27		94	14.70	15.50	71	15.00	15.80
82	14.82		58			94	13.97	15.02	72	15.18	
91	14.80	15.73	66	13.25	13.76	02	14.56	15.71	79	15.00	16.53
96	14.86		71	13.42	14.06	06	14.60	15.67	83	14.90	15.98
53	14.52	15.18	12			39	13.83	14.21	14	14.40	15.13
55	14.40	15.53	04	13.70	14.42	26	13.67	14.47	99		16.05
55	14.35	15.15	04	13.82	14.30	27	13.65	14.46	00	14.68	16.05
65	14.55	15.30	13	13.86	14.48	35	13.80	14.46	08	14.20	15.50
74	14.72	15.50	22	13.92	14.40	43	13.70	14.60	16	14.46	14.80
75	14.50	15.60	22	13.85	14.62	43	13.93	14.40	16	14.00	15.13
79	14.52	15.86	26	13.90	14.70	47	13.80	14.62	20		14.77
96	14.80	15.79	32	13.80	14.34	47	14.05	14.88	18	14.40	15.30
97	14.60	15.44	32	13.87	14.39	47	13.80	14.63	18	14.04	14.82
01	14.60	15.60	36	13.80	14.48	51	13.88	14.82	22	14.22	15.31
11	14.45	15.53	45	13.60	14.28	60	13.85	14.77	30	14.38	
11	14.31	15.29	45	13.70	14.22	60	14.00	15.05	30	14.30	15.22
21	14.10	14.79	54	13.40	13.56	68	14.32	15.25	38	14.30	15.08
26	14.05	14.48	59	13.10	13.38	72	14.20	15.15	42	14.28	14.79
40	14.25	15.20	72	13.40	13.80	85	14.47	15.99	54	14.75	16.03
46	14.07	15.09	76	13.50	13.83	89	14.36	15.68	59	14.60	15.83
68	14.44	15.45	87	13.35	13.80	93	14.57	15.82	61	14.95	15.79
82	14.62	15.78	00	13.70	13.81	06	14.30	15.31	73		
87	14.78	15.74	04	13.69	13.94	10	14.45	15.69	77	15.03	16.13

	2205			847			1967			1369	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	13.67		00	13.50	14.33	00		15.07	00	13.73	14.88
24	13.90		22	13.80	14.73	21	12.97		20	14.19	14.88
11	13.75	14.51	62	14.03	15.29	10	14.12	14.98	65	14.45	15.15
15	14.10	14.50	66	14.18	15.07	14	13.92	14.50	68	14.46	15.02
19	14.00	14.80	70	14.35	15.10	17	13.33	14.34	71	14.40	15.08
27	14.15	14.96	77	14.16	15.00	24	13.06	13.80	78	14.48	14.73
21	14.28	14.80	66	14.32	15.15	06	13.93	14.85	55	14.70	15.08
29	14.35	14.86	73	14.46	14.80	13	13.98	14.60	61	14.40	15.04
33	14.46	15.20	77	14.34	15.19	16	13.43	14.17	65	14.47	14.89
37	14.38		81	14.15	14.89	20	13.27	13.88	68	14.57	14.98
37	14.50	15.20	81	13.90	14.58	20	13.25	13.96	68	14.54	14.79
41	14.38		84	13.55	14.17	23	13.10	13.60	71	14.35	14.99
41	14.73		84	13.56	14.23	24		13.70	71	14.46	14.88
31	14.45	14.96	69	14.22	15.30	02	13.90	15.25	45	14.52	15.30
31			69			03	14.04	15.03	45	14.50	
39	14.45	15.22	76	14.42	15.38	09	13.91	15.00	51		15.25
43	14.63	15.40	80	14.16	15.00	13	14.05	14.76	55	15.20	15.28
68			98	13.43	14.11	23	13.10	13.60	58	14.62	15.56
50	14.60	15.50	75	14.40	15.30	94	14.02	14.82	25	14.45	15.08
51	14.57	15.34	76	14.16		95	13.89	14.68	25	14.10	15.50
59	14.60	15.18	83	13.55	14.92	02	14.13	14.99	32	14.30	15.12
66		15.40	90	13.28		08	14.12	14.83	38	14.40	15.75
66	14.60	15.27	90	13.45		09	13.93	15.00	38	14.30	15.35
70	14.20	14.90	94	13.33	13.96	12	13.87	14.69	41	14.53	15.19
64	14.60	15.27	82	13.87	14.65	94	13.90	15.23	18	14.20	15.04
64	14.62	15.03	83	13.75	14.73	94	14.12	15.06	18	14.25	14.83
68	14.30	15.06	86	13.35	14.19	98		14.99	22	14.10	14.88
76	13.72	13.91	94	13.53	14.15	05	14.14	15.05	28	14.41	15.17
76	13.65	13.82	94	13.48		05	14.06	15.15	28	14.16	15.07
84	13.80	13.90	01	13.55	14.27	12	13.73	14.83	34	14.32	14.86
88	13.66	14.12	05	13.63		15	13.79	14.41	38	14.32	15.38
00	13.90	14.57	16	13.64	14.57	25	13.16	13.72	47	14.73	15.62
04	13.95	14.35	20	13.70	14.90	29	13.25	13.68	51	14.46	15.40
02	13.73	14.34	12	13.50	14.55	15	13.83	14.60	31	14.27	14.80
14	14.05	14.35	23	13.62	14.95	25	13.08	13.80	41	14.32	
18	14.12	14.41	27	13.90	14.91	29	13.20	13.61	44	14.32	
			53			12			90	14.02	14.46
			67			25			03		14.67
			71			29	13.25		06	13.99	14.64
			56	14.07		08			80	14.07	14.85
			60	14.30		11			83	14.20	14.66
						15			86	13.93	14.69
						28	13.20		93	14.08	14.42
						32	13.40		96	13.93	14.85
						35	13.44		99	14.60	14.94
						38	13.28		02		14.71
						42			06	14.10	14.90
						48	13.40		12	14.20	14.83
									89	14.08	14.79

	823			1636			855			840	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	13.90	15.05	00	13.32	14.10	00	13.80	14.92	00	13.44	14.60
19	14.15	15.20	19	13.60	14.39	18	14.15	14.91	18	13.95	14.78
46	13.17	13.68	33	13.85	14.45	26	14.20	15.05	24	14.04	15.20
49	13.60	13.73	36	13.92	14.45	30	14.11	14.83	28	14.12	14.85
52	13.30	14.08	39	13.67	14.50	32	13.90	14.63	30		15.16
59	13.54	14.17	45	13.90	14.48	38	13.50	14.03	37	14.15	15.05
34	14.15	14.90	18	13.95	14.20	11	14.24	15.13	09	13.92	14.85
40	13.45	14.04	24	13.74	14.50	17	14.25	15.12	15	13.81	14.60
43	13.40	13.93	28	13.90	14.33	20	14.35	15.10	18	14.00	14.75
46	13.45	13.89	31	13.73	14.59	23	14.20	15.20	21	13.95	15.08
46	13.42	13.80	31	13.64	14.40	24	14.14	15.19	21		14.84
49	13.34	13.79	34	13.77	14.52	26	14.10	15.06	24	13.86	15.03
49	13.42	13.84	34	13.68	14.37	26	14.32	15.02	24		14.90
21	14.20	15.20	04	13.35	14.37	96	13.96	15.00	94	13.40	14.57
21	14.18		04	12.90	13.71	96	13.71	14.81	94	13.36	14.73
27	14.18	15.11	10	13.35	14.30	02	14.14	15.02	00	13.52	14.52
30	14.43		13	13.34		05	14.30	15.22	03	13.90	14.60
31	14.22	15.32	11	13.27	14.14	02	13.78	14.88	99	13.58	14.68
96	14.00	15.06	75	13.82	14.25	65	13.70	14.45	63	13.00	13.72
96	13.87	15.00	76	13.67	14.75	66	13.56	14.31	63	12.86	13.49
02	14.13	15.06	82	13.35	14.30	72	13.64	14.53	69	13.13	13.77
09	14.30	15.12	88	13.15	13.80	78	13.75	14.58	75	13.20	13.98
09	13.90	15.10	88	13.40	13.75	78	13.73	14.59	75	13.40	14.17
12	14.44	15.38	91	13.30		81	13.77	14.82	78	13.10	13.96
87	13.76	14.63	64	13.85	14.68	53	13.39	14.10	50	13.95	14.69
87	13.82	14.83	64	13.76	14.99	54	13.43	14.24	50	14.10	14.71
90	13.86	14.67	67	13.84	14.60	56	13.45	14.22	53	13.40	13.89
96	13.75	14.96	73	13.80	14.35	62	13.51	14.35	59	13.04	13.75
96	14.04	15.20	74	13.77	14.67	63		14.27	60	12.90	13.84
02	14.31	15.10	80	13.43	14.48	69	13.56	14.40	66	13.20	13.68
06	14.20	14.99	83	13.22	13.93	72	13.65	14.54	69	13.05	13.74
15	14.06	15.20	91	13.40	13.82	81	13.69	14.60	78	13.40	14.03
18	14.17	15.11	95	13.30	13.97	84	13.65	14.75	81	13.30	14.18
96	13.85	14.70	72	13.75	14.80	60	13.40	14.29	56	13.13	13.62
06	14.10	14.85	81	13.23	14.25	69	13.71	14.28	65	12.90	13.86
09	14.03	14.90	84	13.30	14.69	72	13.70	14.30	68	13.18	13.78

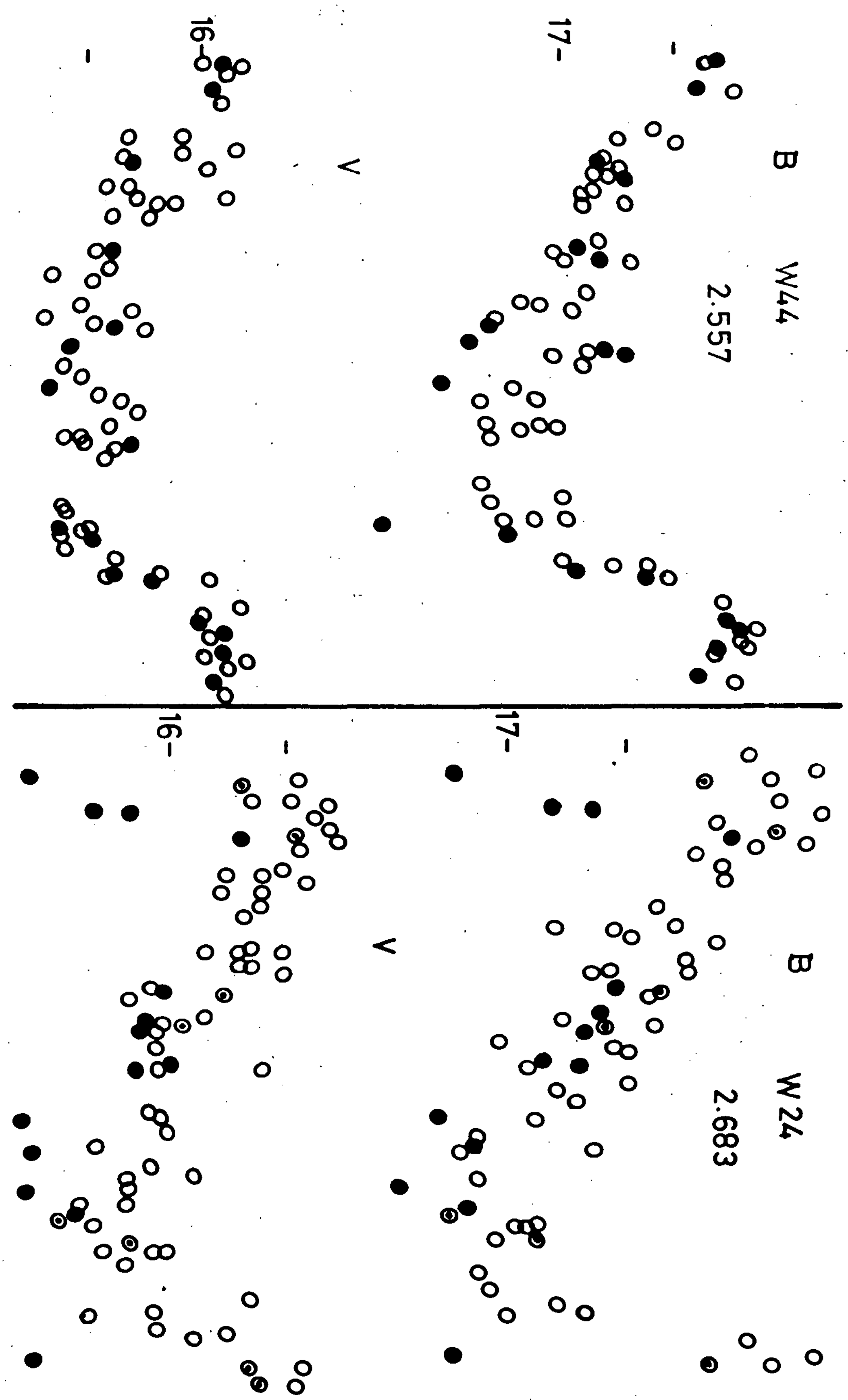
2064			11182			2195			837		
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	13.32	14.09	00	13.80	14.95	00	12.87		00	13.25	14.38
18	13.42	14.10	16	14.05		14	12.95		14	13.60	14.55
14	13.30	14.03	26	14.03	15.05	94	12.80	13.46	84	13.16	14.05
17	13.30	14.01	29	14.18	15.03	96	12.97	13.40	87	13.18	14.05
20	13.31	14.05	31	13.89	15.00	98	12.83	13.34	89	13.22	14.30
26	13.42	14.17	36	13.70	14.63	03	13.07	13.76	94	13.30	14.35
97	13.79	14.48	98	13.94	15.00	60	13.67	14.42	50	13.70	14.73
03	13.50	14.10	03	13.90		65	13.50	14.17	54	13.52	14.10
06	13.40	13.80	05	13.80	15.35	67	13.15	14.03	57	13.25	13.75
09	13.27	13.94	08	13.90	15.10	70	12.66	13.22	59	13.13	13.90
09	13.30	14.00	08		15.03	70	12.65	13.26	59	12.94	13.75
12	13.27	13.86	10	14.00	15.03	72	12.54		62	13.05	13.45
12	13.34	14.02	10	13.96	15.00	72	12.55		62	12.90	13.66
80	14.30	15.42	69	13.50	14.97	27	13.32	14.17	15	13.48	14.65
80	14.13		69	13.47	14.38	27			16	13.56	14.56
86	14.06	15.20	74	13.46	14.88	32	13.40	14.07	20	13.54	14.85
89		15.24	76	13.60	14.73	34	13.47	14.40	22	13.70	14.93
84	14.01	15.15	58	13.36	14.70	11			97	13.36	14.35
46	13.77	14.63	11	13.90	15.10	61	13.65	14.47	46	13.78	14.80
46	13.62	14.69	11	13.90	15.11	61	13.53	14.41	46	13.77	14.73
53	13.79	14.99	16	14.18	15.09	66	13.43	14.18	51	13.78	14.82
58	14.01	14.93	22	13.97	15.20	70	12.80	13.10	56	13.24	14.10
58	13.80	14.88	22	14.00	15.01	70	12.67	13.12	56	13.17	14.03
61	13.98	14.78	24	13.90	15.08	73	12.52	12.84	58	13.00	13.63
33		14.56	85		14.78	30	13.15	14.10	14	13.45	14.50
33	13.63	14.55	85	14.00	15.03	30	13.18	14.26	14	13.62	
36	13.62	14.34	88		14.97	32	13.36	14.20	17	13.50	14.91
42	13.65	14.77	93	13.85	15.03	37	13.35	14.20	21	13.55	14.83
42	13.74	14.51	93	13.78	15.14	37	13.30	14.29	22	13.57	15.36
48		14.60	98	14.03	15.32	42	13.31	14.10	26		15.05
51	13.79		01	14.10	15.12	44	13.43	14.32	29	13.70	15.03
59		14.87	08	13.80	15.15	52	13.32	14.52	36	13.77	14.78
63	13.89		11	13.91	15.15	54	13.44	14.41	38	13.65	14.72
37	13.51	14.61	74	13.66	14.75	14	12.98	13.97	97	13.25	14.42
46	13.80	14.75	82	14.04	14.75	21	13.30	14.07	04	13.33	14.40
49	14.10	14.60	85	13.90	14.73	23	13.27	14.11	06	13.45	14.64
			17			28			03		
			27			38			13		
			29			40			15		
			88			95			69	12.85	
			91			98			71	13.07	
			93			00			74	12.88	
			77			79	12.52	12.87			
			80			81	12.75	13.20			
			82			84	12.74	13.23			
			85			86	12.62	13.34			
			87			88	13.00	13.32			
			92			93		13.61			
			53		14.35	50	13.60				
			54		14.22	50	13.44				
			20								
			30								
			93								
			98								
			98								
			01								
			62	13.60							
			65	13.65							

	824			11157			834			829	
Φ	V	B	Φ	V	B	Φ	V	B	Φ	V	B
00	12.20	13.28	00	12.78	13.82	00			00	12.40	13.41
09	12.33	13.52	09	12.72	13.74	08	12.50	13.80	07	12.13	13.08
14	12.48	13.30	99	12.88	13.82	68	12.37	13.08	35	11.67	12.38
15	12.40	13.34	01	13.13	13.78	69	12.27	13.23	37	11.70	12.43
17	12.51	13.40	02	12.84	13.78	71	12.30	13.15	38	11.63	12.57
20	12.50	13.60	05	12.90	13.87	73	12.37	13.48	40	11.73	12.80
56	12.45	13.33	40	13.05	14.15	04	12.62	13.79	67	11.90	12.97
59	12.02	12.93	43	12.17	14.00	07	12.43	13.03	70	11.92	13.31
61	12.16	12.88	44	13.04	14.08	08	12.20	13.78	71	12.20	13.38
62	12.16	12.60	46	13.13	14.11	10	12.60	13.60	72	12.10	13.19
62	12.15	12.71	46	12.97	14.22	10	12.52	13.49	72	12.25	13.17
64	12.07	12.70	47	13.13	14.30	11	12.60	13.70	73	12.12	13.43
64	12.08	12.42	47	12.93	14.30	11	12.41	13.53	73	12.32	13.10
98	12.07	13.27	80	13.26	14.42	40	12.10	12.90	99	12.03	13.27
99	12.30	13.22	80	13.19	14.00	41	11.89	12.73	99	12.07	13.00
01	12.20	13.38	83	13.28	14.32	43	12.04	12.88	01	11.90	13.09
03	12.26	13.30	85	13.10	14.20	44	12.10	12.97	02	12.00	13.27
52	12.67	13.80	31	12.81	14.04	86	12.49		39	11.75	12.75
83	12.07	12.78	61	13.18	14.32	13	12.20	13.00	63	11.93	12.94
83	12.00	12.70	62	13.10	14.34	13	12.16	12.86	63	11.83	12.90
86	12.05	12.79	64	13.37	14.30	16	11.81	12.56	65	11.94	12.85
90	12.06	12.88	67	13.22	14.53	18		12.38	67	11.90	13.12
90	12.20	12.85	67	13.06	14.63	18	11.91	12.38	68	11.96	13.18
91	12.08	12.80	69	13.31	14.52	20	11.81	13.05	69	11.90	13.17
27	12.48	13.80	03	12.75	14.00	51	12.04	13.12	96	12.04	12.92
28	12.44	13.80	04		13.90	51	12.21	13.17	96	12.19	13.45
29	12.60	13.74	05	12.90	13.83	52	12.10	13.10	97	12.16	13.15
32	12.72	13.90	08	12.91	13.69	55	12.27	13.19	99	12.10	13.38
32	12.63	13.95	08	12.70	14.03	55	12.02	13.30	99	12.05	13.27
35	12.70	13.95	11	12.91	13.68	57	12.27	13.31	02	11.97	13.38
37	12.83	14.13	12	12.98	13.86	59	12.30	13.22	03	11.68	12.80
41	13.00	13.95	16	12.90	13.92	62	12.25	13.46	06	11.80	12.57
43	12.96	13.95	18	12.92	13.92	64	12.30	13.26	07	11.80	12.65
81	12.00	12.75	54	13.14	14.43	96	12.60	13.62	36	11.57	12.48
85	12.04	12.83	59	13.01	14.31	00	12.55	13.62	39	11.44	12.80
87	12.10	12.95	60	13.12	14.41	01	12.45	13.77	40	11.58	12.78
						21	12.05		34		
						27	12.17		38		
						28	12.12		39		
									66		
									67		
									68		
									06		
									07		
									08		
									09		
									10	11.64	12.38
									12	11.51	12.33

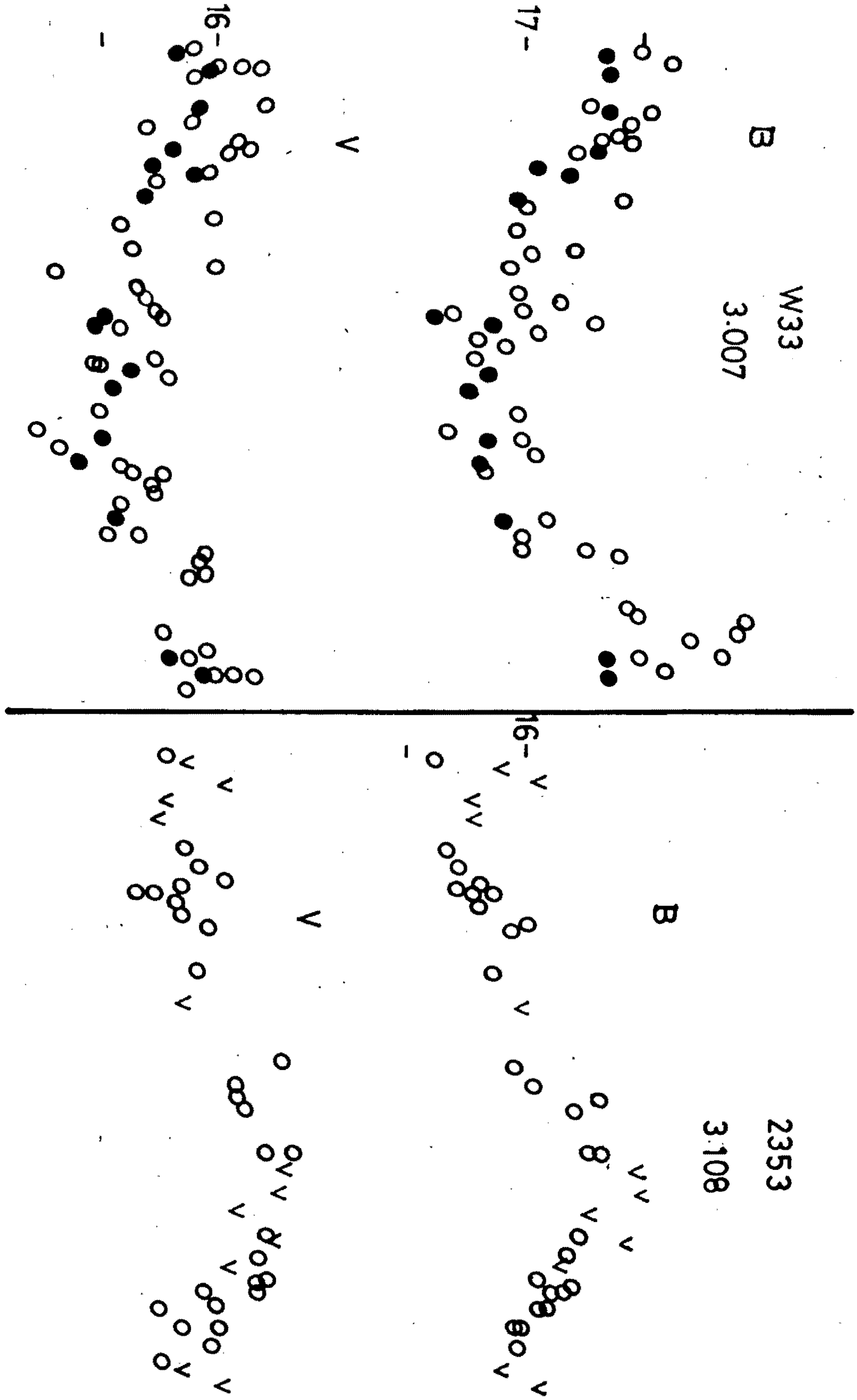
	821			1956	
Φ	V	B	Φ	V	B
00	12.07	13.47	00	12.52	13.90
05	12.45	13.41	03	12.58	13.81
61	11.70	12.47	95	12.73	14.00
62	11.70	12.50	95	12.75	13.98
63	11.60	12.42	96	12.55	13.90
64	11.62	12.62	96	12.63	13.98
83	11.87	13.56	08	12.22	13.11
85	11.75	13.07	08	12.04	13.18
86	12.13	13.41	09	12.08	13.52
86	12.06	13.29	09	12.04	13.23
86	12.00	13.12	09	12.07	13.14
87	12.05	13.10	10	11.98	13.21
87	12.05	13.10	10	12.10	13.20
05	12.03	13.61	20	11.80	12.86
05	12.48	13.35	20	12.00	13.10
07	12.23	13.48	21	11.86	12.94
07	12.12	13.78	22	12.00	12.91
32	12.30	13.28	36	11.95	12.91
49	11.84	12.62	46	12.03	13.41
49	11.76	12.58	46	11.88	13.45
50	11.82	12.48	47	12.05	13.40
52	11.72	12.65	48	12.00	13.65
52	11.80	12.50	48	12.00	13.50
53	11.78	12.62	48	12.03	13.80
71	11.76	12.65	59	12.24	13.65
71	11.80	12.75	59	12.24	13.80
72	11.70	12.59	60	12.30	13.85
74	11.80	12.70	61	12.28	14.10
74	11.81	12.80	61	12.25	13.82
75	11.85	12.85	62	12.27	13.75
76	11.80	13.00	62	12.38	14.02
78	11.87	12.88	63	12.30	13.96
79	11.90	12.83	64	12.34	13.89
99	12.21	13.19	75	12.38	13.88
01	12.15		77	12.40	13.90
02	12.20	13.33	77	12.50	13.85
34	12.10	12.80	55		
37	12.01	12.84	57		
38	11.99	12.88	57		
56		12.64	68	12.34	
57		12.58	68	12.32	
58		12.55	69	12.60	
84			84	12.41	
84			84	12.52	
85			85	12.45	
86			85	12.61	
87			86	12.60	
88			86	12.69	
07		13.68			
07		13.50			
27		13.33			
30		13.17			

APPENDIX B

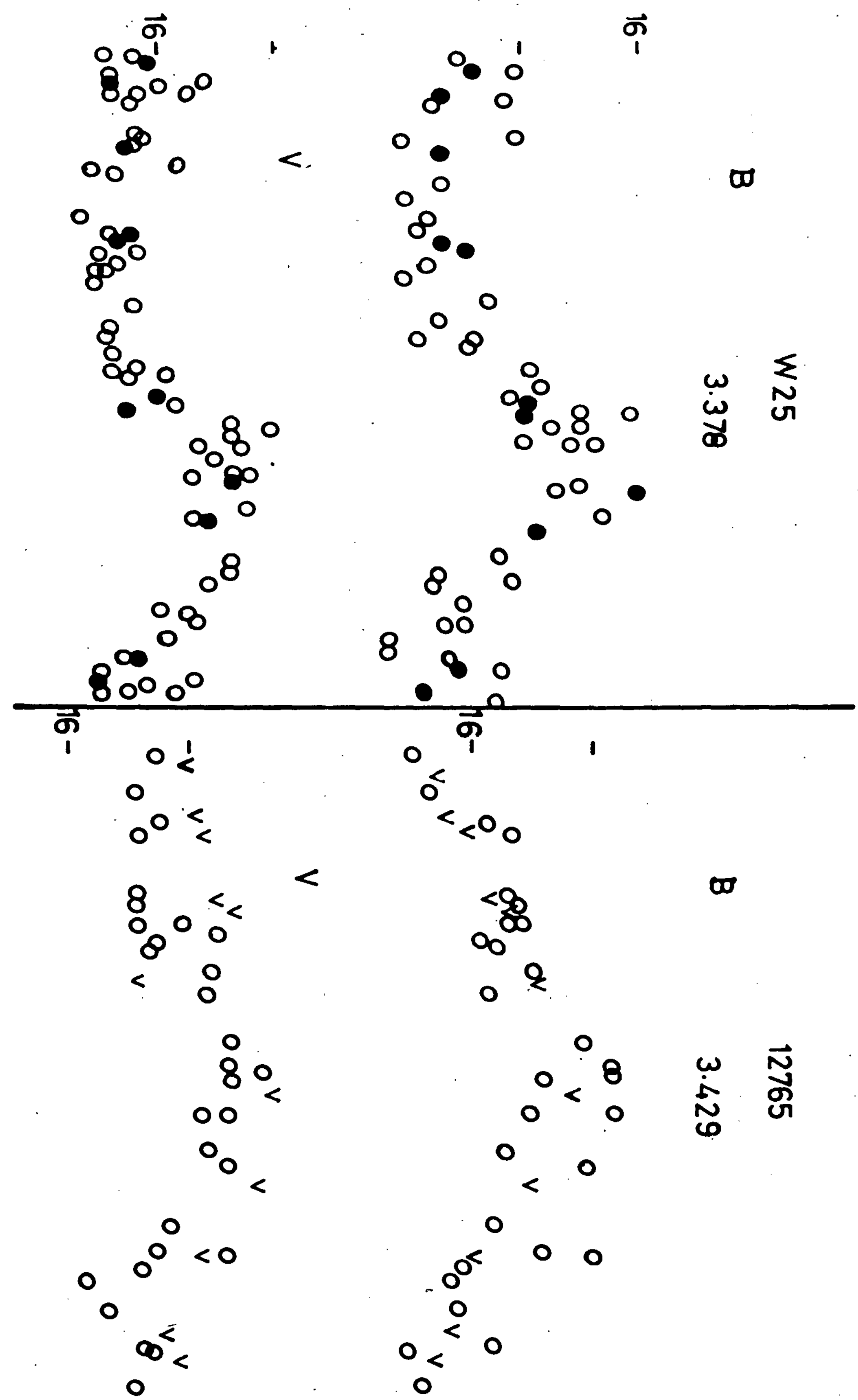
COMPARISON OF B,V LIGHT CURVES



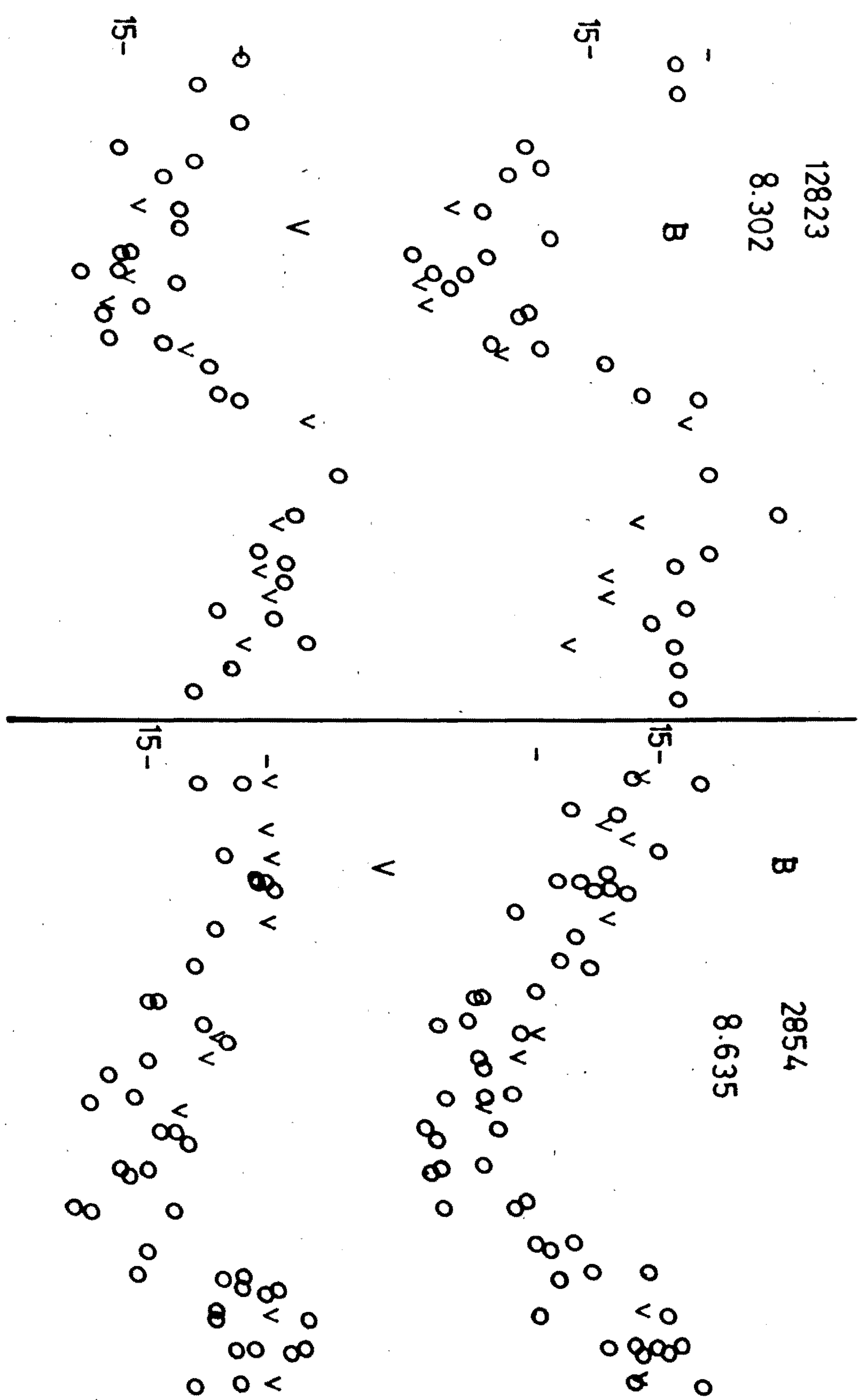
B1



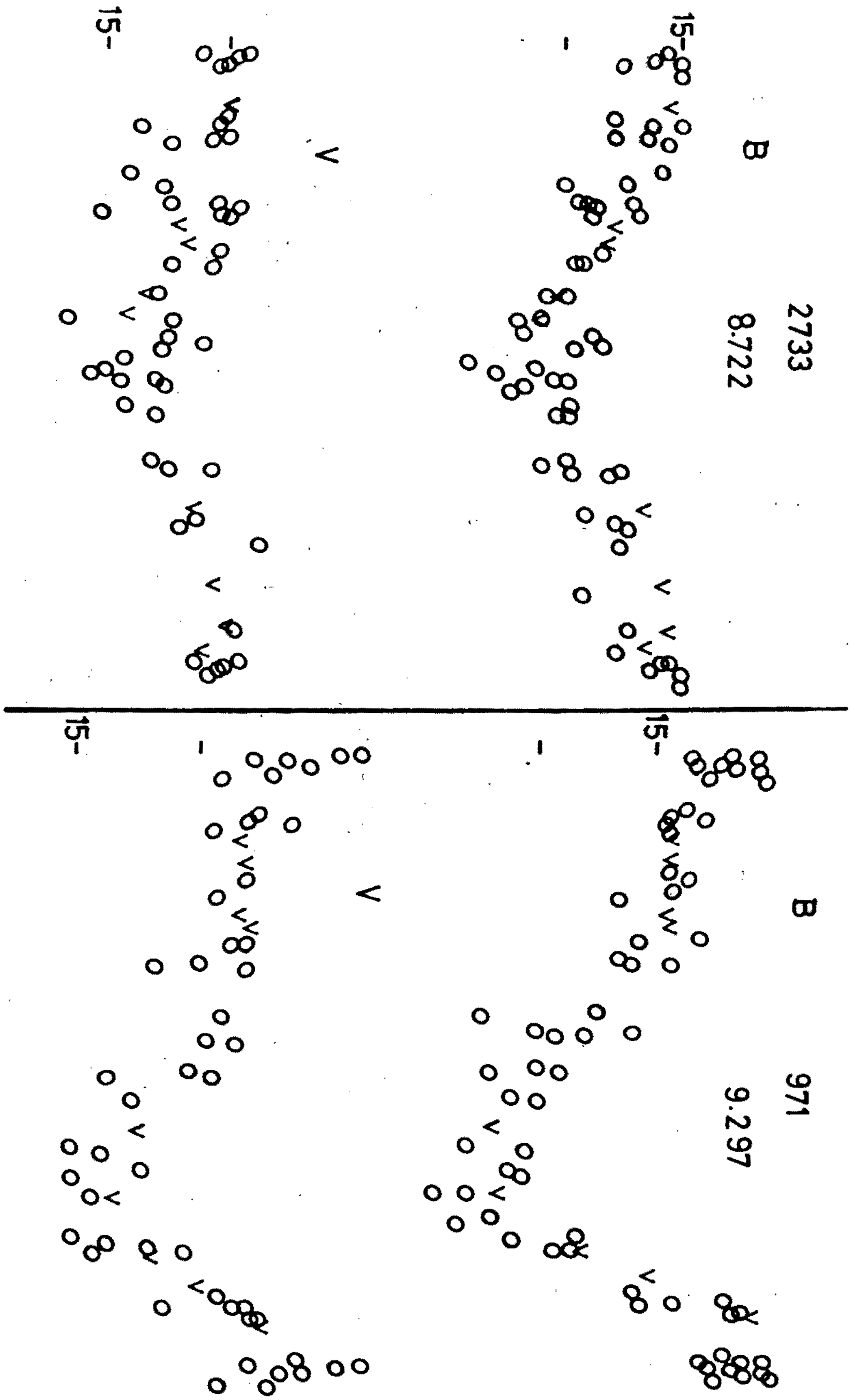
B2



B3



B4



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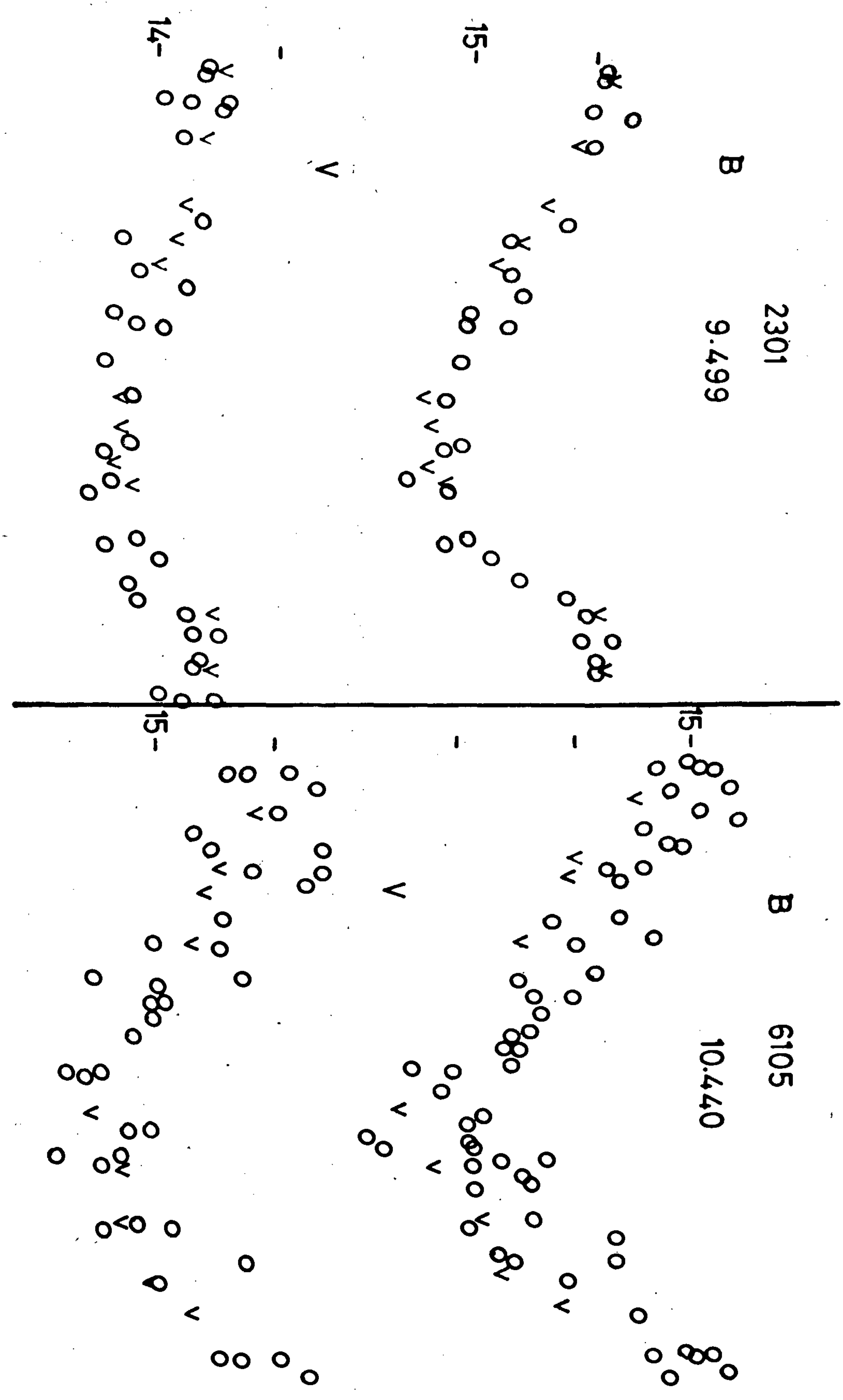
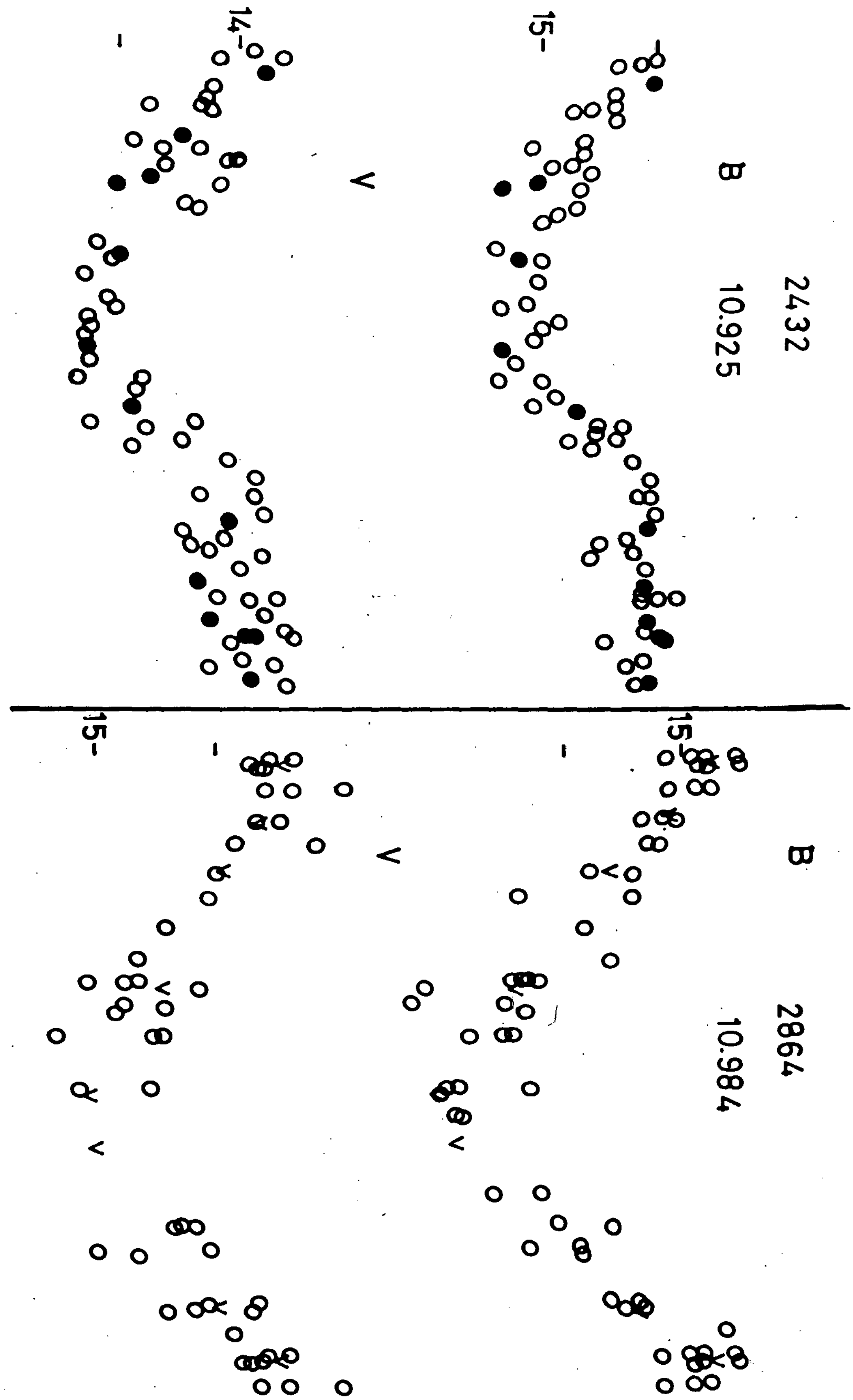
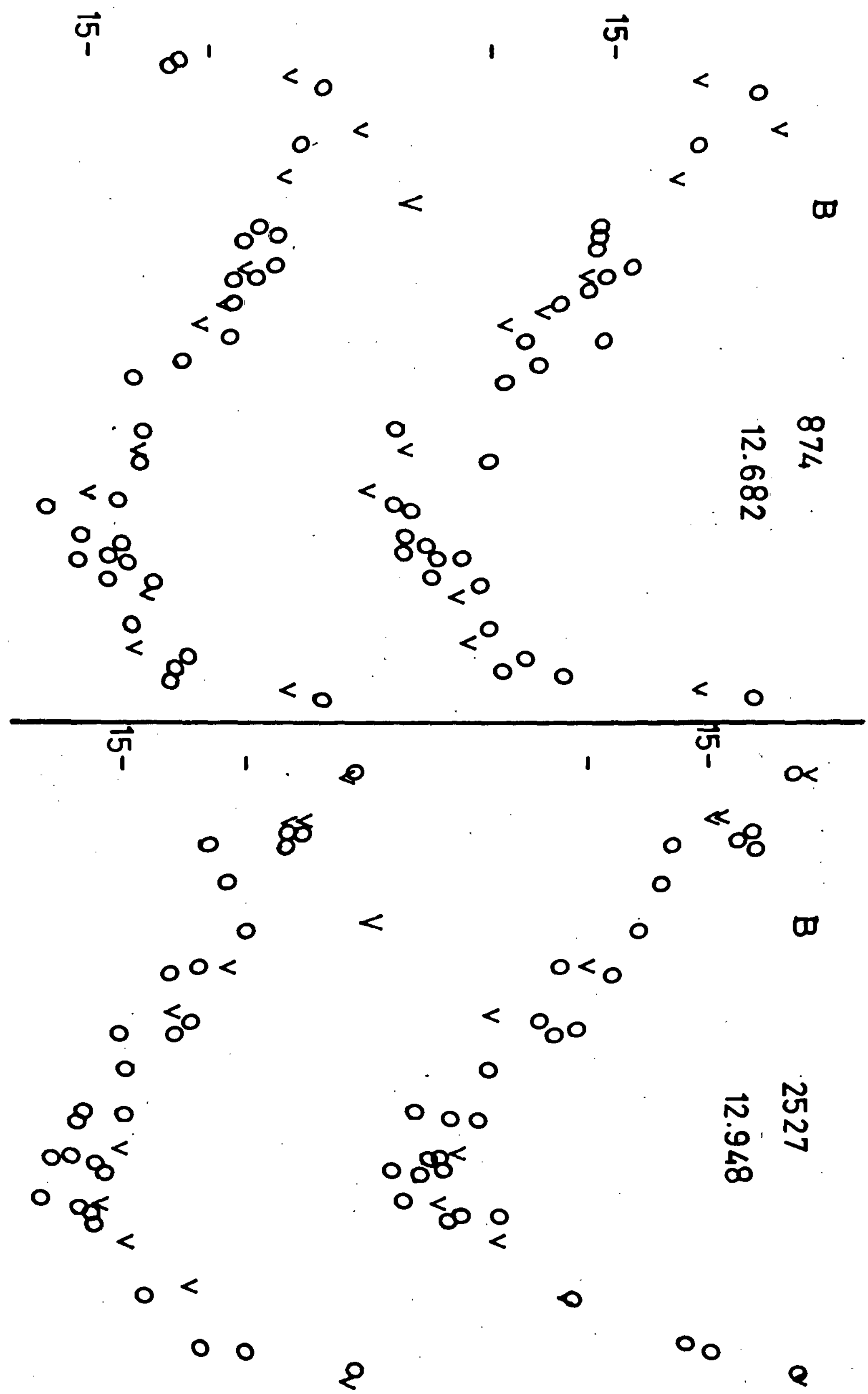
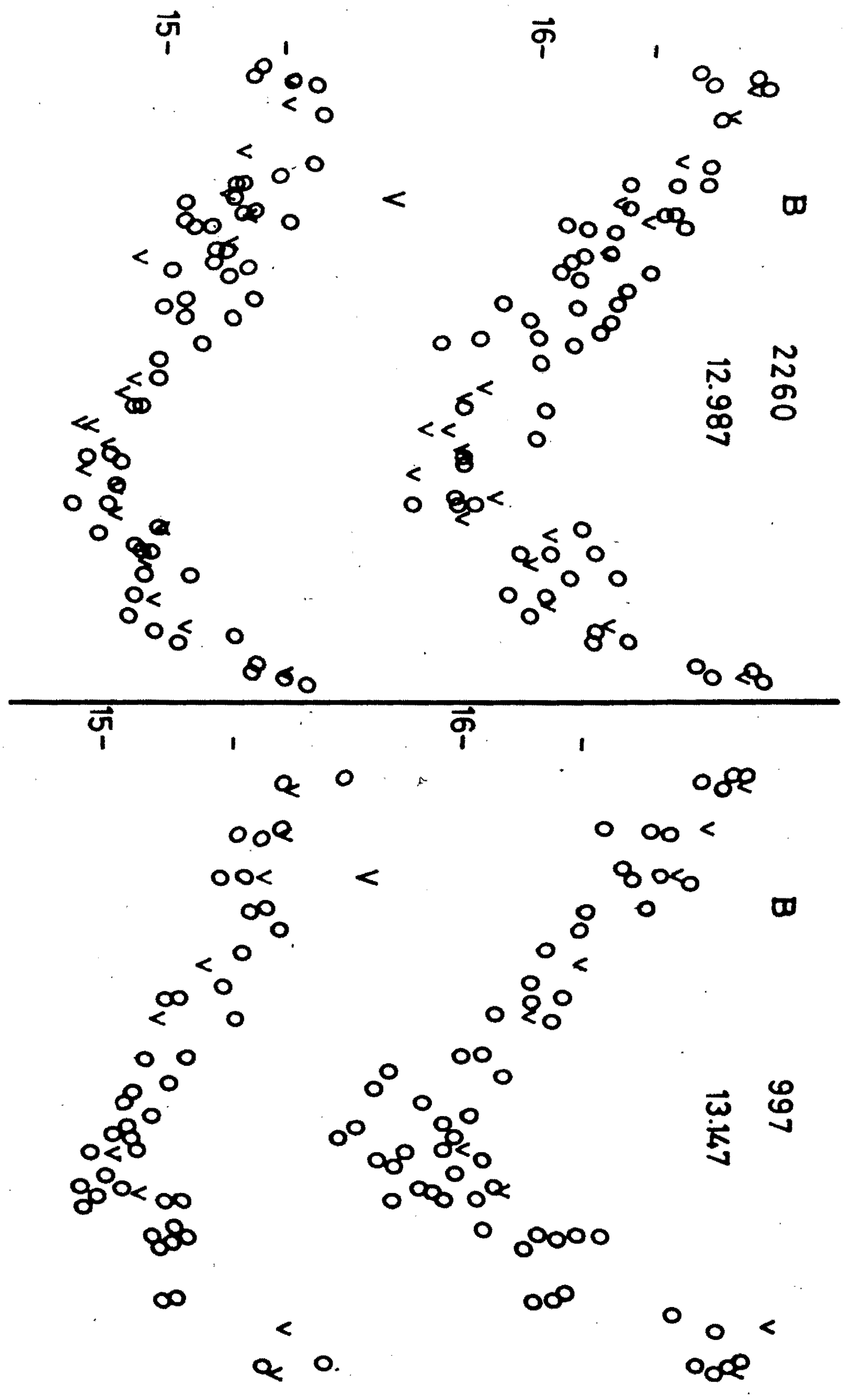
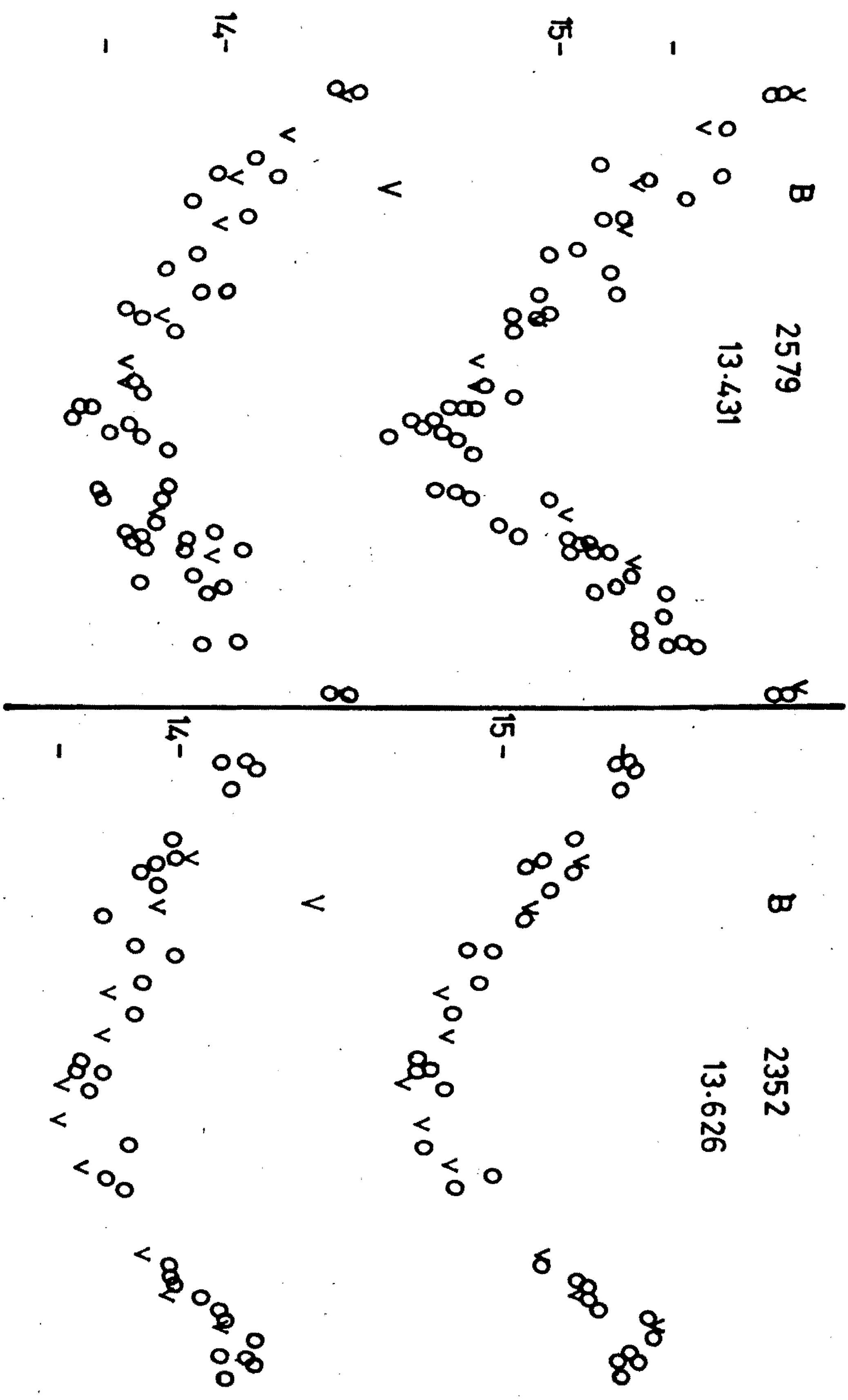

B
2301
9.499
15
14
B
6105
10.440
15
15



B7


B
874
12.682
B
2527
12.948
15-


B
2260
12.987
16-
15-
B
997
13.147
16-
15-



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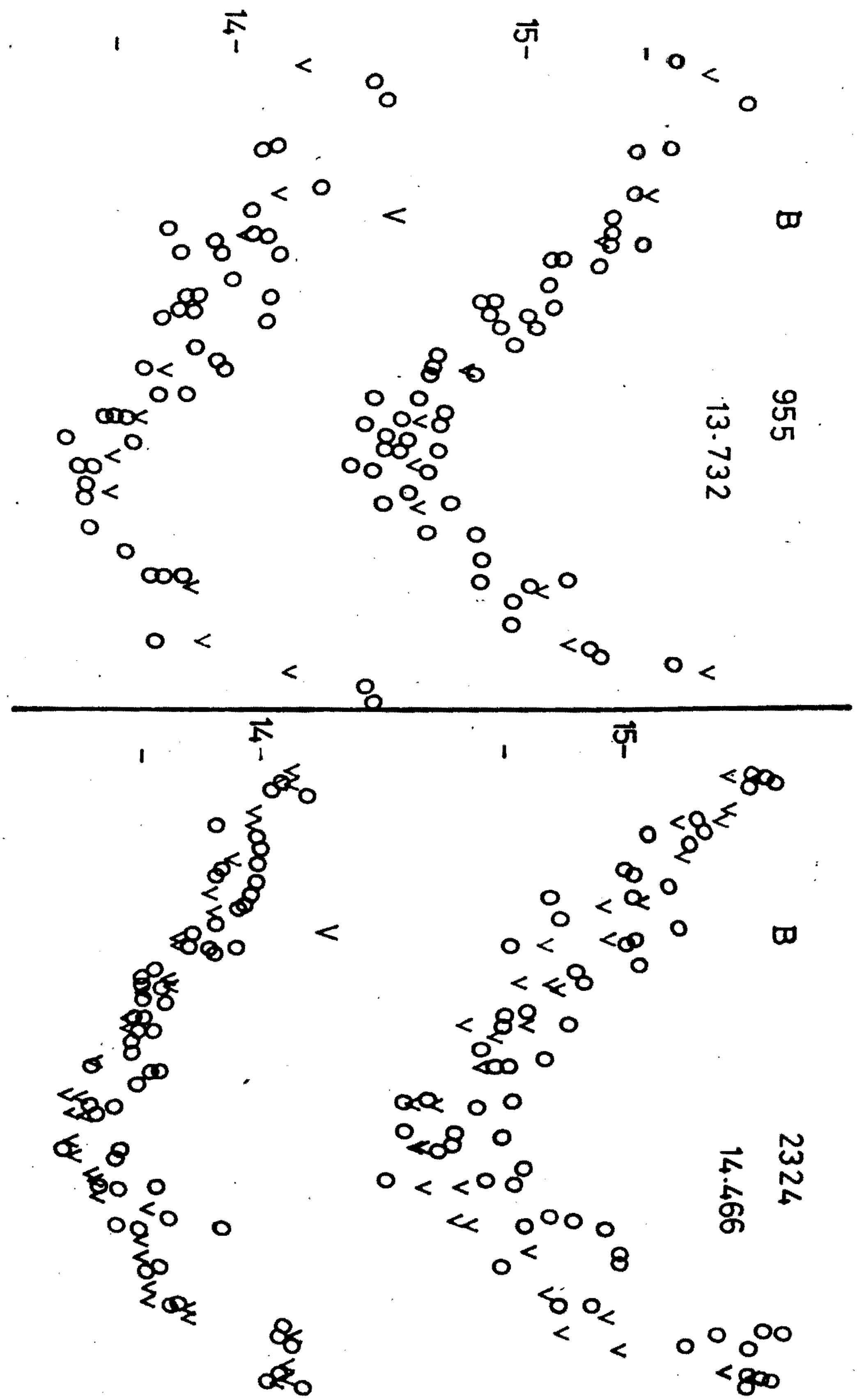

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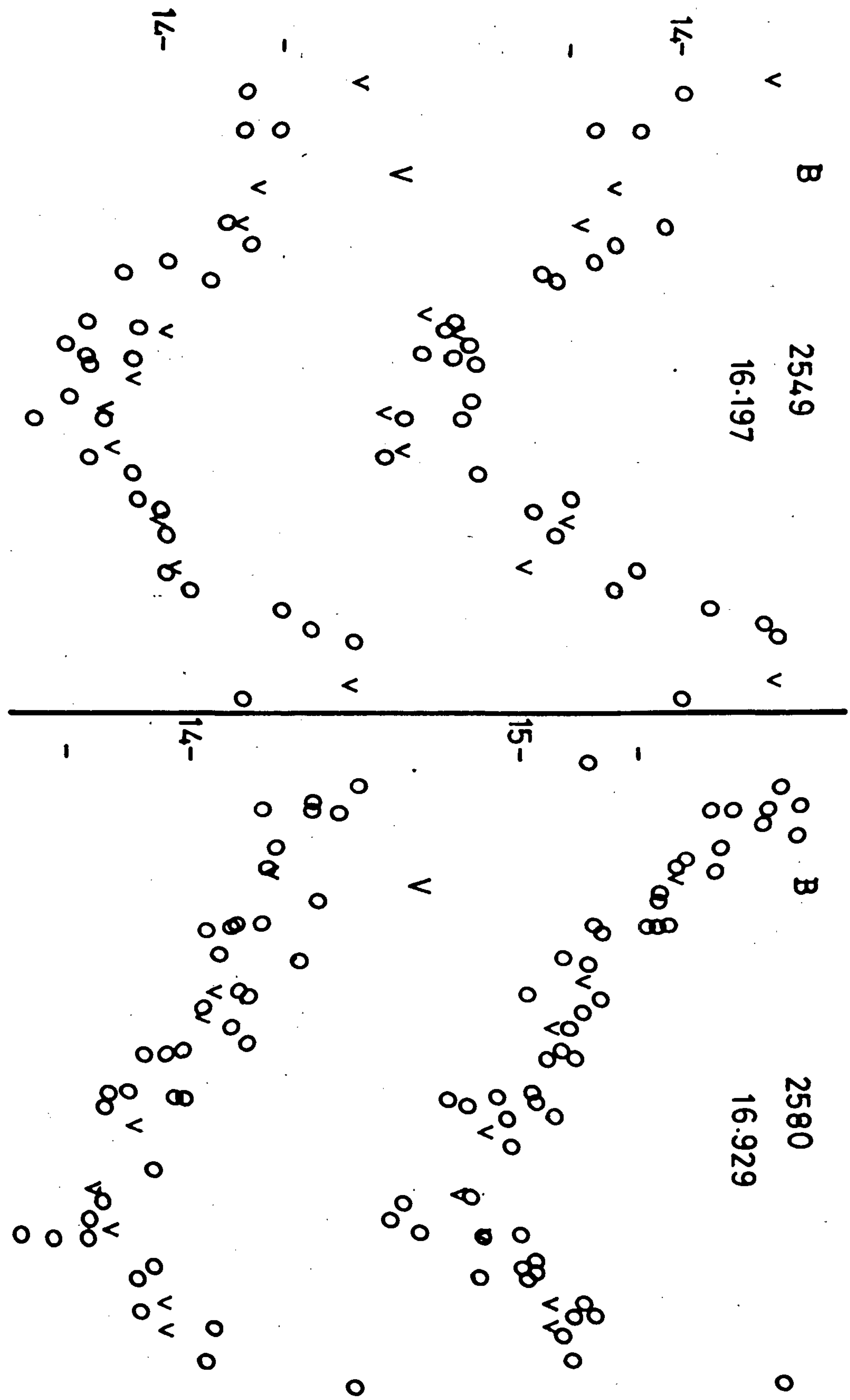
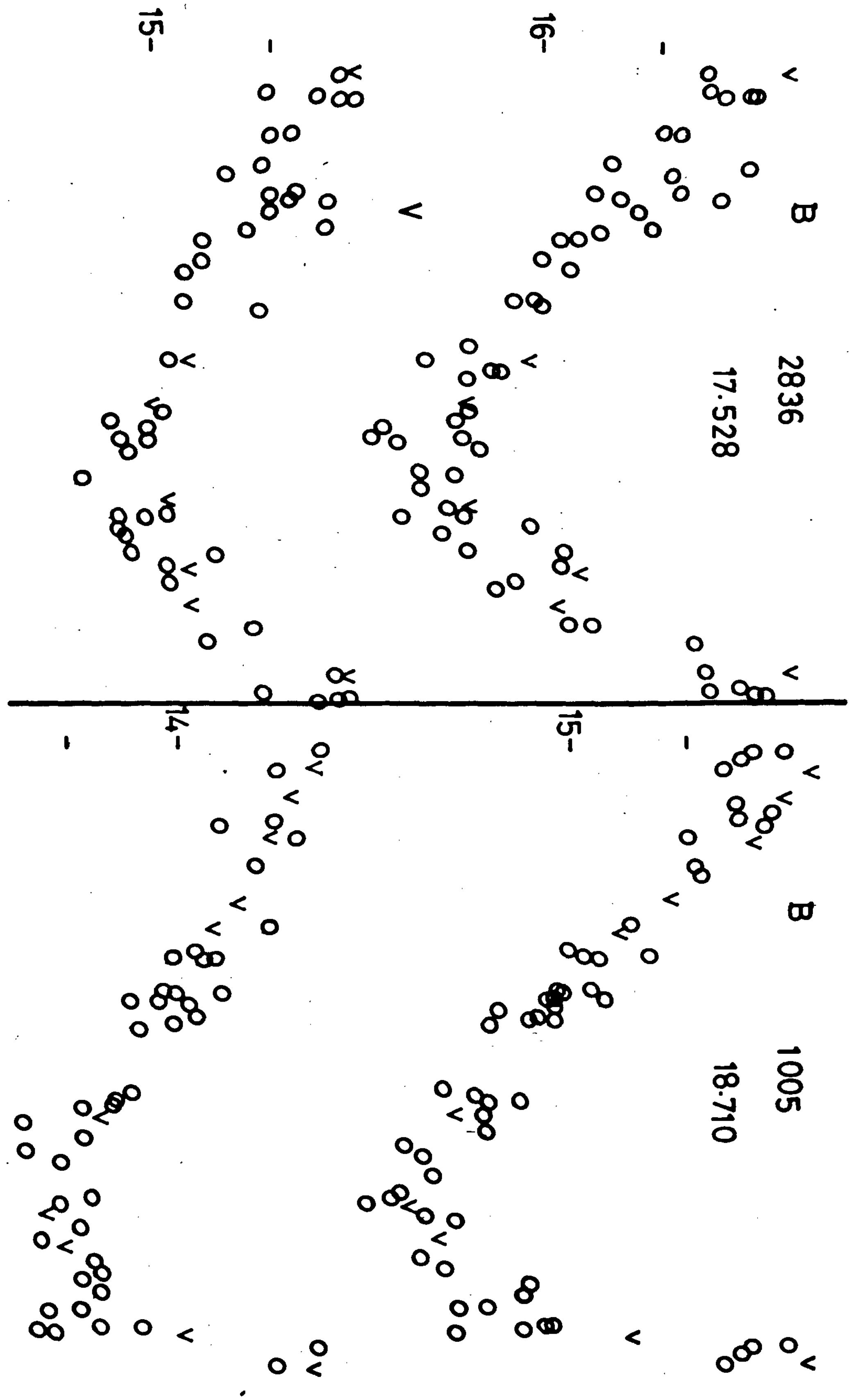
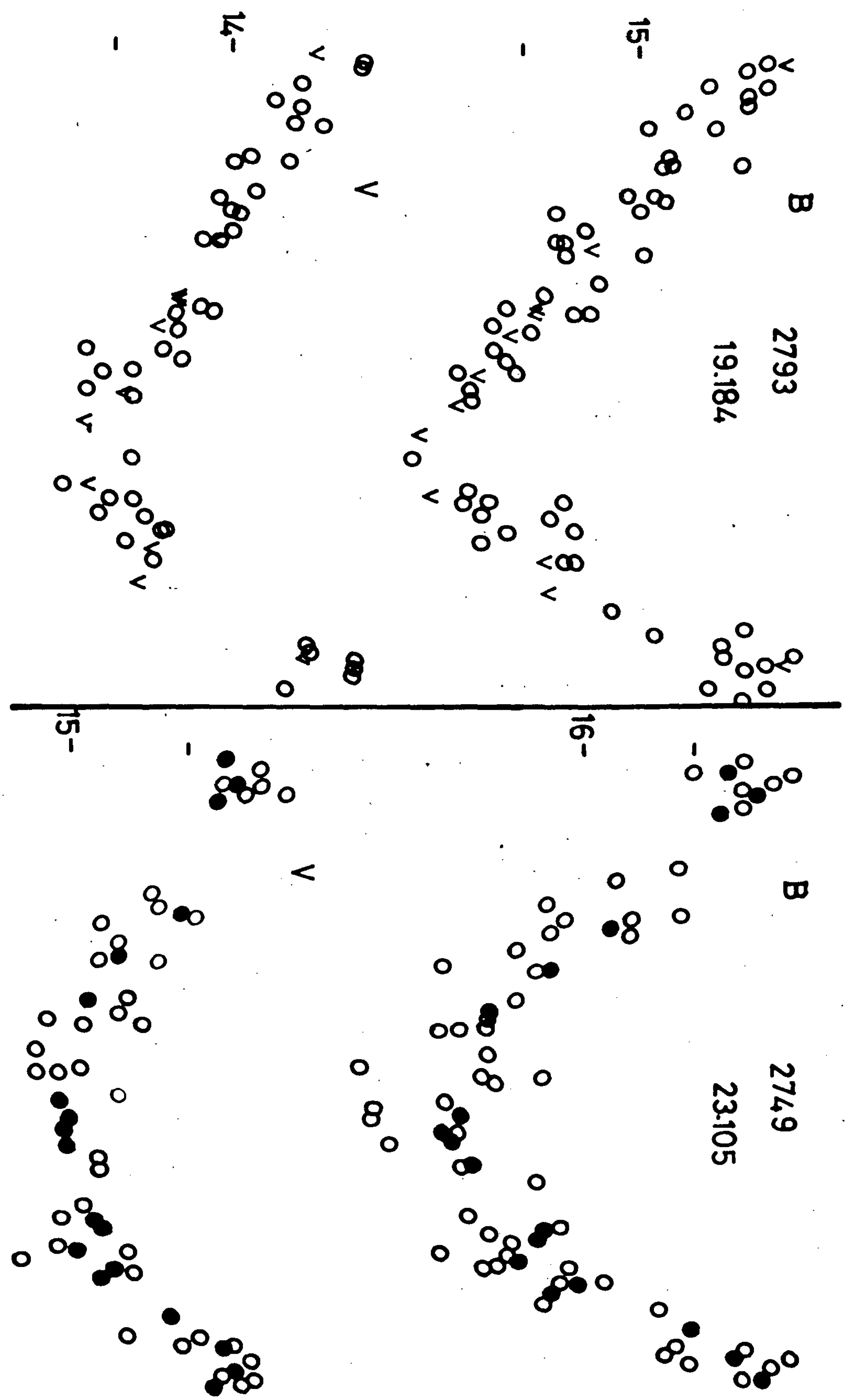

B
2549
16.197
14-
14-
15-
B
2580
16.929



B13



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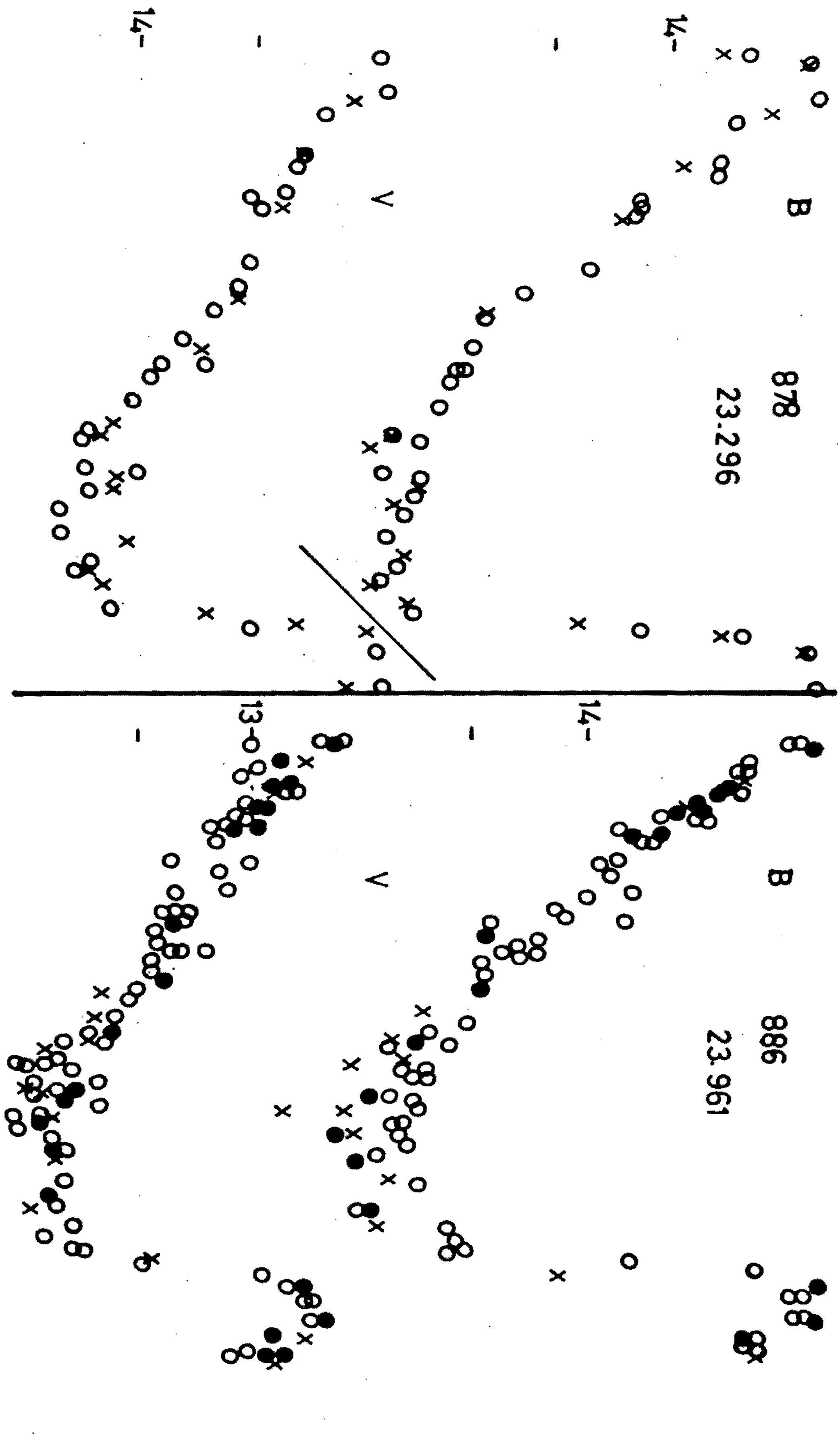

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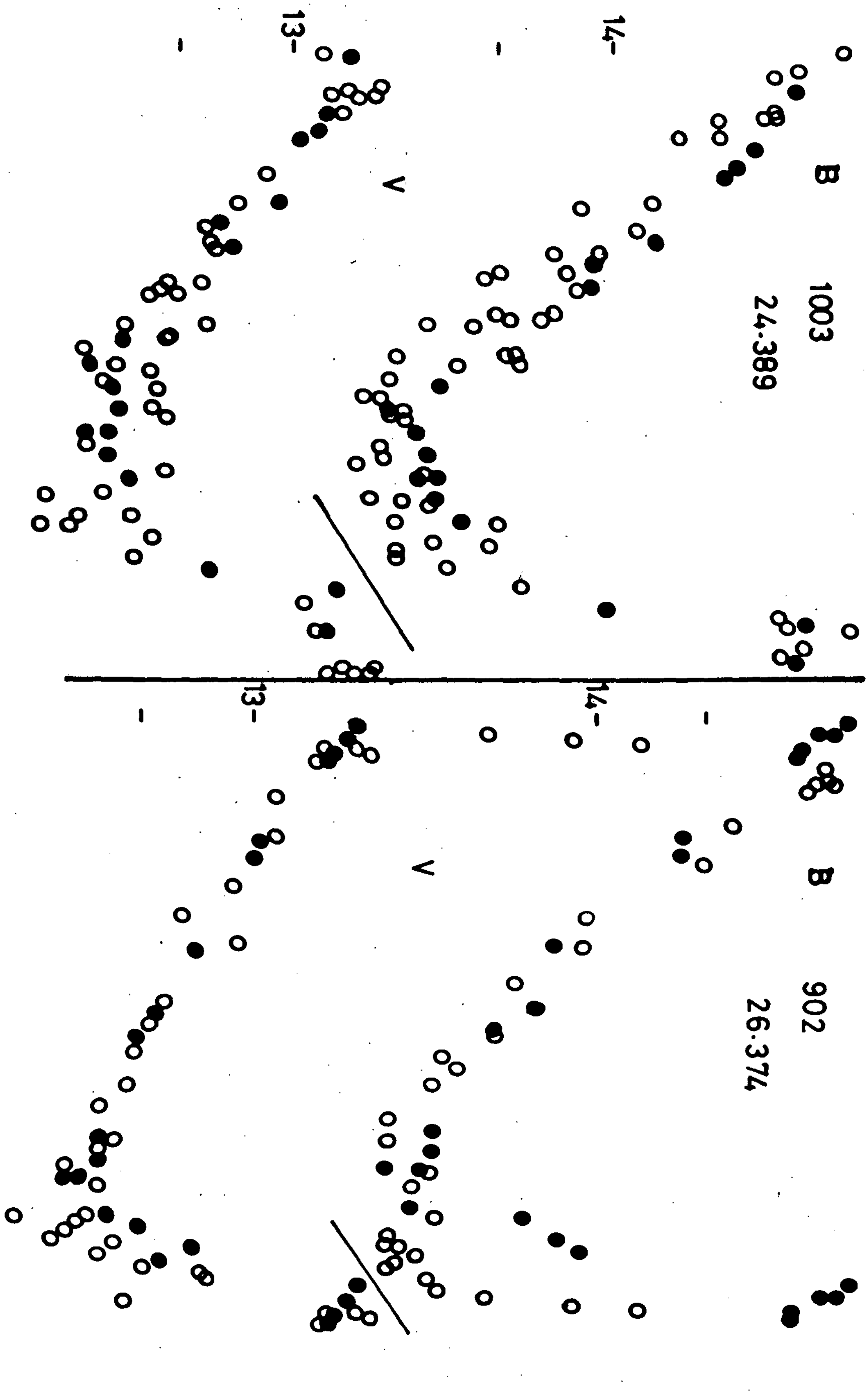

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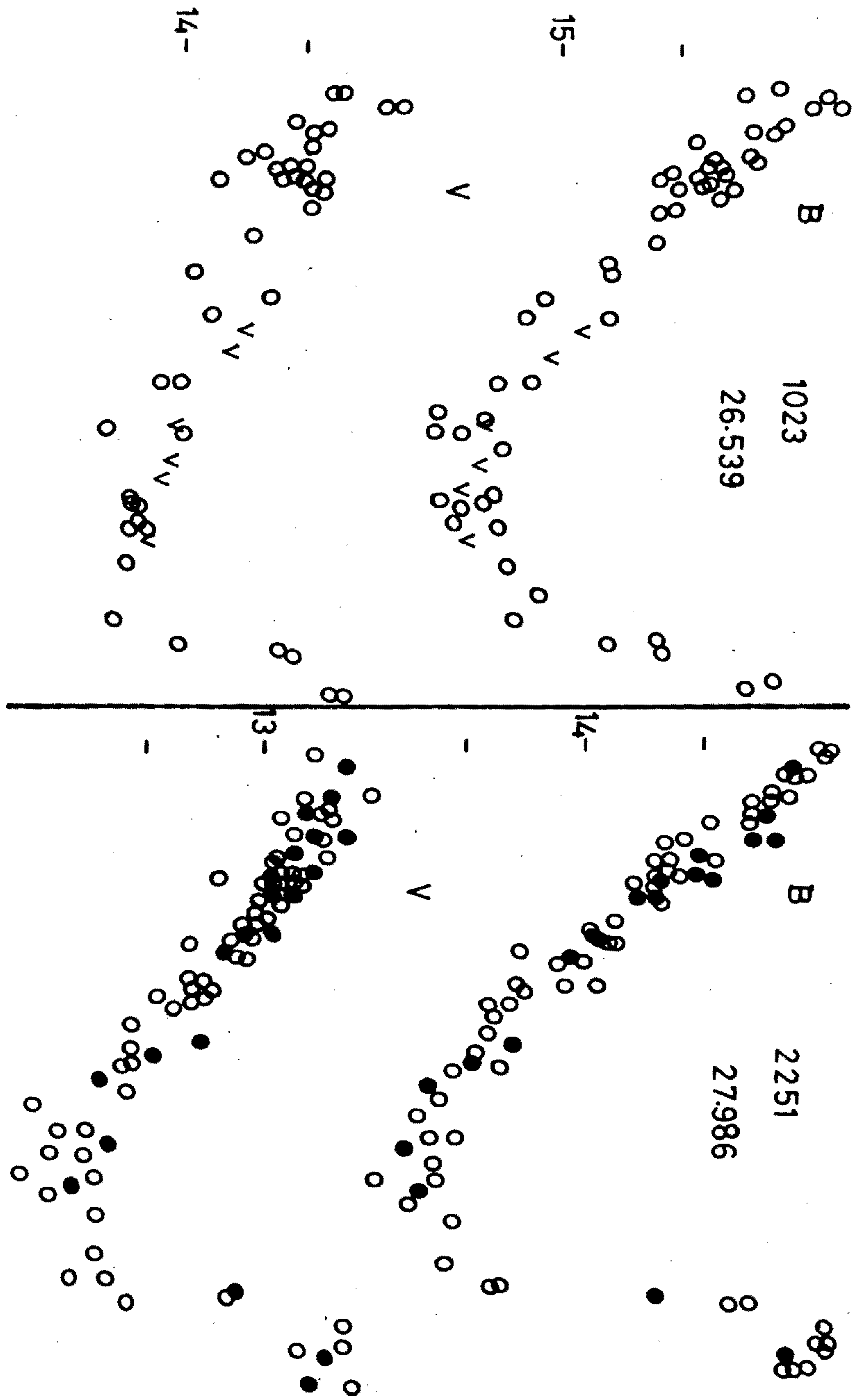

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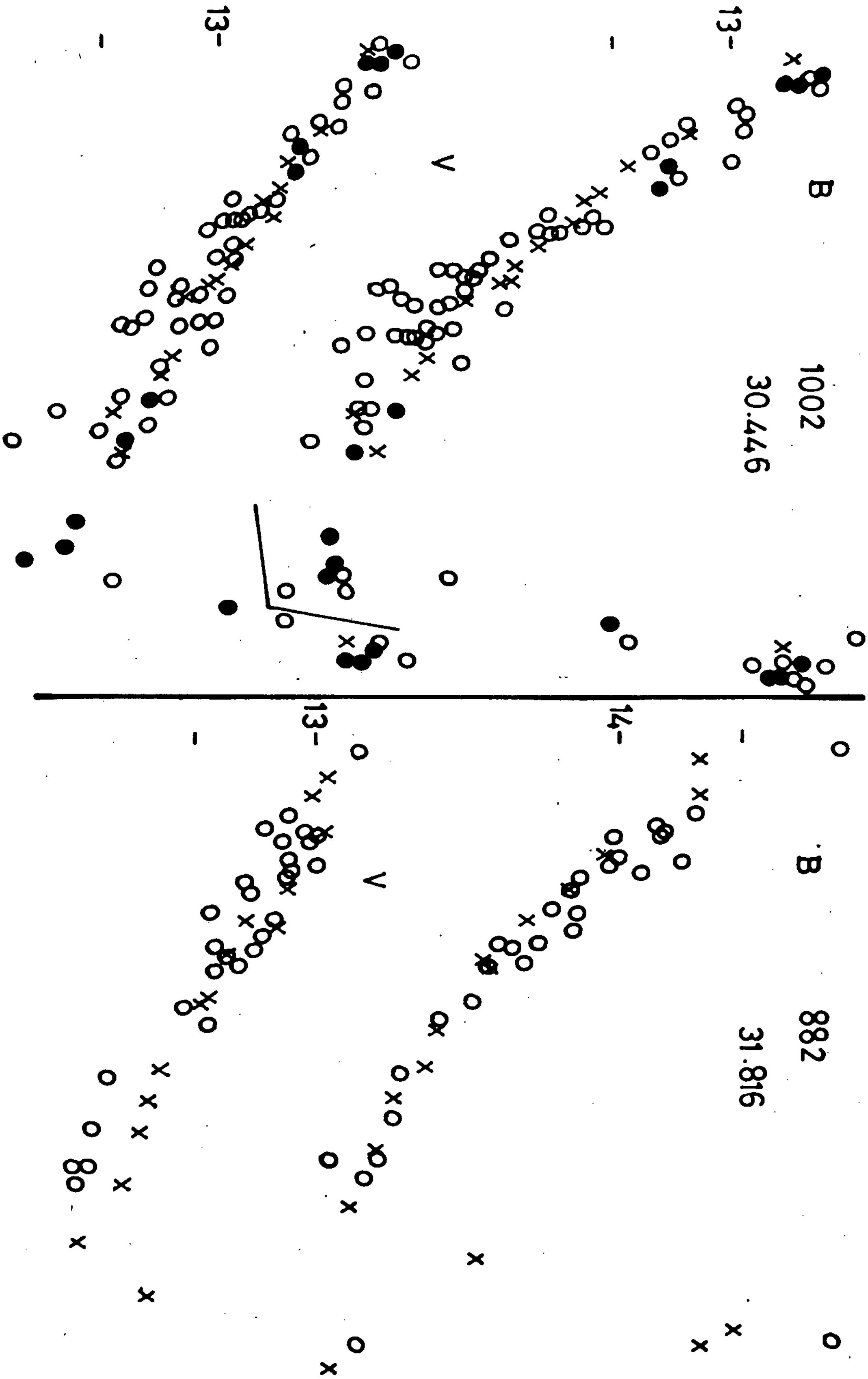
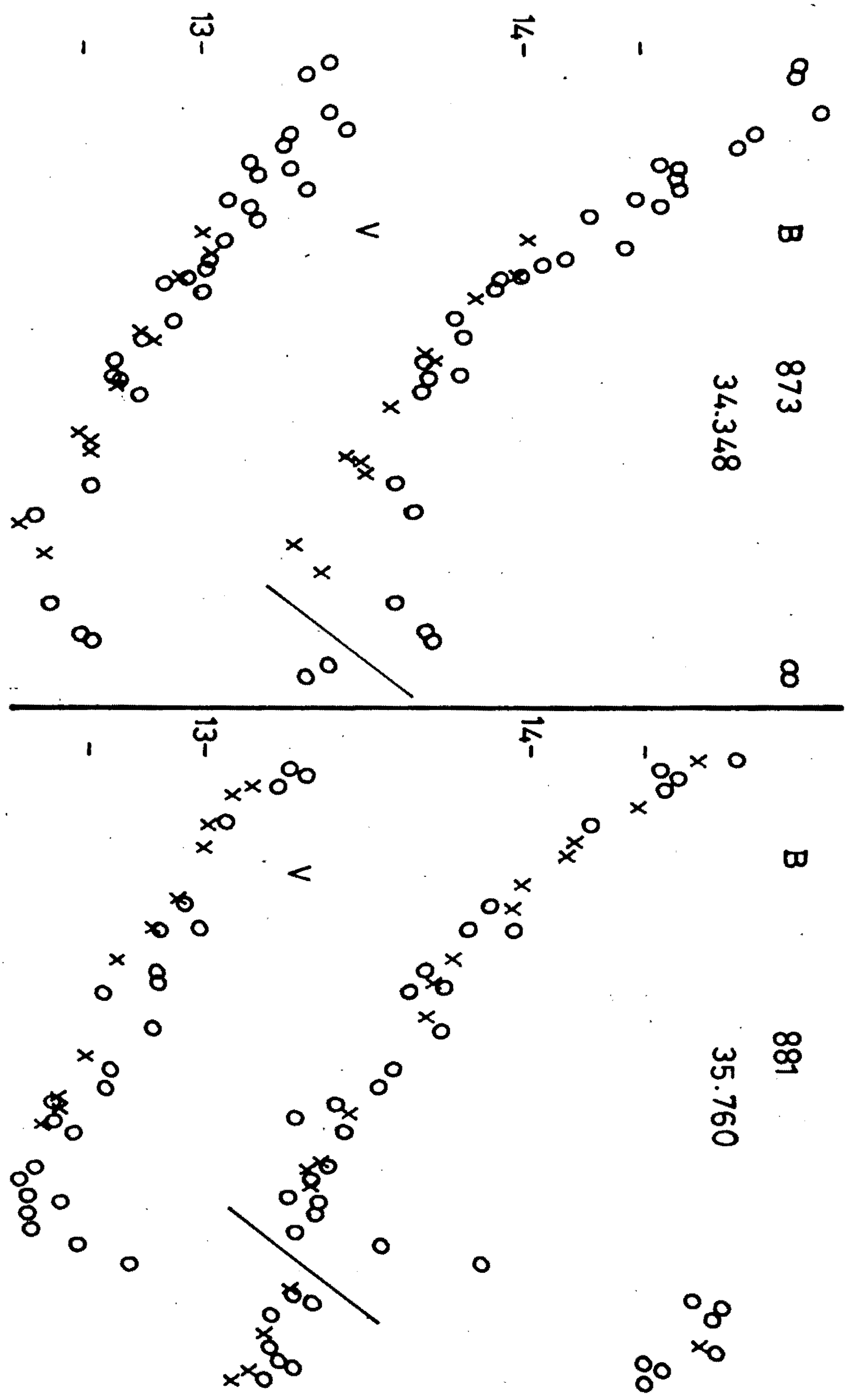

B
V
1002
30.446
13
882
31.816
14



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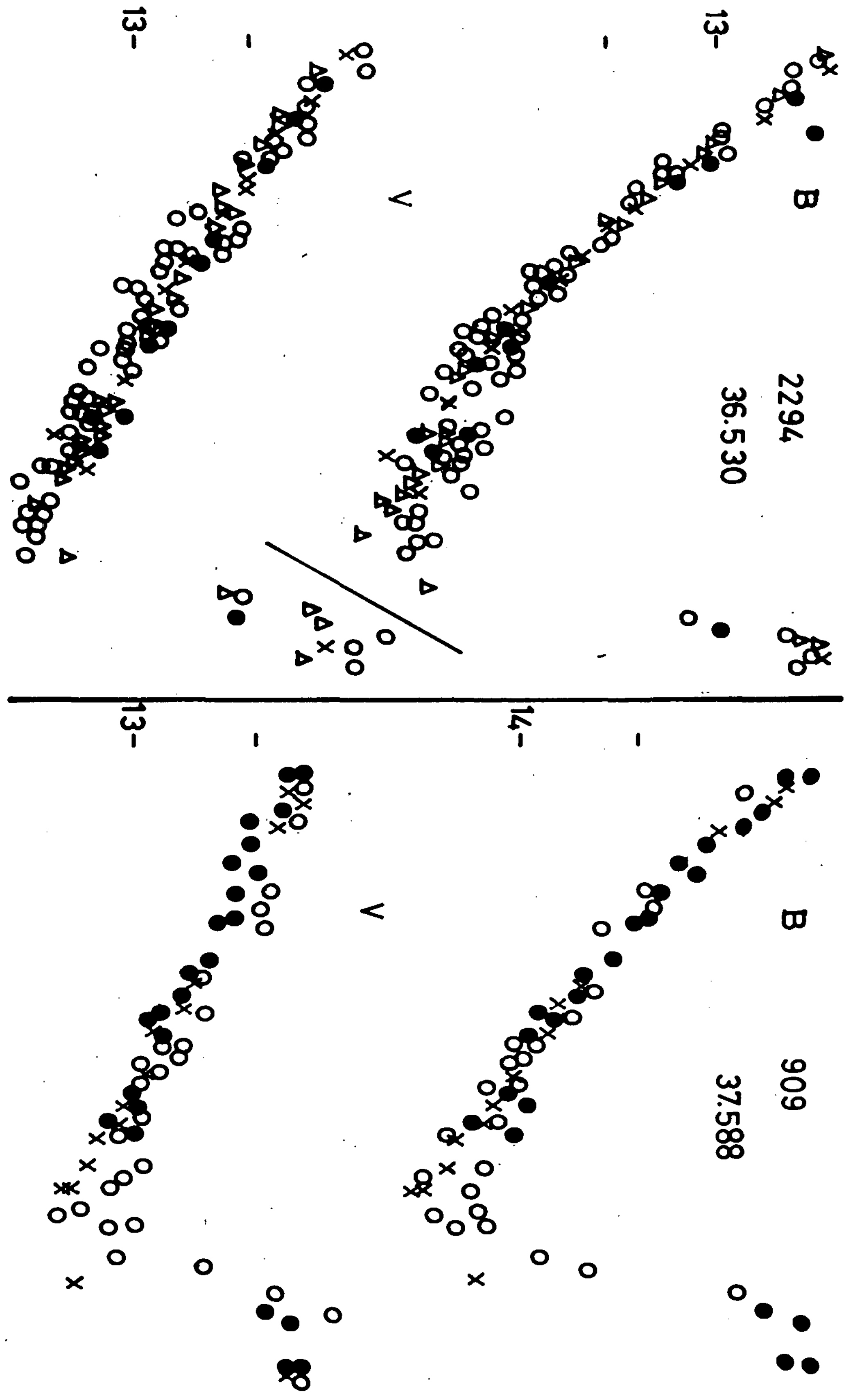

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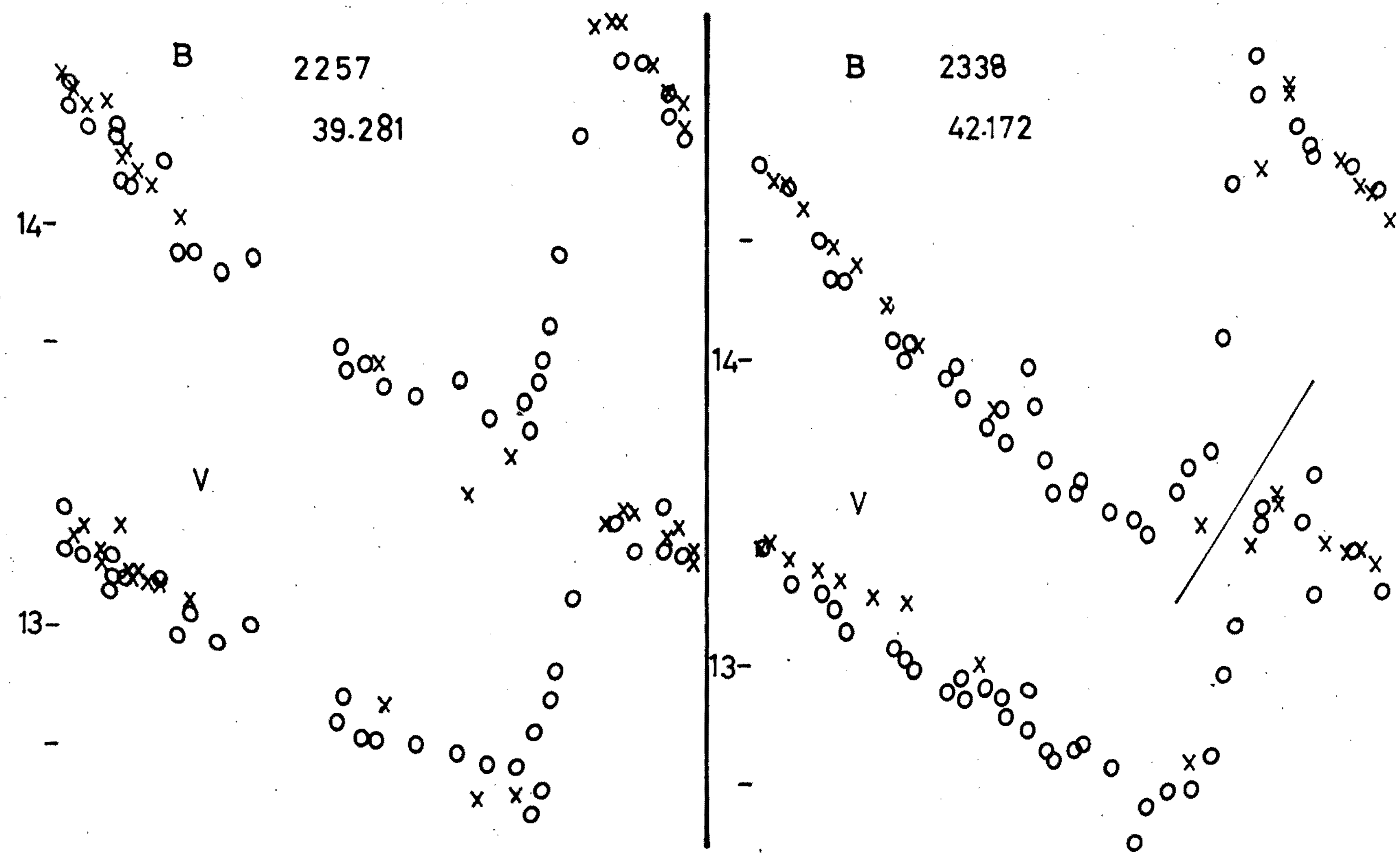

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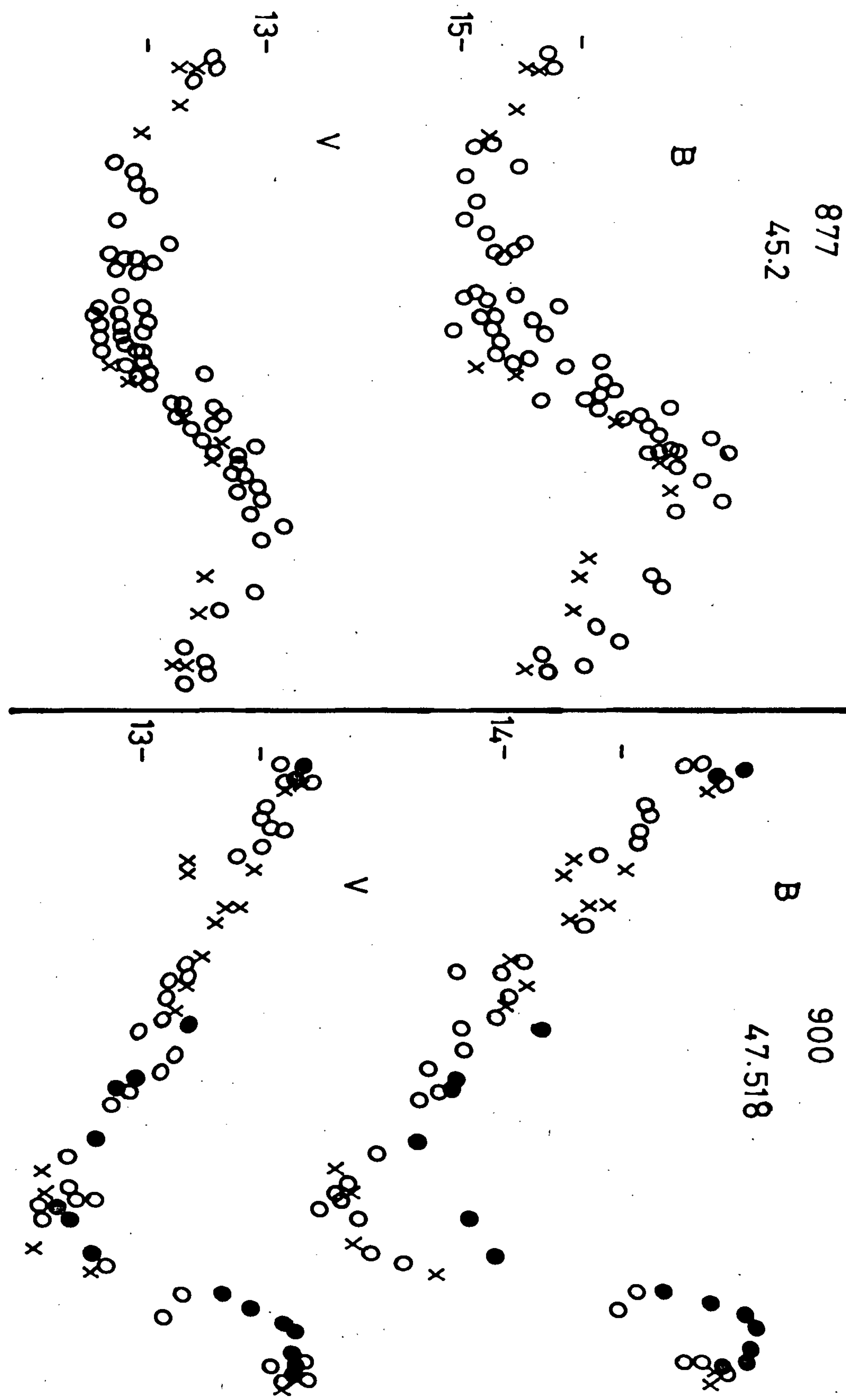
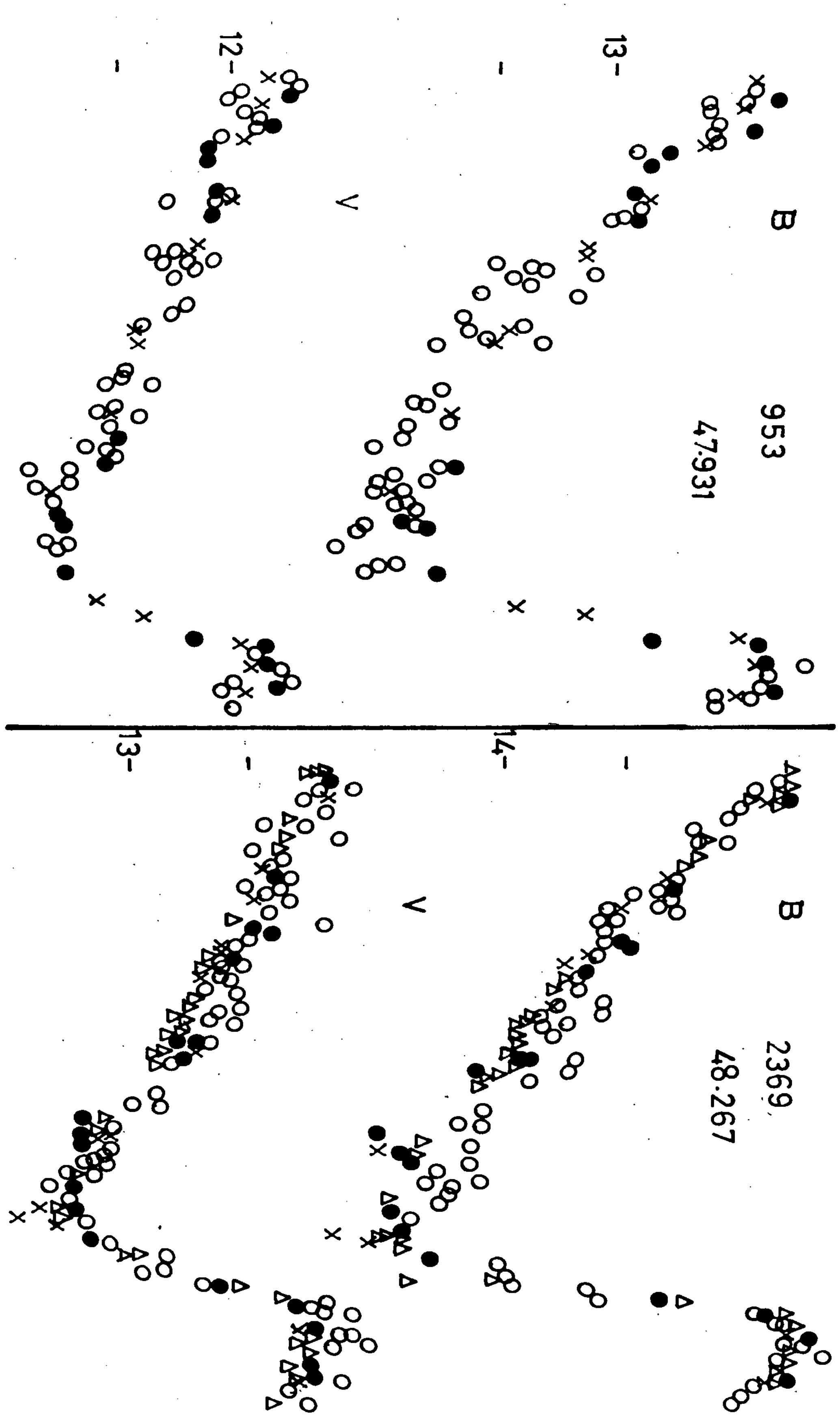
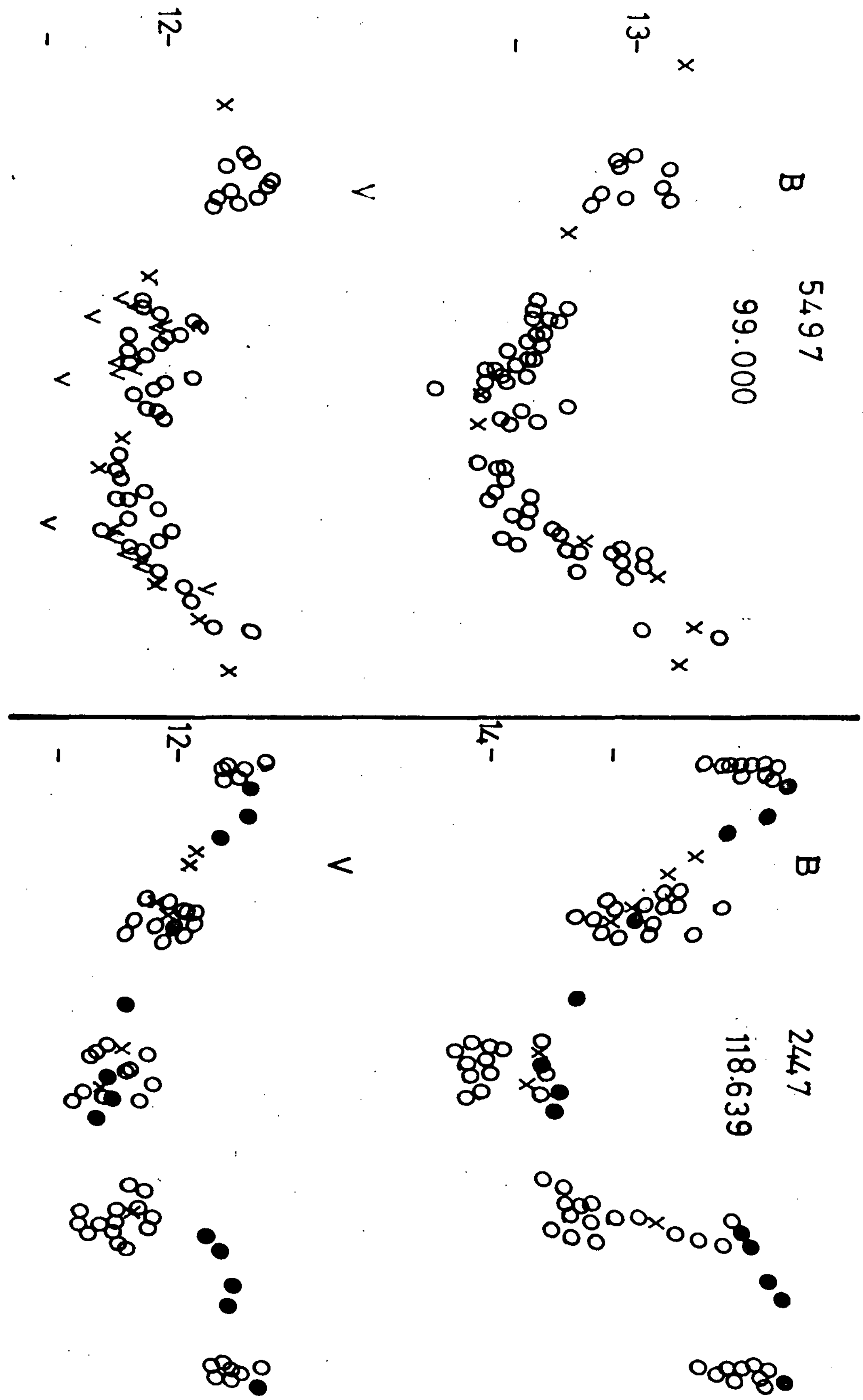


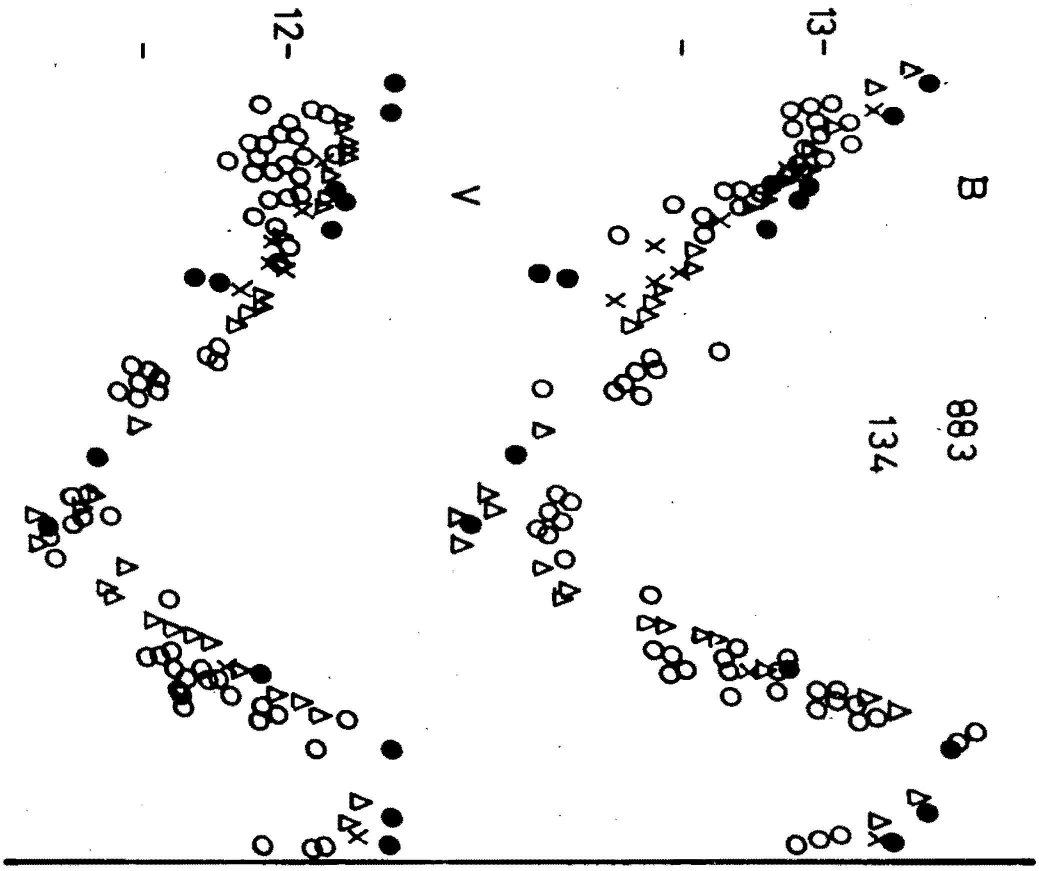
877
45.2
B
V
15
13
900
47.518
B
V
14
13

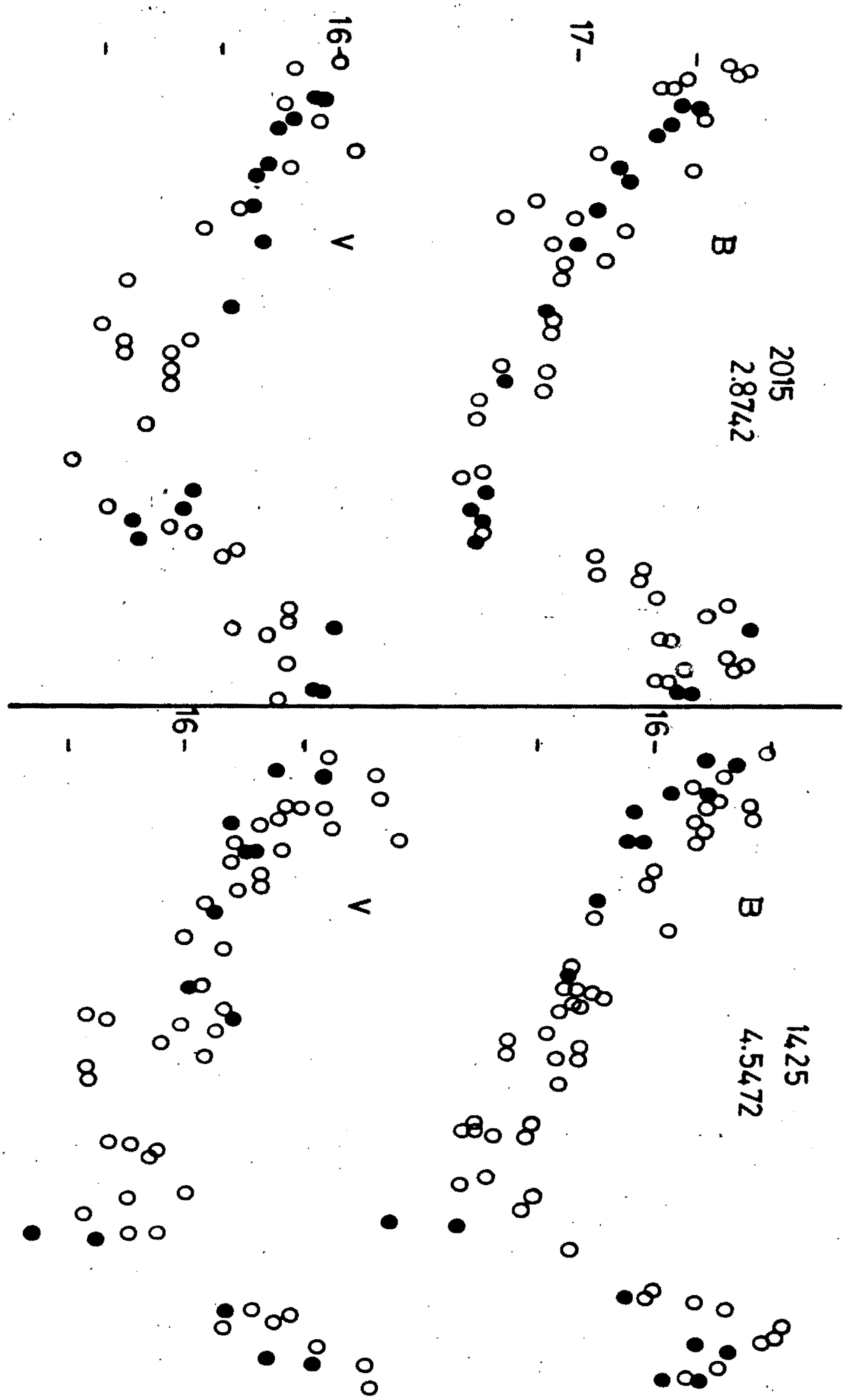


B23

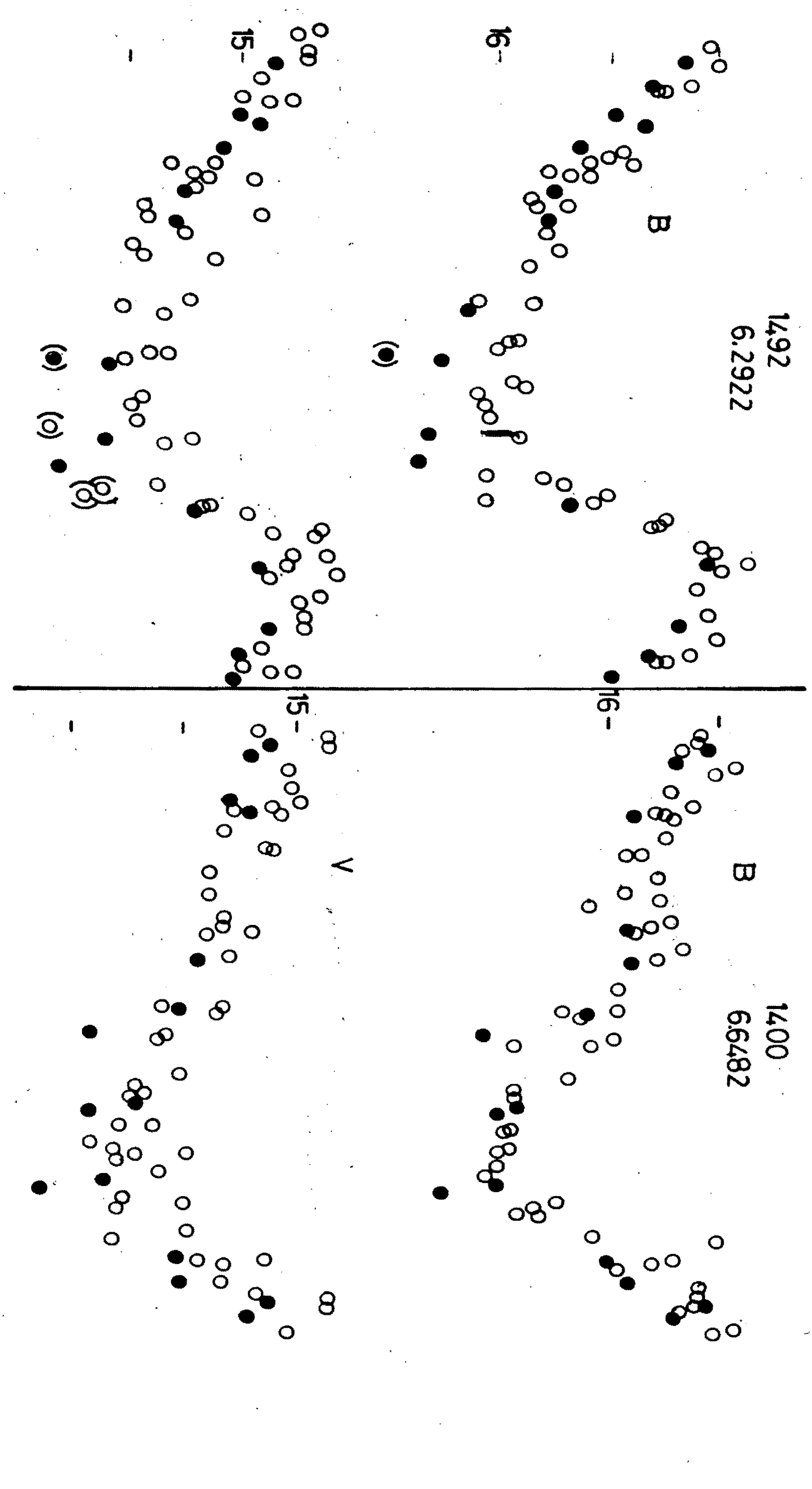


B24

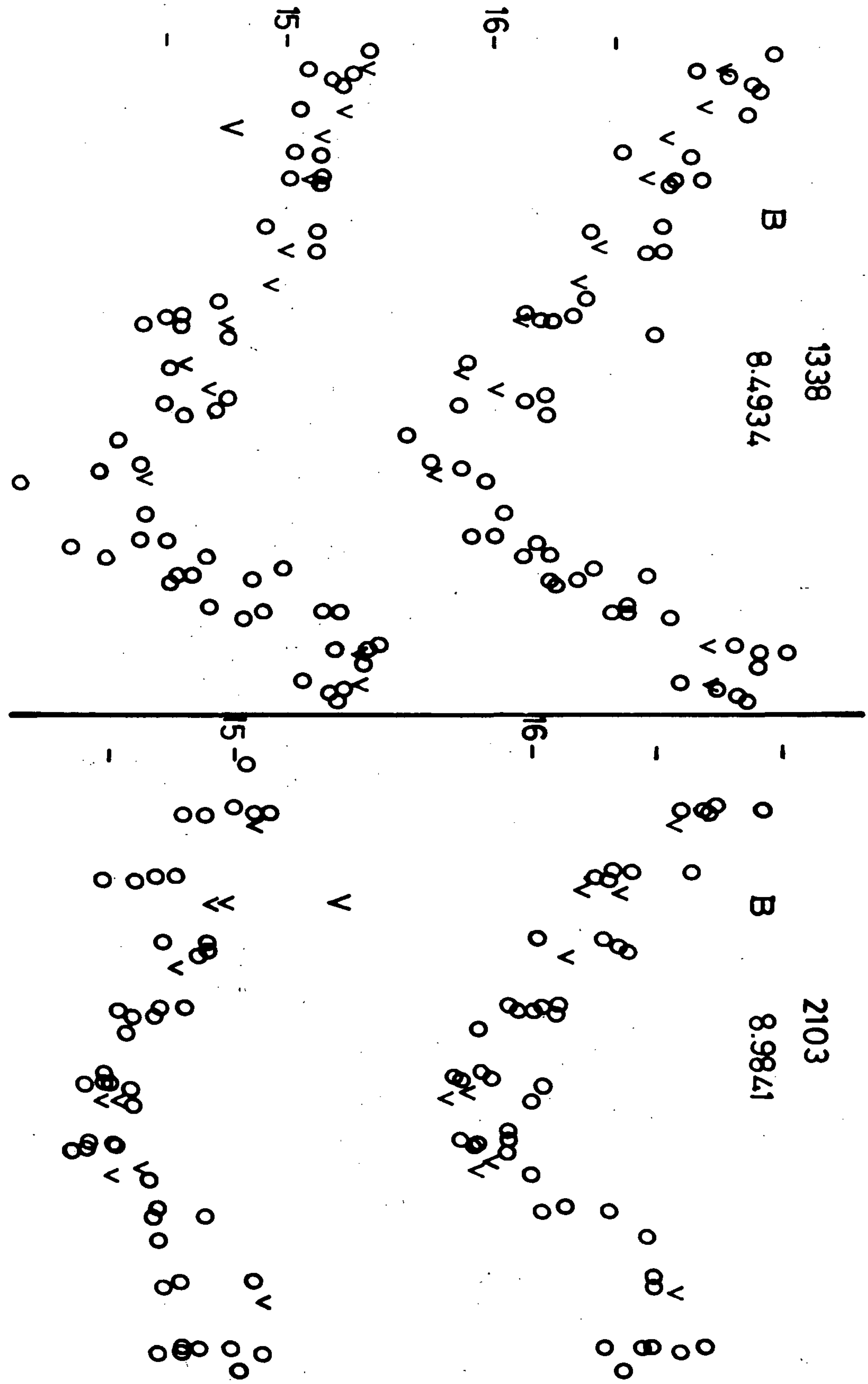

B
V
883
134
13
12



B 26



B27



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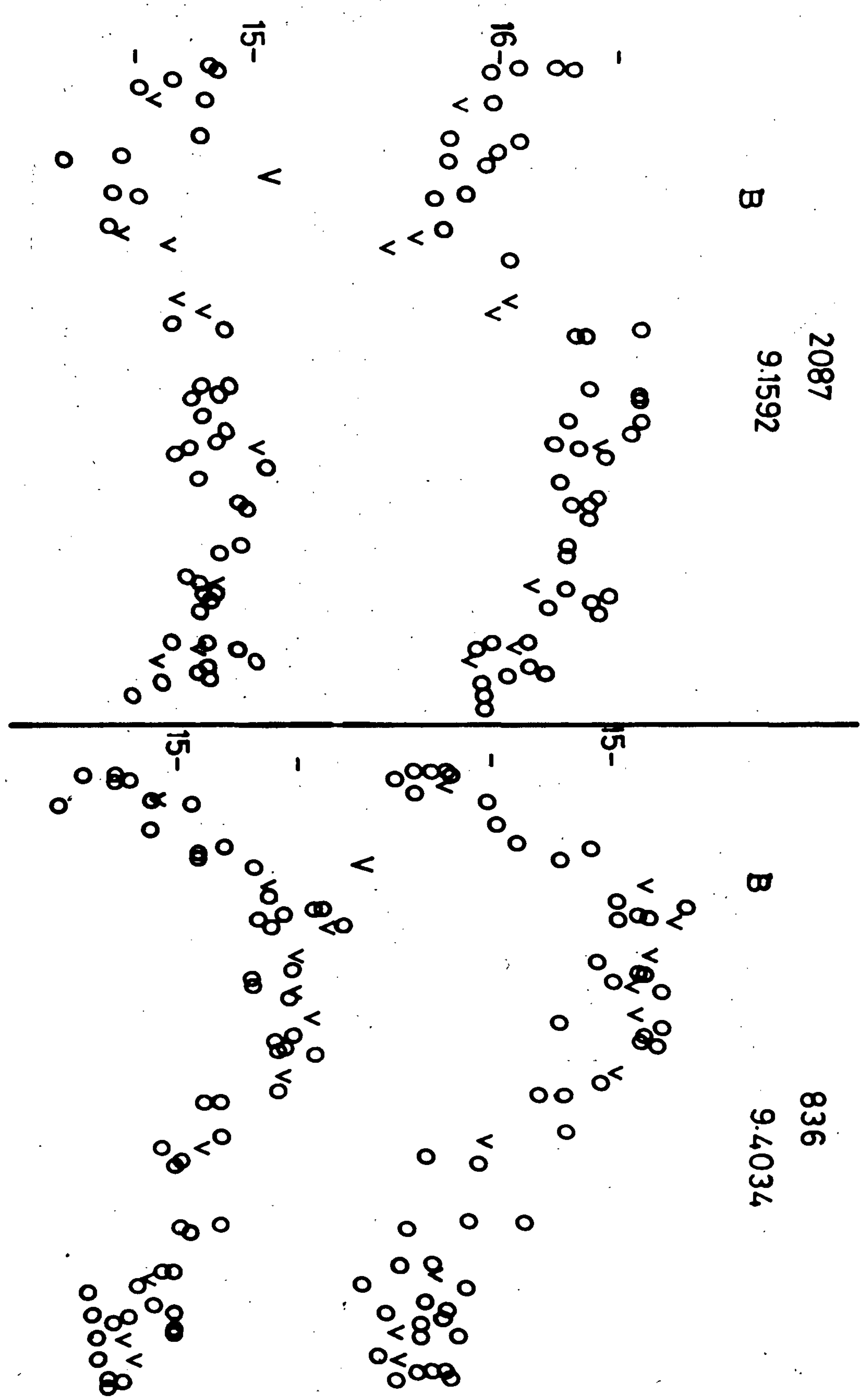
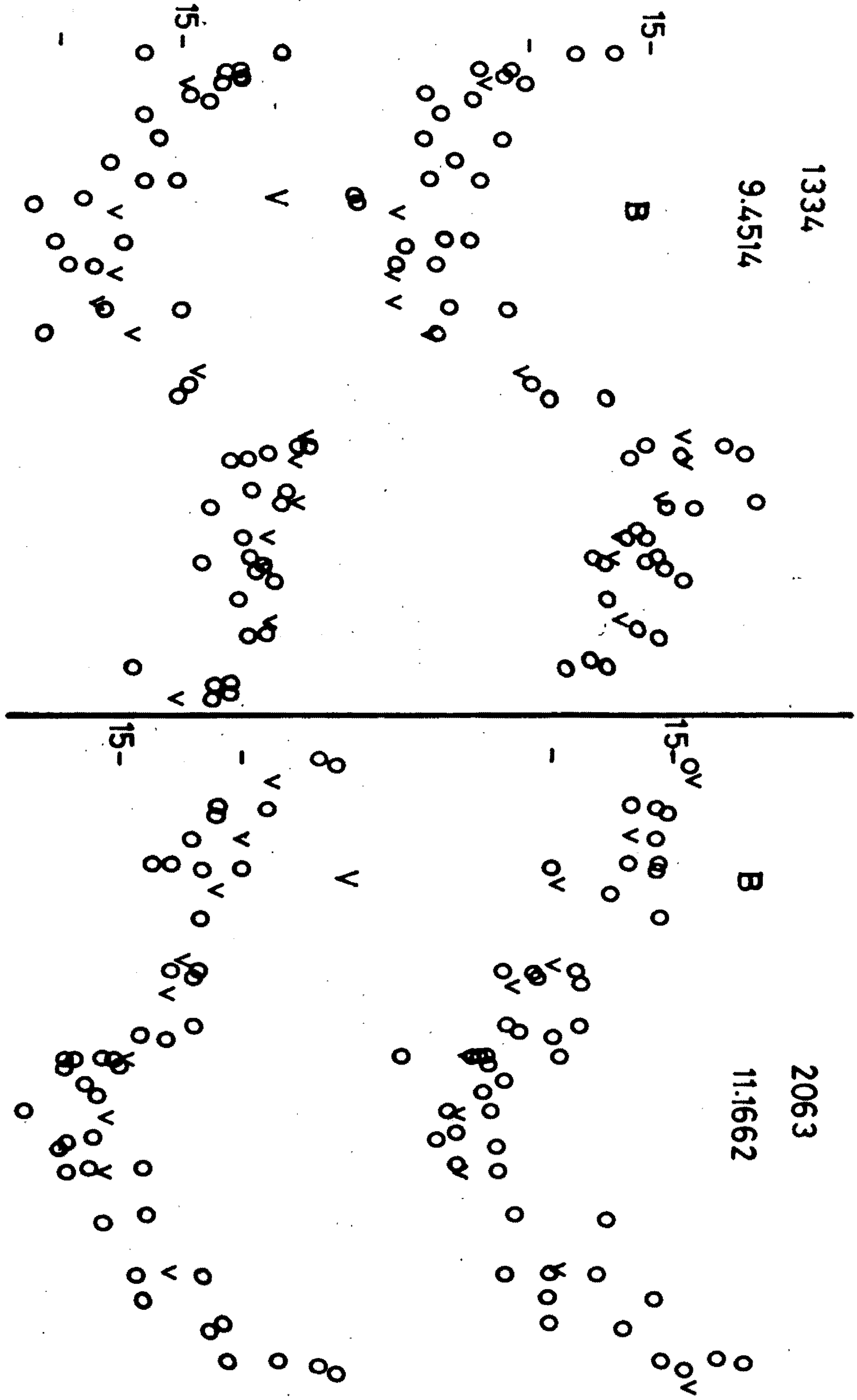
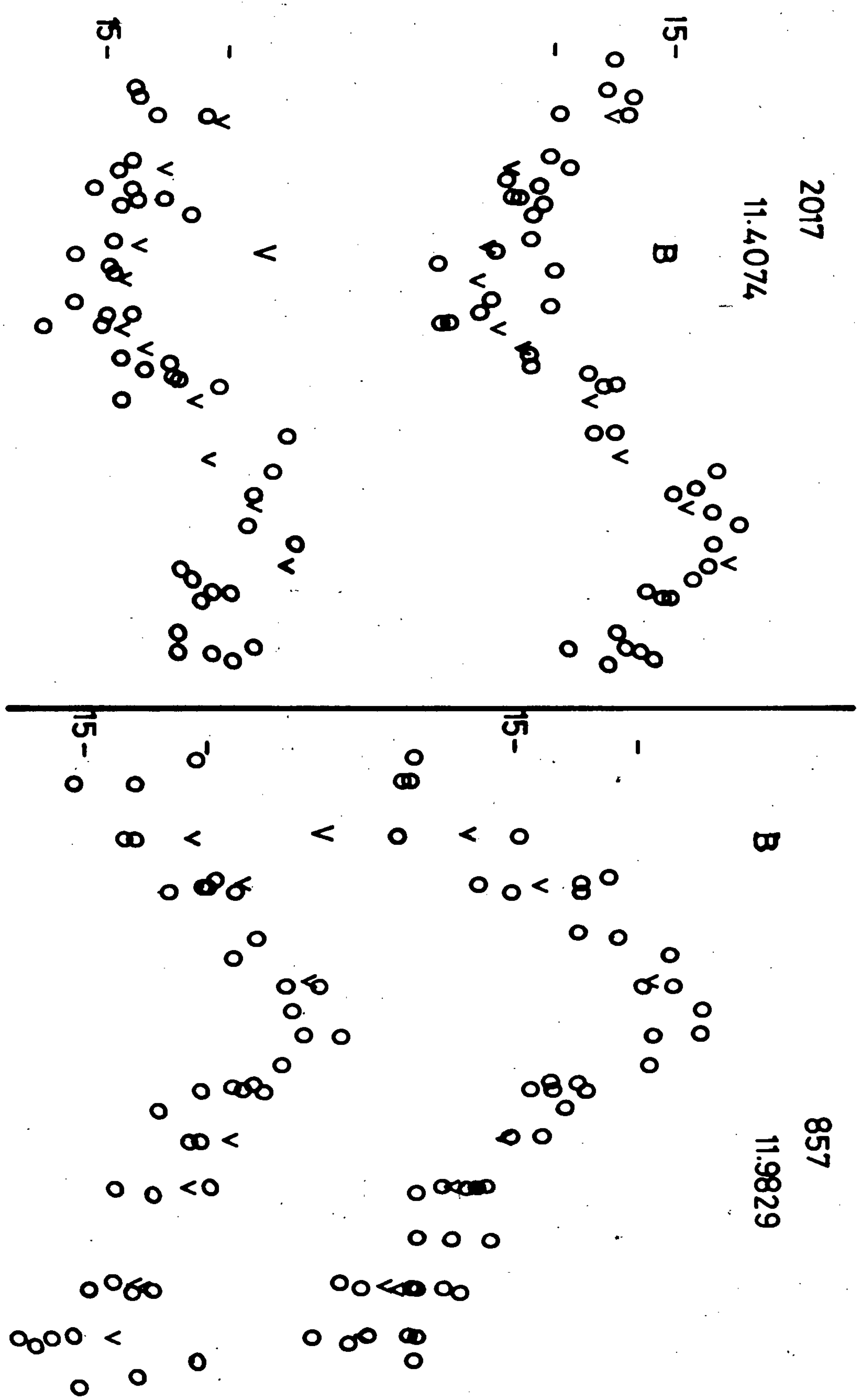
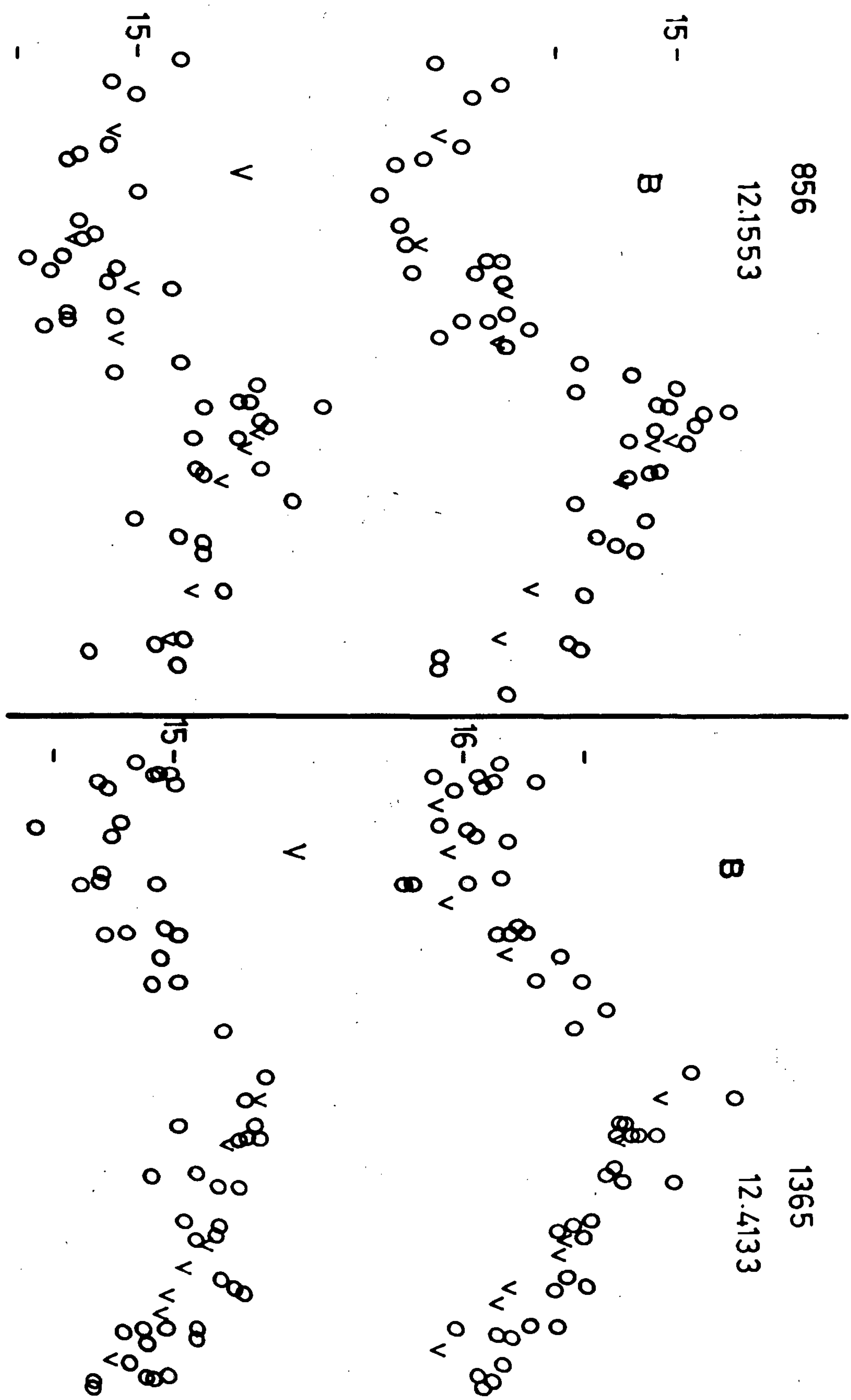


B29


1334
9.4514
2063
11.1662
B
15-



B31



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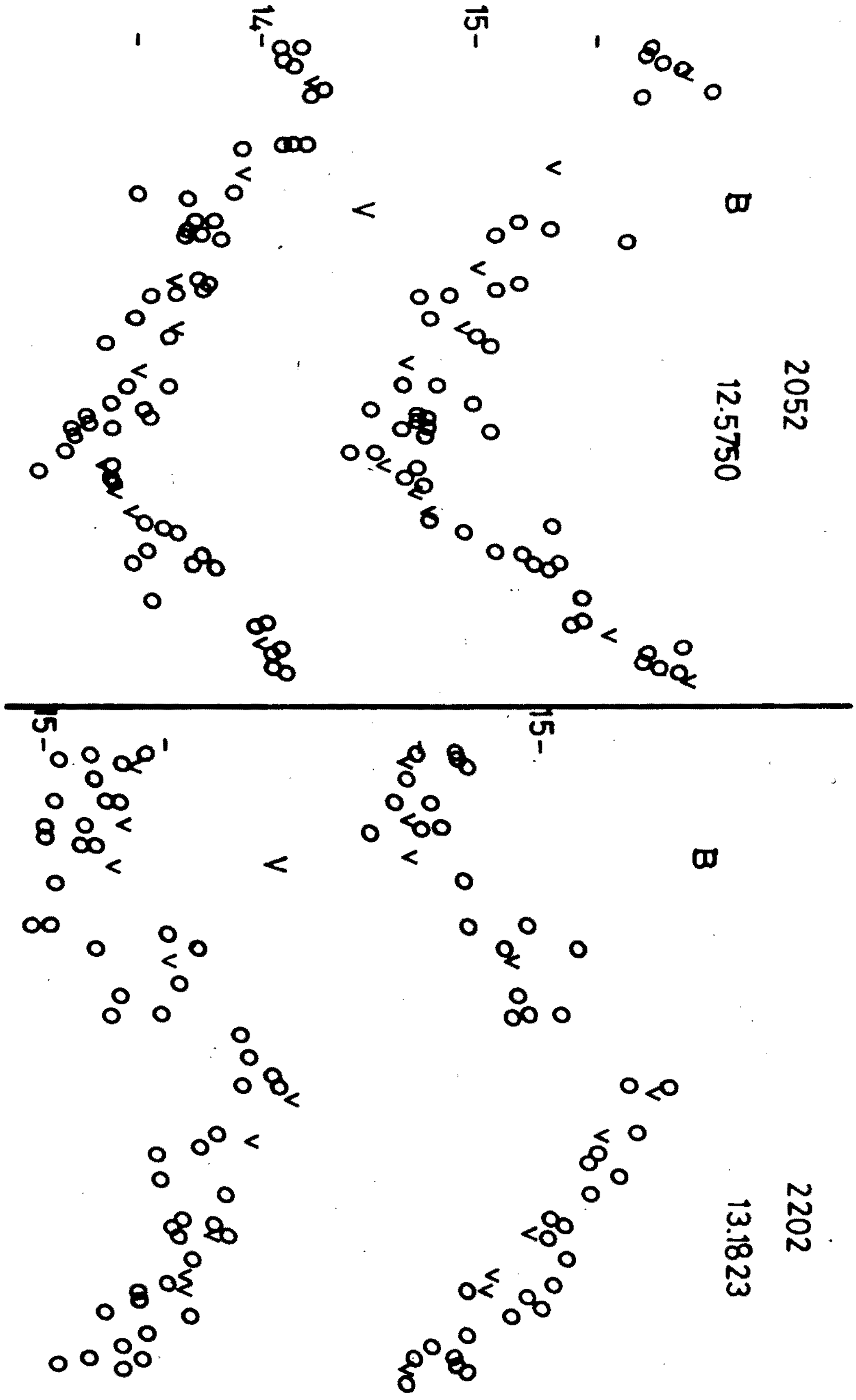
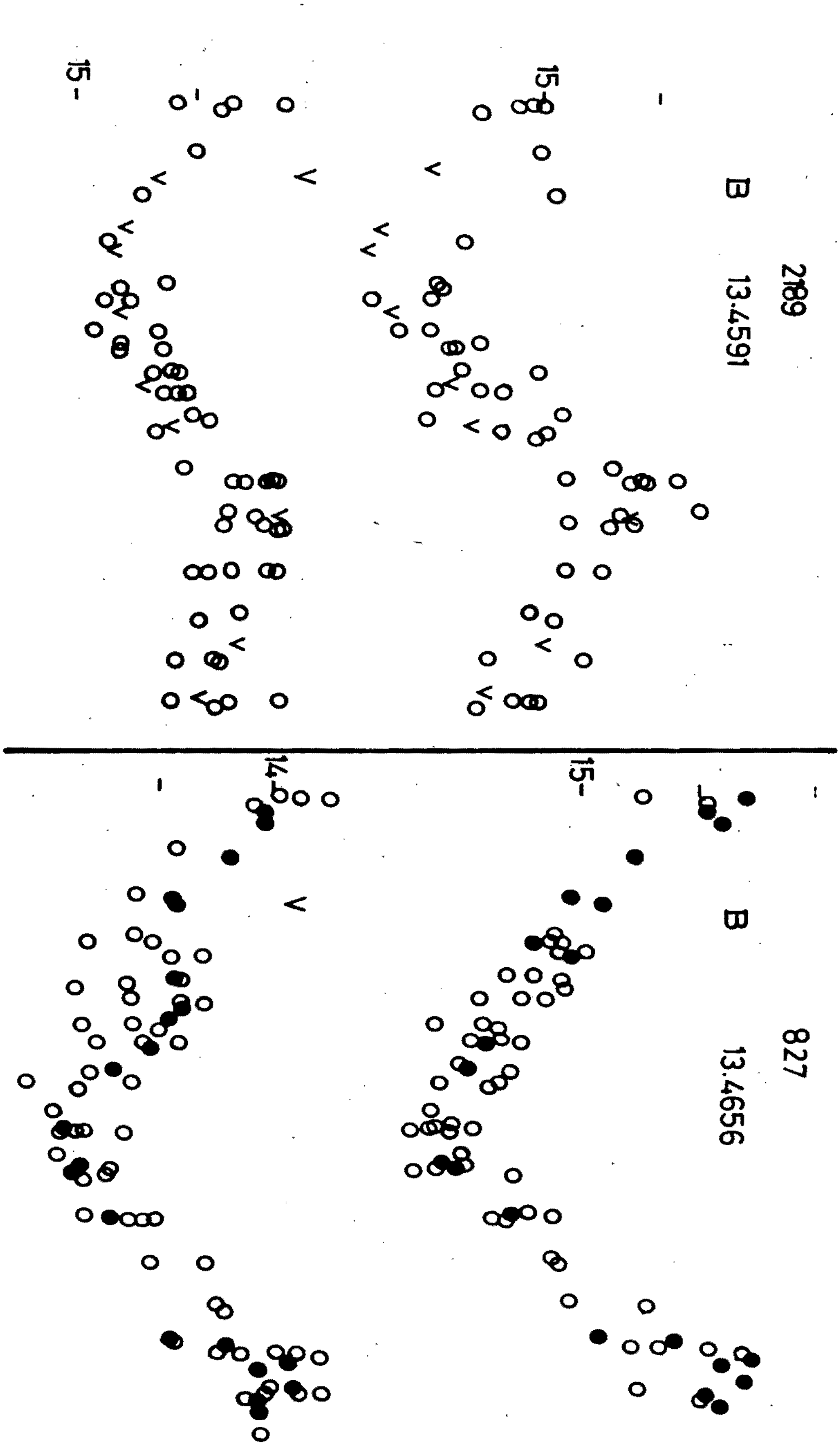
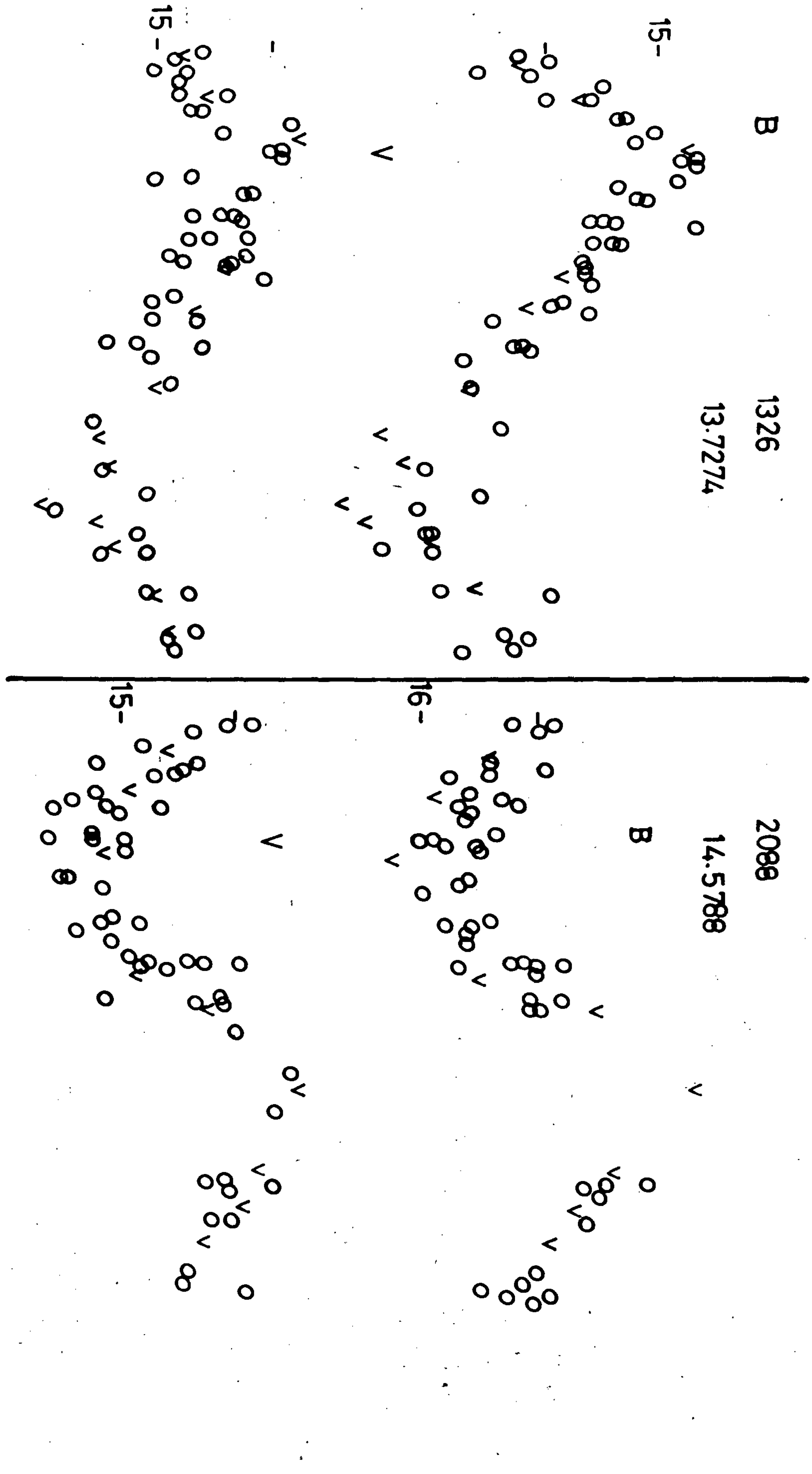
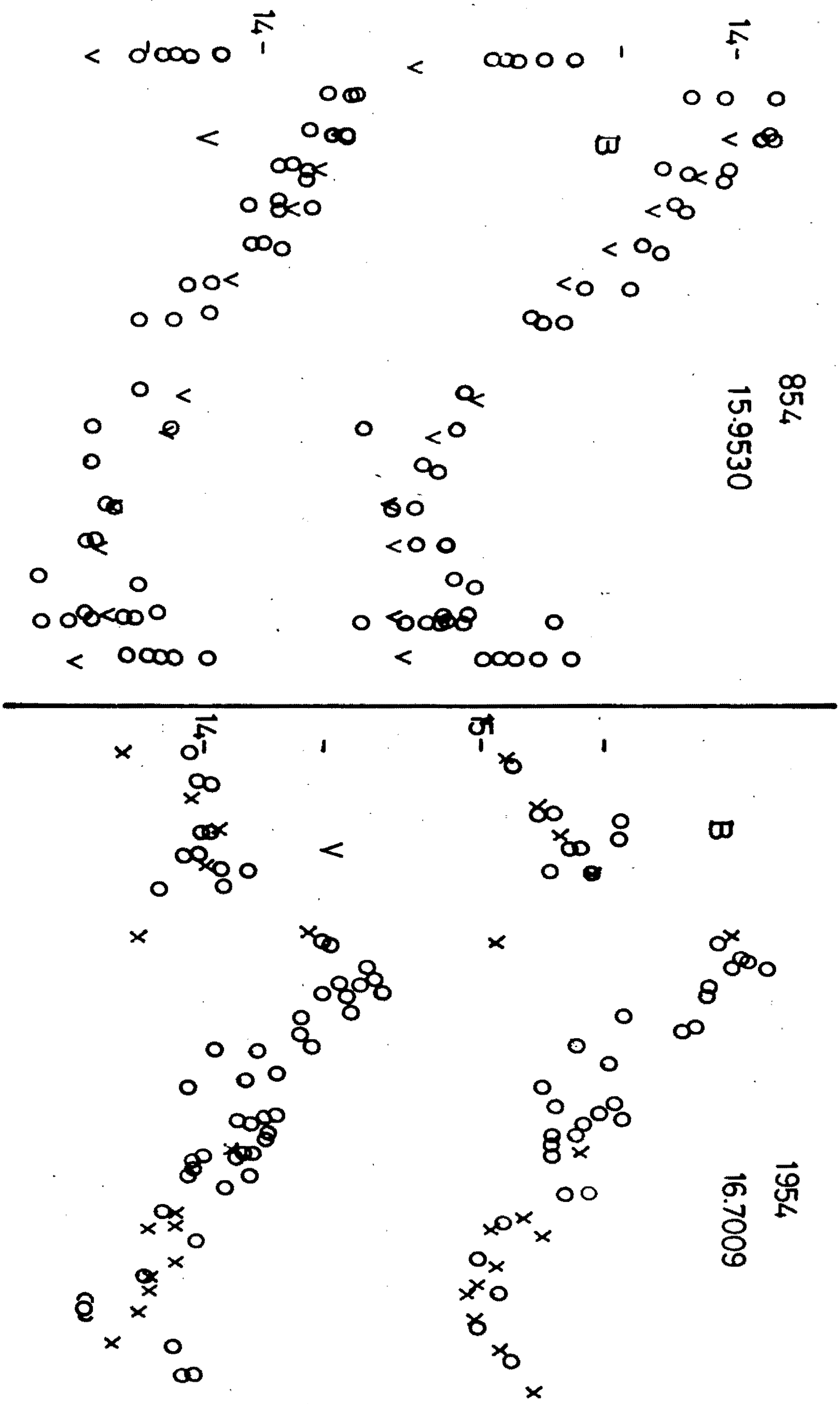
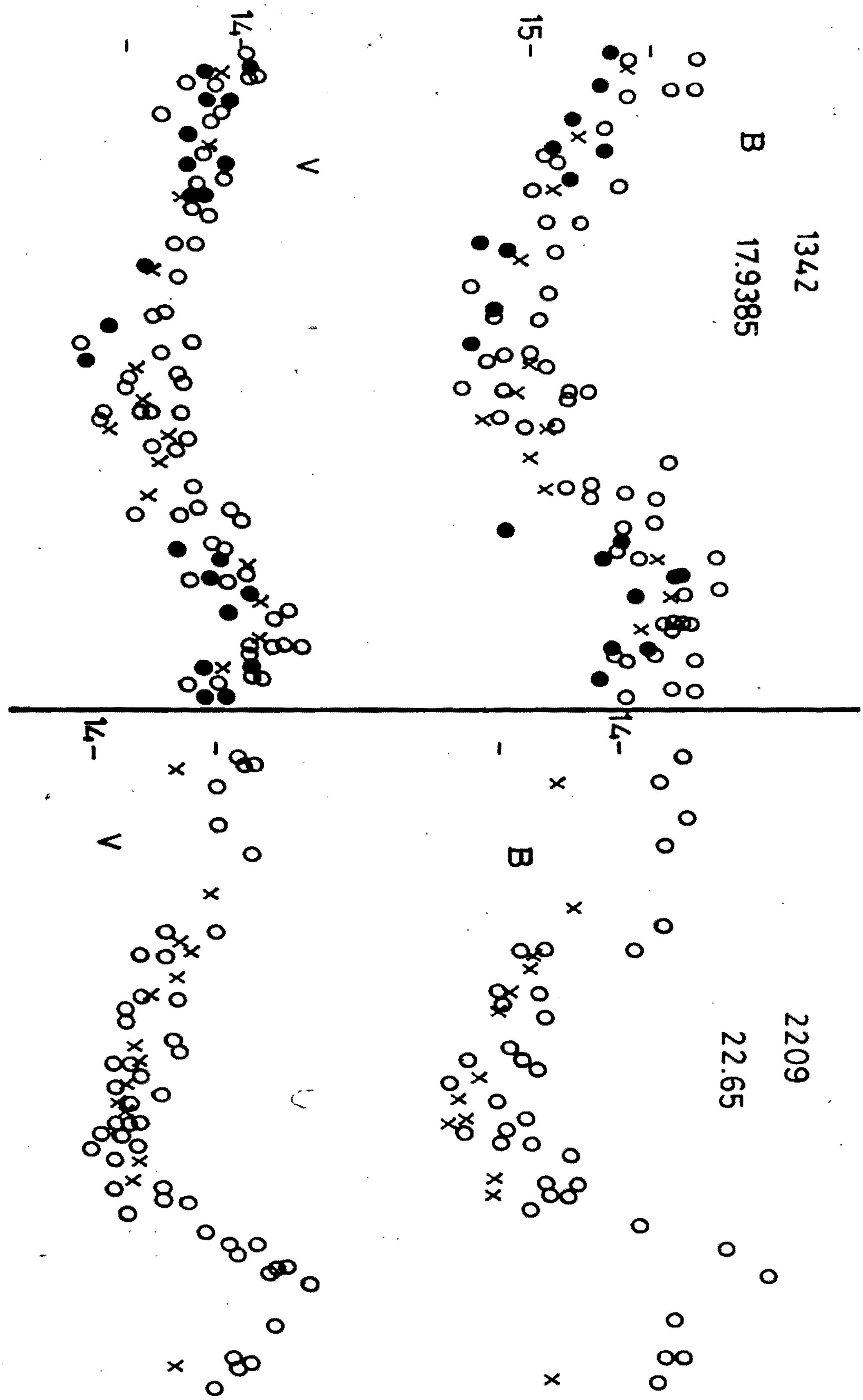

B
2052
12.5750
14
15
B
2202
13.1823
15
15



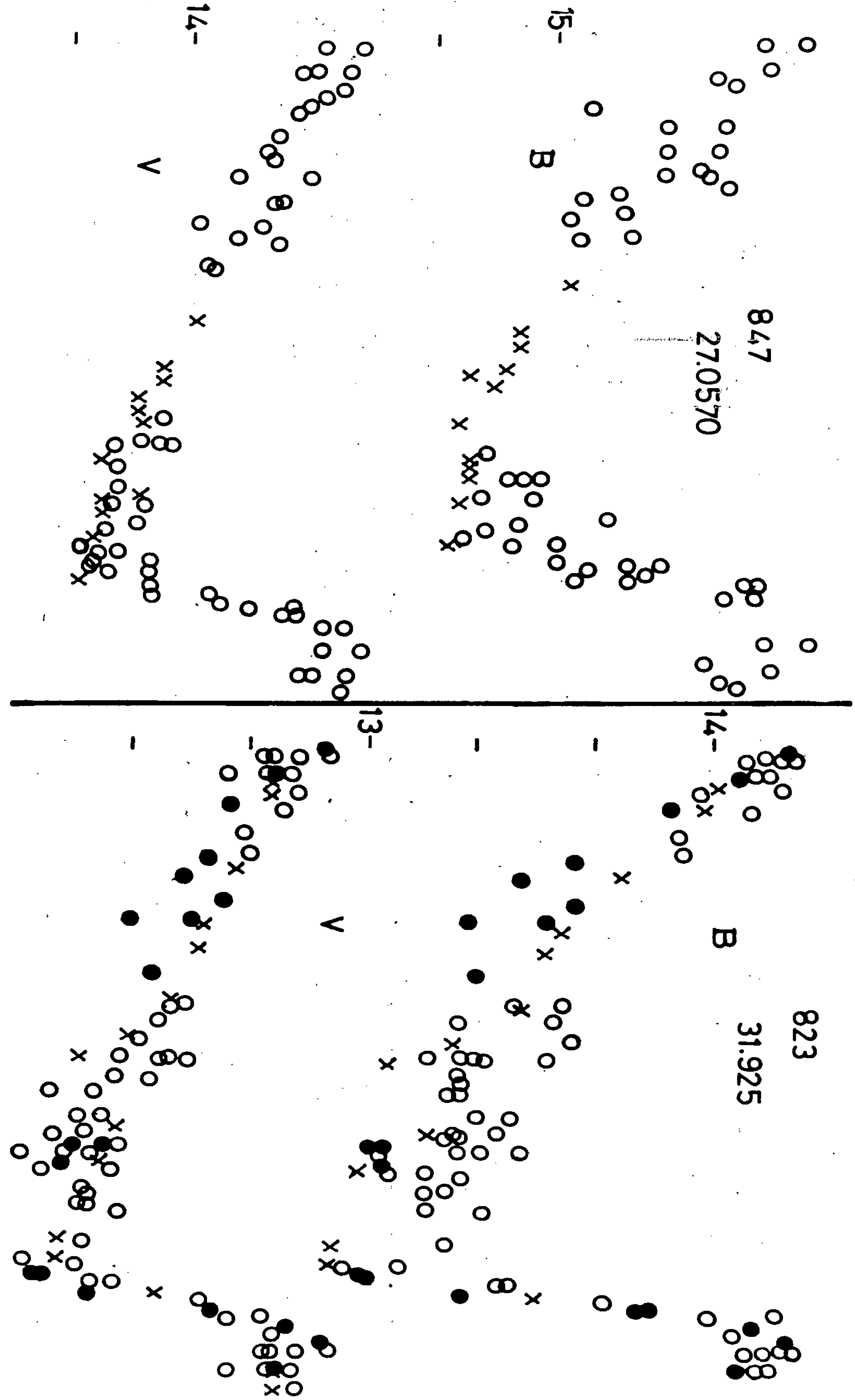
B34


B
1326
13.7274
15-
15-
2088
14.5788
B
16-
15-

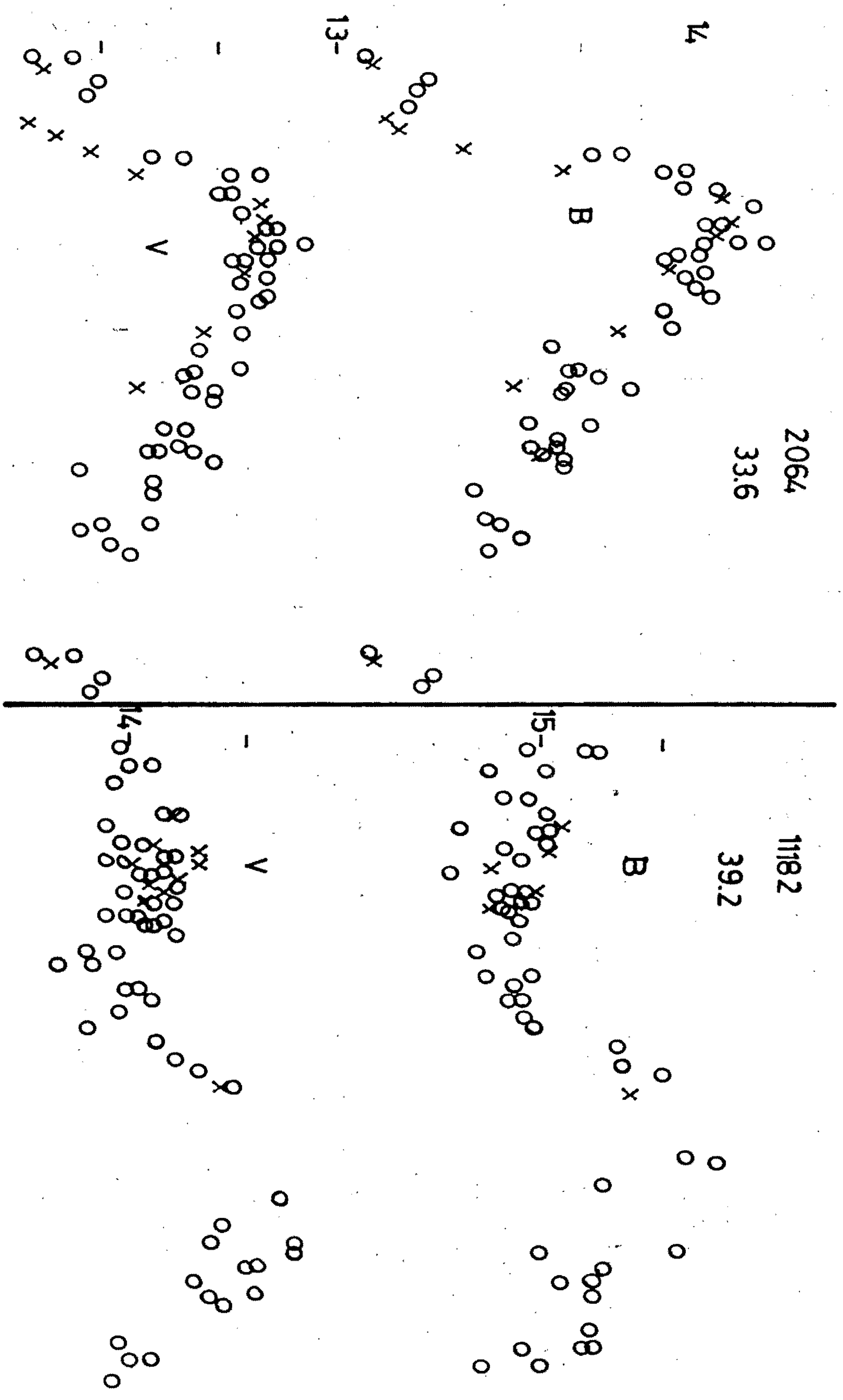

854
15.9530
1954
16.7009
B
V
14
15

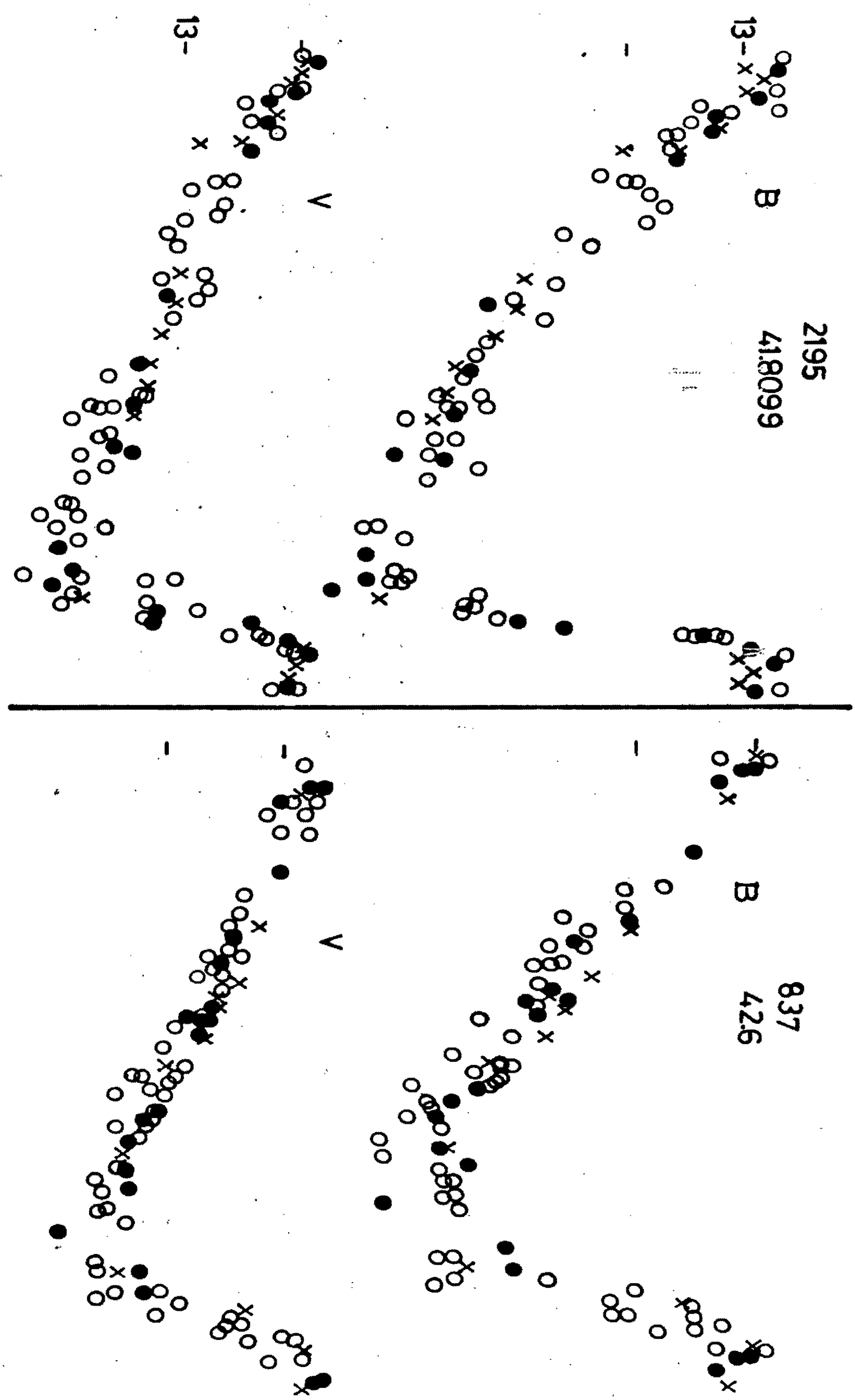


B37

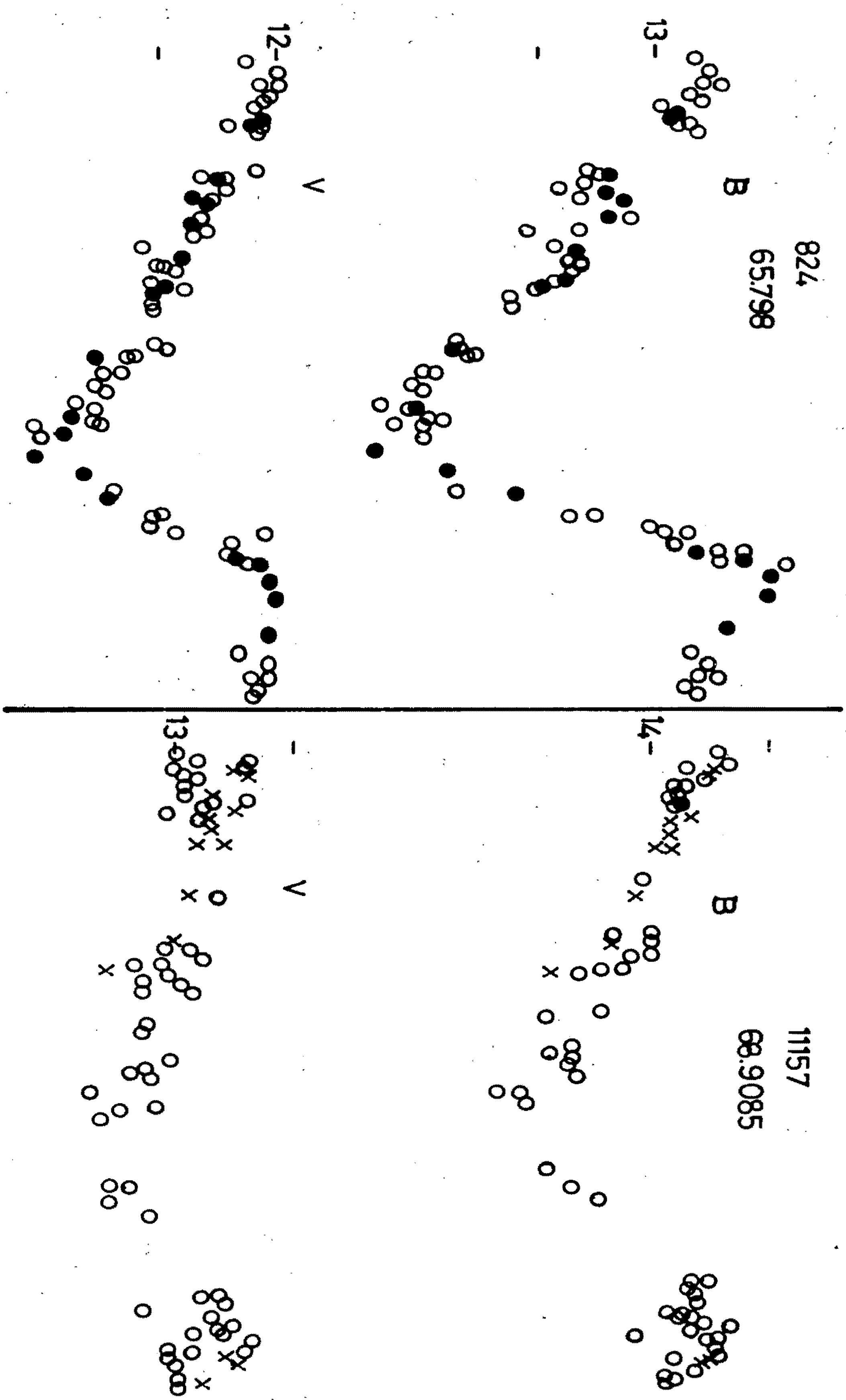


B38

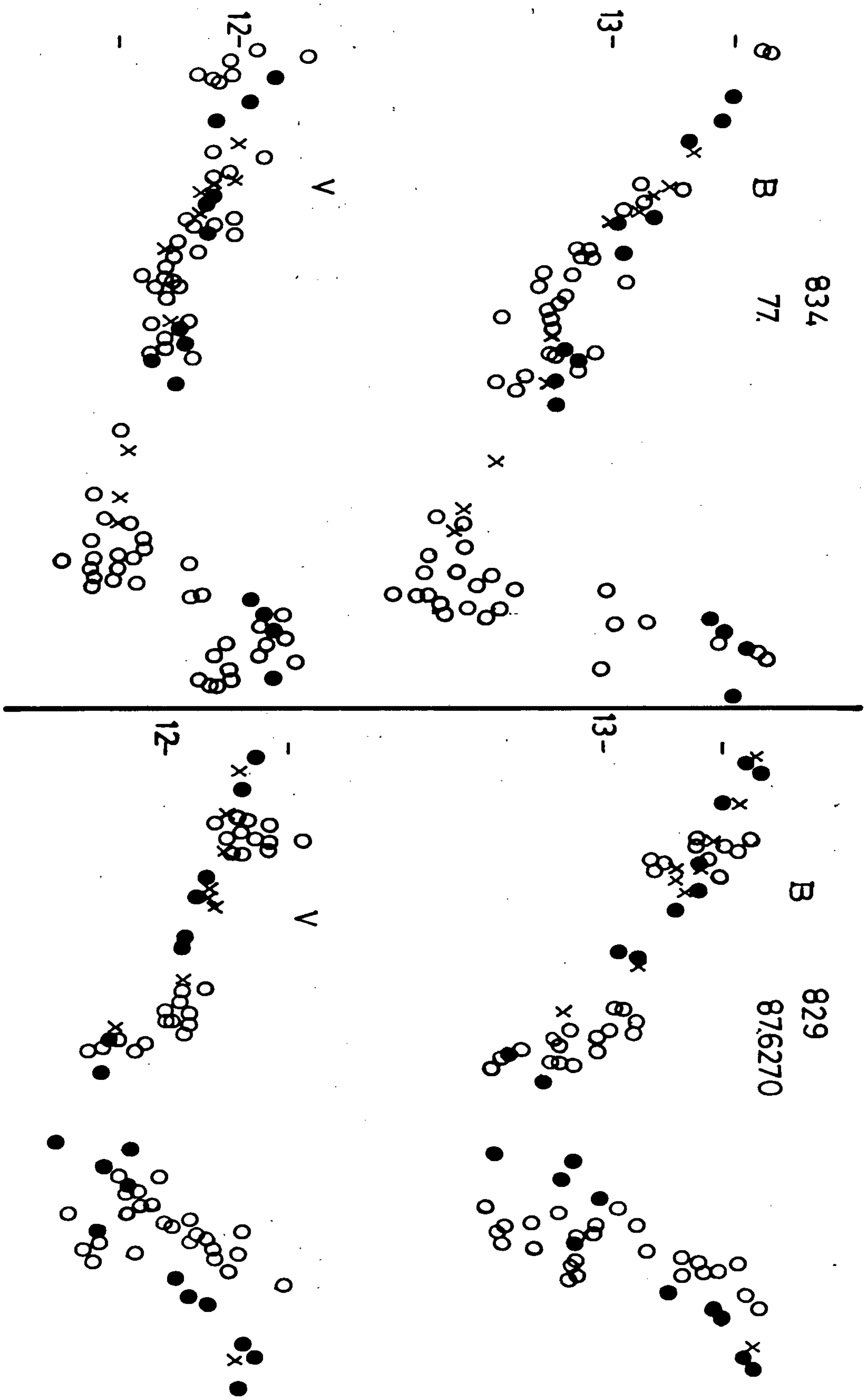

2064
33.6
1182
39.2
B
V
14
13
15
14



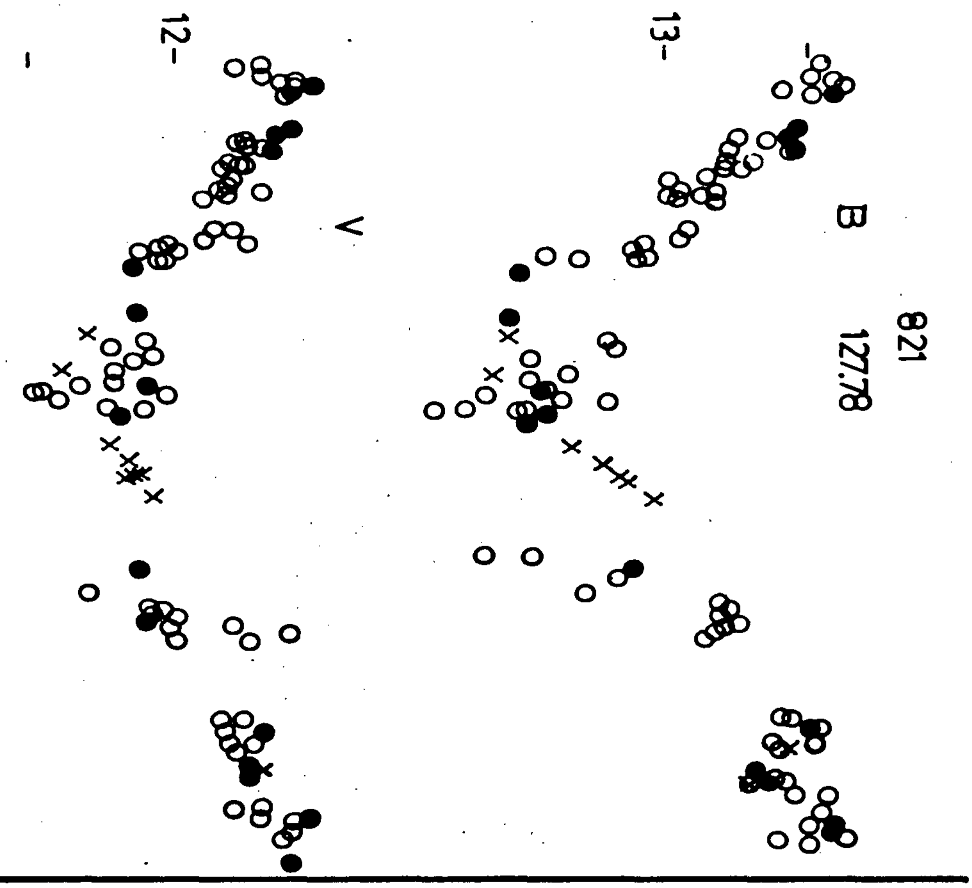
B40



824
65.798
B
V
13-
12-
11157
68.9085
14-
13-



B42



B43

APPENDIX C

INDIVIDUAL PHOTOELECTRIC (B, V) MAGNITUDES

LMC AND SMC

LMC

(2440000.0+)

HV 2353 P = 3.10800

HJD	V	B-V	Φ
3450.515	15.31	0.55	0.989
3453.484	15.14	0.45	0.944
3454.445	15.62	0.60	0.253
3456.464	15.29	0.45	0.903
3457.434	15.58	0.65	0.215
3458.510	15.51	0.52	0.561
3459.455	15.11	0.40	0.865
3460.448	15.34	0.61	0.185
3462.444	15.10	0.44	0.827
3463.468	15.50	0.60	0.157

HV 12765 P = 3.42900

HJD	V	B-V	Φ
3450.522	15.35	0.59	0.995
3453.490	15.46	0.66	0.861
3454.452	15.06	0.66	0.142
3456.470	15.56	0.72	0.730
3457.443	15.30	0.57	0.014
3458.516	15.13	0.45	0.327
3459.461	15.41	0.57	0.602
3460.455	15.42	0.61	0.892
3462.449	15.19	0.56	0.474
3463.478	15.51	0.64	0.774

HV 12700 P = 8.15300

HJD	V	B-V	Φ
3132.530	14.64	0.67	0.558
3133.498	14.70	0.70	0.676
3154.410	15.08	0.84	0.241
3155.533	14.81	0.71	0.379
3158.529	14.74	0.72	0.746
3159.510	14.84	0.79	0.867
5160.517	14.92	0.87	0.990
3162.459	15.11	0.85	0.228
3163.394	14.88	0.75	0.343
3164.528	14.63	0.64	0.482
3150.604	14.75	0.93	0.774
3453.593	14.93	0.86	0.937
3454.582	15.07	0.97	0.059
3457.556	14.71	0.61	0.423
3459.578	14.68	0.72	0.671
3460.576	14.79	0.74	0.794
3462.568	15.02	0.84	0.038
3463.580	15.18	0.99	0.162

HV 12823 P = 8.30200

HJD	V	B-V	Φ
3450.578	15.86	0.63	0.715
3453.552	14.33	0.48	0.073
3454.518	14.37	0.56	0.189
3457.505	14.92	0.67	0.549
3458.559	14.97	0.74	0.676
3463.498	14.48	0.60	0.271
3459.522	14.71	0.65	0.792
3460.529	14.21	0.41	0.913
3462.514	14.42	0.52	0.152
3463.498	14.48	0.60	0.271

HV 2854 P = 8.63500

HJD	V	B-V	Φ
3132.500	14.55	0.70	0.700
3133.463	14.69	0.80	0.811
3153.385	14.97	0.83	0.118
3160.490	14.76	0.80	0.941
3161.474	14.95	0.86	0.055
3162.375	14.90	0.82	0.159
3163.375	14.64	0.68	0.275
3164.459	14.37	0.59	0.401
3165.519	14.50	0.66	0.523
3450.600	14.49	0.71	0.538
3453.582	14.70	0.78	0.883
3454.565	14.87	0.85	0.997
3457.543	14.48	0.58	0.432
3458.577	14.47	0.61	0.462
3459.566	14.46	0.65	0.576
3460.559	14.49	0.72	0.691
3462.554	14.74	0.82	0.922

HV 2733 P = 8.72200

HJD	V	B-V	Φ
3133.567	14.91	0.69	0.621
3154.503	14.59	0.63	0.022
3155.557	14.59	0.62	0.143
3158.468	14.86	0.74	0.476
3159.459	15.00	0.70	0.590
3160.434	14.79	0.65	0.702
3161.444	14.63	0.58	0.818
3162.503	14.54	0.57	0.939
3163.470	14.56	0.62	0.050
3166.414	14.78	0.70	0.387
3167.413	14.85	0.73	0.502
3450.593	14.46	0.58	0.969
3453.568	14.68	0.61	0.310
3454.539	14.81	0.73	0.422
3457.523	14.62	0.56	0.764
3458.573	14.51	0.58	0.884
3459.545	14.55	0.62	0.996
3460.546	14.47	0.59	0.110
3462.534	14.64	0.70	0.338
3463.569	14.91	0.70	0.457

HV 12816 P = 9.11400

HJD	V	B-V	Φ
3132.566	14.54	0.64	0.699
3133.513	14.66	0.68	0.804
3152.411	14.76	0.72	0.877
3153.376	14.89	0.76	0.983
3154.433	14.84	0.69	0.099
3155.489	14.56	0.55	0.215
3158.412	14.25	0.48	0.536
3159.416	14.49	0.61	0.646
3160.391	14.60	0.66	0.753
3161.407	14.74	0.73	0.864
3163.408	14.84	0.71	0.084
3165.455	14.30	0.46	0.309
3166.330	14.24	0.43	0.405
3450.571	14.41	0.52	0.592
3453.543	14.82	0.70	0.918
3454.511	14.86	0.72	0.024
3457.498	14.25	0.40	0.352
3458.553	14.14	0.43	0.468
3459.510	14.31	0.55	0.573
3460.522	14.51	0.62	0.684
3462.508	14.78	0.71	0.902
3463.561	14.87	0.75	0.017

HV 971 P = 9.29700

HJD	V	B-V	Φ
3450.552	14.46	0.59	0.399
3453.522	14.32	0.63	0.719
3454.486	14.28	0.67	0.822
3457.476	14.72	0.96	0.144
3458.541	14.81	0.84	0.258
3459.494	14.66	0.67	0.361
3460.486	14.18	0.48	0.468
3462.481	14.31	0.64	0.682
3463.493	14.33	0.65	0.791

HV 2301 P = 9.49900

HJD	V	B-V	Φ
3450.405	13.92	0.88	0.393
3453.462	14.14	1.02	0.704
3454.725	14.10	1.00	0.806
3456.452	13.73	0.70	0.019
3457.418	13.76	0.67	0.121
3458.466	13.80	0.76	0.231
3459.439	13.89	0.79	0.333
3460.422	14.00	0.91	0.437
3462.426	14.16	1.04	0.648
3463.531	14.18	1.00	0.764

HV 6105 P = 10.44000

HJD	V	B-V	Φ
3450.533	14.81	0.74	0.985
3453.500	14.78	0.76	0.270
3454.463	14.84	0.88	0.362
3457.453	15.25	0.98	0.648
3458.522	15.12	0.98	0.751
3459.474	15.12	0.78	0.842
3460.464	14.99	0.82	0.937
3462.459	14.57	0.68	0.128

HV 2260 P = 12.93600

HJD	V	B-V	Φ
3128.440	14.73	0.93	0.742
3132.446	15.12	1.09	0.052
3133.413	15.36	1.10	0.127
3152.434	14.47	0.69	0.597
3153.321	14.67	0.72	0.666
3155.437	14.74	0.92	0.829
3159.361	15.31	1.08	0.133
3160.343	15.35	1.16	0.208
3161.357	15.22	1.08	0.287
3162.336	15.09	0.92	0.363
3163.305	15.05	0.88	0.437
3450.497	14.47	0.62	0.638
3453.455	14.64	0.90	0.867
3454.421	15.12	1.18	0.942
3457.413	15.18	1.12	0.173
3458.461	15.24	1.07	0.254
3459.434	15.21	0.96	0.329
3460.429	15.01	0.92	0.406
3462.420	14.90	0.79	0.560

HV 2527 P = 12.94800

HJD	V	B-V	Φ
3450.542	14.31	0.66	0.584
3453.509	14.58	0.93	0.813
3454.474	14.81	1.09	0.888
3457.464	15.00	1.07	0.118
3458.531	15.08	1.04	0.201
3459.483	14.99	0.88	0.274
3460.475	14.71	0.87	0.351
3462.470	14.07	0.54	0.505

HV 2864 P = 10.98400

HJD	V	B-V	Φ
3132.517	14.73	0.98	0.485
3133.473	14.85	1.00	0.572
3153.434	14.60	0.88	0.389
3158.436	14.95	0.92	0.845
3159.478	14.78	0.80	0.840
3161.492	14.29	0.57	0.123
3163.384	14.48	0.76	0.295
3164.566	14.59	0.88	0.397
3167.451	14.94	1.03	0.665
3168.390	15.07	1.03	0.751
3453.588	15.00	0.99	0.716
3454.574	14.95	0.98	0.806
3457.550	14.44	0.72	0.077
3458.584	14.22	0.59	0.171
3459.571	14.32	0.71	0.261
3460.570	14.47	0.82	0.351
3462.582	14.74	0.99	0.533

HV 997 P = 13.14700

HJD	V	B-V	Φ
3132.540	14.43	0.94	0.941
3133.531	14.55	1.00	0.017
3154.463	14.68	0.86	0.609
3155.515	14.13	0.63	0.689
3158.395	14.37	0.90	0.908
3160.422	14.61	1.05	0.062
3161.428	14.76	1.09	0.139
3162.487	14.85	1.16	0.219
3163.424	15.00	1.14	0.291
3164.437	15.04	1.16	0.368
3165.484	14.89	1.04	0.447
3166.383	14.71	0.87	0.516
3169.409	14.17	0.70	0.746
3450.584	14.71	1.01	0.133
3453.558	14.94	1.06	0.359
3454.525	14.78	1.02	0.433
3457.511	14.12	0.56	0.660
3458.566	14.15	0.68	0.740
3459.529	14.19	0.78	0.813
3460.535	14.27	0.85	0.890
3462.521	14.52	1.03	0.041

HV 2579 P = 13.43100

HJD	V	B-V	Φ
3450.563	14.38	0.92	0.182
3453.534	14.22	0.72	0.404
3454.498	13.99	0.63	0.475
3457.487	13.48	0.48	0.698
3458.546	13.74	0.62	0.777
3459.502	13.94	0.71	0.848
3460.498	13.99	0.73	0.922
3462.498	14.22	0.88	0.071
3463.551	14.39	0.95	0.149

HV 2352 P = 13.62600

HJD	V	B-V	Φ
3128.480	14.17	0.86	0.022
3132.480	14.49	0.92	0.316
3133.406	14.41	0.85	0.383
3153.314	14.03	0.70	0.845
3153.335	14.02	0.72	0.846
3154.378	14.07	0.75	0.923
3158.345	14.51	0.01	0.214
3160.464	14.43	0.88	0.369
3161.378	14.35	0.78	0.436
3162.362	14.22	0.72	0.509
3163.328	14.07	0.68	0.579
3165.410	13.81	0.60	0.732
3167.393	14.08	0.73	0.878
3169.429	14.22	0.85	0.027
3450.509	13.81	0.54	0.655
3453.473	13.97	0.70	0.873
3454.438	14.09	0.79	0.944
3456.457	14.28	0.98	0.092
3457.428	14.32	0.91	0.163
3458.494	14.48	0.94	0.241
3459.449	14.50	0.85	0.311
3460.442	14.40	0.83	0.384
3462.438	14.14	0.71	0.531
3463.464	14.04	0.64	0.606

HV 955 P = 13.73200

HJD	V	B-V	Φ
3450.538	13.70	0.49	0.431
3453.504	13.81	0.65	0.647
3454.469	13.93	0.76	0.717
3457.458	14.27	0.94	0.935
3458.527	14.38	1.06	0.013
3459.478	14.48	0.98	0.082
3460.469	14.50	0.94	0.154
3462.465	14.15	0.78	0.299
3463.542	14.12	0.71	0.378

HV 2324 P = 14.46600

HJD	V	B-V	Φ
3128.470	14.20	0.89	0.630
3132.470	14.67	1.14	0.907
3133.438	14.78	1.09	0.974
3152.464	14.45	0.85	0.289
3154.360	13.88	0.67	0.420
3155.422	14.03	0.73	0.494
3158.370	14.33	1.00	0.697
3159.388	14.39	1.05	0.768
3160.375	14.53	1.10	0.836
3162.349	14.73	1.15	0.972
3163.317	14.76	1.10	0.039
3164.400	14.66	1.01	0.114
3167.375	14.29	0.76	0.320
3453.468	14.68	1.04	0.097
3454.432	14.45	0.93	0.163
3457.423	13.84	0.60	0.370
3458.476	13.93	0.67	0.443
3459.444	14.04	0.72	0.510
3460.436	14.12	0.82	0.578
3462.432	14.33	0.96	0.716
3463.459	14.49	1.08	0.787

HV 2549 P = 16.19700

HJD	V	B-V	Φ
3450.546	13.19	0.43	0.217
3453.514	13.60	0.71	0.400
3454.480	13.67	0.80	0.460
3457.470	13.98	0.98	0.644
3458.536	14.10	0.98	0.710
3459.488	14.21	1.04	0.769
3460.481	14.19	0.98	0.830
3462.475	13.99	1.32	0.953
3463.486	13.93	0.70	0.016

HV 2580 P = 16.94500

HJD	V	B-V	Φ
3132.505	13.94	0.91	0.141
3133.473	14.06	0.94	0.199
3153.410	14.38	0.98	0.375
3155.470	14.41	0.91	0.497
3158.386	14.15	0.78	0.669
3159.406	13.79	0.62	0.729
3160.406	13.47	0.56	0.788
3161.392	13.58	0.60	0.846
3162.395	13.64	0.67	0.905
3163.343	13.69	0.75	0.961
3164.420	13.81	0.80	0.025
3166.357	13.98	0.89	0.139
3169.455	15.25	0.97	0.322
3450.558	13.63	0.70	0.911
3453.529	13.86	0.84	0.086
3454.492	13.92	0.90	0.143
3457.482	14.20	0.94	0.320
3459.499	14.36	0.85	0.439
3460.492	14.30	0.84	0.497
3462.487	14.07	0.76	0.615
3463.547	14.06	0.74	0.678

HV 2836 P = 17.52600

HDJ	V	B-V	Φ
3152.563	14.59	1.20	0.606
3154.567	14.80	1.29	0.721
3158.496	15.17	1.47	0.945
3159.538	15.10	1.30	0.004
3160.539	14.93	1.17	0.062
3161.542	14.81	1.06	0.119
3162.521	14.87	1.06	0.175
3163.511	14.37	0.76	0.231
3164.492	14.17	0.74	0.287
3166.455	14.30	0.89	0.399
3168.530	14.40	1.08	0.517
3453.574	14.84	1.22	0.782
3454.547	14.98	1.32	0.837
3457.530	14.93	1.36	0.007
3459.552	14.81	1.03	0.123
3460.554	14.82	1.10	0.180
3462.540	14.15	0.77	0.293

HV 1005 P = 18.71000

HJD	V	B-V	Φ
3450.588	14.32	1.13	0.969
3453.562	14.54	1.10	0.128
3454.532	14.47	1.04	0.180
3457.516	13.97	0.73	0.339
3458.568	13.44	0.55	0.395
3459.538	13.52	0.56	0.447
3460.540	13.61	0.63	0.501
3462.526	13.76	0.83	0.607
3463.503	13.87	0.90	0.659

HV 2793 P = 19.18400

HJD	V	B-V	Φ
3152.556	13.63	0.71	0.656
3158.549	14.03	1.15	0.969
3160.447	14.20	1.22	0.068
3160.562	14.19	1.22	0.074
3161.547	14.29	1.24	0.120
3162.511	14.39	1.29	0.175
3163.482	14.42	1.30	0.226
3164.473	14.56	1.33	0.278
3166.437	14.55	1.28	0.380
3168.412	14.29	1.07	0.483
3169.395	14.31	1.04	0.534

HV 12815 P = 26.16900

HJD	V	B-V	Φ
3132.565	13.89	1.13	0.798
3133.523	13.86	1.09	0.835
3148.480	13.57	1.19	0.406
3151.370	13.80	1.28	0.517
3152.405	13.85	1.30	0.556
3153.360	13.91	1.30	0.593
3159.427	13.85	1.10	0.824
3160.398	13.91	1.10	0.861
3161.412	13.84	1.04	0.900
3162.476	13.28	0.71	0.941
3163.414	12.98	0.59	0.977
3165.463	12.99	0.69	0.055
3166.337	13.11	0.75	0.088
3169.377	13.25	0.97	0.205
3450.568	12.93	0.58	0.950
3453.538	13.02	0.71	0.063
3454.507	13.08	0.80	0.100
3457.494	13.26	1.03	0.214
3459.506	13.38	1.08	0.291
3460.517	13.44	1.11	0.330
3462.503	13.57	1.18	0.406
3463.565	13.69	1.22	0.446

HV 1023 P = 26.58800

HJD	V	B-V	Φ
3148.501	13.93	0.99	0.414
3152.534	13.29	0.77	0.293
3154.533	13.40	0.90	0.368
3158.552	13.70	1.20	0.519
3159.563	13.62	0.97	0.557
3163.552	13.72	1.20	1.707
3161.559	13.78	1.21	0.632
3162.530	13.92	1.27	0.669
3163.518	13.93	1.27	0.706
3164.553	13.98	1.26	0.745
3166.477	14.14	1.45	0.817
3168.500	14.13	1.28	0.893
3169.429	14.15	1.26	0.928
3453.577	13.74	1.18	0.615
3454.554	13.81	1.22	0.652
3457.537	14.05	1.26	0.764
3459.560	14.07	1.26	0.840
3460.559	14.12	1.28	0.878
3462.546	14.15	1.24	0.953

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HV 1228 P = 8.49340

HJD	V	B-V	Φ
3450.302	14.74	0.30	0.122
3451.346	14.78	0.36	0.245
3452.280	14.92	0.42	0.355
3453.319	15.01	0.52	0.477
3454.279	15.28	0.58	0.591
3455.277	15.33	0.64	0.708
3456.393	15.59	0.61	0.839
3459.313	14.70	0.35	0.183
3460.283	14.86	0.42	0.297
3462.283	15.08	0.56	0.533
3463.344	15.44	0.66	0.658

HV 2103 P = 8.98410

HJD	V	B-V	Φ
3450.456	15.08	0.73	0.984
3453.409	15.46	0.81	0.312
3454.373	15.36	0.81	0.420
3456.363	14.86	0.54	0.641
3458.438	14.90	0.51	0.872
3459.398	15.02	0.65	0.979
3460.384	15.21	0.67	0.089
3462.371	15.53	0.82	0.310
3463.403	15.49	0.73	0.425

HV 2087 P = 9.15920

HJD	V	B-V	Φ
3450.448	15.39	0.70	0.531
3453.397	15.35	1.08	0.853
3454.366	15.20	0.80	0.959
3456.355	14.99	0.57	0.176
3458.432	15.14	0.69	0.403
3459.392	15.21	0.70	0.507
3460.374	15.44	0.70	0.615
3462.364	15.55	0.76	0.832
3463.390	15.30	0.64	0.944

HV 836 P = 9.40340

HJD	V	B-V	Φ
3450.339	15.15	0.72	0.538
3452.306	14.62	0.24	0.747
3453.339	14.50	0.35	0.857
3454.300	14.44	0.46	0.959
3455.298	14.54	0.45	0.065
3456.416	14.88	0.65	0.184
3458.404	15.10	0.63	0.395
3459.335	15.20	0.69	0.494
3460.302	15.08	0.61	0.597
3462.305	14.38	0.36	0.810
3463.364	14.51	0.41	0.923

HV 1334 P = 9.45140

HJD	V	B-V	Φ
3450.311	15.31	0.76	0.870
3451.354	14.90	0.61	0.980
3452.287	14.46	0.38	0.079
3453.326	14.49	0.43	0.189
3454.285	14.63	0.48	0.290
3455.284	14.60	0.46	0.296
3456.403	15.00	0.68	0.514
3458.297	15.27	0.77	0.725
3459.320	15.26	0.81	0.823
3460.289	15.18	0.70	0.925
3462.289	14.51	0.30	0.137
3463.350	14.63	0.47	0.249

HV 2063 P = 11.66200

HJD	V	B-V	Φ
3450.408	14.75	0.73	0.415
3453.369	15.06	0.82	0.669
3454.333	15.06	0.82	0.751
3456.275	14.80	0.65	0.918
3458.389	14.39	0.51	0.099
3459.364	14.51	0.65	0.183
3460.350	14.62	0.82	0.267
3462.335	14.82	0.83	0.438
3463.384	14.99	0.85	0.528

HV 2017 P = 11.40740

HJD	V	B-V	Φ
3450.348	14.89	0.87	0.708
3452.319	14.83	0.79	0.881
3453.345	14.65	0.68	0.971
3454.308	14.59	0.63	0.055
3455.304	14.40	0.53	0.143
3456.422	14.26	0.49	0.241
3459.342	14.53	0.76	0.496
3460.310	14.77	0.93	0.581
3462.310	14.94	0.86	0.757
3463.373	14.95	0.77	0.850

HV 857 P = 11.98290

HJD	V	B-V	Φ
3450.398	14.82	0.68	0.440
3453.362	14.56	0.64	0.687
3454.326	14.37	0.53	0.768
3456.268	14.08	0.38	0.930
3459.357	14.41	0.63	0.187
3460.345	14.59	0.69	0.270
3462.328	14.81	0.73	0.435
3463.300	14.90	0.75	0.517

HV 956 P = 12.15530

HJD	V	B-V	Φ
3450.415	14.55	0.53	0.342
3453.376	14.79	0.79	0.586
3454.340	14.88	0.83	0.665
3456.336	15.10	0.87	0.829
3458.410	15.26	0.81	0.000
3459.371	15.02	0.68	0.079
3460.357	15.10	0.69	0.160
3462.341	14.51	0.51	0.323
3463.317	14.66	0.55	0.404

HV 1365 P = 12.41329

HJD	V	B-V	Φ
3450.320	14.94	0.67	0.316
3451.361	15.05	0.82	0.400
3452.295	15.25	0.85	0.476
3453.332	15.25	0.88	0.559
3454.293	15.30	0.78	0.637
2455.291	15.29	0.79	0.717
3456.410	15.16	0.68	0.807
3459.328	14.64	0.54	0.042
3460.296	14.79	0.57	0.120
3462.296	14.89	0.73	0.281
3463.357	15.02	0.80	0.367

HV 2052 P = 12.57500

HJD	V	B-V	Φ
3450.434	14.57	0.66	0.173
3453.389	13.99	0.44	0.408
3454.353	13.77	0.31	0.485
3456.348	14.08	0.58	0.643
3458.422	14.35	0.67	0.808
3459.383	14.33	0.74	0.885
3460.369	14.49	0.81	0.963
3462.354	14.63	0.75	0.121
3463.328	14.52	0.86	0.199

HV 2202 P = 13.18230

HJD	V	B-V	Φ
3450.470	14.42	0.81	0.432
3453.428	14.69	0.86	0.657
3454.386	14.72	0.81	0.730
3456.376	14.49	0.61	0.880
3459.412	13.98	0.55	0.111
3460.396	14.15	0.61	0.185
3463.384	14.30	0.74	0.336
3463.420	14.44	0.78	0.415
3465.322	14.67	0.92	0.559

HV 2189 P = 13.45910

HJD	V	B-V	Φ
3450.464	14.83	0.88	0.348
3453.418	14.71	0.66	0.568
3454.380	14.58	0.69	0.639
3456.369	14.14	0.44	0.787
3459.405	14.30	0.67	0.013
3460.390	14.47	0.75	0.086
3462.378	14.66	0.81	0.234
3463.410	14.82	0.85	0.310
3465.307	14.84	0.78	0.451

HV 1326 P = 13.72740

HJD	V	B-V	Φ
3450.284	15.17	0.92	0.039
3451.339	15.48	0.86	0.116
3452.272	15.19	0.76	0.184
3453.312	14.96	0.79	0.259
3454.272	14.92	0.70	0.329
3455.269	14.79	0.57	0.402
3456.386	14.36	0.49	0.483
3459.307	14.69	0.73	0.696
3460.277	14.82	0.74	0.767
3462.275	14.99	0.83	0.912
3463.333	15.20	0.98	0.989
3465.350	15.25	1.00	0.136

HV 2088 P = 14.57880

HJD	V	B-V	Φ
3450.422	15.09	1.05	0.986
3453.381	14.93	0.82	0.189
3454.247	14.64	0.59	0.255
3456.342	14.24	0.53	0.293
3458.416	14.42	0.71	0.534
3459.377	14.47	0.84	0.600
3460.362	14.63	0.81	0.668
3462.348	14.80	0.93	0.804
3463.320	14.97	0.99	0.871

HV 854 P = 15.95300

HJD	V	B-V	Φ
3450.386	14.74	0.64	0.573
3452.328	13.67	0.36	0.694
3453.351	13.77	0.40	0.758
3454.319	13.89	0.46	0.819
3455.310	13.99	0.55	0.881
3456.428	14.11	0.61	0.951
3459.351	14.30	0.79	0.134
3460.338	14.37	0.90	0.196
3462.322	14.60	0.85	0.321
3463.385	14.66	0.81	0.381
3465.289	14.65	0.75	0.507

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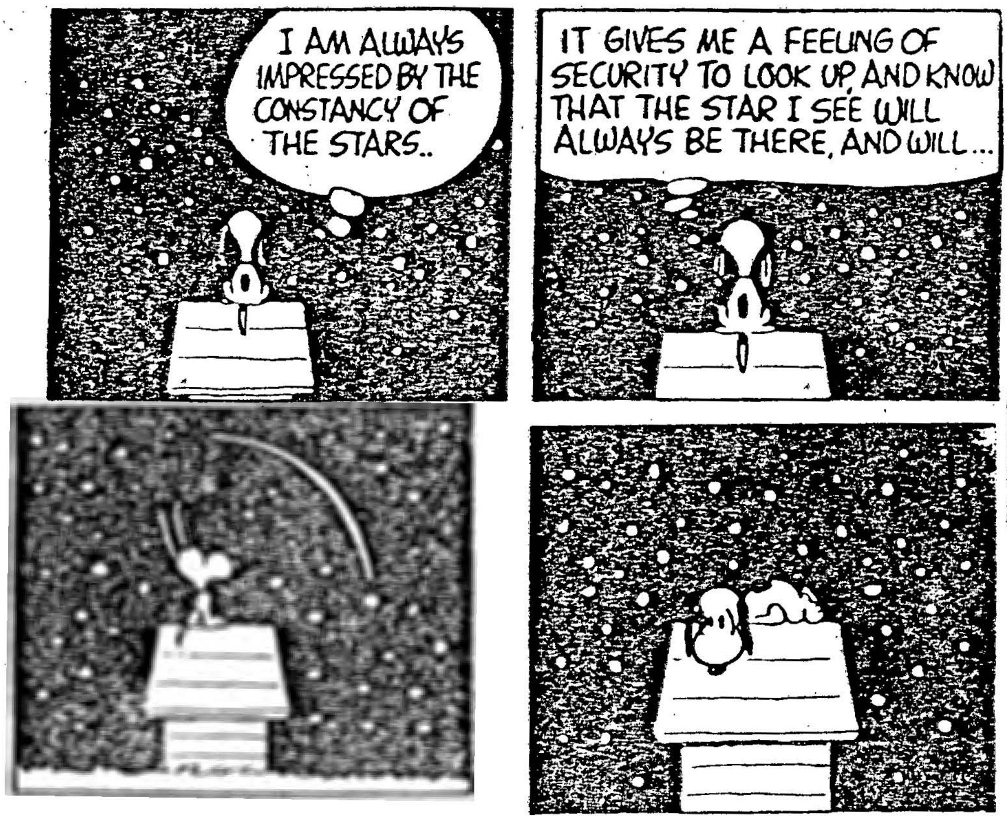
I AM ALWAYS IMPRESSED BY THE CONSTANCY OF THE STARS..
IT GIVES ME A FEELING OF SECURITY TO LOOK UP, AND KNOW THAT THE STAR I SEE WILL ALWAYS BE THERE, AND WILL...