PHOTOMETRY OF THE NEARBY IRREGULAR GALAXY, NGC 6822

Thesis by

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PLEASE NOTE:
Figure and Plate pages are not original copy. Several tend to "curl". Filmed in the best possible way.
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ACKNOWLEDGMENTS

Here, under leave of Brutus and the rest, I should like to thank first of all Dr. Arp, for offering me this project which had been prepared by so many eminent astronomers, for the material with which he supplied me, and for the advice, both scientific and practical, that he gave. Next, Dr. Greenstein, who is second to none in providing moral encouragement--and moral bullying, when needed.

To the staff of the Mount Wilson and Palomar Observatories is owed much gratitude for the facilities they placed at my disposal.

To Miss Swope, who has given me the benefit of her experience in reducing light curves; to Dr. Hodge, who lent me some sorely needed B-photographic plates; and to Dr. Sandage and Dr. Kraft for helpful discussion, I also stand in debt.

Last, a good word for the Caltech computer center staff, for being so very obliging, must be included.

ABSTRACT

NGC 6822 is a member of the Local Group, type Im, coordinates $\alpha = 19^h42^m.1$, $\delta = -14^\circ 53'.1$ (1950). The main body has a diameter of 3.6 c kpc and a mass (from radio rotation curves) of $1.7\ c \times 10^9\ M_\odot$. Mass-to-light ratio is $6.1 \times c^{-1}$. The color-magnitude diagram is plotted from measures on photographic plates calibrated by a photoelectric sequence. Photometry is complete to 19.5 ($M_V = -5$). Major features are bright blue supergiants, the brightest star having $M_V = -9$, and a sequence of very red supergiants one magnitude fainter than the blue, many of which show variations of over 1000 days. A significant number of stars lie in the Hertzsprung gap. Two-color photometry shows there is intervening reddening of $0^m.27$. A luminosity function is calculated.

Thirty-two variable stars are discussed, of which thirteen are Cepheids, two are red semi-regulars, one may be eclipsing, and the others are irregular. The period-luminosity relations for the Cepheids are $\langle V \rangle = 23.35 - 2.97 \log P$ and $\langle B \rangle = 23.91 - 2.61 \log P$. These lead to a true distance modulus $(m-M) = 23.75 \pm 0.10$. Secular changes in period are less than 0.001% in 40 years. The eleven variables with $1.6 < (B-V)_0 < 2.1$ have cycles 200-2500 days.

Comparisons with evolutionary models indicate that the stars observed have masses of 9 to 63 $M_\odot$.

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INTRODUCTION

One of the most useful techniques in astronomy is the investigation of physical aggregates of stars, in two colors, which has revealed the existence of the populations, indicated evolutionary tracks, and yielded the initial stellar luminosity function. Usually we are concerned with globular or galactic clusters, because they are close to us and the stars are therefore bright, and because there are so many of them. However, extragalactic nebulae also deserve attention because they contain a wider spread of ages and composition. Unfortunately, very few galaxies are close enough to be resolved into stars.

One of these neighbors of ours, NGC 6822, is the subject of the present study. It is an irregular galaxy, of the Magellanic type. The coordinates are $\alpha = 19^h42^m.1$, $\delta = -14^\circ 53'.1$ (1950); the galactic coordinates are $l^{II} = 25^\circ.38$, $b^{II} = -18^\circ.38$. Its long extension, the "bar," is aligned north-south, and subtends 20' or 3.6 c kpc. Radio observations of the 21-cm line by Volders and Högbom (1961) show that the radial velocity with respect to the sun is -50 km/sec; reduced to the local standard of rest it is -23 km/sec. The galaxy is rotating about an axis with position angle 30°, to which no optical feature corresponds. Rotation curves indicate a mass of neutral hydrogen, $\mathfrak{M}_H = 1.9\ c^2 \times 10^8$ solar masses, and a total mass, $\mathfrak{M} = 1.7\ c \times 10^9$ solar masses for a distance of 560 c kpc (assuming an inclination of 45° to the plane of the sky).

Smaller and further away than the Magellanic Clouds are, NGC 6822 has the advantage of being seen as a whole. We are not obliged to extrapolate from studies of small portions of it. By comparing it with others of its own kind, i.e. the Clouds, and those of different type, such as the Milky Way, we gain further insight into what Hubble has called "the general principle of the uniformity of nature."

The early research into NGC 6822 has been described by Hubble (1925) in a classic paper. He considered the Cepheid variables (using them as distance indicators)*, the diffuse nebulae, the luminosity function, the total magnitude, and made comparisons with the Clouds. Since this time, photoelectric photometry has provided us with an accurate system of magnitudes to much fainter limits than Hubble could go.** Many additional plates have been taken (by Hubble and Baade and, more recently, Arp, Osterbrock, and Sandage), as this investigation provides important basic data in analyzing the contents of near extragalactic space.

With this new material, and the increased resolution of the 200" telescope, are found improved periods for variable stars, lightcurves in two colors, and the color-magnitude diagram. We determine the period-luminosity relation of the thirteen Cepheid variables, and derive the stellar luminosity function. The distance to the galaxy,

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*This was the first application of the period-luminosity relation to regions outside the Galactic system.

**A comparison of Hubble's magnitudes with those in the present work indicate that his m_{pg} scale was systematically too bright for stars fainter than 16th magnitude. His "18^m" is about 19^m on the B system, and his "19^m" corresponds to 21^m in B.

linear dimensions, density, and the mass-to-light ratio are all deduced. Lastly, comparisons are made for each property between NGC 6822 and the other members of the Local Group.

THE MATERIAL AND REDUCTION PROCEDURE

1. Photoelectric Material

Dr. Arp has obtained a photoelectric sequence in NGC 6822 on the (UBV) system. Twenty-two stars were measured, since a magnitude system is better defined in practice by many stars measured once each than by a few stars known to great accuracy. Reductions were carried out by a standard computer program (Arp, 1959). These primary standards are indicated by small Roman numerals on Plate I*; their magnitudes are presented in Table 1.

2. Photographic Material

From the collection of Mount Wilson and Palomar Observatories 139 photographic plates were obtained. Another six plates were lent by Dr. Hodge. Table 2 lists the plates used. In summary, there are

8	plates with 103a-O + GG 13 (B)
20	plates with 103a-O + GG 1 or WG 2
92	plates with 103a-O** (some with silvered mirror)
120	total for blue magnitudes
24	plates with 103a-D + GG 11 or GG 14 (V)
1	plate with 103a-O + UG 2 (U)

They cover a span of forty years.

Variable stars were detected by blinking pairs of plates on a blink-comparator. Hubble discovered 15 variables, Baade marked 9

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*There is some doubt about the identification of xvi. See the next section.

**Or other blue-sensitive plates.

others, and an additional 8 were found in the present work. They are identified on Plate I.

3. Reduction Procedure

All uncrowded stars with $V \leq 19^{m}.5$ within a rectangle $14'.1 \times 8'.5$ enclosing the main body of the nebula were marked on a negative print and photometered for the color-magnitude diagram.* This rectangle was divided into five concentric sections with similar proportions, labelled A, B, ... , E, with areas in the ratio 1:1:2:2:4, A being the smallest, innermost section. In each section stars in the northwest corner were numbered 1-49, stars in the southwest corner were labelled 51-99, stars in the northeast corner were labelled 101-149, and stars in the southeast corner were labelled 151-199. In two quarters there were more than 50 stars; numbers greater than 200 were applied to the excess. Thus every star has a letter and a number. Identification charts for the stars are Plates II - V. A dozen stars measured in the H II region in the northwest are labelled F, and are shown on Plate I.

To minimize effects due to unresolved background stars, the three best, lightly exposed plates were selected in B** and in V. All the stars with $V < 19^{m}.5$, as well as the standards and the variables, were measured on these six plates with a Sartorius variable-iris

*About 17 stars in D and 28 in E brighter than $19^{m}.5$ were omitted because their visual magnitudes were estimated too faint from the print.

**Only one plate on the B system was lightly exposed; so for the other two, plates taken with the GG 1 filter had to be used.

astrophotometer. Photometer readings for the standards were plotted against photoelectric magnitudes and a calibration curve was drawn for each plate. The deviations of individual readings from the curve were plotted against the color index (B-V) for each of the six plates. No color equation was found.* Distance-to-center effects introduced by coma were negligible. For each standard, the magnitude corresponding to the photometer reading was read from the calibration curve. These magnitudes, termed "photographic" (as opposed to photoelectric), were averaged for the B and V plates. Since they define a calibration curve with much less scatter than the photoelectric values, they were used henceforth; this results in more consistent work. The adopted photographic magnitudes are tabulated in Table 1.**

New calibration curves were drawn with the adopted photographic values, and average magnitudes and colors for all the stars measured on the six plates were derived with the help of an IBM 7090. They are listed in Table 3.

Since the stars fainter than $19^{m}.5$ could be seen only on heavily exposed plates, where background effects are very large, it was necessary to select a faint sample of stars from regions away from the center. We see on the photographs that NGC 6822 has an extension from the main bar to the southeast and another to the east. Stars fainter than $19^{m}.5$ were selected in each of these regions and numbered

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*See page 8 for further discussion.

**Although there is a question as to which star is described by the photoelectric values for xvi, the photographic measures are unambiguous.

consecutively. Those in the east are labelled G; those in the southeast (partly overlapping with section E) are labelled H. To reduce background difficulties still further, stars in these regions, whose magnitudes had been determined in the bright star work were used as secondary standards.* Finding charts are Plates VI and VII, respectively. Three heavily exposed plates in B and in V were measured and reduced as before. Average magnitudes and colors of stars in the faint sample are found in Table 3.

Because most of the plates are exposed so long that background effects are significant, stars were chosen to serve as local standards around each variable and their magnitudes found from the 6 lightly exposed plates. These secondaries were measured with the variables and primary standards on all the remaining plates. Reductions were carried out (by hand) in the same manner as described.

4. Discussion of Errors

Examination of the plots of deviations of standards from the calibration curve, ΔB, against color index indicate an internal consistency of

$$\begin{array}{ll} \pm 0\overset{m}{.}15 \text{ in V or B} & \\ \pm 0\overset{m}{.}20 \text{ in B-V} & \end{array} \quad \text{(single measure)}$$

and an uncertainty of

$$\begin{array}{ll} \pm 0.03 \text{ in V or B} & \\ \pm 0.04 \text{ in B-V} & \end{array} \quad \text{(final average value)}$$

*See notes to Table 3.

for the 78 primary and secondary standards (based on averages of 24 visual and 19 blue plates). Systematic errors, however, may be more sizeable. We consider several possible sources of error:

1. The Zero-Point of the B and V Scales. This depends upon an average of twelve photoelectric observations of the standard "i," made on eight nights. If the extinction coefficients used in the standard reductions to the (UBV) system are correct for the large zenith angle of NGC 6822 (secant z = 1.5), the zero-point is probably known to ± 0.04. The photoelectric standards determine the scale down to $V = 21^m$ and $B = 21^m\!.8$. Values fainter than this are obtained by extrapolating the linear part of the calibration curve for a heavily exposed plate.

2. The Color System for Very Blue Stars. As there were no photoelectric standards with $B-V < 0.6$, the magnitudes of a few blue stars were determined from 103a-O + GG 13 plates to extend the color range. Plots of ΔB against color index showed that GG 13 and GG 1 magnitudes agreed systematically to ± 0.05 for $B-V > 0.0$. For very blue stars we expect a color term of $0.044 - 0.088(B-V)$* (Arp, 1960b,Swope, 1963) for $B-V < 0.5$, to be added to colors in Table 3 for stars in A through F.** That some correction is needed can be seen from the existence of stars in the (uncorrected) C-M diagram with $(B-V)_o = -0.7$. Since no stars have been found bluer than -0.5 in our own galaxy, the probable difference between the color systems

*Use the (B-V) of Table 3 in this expression.

**Magnitudes in G and H depend solely on GG 13 plates.

is 0.2 at B-V = -0.5, whereas the expected correction is only 0.09. No revision has been made in Table 3 or in Figure 3.*

3. The Calibration Curves. Iris diameters are reproducible to the equivalent of $0\overset{m}{.}002$, even for plates with poor image quality, but the relation between the iris diameter and magnitude (i.e. the calibration curve) is uncertain by $\pm 0\overset{m}{.}05$. It is this which contributes a large part of the internal inconsistency. For stars near the plate limit, this uncertainty may be $\pm\, 0\overset{m}{.}25$ or more.

4. Coma, Crowding, and Background Light. Each of these three causes the luminosity to be overestimated. However, the color-magnitude stars were measured from plates on which these effects are very small, and the use of local standards corrects for them on the other plates. The uncertainty of reduction due to these conditions is about $\pm\, 0\overset{m}{.}07$ and is the source of the rest of the internal inconsistency.

In sum, values for the C-M diagram are accurate to

$\pm\, 0\overset{m}{.}10$ in V or B	$(V < 21.0,\ B < 21.8)$	
$\pm$ 0.14 in B-V	$(B-V > 0.0)$	
$\pm$ 0.20 in B-V	$(B-V < -0.3)$	"probable error,"

(means of 3 plates in each color). Stars brighter than 16 are somewhat over-exposed on the plates, so their magnitudes cannot be better

*Variable stars are not affected by this as they are all in the well determined range of color index. The very red stars are subject to analogous uncertainties, however, as the reddest photoelectric measure is 1.8. Similar arguments show that we expect the deviation of tabulated B-V from the true color to be at most 0.1 by $(B-V)_{tab} = 2.6$.

determined than this. Stars fainter than $19^{m}.5$ were measured on heavily exposed plates so they were well above the plate limit and their magnitudes are as well determined as the majority, which lie between 16^{m} and $19^{m}.5$.

REDDENING

To compare the C-M diagram of NGC 6822 with those of other galaxies, it is necessary to correct for interstellar reddening. We determine the color excess E_y by translating stars in the U-B,B-V plot back along the reddening trajectories (Wildey, 1963). To supplement the photoelectric data, 30 bright stars selected from the outer regions* of the nebula were measured with all the primary standards on the one U photographic plate. As the U_{pg} values agreed very well with the U_{pe} for the 14 primaries, the photographic magnitudes were used throughout for consistency. $(U-B)_{pg}$ values may be found in Table 4.

The two-color plot of these stars, Figure 1, shows that most of the points fall in a band to the right of the unreddened luminosity-class V main sequence (Johnson, 1958, Johnson and Iriarte, 1958, Arp, 1958) with $(B-V)_o > 0^m.5$. The assumption is made that on the average these stars should be traced back to the red portion of the class V curve. The secondary standards from G lie to the <u>left</u> of the unreddened curve! If their B values were made fainter by 0.14, these stars would lie on or to the right of the unreddened main sequence. Such a correction would also reduce the number of very blue stars in the faint sample from G. But since the magnitudes for these standards were derived in the same way as for all other stars, there seems to be no reason for a systematic difference to exist.

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*See note c to Table 3.

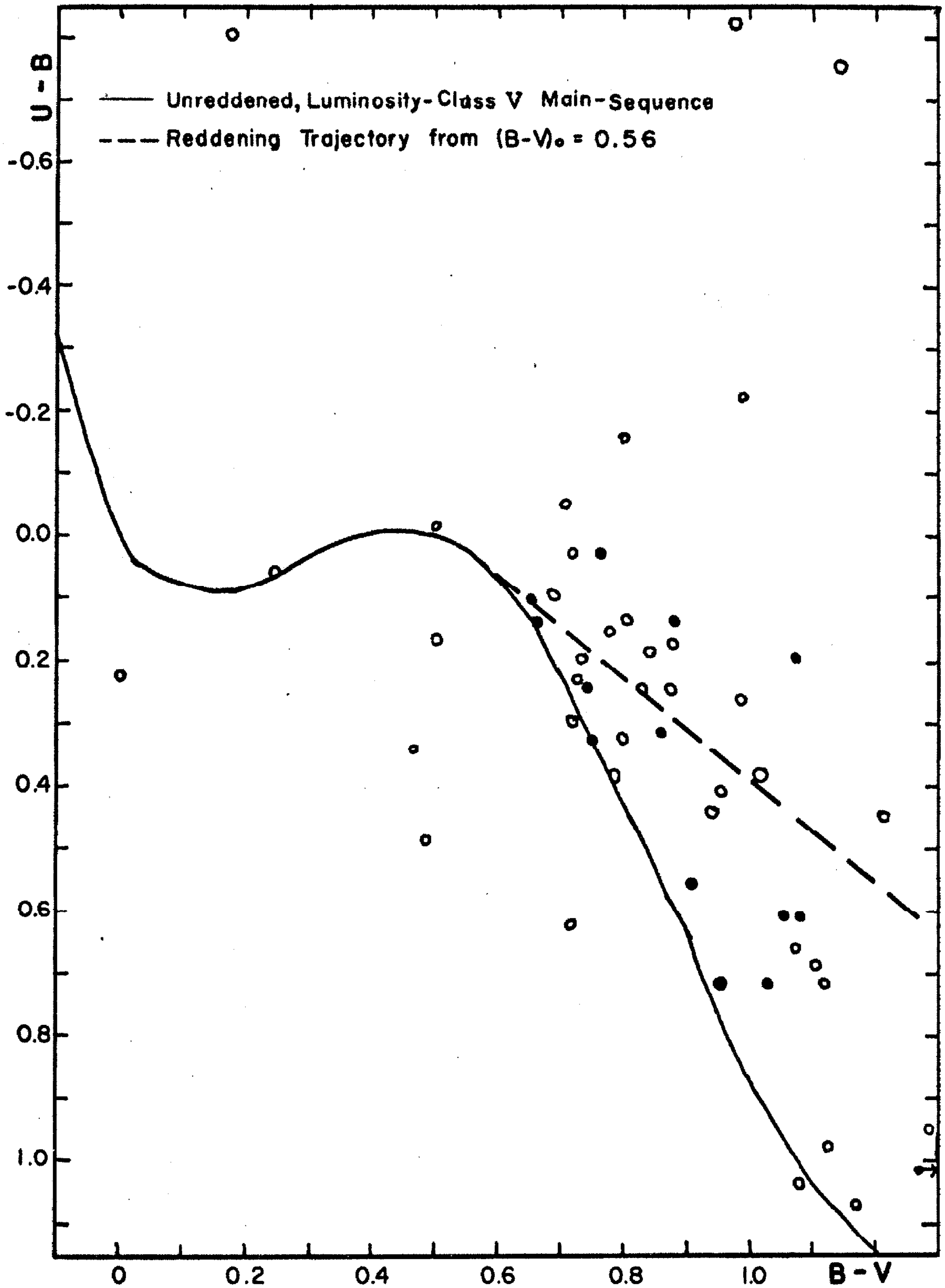

Figure 1. The Two-Color Plot of Stars in the Field. Dots are stars with U_{pe}, open circles are stars with U_{pg} only.

After the color excesses had been determined, the distance to each star, given in Table 4, was calculated from

$$\log r_{pc} = \frac{V - M_v}{5} - 0.6 E_y + 1$$

where the mean M_v - $(B-V)_o^*$ relation is taken from Allen (1963, p. 199). We may wonder if the extremely large color excesses apparently found for stars lying above the $(B-V)_o = 0.56$ trajectory (see Figure 1) are meaningful. Considering that the (U-B) and (B-V) values are uncertain to ±0.14, the "true observed colors" of these stars could easily lie below this critical reddening line. If the slope of the trajectories used was made shallower, many of these stars could be traced back to the red portion. Furthermore, an ultraviolet excess in some stars would lead to their unreddened positions lying above the "knee" of the normal unreddened curve. We conclude that the true color of any star bluer than 0.6 is very uncertain.

When the reddening is plotted against distance (Figure 2) for the stars in Table 4, we see that E_y increases slowly with r until r = 800 pc (corresponding to a distance from the plane, z = 240 pc), at which point it rises suddenly to its final value; presumably the line of sight has passed through a cloud of absorbing material. The data are not inconsistent with a constant linear increase of E_y with r, up to r = 1.2 kpc (z = 360) and no change thereafter. This interpretation requires smooth distribution of dust and gas in the disk. In

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*A mean main-sequence is appropriate here since there is no reason to expect field stars to be "age-zero."

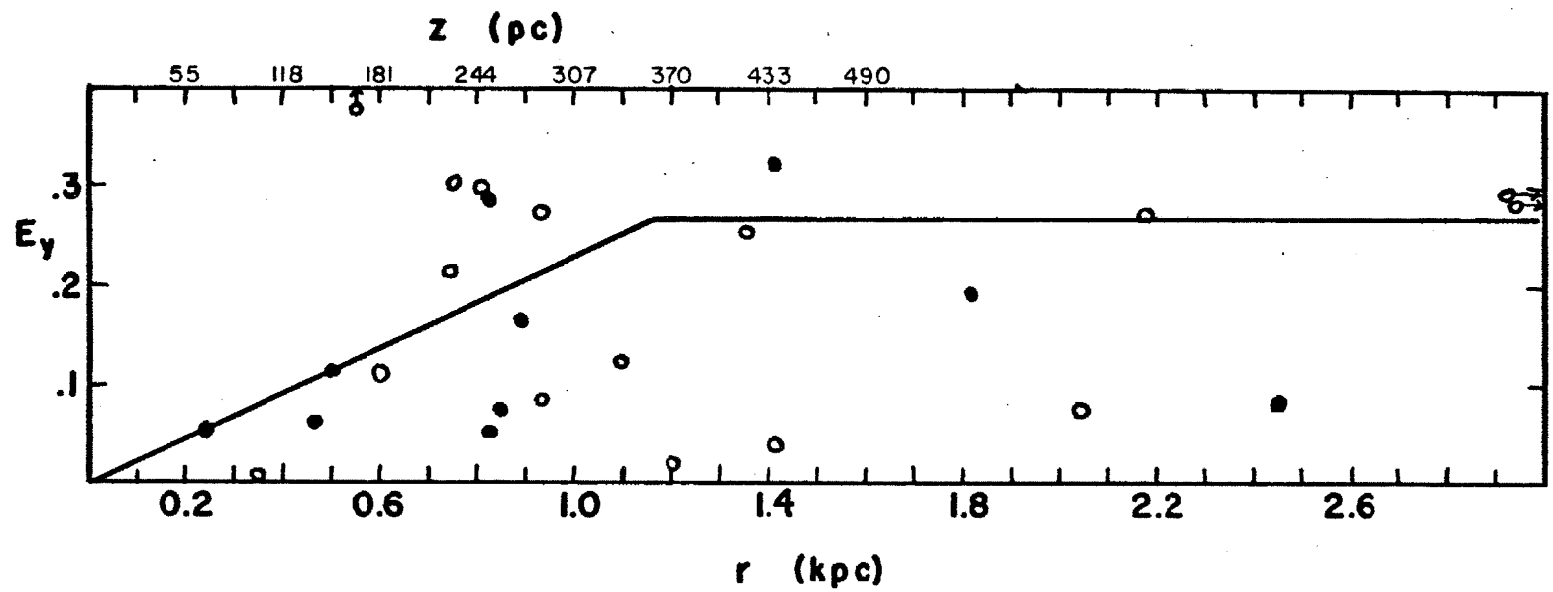

Figure 2. Reddening as a Function of Distance. Dots are stars with photoelectric U measures; open circles are stars with photographic U only. (U_{pg} is used for both.)

either case, absorbing material occurs far from the plane. Arp (1965) finds for NGC 6522 ($l^{II} = 1^{o}$) that the half-width of the absorbing layer is 140 pc, which accords with Allen's (1963) figure of 150 pc for the half-thickness of the disk; and that in the anti-center longitudes, the half-width is only 82 pc. Bearing this in mind, the first interpretation of an extension of absorbing material above the plane at $z = 240$ pc is more likely.

The total reddening is

$$E_y = 0\overset{m}{.}27 \pm 0.03 .$$

Assuming the absorption $A_v = 3.0\, E_y$,

$$A_v = 0\overset{m}{.}8 \pm 0.1 ,$$

with a mean rate of absorption of $0\overset{m}{.}7$ per kpc. (The usual mean rates range from 0.6 to 1.0 per kpc.) We may compare this with the cosecant reddening (Arp, 1962)

$$E_y = 0.058 \sec b = 0\overset{m}{.}18$$

$$A_v = 0\overset{m}{.}6 .$$

Agreement to 30% indicates that the assumptions that the stars came from luminosity class V with $(B-V)_o > 0.56$ were justified.

No differential reddening was found across the nebula but the data do not exclude a change of as much as 0.10 in E_y from one side to the other.

THE COLOR-MAGNITUDE DIAGRAM

Stars lie in three groups in the color-magnitude diagram, Figure 3.*

The blue sequence looks very like the top of the h/χ main sequence (Wildey, 1964), a broad fan curving back toward the red for the brightest stars. Blue stars are found with equal frequency in regions A, B, and C. There are fewer in D, and none in E except in the southern extension of the galaxy. The bluest stars are in C and F; there are also some very blue stars in the eastern extension.

The red stars form a sequence beginning at $(B-V)_o = 1.3$ and go out to 2.2, getting brighter as they get redder. There are equal frequencies of red stars in regions A, B, and C, perhaps increasing from A to C** and favoring the west side. C contains the reddest stars as well as the bluest (and the brightest of each color). Again, the percentage decreases in D and there is none in E except in the southern extension. Indeed, the lack of red and blue stars in E is very striking. There is a large number of variable stars at the red tip of the sequence.

Separating the red and blue stars from the central hump are two gaps. The blue gap is sharply marked by the end of the blue sequence at $(B-V)_o = 0.1$ and by the abrupt start of the hump. The other gap is not as clear, since the red side of the hump straggles

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*All stars of Tables 1 and 3 and all variables are plotted.

**This makes it unlikely there is any significant internal reddening in the nebula, since if there were, A would have the reddest stars.

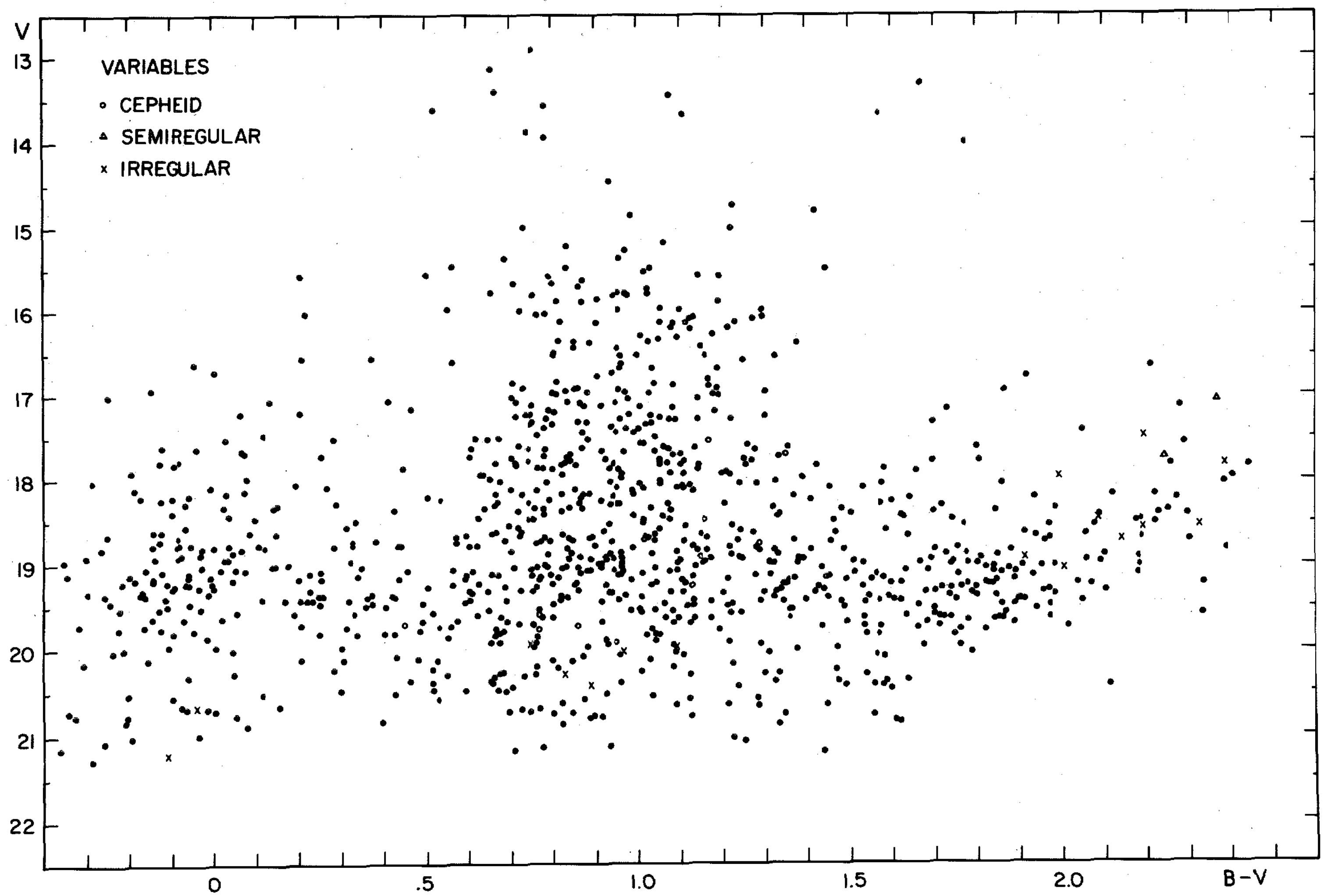

Figure 3. The Color-Magnitude Diagram of NGC 6822.

out to the beginning of the red sequence.

The hump itself lies in the middle of the Hertzsprung gap, where we would expect very few stars other than the Cepheid variables which fall across it. Arguments for and against its being composed of foreground stars are presented in the next section. It may be noted that the hump starts quite clearly at $(B-V)_{obs} = 0.6$, except for the E region (again excluding the southern extension) where it starts at 0.8. The density of stars in the hump decreases, redward of 1.0.

FIELD STARS

The number of foreground stars must be determined before the luminosity function can be calculated. Star counts made by Seares et al. (1925) and collated by van Rhijn (1929) are available for Selected Areas 135 and 136,* for the smoothed average at $|b^I| = 20^o$, and for the smoothed average interpolated to $(-16^o, 351^o)$, the co-ordinates of NGC 6822 in van Rhijn's system. Seares's magnitude scale has been transformed to the B system by

$$B = 0.944\, m_{pg} + 0.177 \qquad B < 16$$

$$B = 1.777\, m_{pg} - 2.696\,, \qquad B > 16$$

a relation deduced from Johnson (1951, 1953), correcting for the scale divergence found for S.A. 68 by Stebbins, Whitford, and Johnson (1950). These counts, reduced to the area of the rectangle enclosing the main bar (0.033 square degrees) are set forth in Table 5a. For comparisons, the counts from NGC 6822 are included in column 6. Although the number of field stars is uncertain by a factor of two, it is evident that all stars in the rectangle with $B < 16^m$ must be foreground stars. The actual counts in NGC 6822 for the first four magnitudes correspond most closely to those of $|b^I| = 20^o$, so we may assume this column gives the most likely number of field stars.

In order to discriminate by color we construct a field star color-magnitude diagram. The $m - \log \pi$ method was used (Bok,

*NGC 6822 is midway between them, 7^o from each.

1931) in which the integral over distance

$$A_m = \omega \int_0^{\infty} \Phi(M_V) \rho(r)\, r^2\, dr$$

is replaced by a sum over shells

$$A_m = \sum_{k=0}^{\infty} \Phi(m_V - k + 5 - A_k) \rho(k) V(k) \ .$$

Here A_m is the number of stars in solid angle ω with apparent magnitude $m_V - \frac{1}{2} < m_V < m_V + \frac{1}{2}$; $k = 5 \log r$; $\rho(r)$ is the density of stars/pc^3 (Allen, p. 240) normalized to unity at the galactic plane; A_k is the total absorption in front of the k^{th} shell, and $V(k)$ is the volume of the k^{th} shell. Table 6 shows the assumed variation of absorption, reddening, and density with distance. For $\Phi(M_V)$, the solar neighborhood luminosity function (Allen, p. 238) was used in all shells. As a result, about 15 stars too few were calculated for V = 19, but this is small compared with the uncertainty introduced by the necessary extrapolation of the density out to 100 kpc. Stars were distributed in color according to Starikova (1960).* The results are presented in Table 7. The number of stars calculated in each magnitude interval by this method is given in Table 5b, column 2. Comparison with the actual counts in the galaxy (column 3) shows that the field star diagram is overpopulated by 50% due to overestimating the density at large distances. When the field star distribution (slightly

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*This distribution is the most probable one, but not the only possibility.

smoothed to remove statistically invalid fluctuations) is subtracted from the observed C-M diagram, the intrinsic distribution remains. This is presented in Figure 4; it has been adjusted for the color divergence of very blue stars.

Table 7 establishes that most of the field stars lie between $0.4 < B-V < 1.6$; that is, they are in the central hump. The fraction of stars in the hump due to foreground stars is found approximately by subtracting the expected number of field stars* from the actual counts in the hump. As we see in Table 5b, this particular procedure predicts no more than 40% of the hump stars would belong to NGC 6822. From a similar comparison using Seares's counts, we find that at least 70% of the hump, and perhaps all of it, comes from our own Galaxy.

Another, and more reliable, way to remove field stars is to compare the C-M diagrams of the outer and inner sections, normalized to equal areas. The outer region, E, contains a much smaller percentage of NGC 6822 stars than the inner region, A, and so it furnishes the possibility of measuring the density of field stars in our own galaxy in the direction of NGC 6822. By subtracting the counts of E** from those in A for each magnitude or color interval (there are too few stars to enable a statistically valid difference of their actual C-M diagrams to be made), we subtract out the field stars from A. Insofar as E does contain intrinsic stars, these are

*The expected number is 2/3 of the counts in Table 5b, col. 2.

**To get a purer sample of field stars, the southeast quarter of E is omitted.

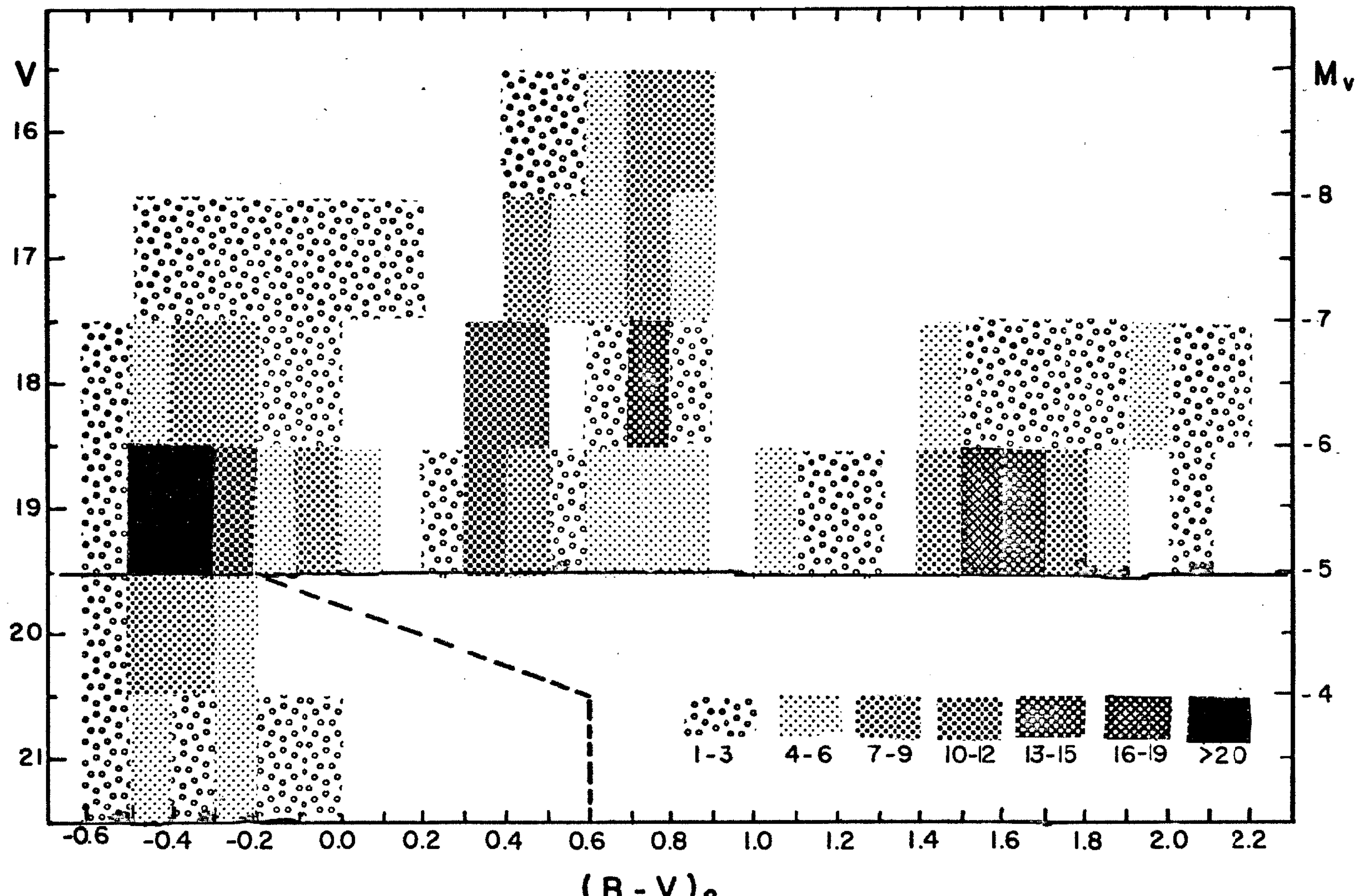

Figure 4. Number of Stars in the C-M diagram in intervals of ($\Delta V = 1^m$, $\Delta(B-V) = 0.1$), after subtracting the constructed field star diagram.

perforce subtracted too, so we have a lower limit to the true distribution in A. The counts (A - E) by magnitude intervals are listed in Table 8, column 6, and the counts by color are presented in Figure 5. The histogram shows that a significant number of stars are present between $0.2 < (B-V)_o < 0.6$, in the Hertzsprung gap. We conclude 50% ± 10% of the stars between $0.4 < (B-V) < 0.8$ are intrinsic, but more than 90% of the stars in the hump redder than 0.8 are from the foreground.

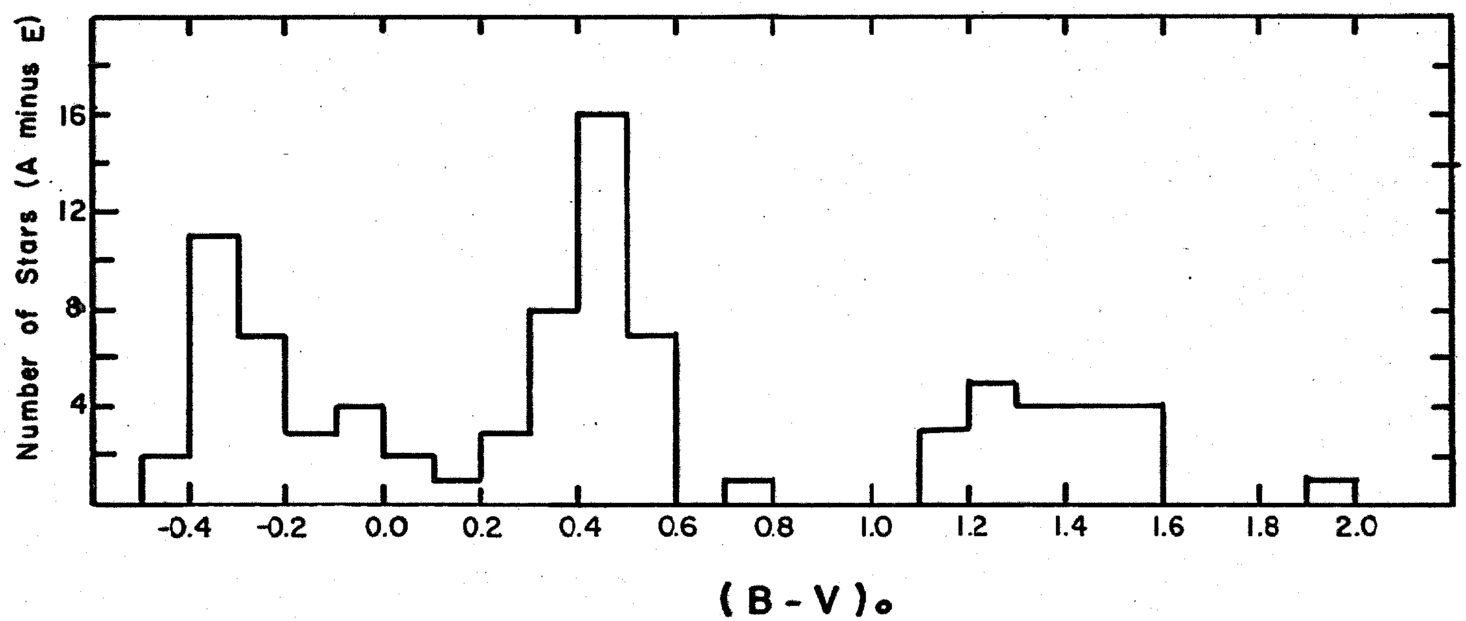

Figure 5. Number of stars in Section A as a function of B-V, after subtracting counts from E (omitting the southeast quarter of E and normalizing to equal areas).

STELLAR CONTENT

The Color-Magnitude Diagram

When the field stars are removed, the color-magnitude diagram loses the scatter of stars brighter than 16^m, and the hump becomes much less dense (see Figure 4). The blue stars must be at the top of the main sequence; there is a very strong resemblence to the fan of supergiants in the C-M diagram of h/χ Persei (Wildey, 1964)*. The similarity does not extend to the red supergiants, for NGC 6822 has almost as many red stars as blue (90 red to 110 blue), and the red stars are only a half-magnitude fainter than the blue, while h/χ Persei itself has no red supergiants and the few found in its association are not as bright as in the nebula. Moreover, the h/χ M-supergiants get fainter with increasing color index, whereas the NGC 6822 red stars brighten. The two systems differ also in the Hertzsprung gap: h/χ has no stars there.

The M31 color-magnitude array for Field IV (Swope, 1963) shows great similarity with the present one, although it has fewer very bright stars, particularly the blue (which are fainter in M31 than the red stars) and extremely red ones. (Irregular galaxies are richer in supergiants than Sb spirals.) We can see in Field IV how the red and blue sequences approach each other at fainter magnitudes.

The C-M diagram for stars in the field of the Large Magellanic Cloud (Wooley, 1963) also has common features with that of NGC 6822, but it is hard to distinguish them because of greater

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*See Figure 10.

contamination by field stars. The blue sequences are alike but the LMC red stars are relatively scarce, although they become as red as those in this work. Wooley's conclusion from proper motion studies, that virtually all the stars in the LMC between $0.5 < B-V < 1.5$ are foreground stars, is open to doubt. It is probable that about 30% of the stars of intermediate color in Figure 3 belong to NGC 6822. If all of them are foreground stars, it is difficult to explain why they cluster against the blue edge of the Cepheid unstability region in section A (see Figure 5).

H II regions are prominent in the nebula. Sérsic's (1959) angular measures of the three largest (identified on plate I) correspond to diameters of

(NGC 6822)	141 pc (III)	116 pc (X)	114 pc (I) .

These are smaller than the ones in the Clouds:

(LMC)	290	185	115
(SMC)	185	135	135 .

In summary, the stellar content of NGC 6822 is much like that of other young population I systems, with a large number of blue supergiants of magnitude $-5 > M_v > -8$, having a spread in color $-0.5 < B-V < +0.1$. It differs in having a much larger proportion of red stars of comparable brightness. Since red and blue stars are always found together in similar numbers throughout the nebula, it is likely they are different evolutionary stages of one type of star. Therefore, the red stars are also population I. As for stars of intermediate color, they are probably as frequent as blue stars, and tend to lie near the blue edge of the Cepheid region.

The Luminosity Function

Only a brief portion of the luminosity function can be obtained. For the galaxy as a whole, subtracting counts from the constructed field star diagram,* we find that the number of stars doubles in each fainter magnitude interval (see Table 8, column 3). For the inmost section A, (subtracting counts from E), the increase is more rapid. This implies that the center is not the part of the galaxy richest in very bright stars. We may interpret this to mean that star formation is most rapid not at the center but in section C, where the fraction of very red and very blue stars is greatest.

We can get an approximation to the volume of the galaxy by assuming its dimension in the line of sight is equal to the mean apparent diameter. If we assume an inclination to the plane of the sky of 45° and a distance of 560 c kpc (c is a correction factor), then the volume filled by stars in the large rectangle is

$$V = 3\ c^3 \times 10^9\ pc^3 \ .$$

This is probably good to a factor of two. The luminosity function $\Phi(M)$--the density of stars/pc^3 with $M-\frac{1}{2} < M < M+\frac{1}{2}$-- is now calculated in Table 8. When we compare this to the luminosity function valid for the plane of our Galaxy (Starikova, 1960) we see that NGC 6822

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*Only two-thirds of the counts were subtracted, to allow for the over-population discussed earlier.

has proportionally more very blue stars* and that blue stars are as a whole twice as dense there as in our own spiral arms. (The relative density of all stars per pc^3 is unknown.) The central density is about five times the nebular average.

The Integrated Magnitude

The integrated magnitude of all stars brighter than 19.5 in the main body of the nebula is

$$V_t = 9.56 \pm 0.05$$
$$B_t = 10.48 \pm 0.05$$
$$(B-V)_t = 0.92 \pm 0.07 \ .$$

Stars fainter than this contribute another 0.06.

The integrated color of the central section A is 0.75, and the color of the faint samples is 0.71. This is probably close to the true value, since field stars will be relatively scarce here. The adopted unreddened color is

$$(B-V)_o = 0^m.46 \pm 0.07 \ .$$

This is comparable to that of the Magellanic Clouds: 0.50 (LMC) and 0.35 (SMC) (de Vaucouleurs, 1964).

We can obtain the luminosity due to the field stars from the counts:

*The slope of $\Phi(M)$ in NGC 6822 is 2-2.5; in our Galaxy it is 3. In the LMC it is also 3 (Shapley, 1943, p. 79).

$$V_f = 9.7 \pm 0.3$$
$$B_f = 10.6 \pm 0.3$$
$$(B-V)_f = 0.9 \pm 0.4 .$$

This is such a large percentage of the total light, and so uncertain, we cannot get a significant value for the total magnitude of the Galaxy. However, we may use Holmberg's (1957) values: integrated $m_{pg} = +9.21$. With the adopted color,* this is equivalent to $V_t = 8.14$, or $L_v = 2.8\ c^2 \times 10^8\ L_\odot$.

From Volders and Högbom (1961), the mass is $1.7\ c \times 10^9\ M_\odot$,** so the mass-to-light ratio is

$$\mathfrak{M}/L \approx 6.1\ c^{-1} .$$

This value is typical of population I: in the solar neighborhood the ratio is 1.7, and in the Clouds it is 2.0 (Limber, 1960). By contrast, in the Sb Galaxy M31, the ratio is 16, and in E-type galaxies, it is at least 200.

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*m_{pg} is corrected to the B system by $B = 0.944\ m_{pg} + 0.177$.

**This is probably satisfactory to a factor of two.

VARIABLE STARS

Twenty-nine stars detected by blinking plates, and seven others whose magnitudes from the C-M plates showed poor agreement, were studied for variation. (The magnitudes from each plate are collected in Table 9.) Thirteen are Cepheids, two are red semi-regulars, one may be an eclipsing binary, and no periods could be found for the others. Four of Hubble's "Cepheids" (V8, V9, V10, and V11) are in this last group. Five stars are probably not variable.

The list is expected to be complete for all variable stars in the large rectangle with $V < 19.5$ and amplitude > 0.5. Smaller amplitudes cannot be unambiguously distinguished from accidental error due to background effects. The degree of completeness is unknown for stars outside these limits. Counts of variable stars (Kukarkin and Parenago, 1958, Plaut and Soudan, 1962) indicates that at most two variables are expected in the foreground.

The Variable Stars

V1. Cepheid. The V curve is poorly delineated except at maximum.

V2. Cepheid. The period seems to be somewhat smaller than average for the first 9000 days by $0^{d}.0002$.

V3. Cepheid.

V4. Cepheid.

V5. Cepheid. The rise to maximum is slow.

V6. Cepheid. The point of maximum is not well determined. The period for the first few years of observation is 0.3% greater than average.

V7. Cepheid. This long-period star exhibits phase changes of ±0.15; that is, when cycles are superposed, three or four parallel curves appear, separated by 0.15 in phase. This is not a period change. For clarity, only the first five years are used in plotting the B lightcurve in Figure 6. All plates have been corrected to the "initial phase" in plotting the V lightcurve.

V8. Irregular. Hubble called this a Cepheid, but it is much too blue. Variations are short term, very small, and do not confirm Hubble's period.

V9. Irregular. Hubble called this a Cepheid, and it has the right color and general type of variation, but no period has been found that satisfies the data. Maxima can occur as little as three,or as much as ten, days apart.

V10. Irregular. This is another of Hubble's "Cepheids" for which his period was not verified. Although this star lies among the Cepheids in the C-M diagram, it appears to have a small five day variation superimposed on a 630 day cycle with larger amplitude.

V11. Irregular. Hubble called this a Cepheid, but it is too blue. There is a small amplitude variation of $3^{d}.5$. This star is very faint, and data is not too reliable.

V12. Semi-regular. This extremely red star has two modes of behavior. Most of the time it varies regularly with a period of 640^d, but every three to six cycles, it does something else for about 180^d. No plates were taken during such hiatuses, so this mode cannot be more clearly described. The blue lightcurve in Figure 6 is drawn for the first three cycles; the V lightcurve is constructed by phase-correcting, as with V7.

V13. Cepheid. This is the longest period Cepheid found in the nebula, with the maximum coming later in V than in B. Like V7, it shows phase changes, although not as markedly, which tend to occur every eighth cycle. Only points with the "initial phase" have been plotted for the B lightcurve in Figure 6. When necessary, V points have been phase-corrected.

V14. Irregular. This very red star has a slow variation of 2400^d. It might be semi-regular.

V15. Irregular. There are small amplitude variations, lasting at least 250 days. It is very red.

V16. Irregular. This star is below the plate limit most of the time, so it is omitted from Table 9. It reaches maximum every eight days, on the average.

C17. Cepheid. This star is much too red for its period.

V18. Semi-regular. There are phase changes of ± 0.10 in this red star. Only the first five years have been plotted in the B lightcurve, Figure 6. Points on the V curve have been phase-corrected.

V19. Eclipsing (?). Real periodicity seems to be present here, although the lightcurves of this bright, red star have a large scatter.

V20. Irregular. As for V16, the data have been omitted from Table 9 because of faintness. Maxima are spaced about ten days apart.

V21. Cepheid. There is more scatter than usual about the B lightcurve.

V22. Irregular. Variations are at least 26, and less than 2600 days. The amplitude is large, especially in V.

V23. Irregular. This red star has variations lasting about two weeks.

V24. Irregular. It has erratic variations of ten days or less.

V25. Irregular (?). A period of $13^{d}.33$ may fit the data, but there is a very large scatter, perhaps because the star is near the faint limit. If this is a true period, the lightcurve shows a secondary maximum.

V26. Irregular. Cycles last less than 25 days.

V27. Irregular. Like V9, this star has the right color and type of variation to be a Cepheid, but it is not periodic. Cycles average fourteen days.

V28. Cepheid.

V29. Cepheid.

V30. Cepheid. This is extremely bright and blue for its period.* The

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*There may be a connection between its color and the presence of many other very blue stars in the eastern extension.

V curve has no points at maximum. This has the shortest period in the nebula.

V31. Irregular. Variations of this red star last 8 to 30 days.

V32. Irregular. The B amplitude of this red star is large. Cycles average thirty days.

A131, A159, and A6 were studied for variation, but the amplitudes are small enough to be explained by background effects. The last of these may be variable, with a five day cycle. The secondary standard E282 also may be variable. A star in the eastern extension, G55, had very bad agreement among the three magnitudes measured for the C-M diagram; this is a possible variable.

The amplitudes, mean magnitudes, and unreddened colors of the irregular variables, the semi-regulars, and the eclipsing binary are collected in Table 10. Most of them lie along the red sequence and share in its characteristic of getting brighter with increasing redness; they tend to have cycles lasting about 500-2500 days. The light curve of NGC 6822 red irregulars is not known well enough to permit close comparison with local red variables such as μ Cep ($M_V = -3$, $P = 750$) or S Per (double period of 810 and 916 days)*, but they give an impression of being considerably more erratic. Stars with variations of 2000 days are not known in our Galaxy. Other irregulars lie among the Cepheids in the C-M diagram, with cycles of 10-30 days. The two very blue ones have 3 day variations.

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*Campbell (1939).

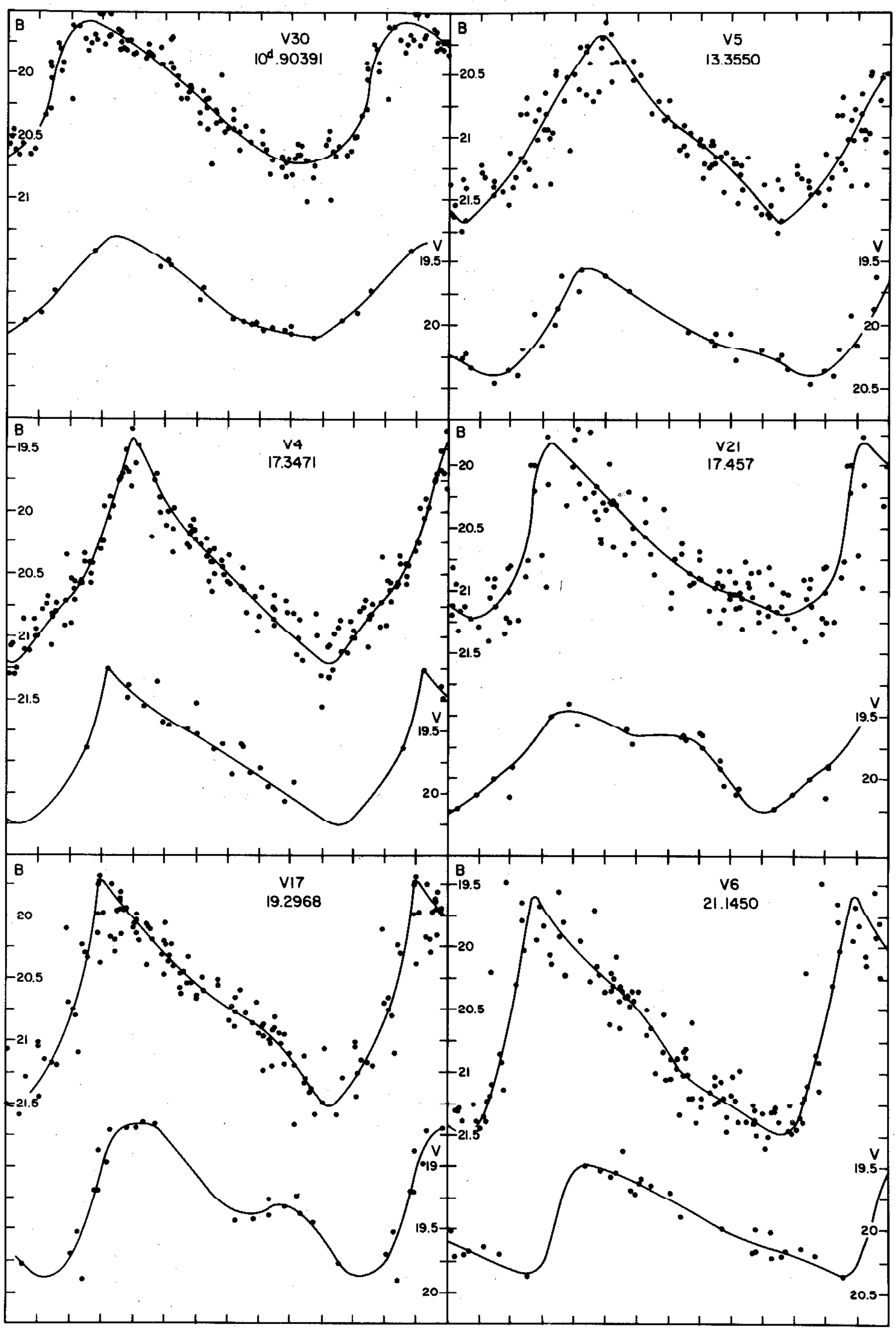


Figure 6a. Lightcurves of Variables.

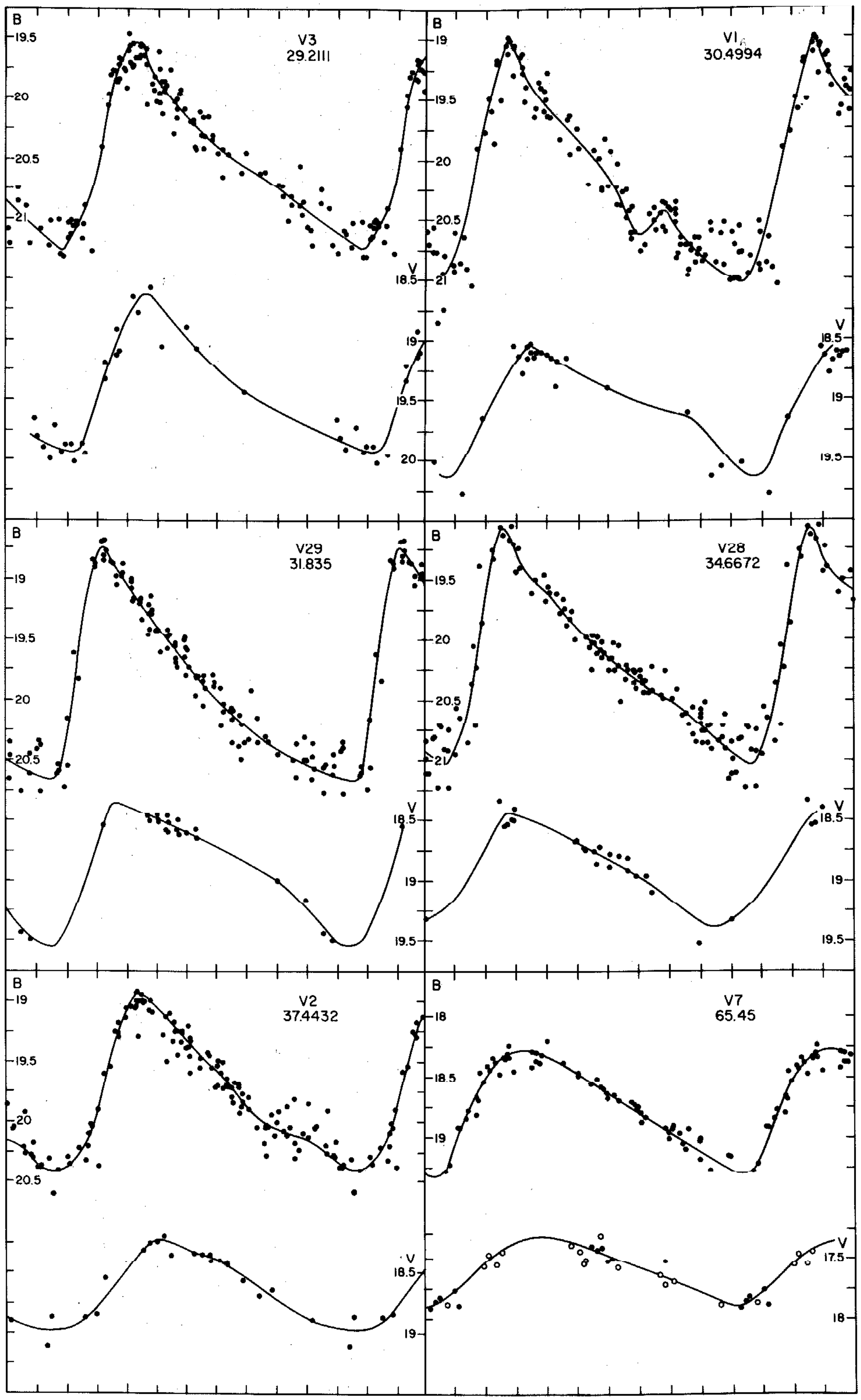


Figure 6b. Lightcurves of Variables.

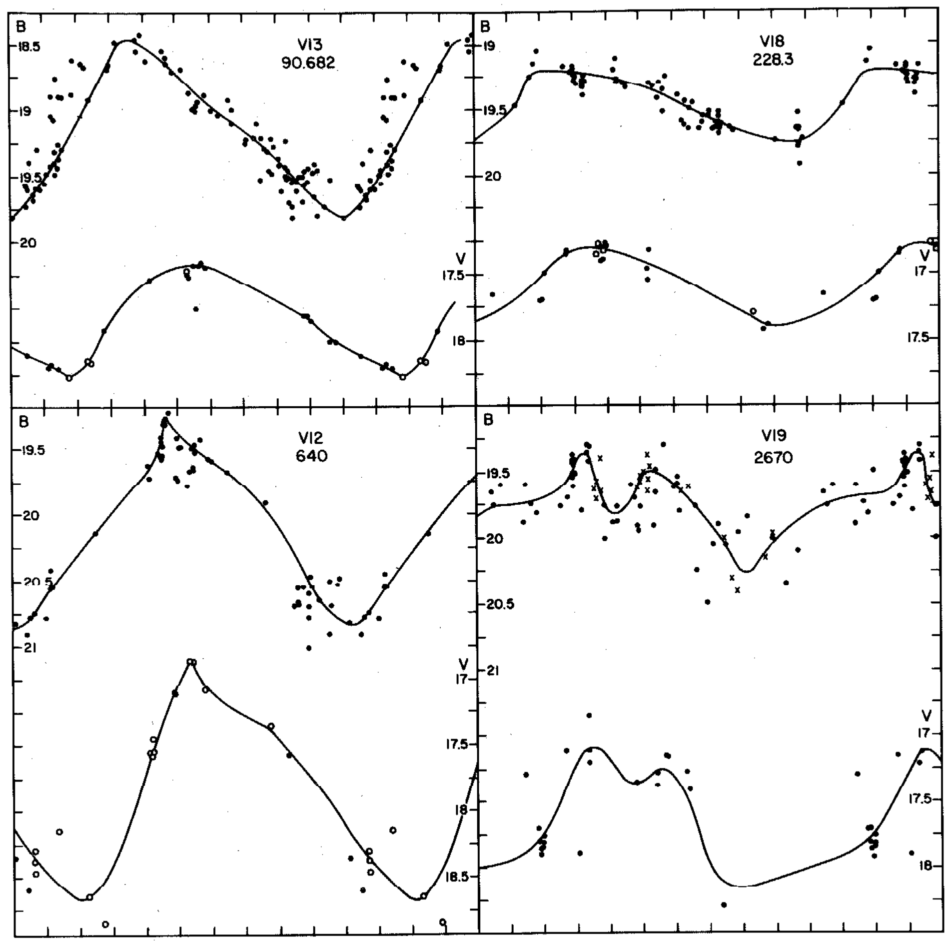


Figure 6c. Lightcurves of Variables in B and V. V19 may be an eclipsing binary, V12 and V18 are semi-regular, the others are Cepheids. Open circles are "phase-corrected" points. The x's (in V19) are averages of 3-6 plates. The abscissa is phase.

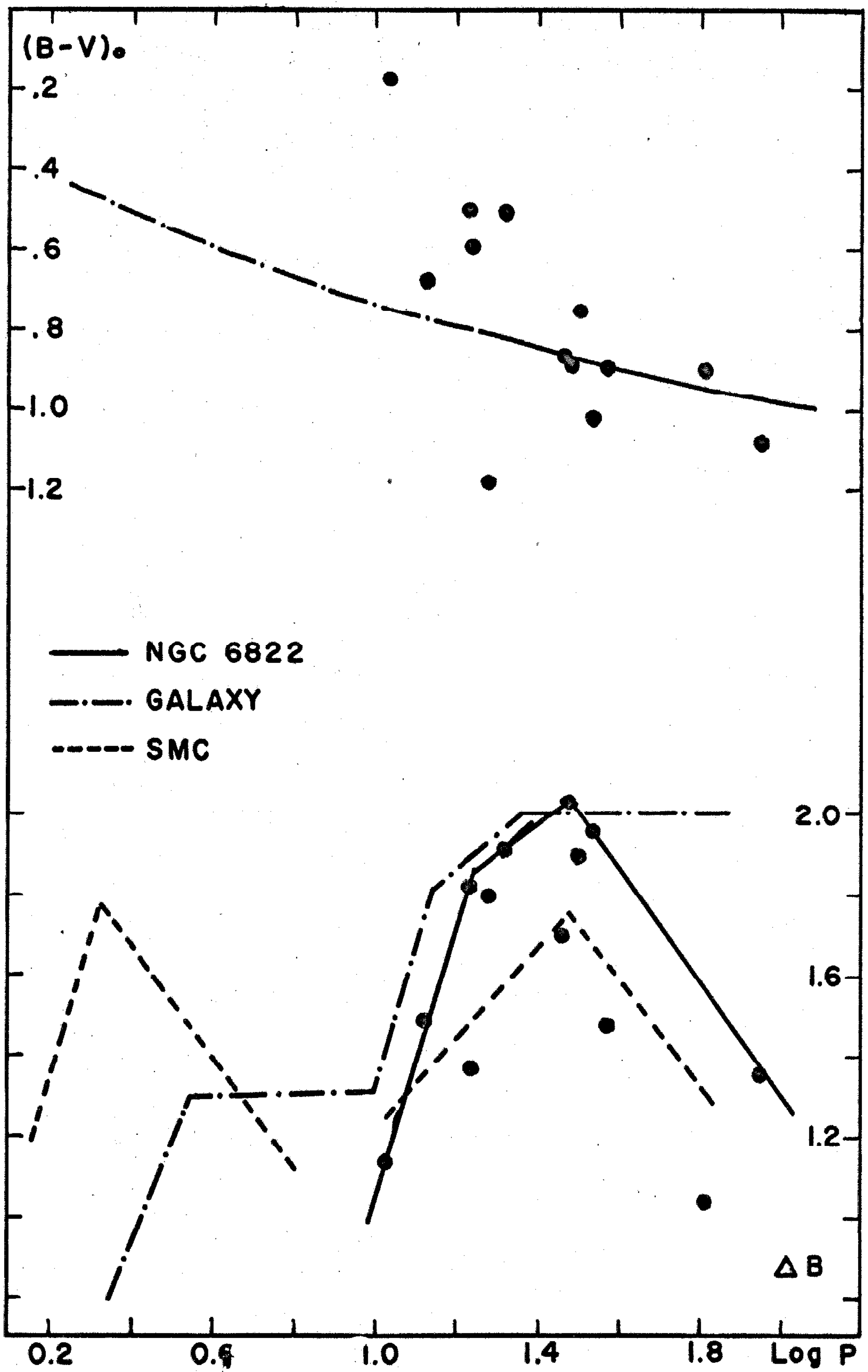
The Cepheids

Lightcurves were drawn in B and in V; they are seen in Figure 6. Despite the "phase changes," secular changes in period are less than 0.001% in 40 yrs. (< 0.036% for V7, < 0.010% for V13). The difference between the mean curves was plotted as the B-V curve and the mean unreddened color, $<(B-V)^{o}>_{mag}$, was found. The B curve was transformed into an intensity curve to calculate the mean $<B>$, following Kraft's (1961) rules. The mean $<V>$ was derived from $<V> = <B> - <(B-V)>_{mag} + C(\Delta B)$, where $C(\Delta B)$ was taken from Kraft. The properties of the Cepheids are presented in Table 11. (Mean magnitudes can be determined to ±0.03, mean colors to ±0.05.)

The period-color and period-amplitude diagrams are plotted in Figure 7. The latter resembles that of our own system more than that of the SMC (Arp, 1960a). For log P> 1.5, the period-color relation is a continuation of that found in our Galaxy and in the SMC.* The shorter period, very blue stars are analogous to the clump of 7 stars above the mean relation at log P = 1.2, shown by Arp (1960a). The stars V30 and V17 (which do not have large amplitude defects) are very blue and red, respectively. V30 falls above the mean period-luminosity line, as expected of a blue star. It appears from Figure 7 and from the shape of the lightcurves that Cepheids in NGC 6822 are like those in our Galaxy.

*Fernie's (1963) correction to Kraft's colors makes the galactic curve redder by 0.04. Dr. Arp (private communication) believes there is 0.06 greater reddening than he previously assumed for the SMC. When this is removed, the two curves as published by Kraft (1963) coincide.

Figure 7. The Period-Color and Period-Amplitude Relations.



The period-luminosity diagram is drawn in Figure 8. The slopes (greater than Arp's (1960a)) found by Gascoign and Kron (1965) for the Clouds were fitted to the points. The period-luminosity relations are:

$$\langle V \rangle = 23.35 - 2.97 \log P$$

$$\langle B \rangle = 23.91 - 2.61 \log P$$

The maximum and minimum slopes that could be fitted to the data were -3.81 and -2.45 in V, -3.31 and -2.09 in B. Arp's SMC slopes are -2.54 (V) and -2.25 (B).

To get the distance modulus, the five galactic cluster Cepheids (Kraft, 1963) were added to the $\langle V \rangle$ - log P line. The best fit was obtained (by eye) with a distance modulus of 24.55 ± 0.07. This corresponds to an unreddened true modulus of

$$(m-M)_o = 23.75 \pm 0.10$$
$$r = 560 \text{ kpc} .$$

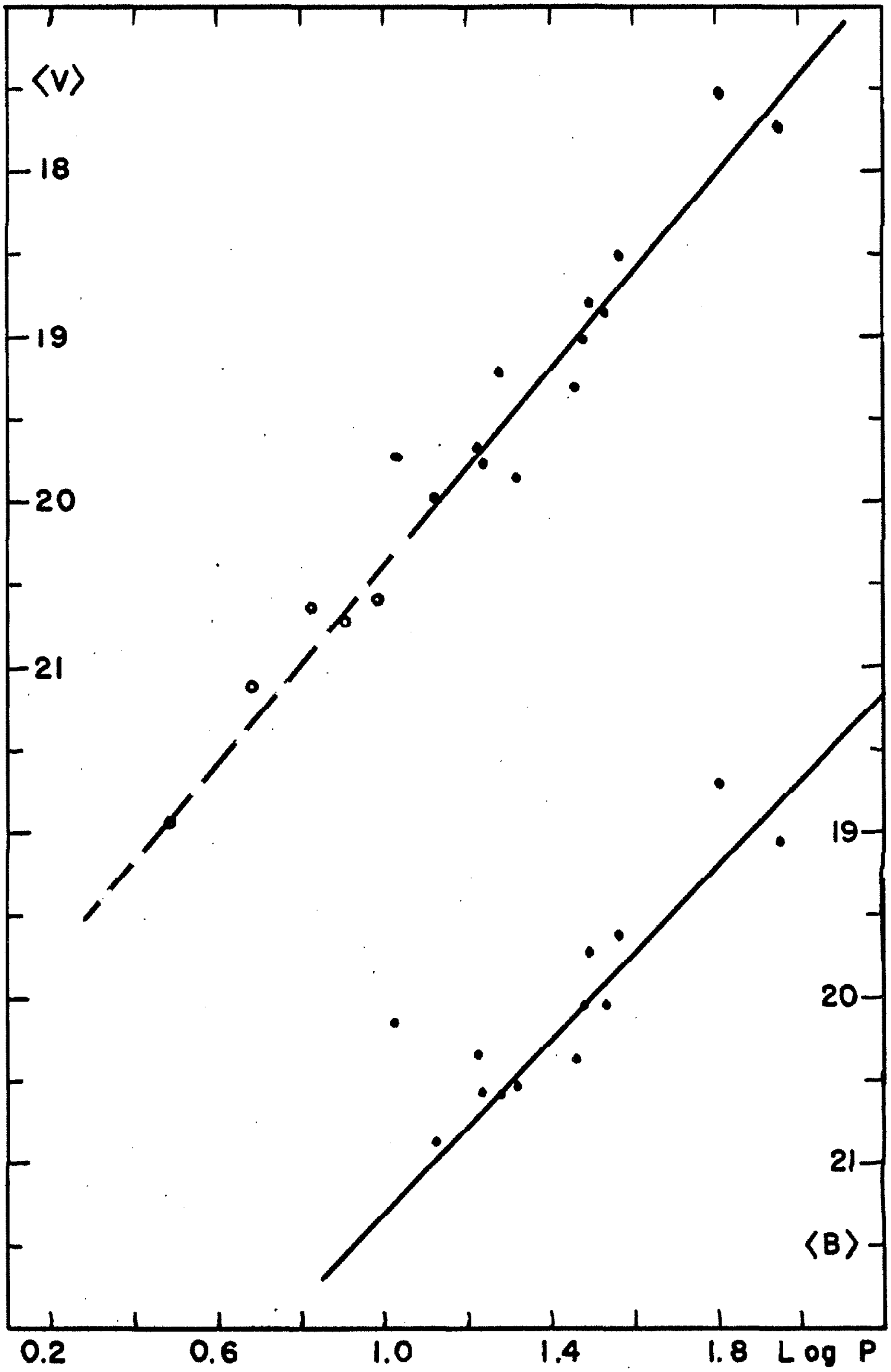
With this zeropoint, the absolute period-luminosity relations are:

$$\langle M_V^o \rangle = -1.20 - 2.97 \log P$$

$$\langle M_B^o \rangle = -0.92 - 2.61 \log P .$$

This is consistent with a distance modulus for the Clouds of 19.0, if there is no reddening.

Figure 8. The Period-Luminosity Relation of the Cepheids. Open circles are Galactic cepheids to which (m-M) = 24.56 has been applied.



THEORY

Because the stars of NGC 6822 were formed over at least 3×10^7 years, we cannot apply theory here as we do to determine the age of clusters. Evolved stars of all initial luminosities are represented, so that we must know not only the initial luminosity function, but also the time-dependent rate of star formation in order to untangle the end condition.

In Figure 9, evolutionary paths have been superposed on a schematic C-M diagram of NGC 6822. The short tracks for the very massive stars (121.1, 62.7, and 28.2 M☉) have been taken from Schwarzschild and Härm (1958), the long track (broken line) of a 15.6 M☉ star was calculated by Hayashi and Cameron (1961),* and the two at 15 and 9 M☉ are by Iben (1965). The age-zero main sequence is indicated. All the calculations were for population I stars (X = 0.7, Y = 0.3, Z = 0.02) except for that at 15.6 which had a composition (X = 0.9, Y = 0.1, Z = 0.02). Hayashi remarks that use of the population I mixture would shift the red limit of the 15.6 zigzag (beginning of helium burning) from B-V = 0.20 to -0.14; with this change, we see the two tracks at 15 and 15.6 are very similar. The 15.6 path includes carbon burning, but the 15 and 9 models are stopped at helium depletion. All the tracks were transformed from (M_{bol} - log T_e) to the (M_v - $(B-V)_o$) plane by the relations from Arp (1958), amended to produce smaller bolometric corrections for cool luminosity class I stars (Arp, private

*Additional stages were reported by Hayashi and others (1962).

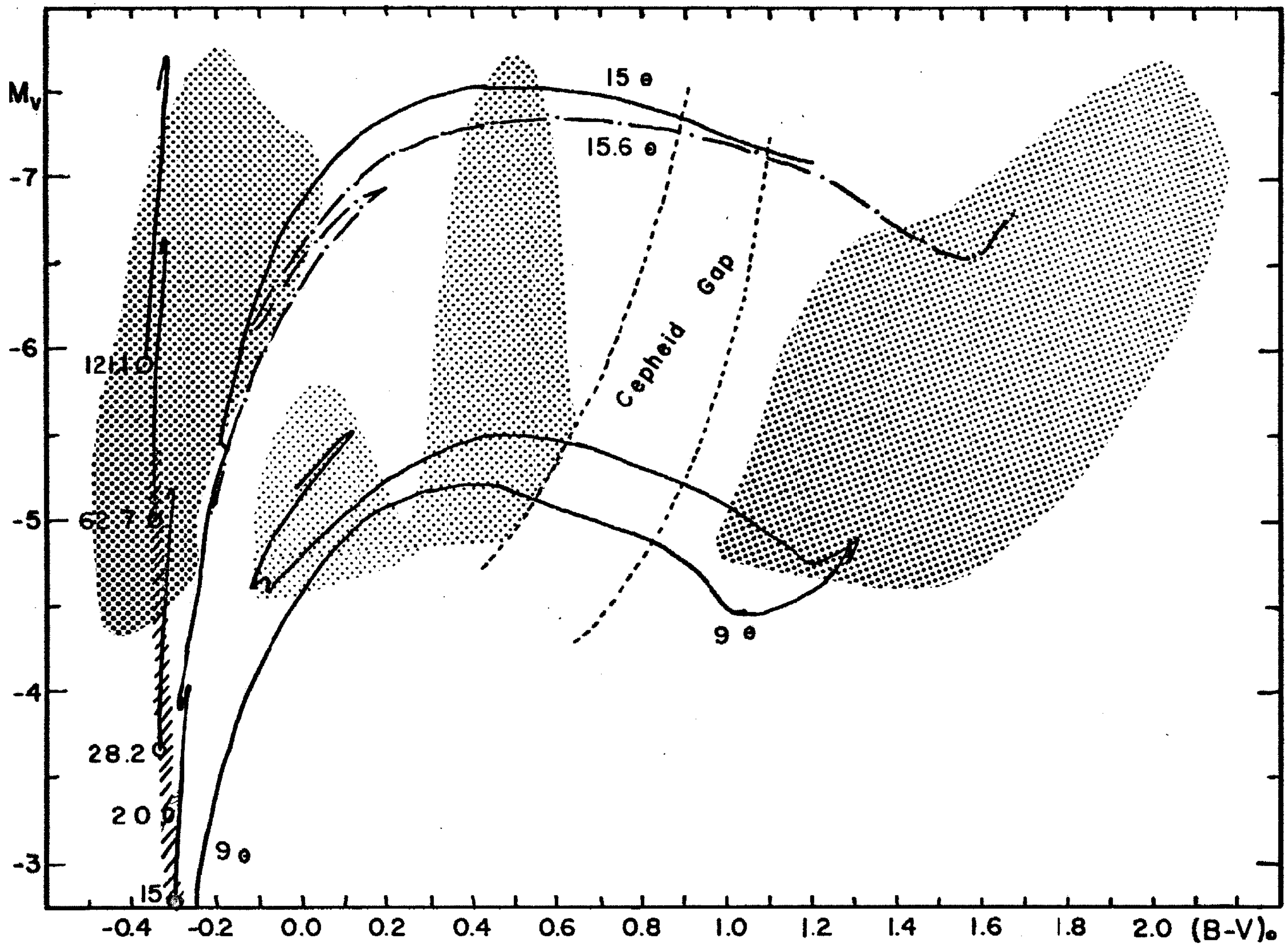


Figure 9. Schematic C-M Diagram of NGC 6822 with Evolutionary Tracks. Hatching Indicates the Main Sequence.

communication).

We may conclude from this picture that stars as massive as 63 M⊙ are present in the galaxy, but probably none so heavy as 121. The tracks at 15 fit just within the boundaries of the blue sequence. This may mean there was a hiatus in star formation from 1.2 to 2.2×10^7 years ago, since otherwise less massive stars older than 1.2×10^7 (the lifetime of the 15 M⊙ star) would have evolved, in which case the red edge of the blue sequence would appear farther to the red than the 15 track, and this is not observed. The 2.2×10^7 year limit is the age of the 9 M⊙ star. Stars at this age will have branched off the main sequence at sufficiently faint levels so that the blue gap will be clear. As further evidence for this limit, if there <u>were</u> stars slightly younger than 2.2×10^7, the more massive would have evolved earlier and masked the cluster of stars we see at (M_V = -5, B-V = 0), just where stars of 9 M⊙ pause for 0.3×10^7 years as a helium-burning shell develops.

No evolutionary path calculated has reached colors as red as observed here. Although this may be a spurious effect due to an incorrect T_e- (B-V) transformation, it is more likely that either the models have not been continued long enough, or else some physical factor has not been included. From the number of stars involved, the red stage must last a considerable fraction of the post-main-sequence lifetime. Neutrino losses may play an important part here. Iben has suggested that such losses might act as a refrigerant, cooling the gravitationally contracting core during the He and H shell-burning phase, which may prolong the time spent on the red giant branch. Inclusion of this effect in models of massive stars may yield, through comparisons with systems like NGC 6822, empirical confirmation of the theory of neutrino interactions.

Since stars pass along the tracks very rapidly in the region $0.2 < (B-V)_o < 1.0$ (the Hertzsprung gap), very few stars are expected to be seen there. This should be considered when interpreting the hump stars. Perhaps models will show that the "hump" is the equivalent of the cluster at $(B-V = 0, M_V = -5)$ for more massive stars.

The use of the brightest stars in a galaxy as distance indicators depends on the uniformity of the luminosity function in all nebulae. As we have seen from the discussion of stellar content (illustrated in Figure 10), the blue sequences are very similar in all systems except insofar as a system, through age, has lost its very brightest stars. On a galactic scale, star formation will be continuous in time, at least to the extent of populating the main sequence up to -8 (in B). The luminosity of the single brightest star, however, is highly dependent on the current rate of star formation, and an average of the three brightest--or the third brightest, alone--should be used. Naturally, the more stars included in the average, the less variation in "the brightest star" will be found. Allowance must be made for the diminution of maximum luminosity with earlier type spirals. Sandage (1958), in his discussion of the distance scale, points out that the brightest stars in the Large Cloud, at -9.8, -9.5, and -10.1, are one magnitude brighter than those in the Small Cloud (-8.8, -8.5)

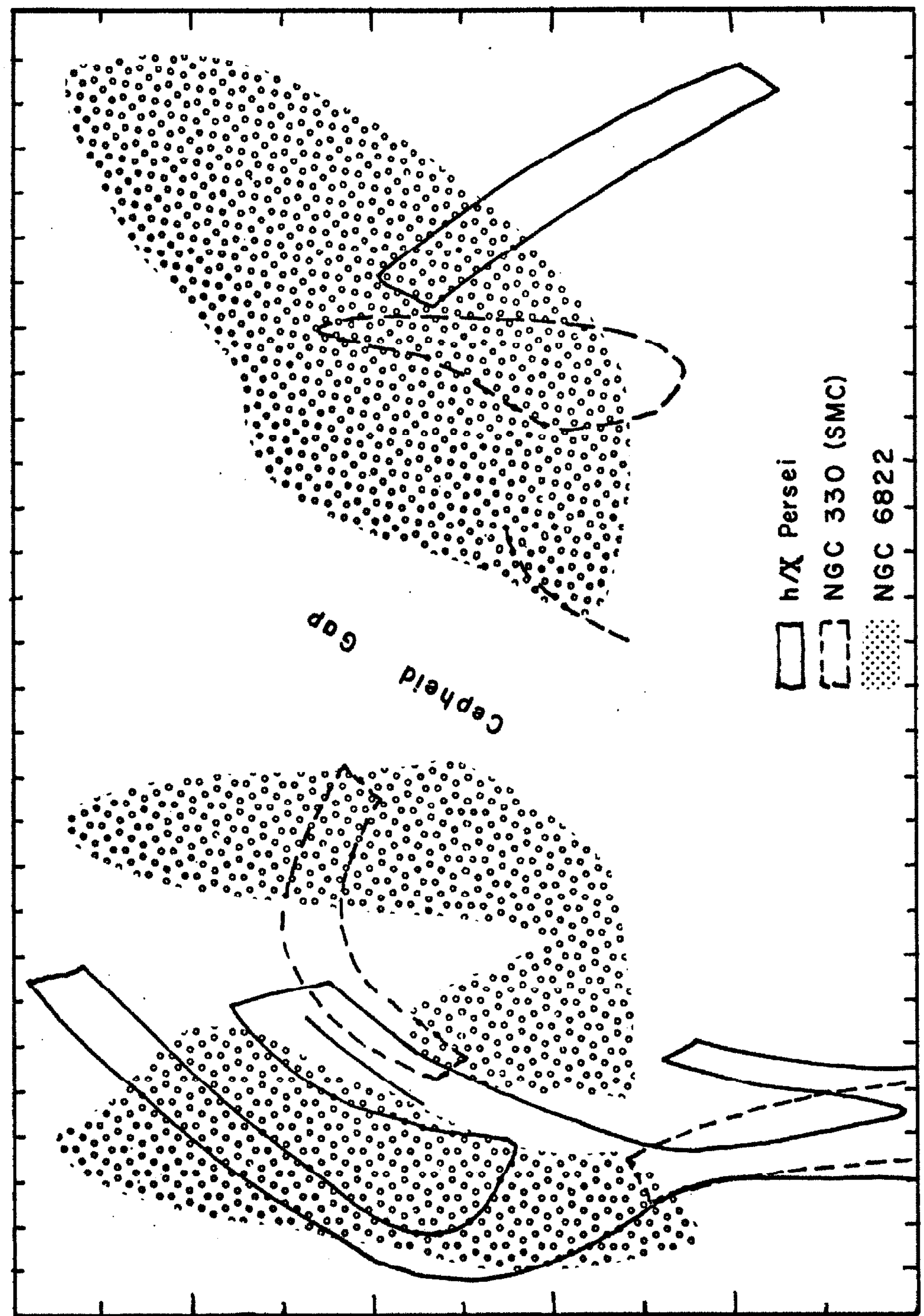


Figure 10. Schematic C-M Diagrams of NGC 6822, h/χ Persei, and NGC 330.

and M31 (-8.3). In our own Galaxy we have No. 12 VI Cygni at -9.6 (Sharpless, 1957). For NGC 6822, the three brightest stars are C74, C84, and D156, with M_B = -8.27, -8.58, and -9.05 respectively.

The red sequences, unlike the blue, are different for each system. This may be because of age differences, which result in clusters having their red giants come from a small mass range (the particular range depending on the cluster age), whereas NGC 6822 has a wide variety of masses, including those of stars which have already burned out in the clusters we know. Possibly the composition may vary slightly between systems. For small differences, the hydrogen-burning stage is relatively unaffected, but the surface temperature of red supergiants is very sensitive to the previous evolution because of mixing by its deeply convective envelope. Since B-V is a steep function of log T_e at low temperatures, large variations in color may well result from this small difference. This nonuniformity of the red supergiants will not create uncertainty in the use of bright stars as distance indicators for far-off galaxies because, on the blue-sensitive plates used to pick out the most luminous stars, the red sequence is two magnitudes fainter than the blue.

CONCLUSION

We have seen that NGC 6822 has a sufficiently close resemblance to other systems previously studied, that we may gain confidence in our knowledge of their properties as a group. Its brightest stars are of comparable luminosity, its Cepheid period-color-luminosity relation shows agreement, the color-magnitude diagram has similar outlines, with those in our own Galaxy, in the Magellanic Clouds, and in M31. We may, therefore, treat its differences as exceptions which prove the rules of general uniformity.

The most noticeable difference is the presence of the many bright red supergiants and the high percentage of variable stars found among them. Intensive observation of the few local red supergiants, and models of far advanced evolutionary stages, can be expected to explain them. The important problem of the space location of the hump stars may be further attacked by radial velocity measures of the analogous stars in the Clouds as well as by measuring a C-M diagram in a field offset from the nebula by 1°. If they are extrinsic to our Galaxy, present evolutionary theory has no interpretation for them.

It is reassuring to see that, to within the uncertainties of the data, the Clouds, NGC 6822, and our Galaxy all agree on Cepheid period-luminosity relation. For M31, the published slope is still that previously found by Arp in the SMC. Although exactly identical relations cannot be expected, we may put reliance on distances

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Table 1. MAGNITUDES OF THE PRIMARY STANDARDS

Star	Photoelectric Values			n	Adopted Photographic Values	
	V_{pe}	$(B-V)_{pe}$	$(U-B)_{pe}$		V_{pg}	$(B-V)_{pg}$
i	12.26	0.74	0.23	12	12.26	0.74
ii	16.13	1.09	0.57	1	16.12	1.06
iii	17.50	1.51	1.02	1	17.32	1.70
iv	19.07	1.06	0.05	1	19.06	1.08
v	18.20	0.98		1	18.27	1.07
vi	20.39	0.71	-0.10	1	20.19	0.77
vii	15.91	1.04	0.71	4	15.99	0.96
viii	18.22	0.85		1	18.36	0.72
ix	19.78	1.13		2	20.11	0.80
x	17.28	0.88	0.18	1	17.31	0.88
xi	16.99	0.87	0.31	1	16.91	0.86
xii	13.15	0.66	0.12	3	13.15	0.66
xiii	15.82	0.92	0.54	1	15.86	0.91
xiv	16.37	1.02	0.50	1	16.35	1.03
xv	21.21	0.60		1	21.15	0.71
xvi	20.50	0.35		1	20.64	1.22
xvii	13.40	0.66	0.14	3	13.40	0.66
xviii	17.30	1.11	0.56	2	17.28	1.08
xix	19.48	0.79		2	19.55	0.99
xx	19.87	1.79		1	19.63	1.86
xxi	20.82	0.74		1	20.57	1.14
xxii	17.27	0.71	0.11	1	17.23	0.75

Table 2. CATALOGUE OF PHOTOGRAPHIC PLATES

Plate #	Julian Day	Exposure	Emulsion + Filter
H-310-H	242,3611.5	210^m	S-30
S-251-H	3616.4	15	S-30
S-252-H	3616.5	60	S-30
H-314-H	3619.47	60	S-30
H-315-H	3619.50	30	S-30
S-255-H	3638.37	60	S-30
S-256-H	3638.51	60	S-30
S-260-H	3639.40	60	S-30
S-261-H	3639.43	15	S-30
S-263-H	3639.48	60	S-30
S-271-H	3640.48	70	S-30
S-277-H	3641.47	75	S-30
H-317-H	3647.35	60	S-30
H-326-H	3678.38	60	S-30
H-329-H	3697.31	60	S-30
H-334-H	3698.33	60	S-30
H-374-H	3969.52	60	S-30
S-332-H	3972.51	105	S-30
S-335-H	3990.46	105	S-30
S-342-H	3994.46	90	S-30
S-347-H	3995.46	100	S-30
H-382-H	3996.40	60	S-30
H-383-H	3996.44	25	S-30
H-387-H	3997.40	60	S-30
H-388-H	3997.44	25	S-30
H-393-H	3998.44	60	S-30
H-401-H	4002.38	66	S-30
H-402-H	4002.42	30	S-30
H-407-H	4003.36	60	S-30
H-408-H	4003.40	30	S-30
H-412-H	4004.37	74	S-30
Δ237	4024.35	90	S-30
Δ242	4025.35	90	S-30
S-352-H	4026.38	75	S-30
H-419-H	4031.34	80	S-30
H-423-H	4032.33	70	S-30
S-365-H	4049.34	86	S-30
S-371-H	4050.34	75	S-30
H-431-H	4054.32	65	S-30
S-378-H	4056.31	75	S-30
S-387-H	4057.32	60	S-30
H-436-H	4058.31	60	S-30
H-442-H	4059.31	70	S-30
H-450-H	4085.31	50	S-30
H-456-H	4090.30	45	S-30
H-561-H	4299.62	80	E-40
S-474-H	4318.62	60	E-40

Table 2 (Continued)

Plate #	Julian Day	Exposure	Emulsion	+ Filter
H-570-H	242,4320.57	60^m	E-40	
H-582-H	4357.38	60	Iso	+ Vis
H-590-H	4378.41	180	Iso	+ Vis
H-595-H	4379.35	46	E-40	
H-596-H	4379.37	12	E-40	
S-502-H	4413.34	100	E-40	
H-663-H	4651.62	70	E-40	
H-667-H	4710.51	80	E-40	
H-685-H	4764.33	60	E-40	
H-758-H	4996.65	50	E-40	
H-775-H	5025.60	60	E-40	
H-779-H	5035.57	60	E-40	
H-797-H	5063.50	80	E-40	
H-801-H	5064.40	30	E-40	
H-805-H	5064.61	30	E-40	
H-807-H	5065.41	40	E-40	
H-811-H	5065.62	40	E-40	
H-857-H	5150.31	40	E-40	
H-919-H	5475.45	60	E-40	
S-855-H	5856.38	60	E-40	
S-986-H	6158.56	60	Iso	+ Vis
Δ430	6187.48	80	E-40	
H-1254-H	6481.62	80	E-40	
H-1293-H	6571.42	80	E-40	
H-1373-H	6888.50	35	E-40	
H-1405-H	6920.48	25	I.E.	
H-1508-H	7241.52	37	E-40	
H-1531-H	7271.51	75	E-40	
B-276-B	7335.36	90	I.E.	
H-1629-H	7691.32	15	E-40	
H-1663-H	7930.63	60	I.E.	
H-1767-H	8393.40	90	E-40	
H-1829-H	8691.57	75	I.E.	
H-1852-H	8749.46	30	I.E.	+ plain glass
H-1865-H	8777.35	90	I.E.	+ GG1
H-1877-H	8779.37	90	I.E.	+ GG1
B-808-B	8780.37	100	I.E.	+ GG1
B-812-B	8781.31	91	I.E.	+ GG1
B-816-B	8782.34	90	I.E.	+ GG1
B-820-B	8783.34	90	I.E.	+ GG1
B-824-B	8784.34	90	I.E.	+ GG1
B-828-B	8785.34	90	I.E.	+ GG1
B-833-B	8786.34	90	I.E.	+ GG1
H-1999-H	9044.62	60	Agfa Blue	
Δ687	9112.48	91	Agfa Blue	
H-2007-H	9136.41	30	Agfa Blue	+ GG1
H-2083-H	9438.60	90	E103	

Table 2 (Continued)

Plate #	Julian Day	Exposure	Emulsion + Filter	
H-2134-H	242,9786.59	105^m	E-103-0	
H-2141-H	9869.35	60	E-103-0	
H-2172-H	243,0175.51	90	Cr Hi Sp	
H-2214-H	0497.63	45	103-0	
B-1620-B	1645.51	120	103a-0	+ UG2
B-1644-B (a)	1702.38	30	103a-0	+ GG1
H-2281-H	1970.60	30	103a-0	
H-2288-H	1971.59	40	103a-0	
H-2298-H	2004.50	40	IIa-0	
H-2435-H	2313.62	30	103a-0	
H-2453-H	2389.44	25	103a-0	
H-2572-H	3062.61	26	103a-0	
PH-112-B	3475.48	30	103a-0	
PH-237-B	3536.39	30	103a-0	+ GG1
PH-391-B (a)	3800.61	30	IIa-0	+ GG1
PH-398-B	3830.55	30	103a-0	+ GG1
PH-417-B (b)	3832.52	50	103a-D	+ GG11
PH-424-B	3833.53	50	103a-D	+ GG11
PH-430-B	3834.52	60	103a-D	+ GG11
PH-433-B	3835.52	60	103a-D	+ GG11
PH-437-B	3836.51	60	103a-D	+ GG11
PH-443-B	3863.44	60	103a-D	+ GG11
PH-448-B	3864.43	60	103a-D	+ GG11
PH-454-B	3865.43	60	103a-D	+ GG11
PH-460-B	3866.46	60	103a-D	+ GG11
H-141-S	4247.35	30	103a-0	+ WG2
H-142-S	4247.39	45	103a-D	+ GG14
H-153-S	4248.38	20	103a-0	+ WG2
H-154-S (a)	4248.41	45	103a-D	+ GG11
H-164-S	4249.44	20	103a-0	+ WG2
H-171-S	4250.35	20	103a-0	+ WG2
H-172-S	4250.39	60	103a-D	+ GG14
S-761-A	4604.43	20	103a-0	+ GG1
PH-160-H	4622.38	30	103a-0	+ WG2
H-307-S	4628.39	20	103a-D	+ GG11
H-69-O (b)	4867.63	40	103a-0	+ GG13
H-74-O (a)	4868.63	60	103a-D	+ GG11
H-81-O	4869.62	72	103a-D	+ GG11
H-88-O	4895.60	60	103a-D	+ GG11
PH-8-O (b)	4954.43	30	103a-0	+ GG13
PH-23-O (a)	4955.42	30	103a-0	+ GG13
PH-107-O (b)	5312.45	55	103a-D	+ GG11
PH-3021-A (b)	6402.53	40	103a-D	+ GG11
PH-3022-A (b)	6402.55	20	103a-0	+ GG13
PH-3292-A (a)	6723.62	20	103a-D	+ GG11
H-3552-PH	7460.56	20	103a-0	+ GG13

Table 2 (Concluded)

Plate #	Julian Day	Exposure	Emulsion	+ Filter
H-3553-PH	243,7460.60	70^m	103a-D	+ GG11
H-3557-PH	7461.58	45	103a-0	+ GG13
H-3558-PH	7461.61	50	103a-D	+ GG11
ED-1779-PH	8120.65	40	103a-0	+ GG13
ED-1786-PH	8200.53	45	103a-0	+ GG13

NOTES:

(a) used for the bright stars of the C-M diagram.

(b) used for the faint sample of the C-M diagram.

Observations before Julian Day 242,7863 were made with a silvered mirror.

Preceding initial S- indicates 60", H- (or B-) means 100", PH- means 200", ED- means 120".

Observers are Hubble (-H), Baade (-B), Duncan (-Δ), Sandage (-S), Arp (-A), Osterbrock (-O) and Hodge (-PH).

Table 3. STARS IN THE COLOR-MAGNITUDE DIAGRAM

Star	V	B-V	Star	V	B-V
A- 1	17.71	0.25	A-51	19.32	0.76
A- 2	19.57	0.53	A-52 a	19.85	0.77
A- 3	19.60	1.73	A-53	19.42	1.13
A- 4	19.23	1.84	A-54	19.70	0.76
A- 5	17.10	0.75	A-55 a	19.32	1.43
A- 6 d	18.70:	2.15:	A-56	18.70	0.84
A- 7 a	18.51	0.93	A-57	18.62	1.28
A- 8	19.67	0.49	A-58	18.16	0.89
A- 9	18.99	0.91	A-59	18.75	-0.05
A-10	18.60	0.72	A-60	16.20	1.08
A-11	19.33	0.65	A-61	15.18	1.07
A-12	18.09	-0.01	A-62	19.36	0.82
A-13	17.47	0.12	A-63	19.21	1.63
A-14	18.29	0.29	A-64	16.35	0.82
A-15 a	19.72	1.44	A-65	19.64	1.87
A-16	17.80	0.67	A-66	17.64	-0.04
A-17	19.04	-0.03	A-67	18.95	1.10
A-18 a	19.28	+0.00	A-68 a,c	15.00	0.73
A-19 a	19.01	0.79	A-69	18.68	0.78
A-20	19.75	-0.12	A-70	17.90	1.22
A-21	18.01	1.33	A-71	18.47	1.75
A-22	17.20	0.81	A-72	18.17	0.87
A-23	18.05	1.58	A-73	17.69	0.07
A-24	16.37	0.89	A-74	19.19	0.05
A-25	19.23	-0.00	A-75	18.03	1.01
A-26	19.47	1.67	A-76	18.24	2.28
A-27	18.78	1.13	A-77	18.88	0.79
A-28	17.62	0.87	A-78	19.42	0.61
A-29 a	19.46	0.80	A-79	19.74	0.53
A-30	19.24	0.63	A-80	18.72	0.69
A-31	19.02	0.83	A-81	18.98	1.10
A-32 a	17.93	0.97	A-82	18.79	0.62
A-33	19.56	1.22	A-83	18.75	-0.08
			A-84	19.81	1.05

Table 3 (Continued)

Star	V	B-V
A-101	17.21	0.06
A-102	18.91	-0.08
A-103	17.76	1.06
A-104	16.95	0.89
A-105	19.72	1.54
A-106	19.42	1.63
A-107	19.81	1.58
A-108	19.30	0.73
A-109 a	19.50	1.49
A-110	19.11	1.32
A-111	19.59	0.19
A-112	19.64	-0.07
A-113	16.15	1.09
A-114	19.43	1.48
A-115	17.64	0.61
A-116	19.07	0.07
A-117	18.09	1.53
A-118	19.07	1.10
A-119 a	17.44	0.87
A-120	19.57	1.01
A-121	18.95	2.06
A-122	17.68	1.10
A-123	18.22	-0.17
A-124	18.66	0.72
A-125	18.61	0.67
A-126	19.04	0.91
A-127	19.21	1.05
A-128	19.21	-0.22
A-129	19.11	1.76
A-130	18.42	0.78
A-131 d	19.42:	0.32:
A-132 a	19.64	0.02
A-133	15.81	0.76
A-134	19.36	1.81
A-135	19.01	1.99
A-136	18.29	0.76
A-137 a	20.08	1.59
A-151	18.93	1.82
A-152	17.75	0.70
A-153	17.20	0.20
A-154	18.50	2.23
A-155	19.29	1.44
A-156	18.73	0.39
A-157	17.81	0.71
A-158	19.25	0.57
A-159 d	18.29:	1.58:
A-160	19.34	1.21
A-161	18.90	-0.07
A-162	18.87	1.78
A-163	18.82	0.07
A-164	19.03	0.35
A-165	17.82	-0.09
A-166	18.16	0.73
A-167	19.68	0.69
A-168	19.16	1.90
A-169	19.01	1.85
A-170	19.07	1.69
A-171	17.94	0.83
A-172	18.06	0.20
A-173	19.73	1.58
A-174	19.73	1.72
A-175	19.17	1.50
A-176	19.41	1.61
A-177	19.28	-0.10
A-178	17.28	1.09
A-179	19.81	0.25
A-180	17.09	0.95

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
B- 1	16.56	0.21	B-51	19.90	1.05
B- 2	18.67	0.60	B-52	19.00	0.97
B- 3	18.98	2.10	B-53	19.80	1.05
B- 4	14.80	1.42	B-54	16.52	1.00
B- 5	17.39	0.98	B-55	15.89	0.82
B- 6	19.61	1.36	B-56	18.09	1.10
B- 7	19.27	0.77	B-57	19.58	2.34
B- 8	18.71	2.31	B-58	19.62	1.54
B- 9 a	19.23	1.84	B-59	19.43	1.58
B-10	18.77:	0.33:	B-60	18.87	1.04
B-11 a	18.43	2.09	B-61	19.44	0.23
B-12	18.63	0.15	B-62	18.52	1.78
B-13	19.22	-0.06	B-63	19.31	2.11
B-14	19.67	1.69	B-64	19.43	0.21
B-15	18.11	0.86	B-65	18.81	1.76
B-16	16.26	1.18	B-66	19.04	0.82
B-17	17.66	0.07	B-67	17.79	1.07
B-18	19.87	-0.01	B-68	19.38	1.32
B-19	18.78	0.04	B-69	18.34	0.87
B-20	19.10	2.18	B-70	19.68	1.12
B-21	18.91	0.92	B-71	18.68	1.03
B-22	19.92	1.22	B-72	19.42	1.92
B-23	16.85	0.81	B-73	19.42	0.11
B-24	19.03	0.86	B-74	19.44	0.17
B-25	19.81	0.40	B-75	19.74	2.02
B-26	19.57	0.33	B-76	18.44	0.04
B-27	18.92	2.19	B-77	19.70	0.21
			B-78	19.19	0.20
			B-79	19.52	-0.03
			B-80	17.64	0.75
			B-81	19.41	0.82
			B-82	19.76	1.20
			B-83 a	19.45	1.86

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
B-101 a	14.01	1.76	B-151	19.09	0.46
B-102	16.63	0.97	B-152	18.80	0.12
B-103	16.50	0.81	B-153	19.26	1.53
B-104	16.60	0.57	B-154	16.00	0.72
B-105 a	18.95	1.38	B-155	18.25	-0.12
B-106	17.24	1.04	B-156	19.52	1.04
B-107	16.09	1.27	B-157	19.62	1.10
B-108	17.95	2.41	B-158	18.10	0.70
B-109	18.20:	1.94:	B-159	19.18	-0.18
B-110	16.65	2.22	B-160	17.34	0.75
B-111	17.50	1.05	B-161	17.85	0.78
B-112	18.49	0.34	B-162	16.97	0.80
B-113	19.23	1.79	B-163	19.44	0.92
B-114	18.24	1.42	B-164	18.25	0.54
B-115	17.21	0.74	B-165	17.70	0.78
B-116	18.65	1.15	B-166	19.20	-0.11
B-117	18.44	1.63	B-167	17.74	0.61
B-118	18.37	0.82	B-168	19.74	0.31
B-119	18.93	-0.14	B-169	19.91	0.68
B-120	18.95	0.89	B-170	19.96	1.76
B-121	18.17	0.67	B-171	17.81	1.10
B-122	18.92	1.25	B-172	19.21	1.35
B-123	18.15	0.07	B-173 a	19.20	1.36
B-124	19.58	1.70	B-174 a,c	19.00	0.18
B-125	19.38	0.84	B-175	19.23	1.61
B-126	18.65	0.83	B-176	16.74	0.94
B-127	19.76	1.04	B-177	19.44	2.05
B-128	19.67	0.92	B-178	18.98	1.67
			B-179	19.45:	0.50:
			B-180	19.23	-0.06
			B-181	19.06	0.57
			B-182	17.17	1.74
			B-183	19.47	-0.06
			B-184 a	19.44	1.18
			B-185 a	20.11	0.48

Table 3 (Continued)

Star	V	B-V
C- 1	15.59	1.15
C- 2	18.73	1.97
C- 3	17.61	1.14
C- 4	17.34	0.75
C- 5 a	18.74	0.77
C- 6	16.35	0.85
C- 7	17.82	2.27
C- 8	13.66	1.57
C- 9	16.54	1.33
C-10	18.18	-0.06
C-11	18.47	0.10
C-12	18.91	-0.30
C-13	19.04	1.88
C-14	19.07	0.89
C-15	19.03	1.04
C-16	19.31	0.23
C-17	19.24	0.80
C-18	19.34	-0.17
C-19	18.66	1.95
C-20	17.34	0.80
C-21	19.16	0.44
C-22	18.32	0.03
C-23	19.12	1.51
C-24	18.47	2.19
C-25	19.18	0.26
C-26 a	17.56	2.30
C-27	18.21	-0.10
C-28	18.73	0.80
C-29	18.46	0.63
C-30	19.26	-0.03
C-31	19.14	0.75
C-32	18.80	1.29
C-33	18.34	1.99
C-34	19.32	-0.17
C-35	16.53	0.97
C-36	19.23	0.85
C-37	18.39	2.24
C-38 c	13.67	1.11
C-39	18.45	1.08
C-40	18.04	1.86
C-41 a,c	13.56	0.78
C-42	19.52	1.70
C-43	15.75	1.03
C-44	18.22	1.65
C-45	18.67	1.17
C-46	16.65	0.96
C-47 c	16.07	1.30
C-48 c	16.95	0.98
C-49	16.38	1.38
C-51	16.42	1.15
C-52	17.81	0.94
C-53	18.47	1.02
C-54	18.83	1.29
C-55	18.93	0.95
C-56 a	18.96	1.38
C-57	19.65	1.85
C-58 a	19.48	1.98
C-59	19.15	1.59
C-60	18.95	0.03
C-61	18.90	2.10
C-62	18.87	1.34
C-63	18.56	0.31
C-64	18.90	0.87
C-65	12.90:	0.75:
C-66	18.00	0.08
C-67	18.81	-0.26
C-68	17.84	2.45
C-69	18.79	0.60
C-70	16.05	0.77
C-71	19.23	2.34
C-72	17.51	0.28
C-73	19.62	1.98
C-74	16.60	-0.05
C-75	19.61	1.18
C-76	19.66	1.09
C-77	19.32	1.11
C-78	17.50	0.62
C-79 a,c	17.13	2.29
C-80	18.67	1.02
C-81	19.33	0.94
C-82	19.17	0.60
C-83	19.45	1.07
C-84	16.03	0.22
C-85	16.43	0.85
C-86	15.89	0.87
C-87	19.05	0.05
C-88	19.42	1.76
C-89	19.45	1.35

Table 3 (Continued)

Star	V	B-V
C-101	16.55	0.37
C-102	18.20	1.37
C-103	19.36	-0.25
C-104	18.20	0.94
C-105	18.29	-0.06
C-106	18.55	-0.06
C-107	18.19:	2.13:
C-108	18.86	0.94
C-109	18.31	1.72
C-110	19.37	1.60
C-111	19.13	0.34
C-112 a	18.27	0.75
C-113	19.37	0.37
C-114	18.81:	-0.03:
C-115	18.13	0.77
C-116	19.42	1.40
C-117	17.82	0.72
C-118	17.89	1.67
C-119	19.25	1.43
C-120	19.05	-0.16
C-121	18.39	-0.10
C-122	19.53	-0.22
C-123	18.94	1.40
C-124	18.53	0.70
C-125	17.08	0.71
C-126 c	15.66	0.80
C-127	18.46	0.75
C-128	17.00	1.20
C-129	19.42	0.22
C-130	18.25	0.79
C-131	17.39	0.78
C-132	19.09	1.02
C-133 a	18.93	1.70
C-134	18.49	1.47
C-135	17.77	1.06
C-136	19.21	1.83
C-137	15.80	0.95
C-138	17.86	0.77
C-139	18.93	1.18
C-140	19.36	0.97
C-141	18.48	0.76
C-142	18.34	0.78
C-143	19.31	1.30
C-151	19.18	1.11
C-152	17.78	0.74
C-153	16.91	0.73
C-154	18.01	0.68
C-155	19.54	1.08
C-156	18.29	0.94
C-157	19.06	0.95
C-158	19.21	0.86
C-159	16.45	0.96
C-160	19.03	0.97
C-161	19.28	1.72
C-162	17.26	0.79
C-163	18.86	0.85
C-164	18.78	0.44
C-165	18.99	-0.35
C-166 a	19.54	1.37
C-167 a	19.24	2.08
C-168	16.91	0.86
C-169	19.74	-0.16
C-170	17.15	0.47
C-171	13.61	0.52
C-172	19.26	1.77
C-173	19.45	1.54
C-174	19.39	0.42
C-175	17.71	0.84
C-176	19.97	0.01
C-177	19.81	0.67
C-178 c	15.47	0.57
C-179	19.38	0.26
C-180	19.80:	-0.09:
C-181	20.00	-0.21
C-182	19.34	-0.30
C-183	19.94	1.30
C-184	18.68	-0.08
C-185	16.67	1.04
C-186	18.64	0.09
C-187	19.78	-0.05
C-188	16.30	1.01
C-189	19.32	1.96
C-190	18.94	0.84
C-191	18.62	-0.12
C-192 a	17.60	0.72
C-193	19.83	1.75
C-194	18.26	0.67
C-195	19.38	1.01
C-196 a,c	15.55	0.50
C-197	15.28	0.98

Table 3 (Continued)

Star	V	B-V
C-201	19.10	-0.06
C-202	18.66	1.64
C-203	19.08	1.85
C-204 a	19.18	0.99
C-205	19.45	0.60
C-206	19.15	0.82
C-207	18.73	0.94
C-208	19.46	1.90
C-209	19.33	1.71
C-210	19.10	1.90

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
D- 1	12.51	1.38	D-51	17.06	0.84
D- 2	18.70	1.98	D-52	17.17	0.79
D- 3	17.77	1.11	D-53	16.10	1.13
D- 4	19.11	0.66	D-54	19.62	1.07
D- 5	16.81	1.17	D-55 c	15.37	0.96
D- 6	16.14:	0.90:	D-56	18.53	1.98
D- 7	16.50:	0.81:	D-57	19.24	1.04
D- 8	17.79	-0.13	D-58	15.66	0.71
D- 9	18.02:	-0.29:	D-59	18.86	0.04
D-10 a	18.71	1.04	D-60	18.04	2.39
D-11	19.36:	1.74:	D-61	19.13	1.94
D-12 a	18.82	1.71	D-62	18.88	-0.03
D-13	19.12	0.96	D-63	18.81	2.39
D-14	17.07	0.13	D-64	18.83	1.33
D-15	18.27	0.87	D-65	19.12	0.23
D-16	18.91	1.25	D-66	19.00	2.19
D-17	18.35	1.85	D-67	18.88	1.73
D-18	17.28	1.15	D-68	18.95	1.51
D-19	17.45	0.95	D-69	18.10	0.27
D-20	18.69	0.89	D-70	15.89	1.20
D-21	19.04	1.14	D-71	17.60	1.36
D-22	18.71	1.38	D-72	17.32	1.04
D-23	17.70	1.09	D-73	18.17	1.00
D-24	17.24	1.30	D-74	19.13	0.80
D-25	17.07	0.41	D-75	18.79	0.29
D-26	15.97	1.06	D-76	19.05	0.02
D-27	18.33	1.04	D-77	19.01	0.14
D-28	18.06	2.75	D-78	18.98	1.32
D-29	18.35:	0.43:	D-79	17.80	0.83
D-30	18.97	1.16	D-80	19.19	1.85
D-31	18.71	1.24	D-81	19.35	1.85
D-32	17.64	1.28	D-82	18.65	2.06
D-33 c	15.79	1.03	D-83	18.35	0.64
D-34	19.21	2.04	D-84	18.80	0.99
D-35	17.95	0.64	D-85	18.54	2.09
D-36	17.75	1.26	D-86	19.10	1.87
D-37	17.87	0.45	D-87	18.30	0.67
D-38	17.90	1.08	D-88	18.18	2.23
D-39	18.31:	0.15:	D-89	17.76	1.27
			D-90	18.06	1.12

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
D-101	19.14	0.77	D-151	14.74	1.23
D-102	16.92	1.19	D-152	17.56	1.02
D-103	18.78	0.44	D-153	18.28	0.96
D-104	18.03	1.28	D-154 c	13.95	0.78
D-105	15.78	0.96	D-155	17.52	0.03
D-106	16.98	0.81	D-156 c	15.57	0.20
D-107	19.40	1.91	D-157	19.03	1.44
D-108	19.12	-0.35	D-158	19.61	0.80
D-109	19.48	-0.11	D-159	17.65	1.04
D-110	17.27	0.96	D-160	18.20	0.50
D-111	18.89	1.23	D-161	19.02	0.79
D-112	19.26	0.69	D-162	19.42	0.96
D-113	18.74	0.58	D-163	19.03	0.71
D-114	17.02	0.70	D-164	18.10	0.95
D-115	17.47	0.77	D-165	19.34	0.94
D-116	18.55	1.12	D-166	19.09	0.61
D-117	17.12	0.92	D-167	18.72	1.46
D-118	17.97	1.40	D-168	18.96	0.32
D-119	19.39	1.55	D-169	18.85	0.97
D-120	15.00	1.22	D-170	17.86	0.80
D-121	17.93	1.22	D-171	17.25	0.71
D-122 c	17.09	0.87	D-172	16.07	1.14
D-123 c	17.67	0.97	D-173	18.74	0.33
D-124 c	16.30	1.10	D-174	17.77	1.70
D-125	18.97	1.75	D-175	18.95	0.02
D-126	18.34	1.49	D-176	19.41	1.90
			D-177 a	19.59	0.63
			D-178	19.19	1.55
			D-179	18.76	0.11
			D-180 a	19.24	0.93
			D-181	17.03	1.15
			D-182	19.10	0.25
			D-183	19.52	1.01

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
E- 1	18.89	1.86	E-51	15.50	1.45
E- 2	16.89	1.17	E-52	15.99	1.10
E- 3	18.77	0.90	E-53	18.72	1.11
E- 4	18.61	0.92	E-54	18.29	1.21
E- 5	19.13:	1.46:	E-55	17.75	0.93
E- 6	16.59	1.25	E-56	18.83	1.41
E- 7	16.87	1.09	E-57	18.64	1.92
E- 8	17.44	1.00	E-58	16.94	1.87
E- 9	17.63	1.07	E-59	17.39	1.01
E-10	17.19	1.19	E-60	17.04	0.98
E-11	17.34	1.02	E-61	19.01	1.91
E-12	17.89	0.96	E-62	18.42	1.00
E-13	17.98	0.97	E-63	18.09	1.46
E-14	18.12	0.99	E-64	16.75	0.91
E-15	17.55	1.01	E-65	17.92	1.11
E-16	18.38:	1.70:	E-66	17.86	0.94
E-17	17.58	1.26	E-67	18.99	1.16
E-18	18.99:	1.79:	E-68	16.95:	1.31:
E-19 c	13.32:	1.67:	E-69	15.71	0.86
E-20	19.08	0.97	E-70	19.30	0.86
E-21	18.01	0.94	E-71	16.96	1.03
E-22 c	15.49	0.84	E-72	16.52	1.17
E-23	18.25:	0.91:	E-73	15.63	0.87
E-24	17.82	1.15	E-74	18.06	1.11
E-25	18.82:	1.49:	E-75	15.77	0.66
E-26	16.33	1.05	E-76	18.25	1.61
E-27	17.25	1.06	E-77	18.15	0.83
E-28	18.42:	1.34:	E-78	18.34	0.14
E-29	16.99	1.18	E-79	19.14	1.13
E-30	17.76	1.81	E-80	17.87	1.15
E-31 c	14.46	0.93	E-81	17.69	0.84
E-32	17.80	1.26	E-82	16.11	0.82
E-33	17.30	0.86	E-83	17.83	1.43
E-34	18.03	1.06	E-84	17.75	0.84
E-35	17.13	1.09	E-85	19.21	1.11
E-36	18.04	1.25	E-86	19.28	1.75
E-37	16.14	1.12	E-87	18.94	0.93
E-38	17.42	2.06	E-88	19.17	1.22
E-39	17.37	0.94	E-89	18.96	1.31
E-40	18.64:	1.04:	E-90	19.26	1.81
E-41	18.94:	1.39:	E-91	19.32	1.33
E-42	18.80:	1.22:	E-92	18.84	1.10
E-43	19.02	1.96	E-93	19.30	1.97

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
E-101 c	17.27	1.22	E-151	18.00	0.65
E-102 c	17.11	0.88	E-152	19.06	1.64
E-103 c	15.81	0.98	E-153	17.95	0.63
E-104	18.41	2.30	E-154	18.54	1.23
E-105	18.10	1.02	E-155	18.77	-0.08
E-106 c	16.14	1.24	E-156	18.02	1.06
E-107 c	16.04	0.79	E-157	18.08	1.11
E-108	19.30:	1.34:	E-158	18.85	0.70
E-109	18.13	1.13	E-159	15.79	0.98
E-110	19.06:	0.89:	E-160	19.04	1.83
E-111	18.64	0.66	E-161 c	15.97	0.56
E-112	16.93	0.96	E-162	18.43	1.33
E-113	17.73	1.34	E-163	19.31	0.61
E-114	17.60	1.07	E-164	19.11	1.57
E-115	18.99	1.74	E-165	19.11	0.96
E-116	17.90	1.20	E-166	19.02	0.15
E-117	18.68	0.90	E-167	17.51	0.65
E-118 c	13.88	0.74	E-168	18.42	1.06
E-119	17.85	1.59	E-169	15.52	1.02
E-120	17.22	0.98	E-170	18.02	0.79
E-121	19.19	1.36	E-171	18.68	0.57
E-122 c	16.20	1.22	E-172	16.85	0.71
E-123 c	15.39	0.69	E-173	18.59	1.25
E-124	18.99	1.54	E-174 a	17.84	0.83
E-125	16.85	1.04	E-175	15.49	1.03
E-126	18.60	1.59	E-176	17.65	0.79
E-127	18.80	0.84	E-177	19.23	1.35
E-128	18.51	1.02	E-178	18.72:	-0.13:
E-129	16.95	0.83	E-179	19.13	0.60
E-130	15.59	0.80	E-180	14.86	0.99
E-131	12.25	0.95	E-181	18.69	2.19
E-132	13.45	1.08	E-182	18.67	-0.25
E-133	18.84	1.17	E-183	18.80	0.00
E-134	18.79	-0.14	E-184	18.83	1.89
E-135	17.66	0.92	E-185	17.13	1.01
E-136	17.91	-0.19	E-186	18.76	-0.08
E-137	18.43	1.63	E-187	17.82	0.86
E-138	18.33	0.84	E-188	18.58	1.05
E-139	18.20	0.87	E-189	18.91	0.97
E-140	16.79	1.92	E-190	19.00	1.81
E-141	16.69	1.19	E-191	16.93	-0.15
E-142 c	15.98	1.30	E-192	18.15	0.03
			E-193	15.58	1.20
			E-194	18.33	1.32
			E-195	16.20	1.13
			E-196	18.37	2.26
			E-197	18.29	0.96
			E-198 a	17.62	1.81
			E-199	15.24	0.84

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
E-251	19.26	-0.09	F- 1	19.15	-0.06
E-252	19.17	0.77	F- 2	19.63	-0.14
E-253	19.75	1.67	F- 3	19.39	-0.11
E-254	19.63	0.78	F- 4	20.02	0.04
E-255	19.49	0.37	F- 5	18.73	0.78
E-256 a	19.33	1.80	F- 6	19.71	-0.32
E-257 b	19.43	1.29	F- 7	17.62	-0.12
E-258 b	19.56	1.87:	F- 8	18.12	-0.19
E-259 b	19.12	1.28	F- 9	17.00	-0.24
E-260 b	19.60	1.64	F-10	18.72	0.85
E-261	19.37	0.25	F-11	18.62	-0.14
E-262 b	19.69	0.72	F-12	19.56	1.25
E-263 a	19.65	0.58			
E-264	19.39	1.45			
E-265 b	19.49	0.36			
E-266	19.43	-0.24			
E-267 b	19.51	1.94			
E-268	19.35	-0.01			
E-269	19.43	0.69			
E-270	19.31	1.08			
E-271	19.17	-0.14			
E-272 b	19.35	1.99			
E-273	19.14	-0.00			
E-274 b	19.47	0.25			
E-275 b	19.49	0.41			
E-276 b	19.39	0.43			
E-277 b	19.81	0.43			
E-278	19.37	-0.16			
E-279 b	19.39	0.37			
E-280 b	19.84	1.02			
E-281 b	19.69	1.50			
E-282 a,d	19.16	1.37:			
E-283	19.52	-0.13			
E-284 a	19.77	1.83			
E-285 b	19.70	1.89			
E-286 b	19.62	1.74			

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
G- 1 a	16.72	0.00	G-34	21.20	1.44:
G- 2 a	17.81	1.06	G-35	20.42	2.12
G- 3 a	18.55	0.72	G-36	20.32	0.73
G- 4 a	19.48	1.22	G-37	20.38	0.51
G- 5 a	18.35	1.08	G-38	19.48	1.13
G- 6 a	20.15	-0.31	G-39	20.48	0.30
G- 7 a	19.27	0.51	G-40	19.78	0.69
G- 8 a	19.77	0.49	G-41	20.83	0.40
G- 9	20.57	1.28	G-42	20.44	0.70
G-10	20.29	1.12	G-43	19.04	0.77
G-11	19.86	0.56	G-44	19.51	0.77
G-12	19.88	-0.47	G-45	20.54	-0.20
G-13	20.23	0.52	G-46	19.13	0.67
G-14	19.62	0.68	G-47	20.72	0.85
G-15	20.27	0.68	G-48	20.87	0.82
G-16	20.77	-0.33	G-49	20.39	0.96
G-17	20.30	1.54	G-50	20.88	1.33
G-18	20.08	0.87	G-51	20.13	-0.15
G-19	19.81	0.34	G-52	20.29	1.34
G-20	20.02	-0.24	G-53	19.63	1.13
G-21	20.81	-0.21	G-54	20.09	0.43
G-22	21.15	-0.36	G-55 d	20.63:	1.45:
G-23	20.32	0.66	G-56	20.75	0.80
G-24	20.49	0.60	G-57	20.15	0.85
G-25	20.63	1.09	G-58	21.15	0.78
G-26	20.79	1.13	G-59	20.70	0.70
G-27	21.07	-0.26	G-60	21.28	-0.28
G-28	19.97	0.76	G-61	20.46	0.52
G-29	20.37	0.46	G-62	19.50	1.12
G-30	19.76	0.67	G-63 a	19.93	0.76
G-31	19.81	0.67	G-64	20.59	0.53
G-32	19.84	0.67	G-65	20.72	-0.34
G-33	20.35	1.64			

Table 3 (Continued)

Star	V	B-V	Star	V	B-V
H- 1	20.16	1.23	H-48	20.20	0.81
H- 2	19.95	0.94	H-49	20.77	0.90
H- 3	19.98	0.88	H-50 a	19.06	0.75
H- 4	20.48	0.69	H-51	20.23	1.47
H- 5	21.12	0.93	H-52	20.30	0.77
H- 6	20.80	0.89	H-53	20.20	1.09
H- 7	20.63	0.82	H-54	20.00	1.38
H- 8	20.70	0.73	H-55	20.11	1.03
H- 9	19.92	0.66	H-56	20.38	1.59
H-10	18.83	1.14	H-57	20.39	0.66
H-11	20.77	0.92	H-58	20.51	0.93
H-12	20.48	0.67	H-59	19.81	1.54
H-13	20.58	0.87	H-60	20.50	0.43
H-14	20.06	1.11	H-61	20.65	-0.07
H-15	19.54	0.65	H-62	19.73	0.56
H-16	19.18	-0.14	H-63	19.95	1.68
H-17	20.72	0.75	H-64	20.29	0.55
H-18	20.52	0.12	H-65	20.37	1.33
H-19	21.03	-0.19	H-66	20.04	1.79
H-20	19.14	-0.20	H-67	20.65	0.16
H-21	20.43	1.24	H-68	20.41	1.49:
H-22	20.65	1.29	H-69	20.13	0.31
H-23	20.27	0.67	H-70	20.37	1.48
H-24	19.89	0.93	H-71	20.28	0.05
H-25	20.14	0.53	H-72	21.04	1.23
H-26	19.65	1.79	H-73	20.75	1.35
H-27	19.10	0.87	H-74	19.35	0.61
H-28	20.65	1.04	H-75	20.41	1.56
H-29	19.32	1.69	H-76	20.45	1.60
H-30	20.76	0.06	H-77	19.57	0.05
H-31	20.68	-0.06	H-78	20.41	1.58:
H-32	20.99	-0.03	H-79	21.06	1.25
H-33	20.84	1.62:	H-80	20.89	0.08
H-34	20.02	1.09	H-81	19.53	1.36
H-35	20.28	1.30	H-82	19.75	-0.22
H-36	20.37	0.65	H-83	20.25	0.28
H-37	20.75	1.56	H-84	20.84 :	1.61:
H-38	20.55	-0.10	H-85	19.61	1.72
H-39	20.78	-0.20	H-86	18.50	2.18
H-40	20.32	-0.06	H-87	18.99	0.91
H-41	19.76	1.76	H-88	20.06	1.57
H-42	20.25	1.01	H-89	20.72	0.00
H-43	20.70	0.77	H-90	19.09	-0.12
H-44	20.04	0.97	H-91	19.98	-0.10
H-45	20.04	1.31	H-92	19.47	1.23
H-46	20.14	0.21	H-93	19.98	1.47
H-47	20.00	0.30	H-94	20.70	-0.01

Table 3 (Concluded)

NOTES

:	A colon indicates low accuracy.
a	A local secondary standard, used in reducing variable star data.
b	A local standard used on region H.
c	Measured on the U plate.
d	Possibly variable.

Table 4. REDDENING FROM THE TWO-COLOR PLOT

Star	$(U-B)_{pg}$	$(B-V)_{pg}$	E_y	V_{pg}	M_v	r(pc)	Notes
i	0.24	0.74	0.06	12.26	5.16	246	*
ii	0.61	1.06	0.29	16.12	5.65	832	*
iii	1.02	1.70					*,a
iv	0.20	1.08	1.28				*,b
v	0.66	1.07	0.27	18.27	5.81	2180	
vi	0.03:	0.77					*,b
vii	0.71	0.96	0.05	15.99	6.31	832	*
viii	0.30	0.72	0.37:	18.36	3.01:	7090:	c
ix	-0.16:	0.80	1.06				b
x	0.14	0.88	1.05				*,b
xi	0.32	0.86	0.19	16.91	5.03	1820	*
xii	0.10	0.66	0.12	13.15	4.39	501	*
xiii	0.56	0.91	0.08	15.86	5.97	852	*
xiv	0.71:	1.03	0.16:	16.35	6.13	892	*
xv	> -0.06	0.71					b
xvi	> -0.64	1.22					g
xvii	0.14	0.66	0.02	13.40	4.89	468	*
xviii	0.61	1.08	0.32	17.28	5.58	1413	*
xix	-0.22:	0.99					b
xx	0.17:	1.86					g
xxi	> -0.75:	1.14					g
xxii	0.32:	0.75	0.08	17.23	5.00	2460	*,d
G1	0.23	0.00					
G2	1.23	1.06					
G3	0.62	0.72					
G4	0.45:	1.22					
G5	1.04	1.08					
G6	-0.24:	-0.31					
G7	0.16:	0.51					
G8	0.49:	0.49					

Table 4 (Concluded)

Star	$(U-B)_{pg}$	$(B-V)_{pg}$	E_y	V_{pg}	M_v	r(pc)	Notes
A 68	0.20:	0.73	0.08	15.00	4.91	935	
B174	-0.80	0.18	0.50:	19.00	-4.24:	2×10^5:	e
C 38	0.39	1.02					b
C 41	0.39	0.78	0.00	13.56	5.70	372	
C 47	0.95	1.29	0.41	16.11	6.17	550	
C 48	-0.83:	0.98					
C 79	1.18	2.29					a
C126	0.18	0.88					g
C178	0.15	0.67	0.02	15.39	4.92	1202	
C196	-0.02	0.50					b
D 33	0.25	0.83	0.26	15.89	4.45	1350	
D 55	0.44	0.94	0.22	15.37	5.35	741	
D122	0.25	0.88					b
D123	0.27	0.99					b
D124	0.69	1.10	0.30	16.30	5.85	814	
D154	0.16	0.78					b
D156	0.06	0.25	0.29	15.60	0.34	5785	f
E 19	1.13	1.68:					a
E 22	0.14	0.81					b
E 31	0.19	0.84					b
E101	0.98	1.13	0.13	17.30	6.70	1098	
E102	0.32	0.80	0.08	17.14	5.35	2041	
E103	0.41	0.96	0.28	15.81	5.12	934	
E106	1.07	1.17	0.11	16.15	6.90	602	
E107	0.23	0.73	0.04	16.05	5.16	1412	
E118	0.03	0.72:					b
E122	1.23	1.17					g
E123	0.10	0.69					b
E142	0.72	1.12	0.30	16.20	5.89	759	
E161	0.35	0.47	0.29	16.10	1.99	4436	f

NOTES:

- * $(U-B)_{pe}$ available.
- a Probably an M star. The unreddened sequence is not well determined here.
- b Stars that fall in this region, above the $(B-V)_o = 0.56$ trajectory, cannot be reliably unreddened.
- c Or $E_y \sim 0$, if there is a small error in a color.
- d $(U-B)_{pe}$ was used.
- e Perhaps luminosity class I?
- f The more likely of the two possibilities was chosen.
- g Did not fall on any trajectory.

Table 5a. FIELD STAR COUNTS

	A_m					
					NGC 6822	
B	S.A.135	$-16°, 351°$	S.A.136	$\|b^I\|=20°$	Total	Hump
13	4	4	2	2	2	2
14	10	10	5	5	5	5
15	32	26	14	10	7	7
16	81	61	21	20	20	20
17	187	118	48	36	60	50
18	627	235	100	63	119	87
19	-	462	-	105	214	129

Table 5b. COUNTS FROM NGC 6822 AND FROM CONSTRUCTED FIELD STAR DIAGRAM

	A_m					
V	Calculated	NGC 6822 Total	NGC 6822 Hump	Hump - (2/3) Calculated	Blue	Red
12	3	2	2	0		
13	6	5	5	0		
14	12	8	8	0		
15	23	14	14	0		
16	41	53	52	25	1	0
17	70	97	81	34	9	7
18	117	194	133	55	32	29
19	192	358	191	63	87	80

Table 6. ASSUMED VARIATION OF ABSORPTION AND DENSITY WITH DISTANCE

k	r(pc)	z(pc)	R(kpc)	A_v	E_v	2 + log ρ	log ρV
10	100	24	9.92	$0^{m}.0$	$0^{m}.0$	1.98	0.81
11	159	42	9.87	0.1	0.0	1.96	1.27
12	252	71	9.78	0.2	0.1	1.94	1.84
13	398	117	9.66	0.3	0.1	1.89	2.39
14	631	191	9.46	0.4	0.1	1.77	2.88
15	1,000	307	9.15	0.7	0.2	1.57	3.27
16	1,585	491	8.67	0.8	0.3	1.23	3.54
17	2,515	783	7.91	0.8	0.3	0.81	3.72
18	3,980	1,245	6.80	0.8	0.3	0.49	4.00
19	6,310	1,980	5.28	0.8	0.3	0.03	4.13
20	10,000	3,140	4.30	0.8	0.3	-0.4	4.3
21	15,850	4,980	7.40	0.8	0.3	-0.8	4.5
22	25,152	7,900	15.45	0.8	0.3	-1.2	4.7
23	39,800	12,520	29.0	0.8	0.3	-1.6	4.9
24	63,130	19,880	51.0	0.8	0.3	-2.0	5.1
25	100,000	31,530	86.0	0.8	0.3	-2.4	5.3

R = distance from center of Galaxy, assuming the sun is 10 kpc from center

Table 7. FIELD STAR COLOR-MAGNITUDE DISTRIBUTION

B-V \ V	13	14	15	16	17	18	19
0.1			1		1	1	2
0.2			1			2	3
0.3	1	2	1	2	2	2	6
0.4	2		2	2	3	5	8
0.5		2	1	2	3	4	7
0.6	1	2	1	1	3	3	4
0.7	1	2	3	3	7	10	12
0.8		1	3	10	12	18	24
0.9		1	1	4	11	15	23
1.0			1	4	7	8	14
1.1			1	2	4	8	15
1.2	1		3	4	5	11	16
1.3			1	1	3	7	14
1.4		1	1	2	2	8	10
1.5				3	3	6	9
1.6					2	4	11
1.7			1			2	9
1.8						1	1
1.9					1	1	1
2.0				1			
2.1							
2.2			1		1	1	3

Table 8. LUMINOSITY FUNCTION

		All sections A-E			Section A			Galactic Plane
V	M_v	# of Stars*	Stars/pc^3	$10 + \log \Phi(M)$	# of Stars*	Stars/pc^3	$10 + \log \Phi(M)$	$10 + \log \Phi(M)$**
16	-8.5	26	87×10^{-10}	1.94				
17	-7.5	50	167	2.24	< 1	$< 90 \times 10^{-10}$	< 2.0	1.64
18	-6.5	116	389	2.59	15	1410	3.15	2.15
19	-5.5	226	760	2.88	51	4800	3.68	2.63

*Corrected for field stars.

**From Starikova (1960).

Table 9. MAGNITUDES OF VARIABLE STARS

	B Magnitude				
Julian Day	V1	V2	V3	V4	V5
242,3611.5	19.49	19.47	21.02	19.68	20.27
3616.4	19.36	>20.0	19.59	>20.0	>19.7
3616.5	19.41	19.78	19.69	20.39	21.04
3619.47	19.63	20.05	19.95	20.90	21.60
3619.50	19.94	20.28	20.06	20.77	21.62
3638.37	20.92	19.27	>20.6	21.18	20.31
3638.51	20.60::	19.18	22.5 ::	>22.5	20.40
3639.40	20.64	19.14	21.30	21.55	20.17
3639.43	>19.5	-	>20.15	>20.0	-
3639.48	20.90	-	>21.0	20.09	-
3640.48	19.90	19.00	21.05:	21.12	21.80
3641.47	19.77	19.00	20.89	20.78	20.71
3647.35	19.43	19.38	19.71	20.20:	21.28
3678.38	19.64	18.92	19.91	20.34	20.66
3697.31	20.56	20.05:	>20.8	19.95	21.15
3698.33	20.94	20.23	21.03	19.33	21.22
3969.52	20.85	20.35	19.81	21.30	21.16
3972.51	21.36	20.05:	20.08:	20.71:	20.26:
3990.46	20.38	19.72	21.16	20.58:	21.00
3994.46	20.44	19.94:	19.79	19.74	>22.0
3995.46	20.42	19.92	19.67	20.32	21.43:
3996.40	20.64	20.12	19.71	20.28	21.20
3996.44	20.70	19.88	19.73	20.16	20.68:
3997.40	20.70	19.82	19.54	20.55	20.92
3997.44	20.75	20.30	19.55	20.31	21.00
3998.44	20.74	20.10	19.87	20.56	20.50
4002.38	20.77	20.29	20.17	21.00	20.83
4002.42	21.00	>20.4	20.20	20.85	>21.0
4003.36	21.25	20.37	20.15	20.80	>20.8
4003.40	20.79	20.36	20.40	20.98	>20.5
4004.37	20.87	20.31	20.33	20.97	21.20:
4024.35	20.40	19.45	19.85	20.35:	20.48
4025.35	20.37:	19.49	19.45	20.40	>20.8
4026.38	20.42	19.70	19.65	19.95	20.20
4031.34	20.52	20.03:	20.18	20.14	21.14
4032.33	20.99	20.11	20.10	20.40	21.41
4049.34	19.98::	19.54	21.06:	20.35	21.40
4050.34	19.93	19.30	21.04	20.51	21.01
4054.32	20.46	19.08	19.76	21.13	20.54
4056.31	20.40:	19.13	19.58	21.25	21.09

Table 9 (Continued)

Julian Day	V1	V2	V3	V4	V5
			B Magnitude		
242,4057.32	20.35::	19.33	20.02	20.86	21.06
4058.31	20.91	19.34	19.88	20.82	21.11
4059.31	20.64:	19.59	20.08	20.53	21.00:
4085.31	20.50	20.37	19.63	20.57	21.20:
4090.30	20.79:	19.30	20.41	21.30::	21.38
4299.62	20.36	20.04	20.44	20.86	21.16
4318.62	19.28	19.50	19.63	20.80::	20.52
4320.57	19.67	19.27	19.74	20.57	20.56::
4379.35	19.60	20.60	19.93	20.29	21.52
4379.37	20.2 ::	> 19.7	19.85	20.48	> 20.6
4413.34	19.90	19.92	20.30	20.26	21.30
4651.62	19.12	19.06	20.61	> 20.1	20.64
4710.51	19.51	20.13	20.59	20.45	20.90
4764.33	20.71	19.00	20.44	20.67	20.89
4996.65	20.37	19.55	20.30	20.56	21.39
5025.60	20.24	19.05	20.29	20.81	20.81:
5035.57	20.84	19.55	20.84	19.88::	19.66::
5063.50	20.82	18.93	20.80	21.00	21.45:
5064.40	21.25	19.02	20.54	20.84	21.32:
5064.61	20.96	19.01	20.95:	20.73:	20.82
5065.41	20.65	19.00	21.08:	20.89	20.77:
5065.62	20.78:	19.10	21.20	20.56	20.93
5150.31	20.42	19.72	20.72	21.00	20.81
5475.45	19.39	19.04	20.74	20.76	21.60
5856.38	20.52:	19.21	20.34	20.83	20.40:
6187.48	20.61:	18.95	19.72	20.79	> 20.8
6481.62	19.23	19.91	19.92	20.84	20.95:
6571.42	19.04	19.53	19.99	21.06	21.40
6888.50	20.48	20.40	19.53	20.30	> 21.2
6920.48	20.75	20.05	19.85	21.07	21.53
7241.52	19.20	19.39	19.59	20.63	> 20.2
7271.51	19.59	19.06	20.12	19.50	20.63
7335.36	19.15	20.37	20.41	21.11	21.25:
7691.32	20.87	19.45	20.70	20.11	> 20.6
7930.63	20.78	19.86	21.27:	19.67	21.05
8393.40	21.01	19.25	21.00:	20.91	20.27
8691.57	20.56:	19.59	21.22:	20.56	21.20
8749.46	20.66	20.05	21.11	20.17	21.34
8777.35	19.82	19.33	21.20	20.91	> 20.6
8779.37	20.25	19.43	21.02	20.23	21.09

Table 9 (Continued)

Julian Day	V1	V2	B Magnitude V3	V4	V5
242,8780.37	20.60	19.72	21.30	19.73	20.70
8781.31	20.70	19.73	21.01	19.47	20.39
8782.34	20.58	19.80	21.17	19.69	20.50
8783.34	20.60	19.93	21.27	19.97	20.85
8784.34	20.45	19.90	20.40	20.06	21.13
8785.34	20.70	20.05	19.76	20.39	21.02
8786.34	20.86	20.18	19.74	20.34	21.20
9044.62	19.64:	19.85	20.99	20.22	20.81:
9112.48	20.25	19.25	20.28	20.11	21.37
9136.41	19.57	20.29	19.66	20.70	21.32
9438.60	19.12	20.10	20.64	20.23	21.06
9786.59	20.40	19.45	20.39	19.69	21.32
9869.35	19.50	19.88	20.04	20.68	21.37
243,0175.51	19.83	20.18	20.87	20.67:	21.29
0497.63	21.26	19.18	20.88	19.75:	21.33
1702.38	19.74	19.71	21.13	20.59	> 21.3
1970.60	19.29	20.01	19.91	20.41	20.50
1971.59	19.28	20.08	19.66	20.04	20.62
2004.50	19.64	19.81	20.02	20.70	21.43
2313.62	20.20::	20.20:	19.65	20.35	20.86
2389.44	20.99	20.28:	20.45:	19.62	20.70
3062.61	20.52	20.26	20.60	20.62	21.22
3475.48	20.23	20.17	20.81	21.07	21.53
3536.39	20.03	19.59	21.06	20.13	20.38
3800.61	19.07	19.69	20.86	20.80	20.70
3830.55	18.99	19.25	20.89	20.00	20.86
4247.35	20.59	19.71	20.05	19.99::	21.28
4248.38	20.61	19.64	19.70	20.26	21.35
4249.44	20.60	19.68	19.55	20.21	21.55
4250.35	20.77	19.84	19.56	20.44	21.74
4604.43	20.27:	20.22::	20.16:	20.94:	20.38:
4622.38	19.17	19.51	21.01	20.74	21.16
4867.63	19.01	20.20	19.96	20.50	21.00::
4954.43	20.86	19.26	19.75	20.42	20.94
4955.42	21.04	19.30	19.92	19.88	21.21
6402.55	20.22	20.32	21.08	20.62:	21.12
7460.56	19.06	19.28	19.96	20.59:	> 19.7
7461.58	19.52:	19.10	19.83	20.21	20.08
8120.65	20.53	19.74:	20.16	20.95	21.05
8200.53	19.92	20.02	20.14	19.80	21.23

Table 9 (Continued)

Julian Day	V Magnitude V1	V2	V3	V4	V5
242,4357.38	18.9 ::	18.70	21.0 ::	>18.8	19.90::
4378.41	18.64	19.10	18.57	19.27	20.05
6158.56	19.3 ::	18.35	18.65	>19.5	-
243,3832.52	18.55	18.34	19.90	19.52	20.04
3833.53	18.60	18.35	19.72	19.64	20.11
3834.52	18.62	18.41	19.87	19.84	20.27
3835.52	18.67	18.40	20.02	19.83	20.18
3836.51	18.64	18.42	19.95	19.94	20.22
3863.44	18.53	18.32	19.93	19.13	20.33
3864.43	18.60	18.26	19.87	19.30	20.46
3865.43	18.65	18.23	19.87	19.53	20.39
3866.46	-	-	-	-	20.15:
4247.39	19.63	18.40	19.33	19.45	20.14
4248.41	19.55	18.44	18.92	19.46	20.04
4250.39	19.52	18.57	18.78	19.60	20.26
4628.39	18.88	18.65	19.09	19.11	19.85
4868.63	18.63	18.84	18.90	19.00	19.98
4869.62	18.64	18.54	19.07	19.23	19.72
4895.60	19.14	18.89	19.06	20.06	19.60
5312.45	19.11	18.87	19.44	19.91:	19.72
6402.53	18.90	18.87	19.81	19.62	20.35
6723.62	19.78	18.67	19.66	19.63	20.18
7460.60	18.55	18.20	19.20	19.61	19.55
7461.61	18.78	18.35	19.13	19.79	19.60

Table 9 (Continued)

	B Magnitude				
Julian Day	V6	V7	V8	V9	V10
242,3611.5	20.43	18.38	20.50	20.77	21.14
3616.4	> 20.0	18.38	> 20.0	20.70 ::	> 20.0
3616.5	21.16	18.38	20.56	20.72	21.40
3619.47	21.38	18.49	20.72	20.28	20.96
3619.50	21.30	18.47	20.85	20.64	20.51
3638.37	21.07	18.96	21.18	21.21	21.25
3638.51	21.20	19.02	20.38	20.58	20.90
3639.40	> 21.5	18.93	20.79	20.10	22.13
3639.43	-	18.93	-	-	-
3639.48	> 20.2	18.64	-	> 22.0	> 22.5
3640.48	21.50 ::	18.97	21.63	20.00	21.15
3641.47	21.51	19.06	20.23	20.89	21.55
3647.35	19.67	19.27	21.50	21.04	22.34
3678.38	21.02	18.21	20.72	20.90	21.07
3697.31	> 21.3	18.77	20.67	20.63	> 22.0
3698.33	> 21.2	18.88	21.04	20.58	20.64
3969.52	20.26	19.10	20.61	20.48	20.35
3972.51	21.00	19.18	20.15	20.44	20.0 :
3990.46	20.21	18.81	20.74	21.00	20.57
3994.46	20.90	18.38	20.14	21.42	20.73 :
3995.46	20.88	18.48	20.31	20.74	20.76
3996.40	21.28	18.34	20.45	20.64	20.47
3996.44	> 21.0	18.35	20.52	20.16	> 20.5
3997.40	21.25	18.24	20.81	22.01 :	22.01 ::
3997.44	21.10	18.34	21.02	> 20.6	20.35
3998.44	21.18	18.45	20.60	21.18	21.12
4002.38	21.26	18.42	20.99	20.66	20.42
4002.42	> 20.48	18.29	> 21.0	> 21.0	> 21.0
4003.36	21.23	18.37	20.53	20.59	20.70
4003.40	> 20.2	18.30	21.07	20.88	21.40
4004.37	21.14	18.32	20.35	20.19	20.55
4024.35	21.40	18.74	20.37	19.71	20.62
4025.35	20.86	18.80	20.71	20.29	20.49
4026.38	20.30 :	18.84	20.41	20.40	21.40 ::
4031.34	20.28	18.93	20.15	21.32 :	20.46
4032.33	20.36	18.91	20.67	> 20.89	20.65
4049.34	19.83	19.28	20.54	20.30 :	21.09
4050.34	19.55	19.22	20.36	21.32	21.10
4054.32	21.11	18.78	20.50	20.02	20.62
4056.31	20.71	18.69	20.30 :	21.05	20.88 :

Table 9 (Continued)

Julian Day	V6	V7	B Magnitude V8	V9	V10
242,4057.32	20.84	18.54	20.88	20.04	21.13
4058.31	20.89	18.41	20.44	20.60	20.99
4059.31	21.20:	18.34	20.24	20.14	21.11
4085.31	21.60	18.66	20.49	21.12	20.75
4090.30	20.03	18.76	20.89	20.39	21.01
4299.62	21.10	19.02	20.32	20.69	21.26
4318.62	21.28	18.46	20.98	20.38	21.87:
4320.57	21.19	18.44	20.74	20.68	21.64
4379.35	21.22	18.92	20.71	20.57	21.93
4379.37	> 20.2	18.92	20.16	> 20.17	20.06
4413.34	20.62	18.70	20.11	20.80	21.01:
4651.62	21.40	18.31	20.64	20.59	20.12
4710.51	20.39	18.67	20.61	20.44	20.24
4764.33	21.36:	19.16	20.60	20.34	20.53
4996.65	21.45	18.56	21.28	21.00	22.10
5025.60	20.16	19.15	20.63	20.84	21.39
5035.57	21.39	18.85	20.43	20.42	21.09
5063.50	21.45	18.52	20.49	20.66	21.80
5064.40	21.16	18.59	21.06	20.54	> 22.0
5064.61	21.40	18.61	21.07	20.80:	21.60:
5065.41	19.92	18.64	20.99:	20.21	> 22.0
5065.62	19.81	18.68	20.37	20.57:	> 22.4
5150.31	20.23	19.03	20.72	20.31	21.32
5475.45	20.84	18.94	20.74	20.63	21.56
5856.38	21.20 ::	18.72	20.76	20.37:	19.87
6187.48	19.95	18.50	20.86	21.30	> 22.0
6481.62	21.32	19.09	20.99	20.18	20.57
6571.42	20.48	18.42	20.52	20.70	20.67
6888.50	20.39	18.28	20.56	20.16	> 21.2
6920.48	21.20	18.68	20.59	20.64	21.70
7241.52	> 20.0	18.90	20.48	20.08	20.10
7271.51	20.54	18.89	20.63	20.94	21.13
7335.36	21.05	18.77	20.56	20.70	20.38
7691.32	20.43	18.36	> 21.0	20.48	20.54
7930.63	20.23:	18.43	20.59	20.24	21.67
8393.40	21.02	18.33	20.58	21.01	21.44:
8691.47	21.03:	19.17	20.59	20.54	22.10
8749.46	20.36	18.93	20.62	21.28	21.67
8777.35	21.03	18.47	20.60	19.95:	> 20.96
8779.37	21.32	18.34	20.59	20.67	21.08

Table 9 (Continued)

Julian Day	B Magnitude V6	V7	V8	V9	V10
242,8780.37	21.39	18.40	20.43	20.91	21.15
8781.31	21.39	18.25	20.52	20.94	20.58
8782.34	20.20	18.41	20.47	21.30	20.32
8783.34	19.48	18.28	20.83	21.27	21.25
8784.34	19.64	18.33	20.31	21.10	21.25
8785.34	19.94	18.31	20.60	21.03	> 20.55
8786.34	20.14	18.29	20.83	21.02	20.42
9044.62	20.08	18.35	> 20.24	20.53	21.00
9112.48	20.82	18.30	20.48	20.42	21.89
9136.41	21.48	18.72	20.40	20.96	21.43
9438.60	20.92	18.30	20.66	20.71	> 20.66
9786.59	20.50	18.87	20.59	20.44	21.35
9869.35	20.66	19.24	20.57	20.35	21.70
243,0175.51	21.31	18.82:	20.73	20.37	20.40
0497.63	21.36	18.74	20.35	20.37	21.41
1702.38	19.79	18.66	20.64	21.06	21.61
1970.60	21.39	18.39	20.90	20.47	20.77
1971.59	21.26	18.31	20.69	20.81	21.08
2004.50	20.32	18.92	20.74	20.74	21.14
2313.62	> 19.6	18.63	20.23	20.74	21.76
2389.44	20.97	18.78	20.45	21.35	21.57
3062.61	20.40	18.97	20.72	20.80	21.10
3475.48	21.48	18.77	20.69	20.25	20.66
3536.39	21.41	19.07	20.55	21.17	22.12
3800.61	19.71	19.12	20.62	20.71	20.79
3830.55	21.36	18.41	20.56	20.45	20.95
4247.35	22.80	18.91	20.57	20.66	20.66
4248.38	20.65	18.83	20.74	20.78	20.63
4249.44	21.06:	18.93	20.62	20.63	21.29
4250.35	21.34:	19.00	20.78	20.22	20.71
4604.43	20.22::	18.72	20.24::	19.91:	21.89
4622.38	20.07	18.37	20.69	20.48	21.80
4867.63	20.98:	18.44	20.49	21.30	21.57
4954.43	21.31	18.40	20.66	20.69	20.33
4955.42	21.46	18.48	20.61	21.28	20.48
6402.55	20.35	18.58	20.66	21.12	21.97
7460.56	20.35	18.55	> 20.1	> 21.5	> 21.5
7461.58	20.36	18.50	> 20.7	19.72	21.10:
8120.65	20.60	19.22	20.95	20.43	21.49
8200.53	20.32	19.06	20.58	20.86	21.90

Table 9 (Continued)

Julian Day	V Magnitude V6	V7	V8	V9	V10
242,4357.38	>18.6	17.53	>19.5	>19.1	>19.0
4378.41	19.99	17.77	20.28	19.59	21.11
6158.56	20.20	17.87	-	-	>19.5
243,3832.52	20.17	17.40	20.68	19.77	20.21
3833.53	20.22	17.43	20.56	19.89	20.17
3834.52	20.17	17.41	20.59	19.74	20.16
3835.52	20.14	17.52	20.44	19.73	20.12
3836.51	20.20	17.50	20.45	19.56	20.12
3863.44	19.49	17.92	20.66	19.50	20.37
3864.43	19.53	17.86	20.62	19.52	20.35
3865.43	19.55	17.83	20.70	19.60	20.41
3866.46	19.68:	-	-	-	-
4247.39	19.72	17.64	21.05:	20.00	19.80
4248.41	19.65	17.72	20.40	19.94	19.68
4250.39	19.90	17.69	20.94	19.49	19.80
4628.39	19.59	17.52	21.40::	20.80:	>22.0
4868.63	19.98	17.55	20.57	20.23	19.80
4869.62	20.02	17.44	20.36	20.09	19.81
4895.60	20.37	17.58	20.51	19.92	19.67
5312.45	20.18	17.88	20.87	19.63	21.38
6402.53	19.58	17.31	20.64	20.22	21.52
6723.62	19.71	17.38	21.03	21.17	20.31
7460.60	19.38	17.56	20.61	20.16	20.51
7461.61	19.63	17.47	22.00::	19.99	20.25

Table 9 (Continued)

Julian Day	B Magnitude V11	V12	V13	V14	V15
242,3611.5	20.97	20.69	19.49	> 20.15	20.18
3616.4	> 20.0	> 20.0	19.49	19.93	> 20.0
3616.5	21.29	20.56	19.56	19.24	20.06
3619.47	21.14	20.67	19.40	20.22	20.19
3619.50	21.07	20.68	19.66	20.45	20.27
3638.37	21.34	20.78	19.05	21.27	20.99
3638.51	21.16	20.70	18.90	> 20.53	22.3
3639.40	21.52	20.59	19.07	20.06	20.41
3639.43	-	19.21	18.76	19.66	19.75
3639.48	> 21.2	-	20.19	> 21.8	22.00::
3640.48	20.53	21.00	18.90	20.80:	21.13
3641.47	21.26	20.47	18.90	20.85	20.35
3647.35	20.83	20.55	18.67	20.46	20.50
3678.38	21.06	20.51	18.93	20.61	20.17
3697.31	> 21.8	20.53	19.30	20.49	21.25
3698.33	21.67	20.48	19.21	20.30	20.31
3969.52	22.50	19.63	19.45	20.16	19.53
3972.51	20.43	19.72	19.41	20.75	20.59
3990.46	21.03	19.53	19.81	19.88	19.76
3994.46	22.00:	19.55	19.58	20.14	19.58
3995.46	21.01	19.58	19.40	19.90	19.63
3996.40	21.32	19.57	19.64	19.68	19.56
3996.44	> 20.4	19.41	19.68	19.58	19.44
3997.40	21.20	19.45	19.52	19.58	19.48
3997.44	> 21.2	19.56	19.60	19.93	19.77
3998.44	21.21	19.48	19.60	19.89	19.61
4002.38	> 21.8	19.31	19.40	19.56	19.49
4002.42	> 20.6	19.32	19.48	> 19.8	> 19.8
4003.36	20.78	19.32	19.25	19.86	19.70
4003.40	> 20.6	19.28	19.37	19.86	19.72
4004.37	21.04	19.27	19.29	19.96	19.67
4024.35	21.04	19.72	18.46	20.80	19.76
4025.35	20.40	19.42	18.42	19.78	20.30
4026.38	> 20.9	19.74	18.62	20.47	19.65
4031.34	21.47	19.49	18.54	19.78	19.65
4032.33	20.88	19.49	18.63	19.73	19.65
4049.34	21.02	19.78	18.92	19.88	19.70
4050.34	21.80	19.67	18.99	20.01	19.42
4054.32	21.62:	19.49	19.24	19.62	19.52
4056.31	20.64	19.64	19.20	19.88	19.34

Table 9 (Continued)

Julian Day	V11	V12	B Magnitude V13	V14	V15
242,4057.32	21.48:	19.66	19.09	19.96	19.59
4058.31	21.48	19.53	19.21	19.82	19.60
4059.31	21.40	19.47	19.28	19.80	19.82
4085.31	21.09	19.58	19.73	19.81	19.63
4090.30	21.19	19.60	19.56	19.62	19.68
4299.62	20.96	20.65	19.30	20.14	20.11
4318.62	20.58	20.91	19.58	20.54	20.10
4320.57	21.00	20.69	19.57	20.21	20.29
4379.35	21.18	20.91	18.68	20.37	20.18
4379.37	> 20.2	> 19.6	18.65	19.19	19.71
4413.34	20.60	20.79::	19.09	20.24	19.86
4651.62	20.93	19.23	18.95	20.01	19.83
4710.51	21.11	19.43	19.73	20.40	19.65
4764.33	21.17	19.68	18.87	20.28	20.20
4996.65	20.66	20.82	18.64	20.84	19.75
5025.60	21.42	20.78	19.38	20.80:	20.08:
5035.57	20.49	20.75	19.34	20.88	19.76
5063.50	21.19	20.54	19.70	20.89	20.01
5064.40	20.77	20.55	19.72	20.83	19.91
5064.61	21.20	20.56:	19.81	20.41	19.89
5065.41	20.93	20.55:	19.52	20.88	19.71
5065.62	21.09	20.44	19.61	20.70	19.66
5150.31	21.23	20.14	19.34	20.51	19.61
5475.45	21.02	19.91	18.54	20.74	19.87
5856.38	> 22.5	> 20.7	18.88	20.17	19.59
6187.48	> 22.0	20.55:	18.92	20.07	19.92
6481.62	21.19	20.38	19.32	20.24	20.52
6571.42	21.06	20.40	18.59	19.74	19.58
6888.50	20.95	19.96	19.52	20.03	19.87
6920.48	21.10	19.90	18.48	19.96	19.83
7241.52	> 20.14	> 20.8	19.50	> 20.0	> 20.0
7271.51	21.11	20.80	18.88	20.08	19.84
7335.36	21.02	20.29	19.43	20.16	20.15
7691.32	20.43	20.40	19.36	20.80	19.89
7930.63	20.79	20.39	19.54	20.69	19.88
8393.40	21.32	20.69	19.01	20.41	19.70
8691.57	20.78	19.62	19.54	20.32	20.31
8749.46	> 20.76	19.77	19.00	20.05	20.00
8777.35	20.61	19.87	19.27	20.37	19.92
8779.37	21.04	19.96	19.61	20.00	19.95

Table 9 (Continued)

			B Magnitude		
Julian Day	V11	V12	V13	V14	V15
242,8780.37	21.67	20.01	19.42	20.00	20.06
8781.31	>21.13	20.13	19.45	20.10	19.96
8782.34	21.79	19.93	19.42	20.37	20.07
8783.34	21.49	19.99	19.53	19.84	19.93
8784.34	20.89	20.08:	19.49	20.19	20.12
8785.34	21.26	19.92	19.45	20.27	20.05
8786.34	21.16	20.11	19.53	20.17	20.10
9044.62	21.13:	20.35	20.29	20.47	20.44
9112.48	21.59	20.18	18.70	20.31	19.90
9136.41	20.92:	20.42	19.52	20.32	20.30
9438.60	20.85	20.04	19.29	20.24	20.33
9786.59	20.71	20.05	19.79	20.08	20.21
9869.35	20.88	20.42	19.50	20.11	20.38
243,0175.51	20.98	20.33	18.64	20.72	20.25
0497.63	20.80	20.38	19.87	20.62	20.09
1702.38	20.79	20.67	19.57	19.79	20.00
1970.60	20.68	20.15	19.33	20.40	19.70
1971.59	21.07	20.11	19.32	20.46	19.74
2004.50	21.20	20.11	18.73	20.23	19.45
2313.62	21.30:	21.08	19.47	19.73	19.92:
2389.44	21.23	20.17	19.03	20.35	19.67
3062.61	20.86	20.24	19.04	20.13	19.76
3475.48	20.86	20.91	19.00	20.39	19.88
3536.39	21.45	20.97	19.18	20.36	19.89
3800.61	21.22	20.02	18.62	19.84	20.19
3830.55	21.29	19.69	18.68	19.97	20.24
4247.35	21.08	20.84	19.48	20.55	20.47
4248.38	20.82	20.89	19.44	20.32	20.29
4249.44	21.60	20.80	19.31	20.16	19.91
4250.35	21.06	20.70	19.43	20.40	20.11
4604.43	20.28:	20.62::	19.60	20.74::	19.94
4622.38	21.18	20.56	19.50	20.68	19.88
4867.63	21.14	19.42	18.96	20.14	19.79
4954.43	21.17	19.75	19.46	19.92	19.89
4955.42	21.11	19.77	19.45	19.92	19.55
6402.55	21.35	20.04	19.69	19.82	20.05
7460.56	>22.0	19.48	18.98	20.63	19.86
7461.58	>22.0	19.54	18.96	20.67	20.17
8120.65	21.48	19.84	19.23	19.85	19.89
8200.53	21.12	19.90	19.22	20.10	20.16

Table 9 (Continued)

Julian Day	V Magnitude V11	V12	V13	V14	V15
242,4357.38	>18.62	18.35	18.10	>18.2	18.02
4378.41	21.13	18.59	17.92	18.04	18.08
6158.56	>19.5	17.60	>19.5	18.32	18.23
243,3832.52	21.45	17.55	17.50	17.64	18.24
3833.53	21.42	17.58	17.42	17.55	18.05
3834.52	21.38	17.54	17.42	17.65	18.27
3835.52	21.54	17.55	17.40	17.64	18.29
3836.51	21.05	17.45	17.43	17.64	18.21
3863.44	21.18	17.45	17.80	17.92	18.16
3864.43	21.22	17.43	17.81	17.74	18.22
3865.43	21.39	17.43	17.84	17.75	18.15
3866.46	-	-	-	-	-
4247.39	21.33	18.29	18.19	18.04	17.82
4248.41	20.59	18.37	18.17	17.85	17.86
4250.39	21.59	18.46	18.20	17.84	17.77
4628.39	>19.68	17.84	18.26	18.08	17.60
4868.63	21.39	16.86	18.14	17.62	17.71
4869.62	20.85	16.86	18.15	17.67	17.77
4895.60	21.52	17.08	17.46	17.41	17.76
5312.45	21.50	18.64	18.00	17.85	17.94
4602.53	21.14	17.36	18.00	17.22	17.81
6723.62	21.12	18.84	17.52	17.91	17.90
7460.60	20.40:	17.10	17.51	18.36	17.66
7461.61	>20.4	17.11	17.75	18.27	17.72

Table 9 (Continued)

	B Magnitude				
Julian Day	V17	V18	V19	V21	V22
242,3611.5	20.58	19.39	19.62	20.42	21.43
3616.4	>20.1	19.62	19.71	>20.0	>20.0
3616.5	20.89	19.44	19.56	20.95	21.41
3619.47	21.42	19.50	19.60	21.29	21.25
3619.50	21.39:	19.66	19.64	21.05	21.20
3638.37	21.34	19.64	19.72	20.81	21.15
3638.51	20.25	19.59	19.44	20.94::	21.06
3639.40	>21.4	19.60	19.56	21.02::	22.14
3639.43	>19.7	19.68	19.60	-	>21.5
3639.48	>21.0	19.52	19.65	-	>20.8
3640.48	21.30	19.65	19.65	21.12	20.54
3641.47	21.06	19.61	19.57	21.24	21.33
3647.35	20.15	19.63	19.66	20.31	21.25
3678.38	21.07	19.74	19.34	20.97	21.16
3697.31	>20.6	19.72	19.62	21.8	21.33
3698.33	>21.5	19.73	19.45	19.73	20.91:
3969.52	21.02	19.15	19.54	21.17	20.46
3972.51	20.31:	19.05	19.55::	20.97	>20.8
3990.46	21.12	19.17	19.65	21.21	20.59
3994.46	20.11	19.22	19.59	20.14	20.64
3995.46	20.10	19.23	19.53	20.16	20.54:
3996.40	20.22	19.17	19.53	20.65	20.46
3996.44	20.07:	19.18	19.61	21.26	20.89:
3997.40	20.47	19.28	19.57	20.49	21.02
3997.44	20.63:	19.25	19.51	>20.4	19.87
3998.44	20.64	19.31	19.58	20.71	20.93
4002.38	21.24	19.32	19.56	20.96	20.54
4002.42	>21.0	19.39	19.48	>20.6	20.40
4003.36	20.82	19.24	19.57	21.12	21.19:
4003.40	20.09	19.28	19.57	21.01	20.42
4004.37	21.68	19.28	19.54	21.24	20.80
4024.35	21.30	19.19	19.48	20.90:	20.63
4025.35	21.50	19.11	19.36	21.34	19.57
4026.38	>20.4	19.27	19.50	>21.0	20.60
4031.34	19.98	19.30	19.48	20.31	20.94
4032.33	19.89	19.33	19.49	20.62	21.29
4049.34	>21.4	19.30	19.46	20.71	20.72
4050.34	19.73	19.32	19.64	>19.7	>21.5
4054.32	20.48	19.42	19.35	20.97:	22.30::
4056.31	20.67	19.29	19.66	20.86	21.75

Table 9 (Continued)

Julian Day	B Magnitude V17	V18	V19	V21	V22
242,4057.32	21.68	19.36	19.61	21.12	20.94:
4058.31	20.85	19.52	19.50	21.22	20.61
4059.31	20.79	19.25	19.42	21.40	>21.0
4085.31	21.45	19.60	19.47	20.26:	21.02
4090.30	20.16:	19.52	19.40	21.02	>21.5
4299.62	20.76	19.59	19.62	21.02	21.85
4318.62	20.70	19.55	19.67	20.84	21.13:
4320.57	20.39	19.66	19.63	21.28	21.46:
4379.35	20.20	19.53	19.67	20.36	21.77:
4379.37	20.30	19.76	19.80	20.21	-
4413.34	>20.7	19.47	19.76	19.69	20.99:
4651.62	20.12	19.25	19.99	21.00	21.28:
4710.51	20.24	19.29	20.26	20.25	22.60:
4764.33	19.75	19.46	20.42	20.29	20.89
4996.65	19.75	19.64	20.15	21.16	21.39
5025.60	21.03	19.55	19.92	20.58	21.86:
5035.57	19.97	19.56	20.00	21.12:	20.95
5063.50	20.95	19.64	19.99	20.87	21.33
5064.40	20.93	19.78	19.88	21.13	>20.52
5064.61	20.92	19.66	20.04:	20.74:	20.65
5065.41	21.11	19.64	19.97	20.85::	21.02
5065.62	21.20	19.93	20.03	20.93	>20.75
5150.31	19.69	19.82	19.99	20.44	20.68
5475.45	21.18	19.67	19.74	20.76	21.29
5856.38	>20.2	19.54	19.48	>21.2	>21.2
6187.48	21.60	19.29	19.93	21.16	21.30
6481.62	19.99	19.63	19.76	20.84	20.78
6571.42	21.13	19.71	19.59	21.32	21.06
6888.50	19.97	>19.9	19.80	19.80	>21.04
6920.48	20.70	19.05	19.61	>21.5	21.42
7241.52	20.52	19.83	20.04	>20.0	20.50
7271.51	20.81	19.90:	19.89	21.05	20.76
7335.36	20.42	19.90	20.05	20.74	20.80
7691.32	21.60	19.52	19.78	>20.6	21.20
7930.63	19.94	19.69:	20.08	21.06	21.20
8393.40	19.87	19.45	19.63	19.78	21.12
8691.57	20.88	19.48	19.75	20.62	20.61
8749.46	20.97	19.53	19.58	20.91	20.66
8777.35	20.34	19.24	19.52	20.00:	20.53
8779.37	19.95	19.29	19.43	19.98	21.06

Table 9 (Continued)

Julian Day	B Magnitude				
	V17	V18	V19	V21	V22
242,8780.37	19.99	19.31	19.36	20.20	20.90
8781.31	20.20	19.30	19.41	20.57	20.97
8782.34	20.33	19.27	19.46	20.34	20.99
8783.34	20.55	19.27	19.53	20.70	20.58
8784.34	20.50	19.34	19.62	20.90	20.59
8785.34	20.57	19.29	19.55	20.93	20.89
8786.34	20.90	19.39	19.55	20.93	20.49
9044.62	21.27	19.58	20.00	21.01	20.97:
9112.48	20.61	19.80	19.88	<20.9	21.38
9136.41	20.95	19.74	19.87	21.04	21.16
9438.60	20.24	19.60	20.00	19.98	21.00
9786.59	20.46	20.04	20.24	>20.1	21.90
9869.35	20.91	19.75	20.50	20.93	21.22
243,0175.51	20.73	19.72	20.46	20.29	21.07
0497.63	20.07	20.07	20.34	20.76	22.40:
1702.38	21.21	19.35	19.76	20.94	21.73
1970.60	20.60	19.88	19.91	20.14	20.31
1971.59	20.70	19.92:	19.94	20.31	20.60
2004.50	20.32	19.83	19.74	19.99	20.53
2313.62	20.37	19.25:	19.79	19.98	21.80:
2389.44	20.08	19.54	19.76	19.76	21.23
3062.61	20.18	19.40	20.00	21.14	21.18
3475.48	20.78	19.16	19.65	20.28	20.92
3536.39	21.19	18.95	19.59	21.19	21.11
3800.61	20.34	18.91	19.73	20.90	21.50
3830.55	21.16	18.96	19.81	21.24	21.98
4247.35	20.66	19.30	19.34	20.62	21.20
4248.38	20.87	19.26	19.28	20.68	20.84:
4249.44	21.00	19.31	19.29	21.50	20.96:
4250.35	20.96	19.25	19.42	21.13	21.13
4604.43	21.10	19.66	19.52::	21.01	20.13:
4622.38	21.20	19.54	19.68	21.23	20.92
4867.63	21.03	18.95	19.27	20.20	20.72
4954.43	19.82	19.16	19.53	20.88	21.15
4955.42	20.21	19.29	19.59	20.71	21.23
6402.55	20.05	19.92	19.88	20.80	21.66
7460.56	20.24	19.20	19.47	>20.0	20.25
7461.58	20.15	19.25	19.66	20.83	20.24
8120.65	20.41	19.44	19.97	21.35	20.72
8200.53	20.55	19.38	19.82	20.81	20.86

Table 9 (Continued)

Julian Day	V17	V18	V19	V21	V22
			V Magnitude		
242,4357.38	19.70:	17.38	17.41	19.90::	19.26
4378.41	18.88	17.57	17.41	19.57	19.51
6158.56	-	17.81	17.88	>18.1	>18.78
243,3832.52	19.53	16.90	17.70	20.25	20.07
3833.53	19.20	16.79	17.70	20.23	20.03
3834.52	18.72	16.88	17.81	20.12	19.97
3835.52	18.71	16.76	17.85	19.99	19.96
3836.51	18.66	16.78	17.92	19.89	19.86
3863.44	19.27	16.96	17.84	19.65	20.09
3864.43	19.33	17.04	17.76	19.75	19.99
3865.43	19.38	16.81	17.75	19.85	20.01
3866.46	-	-	-	20.07	-
4247.39	19.44	17.20	16.85	19.66	18.33
4248.41	19.43	17.19	17.20	19.63	18.37
4250.39	19.40	16.99	17.11	20.12	18.33
4628.39	18.67	17.42	17.35	19.60:	18.60
4868.63	19.23	16.84	17.14	19.50	18.01
4869.62	19.46	16.76	17.15	19.40	17.97
4895.60	18.98	16.80	17.60	20.05	18.04
5312.45	19.23	16.83	18.29	19.69	18.50
6402.53	18.70	17.29	17.28	20.14	19.86
6723.62	19.78	17.16	17.12	19.72	18.61
7460.60	19.91	16.84	17.27	19.64	17.74
7461.61	19.21	16.82	17.37	19.92	17.70

Table 9 (Continued)

Julian Day	V23	V24	B Magnitude V25	V26	V27
242,3611.5	20.31	21.09	20.62	21.13	20.59
3616.4	>20.0	>20.0	>20.0	>20.0	>20.0
3616.5	19.29	20.95	21.81:	21.21	20.96
3619.47	20.35	21.12	21.32	20.64	21.07
3619.50	20.55	20.97	20.96	20.97:	21.59:
3638.37	20.52	20.85	>22.2	21.46	21.46
3638.51	20.87	20.77	21.40	21.00:	21.30
3639.40	20.09	20.95	20.72	20.56	22.50::
3639.43	-	-	-	-	-
3639.48	20.09	19.55	-	>20.5	>20.0
3640.48	20.19	19.94	21.40	20.74	>22.0 ::
3641.47	20.55	21.25	21.78	20.64	21.48
3647.35	20.32	21.16:	20.98	20.78	20.89
3678.38	20.35	20.97	20.63	21.27	21.27
3697.31	>21.1	>22.0	>22.0	20.55	20.62
3698.33	20.44	20.93	21.04	21.01	20.59
3969.52	21.10	20.80	21.21	20.75	20.87
3972.51	20.40:	20.36	20.79	>21.5	>21.0
3990.46	20.83	20.78	>22.0	20.82	21.31
3994.46	21.08	19.19	21.18	21.25	>22.0
3995.46	20.82	20.80	20.91	20.22	21.44
3996.40	20.78	21.67	21.24	20.98	21.48
3996.44	20.60	>21.0	20.52	20.28	>20.52
3997.40	21.02	21.08	>21.6	20.92	20.68
3997.44	20.76	21.20	>20.47	>21.5	20.59
3998.44	20.94	21.82	21.40	21.00	21.58
4002.38	20.47	21.25	21.20	20.70	20.48
4002.42	>20.9	>20.5	-	>20.6	20.44
4003.36	>20.72	20.90	22.08	21.94::	20.47
4003.40	20.87	21.00	>21.4	>20.23	20.50
4004.37	20.94	21.09	20.77	20.62	20.94
4024.35	20.19	20.85	21.50	21.45	22.20
4025.35	20.11:	21.06	>20.29	21.50	21.38
4026.38	>21.0	21.74	>21.0	20.48:	20.64:
4031.34	20.76	21.06	21.00	20.74	21.24
4032.33	20.65	21.00	20.52	20.68	>21.2
4049.34	20.64	19.98	22.04	20.78	21.00
4050.34	20.74	20.97	>22.05	>20.0	21.28
4054.32	20.58	20.98	21.70	20.79	21.90:
4056.31	20.43	20.74	21.65	20.54	21.06

Table 9 (Continued)

			B Magnitude		
Julian Day	V23	V24	V25	V26	V27
242,4057.32	20.26	20.76	21.05	20.68	20.44
4058.31	20.37	21.27	21.31	20.68	21.18
4059.31	20.72	20.88	20.88	20.96	20.59
4085.31	21.14	20.95	> 21.6	20.90	20.64
4090.30	21.30	21.19	> 22.2	20.69	21.58
4299.62	20.62	20.96	21.25:	20.87	20.50
4318.62	20.71	21.06	20.64	20.78	20.02
4320.57	20.96	20.59	21.47	20.67	20.59
4379.35	21.70:	21.22	21.00	20.88	20.56
4379.37	> 20.2	> 20.2	> 20.2	> 19.7	> 19.7
4413.34	20.62	20.29	21.32:	20.39	20.60
4651.62	20.42	20.67	20.55	20.42	20.38
4710.51	20.57	21.14	21.20	20.83	20.40
4764.33	20.75	21.30	21.24	20.95	21.65
4996.65	20.70	21.07	20.90	20.64	21.84
5025.60	20.88	20.55	20.70	20.93	20.40
5035.57	20.52	21.26	21.10	20.75	21.82
5063.50	21.28	21.19	21.08	21.02	20.58
5064.40	20.92	20.99	21.04	20.67	21.52
5064.61	20.68:	21.07	21.50	21.59::	21.59:
5065.41	20.54	21.01:	20.76	> 20.8	21.29:
5065.62	21.00	21.15	> 21.7	21.07	20.60
5150.31	21.00	20.94	21.51	20.75	21.13
5475.45	20.68	20.92	20.87	20.98	20.98
5856.38	21.60::	20.39	> 20.4	21.30::	> 22.0 ::
6187.48	22.10	20.84	21.00	20.68	> 22.0 ::
6481.62	20.79	20.73	21.40	20.80	20.60
6571.42	21.06	20.97	21.12	20.63	20.38
6888.50	20.22	21.00	21.00	20.54	20.95
6920.48	20.42	20.64	21.70	21.13	> 21.8
7241.52	> 20.6	> 19.89	> 20.8	> 20.0	> 20.0
7271.51	20.58	21.08	20.86	20.76	21.06
7335.36	20.28	20.87	21.23	20.70	20.32
7691.32	20.80	20.72	> 21.0	20.23:	20.49
7930.63	21.19	20.64	> 21.8	20.91	21.24:
8393.40	20.53	20.73	> 22.2	> 21.15	20.29
8691.57	21.68	20.89	> 22.4	21.09	20.75
8749.46	> 21.8	20.84	22.3 ::	20.65	20.63
8777.35	20.96:	20.60	21.30:	20.27	> 21.3
8779.37	21.07	21.16	20.69	21.24	> 21.6

Table 9 (Continued)

Julian Day	V23	V24	B Magnitude V25	V26	V27
242,8780.37	21.29	21.09	20.82	21.09	21.67
8781.31	21.20	21.00	21.06	20.73	21.48
8782.34	21.03	21.29	21.30:	20.65	21.16
8783.34	20.98	21.07	21.30	21.13	21.37
8784.34	20.96	20.90	20.87	21.04	21.05
8785.34	21.12	21.07	21.61	>20.78	20.40
8786.34	21.21	20.90	21.36	20.89	20.27
9044.62	20.86	21.10	21.18:	21.10	21.19:
9112.48	20.67	21.03	21.00:	20.82	21.51
9136.41	20.77	20.90	21.07	21.13	21.45
9438.60	20.64	20.62	21.82	20.92	21.05
9786.59	20.73	20.73	20.45	20.93	20.45
9869.35	21.16	21.00	21.60	20.86	20.82
243,0175.51	20.18	20.97	21.74	21.04	21.40:
0497.63	21.13	21.25	21.28	20.78	21.00
1702.38	>21.46	20.94	22.08	20.77	21.46
1970.60	20.72	20.53	21.32	20.80	21.60::
1971.59	20.57	20.93	20.94	20.84	21.24:
2004.50	20.51	20.97	21.64	20.69	20.66
2313.62	20.27	20.91	21.68	20.99	<21.43
2389.44	20.64	20.48	20.96	20.72	21.24
3062.61	21.96	20.66:	21.33	20.85	21.13
3475.48	20.86	21.14	21.45	20.66	20.51
3536.39	21.49	21.23	21.09	20.72	20.87
3800.61	20.36	21.34	21.35	20.86	21.58
3830.55	20.71	21.25	21.55	20.85	20.91
4247.35	20.92	20.91	20.65	20.76	20.75
4248.38	20.93	21.09	21.00	20.65	21.48
4249.44	21.02	22.00:	22.00::	20.85	22.0 ::
4250.35	21.33	22.1 :	21.01	21.10	23.0 ::
4604.43	21.05	>21.0	23.0 ::	20.37:	22.16:
4622.38	20.85	21.20	21.28	20.76	21.50
4867.63	20.17	21.75	21.43	20.88	20.55
4954.43	20.30	21.18	22.09	20.89	21.58
4955.42	20.42	21.34	21.98	20.93	21.50
6402.55	20.88	21.43	21.66	>20.75	21.24
7460.56	19.82	>21.0	>21.0	>21.0	>20.5
7461.58	20.11	21.14	22.00	20.90	20.82
8120.65	21.00	21.35	21.06	20.76	20.63
8200.53	21.23	21.02	21.16	20.77	20.52

Table 9 (Continued)

Julian Day	V Magnitude V23	V24	V25	V26	V27
242,4357.38	18.30	>18.55	>18.7	18.70	>18.91
4378.41	19.05	19.65	>19.72	19.23	20.69
6158.56	18.36	>18.14	-	18.70	>19.5
243,3832.52	18.64	20.10	21.13	18.93	19.98
3833.53	18.68	20.18	20.46	18.93	20.21
3834.52	18.70	20.14	20.31	18.99	20.07
3835.52	18.80	20.05	20.30	18.99	20.11
3836.51	18.84	19.85	20.08	19.00	20.12
3863.44	18.98	20.14	20.12	19.00	19.99
3864.43	18.97	20.10	20.33	18.86	19.65
3865.43	18.98	19.98	20.30	18.87	19.57
3866.46	-	-	-	18.89	19.51
4247.39	18.92	20.09	20.51	18.82	20.21
4248.41	19.23	19.87	20.15	18.88	20.10
4250.39	19.13	19.79	20.38	18.85	20.23
4628.39	18.27	21.50 ::	20.18	19.51	>20.0
4868.63	17.91	20.02	20.50	18.95	19.86
4869.62	17.99	19.98	20.59:	19.00	19.66
4895.60	18.23	20.11	20.30	18.94	20.35
5312.45	18.98	20.04	20.81	18.97	20.24
6402.53	18.20	20.54	20.88	18.62	19.73
6723.62	18.46	20.25	20.67	18.73	20.26
7460.60	17.60	20.09	20.04	18.91	19.67
7461.61	17.67	19.62:	20.15	18.76	19.95

Table 9 (Continued)

Julian Day	V28	V29	B Magnitude V30	V31	V32
242,3611.5	20.45	19.21	19.83	20.44	20.81
3616.4	20.75::	19.79	>20.0	>20.0	>20.0
3616.5	21.69	19.58	20.68	20.01	21.11
3619.47	20.84	19.88	19.91	20.59	20.84
3619.50	20.98:	19.85	20.04	20.62	21.15
3638.37	20.24	18.84	20.82	20.72	21.17:
3638.51	20.02	18.87	20.67	20.92	20.55
3639.40	20.14	18.85	20.73	20.80::	20.46
3639.43	20.01	-	>20.3	-	>19.75
3639.48	-	18.76	>19.6	>21.5	20.25
3640.48	20.02	19.04	20.60:	20.89	20.19
3641.47	20.50	18.94	19.76	20.57	20.85
3647.35	20.48	20.06	20.42	20.43	20.72
3678.38	20.30	19.46	20.19	20.49	20.99
3697.31	19.05	21.27	19.72	20.56	21.18:
3698.33	19.16	20.62	19.73	20.73	20.28:
3969.52	20.94	19.79	19.72	20.33	21.58
3972.51	19.38	20.38:	19.71	20.59	20.65
3990.46	20.25	18.86	19.80	20.71	20.76
3994.46	20.41	19.28	20.09	21.00	20.83
3995.46	20.69	19.42	20.20	21.13	21.54:
3996.40	20.71	19.47	20.36	20.43	20.87
3996.44	>21.2	19.57	20.28	20.50	19.83
3997.40	20.85	19.53	20.56::	20.65	20.80:
3997.44	20.75	19.69	>20.2	19.98	21.49
3998.44	20.91	19.64	20.81	20.64	21.66
4002.38	20.71	20.09	19.82	20.23	21.09
4002.42	20.72	20.03	>19.8	>20.4	>20.8
4003.36	20.92	20.16	19.64	20.94	21.48
4003.40	20.74:	20.08	19.66:	20.40:	21.18
4004.37	20.56	20.20	19.76	20.44	20.65
4024.35	20.35	19.07	19.68	20.54	20.87
4025.35	20.34	19.16	19.79	21.86	20.72
4026.38	20.22	19.41	19.85	20.40	>20.4
4031.34	20.84	19.80	20.55	20.65	20.31
4032.33	20.52	19.90	20.56	20.82	20.55
4049.34	19.56	20.73	20.19	21.00	>21.6
4050.34	19.61	19.63	20.39:	20.39	20.46
4054.32	19.96	18.87	21.00:	20.76	20.89
4056.31	20.15	19.18	19.51	20.08	20.75

Table 9 (Continued)

Julian Day	B Magnitude V28	V29	V30	V31	V32
242,4057.32	20.04	19.33	19.62	20.44	20.37
4058.31	20.24	19.13	19.73	20.56	20.68
4059.31	21.32	19.61	19.92	20.34:	20.76
4085.31	19.77	18.67	20.75	20.36	20.96
4090.30	20.09	19.28	19.52	20.36	20.81:
4299.62	20.24	20.53	19.72	20.45	20.71
4318.62	20.23	19.26	19.75	20.49	20.48
4320.57	19.32	20.22	19.84	20.31	20.68
4379.35	20.85	19.55	20.69::	20.68	20.94
4379.35	> 20.6	19.66	-	> 20.4	> 20.3
4413.34	20.63:	19.96	21.03:	20.78:	20.93
4651.62	20.48	20.39:	20.46	20.44	20.75
4710.51	19.82	20.36	20.20	20.34	20.56
4764.33	20.82	20.04	19.96	20.46	20.54
4996.65	20.43	20.50	19.83	20.45	21.50
5025.60	20.11	20.31	20.50	20.30:	20.94
5035.57	20.61	20.54	20.51	20.26	21.50
5063.50	20.32	20.54	20.09	20.33	21.37
5064.40	20.24:	20.62	20.32	20.13	21.00
5064.61	20.39	20.55	20.01	20.34	20.86
5065.41	20.43	20.36	20.41:	20.16	21.02
5065.62	20.33	19.24	20.53	20.21	21.36
5150.31	20.05	20.49	20.02	20.42	20.87
5475.45	20.06	20.50	19.80	20.60	20.65
5856.38	19.97	23.0	19.51	20.53	20.70
6187.48	21.22	18.97	20.29	20.69	21.00
6481.62	19.97	19.57	20.44	20.64	20.50
6571.42	20.36	19.16	20.66	20.45	20.93
6888.50	19.43	18.98	20.69	20.36	20.70
6920.48	19.25	18.87	20.71	20.44	20.96
7241.52	19.75	19.46	19.68	> 20.4	20.86
7271.51	19.60	19.02	20.64	20.36	21.15
7335.36	19.85	18.99	20.57	20.53	21.11
7691.32	19.73	19.48	20.15	20.16	21.15:
7930.63	19.49	20.77	19.96	20.69	20.67
8393.40	20.34	19.84	20.83	20.24:	20.75
8691.57	19.39	20.47	19.76	20.44	20.88
8749.46	20.90	20.14	20.13	20.27	20.81
8777.35	20.25	19.92	19.98:	20.38	20.54
8779.37	20.62	20.12	19.74	20.27	20.74

Table 9 (Continued)

Julian Day	V28	V29	B Magnitude V30	V31	V32
242,8780.37	20.78	20.33	19.83	20.26	20.68
8781.31	20.61	20.36	20.17	20.35	20.90
8782.34	20.70:	20.35	20.44	21.00	20.74
8783.34	20.83	20.45	20.71	20.41	20.76
8784.34	21.14	20.98	20.46	20.49	20.78
8785.34	21.10	20.63	20.57	20.38	20.57
8786.34	21.22	20.50	20.64	20.42	20.62
9044.62	19.99	20.42	20.46	20.66	20.92
9112.48	19.66	19.73	20.67	20.47	21.97
9136.41	20.85	20.31	20.49	20.38	20.72
9438.60	20.69	19.25	20.60	20.71	20.85
9786.59	20.57	19.79	20.60	20.39	20.65
9869.35	19.04	20.66	19.69	20.54	20.72
243,0175.51	20.64	19.81	19.84	20.70	20.88
0497.63	19.60	20.07	20.68	20.96	21.30
1702.38	20.70	19.50	-	20.60	20.82
1970.60	20.75	20.36	20.61	21.13	20.88
1971.59	20.71	20.76	20.33	20.64	20.45
2004.50	20.81	20.44	20.28	20.26	20.52
2313.62	21.54	20.36	19.78	20.41:	20.82 :
2389.44	20.61	20.60	19.87	20.84	21.05
3062.61	19.67	18.81	19.91	20.30	21.00:
3475.48	19.23	18.90	20.65	20.56	20.99
3536.39	20.91	20.56	20.27	20.62	20.89
3800.61	20.24	19.42	-	20.51	21.33
3830.55	20.02	19.68	20.30	20.73	21.18
4247.35	20.08	19.41	20.80	20.98	21.38
4248.38	20.24:	19.73	20.64	20.95	20.73
4249.44	20.20	19.73	20.44	20.59	20.90
4250.35	20.20	19.80	21.68	20.86	20.74
4604.43	20.56	20.36	20.11	21.67:	19.62:
4622.38	19.46	18.68	19.62	20.72	20.81
4867.63	19.87	20.57	20.43	20.43	20.72
4954.43	20.80	20.08	20.37	20.67	20.60
4955.42	21.11	19.80	-	20.75	20.72
6402.55	20.42::	-	19.92	20.71	21.16
7460.56	19.12	19.20	19.91	>21.4	>20.9
7461.58	19.20	18.73	20.40	21.85	<21.3
8120.65	20.79	20.16	20.57	20.50	21.38
8200.53	20.15	19.89	19.80	<20.6	21.23

Table 9 (Concluded)

Julian Day	V28	V29	V30	V31	V32
242,4357.38	18.49	>18.6	>18.6	18.15	>18.4
4378.41	19.52	18.58	19.97	18.42	18.76
6158.56	18.33	>18.2	>19.5	18.61	18.45
243,3832.52	18.78	18.50	19.96	18.52	18.76
3833.53	18.79	18.46	20.04	18.40	18.82
3834.52	18.92	18.58	20.10	18.51	18.87
3835.52	18.96	18.61	19.97	<18.63	18.88
3836.51	18.96	18.65	19.73	18.55	18.87
3863.44	18.67	18.51	19.71	18.55	18.84
3864.43	18.74	18.51	19.95	18.56	18.89
3865.43	18.76	18.52	20.04	18.61	18.91
3866.46	-	18.62	20.07	-	-
4247.39	18.73	18.60	20.02	18.74	18.70
4248.41	18.88	18.50	-	18.80	18.71
4250.39	18.80	18.56	19.91	18.62	18.60
4628.39	18.86	18.51	19.99	18.64	18.03
4868.63	18.67	19.44	-	>18.16	18.05
4869.62	18.73	19.49	20.01	18.22	18.03
4895.60	18.53	18.99	19.41	18.36	18.17
5312.45	18.39	19.16	19.49	18.52	18.73
6402.53	19.09	-	19.54	18.27	18.12
6723.62	19.32	18.54	-	18.47	18.03
7460.60	18.54	18.46	19.53	18.27	18.09
7461.61	18.49	18.46	19.80:	18.25	18.33

Table 10. NON-REGULAR VARIABLES

Star	$\overline{V}$	$\overline{B}$	$(B-V)_o$	ΔB	ΔV	Type of Variation*
V14	17.82	20.21	2.12	1.3	1.1	Long
V18	17.07	19.44	2.10	0.54	0.62	Semi-regular; P=228.3
V32	18.53	20.86	2.06	1.3	0.9	Medium
V12	17.74	19.99	1.98	1.57	1.81	Semi-regular; P~ 640
V19	17.49	19.69	1.93	0.95	1.05	Eclipsing Binary (?); P = 2670
V23	18.56	20.76	1.93	1.2	1.6	Medium
V31	18.47	20.56	1.82	1.1	0.5	Medium
V22	19.04	21.05	1.74	1.5	2.3	Medium - Long
V15	17.97	19.97	1.73	0.9	0.7	Long
V26	18.92	20.84	1.65	1.1	0.8	Medium
V27	19.97	21.06	0.82	1.5	0.8	Medium
V24	20.03	21.00	0.70	0.8	0.9	Short
V25	20.41	21.30	0.62	1.4	0.8	P = 13.33 (?)
V10	20.28	21.11	0.56	1.8	1.8	Medium - Long
V 9	19.93	20.68	0.48	1.4	0.7	Short
V 8	20.67	20.63	-0.31	0.9	0.7	Short
V11	21.22	21.11	-0.38	0.8	0.9	Short

NOTES:

* Type of Variation: Long ~ 2500^d
Medium ~ 30
Short ~ 3

Table 11. PROPERTIES OF THE CEPHEID VARIABLES

Star	P	log P	< V >	< B >	$<(B-V)^o>_{mag}$	ΔV	ΔB	(m-M)*
V13	$90^d.682$	1.957	17.75	19.05	1.08	0.84	1.35	0.35
V 7	65.45	1.816	17.56	18.70	0.90	0.58	1.04	0.29
V 2	37.4432	1.573	18.52	19.62	0.89	0.76	1.48	0.27
V28	34.6672	1.540	18.85	20.03	1.02	0.96	1.96	0.19
V29	31.835	1.503	18.80	19.72	0.75	1.20	1.90	0.17
V 1	30.4994	1.484	19.02	20.05	0.88	1.08	2.03	0.23
V 3	29.2111	1.466	19.32	20.38	0.86	1.30	1.70	0.25
V 6	21.1450	1.325	19.87	20.54	0.50	0.87	1.91	0.24
V17	19.2968	1.285	19.22	20.58	1.18	1.22	1.80	0.28
V21	17.457	1.242	19.76	20.57	0.59	0.81	1.37	0.25
V 4	17.3471	1.239	19.67	20.35	0.50	1.25	1.82	0.38
V 5	13.3550	1.126	19.98	20.87	0.68	0.86	1.48	0.43
V30	10.9039	1.038	19.73	20.15	0.18	0.82	1.14	0.32

NOTES:

* (m-M) is the fraction of the period from minimum to maximum (B curve).

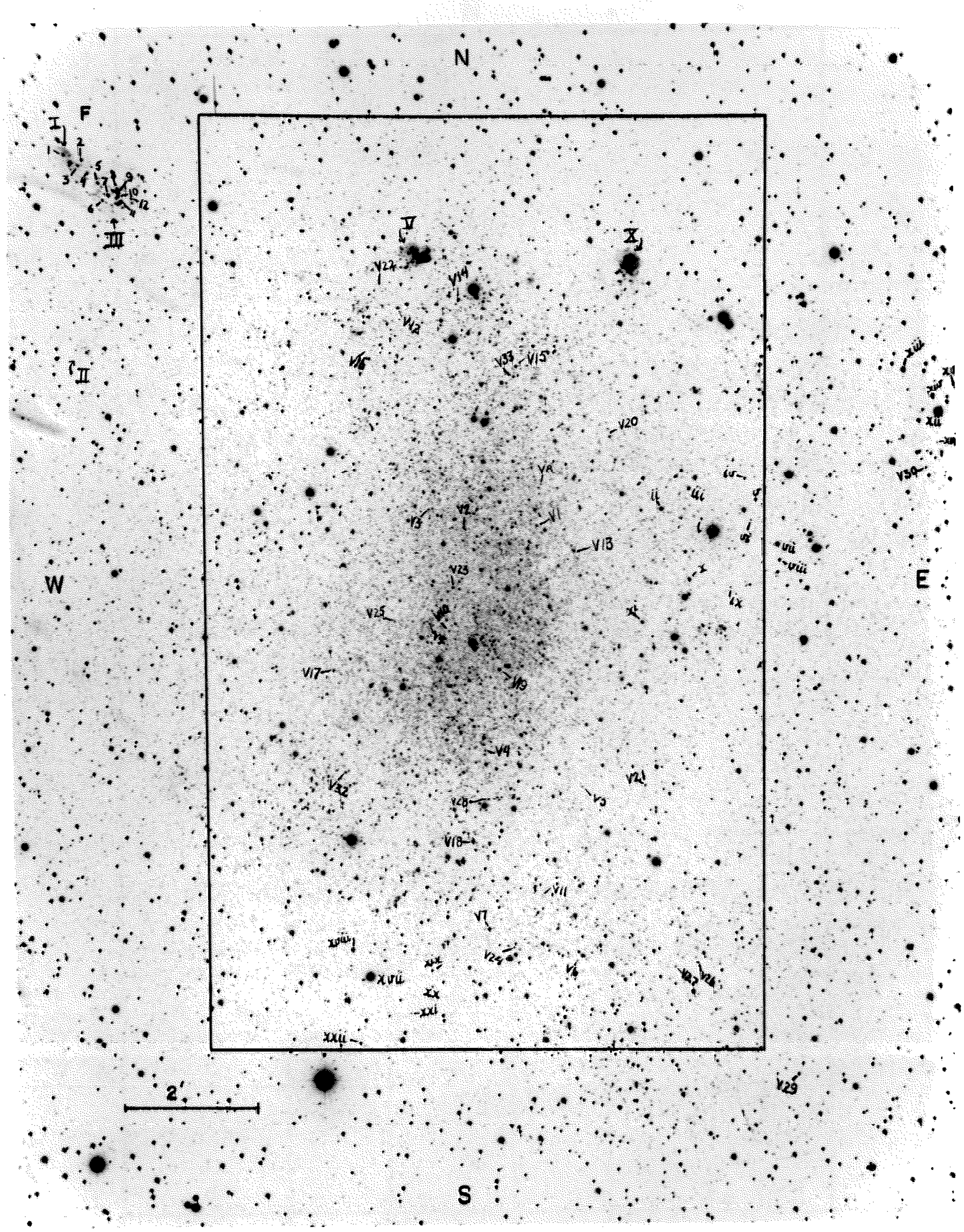

Plate I. NGC 6822: the Variable Stars and the Photoelectric Standards. (Large roman numerals are emission regions.)

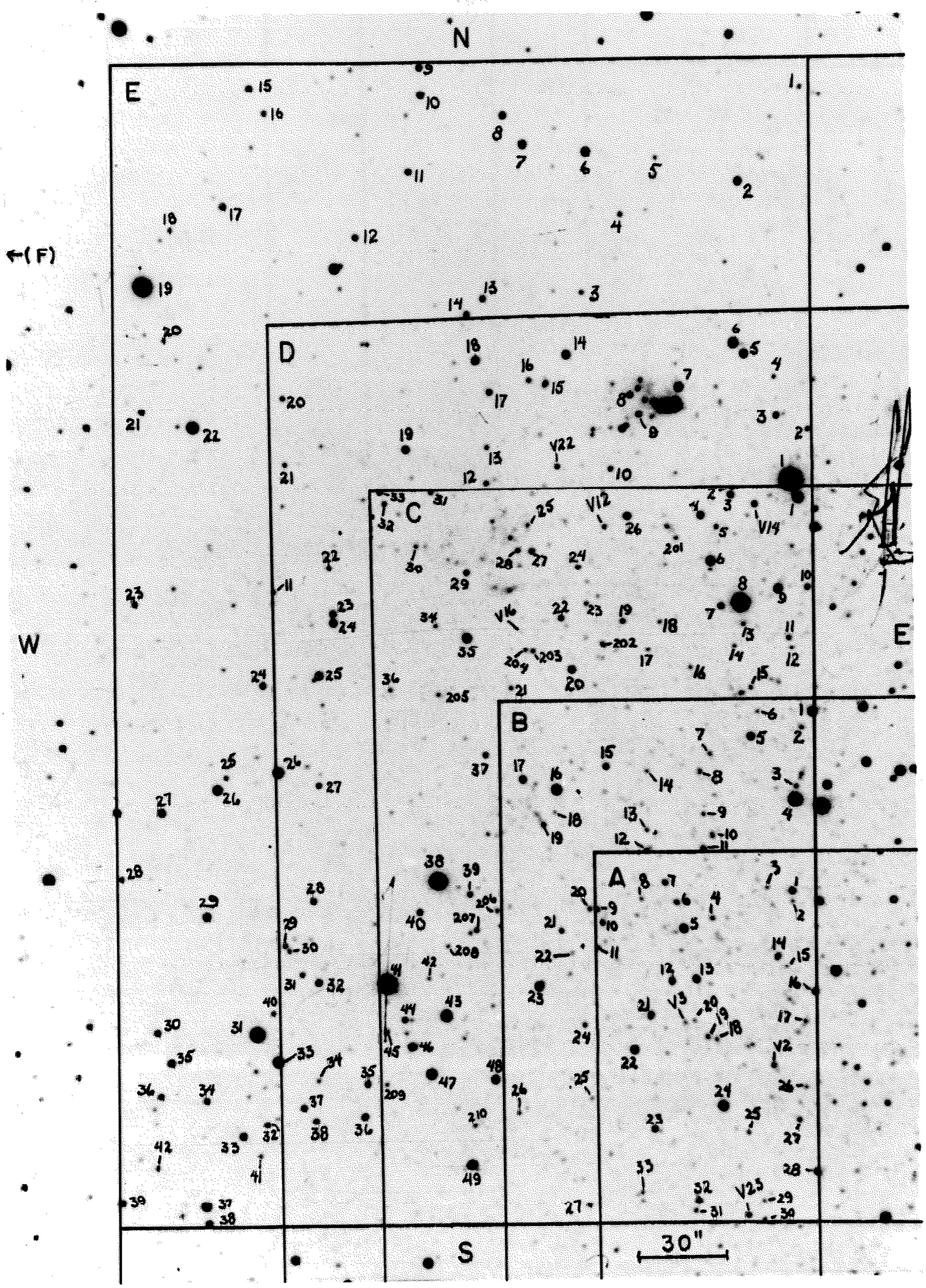

Plate II. NGC 6822: the Northwest Quarter.

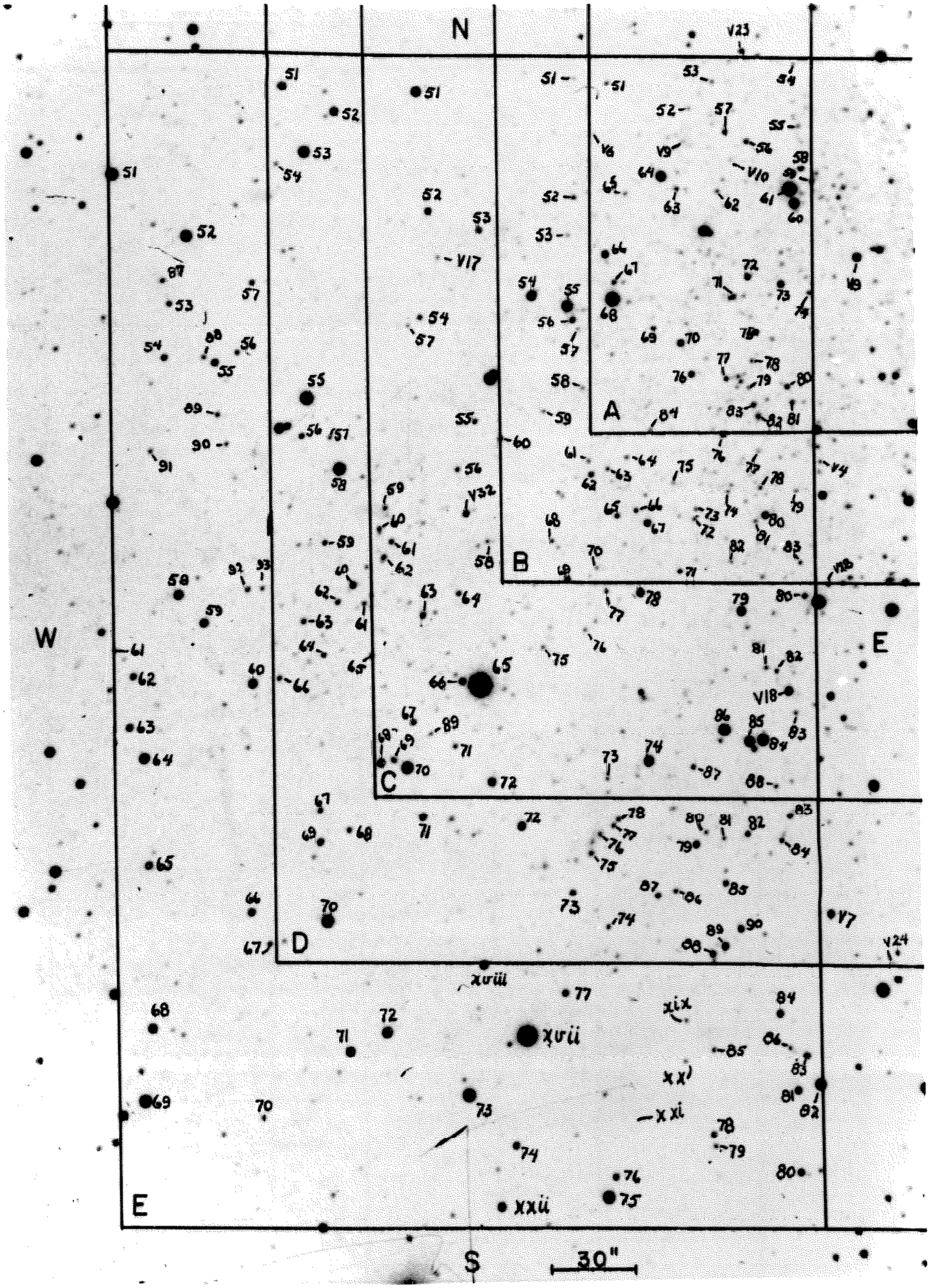

Plate III. NGC 6822: the Southwest Quarter.

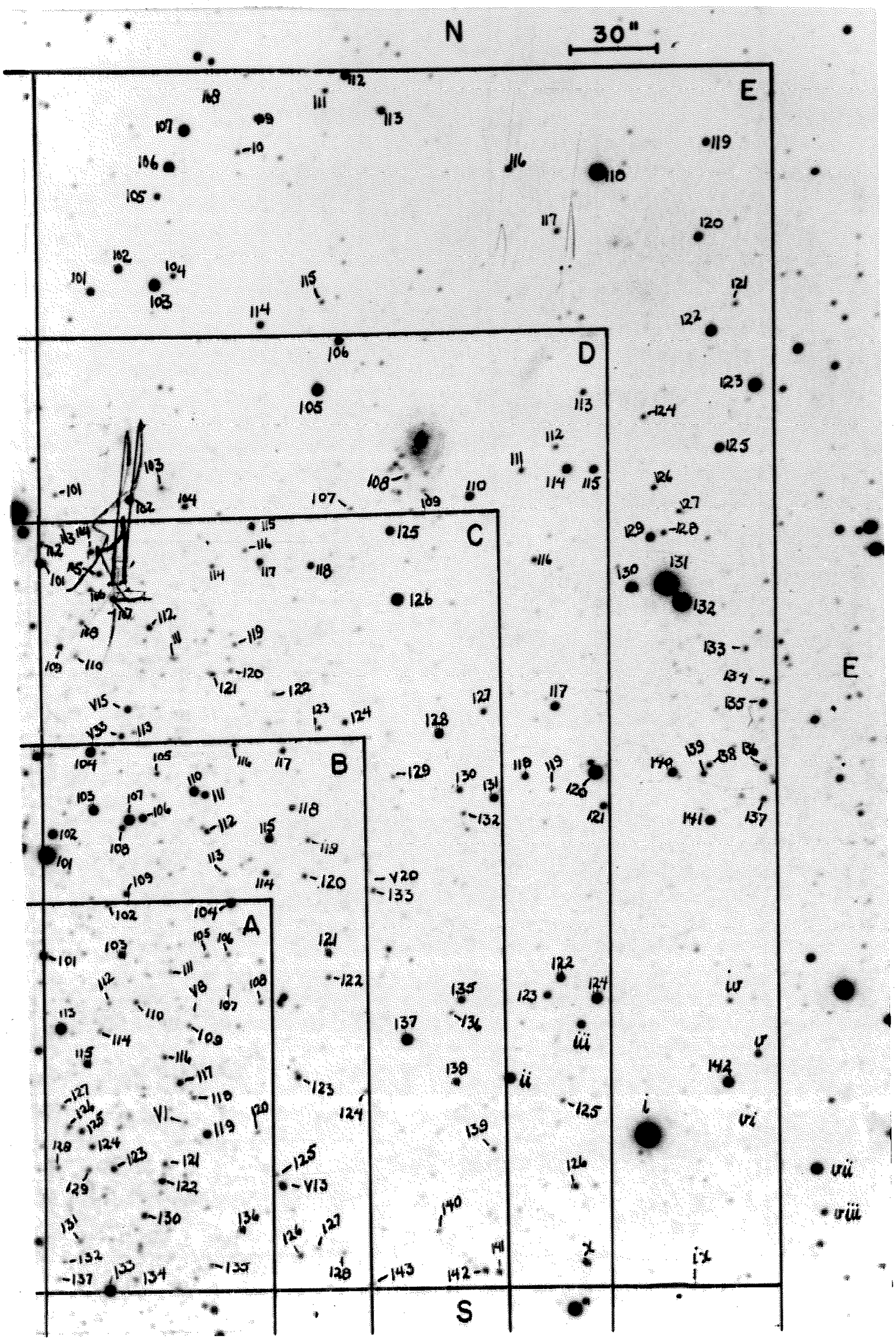

Plate IV. NGC 6822: the Northeast Quarter.

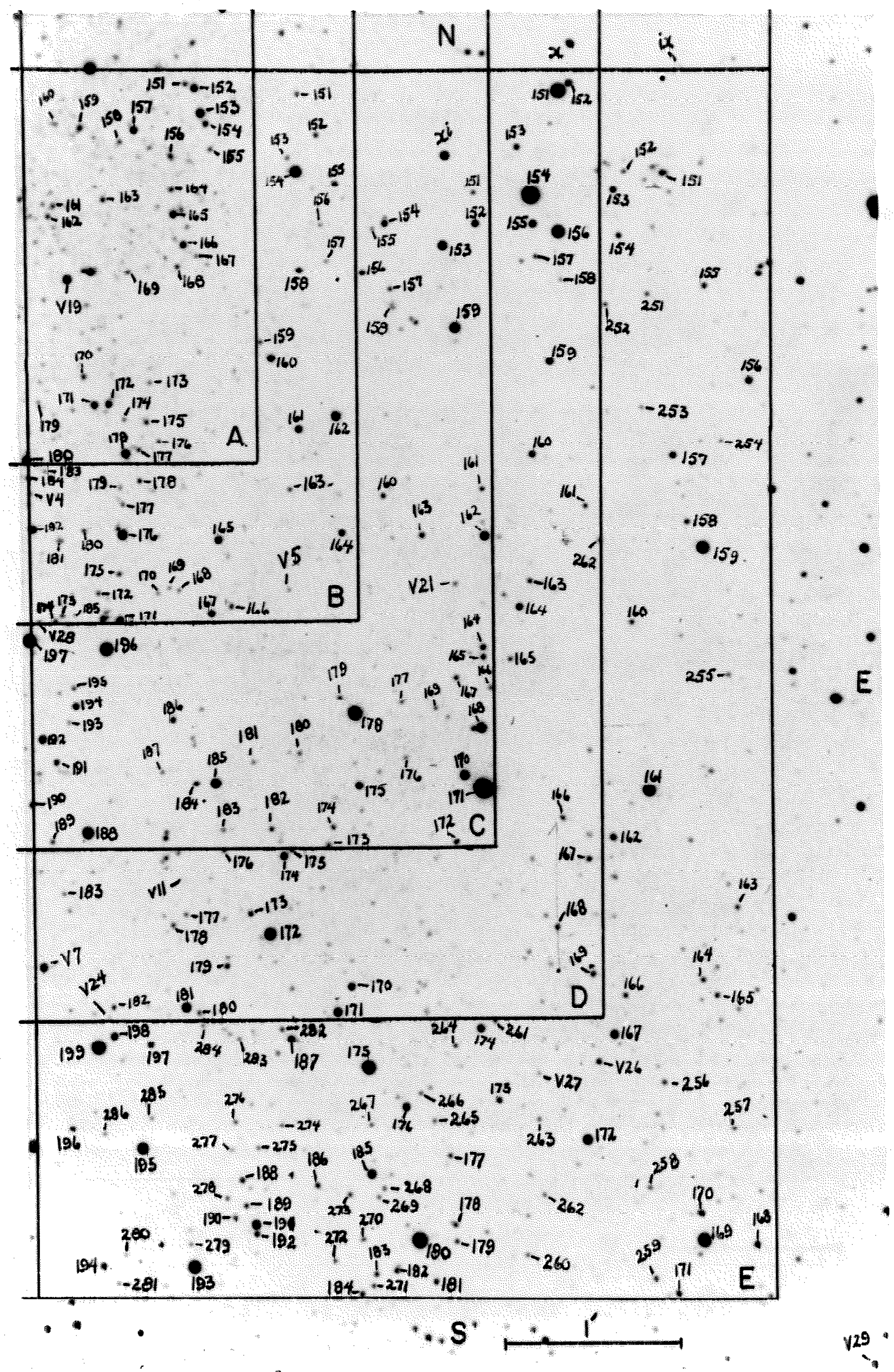

Plate V. NGC 6822: the Southeast Quarter.

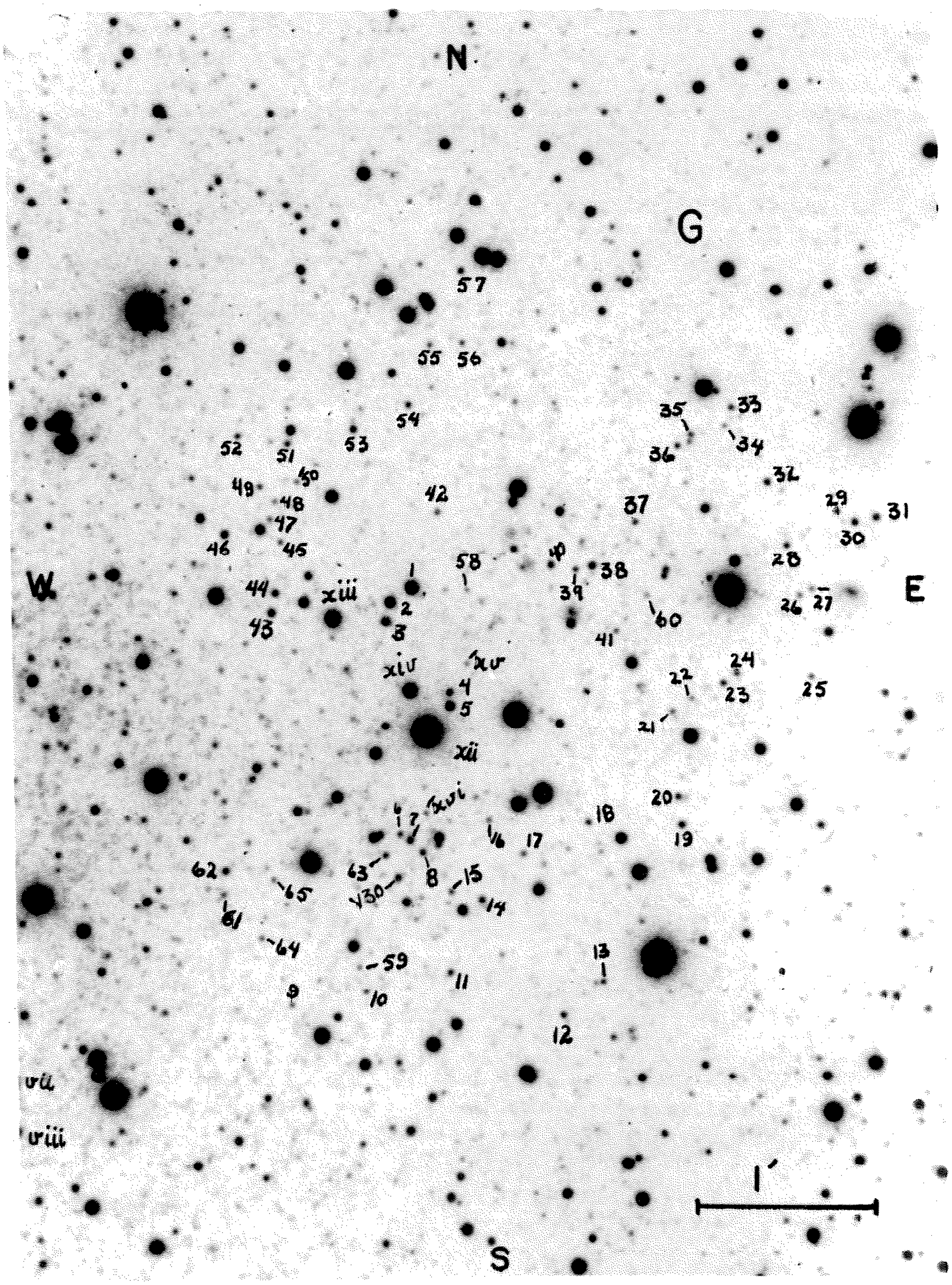

Plate VI. NGC 6822: the Eastern Extension (G).

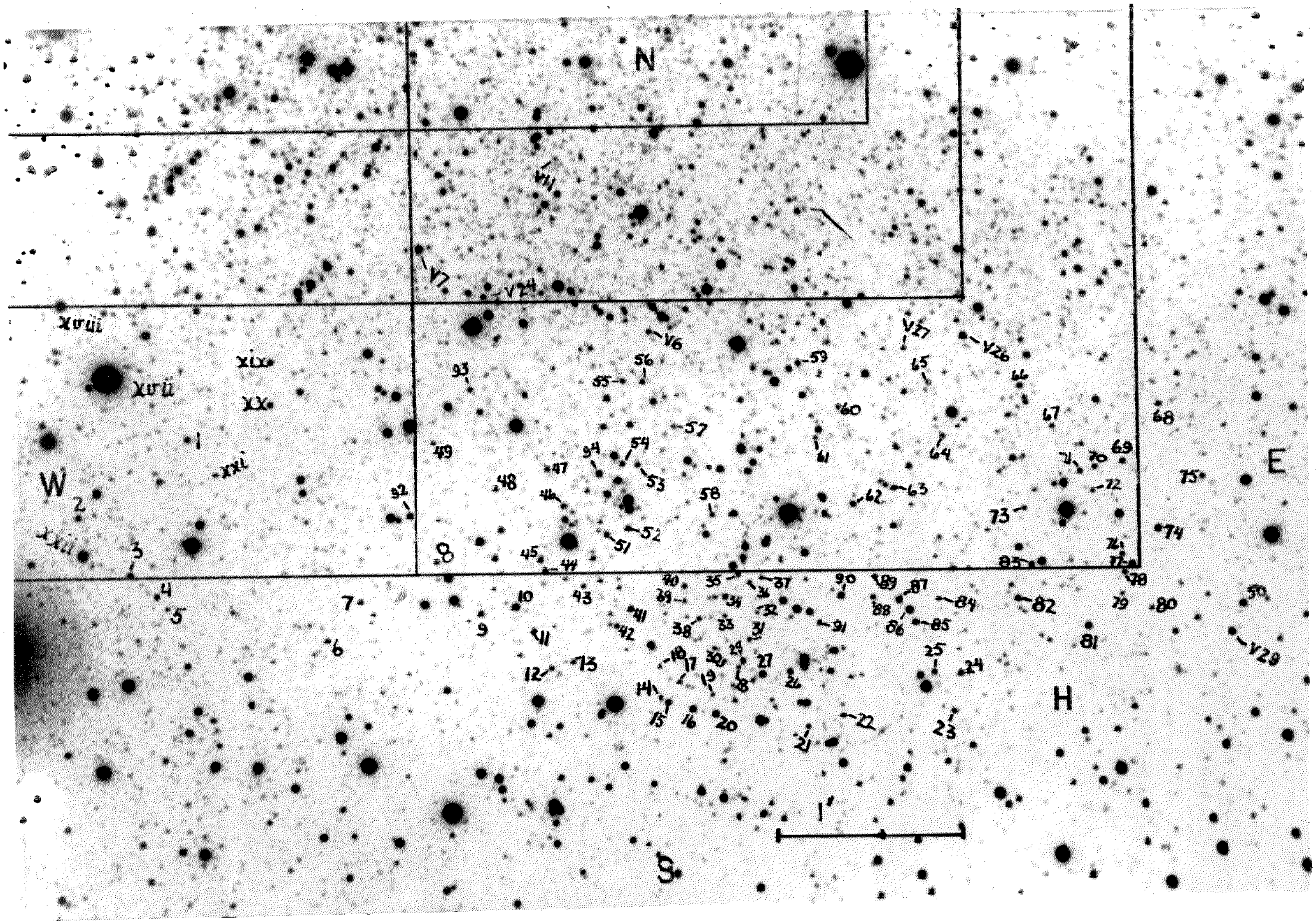

Plate VII. NGC 6822: the Southern Extension (H).