# NARROW- AND BROAD-BAND PHOTOMETRY OF RED STARS
## I. NORTHERN GIANTS*

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ABSTRACT

A total of 1300 observations in the *UBV* system have been obtained for 370 stars mostly later than K5, north of −10° and brighter than 6.5 mag (visual). An additional 1000 observations of 260 of these stars were made using a 7102 photomultiplier and narrow-band filters centered near 6250, 6500, and 10200 Å. Also, 100 *UBV* and 150 narrow-band observations were made of 41 fainter, known variables mostly of the semiregular and long-period types. The narrow-band magnitudes and colors are referred to as follows: (102), the magnitude at 10200 Å; (65,62), the magnitude difference between the band passes at 6250 Å, which contains a strong TiO bandhead and 6500 Å which does not; and (102,65), the magnitude difference between the 10200 and 6500 Å band passes, both of which are relatively free of TiO and terrestrial water-vapor absorption.

The relation between the infrared luminosity, $M(102)$, and the continuum color (102,65) for values of (102,65) redder than about −1.6 mag (black-body $T_e$ = 6000° K) is found to be the same for young disk (Hyades group) and old disk (Wolf 630 group, M67) giants. The reddest halo giants (M13, M5, M92) are at (102,65) ≈ −1.0 mag (black-body $T_e$ = 4200°) and at a given temperature are about 2.5 mag brighter than the disk giants.

The TiO absorption in disk giants is the same as in the supergiants but less than half that in the main-sequence stars of the same temperature.

The red instability region for disk stars begins near (102,65) = −0.1 mag (black-body $T_e$ = 2800). The young disk variables show a well-defined period-temperature relation.

The space motions indicate that the brightest red stars are about equally divided between young and old disk populations.

### I. PROGRAM

Most of the stars north of $\delta = -10°$ and classified as of type M0 or later in the *Bright Star Catalogue* are listed in Table 1; a small selection of K-type giants is also included. These stars have been observed in the *UBV* system mainly with the 20-inch reflector on Palomar Mountain. The narrow-band red and infrared photometry was obtained in the first 6 months of 1966 with an RCA 7102 photomultiplier on the 20-inch reflector and on the 60-inch Mount Wilson reflector. The interference filters (Baird Atomic, type "B") were selected (Jones 1965) to give two regions near 1 and 0.65 $\mu$ that were free of TiO bandheads and atmospheric water vapor and one region, near 0.625 $\mu$, that is centered on a strong TiO bandhead. The transmission characteristics of the filters and the response curve of the photomultiplier are shown in Figure 1. The magnitude difference measured through the filters (62) and (65) [hereinafter referred to as "(65,62)"] is a measure of the TiO absorption and that measured through filters (102) and (65) [referred to hereinafter as "(102,65)"] measures the continuum color.

Table 1 contains the following information:

HR: The number in the *Bright Star Catalogue* (*BSC*).

$V_E$, $B - V$, $U - B$: The results of the *UBV* photometry.

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TABLE 1

PHOTOMETRY OF BRIGHT RED STARS

| HR | $V_E$ | B−V | U−B | (102) | (65,62) | (102,65) | n,n | E ($0^m.01$) | δ(65,62) ($0^m.01$) | Sp.T. | M(102) | U | V | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | $4^m.81$ | $+1^m.58$ | $+1^m.92$ | | | | 3 | | | M2 III | | | | |
| 46 | Var. | | | | | | 6,1 | 4 | | gM4 | $-3^m.7$ | +36 | -17 | - 3 |
| 48 | Var. | | | | | | 5 | | | gM1 | | | | |
| 90 | Var. | | | | | | 6,2 | | | S6 | (-5) | (-26 | - 9 | -17) |
| 103 | Var. | | | | | | 14 | | | M3 III | | | | |
| 117 | 5.74 | +1.54 | +1.88 | | | | 4 | | | MO III | | | | |
| 201 | 6.16 | +1.60 | +2.02 | | | | 4 | | | gMO | | | | |
| 211 | 5.32 | +1.60 | +1.76 | | | | 5 | | | gM4 | | | | |
| 248 | 4.75 | +1.56 | +1.91 | | | | 4 | | | MO III | | | | |
| 256 | 6.27 | +1.68 | +2.00 | | | | 3 | | | M1 | | | | |
| 259 | 6.23 | +1.61 | +1.75 | | | | 5 | | | gM7 | | | | |
| 284 | Var. | | | | | | 6 | | | gM2 | | | | |
| 337 | 2.03 | +1.58 | +2.01 | $-0^m.25$ | $+0^m.42$ | $-0^m.65$ | 4,2 | 0 | -3.5 | MO III | -2.9 | +20 | -24 | -14 |
| 341 | 5.80 | +1.46 | +1.82 | | | | 2 | | | gK5 | | | | |
| 355 | 6.11 | +1.64 | +2.03 | | | | 4 | | | gM1 | | | | |
| 363 | 6.43 | +1.70 | +1.87 | | | | 4 | | | M2S | | | | |
| 392 | 6.18 | +1.50 | +1.87 | | | | 2 | | | gMO | | | | |
| 450 | 5.94 | +1.48 | +1.8: | | | | 2 | | | gM2 | | | | |
| 564 | 5.85 | +1.57 | +1.89 | | | | 3 | | | gM2 | | | | |
| 587 | Var. | | | | | | 4,1 | 12 | | gM5 | -4.8 | +60 | -50 | +14 |
| 601 | 5.99 | +1.60 | +1.83 | | | | 3 | | | gM2 | | | | |
| 614 | Var. | | | | | | 3,1 | 9 | | M4 | -3.8 | -46 | - 3 | - 1 |
| 625 | 6.16 | +1.57 | +1.92 | | | | 2 | | | M1 | | | | |
| 631 | 5.70 | +1.64 | +1.91 | | | | 5 | | | gM3 | | | | |
| 648 | 5.70 | +1.56 | +1.94 | | | | 2 | | | MO III | | | | |
| 681 | Var. | | | | | | - | | | gM6e | | | | |
| 711 | 6.18 | +1.43 | +1.82 | | | | 2 | | | K5 | | | | |
| 736 | 5.16 | +1.47 | +1.77 | | | | 3 | | | K5 III | | | | |
| 750 | 5.39 | +1.64 | +1.93 | 2.55 | +0.52 | -0.24 | 5,1 | 4 | -3.5 | gM3 | -3.7 | + 6 | -44 | -20 |
| 758 | Var. | | | | | | 4,1 | 10 | | gM4e | (-6.5) | (+91 | -29 | -32) |
| 832 | Var. | | | | | | 6,1 | | | M4 III | -5.0 | -35 | -48 | + 1 |
| 843 | 4.56 | +1.53 | +1.92 | | | | 2 | | | K5 III | | | | |
| 867 | Var. | | | | | | 8,2 | | | gM6 | -5.45 | -28 | +26 | +40 |
| 877 | Var. | | | | | | 7,1 | 20 | | M2 | -4.4 | +63 | +22 | - 9 |
| 904 | Var. | | | | | | 6,1 | 4 | | gM1 | -3.4 | +68 | - 6 | -49 |
| 911 | 2.49 | +1.62 | +1.95 | 0.06 | +0.49 | -0.43 | 5,2 | 0 | -2.5 | M2 III | -3.3 | -26 | -14 | + 7 |
| 921 | Var. | | | | | | 5,2 | 9 | | M4II-III | -4.4 | +56 | -48 | -18 |
| 935 | 5.26 | +1.59 | +1.79 | | | | 4 | | | gM3 | | | | |
| 940 | 6.30 | +1.53 | +2.09 | | | | 1 | | | gMO | | | | |
| 949 | 6.30 | +1.43 | +1.65 | | | | 2 | | | K5 III | | | | |
| 955 | 6.04 | +1.67 | +1.92 | | | | 2 | | | gM1 | | | | |
| 973 | 6.21 | +1.68 | +2.00 | | | | 2 | | | gM2 | | | | |
| 1003 | Var.? | | | 0.73 | +0.60 | +0.01 | 1 | 0 | -3 | gM3 | -4.0 | +39 | -17 | -21 |
| 1009 | 5.14 | +2.00 | +2.06 | | | | 2 | | | MO III | | | | |
| 1032 | 6.32 | +1.80 | +1.88 | | | | 2 | | | M1 | | | | |
| 1105 | 5.06 | +1.63 | +1.81 | | | | 3 | | | S5 | | | | |
| 1155 | Var.? | | | | | | 5,1 | 2 | | M2 II | (-6.0) | (- 1 | - 2 | - 8) |
| 1162 | 4.40 | +1.61 | +1.96 | | | | 4 | | | gM2 | | | | |
| 1231 | 2.91 | +1.58 | +1.96 | 0.80 | +0.42 | -0.71 | 8,1 | 0 | -2 | MO III | -2.8 | +28 | -49 | -41 |
| 1335 | 5.41 | +1.50 | +1.81 | | | | 3 | | | gMO | | | | |
| 1409 | | | | 2.59 | +0.225 | -1.43 | 1 | 0 | - | KO III | -0.5 | +12 | -17 | - 3 |
| 1451 | 5.12 | +1.69 | +1.99 | | | | 4 | | | gM3 | | | | |
| 1457 | | | | -1.16 | +0.405 | -0.775 | 2 | 0 | - | K5 III | -2.5 | +48 | -17 | -24 |
| 1496 | 4.30± | +1.59 | +1.80 | 1.58 | +0.59 | -0.12 | 6,1 | 0 | -1 | gM4 | -3.9 | -59 | -27 | +16 |
| 1527 | 5.41 | +1.55 | +1.76 | 2.34 | +0.61 | +0.04 | 4,2 | 3 | -2 | gM2 | -4.2 | +29 | -98 | -30 |
| 1556 | Var. | | | | | | 8,1 | 6 | | M3S | -4.4 | -19 | -33 | -25 |
| 1562 | 5.35 | +1.62 | +1.90 | | | | 3 | | | gM1 | | | | |
| 1572 | 6.04 | +1.55 | +1.86 | | | | 3 | | | K5 III | | | | |
| 1607 | Var. | | | | | | 4 | | | C7e | | | | |
| 1648 | Var. | | | | | | 6,3 | 6 | | C5 | -4.5 | +12 | -12 | - 8 |
| 1693 | Var. | | | | | | 5,1 | 12 | | gM6 | -5.5 | +76 | - 1 | +24 |
| 1707 | Var. | | | | | | 3,4 | (10) | | gM7e | (-6.5) | (+34 | -54 | +13) |
| 1722 | 5.64± | +1.58 | +1.62 | 1.90 | +0.71 | +0.53 | 8,2 | 9 | -4 | gM4 | -4.6 | -27 | -50 | +18 |
| 1802 | 5.44 | +1.70 | +2.02 | | | | 2 | | | gM1 | | | | |
| 1816 | 5.28 | +1.58 | +2.00 | | | | 4 | | | gM1 | | | | |
| 1844 | 6.14 | +1.60 | +1.95 | | | | 2 | | | gMO | | | | |
| 1845 | Var. | | | | | | 2,3 | 30 | | M2Ib | -8.0 | +22 | - 3 | - 7 |
| 1866 | 5.69 | +1.63 | +1.98 | 3.46 | +0.445 | -0.65 | 2,2 | 1 | -0.5 | gMO | -2.9 | +25 | -12 | - 5 |

TABLE 1 (CONT'D)

| HR | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) | n,n | E (0$^m$.01) | δ(65,62) (0$^m$.01) | Sp.T. | M(102) | U | V | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1885 | 6$^m$.10 | +1$^m$.56 | +1$^m$.90 | | | | 2 | | | gMO | | | | |
| 1939 | Var. | | | | | | 5,2 | 25 | | M1 | -3$^m$.8 | + 5 | - 2 | +11 |
| 1977 | Var. | | | | | | 8,4 | 6 | | C7e | -4.5 | +15 | - 9 | -12 |
| 2011 | 4.73 | +1.61 | +1.90 | 2$^m$.38 | +0$^m$.45 | -0$^m$.59 | 5,Std | 5 | -1 | gM1 | -2.9 | +42 | -43 | +14 |
| 2018 | 6.24 | +1.76 | +2.00 | 3.32 | +0.59 | -0.06 | 3,1 | 5 | -1 | M3 III | -3.9 | +102 | + 6 | + 8 |
| 2061 | Not obs. | | | | | | | | | M2Iab | | | | |
| 2063 | Var. | | | | | | 2,1 | (10) | | gM8e | (-6.5) | (-29 | -24 | -72) |
| 2091 | Var. | | | | | | 6,3 | (12) | | M3 II | - | - | - | - |
| 2146 | 6.04 | +1.66 | +1.81 | | | | 6 | | | M3 II | | | | |
| 2168 | 5.26 | +1.66 | +1.95 | | | | 2 | | | gM2 | | | | |
| 2190 | Var. | | | | | | 3,3 | 50 | | M1Iab | See Section VII | | | |
| 2197 | Var. | | | | | | 5,1 | | | M1Ia | See Section VII | | | |
| 2215 | 4.98± | +1.83 | +1.96 | 1.66 | +0.615 | +0.14 | 5,2 | 2 | -5.5 | gM3 | -4.3 | +11 | + 2 | + 3 |
| 2216 | Var. | | | | | | 8,3 | 2 | | M3 III | | | | |
| 2268 | 6.05 | +1.66 | +1.97 | | | | 3 | | | gM1 | | | | |
| 2269 | 5.66 | +1.57 | +1.95 | 3.61 | +0.415 | -0.78 | 3,3 | 5 | +1 | gMO | -2.6 | + 6 | - 4 | + 1 |
| 2275 | 4.91 | +1.59 | +1.95 | | | | 5 | | | gM1 | | | | |
| 2286 | 2.88± | +1.65 | +1.85 | 0.22 | +0.58 | -0.215 | 8,2 | 0 | +1 | M3 III | -3.8 | +49 | -46 | + 4 |
| 2289 | 4.91 | +1.96 | +2.14 | | | | 2 | | | MOIab | | | | |
| 2308 | Var. | | | | | | 8,4 | 6 | | C6 | -4.5 | +12 | - 6 | - 6 |
| 2355 | 6.15 | +1.52 | +1.82 | | | | 3 | | | M1 | | | | |
| 2406 | 5.88 | +1.50 | +1.79 | | | | 2 | | | gK5 | | | | |
| 2419 | 5.68 | +1.34 | +1.56 | | | | 2 | | | gK5 | | | | |
| 2458 | 6.20 | +1.67 | +2.03 | | | | 3 | | | M1 | | | | |
| 2459 | 5.00 | +1.50 | +1.81 | | | | 4 | | | K5 III | | | | |
| 2469 | 5.20 | +1.52 | +1.89 | | | | 2 | | | gMO | | | | |
| 2508 | 5.05 | +1.80 | +1.88 | | | | 4 | | | M1 II | | | | |
| 2533 | 5.68 | +1.47 | +1.96 | | | | 4 | | | gK5 | | | | |
| 2609 | 5.00 | +1.59 | +1.90 | 2.50 | +0.48 | -0.50 | 5,3 | 2- | -1 | gM2 | -3.2 | +10 | -22 | -31 |
| 2631 | Var. | | | | | | 6,2 | 12 | | M1 | -4.1 | +22 | +12 | +35 |
| 2635 | 5.94 | +1.65 | +1.92 | 3.50 | +0.485 | -0.51 | 5,4 | +0.5 | | gM2 | -3.1 | +30 | -22 | - 3 |
| 2639 | 5.19 | +1.66 | +1.98 | | | | 5 | | | gM2 | | | | |
| 2663 | 5.80 | +1.50 | +1.90 | | | | 4 | | | gMO | | | | |
| 2671 | Var. | | | | | | 2,2 | | | S3e | - | - | - | - |
| 2703 | 5.47 | +1.64 | +1.90 | | | | 2 | | | gM3 | | | | |
| 2717 | Var. | | | | | | 10,4 | 4 | | M4 III | -4.3 | -21 | -32 | - 8 |
| 2725 | 5.80 | +1.55 | +1.80 | | | | 4 | | | M1 III | | | | |
| 2738 | 5.72 | +1.59 | +1.93 | | | | 2 | | | gM1 | | | | |
| 2742 | Var. | | | | | | 10,4 | 5 | | gM4 | -4.7 | +38 | -17 | + 8 |
| 2747 | 5.83 | +1.58 | +1.74 | | | | 4 | | | gM4 | | | | |
| 2795 | 5.09 | +1.53 | +1.87 | | | | 3 | | | gMO | | | | |
| 2804 | 5.80 | +1.61 | +1.96 | | | | 2 | | | gK5 | | | | |
| 2865 | 5.60 | +1.48 | +1.75 | | | | 4 | | | gK5 | | | | |
| 2902 | 5.03 | +1.45 | +0.18 | | | | 2 | | | M2I+B | | | | |
| 2903 | 5.68 | +1.58 | +1.58 | | | | 2 | | | gMO | | | | |
| 2905 | 4.05 | +1.54 | +1.66 | 2.04 | +0.40 | -0.88 | 3,1 | 0 | +1 | MO III | -2.5 | -16 | -30 | -32 |
| 2915 | 6.36 | +1.59 | +1.94 | | | | 2 | | | M1 | | | | |
| 2929 | 6.10 | +1.44 | +1.66 | | | | 2 | | | gK5 | | | | |
| 2935 | 5.78 | +1.64 | +1.95 | | | | 2 | | | gMO | | | | |
| 2938 | 5.06 | +1.56 | +1.92 | | | | 2 | | | gMO | | | | |
| 2965 | 5.81 | +1.67 | +1.99 | | | | 3 | | | M1 | | | | |
| 2967 | 5.52 | +1.61 | +1.66 | | | | 2 | | | M35 | | | | |
| 2983 | 5.32 | +1.51 | +1.87 | | | | 4 | | | K5 III | | | | |
| 2999 | 5.18 | +1.58 | +1.94 | | | | 4 | | | gM3 | | | | |
| 3003 | 4.90 | +1.45 | +1.76 | | | | 4 | | | K5 III | | | | |
| 3013 | 5.14 | +1.59 | +1.90 | | | | 3 | | | gMO | | | | |
| 3027N | 6.40 | +1.70 | +1.90 | | | | 2 | | | G8Iab | | | | |
| 3027S | 6.33 | +1.78 | +1.90 | | | | 2 | | | M2II-III | | | | |
| 3061 | Var. | | | | | | 6,2 | 5 | | M4 | -4.5 | -129 | -70 | -10 |
| 3169 | Var. | | | | | | 5,1 | 5 | | gM3 | -3.6 | +20 | -26 | + 2 |
| 3236 | 6.03 | +1.50 | +1.46 | 3.84 | +0.365 | -0.765 | 1,2 | 6 | -4.5 | gMO | -2.6 | +17 | -13 | +13 |
| 3246 | 6.28 | +1.57 | +1.91 | 4.12 | +0.405 | -0.743 | 3,2 | 9 | 0 | K5 | -2.6 | +41 | -29 | - 1 |
| 3248 | Var. | | | | | | 9,5 | 4 | | gM7e | -6.0 | +15 | -37 | + 7 |
| 3287 | 6.02 | +1.59 | +1.94 | 3.98 | +0.385 | -0.795 | 3,3 | 5 | -2 | gK5 | -2.6 | +13 | 0 | +30 |
| 3290 | 6.16 | +1.52 | +1.54 | 4.11 | +0.44 | -0.725 | 1,3 | 0 | 0 | gM2 | -2.7 | -10 | -24 | - 3 |
| 3305 | | | | 4.20 | +0.34 | -0.93 | 2 | 4 | -2 | gK5 | -2.2 | | | |
| 3357 | 5.34 | +1.58 | +1.92 | 3.30 | +0.425 | -0.74 | 2,5 | 2 | 0 | gM1 | -2.7 | +48 | -52 | -26 |
| 3427 | | | | 5.58 | +0.22 | +1.52 | 1 | 2 | - | KO III | +0.1 | +38 | -20 | - 2 |
| 3428 | | | | 5.76 | +0.21 | -1.48 | 1 | 2 | - | KO III | +0.2 | +37 | -22 | 0 |

TABLE 1 (CONT'D)

| HR | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) | n,n | E ($0^m.01$) | δ(65,62) ($0^m.01$) | Sp.T. | M(102) | U | V | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3521 | Var. | | | | | | 6,2 | 5 | | gM3 | $-3^m.9$ | +21 | -12 | -13 |
| 3541 | Var. | | | | | | 5,7 | 4 | | C5 | -4.5 | + 1 | + 2 | - 1 |
| 3576 | $4^m.74$ | $+1^m.56$ | $+1^m.84$ | | | | 4 | | | M3 III | | | | |
| 3577 | 6.38 | +1.54 | +1.64 | $3^m.35$ | $+0^m.655$ | $+0^m.06$ | 6,4 | 2 | +1.5 | M4 III | -4.1 | +34 | -107 | -77 |
| 3618 | 6.20 | +1.63 | +1.92 | | | | 4 | | | M1 | | | | |
| 3639 | Var. | | | | | | 15,6 | 5 | | M6Se | (-5.6) | (+17 | -30 | - 6) |
| 3698 | Var. | | | | | | 5,6 | 5 | | gM4 | -4.5 | +21 | - 4 | +11 |
| 3705 | 3.14 | +1.54 | +1.94 | 1.19 | +0.375 | -0.845 | 4,Std | 0 | -2.5 | M0 III | -2.6 | +70 | - 2 | -17 |
| 3738 | 5.60 | +1.50 | +1.80 | | | | 2 | | | K5 III | | | | |
| 3769 | 5.40 | +1.81 | +1.81 | 3.37 | +0.41 | +0.805 | 3,2 | 0 | 0 | gM1 | -2.6 | +46 | -83 | - 3 |
| 3820 | 5.58 | +1.56 | +1.86 | 4.46 | +0.44 | -0.72 | 4,3 | 0 | +0.5 | gM2 | -2.8 | -27 | -48 | -14 |
| 3824 | 5.95 | +1.54 | +1.93 | 3.87 | +0.41 | -0.745 | 2,2 | 0 | -2 | K5 | -2.7 | +27 | -30 | +24 |
| 3850 | | | | 3.86 | +0.41 | -0.78 | 3 | 0 | -1 | gK6 | -2.6 | | | |
| 3866 | 5.38 | +1.60 | +1.95 | 3.20 | +0.47 | -0.63 | 3,2 | 0 | +1 | gM2 | -3.0 | - 1 | - 6 | + 7 |
| 3870 | | | | 2.10 | +0.60 | -0.03 | 3 | 0 | -2 | gM3 | -4.0 | 0 | +28 | 0 |
| 3876 | 5.82 | +1.63 | +1.96 | 3.62 | +0.47 | -0.63 | 2,3 | 0 | +1 | gM1 | -3.0 | -18 | -25 | - 4 |
| 3882 | Var. | | | | | | 7,12 | 5 | | gM8e | -6.0 | - 5 | -31 | + 1 |
| 3896 | 6.50 | +1.58 | +1.92 | 4.40 | +0.41 | -0.67 | 2,Std | 2 | -3.5 | gM0 | -2.8 | -34 | + 1 | +12 |
| 3915 | 5.97 | +1.65 | +1.90 | 3.50 | +0.52 | -0.425 | 3,2 | 2 | +1 | gM2 | -3.3 | + 2 | - 7 | - 6 |
| 3923 | 4.94 | +1.56 | +1.88 | | | | 4 | | | M1 III | | | | |
| 3939 | 5.50 | +1.48 | +1.82 | 3.66 | +0.35 | -0.93 | 2,3 | 0 | -3 | gK5 | -2.4 | + 8 | -27 | -15 |
| 3950 | 4.70 | +1.60 | +1.88 | 2.38 | +0.48 | -0.555 | 5,4 | 0 | 0 | M2 III | -3.1 | +18 | -27 | + 1 |
| 4008 | 6.20 | +1.62 | +1.9: | 3.83 | +0.45 | -0.605 | 2,4 | 2 | -1 | M0 III | -3.0 | -26 | - 8 | - 4 |
| 4035 | 5.44 | +1.60 | +1.64 | 3.33 | +0.45 | -0.71 | 2,3 | 0 | +1 | gM1 | -2.8 | + 9 | -16 | -11 |
| 4069 | 3.06 | +1.57 | +1.90 | 0.87 | +0.405 | -0.72 | 6,3 | 0 | -3 | M0 III | -2.8 | + 6 | + 3 | -29 |
| 4088 | 5.60 | +1.60 | +1.95 | 3.48 | +0.475 | -0.66 | 3,2 | 0 | +2 | gM3 | -2.9 | -32 | -17 | -22 |
| 4092 | 5.50 | +1.58 | +1.87 | | | | 5 | | | M0 III | | | | |
| 4127 | 5.45 | +1.70 | +2.04 | 3.15 | +0.49 | -0.56 | 3,3 | 0 | +1 | gM2 | -3.1 | +47 | - 6 | +18 |
| 4184 | Var. | | | | | | 5,3 | 1 | | gM5 | -4.0 | - 9 | -29 | +19 |
| 4195 | Var. | | | | | | 9,10 | 5 | | C6 | -4.5 | - 7 | - 4 | + 1 |
| 4202 | 6.36 | +1.57 | +1.90 | 4.02 | +0.47 | -0.60 | 2,3 | 4 | +1 | M1 III | -2.9 | +37 | -78 | + 3 |
| 4224 | 5.94 | +1.59 | +1.92 | 3.86 | +0.465 | -0.66 | 4,2 | 2 | +2 | gM2 | -2.8 | +15 | - 1 | - 1 |
| 4267 | Var. | | | | | | 10,10 | 5 | | M5 III | -5.5 | +10 | - 5 | -22 |
| 4278 | 6.00 | +1.60 | +1.90 | 3.40 | +0.525 | -0.36 | 2,3 | 5 | +0.5 | M2 III | -3.4 | -101 | -30 | +14 |
| 4284 | 5.88 | +1.62 | +1.91 | | | | 3 | | | gM2 | | | | |
| 4299 | 4.75 | +1.60 | +1.90 | 2.75 | +0.415 | -0.76 | 3,2 | 0 | -1 | K5 III | -2.7 | -20 | - 3 | -16 |
| 4333 | 5.81 | +1.49 | +1.53 | 2.34 | +0.605 | +0.37 | 5,Std | 4 | -11 | gM3.5 | -4.5 | +44 | -45 | + 3 |
| 4336 | 5.90 | +1.56 | +1.89 | 3.22 | +0.54 | -0.34 | 3,4 | 4 | +1 | M2 III | -3.4 | +60 | -34 | - 6 |
| 4362 | 4.63 | +1.65 | +1.81 | 1.91 | +0.535 | -0.265 | 4,3 | 1 | -2 | M3 III | -3.7 | +15 | -11 | +10 |
| 4371 | 5.18 | +1.52 | +1.81 | 3.39 | +0.415 | -0.89 | 2,2 | 2 | +3 | M0 III | -2.4 | -84 | -27 | -76 |
| 4404 | 5.80 | +1.39 | +1.56 | 4.43 | +0.31 | -1.155 | 4,4 | 1 | -1 | K4 III | -1.6 | +71 | -43 | + 8 |
| 4434 | 3.86 | +1.60 | +1.96 | 1.62 | +0.425 | -0.69 | 6,Std | 0 | -2 | M0 III | -2.8 | +16 | -10 | + 6 |
| 4483 | Var. | | | | | | 8,10 | 5 | | M4 III | -4.5 | + 6 | + 1 | + 4 |
| 4491 | 6.17 | +1.62 | +1.75 | | | | 4 | | | gM2 | | | | |
| 4517 | 4.04 | +1.52 | +1.80 | 1.98 | +0.43 | -0.75 | 5,Std | 0 | -0 | M1 III | -2.7 | -27 | -86 | +17 |
| 4562 | 6.50 | +1.59 | +1.72 | 3.81 | +0.55 | -0.325 | 1,4 | 4 | +1.5 | gM2 | -3.5 | +39 | -108 | +20 |
| 4586 | 6.20 | +1.60 | +1.90 | 3.45 | +0.56 | -0.225 | 4,2 | 4 | 0 | M2 III | -3.7 | +81 | -44 | +40 |
| 4666 | 5.69 | +1.59 | +1.95 | 3.44 | +0.425 | -0.645 | 2,2 | 2 | -2.5 | M1 III | -2.9 | -32 | -20 | - 5 |
| 4672 | 5.78 | +1.34 | +1.52 | 4.21 | +0.29 | -1.13 | 2,4 | 1 | -3 | gK6 | | | | |
| 4690 | 5.26 | +1.63 | +1.97 | 2.96 | +0.45 | -0.605 | 2,Std | 2 | -1 | hM1 | -2.9 | + 9 | 0 | + 6 |
| 4701 | 5.52 | +1.45 | +1.71 | 3.70 | +0.33 | -0.97 | 2,3 | 2 | -3 | gK5 | -2.2 | -61 | -40 | - 7 |
| 4726 | 5.88 | +1.62 | +1.83 | 3.13 | +0.555 | -0.275 | 2,Std | 2 | +0.5 | gM3 | -3.6 | - 3 | -30 | - 6 |
| 4765 | Var. | | | | | | 4,2 | 4 | | gM4 | -3.7 | +18 | - 2 | +13 |
| 4770 | | | | 4.28 | +0.36 | -0.95 | 4 | 4 | -0.5 | K5 | -2.2 | | | |
| 4800 | Var. | | | | | | 5,7 | 4 | | gM4e | -4.5 | +12 | -114 | -54 |
| 4801 | 5.69 | +1.45 | +1.75: | 4.08 | +0.305 | -1.08 | 2,Std | 2 | -3.0 | gK5 | -1.8 | +14 | -23 | -11 |
| 4807 | 5.70 | +1.59 | +1.80 | 3.00 | +0.59 | -0.225 | 2,2 | 2 | +2 | gM3 | -3.7 | +65 | -49 | -26 |
| 4808 | Var. | | | | | | 10,12 | 4 | | gM4e | -4.5 | +62 | -30 | -26 |
| 4846 | Var. | | | | | | 5,8 | 6 | | C5 | -4.5 | - 1 | + 4 | -14 |
| 4858 | 6.41 | +1.59 | +1.81 | 3.85 | +0.555 | -0.36 | 2,3 | 4 | +3.5 | gM4 | -3.4 | - 0 | - 7 | + 6 |
| 4884 | 6.36 | +1.61 | +1.99 | 4.28 | +0.42 | -0.795 | 2,2 | 4 | +1 | gM0 | -2.5 | -10 | -10 | - 3 |
| 4902 | 4.80± | +1.58 | +1.57 | 2.24 | +0.53 | -0.31 | 5,2 | 2 | -1 | M3 III | -3.5 | + 2 | -23 | + 8 |
| 4909 | Var. | | | | | | 4,8 | 5 | | M4 | -5.0 | + 8 | -24 | -12 |
| 4910 | 3.39 | +1.57 | +1.80 | 0.67 | +0.58 | -0.23 | 3,2 | 0 | +1 | M3 III | -3.7 | +131 | -99 | -21 |
| 4920 | 4.82 | +1.57 | +1.93 | 2.70 | +0.435 | -0.765 | 2,2 | 0 | +1 | M1 III | -2.7 | +25 | + 5 | + 2 |
| 4949 | 5.52 | +1.58 | +1.50 | 1.91 | +0.725 | +0.50 | 2,4 | 2 | -3.5 | gM5 | -4.7 | -43 | -20 | -11 |
| 4962 | | | | 4.17 | +0.34 | -0.96 | 3 | 4 | -2 | gK6 | -2.1 | | | |
| 5015 | 4.86 | +1.62 | +1.86 | 2.53 | +0.475 | -0.59 | 3,Std | 0 | +0.5 | gM2 | -3.0 | +15 | +12 | -21 |
| 5052 | Var. | | | | | | 3,5 | 4 | | gM4 | -3.8 | -28 | + 5 | - 1 |





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TABLE 1 (CONT'D)

| HR | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) | n,n | E ($0^m01$) | δ(65,62) ($0^m01$) | Sp.T. | M(102) | U | V | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5064 | $5^m25$ | $+1^m55$ | $+1^m75$ | $3^m52$ | $+0^m38$ | $-0^m925$ | 4,2 | 2 | +0.5 | M0 III | $-2^m3$ | +78 | -50 | -18 |
| 5073 | 5.77 | +1.61 | +1.90 | 3.55 | +0.45 | -0.64 | 1,3 | 2 | 0 | gM1 | -2.9 | -37 | -13 | -27 |
| 5080 | Var. | | | | | | 5,4 | 6 | | gM7e | -6.4 | +44 | -17 | + 7 |
| 5095 | 4.70 | +1.59 | +1.95 | 2.33 | +0.505 | -0.48 | 5,2 | 1 | +0.5 | M2 III | -3.2 | +28 | -62 | +10 |
| 5101 | Var. | | | | | | 3 | 5 | | gM7e | (-5.5) | (-112 | +56 | -28) |
| 5123 | 5.70 | +1.58 | +1.85 | 3.40 | +0.515 | -0.56 | 2,2 | 4 | +4.5 | gM2 | -3.0 | +20 | -21 | -26 |
| 5133 | 6.42 | +1.55 | +1.66 | 4.19 | +0.445 | -0.62 | 2,2 | 4 | -0.5 | M2II-III | -2.9 | + 1 | -34 | -38 |
| 5150 | 5.00 | +1.62 | +1.86 | 2.66 | +0.50 | -0.47 | 5,3 | 4 | +0.5 | M2 III | -3.2 | +77 | - 6 | - 1 |
| 5154 | 4.64 | +1.62 | +1.90 | 2.17 | +0.48 | -0.51 | 4,3 | 1 | -1 | M2 III | -3.2 | + 3 | -19 | -10 |
| 5181 | 5.43 | +1.65 | - | | | | 1 | | | M1 III | | | | |
| 5199 | Var. | | | | | | 5,7 | 6 | | gM6e | -5.8 | -44 | +18 | -13 |
| 5200 | 4.05 | +1.51 | +1.88 | 2.16 | +0.375 | -0.91 | 4,2 | 0 | -1 | K5 III | -2.4 | +39 | - 9 | + 6 |
| 5215 | 5.88 | +1.60 | +1.96 | 3.58 | +0.45 | -0.63 | 2,3 | 4 | 0 | gM1 | -2.9 | -29 | -41 | -34 |
| 5219 | 4.78 | +1.64 | +1.91 | 1.97 | +0.565 | -0.26 | 5,2 | 0 | +0.5 | K5 III | -3.7 | + 1 | -35 | -36 |
| 5226 | 4.66 | +1.57 | +1.84 | 1.70 | +0.59 | -0.16 | 5,3 | 1 | +0.5 | gM3 | -3.8 | - 4 | - 7 | - 7 |
| 5254 | 6.02 | +1.40 | +1.70 | 4.43 | +0.31 | -1.08 | 1,3 | 4 | -2 | gK5 | -2.7 | +21 | -76 | -36 |
| 5299 | Var. | | | | | | 8,8 | 1 | | gM4 | -4.7 | -24 | -24 | -30 |
| 5300 | 5.26 | +1.63 | +1.92 | 2.81 | +0.49 | -0.53 | 6,Std | 2 | +1 | gM2 | -3.1 | +59 | - 8 | -14 |
| 5301 | 4.94 | +1.67 | +1.95 | 2.84 | +0.46 | -0.76 | 3,2 | 1 | +4 | gM3 | -2.6 | -15 | - 9 | + 7 |
| 5331 | Var. | | | | | | 4,2 | 4 | | gM4 | -3.9 | +64 | -70 | -29 |
| 5334 | 5.24 | +1.58 | +1.84 | 2.85 | +0.475 | -0.615 | 5,Std | 0 | +1 | gM2 | -3.0 | -16 | -41 | +10 |
| 5340 | | | | -1.53 | +0.265 | -1.13 | 2 | 0 | - | K2 III | -1.75 | -25 | -116 | - 3 |
| 5352 | 5.84 | +1.65 | +1.92 | 3.50 | +0.49 | -0.53 | 2,2 | 1 | +0.5 | gM3 | -3.1 | + 1 | +11 | -11 |
| 5394 | 6.20 | +1.18 | +1.24 | 4.98 | +0.27 | -1.31 | 2,3 | 2 | - | gK4 | -0.8 | +32 | -98 | -21 |
| 5452 | 5.74 | +1.56 | +1.88 | 3.67 | +0.40 | -0.815 | 2,3 | 2 | -0.5 | gM1 | -2.5 | +54 | -12 | -15 |
| 5490 | Var. | | | | | | 6,7 | 0 | | gM3 | -3.4 | - 4 | -12 | + 8 |
| 5496 | 6.03 | +1.61 | +1.93 | 4.22 | +0.47 | -0.55 | 1,2 | 2 | -0.5 | gM1 | -3.1 | +73 | -45 | - 7 |
| 5510 | 6.24 | +1.58 | +1.90 | 3.98 | +0.465 | -0.615 | 2,5 | 2 | +0.5 | gM1 | -2.9 | -100 | -21 | +13 |
| 5512 | 5.82 | +1.50 | +1.26 | 1.54 | +0.80 | +1.08 | 4,3 | 1 | -11 | gM5 | -5.4 | +87 | -44 | +27 |
| 5584 | 5.90 | +1.59 | +1.86 | 3.55 | +0.52 | -0.49 | 1,4 | 2 | +2.5 | gM1 | -3.2 | 0 | -10 | -15 |
| 5589 | Var. | | | | | | 11,9 | 4 | | gM5 | -4.4 | +38 | -17 | +16 |
| 5590 | 5.47 | +1.66 | +1.95 | 3.40 | +0.42 | -0.71 | 1,3 | 2 | -1.5 | gM0 | -2.7 | -11 | + 6 | -31 |
| 5594 | 5.70 | +1.50 | +1.54 | 3.61 | +0.425 | -0.69 | 2,3 | 2 | -1.5 | gM2 | -2.8 | + 8 | -12 | -39 |
| 5654 | Var. | | | | | | 3,6 | 1 | | gM4 | -4.4 | +35 | -12 | -18 |
| 5677 | 6.15 | +1.62 | +1.93 | 3.57 | +0.53 | -0.43 | 3,4 | 4 | +2.5 | gM2 | -3.3 | -23 | - 4 | -11 |
| 5739 | 5.20 | +1.65 | +1.95 | 3.00 | +0.435 | -0.70 | 8,Std | 1 | -0.5 | M1 III | -2.8 | +13 | -15 | -11 |
| 5800 | 5.13 | +1.62 | +2.04 | 2.42 | +0.445 | -0.665 | 2,2 | 1 | -0.5 | gM2 | -2.9 | - 2 | 0 | -24 |
| 5844 | 5.60 | +1.37 | +1.58 | 4.07 | +0.285 | -1.09 | 2,3 | 4 | -4 | gM0 | -1.7 | +38 | -40 | -11 |
| 5879 | 4.11 | +1.60 | +1.99 | 2.01 | +0.42 | -0.76 | 8,Std | 0 | -0.5 | M1 III | -2.7 | + 4 | -50 | -25 |
| 5894 | Var. | | | | | | 9,8 | 10 | | gM7e | -5.4 | -49 | -39 | + 8 |
| 5932 | 5.35 | +1.64 | +1.95 | 2.73 | +0.52 | -0.385 | 3,4 | 4 | +0.5 | gM3 | -3.4 | +54 | - 4 | + 6 |
| 5958 | Var. | | | | | | 1,6 | 4 | | Nova | - | - | - | - |
| 5995 | 6.19 | +1.57 | +1.91 | 3.93 | +0.455 | -0.65 | 3,Std | 4 | +1 | M1 | -2.8 | -12 | -28 | +22 |
| 6010 | 5.72 | +1.59 | +1.72 | 2.69 | +0.625 | 0.00 | 5,2 | 1 | -0.5 | gM3 | -4.1 | +17 | -26 | - 4 |
| 6039 | Var. | | | | | | 9,6 | 10 | | gM4 | -4.6 | +12 | -39 | - 2 |
| 6056 | 2.74 | +1.60 | +1.95 | 0.71 | +0.445 | -0.755 | 8,3 | 1 | +2 | M1 III | -2.7 | + 2 | -34 | -20 |
| 6086 | Var. | | | | | | 5,10 | 10 | | gM4 | -4.2 | +18 | -18 | -33 |
| 6107 | 5.20 | +1.60 | +1.94 | 2.84 | +0.485 | -0.54 | 5,3 | 2 | +0.5 | gM2 | -3.1 | -20 | -22 | -13 |
| 6108 | 5.41 | +1.52 | +1.89 | | | | 5 | | | K5 III | | | | |
| 6119 | Var. | | | | | | 5,6 | 9 | | gM7e | -6.0 | +26 | -12 | -10 |
| 6128 | Var. | | | | | | 5,5 | 2 | | M2 III? | -3.4 | -133 | -70 | -21 |
| 6134 | 0.96 | +1.82 | +1.35 | -1.69 | +0.49 | -0.32 | 3,2 | 8 | -3 | M1 Ib | -7.7 | - 3 | -18 | -10 |
| 6146 | Var. | | | | | | 6,8 | 2 | | M6 III | -5.8 | - 9 | +13 | -12 |
| 6200 | 4.90 | +1.57 | +1.76 | 2.39 | +0.51 | -0.47 | 4,Std | 2 | +1.5 | gM2 | -3.2 | +36 | -51 | -17 |
| 6227 | | | | 2.86 | +0.62 | -0.23 | 3 | 8 | +6 | gM3 | -3.6 | -19 | -26 | -38 |
| 6242 | Var. | | | | | | 5,10 | 10 | | M4 | -4.4 | -22 | -18 | - 2 |
| 6258 | 5.74 | +1.62 | +1.92 | 3.76 | +0.395 | -0.75 | 1,2 | 10 | -0.5 | gM1 | -2.5 | + 6 | - 8 | - 4 |
| 6306 | 6.56 | +1.62 | +1.98 | 4.24 | +0.475 | -0.56 | 2,3 | 10 | +2.5 | gM2 | -2.9 | - 1 | -47 | + 7 |
| 6337 | 4.98 | +1.62 | +1.95 | 2.44 | +0.54 | -0.395 | 5,2 | 5 | +2.5 | M3 III | -3.3 | -60 | + 5 | - 4 |
| 6346 | Var. | | | | | | 4,8 | 12 | | gM4 | -4.4 | -40 | - 6 | -41 |
| 6393 | 5.38 | +1.59 | +1.64 | 3.10 | +0.44 | -0.64 | 2,3 | 10 | +1 | gM2 | -2.7 | -31 | + 4 | 0 |
| 6452 | 4.98 | +1.62 | +2.06 | 2.80 | +0.43 | -0.715 | 2,3 | 5 | +0.5 | gM2 | -2.7 | + 8 | -44 | -36 |
| 6463 | 6.35 | +1.61 | +1.98 | 3.98 | +0.515 | -0.525 | 3,4 | 6 | +4 | gM2 | -3.1 | -44 | + 1 | +19 |
| 6464 | 5.55 | +1.57 | +1.92 | 3.44 | +0.375 | -0.80 | 3,2 | 4 | -3 | gM0 | -2.5 | +48 | -50 | -10 |
| 6495 | Var. | | | | | | 5,8 | 10 | | gM4 | -4.5 | +16 | - 3 | + 9 |
| 6543 | 6.51± | +6.56 | +1.60 | 3.03 | +0.72 | +0.40 | 5,4 | 12 | +0.5 | gM4 | -4.45 | -93 | -29 | -50 |
| | | | | 3.15 | +0.70 | +0.32 | 3 | 12 | +0.5 | | - | - | - | - |
| 6578 | 6.20 | +1.67 | +1.85 | 2.35 | +0.59 | -0.12 | 2,2 | 17 | +3 | gM4 | -3.6 | +26 | -36 | - 5 |
| 6584 | 6.09 | +1.57 | +1.98 | 3.81 | +0.46 | -0.67 | 1,3 | 5 | +2.5 | gM2 | -2.8 | +17 | -10 | -13 |
| 6702 | Var. | | | | | | 8 | 10 | | M65 | -4.8 | -33 | + 6 | - 1 |

TABLE 1 (CONT'D)

| HR | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) | n,n | E ($0^m.01$) | δ(65,62) ($0^m.01$) | Sp.T. | M(102) | U | V | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6728 | $5^m.70$ | $+1^m.56$ | $+2^m.0$: | $3^m.57$ | $+0^m.405$ | $-0^m.77$ | 2,Std | 4 | -0.5 | gMO | $-2^m.6$ | -13 | -14 | - 3 |
| 6765 | 5.00 | +1.67 | +1.93 | 2.28 | +0.545 | -0.32 | 2,3 | 2 | +1 | gM2 | -3.5 | + 8 | -20 | - 4 |
| 6815 | 5.02 | +1.64 | +1.94 | 2.36 | +0.545 | -0.345 | 2,2 | 1 | +1 | gM3 | -3.5 | +16 | + 2 | +15 |
| 6834 | Var. | | | | | | 3 | 10 | | gM4 | -4.3 | -32 | - 8 | - 3 |
| 6868 | 4.94 | +1.58 | +1.98 | 2.75 | +0.435 | -0.72 | 4,2 | 2 | +0.5 | gMO | -2.7 | - 3 | -36 | -29 |
| 6882 | | | | 3.30 | +0.40 | +0.745 | Std | 2 | -2 | gK5 | -2.7 | +80 | -11 | - 5 |
| 6891 | 5.00 | +1.61 | +1.94 | 2.53 | +0.495 | -0.465 | 2,3 | 2 | -0.5 | gM2 | -3.2 | +29 | + 8 | +30 |
| 6973 | | | | 2.70 | +0.275 | -1.34 | 1 | 0 | - | K3 III | -0.8 | -60 | -47 | -32 |
| 7002 | Var. | | | | | | 3,4 | 6 | | gM6e | - | - | - | - |
| 7009 | Var. | | | | | | 2,5 | 25 | | CM4 | (-8) | (+33 | -12 | +10) |
| 7045 | Not obs. | | | | | | | | | gM4 | | | | |
| 7139 | Var. | | | | | | 9,7 | 9 | | M4 II | (-6) | (+16 | -27 | + 9) |
| 7157 | Var. | | | | | | 7,14 | 0 | | M5 III | -4.5 | +39 | -18 | - 4 |
| 7183 | 6.36 | +1.65 | +2.00 | 3.16 | +0.64 | +0.10 | 2,2 | 2 | -1 | gM3 | -4.2 | - 2 | - 7 | +36 |
| 7201 | Var. | | | | | | 12 | 2 | | M1 | -4.5 | -10 | - 9 | + 1 |
| 7220 | Var. | | | | | | 3,3 | ? | | C6 | - | - | - | - |
| 7237 | 5.50 | +1.55 | +1.90 | 2.66 | +0.385 | -0.87 | 2,2 | 4 | 0 | MO III | -2.4 | -19 | + 6 | -26 |
| 7238 | 6.06 | +1.52 | +1.88 | 3.74 | +0.49 | -0.60 | 2,2 | 4 | +3 | gM2 | -2.9 | - 3 | -12 | -33 |
| 7243 | Var. | | | | | | 13,3 | ? | | gM7e | -5.8 | -70 | -29 | -44 |
| 7244 | 6.31 | +1.65 | +1.98 | 4.10 | +0.43 | -0.67 | 3,1 | 4 | -1 | gMO | -2.8 | + 3 | -31 | + I |
| 7302 | 5.87 | +1.64 | +2.03 | 3.55 | +0.465 | -0.58 | 2,3 | 4 | 0 | gMO | -2.9 | +13 | -55 | -36 |
| 7356 | 5.90 | +1.64 | +2.01 | 3.62 | +0.45 | -0.62 | 2,3 | 2 | -0.5 | gM1 | -2.9 | +18 | -16 | -16 |
| 7391 | 4.87 | +1.53 | +1.93 | | | | 5 | | | gMO | | | | |
| 7394 | 6.40 | +1.58 | +1.80 | | | | 2 | | | M1 III | | | | |
| 7405 | 4.42 | +1.50 | +1.81 | 2.52 | +0.43 | +0.865 | 8,4 | 1 | +4 | MO III | -2.5 | -16 | -112 | +23 |
| 7414 | 5.06 | +1.72 | +2.02 | 2.78 | +0.465 | -0.59 | 2,1 | 10 | +2 | M1 III | -2.8 | +12 | - 6 | -12 |
| 7417 | 3.10 | +1.16 | +0.66 | 1.20 | +0.275 | -1.24 | 2,1 | 2 | - | K5II+B | (-5.3) | (+ 9 | -22 | - 1) |
| 7442 | 5.90 | +1.66 | +1.77 | 2.71 | +0.66 | +0.245 | 2,4 | 4 | -2.5 | gM4 | -4.4 | - 2 | - 3 | - 7 |
| 7492 | 6.11 | +1.56 | +1.42 | 3.49 | +0.50 | -0.27 | 2,3 | 5 | -4.5 | gM2 | -3.5 | + 2 | - 3 | - 7 |
| 7509 | Var. | | | | | | 3,7 | 4 | | gM5 | -5.0 | -11 | + 6 | - 4 |
| 7514 | 5.84 | +1.59 | +1.99 | 3.73 | +0.39 | -0.74 | 2,2 | 4 | -3 | gMO | -2.6 | +24 | -36 | - 8 |
| 7520 | 6.40 | +1.63 | +1.70 | 2.89± | +0.67 | +0.38 | 2,5 | 6 | -4.5 | M1 | | Supergiant? | | |
| 7523 | Var. | | | | | | 6,4 | 4 | | M3 III | -4.2 | -52 | -127 | +72 |
| 7536 | 3.83 | +1.40 | +0.98 | 1.30 | +0.54 | -0.345 | 4,2 | 2 | +1 | M2II+B | (-6) | (+ 2 | +15 | + 2) |
| 7547 | 6.14 | +1.64 | +2.03 | 3.77 | +0.475 | -0.565 | 2,2 | 4 | +1 | gM1 | -3.0 | | | |
| 7564 | Var. | | | | | | 2 | 6 | | S7e | | | | |
| 7566 | 5.26 | +1.67 | +2.10 | 2.64 | +0.51 | -0.425 | 2,2 | 5 | +1 | gM2 | -3.3 | +76 | -22 | +28 |
| 7568 | 6.16 | +1.66 | +1.56 | 2.69± | +0.59 | +0.31 | 1,3 | 5 | -11 | gM3 | -4.4 | +24 | - 8 | -15 |
| 7645 | Var. | | | | | | 1,2 | 4 | | gM4 | -4.3 | + 3 | -20 | - 9 |
| 7676 | 5.27 | +1.56 | +1.81 | 2.90 | +0.45 | -0.59 | 2,2 | 2 | -1.5 | gM1 | -3.0 | - 9 | -30 | -17 |
| 7686 | 6.20 | +1.60 | +1.90 | 3.64 | +0.54 | -0.41 | 2,1 | 4 | +3 | M3 III | -3.3 | -91 | -39 | -20 |
| 7687 | 6.12 | +1.62 | +1.95 | 3.88 | +0.45 | -0.66 | 1,3 | 2 | +0.5 | M1 | -2.8 | +46 | -52 | -12 |
| 7696 | 6.42 | +1.91 | +1.86 | | | | 1 | | | gM3 | | | | |
| 7704 | 6.32 | +1.65 | +2.00 | 3.68 | +0.54 | -0.34 | 1,2 | 4 | +1.5 | M1 | -3.4 | -30 | -41 | - 6 |
| 7771 | Not obs. | | | | | | | | | gM1 | | | | |
| 7800 | 5.92 | +1.63 | +1.98 | 3.80 | -0.41 | -0.74 | 1,2 | 2 | -1.5 | gMO | -2.7 | -36 | - 6 | -20 |
| 7851 | 5.42 | +1.55 | +1.90 | 3.13 | +0.48 | -0.63 | 3,2 | 2 | +2.5 | gM2 | -2.9 | -11 | -63 | -21 |
| 7886 | Var. | | | | | | 2,2 | 6 | | gM6 | -5.6 | +100 | -13 | +35 |
| 7900 | 5.19 | +1.64 | +1.98 | | | | 2 | | | M2 III | | | | |
| 7941 | Var. | | | | | | 1 | 5 | | M5II-III | - | - | - | - |
| 7944 | 6.00 | +1.68 | +1.86 | 3.01 | +0.61 | -0.10 | 1,2 | 4 | +1.5 | gM3 | -3.9 | -15 | -26 | -11 |
| 7951 | 4.45 | +1.62 | +1.96 | | | | 4 | | | M3 III | | | | |
| 7966 | 6.40 | +1.61 | +2.02 | | | | 1 | | | gMO | | | | |
| 8044 | Not obs. | | | | | | | | | gM3 | | | | |
| 8057 | 6.29 | +1.68 | +2.04 | 4.02 | +0.45 | -0.595 | 1,2 | 4 | +0.5 | M1 | -2.9 | +45 | -21 | - 6 |
| 8062 | 6.12 | +1.70 | +1.90 | | | | 1 | | | M3I-II | | | | |
| 8128 | 5.29 | +1.62 | +1.86 | 2.83 | +0.56 | -0.30 | 2,1 | 2 | +1.5 | gM3 | -3.3 | + 4 | -17 | + 8 |
| 8163 | 5.80 | +1.65 | +1.97 | 3.54 | +0.46 | -0.61 | 4,2 | 2 | 0 | gM2 | -2.9 | +26 | -24 | -22 |
| 8164 | 5.64 | +1.28 | -0.04 | 2.80 | +0.48 | -0.14 | 1,1 | - | - | M1 I+B | - | - | - | - |
| 8175 | 6.01 | +1.51 | +1.90 | | | | 5 | | | gMO | | | | |
| 8219 | 6.42 | +1.62 | +1.90 | 3.90 | +0.56 | -0.42 | 3,1 | 4 | +5 | M1 | -3.3 | - 5 | -21 | -15 |
| 8224 | 6.09 | +1.73 | +1.72 | 2.98 | +0.605 | -0.015 | 2,1 | - | - | M1 | | | | |
| 8225 | 4.52 | +1.62 | +1.92 | 2.42 | +0.44 | -0.73 | 2,2 | 1 | +1 | M1 III | -2.7 | +14 | -17 | 0 |
| 8262 | Var. | | | | | | 4,3 | 15 | | gM4e | -5.9 | +36 | -17 | -27 |
| 8284 | 5.12 | +1.57 | +1.83 | 2.90 | +0.445 | -0.71 | 3,4 | 5 | +2 | gMO | -2.7 | | | |
| 8297 | Var. | | | | | | 2 | (25) | | C6 | -4.5 | - | - | - |
| 8298 | Var. | | | | | | 3,1 | 6 | | M4 | -5.0 | -14 | + 8 | -14 |
| 8306 | 5.48 | +1.60 | +1.96 | 3.14 | +0.49 | -0.55 | 2,1 | 4 | +1.5 | gM2 | -3.0 | -23 | -22 | +12 |
| 8318 | 6.00 | +1.65 | | | | | 3 | | | gM3 | | | | |
| 8339 | 5.47 | +1.56 | +1.93 | 3.36 | +0.43 | -0.72 | 5,1 | - | - | gM1 | - | - | - | - |

TABLE 1 (CONT'D)

| HR | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) | n,n | E ($0^{m}.01$) | δ(65,62) ($0^{m}.01$) | Sp.T. | M(102) | U | V | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8347 | $6^{m}.14$ | $+1^{m}.68$ | $+2^{m}.03$ | $3^{m}.74$ | $+0^{m}.46$ | $-0^{m}.54$ | 5,1 | 2 | -2 | M1II-III | $-3^{m}.1$ | -19 | -14 | -16 |
| 8350 | Not obs. | | | | | | | | | M4 | | | | |
| 8383 | Var. | | | | | | 1 | (8) | | M2Ia | (-8) | (-19 | -20 | +58) |
| 8388 | 5.87 | +1.66 | +1.81 | 2.44 | +0.58 | -0.02 | 6,2 | 5 | -3 | gM3 | -4.0 | +10 | -22 | +21 |
| 8416 | 5.33± | +1.54 | +1.65 | 1.97± | +0.185 | +0.235 | 3,2 | 2 | -0.5 | gM5 | -4.4 | +45 | -19 | +27 |
| 8421 | Var. | | | | | | 11,2 | 6 | | gM8 | -4.4 | -60 | - 5 | +20 |
| 8436 | Not obs. | | | | | | | | | M1 | | | | |
| 8458 | 5.73 | +1.59 | +1.94 | | | | 4 | | | gM1 | | | | |
| 8483 | 5.71 | +1.56 | +1.93 | 2.96 | +0.57 | -0.205 | 4,1 | 4 | +0.5 | gM3 | -3.7 | -14 | - 9 | 0 |
| 8517 | 6.47 | +1.59 | +1.71 | | | | 4 | | | gM4 | | | | |
| 8572 | 4.37 | +1.66 | +1.07 | 1.92 | +0.43 | -0.52 | 6,1 | 27 | -3 | MOI+B | -7.5: | - 9: | - 3: | - 1: |
| 8621 | 5.09 | +1.58 | +1.71 | | | | 3 | | | M4 III | | | | |
| 8625 | 5.72 | +1.60 | +1.91 | 3.58 | +0.435 | -0.68 | 2,1 | 2 | -0.5 | gM1 | -2.8 | +31 | -19 | -12 |
| 8698 | 3.80 | +1.63 | +1.75 | | | | 5 | | | M2 III | | | | |
| 8699 | 5.00 | +1.56 | +1.92 | 2.88 | +0.41 | -0.78 | 3,1 | 2 | -0.5 | gMO | -2.6 | +33 | -26 | - 4 |
| 8714 | Var. | | | | | | 4 | | | S5 | | | | |
| 8763 | 6.12 | +1.60 | +1.88 | | | | 3 | | | gM2 | | | | |
| 8775 | 2.45 | +1.70 | +1.96 | | | | 2 | | | M2II-III | | | | |
| 8795 | 4.53 | +1.56 | +1.91 | | | | 3 | | | M2 III | | | | |
| 8815 | 5.12± | +1.47 | +1.14 | | | | 3 | | | gM4 | | | | |
| 8834 | 4.20 | +1.56 | +1.88 | | | | 5 | | | M2 III | | | | |
| 8850 | 5.06± | +1.59 | +1.80 | | | | 3 | | | gM5 | | | | |
| 8860 | 4.76 | +1.66 | +1.95 | 2.28 | +0.57 | -0.44 | 4,1 | 2 | +6 | gM2 | -3.3 | +16 | -13 | + 1 |
| 8876 | 5.77 | +1.51 | +1.90 | 3.88 | +0.35 | -0.895 | 4,1 | 4 | -3 | gMO | -2.4 | +30 | - 5 | 0 |
| 8882 | 5.64 | +1.50 | +1.90 | | | | 2 | | | gMO | | | | |
| 8904 | 4.96 | +1.66 | +1.93 | 2.56 | +0.47 | -0.56 | 2,1 | 2 | -0.5 | M1 III | -3.0 | -14 | -34 | - 5 |
| 8940 | 5.34 | +1.58 | +1.61 | | | | 4 | | | gM5 | | | | |
| 8942 | 6.06 | +1.70 | +1.88 | | | | 4 | | | gM3 | | | | |
| 8989 | Var.? | | | | | | 6,1 | 10 | | M2 III | -3.9 | - 6 | - 1 | + 7 |
| 8991 | 5.05 | +1.69 | +2.03 | | | | 6 | | | gM2 | | | | |
| 8992 | Var. | | | | | | 1 | | | gM7e | - | - | - | - |
| 9004 | Var. | | | | | | 4 | | | C6 | | | | |
| 9030 | Var. | | | | | | 4 | | | gM3 | | | | |
| 9035 | 6.13 | +1.60 | +1.97 | | | | 4 | | | gM2 | | | | |
| 9036 | 5.07 | +1.56 | +1.88 | | | | 3 | | | gM2 | | | | |
| 9047 | 5.55± | +1.59 | +1.65 | | | | 4 | | | gM5 | | | | |
| 9055 | 6.17 | +1.61 | +1.97 | | | | 4 | | | gM2 | | | | |
| 9064 | 4.65 | +1.60 | +1.69 | | | | 6 | | | M3 III | | | | |
| 9066 | Var. | | | | | | 2 | | | gM7e | - | - | - | - |
| 9099 | 6.30± | +1.65 | +1.94 | | | | 4 | | | gM4 | | | | |

TABLE 2

OBSERVATIONS OF BRIGHT VARIABLE STARS

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 46 | Oct 17 1962 | $5^{\mathrm{m}}.16$ | $+1^{\mathrm{m}}.54$ | $+1^{\mathrm{m}}.83$ | | | |
| | 26 1962 | 5.26 | +1.56 | +1.83 | | | |
| | Dec 21 1962 | 4.96 | +1.56 | +1.85 | | | |
| | Dec 25 1963 | 4.98 | +1.58 | +1.83 | | | |
| | 26 1963 | 5.06 | +1.57 | +1.83 | | | |
| | Dec 23 1965 | 5.09 | +1.60 | +1.84 | | | |
| | Jan 28 1966 | | | | $2^{\mathrm{m}}.23$ | $+0^{\mathrm{m}}.57$ | $-0^{\mathrm{m}}.06$ |
| 48 | Dec 25 1963 | 4.26 | +1.62 | +1.98 | | | |
| | 26 1963 | 4.34 | +1.59 | +1.96 | | | |
| | 27 1963 | 4.36 | +1.63 | +1.97 | | | |
| | Nov 30 1965 | 4.41 | +1.66 | +1.96 | | | |
| | Dec 23 1965 | 4.41 | +1.64 | +1.97 | | | |
| 90 | Nov 26 1965 | 8.58 | +2.04 | +0.51 | | | |
| R And | 27 1965 | 8.57 | +2.17 | | | | |
| | 30 1965 | 8.63 | +2.22 | +0.50 | | | |
| | Dec 1 1965 | 8.63 | +2.18 | - | | | |
| | 23 1965 | 9.36 | +2.32 | - | | | |
| | Jan 6 1966 | 10.30 | +2.35 | - | | | |
| | 13 1966 | | | | 2.80 | +6.73 | +2.74 |
| | 18 1966 | | | | 2.80 | +1.73 | +2.74 |
| 103 | Dec 26 1962 | 4.99 | +1.64 | +1.75 | | | |
| TV Psc | Dec 25 1963 | 4.93 | +1.64 | +1.76 | | | |
| | 26 1963 | 4.95 | +1.62 | +1.74 | | | |
| | 27 1963 | 4.95 | +1.64 | +1.77 | | | |
| | Aug 1 1964 | 4.87 | +1.67 | +1.88 | | | |
| | 2 1964 | 4.88 | +1.66 | +1.89 | | | |
| | 3 1964 | 4.87 | +1.64 | +1.87 | | | |
| | 6 1964 | 4.96 | +1.66 | +1.88 | | | |
| | 12 1964 | 5.02 | +1.64 | +1.82 | | | |
| | 15 1964 | 5.02 | +1.63 | +1.74 | | | |
| | Sep 1 1964 | 5.15 | +1.62 | +1.70 | | | |
| | 2 1964 | 5.23 | +1.61 | +1.63 | | | |
| | Dec 23 1965 | 4.88 | +1.66 | +1.88 | | | |
| | 9 1966 | 5.42 | +1.62 | +1.51 | | | |
| 284 | Nov 26 1965 | 6.11 | +1.67 | +1.99 | | | |
| | 27 1965 | 6.12 | +1.67 | +2.00 | | | |
| | 30 1965 | 6.14 | +1.67 | +1.97 | | | |
| | Dec 1 1965 | 6.13 | +1.67 | +1.97 | | | |
| | 23 1965 | 6.09 | +1.66 | +2.00 | | | |
| | Jan 9 1966 | 5.97 | +1.64 | - | | | |
| 587 | Nov 30 1965 | 5.40 | +1.48 | +1.39 | | | |
| | Dec 1 1965 | 5.41 | +1.49 | +1.42 | | | |
| | 23 1965 | 5.47 | +1.51 | +1.59 | | | |
| | Jan 9 1966 | 5.61 | +1.53 | - | | | |
| | 28 1966 | | | | 1.58 | +0.75 | +0.725 |
| 614 | Dec 23 1965 | 6.34 | +1.63 | +1.88 | | | |
| | Jan 6 1966 | | | | 3.69 | +0.60 | -0.10 |
| | 9 1966 | 6.27 | +1.63 | +1.86 | | | |
| | Feb 15 1966 | 6.20 | +1.62 | +1.80 | | | |
| 758 | Nov 27 1965 | 6.43 | +1.62 | +0.89 | | | |
| R Tri | 30 1965 | 6.49 | +1.60 | +0.91 | | | |
| | Dec 1 1965 | 6.53 | +1.60 | +0.86 | | | |
| | Jan 9 1966 | 8.68 | +1.61 | - | | | |
| | 28 1966 | | | | 2.92 | +1.34 | +2.08 |
| 832 | Nov 27 1965 | 6.58 | +1.58 | +1.39 | | | |
| Z Eri | 30 1965 | 6.53 | +1.59 | +1.33 | | | |
| | Dec 1 1965 | 6.52 | +1.58 | +1.36 | | | |
| | 23 1965 | 6.19 | +1.58 | - | | | |
| | Jan 6 1966 | | | | 2.70 | +0.79 | +0.75 |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| | Jan 9 1966 | $6^m.43$ | $+1^m.58$ | - | | | |
| | Feb 20 1966 | 6.60 | +1.65 | $+1^m.30$ | | | |
| 867 | Dec 21 1963 | 5.73 | +1.42 | - | | | |
| RZ Ari | Nov 27 1965 | 5.82 | +1.44 | +1.09 | | | |
| | 30 1965 | 5.84 | +1.43 | +1.08 | | | |
| | Dec 1 1965 | 5.83 | +1.45 | +1.08 | | | |
| | 23 1965 | 5.93 | +1.45 | +1.07 | | | |
| | Jan 6 1966 | | | | $1^m.37$ | $+0^m.925$ | $+1^m.28$ |
| | 9 1966 | 5.78 | +1.46 | - | | | |
| | 28 1966 | | | | 1.01 | +0.895 | +1.34 |
| | Feb 19 1966 | 5.94 | +1.42 | +0.99 | | | |
| | 20 1966 | 6.01 | +1.42 | +1.01 | | | |
| 877 | Dec 21 1963 | 6.18 | +1.62 | +1.82 | | | |
| | 22 1963 | 6.24 | +1.61 | +1.83 | | | |
| | Nov 27 1965 | 6.16 | +1.66 | +1.87 | | | |
| | Dec 1 1965 | 6.20 | +1.67 | +1.82 | | | |
| | Jan 6 1966 | | | | 3.40 | +0.64 | +0.40 |
| | 9 1966 | 6.15 | +1.64 | +1.86 | | | |
| | Feb 19 1966 | 6.10 | +1.60 | +1.91 | | | |
| | 20 1966 | 6.16 | +1.63 | +1.88 | | | |
| 904 | Dec 20 1962 | 6.16 | +1.65 | +2.17 | | | |
| | 21 1962 | 6.14 | +1.67 | +2.18 | | | |
| | Nov 27 1965 | 6.24 | +1.74 | +2.05 | | | |
| | Dec 1 1965 | 6.29 | +1.73 | +2.04 | | | |
| | 23 1965 | 6.13 | +1.77 | +2.07 | | | |
| | Jan 28 1966 | | | | 3.52 | +0.52 | -0.35 |
| | Feb 19 1966 | 6.22 | +1.70 | +2.00 | | | |
| 921 | Nov 27 1965 | 3.42 | +1.62 | +1.71 | | | |
| | 30 1965 | 3.44 | +1.61 | +1.71 | | | |
| | Dec 1 1965 | 3.49 | +1.60 | +1.70 | | | |
| | 23 1965 | 3.39 | +1.61 | +1.68 | | | |
| | Jan 5 1965 | | | | -0.12 | +0.685 | +0.35 |
| | 28 1966 | | | | -0.12 | +0.68 | +0.345 |
| | Feb 19 1966 | 3.36 | +1.60 | +1.66 | | | |
| 1153 | Dec 24 1963 | 4.42 | +1.84 | +2.12 | | | |
| | 25 1963 | 4.42 | +1.84 | +2.12 | | | |
| | Nov 27 1965 | 4.39 | +1.90 | +2.01 | | | |
| | 30 1965 | 4.31 | +1.88 | +2.00 | | | |
| | Jan 18 1966 | | | | 2.30 | +0.56 | -0.07 |
| | Feb 19 1966 | 4.43 | +1.86 | +1.98 | | | |
| 1556 | Dec 24 1963 | 4.73 | +1.74 | +2.08 | | | |
| | 25 1963 | 4.72 | +1.76 | +2.07 | | | |
| | Nov 17 1965 | 4.79 | +1.82 | +1.99 | | | |
| | 30 1965 | 4.81 | +1.82 | +1.97 | | | |
| | Dec 1 1965 | 4.85 | +1.80 | +1.98 | | | |
| | 23 1965 | 4.72 | +1.83 | +2.03 | | | |
| | 30 1965 | 4.69 | +1.80 | +2.03 | | | |
| | Jan 6 1966 | | | | 1.75 | +0.61 | +0.14 |
| | Feb 20 1966 | 4.77 | +1.78 | +1.95 | | | |
| 1607 | Nov 27 1965 | 7.14 | +4.06 | - | | | |
| R Sep | Dec 1 1965 | 7.24 | +4.00 | - | | | |
| | 23 1965 | 7.46 | +4.03 | - | | | |
| | 30 1965 | 7.55 | +3.96 | - | | | |
| 1648 | Nov 27 1965 | 5.81 | +3.47 | - | | | |
| W Ori | 30 1965 | 5.84 | +3.45 | - | | | |
| | Dec 1 1965 | 5.89 | +3.46 | - | | | |
| | 23 1965 | 5.75 | +3.47 | - | | | |
| | 30 1965 | 5.70 | +3.30 | - | | | |
| | Jan 6 1966 | | | | 2.25 | +0.47 | +0.11 |
| | 27 1966 | | | | 2.21 | +0.46 | +0.11 |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| | Mar 14 1966 | | | | $2^{m}.22$ | $+0^{m}.48$ | $+0^{m}.11$ |
| | 27 1966 | $5^{m}.85$ | $+3^{m}.26$ | - | | | |
| 1693 | Nov 27 1965 | 5.82 | +1.55 | $+1^{m}.04$ | | | |
| RX Lep | Dec 1 1965 | 5.86 | +1.54 | +1.03 | | | |
| | 30 1965 | 5.72 | +1.48 | +1.11 | | | |
| | Jan 28 1966 | | | | 1.34 | +0.87 | +1.35 |
| | Feb 19 1966 | 5.90 | +1.49 | +0.95 | | | |
| | 20 1966 | 5.96 | +1.50 | +1.00 | | | |
| 1707 | Dec 1 1965 | 10.18 | +1.86 | -0.06 | | | |
| R Aur | Jan 3 1966 | | | | 2.04 | +2.93 | +2.91 |
| | 12 1966 | 10.99 | +1.95 | -0.43 | | | |
| | 19 1966 | | | | 2.21 | +2.96 | +2.99 |
| | Mar 30 1966 | | | | 2.85 | +3.50 | +3.43 |
| | 31 1966 | 13.12 | +1.91 | - | | | |
| | Apr 1 1966 | | | | 2.84 | +3.56 | +3.46 |
| 1845 | Dec 23 1965 | 4.38 | +2.07 | +2.16 | | | |
| CE Tau | Jan 28 1966 | | | | 1.18 | +0.565 | +0.09 |
| | Feb 19 1966 | 4.41 | +2.02 | +2.06 | | | |
| | Mar 14 1966 | | | | 1.22 | +0.53 | +0.04 |
| | 29 1966 | | | | 1.30 | +0.54 | 0.00 |
| 1939 | Nov 27 1965 | 6.27 | +2.10 | +2.09 | | | |
| | 30 1965 | 6.32 | +2.09 | +2.10 | | | |
| | Dec 23 1965 | 6.32 | +2.09 | +2.09 | | | |
| | 30 1965 | 6.26 | +2.03 | +2.09 | | | |
| | Jan 28 1966 | | | | 3.00 | +0.53 | +0.07 |
| | Feb 19 1966 | 6.13 | +2.06 | +2.08 | | | |
| | Mar 14 1966 | | | | 3.00 | +0.54 | +0.09 |
| 1977 | Nov 27 1965 | 6.82 | +3.25 | - | | | |
| Y Tau | 30 1965 | 6.85 | +3.27 | - | | | |
| | Dec 1 1965 | 6.89 | +3.31 | - | | | |
| | 23 1965 | 6.80 | +3.36 | - | | | |
| | 30 1965 | 6.80 | +3.16 | - | | | |
| | Jan 6 1966 | | | | 3.31 | +0.50 | +0.27 |
| | 28 1966 | | | | 3.08 | +0.50 | +0.28 |
| | Feb 8 1966 | 6.73 | +3.07 | - | | | |
| | 19 1966 | 6.71 | +3.07 | - | | | |
| | Mar 14 1966 | | | | 3.27 | +0.51 | +0.24 |
| | 27 1966 | 6.85 | +3.02 | - | | | |
| | 29 1966 | | | | 3.23 | +0.46 | +0.20 |
| 2063 | Jan 13 1966 | 11.80 | +2.07 | - | | | |
| U Ori | Feb 8 1966 | 11.85 | +2.22 | - | | | |
| | 14 1966 | | | | 2.81 | +2.35 | +3.35 |
| 2091 | Dec 24 1963 | 4.24 | +1.66 | +1.81 | | | |
| | 26 1963 | 4.24 | +1.68 | +1.78 | | | |
| | Nov 27 1965 | 4.30 | +1.70 | +1.79 | | | |
| | 30 1965 | 4.30 | +1.71 | +1.77 | | | |
| | Dec 23 1965 | 4.33 | +1.70 | +1.76 | | | |
| | Jan 5 1966 | | | | 1.09 | +0.61 | +0.17 |
| | 28 1966 | | | | 1.05 | +0.60 | +0.08 |
| | Feb 19 1966 | 4.34 | +1.68 | +1.76 | | | |
| | Mar 14 1966 | | | | 1.03 | +0.61 | +0.11 |
| 2190 | Jan 8 1966 | | | | 3.38 | +0.545 | +0.21 |
| TV Gem | Feb 8 1966 | 6.77 | +2.25 | +1.49 | | | |
| | Mar 14 1966 | | | | 3.11 | +0.57 | +0.30 |
| | 27 1966 | 6.68 | +2.25 | +1.67 | | | |
| | 29 1966 | | | | 2.92 | +0.55 | +0.10 |
| | Apr 14 1966 | 6.57 | +2.28 | +1.55 | | | |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 2197 BU Gem | Nov 27 1965 | $5^m.74$ | $+1^m.66$ | $+1^m.99$ | | | |
| | 30 1965 | 5.79 | +1.65 | +2.00 | | | |
| | Dec 1 1965 | 5.81 | +1.65 | +1.98 | | | |
| | 23 1965 | 5.77 | +1.64 | +2.02 | | | |
| | Feb 19 1966 | 5.74 | +1.63 | +1.93 | | | |
| | Mar 14 1966 | | | | $3^m.20$ | $+0^m.59$ | $+0^m.46$ |
| 2216 η Gem | Dec 24 1963 | 3.18 | +1.54 | +1.60 | | | |
| | 25 1963 | 3.19 | +1.54 | +1.58 | | | |
| | Nov 27 1965 | 3.19 | +1.60 | +1.63 | | | |
| | 30 1965 | 3.23 | +1.58 | +1.65 | | | |
| | Dec 1 1965 | 3.28 | +1.59 | +1.61 | | | |
| | 23 1965 | 3.30 | +1.59 | +1.60 | | | |
| | 30 1965 | 3.35 | +1.58 | +1.61 | | | |
| | Jan 6 1966 | | | | 0.65 | +0.545 | -0.19 |
| | 28 1966 | | | | 0.53 | +0.54 | -0.15 |
| | Feb 14 1966 | 3.15 | +1.60 | +1.62 | | | |
| | Mar 14 1966 | | | | 0.47 | +0.54 | -0.20 |
| 2308 BL Ori | Nov 27 1965 | 6.06 | +2.40 | - | | | |
| | 30 1965 | 6.09 | +2.38 | - | | | |
| | Dec 1 1965 | 6.14 | +2.38 | - | | | |
| | 23 1965 | 6.16 | +2.38 | - | | | |
| | 30 1965 | 6.19 | +2.35 | - | | | |
| | Jan 6 1966 | | | | 3.23 | +0.43 | -0.03 |
| | 28 1966 | | | | 3.18 | +0.44 | -0.02 |
| | Feb 8 1966 | 6.27 | +2.34 | - | | | |
| | 20 1966 | 6.28 | +2.36 | - | | | |
| | Mar 14 1966 | | | | 3.23 | +0.44 | -0.05 |
| | 29 1966 | | | | 3.18 | +0.43 | -0.085 |
| | Apr 14 1966 | 6.26 | +2.96 | - | | | |
| 2631 | Nov 27 1965 | 5.99 | +1.59 | +1.70 | | | |
| | 30 1965 | 6.00 | +1.60 | +1.71 | | | |
| | Dec 1 1965 | 6.02 | +1.59 | +1.70 | | | |
| | 23 1965 | 6.08 | +1.50 | +1.66 | | | |
| | Jan 28 1966 | | | | 2.80 | +0.65 | +0.145 |
| | Feb 19 1966 | 5.98 | +1.56 | +1.63 | | | |
| | Mar 14 1966 | | | | 2.78 | +0.63 | +0.135 |
| | Apr 14 1966 | 5.89 | +1.61 | +1.64 | | | |
| 2671 R Gem | Mar 14 1966 | | | | 3.92 | +0.90 | +1.43 |
| | 27 1966 | 8.35 | +2.14 | - | | | |
| | 29 1966 | | | | 4.08 | +0.74 | +0.86 |
| | Apr 25 1966 | 7.64 | +2.06 | - | | | |
| 2717 BQ Gem | Nov 27 1965 | 5.07 | +1.63 | +1.71 | | | |
| | 30 1965 | 5.08 | +1.63 | +1.71 | | | |
| | Dec 1 1965 | 5.08 | +1.64 | +1.69 | | | |
| | 23 1965 | 5.08 | +1.65 | +1.74 | | | |
| | 30 1965 | 5.19 | +1.64 | +1.74 | | | |
| | Jan 6 1966 | | | | 1.99 | +0.69 | +0.26 |
| | 28 1966 | | | | 1.91 | +0.69 | +0.16 |
| | Feb 8 1966 | 4.98 | +1.66 | +1.77 | | | |
| | 20 1966 | 5.06 | +1.62 | +1.72 | | | |
| | Mar 27 1966 | 5.04 | +1.66 | +1.76 | | | |
| | 29 1966 | | | | 1.91 | +0.62 | +0.05 |
| | Apr 14 1966 | 5.01 | +1.66 | +1.75 | | | |
| | 25 1966 | 5.08 | +1.65 | +1.77 | | | |
| | 27 1966 | | | | 1.91 | +0.66 | +0.15 |
| 2742 VZ Cam | Dec 25 1963 | 4.82 | +1.61 | +1.77 | | | |
| | 27 1963 | 4.86 | +1.62 | +1.76 | | | |
| | Nov 27 1965 | 4.85 | +1.65 | +1.79 | | | |
| | 30 1965 | 4.85 | +1.63 | +1.81 | | | |
| | Dec 1 1965 | 4.91 | +1.62 | +1.83 | | | |
| | 23 1965 | 4.82 | +1.65 | +1.80 | | | |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 2742 | Jan 5 1966 | | | | 1$^m$.83 | +0$^m$.645 | -0$^m$.07 |
| VZ Cam | 18 1966 | | | | 1.84 | +0.60 | -0.12 |
| | Feb 20 1966 | 4$^m$.81 | +1$^m$.60 | +1$^m$.82 | | | |
| | Mar 30 1966 | | | | 1.82 | +0.63 | -0.04 |
| | 31 1966 | 4.82 | +1.68 | +1.80 | | | |
| | Apr 1 1966 | | | | 1.82 | +0.66 | +0.09 |
| | 14 1966 | 4.91 | +1.63 | +1.76 | | | |
| | 28 1966 | 4.94 | +1.63 | +1.83 | | | |
| 3061 | Nov 27 1965 | 6.37 | +1.55 | +1.61 | | | |
| | 30 1965 | 6.37 | +1.59 | +1.58 | | | |
| | Dec 1 1965 | 6.42 | +1.58 | +1.57 | | | |
| | 30 1965 | 6.42 | +1.56 | +1.60 | | | |
| | Jan 6 1966 | | | | 3.01 | +0.72 | +0.35 |
| | 28 1966 | | | | 2.96 | +0.72 | +0.38 |
| | Feb 19 1966 | 6.45 | +1.55 | +1.58 | | | |
| | Apr 14 1966 | 6.36 | +1.55 | +1.57 | | | |
| 3169 | Nov 30 1965 | 6.04 | +1.65 | +1.94 | | | |
| | Dec 1 1965 | 6.07 | +1.65 | +1.93 | | | |
| | 23 1965 | 6.06 | +1.65 | +1.90 | | | |
| | Jan 28 1966 | | | | 3.30 | +0.55 | -0.27 |
| | Feb 19 1966 | 5.96 | +1.63 | +1.88 | | | |
| | 20 1966 | 5.97 | +1.63 | +1.90 | | | |
| 3248 | Nov 30 1965 | 8.69 | +1.38 | +0.36 | | | |
| R Cnc | Dec 1 1965 | 8.67 | +1.39 | +0.22 | | | |
| | 23 1965 | 8.29 | +1.37 | +0.36 | | | |
| | 30 1965 | 7.87 | +1.30 | +0.38 | | | |
| | Jan 6 1966 | | | | 1.72 | +1.20 | +1.89 |
| | 28 1966 | | | | 1.54 | +1.00 | +1.40 |
| | Feb 8 1966 | 6.39 | +1.40 | +0.60 | | | |
| | 19 1966 | 6.68 | +1.36 | +0.38 | | | |
| | Mar 14 1966 | | | | 1.61 | +1.23 | +1.97 |
| | 27 1966 | 8.04 | +1.47 | +0.03 | | | |
| | 29 1966 | | | | 1.65 | +1.46 | +2.18 |
| | Apr 14 1966 | 8.51 | +1.44 | -0.15 | | | |
| | 25 1966 | 8.80 | +1.54 | -0.07 | | | |
| | 27 1966 | | | | 1.91 | +1.58 | +2.49 |
| 3521 | Nov 30 1965 | 6.32 | +1.60 | +1.56 | | | |
| | Dec 1 1965 | 6.35 | +1.59 | +1.54 | | | |
| | 23 1965 | 6.36 | +1.58 | +1.54 | | | |
| | 30 1965 | 6.34 | +1.59 | +1.56 | | | |
| | Jan 8 1966 | | | | 3.40 | +0.58 | -0.08 |
| | 28 1966 | | | | 3.40 | +0.57 | -0.10 |
| | Feb 19 1966 | 6.23 | +1.59 | +1.52 | | | |
| | 20 1966 | 6.25 | +1.58 | +1.54 | | | |
| 3541 | Nov 30 1965 | 6.27 | +2.98 | - | | | |
| X Cnc | Dec 1 1965 | 6.33 | +2.97 | - | | | |
| | Jan 6 1966 | | | | 2.95 | +0.46 | +0.03 |
| | 8 1966 | | | | 2.90 | +0.46 | +0.02 |
| | 28 1966 | | | | 2.94 | +0.43 | -0.02 |
| | Feb 19 1966 | 6.24 | +2.88 | - | | | |
| | Mar 14 1966 | | | | 3.08 | +0.44 | -0.03 |
| | 29 1966 | | | | 3.01 | +0.44 | 0.00 |
| | Apr 14 1966 | 6.44 | +3.05 | - | | | |
| | 27 1966 | | | | 3.11 | +0.45 | -0.06 |
| | May 6 1966 | | | | 3.33 | +0.46 | +0.06 |
| 3639 | Dec 25 1963 | 5.81 | +1.55 | +1.15 | | | |
| RS Cnc | 27 1963 | 5.87 | +1.60 | +1.06 | | | |
| | 28 1963 | 5.88 | +1.58 | +1.00 | | | |
| | Nov 27 1965 | 5.34 | +1.56 | +1.14 | | | |
| | 30 1965 | 5.32 | +1.57 | +1.19 | | | |
| | Dec 1 1965 | 5.30 | +1.57 | +1.14 | | | |
| | 23 1965 | 5.20 | +1.60 | +1.24 | | | |

TABLE 2 (CONT'D)

| HR/Name | Date | | | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|---|---|
| 3639 | Jan | 5 | 1966 | | | | $0^m_.43$ | $+0^m_.94$ | $+1^m_.40$ |
| RS Cnc | | 8 | 1966 | | | | 0.48 | +0.94 | +1.41 |
| | | 18 | 1966 | | | | 0.39 | +0.96 | +1.46 |
| | Feb | 8 | 1966 | $5^m_.61$ | $+1^m_.62$ | $+1^m_.05$ | | | |
| | | 19 | 1966 | 5.88 | +1.53 | +0.96 | | | |
| | | 20 | 1966 | 5.89 | +1.54 | +0.96 | | | |
| | Mar | 17 | 1966 | 5.84 | +1.57 | +1.01 | | | |
| | | 27 | 1966 | 5.72 | +1.57 | +0.98 | | | |
| | Apr | 14 | 1966 | 5.55 | +1.58 | +0.97 | | | |
| | | 25 | 1966 | 5.47 | +1.60 | +1.14 | | | |
| | | 27 | 1966 | | | | 0.72 | +0.97 | +1.75 |
| | May | 6 | 1966 | | | | 0.93 | +1.02 | +1.58 |
| | | 21 | 1966 | 5.84 | +1.51 | +0.96 | | | |
| | | 27 | 1966 | | | | 0.64 | +1.08 | +1.67 |
| 3698 | Nov | 30 | 1965 | 5.87 | +1.58 | +1.65 | | | |
| | Dec | 1 | 1965 | 5.91 | +1.58 | +1.65 | | | |
| | | 23 | 1965 | 5.86 | +1.61 | +1.63 | | | |
| | Jan | 18 | 1966 | | | | 2.30 | +0.69 | +0.32 |
| | | 28 | 1966 | | | | 2.38 | +0.71 | +0.43 |
| | Feb | 19 | 1966 | 5.77 | +1.60 | +1.59 | | | |
| | May | 6 | 1966 | | | | 2.16 | +0.68 | +0.29 |
| | | 20 | 1966 | | | | 2.31 | +0.71 | +0.52 |
| | | 21 | 1966 | 5.95 | +1.59 | +1.58 | | | |
| | | 22 | 1966 | | | | 2.36 | +0.74 | +0.50 |
| | June | 5 | 1966 | | | | 2.30 | +0.70 | +0.35 |
| 3882 | Jan | 6 | 1966 | | | | 0.20 | +1.96 | +3.13 |
| | | 8 | 1966 | | | | 0.20 | +1.74 | +3.20 |
| | | 28 | 1966 | | | | 0.15 | +1.78 | +2.98 |
| | Feb | 19 | 1966 | 6.70 | +1.22 | +0.16 | | | |
| | | 20 | 1966 | 6.64 | +1.22 | +0.18 | | | |
| | Mar | 14 | 1966 | | | | -0.40 | +1.31 | +2.24 |
| | | 20 | 1966 | 6.14 | +1.28 | +0.20 | | | |
| | | 27 | 1966 | 6.45 | +1.27 | +0.10 | | | |
| | | 29 | 1966 | | | | -0.40 | +1.48 | +2.49 |
| | Apr | 14 | 1966 | 7.09 | +1.23 | -0.19 | | | |
| | | 24 | 1966 | | | | -0.18 | +1.72 | +2.72 |
| | | 25 | 1966 | 7.39 | +1.32 | -0.12 | | | |
| | | 27 | 1966 | | | | -0.07 | +1.76 | +2.78 |
| | May | 5 | 1966 | | | | -0.20 | +1.91 | +2.90 |
| | | 6 | 1966 | | | | -0.18 | +1.95 | +2.81 |
| | | 14 | 1966 | | | | 0.07 | +1.82 | +3.03 |
| | | 20 | 1966 | | | | 0.10 | +1.92 | +3.06 |
| | | 21 | 1966 | 8.08 | +1.31 | -0.35 | | | |
| | | 22 | 1966 | | | | 0.17 | +1.94 | +3.02 |
| 4184 | Nov | 30 | 1965 | 6.12 | +1.61 | +1.78 | | | |
| | Dec | 1 | 1965 | 6.16 | +1.59 | +1.76 | | | |
| | | 23 | 1965 | 6.10 | +1.62 | +1.80 | | | |
| | Jan | 28 | 1966 | | | | 3.10 | +0.60 | -0.03 |
| | Feb | 19 | 1966 | 5.98 | +1.61 | +1.79 | | | |
| | Apr | 14 | 1966 | 6.04 | +1.60 | +1.76 | | | |
| | May | 6 | 1966 | | | | 2.96 | +0.62 | -0.01 |
| | | 20 | 1966 | | | | 3.14 | +0.61 | -0.03 |
| 4195 | Dec | 1 | 1965 | 5.87 | +2.42 | - | | | |
| VY UMa | | 23 | 1965 | 5.83 | +2.41 | - | | | |
| | Jan | 18 | 1966 | | | | 2.91 | +0.415 | -0.095 |
| | | 28 | 1966 | | | | 7.88 | +0.44 | -0.06 |
| | Feb | 19 | 1966 | 6.07 | +2.52 | - | | | |
| | | 20 | 1966 | 6.06 | +2.51 | - | | | |
| | Mar | 30 | 1966 | | | | 2.87 | +0.425 | -0.12 |
| | | 31 | 1966 | 5.96 | +2.45 | - | | | |
| | Apr | 1 | 1966 | | | | 2.87 | +0.42 | -0.13 |
| | | 14 | 1966 | 5.90 | +2.47 | - | | | |
| | | 28 | 1966 | 5.95 | +2.38 | - | | | |
| | | 29 | 1966 | | | | 2.82 | +0.415 | -0.12 |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 4195 VY UMa | May 1 1966 | $5^{m}.93$ | $+2^{m}.39$ | - | | | |
| | 6 1966 | | | | $2^{m}.74$ | $+0^{m}.44$ | $-0^{m}.08$ |
| | 15 1966 | | | | 2.89 | +0.425 | -0.09 |
| | 20 1966 | | | | 2.88 | +0.44 | -0.08 |
| | 21 1966 | 5.99 | +2.48 | - | | | |
| | 22 1966 | | | | 2.88 | +0.45 | -0.09 |
| | June 5 1966 | | | | 2.86 | +0.42 | -0.10 |
| 4267 VY Leo | Mar 24 1962 | 5.92 | +1.45 | $+1^{m}.29$ | | | |
| | Nov 30 1965 | 5.84 | +1.43 | +1.25 | | | |
| | Dec 1 1965 | 5.87 | +1.43 | +1.18 | | | |
| | 23 1965 | 5.82 | +1.45 | +1.20 | | | |
| | Jan 6 1966 | | | | 1.41 | +0.92 | +1.24 |
| | 28 1966 | | | | 1.57 | +0.87 | +1.14 |
| | Feb 19 1966 | 5.88 | +1.42 | +1.11 | | | |
| | 20 1966 | 5.87 | +1.42 | +1.11 | | | |
| | Mar 14 1966 | | | | 1.36 | +0.895 | +1.16 |
| | 27 1966 | 5.94 | +1.47 | +1.18 | | | |
| | 29 1966 | | | | 1.48 | +0.885 | +1.145 |
| | Apr 14 1966 | 5.89 | +1.42 | +1.25 | | | |
| | 25 1966 | 5.74 | +1.45 | +1.23 | | | |
| | 28 1966 | | | | 1.48 | +0.88 | +1.16 |
| | May 5 1966 | | | | 1.34 | +0.90 | +1.16 |
| | 6 1966 | | | | 1.32 | +0.88 | +1.16 |
| | 20 1966 | | | | 1.56 | +0.855 | +1.16 |
| | 21 1966 | 5.95 | +1.39 | +1.10 | | | |
| | 22 1966 | | | | 1.58 | +0.86 | +1.08 |
| | June 9 1966 | | | | 1.27 | +0.85 | +1.12 |
| 4483 | 27 1965 | 5.34 | +1.59 | +1.60 | | | |
| | Nov 27 1965 | 5.32 | +1.55 | +1.57 | | | |
| | Dec 1 1965 | 5.38 | +1.55 | +1.55 | | | |
| | Jan 6 1966 | | | | 1.87 | +0.71 | +0.40 |
| | Feb 19 1966 | 5.39 | +1.57 | +1.54 | | | |
| | 20 1966 | 5.40 | +1.56 | +1.54 | | | |
| | Mar 14 1966 | | | | 1.90 | +0.69 | +0.315 |
| | 29 1966 | | | | 1.86 | +0.72 | +0.46 |
| | Apr 14 1966 | 5.36 | +1.56 | +1.53 | | | |
| | 24 1966 | | | | 1.90 | +0.69 | +0.39 |
| | 25 1966 | 5.28 | +1.55 | +1.60 | | | |
| | 28 1966 | | | | 1.98 | +0.715 | +0.34 |
| | May 5 1966 | | | | 1.86 | +0.71 | +0.41 |
| | 6 1966 | | | | 1.85 | +0.70 | +0.38 |
| | 14 1966 | | | | 1.91 | +0.685 | +0.38 |
| | 21 1966 | 5.28 | +1.58 | +1.61 | | | |
| | 22 1966 | | | | 2.08 | +0.68 | +0.27 |
| | June 9 1966 | | | | 1.82 | +0.70 | +0.43 |
| 4765 | Dec 27 1963 | 5.04 | +1.64 | +1.77 | | | |
| | Feb 19 1966 | 4.87 | +1.61 | +1.83 | | | |
| | Apr 30 1966 | | | | 2.05 | +0.58 | -0.19 |
| | May 20 1966 | | | | 2.22 | +0.565 | -0.185 |
| | 21 1966 | 4.98 | +1.60 | +1.80 | | | |
| | June 22 1966 | 4.96 | +1.61 | +1.84 | | | |
| 4800 T UMa | Mar 30 1966 | | | | 4.59 | +0.615 | +0.37 |
| | 31 1966 | 9.05 | +1.36 | +0.85 | | | |
| | Apr 1 1966 | | | | 4.61 | +0.615 | +0.36 |
| | 14 1966 | 8.11 | +1.40 | +0.77 | | | |
| | 29 1966 | | | | 4.43 | +0.675 | +0.52 |
| | 30 1966 | | | | 4.46 | +0.69 | +0.535 |
| | May 1 1966 | 8.27 | +1.51 | +0.79 | | | |
| | 21 1966 | 8.99 | +1.43 | +0.45 | | | |
| | 22 1966 | | | | 4.51 | +0.835 | +1.215 |
| | 29 1966 | | | | 4.51 | +0.95 | +1.41 |
| | June 9 1966 | | | | 4.70 | +1.085 | +1.795 |
| | 22 1966 | 10.69 | +1.39 | +0.16 | | | |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 4808 | Nov 22 1965 | $7^m.61$ | $+1^m.34$ | $+1^m.15$ | | | |
| R Vir | Jan 6 1966 | | | | $3^m.82$ | $+0^m.62$ | $+0^m.16$ |
| | 8 1966 | | | | 3.84 | +0.64 | -0.10 |
| | Feb 8 1966 | 9.43 | +1.38 | - | | | |
| | 16 1966 | | | | 4.22 | +1.16 | +7.015 |
| | 19 1966 | 10.06 | +1.37 | +0.54 | | | |
| | Mar 14 1966 | | | | 4.45 | +1.40 | +2.10 |
| | 27 1966 | 9.69 | +1.21 | +0.51 | | | |
| | 29 1966 | | | | 4.46 | +1.30 | +2.14 |
| | Apr 14 1966 | 9.47 | +1.17 | +0.73 | | | |
| | 25 1966 | 8.27 | +1.20 | +0.84 | | | |
| | 27 1966 | | | | 4.33 | +0.82 | +1.76 |
| | May 14 1966 | | | | 4.14 | +0.63 | -0.17 |
| | 20 1966 | | | | 4.19 | +0.64 | -0.79 |
| | 21 1966 | 6.75 | +1.43 | +1.12 | | | |
| | 22 1966 | | | | 4.17 | +0.60 | -0.21 |
| | 24 1966 | 6.81 | +6.46 | +1.23 | | | |
| | 25 1966 | 6.80 | +1.47 | +1.24 | | | |
| | 26 1966 | | | | 4.02 | +0.62 | -0.10 |
| | June 9 1966 | | | | 3.82 | +0.715 | +0.38 |
| | 10 1966 | 7.32 | +1.55 | +1.31 | | | |
| | 15 1966 | | | | 4.14 | +0.77 | +0.41 |
| 4846 | Jan 18 1966 | | | | 1.94 | +0.445 | +0.19 |
| Y CVn | Feb 19 1966 | 5.26 | +3.00 | - | | | |
| | Mar 30 1966 | | | | 1.75 | +0.445 | +0.12 |
| | 31 1966 | 5.16 | +2.80 | - | | | |
| | Apr 1 1966 | | | | 1.78 | +0.44 | +0.12 |
| | 14 1966 | 5.08 | +2.86 | - | | | |
| | 30 1966 | | | | 1.76 | +0.41 | +0.11 |
| | May 1 1966 | 5.09 | +2.74 | - | | | |
| | 15 1966 | | | | 1.78 | +0.42 | +0.12 |
| | 20 1966 | | | | 1.89 | +0.405 | +0.07 |
| | 21 1966 | 5.05 | +2.75 | - | | | |
| | 22 1966 | | | | 1.85 | +0.42 | +0.10 |
| | June 9 1966 | | | | 1.74 | +0.43 | +0.18 |
| 4909 | Mar 30 1966 | | | | 1.92 | +0.745 | +0.69 |
| TU CVn | 31 1966 | 5.87 | +1.57 | +1.49 | | | |
| | Apr 1 1966 | | | | 1.94 | +0.74 | +0.715 |
| | 14 1966 | 5.89 | +1.54 | +1.42 | | | |
| | 29 1966 | | | | 1.88 | +0.72 | +0.64 |
| | 30 1966 | | | | 1.91 | +0.73 | +0.63 |
| | May 1 1966 | 5.80 | +1.61 | +1.50 | | | |
| | 15 1966 | | | | 1.94 | +0.76 | +0.80 |
| | 20 1966 | | | | 2.08 | +0.77 | +0.78 |
| | 21 1966 | 6.06 | +1.51 | +1.35 | | | |
| | 22 1966 | | | | 2.04 | +0.77 | +0.85 |
| | 29 1966 | | | | 1.94 | +0.77 | +0.86 |
| 5052 | Jan 5 1966 | | | | 3.38 | +0.61 | -0.20 |
| | Feb 19 1966 | 6.06 | +1.66 | +1.81 | | | |
| | Mar 14 1966 | | | | 3.29 | +0.58 | -0.17 |
| | Apr 1 1966 | | | | 3.30 | +0.55 | -0.17 |
| | 14 1966 | 6.12 | +1.64 | +1.79 | | | |
| | May 1 1966 | 6.21 | +1.67 | +1.82 | | | |
| | 5 1966 | | | | 3.34 | +0.59 | -0.18 |
| | 6 1966 | | | | 3.29 | +0.58 | -0.18 |
| 5080 | Jan 11 1964 | 5.19 | +1.54 | +0.40 | | | |
| R Hya | 14 1964 | 5.21 | +1.54 | +0.40 | | | |
| | Jan 8 1966 | | | | 0.62 | +2.28 | +3.21 |
| | Feb 15 1966 | | | | 0.54 | +2.00 | +2.91 |
| | 19 1966 | 8.06 | +1.77 | +0.08 | | | |
| | May 6 1966 | | | | -0.02 | +1.50 | +2.26 |
| | 21 1966 | 6.04 | +1.52 | +0.25 | | | |
| | 26 1966 | 6.01 | +1.50 | +0.47 | | | |
| | June 9 1966 | | | | -0.05 | +1.20 | +1.97 |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-V | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 5101 | Mar 29 1966 | | | | $3^m.64$ | $+2^m.25$ | $+3^m.18$ |
| S Vir | May 26 1966 | | | | 3.54 | +2.00 | +3.36 |
| | June 16 1966 | | | | 3.32 | +1.91 | +3.24 |
| 5199 | Mar 30 1966 | | | | 2.97 | +1.685 | +2.77 |
| R CVn | 31 1966 | $10^m.28$ | $+1^m.50$ | $+0^m.41$ | | | |
| | Apr 1 1966 | | | | 2.96 | +1.665 | +2.70 |
| | 14 1966 | 9.75 | +1.27 | +0.23 | | | |
| | 28 1966 | 9.44 | +1.27 | +0.35 | | | |
| | 30 1966 | | | | 2.78 | +1.40 | +2.36 |
| | May 21 1966 | 8.72 | +1.22 | +0.31 | | | |
| | 22 1966 | | | | 2.44 | +1.25 | +1.95 |
| | 27 1966 | 8.55 | +1.22 | +0.41 | | | |
| | 29 1966 | | | | 2.65 | +1.28 | +1.98 |
| | June 9 1966 | | | | 2.51 | +1.08 | +1.63 |
| | 21 1966 | | | | 2.46 | +0.97 | +1.35 |
| 5299 | June 11 1964 | 5.25 | +1.55 | +1.57 | | | |
| | 12 1964 | 5.20 | +1.57 | +1.57 | | | |
| | 14 1964 | 5.13 | +1.54 | +1.60 | | | |
| | Feb 19 1966 | 5.15 | +1.56 | +1.50 | | | |
| | Mar 14 1966 | | | | 1.65 | +0.715 | +0.46 |
| | 30 1966 | | | | 1.79 | +0.68 | +0.44 |
| | 31 1966 | 5.18 | +1.67 | +1.59 | | | |
| | Apr 1 1966 | | | | 1.87 | +0.685 | +0.405 |
| | 14 1966 | 5.22 | +1.55 | +1.54 | | | |
| | 28 1966 | 5.34 | +1.57 | +1.60 | | | |
| | 29 1966 | | | | 1.66 | +0.705 | +0.54 |
| | 30 1966 | | | | 1.56 | +0.71 | +0.52 |
| | May 20 1966 | | | | 1.53 | +0.68 | +0.51 |
| | 21 1966 | 5.27 | +1.56 | +1.58 | | | |
| | 22 1966 | | | | 1.58 | +0.70 | +0.55 |
| | June 9 1966 | | | | 1.60 | +0.71 | +0.46 |
| 5331 | July 2 1962 | 6.37 | +1.60 | +1.80 | | | |
| | 12 1962 | 6.62 | +1.58 | +1.78 | | | |
| | Feb 19 1966 | 6.48 | +1.61 | +1.75 | | | |
| | Mar 14 1966 | | | | 3.65 | +0.63 | -0.11 |
| | Apr 14 1966 | 6.46 | +1.59 | +1.74 | | | |
| | May 5 1966 | | | | 3.65 | +0.63 | -0.14 |
| 5490 | June 11 1964 | 4.83 | +1.67 | +1.86 | | | |
| W Boo | 13 1964 | 4.81 | +1.67 | +1.84 | | | |
| | Feb 16 1966 | | | | 2.30 | +0.52 | -0.42 |
| | Mar 20 1966 | 4.75 | +1.66 | +2.02 | | | |
| | 24 1966 | | | | 2.27 | +0.53 | -0.45 |
| | 27 1966 | 4.66 | +1.64 | +1.90 | | | |
| | 29 1966 | | | | 2.21 | +0.53 | -0.39 |
| | Apr 1 1966 | 4.80 | +1.65 | +1.82 | | | |
| | May 5 1966 | | | | 2.26 | +0.55 | -0.41 |
| | 20 1966 | | | | 2.65 | +0.53 | -0.365 |
| | 21 1966 | 4.79 | +1.64 | +1.90 | | | |
| | 22 1966 | | | | 2.63 | +0.52 | -0.31 |
| | June 9 1966 | | | | 2.21 | +0.53 | -0.40 |
| 5589 | July 31 1962 | 4.68 | +1.54 | +1.54 | | | |
| RR UMi | Aug 2 1962 | 4.70 | +1.55 | +1.53 | | | |
| | Feb 19 1966 | 4.61 | +1.58 | +1.52 | | | |
| | Mar 30 1966 | | | | 0.99 | +0.71 | +0.405 |
| | 31 1966 | 4.59 | +1.58 | +1.52 | | | |
| | Apr 1 1966 | | | | 1.03 | +0.71 | +0.42 |
| | 14 1966 | 4.80 | +1.53 | +1.47 | | | |
| | 28 1966 | 4.53 | +1.60 | +1.60 | | | |
| | 29 1966 | | | | 0.48 | +0.70 | +0.34 |
| | 30 1966 | | | | 1.02 | +0.70 | +0.35 |
| | May 1 1966 | 4.55 | +1.61 | +1.63 | | | |
| | 15 1966 | | | | 1.01 | +0.74 | +0.54 |
| | 20 1966 | | | | 0.82 | +0.75 | +0.67 |
| | 21 1966 | 4.78 | +1.55 | +1.48 | | | |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 5589 | May 22 1966 | | | | $0^m.87$ | $+0^m.74$ | $+0^m.65$ |
| RR UMi | 27 1966 | $4^m.75$ | $+1^m.57$ | $+1^m.50$ | | | |
| | 29 1966 | | | | 1.08 | +0.73 | +0.49 |
| | June 9 1966 | 4.73 | +1.57 | | | | |
| | 12 1966 | | | | 1.06 | +0.73 | +0.52 |
| | 22 1966 | 4.73 | +1.57 | +1.65 | | | |
| 5654 | Feb 19 1966 | 5.79 | +1.55 | +1.45 | | | |
| | Mar 29 1966 | | | | 2.64 | +0.625 | +0.17 |
| | Apr 14 1966 | 5.90 | +1.50 | +1.39 | | | |
| | 27 1966 | | | | 2.68 | +0.67 | +0.21 |
| | May 5 1966 | | | | 2.72 | +0.65 | +0.14 |
| | 21 1966 | 6.02 | +1.48 | +1.38 | | | |
| | 22 1966 | | | | 2.75 | +0.60 | +0.30 |
| | June 9 1966 | | | | 2.71 | +0.62 | +0.15 |
| | 16 1966 | | | | 2.75 | +0.64 | +0.18 |
| 5894 | Feb 19 1966 | 7.10 | +1.39 | +0.39 | | | |
| R Ser | Mar 14 1966 | | | | 2.36 | +1.20 | +1.84 |
| | 20 1966 | 8.15 | +1.40 | +0.13 | | | |
| | 28 1966 | 8.42 | +1.38 | -0.01 | | | |
| | 29 1966 | | | | 2.20 | +1.42 | +2.13 |
| | Apr 14 1966 | 8.98 | +1.38 | -0.19 | | | |
| | 25 1966 | 9.39 | +1.37 | -0.11 | | | |
| | 27 1966 | | | | 2.50 | +1.70 | +2.47 |
| | May 12 1966 | 9.86 | +1.41 | -0.12 | | | |
| | 13 1966 | 9.97 | +1.43 | -0.11 | | | |
| | 14 1966 | | | | 2.69 | +1.81 | +2.70 |
| | 20 1966 | | | | 2.76 | +1.82 | +2.74 |
| | 21 1966 | 10.15 | +1.33 | -0.21 | | | |
| | 22 1966 | | | | 2.83 | +1.78 | +2.66 |
| | 24 1966 | 10.26 | +1.51 | -0.06 | | | |
| | 26 1966 | | | | 2.83 | +1.85 | +2.79 |
| | June 14 1966 | | | | 3.06 | +1.98 | +2.99 |
| 5958 | Feb 16 1966 | | | | 6.98 | +0.65 | +0.15 |
| T CrB | Apr 16 1966 | | | | 6.92 | +0.64 | +0.14 |
| | 23 1966 | | | | 7.15 | +0.68 | +0.465 |
| | 24 1966 | | | | 6.93 | +0.68 | +0.31 |
| | May 14 1966 | | | | 6.89 | +0.665 | +0.09 |
| | 24 1966 | 10.00 | +1.54 | +1.24 | | | |
| | 26 1966 | | | | 6.89 | +0.665 | +0.16 |
| 6039 | June 3 1964 | 5.83 | +1.55 | +1.58 | | | |
| LQ Her | 5 1964 | 5.79 | +1.56 | +1.58 | | | |
| | 7 1964 | 5.72 | +1.57 | +1.59 | | | |
| | 9 1964 | 5.72 | +1.58 | +1.55 | | | |
| | 13 1964 | 5.75 | +1.56 | +1.58 | | | |
| | Feb 19 1966 | 5.76 | +1.60 | +1.55 | | | |
| | Mar 29 1966 | | | | 2.20 | +0.725 | +0.50 |
| | Apr 14 1966 | 5.83 | +1.60 | +1.61 | | | |
| | 25 1966 | 5.85 | +1.61 | +1.64 | | | |
| | 27 1966 | | | | 2.25 | +0.705 | +0.49 |
| | May 5 1966 | | | | 2.34 | +0.72 | +0.43 |
| | 20 1966 | | | | 2.27 | +0.70 | +0.44 |
| | 21 1966 | 5.58 | +1.57 | +1.62 | | | |
| | 22 1966 | | | | 2.35 | +0.71 | +0.41 |
| | June 9 1966 | | | | 2.30 | +0.70 | +0.46 |
| 6086 | Feb 19 1966 | 5.43 | +1.64 | +1.62 | | | |
| AT Dra | Mar 30 1966 | | | | 2.17 | +0.72 | +0.15 |
| | 31 1966 | 5.35 | +1.63 | +1.70 | | | |
| | Apr 1 1966 | | | | 2.02 | +0.67 | +0.21 |
| | 14 1966 | 5.47 | +1.60 | +1.65 | | | |
| | 28 1966 | 5.35 | +1.62 | +1.70 | | | |
| | 29 1966 | | | | 1.99 | +0.66 | +0.21 |
| | 30 1966 | | | | 2.04 | +0.665 | +0.22 |
| | May 5 1966 | | | | 2.06 | +0.68 | +0.20 |
| | 15 1966 | | | | 2.05 | +0.70 | +0.30 |
| | 20 1966 | | | | 1.89 | +0.67 | +0.41 |

TABLE 2 (CONT'D)

| HR/Name | Date | | | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|---|---|
| 6086 | May | 21 | 1966 | $5^m.50$ | $+1^m.61$ | $+1^m.68$ | | | |
| AT Dra | | 29 | 1966 | | | | $2^m.01$ | $+0^m.66$ | $+0^m.24$ |
| | June | 9 | 1966 | | | | 1.90 | +0.66 | +0.23 |
| | | 21 | 1966 | | | | 2.02 | +0.68 | +0.28 |
| 6119 | Mar | 20 | 1966 | 11.60 | +2.00 | +0.64 | | | |
| U Her | | 29 | 1966 | | | | 2.78 | +1.68 | +3.45 |
| | Apr | 25 | 1966 | 9.00 | +1.64 | +0.77 | | | |
| | | 27 | 1966 | | | | 2.11 | +1.24 | +2.64 |
| | May | 1 | 1966 | | | | 2.13 | +1.26 | +2.33 |
| | | 12 | 1966 | 8.46 | +1.52 | +0.69 | | | |
| | | 13 | 1966 | 8.50 | +1.54 | +0.65 | | | |
| | | 14 | 1966 | | | | 2.02 | +1.09 | +2.36 |
| | | 24 | 1966 | 8.50 | +1.53 | +0.62 | | | |
| | | 26 | 1966 | | | | 1.98 | +1.22 | +2.44 |
| | June | 9 | 1966 | | | | 2.02 | +1.28 | +2.55 |
| 6128 | Mar | 24 | 1962 | 5.38 | +1.74 | +2.15 | | | |
| | July | 3 | 1962 | 5.01 | +1.76 | +2.03 | | | |
| | Aug | 8 | 1962 | 5.21 | +1.73 | +2.05 | | | |
| | Mar | 29 | 1966 | | | | 2.57 | +0.55 | -0.30 |
| | May | 5 | 1966 | | | | 2.74 | +0.57 | -0.32 |
| | | 20 | 1966 | | | | 2.72 | +0.54 | -0.42 |
| | | 21 | 1966 | 5.25 | +1.76 | +2.02 | | | |
| | | 22 | 1966 | | | | 2.82 | +0.53 | -0.43 |
| | | 25 | 1966 | 5.22 | +1.74 | +2.08 | | | |
| | | 26 | 1966 | | | | 2.56 | +0.54 | -0.33 |
| 6146 | July | 2 | 1962 | 4.93 | +1.48 | +1.10 | | | |
| g Her | Aug | 2 | 1962 | 4.82 | +1.47 | +1.13 | | | |
| | Feb | 16 | 1966 | 4.92 | +1.50 | +1.01 | | | |
| | Apr | 1 | 1966 | | | | 0.06 | +0.88 | +1.16 |
| | | 28 | 1966 | 4.90 | +1.51 | +1.10 | | | |
| | | 29 | 1966 | | | | 0.09 | +0.90 | +1.30 |
| | | 30 | 1966 | | | | 0.11 | +0.90 | +1.34 |
| | May | 5 | 1966 | | | | 0.16 | +0.95 | +1.27 |
| | | 15 | 1966 | | | | 0.15 | +0.91 | +1.35 |
| | | 20 | 1966 | | | | 0.06 | +0.87 | +1.33 |
| | | 21 | 1966 | 4.88 | +1.45 | +1.10 | | | |
| | June | 9 | 1966 | | | | 0.08 | +0.86 | +1.22 |
| | | 21 | 1966 | | | | 0.06 | +0.89 | +1.27 |
| | | 22 | 1966 | 4.77 | +1.58 | +1.26 | | | |
| 6242 | Feb | 19 | 1966 | 5.83 | +1.60 | +1.60 | | | |
| | Mar | 14 | 1966 | | | | 2.63 | +0.68 | +0.20 |
| | | 30 | 1966 | | | | 2.51 | +0.685 | +0.335 |
| | | 31 | 1966 | 6.03 | +1.58 | +1.65 | | | |
| | Apr | 1 | 1966 | | | | 2.56 | +0.69 | +0.32 |
| | | 28 | 1966 | 5.90 | +1.59 | +1.70 | | | |
| | | 29 | 1966 | | | | 2.59 | +0.65 | +0.26 |
| | | 30 | 1966 | | | | 2.54 | +0.66 | +0.28 |
| | May | 5 | 1966 | | | | 2.65 | +0.69 | +0.24 |
| | | 15 | 1966 | | | | 2.56 | +0.68 | +0.28 |
| | | 20 | 1966 | | | | 2.51 | +0.67 | +0.32 |
| | | 21 | 1966 | 5.98 | +1.56 | +1.64 | | | |
| | June | 9 | 1966 | | | | 2.57 | +0.68 | +0.30 |
| | | 21 | 1966 | | | | 2.56 | +0.67 | +0.30 |
| | | 22 | 1966 | 5.91 | +1.60 | +1.69 | | | |
| 6346 | Mar | 30 | 1966 | | | | 2.75 | +0.705 | +0.36 |
| | | 31 | 1966 | 6.29 | +1.56 | +1.62 | | | |
| | Apr | 1 | 1966 | | | | 2.79 | +0.71 | +0.34 |
| | | 28 | 1966 | 6.22 | +1.58 | +1.68 | | | |
| | | 29 | 1966 | | | | 2.74 | +0.67 | +0.32 |
| | | 30 | 1966 | | | | 2.76 | +0.67 | +0.30 |
| | May | 5 | 1966 | | | | 2.87 | +0.69 | +0.21 |
| | | 15 | 1966 | | | | 2.83 | +0.72 | +0.42 |
| | | 20 | 1966 | 6.42 | +1.54 | +1.60 | | | |
| | June | 9 | 1966 | | | | 2.83 | +0.70 | +0.36 |
| | | 22 | 1966 | 6.23 | +1.58 | +1.66 | | | |

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TABLE 2 (CONT'D)

| HR/Name | Date | | | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|---|---|
| 6495 | Mar | 28 | 1966 | $6^m.12$ | $+1^m.63$ | $+1^m.66$ | | | |
| | | 29 | 1966 | | | | $2^m.64$ | $+0^m.675$ | $+0^m.36$ |
| | Apr | 24 | 1966 | | | | 2.72 | +0.69 | +0.36 |
| | | 25 | 1966 | 6.18 | +1.62 | +1.68 | | | |
| | | 27 | 1966 | | | | 2.93 | +0.70 | +0.37 |
| | May | 5 | 1966 | | | | 2.83 | +0.71 | +0.36 |
| | | 14 | 1966 | 6.24 | +1.60 | +1.70 | | | |
| | | | 1966 | | | | 2.73 | +0.72 | +0.42 |
| | | 20 | 1966 | | | | 2.82 | +0.70 | +0.35 |
| | | 21 | 1966 | 6.28 | +1.59 | +1.66 | | | |
| | | 25 | 1966 | 6.21 | +1.61 | +1.67 | | | |
| | | 26 | 1966 | | | | 2.71 | +0.72 | +0.41 |
| | June | 9 | 1966 | | | | 2.78 | +0.68 | +0.20 |
| 6702 | Mar | 30 | 1966 | | | | 2.10 | +0.755 | +0.68 |
| OP Her | Apr | 1 | 1966 | | | | 2.14 | +0.75 | +0.67 |
| | | 29 | 1966 | | | | 2.12 | +0.73 | +0.68 |
| | | 30 | 1966 | | | | 2.14 | +0.73 | +0.68 |
| | May | 5 | 1966 | | | | 2.24 | +0.74 | +0.60 |
| | | 15 | 1966 | | | | 2.12 | +0.745 | +0.675 |
| | | 20 | 1966 | | | | 2.14 | +0.72 | +0.65 |
| | June | 9 | 1966 | | | | 2.12 | +0.725 | +0.645 |
| 6834 | Apr | 27 | 1966 | | | | 2.82 | +0.69 | +0.23 |
| | May | 20 | 1966 | | | | 3.02 | +0.65 | +0.15 |
| | | 26 | 1966 | | | | 2.84 | +0.695 | +0.27 |
| 7002 | Apr | 27 | 1966 | | | | 1.72 | +1.42 | +2.54 |
| X Oph | May | 12 | 1966 | 6.37 | +1.29 | +0.91 | | | |
| | | 20 | 1966 | | | | 2.12 | +1.24 | +2.54 |
| | | 21 | 1966 | 6.42 | +1.34 | +0.85 | | | |
| | | 24 | 1966 | 8.46 | +1.32 | +0.92 | | | |
| | | 26 | 1966 | | | | 1.98 | +1.22 | +2.54 |
| | June | 9 | 1966 | | | | 2.14 | +1.18 | +2.68 |
| 7009 | Mar | 31 | 1966 | 5.88 | +1.66 | +1.56 | | | |
| XY Lyr | Apr | 1 | 1966 | 1.82 | +0.76 | +0.77 | | | |
| | | 29 | 1966 | | | | 1.84 | +0.76 | +0.97 |
| | May | 15 | 1966 | | | | 1.84 | +0.76 | +0.94 |
| | | 20 | 1966 | | | | 1.93 | +0.76 | +0.84 |
| | | 21 | 1966 | 6.05 | +1.65 | +1.46 | | | |
| | June | 9 | 1966 | | | | 1.90 | +0.75 | +0.80 |
| 7139 | June | 11 | 1964 | 4.33 | +1.65 | +1.60 | | | |
| | | 12 | 1964 | 4.32 | +1.67 | +1.63 | | | |
| | | 13 | 1964 | 4.30 | +1.67 | +1.58 | | | |
| | | 14 | 1964 | 4.23 | +1.65 | +1.65 | | | |
| | Mar | 30 | 1966 | | | | 0.57 | +0.62 | +0.36 |
| | | 31 | 1966 | 4.16 | +1.61 | +1.55 | | | |
| | Apr | 1 | 1966 | | | | 0.80 | +0.62 | +0.24 |
| | | 25 | 1966 | 4.13 | +1.61 | +1.55 | | | |
| | | 27 | 1966 | | | | 0.82 | +0.62 | +0.23 |
| | | 28 | 1966 | 4.17 | +1.61 | +1.54 | | | |
| | May | 12 | 1966 | 4.29 | +1.59 | +1.52 | | | |
| | | 14 | 1966 | | | | 0.90 | +0.61 | +0.30 |
| | | 15 | 1966 | | | | 0.86 | +0.64 | +0.34 |
| | | 20 | 1966 | | | | 0.95 | +0.61 | +0.27 |
| | | 21 | 1966 | 4.30 | +1.59 | +1.48 | | | |
| | June | 9 | 1966 | | | | 0.90 | +0.60 | +0.20 |
| 7157 | Mar | 30 | 1966 | | | | -0.07 | +0.78 | +0.76 |
| R Lyr | | 31 | 1966 | 3.94 | +1.58 | +1.51 | | | |
| | Apr | 1 | 1966 | | | | -0.02 | +0.76 | +0.73 |
| | | 23 | 1966 | | | | 0.06 | +0.77 | +0.74 |
| | | 24 | 1966 | | | | 0.06 | +0.76 | +0.75 |
| | | 25 | 1966 | 4.01 | +1.56 | +1.42 | | | |
| | | 27 | 1966 | | | | -0.03 | +0.77 | +0.78 |
| | | 28 | 1966 | 4.02 | +1.57 | +1.48 | | | |
| | | 29 | 1966 | | | | -0.03 | +0.74 | +0.75 |
| | | 30 | 1966 | | | | 0.08 | +0.77 | +0.76 |

TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 7157 | May 5 1966 | | | | $0^{m}.15$ | $+0^{m}.77$ | $+0^{m}.66$ |
| R Lyr | 12 1966 | $3^{m}.89$ | $+1^{m}.54$ | $+1^{m}.52$ | | | |
| | 14 1966 | | | | 0.00 | +0.73 | +0.66 |
| | 15 1966 | | | | -0.02 | +0.74 | +0.69 |
| | 20 1966 | | | | 0.05 | +0.74 | +0.65 |
| | 21 1966 | 3.95 | +1.57 | +1.48 | | | |
| | 24 1966 | 4.01 | +1.57 | +1.44 | | | |
| | 26 1966 | | | | 0.05 | +0.74 | +0.78 |
| | 27 1966 | 4.14 | +1.58 | +1.84 | | | |
| | 29 1966 | | | | 0.06 | +0.78 | +0.80 |
| | June 9 1966 | | | | 0.05 | +0.76 | +0.78 |
| 7201 | Mar 30 1966 | | | | 3.17 | +0.675 | +0.33 |
| | Apr 1 1966 | | | | 3.21 | +0.67 | +0.31 |
| | 14 1966 | | | | 3.22 | +0.655 | +0.25 |
| | 23 1966 | | | | 3.27 | +0.645 | +0.24 |
| | 24 1966 | | | | 3.26 | +0.64 | +0.23 |
| | 29 1966 | | | | 3.19 | +0.63 | +0.26 |
| | 30 1966 | | | | 3.19 | +0.63 | +0.28 |
| | May 5 1966 | | | | 3.34 | +0.65 | +0.21 |
| | 15 1966 | | | | 3.20 | +0.65 | +0.30 |
| | 20 1966 | | | | 3.24 | +0.64 | +0.27 |
| | 29 1966 | | | | 3.22 | +0.665 | +0.285 |
| | June 9 1966 | | | | 3.26 | +0.665 | +0.24 |
| 7220 | Apr 23 1966 | | | | 2.90 | +0.52 | +0.35 |
| V Agl | 25 1966 | 6.74 | +3.85 | - | | | |
| | 27 1966 | | | | 2.82 | +0.52 | +0.38 |
| | May 12 1966 | 6.88 | +3.85 | - | | | |
| | 14 1966 | | | | 2.91 | +0.52 | +0.33 |
| | 21 1966 | 6.71 | +4.00 | - | | | |
| 7243 | June 11 1964 | 6.58 | +1.13 | +0.61 | | | |
| R Agl | 12 1964 | 6.42 | +1.10 | +0.62 | | | |
| | 13 1964 | 6.58 | +1.13 | +0.61 | | | |
| | 14 1964 | 6.17 | +1.18 | +0.67 | | | |
| | July 3 1964 | 6.07 | +1.19 | +0.64 | | | |
| | 5 1964 | 6.14 | +1.19 | +0.59 | | | |
| | 7 1964 | 6.14 | +1.19 | +0.59 | | | |
| | 9 1964 | 6.19 | +1.20 | +0.55 | | | |
| | 11 1964 | 6.26 | +1.17 | +0.56 | | | |
| | 13 1964 | 6.34 | +1.19 | +0.48 | | | |
| | Apr 23 1966 | | | | 1.51 | +1.72 | +2.51 |
| | 25 1966 | 8.75 | +1.62 | +0.17 | | | |
| | 27 1966 | | | | 2.06 | +1.81 | +2.57 |
| | May 12 1966 | 9.25 | +1.60 | +0.21 | | | |
| | 14 1966 | | | | 1.78 | +1.70 | +2.76 |
| | 21 1966 | 6.92 | +1.64 | +0.10 | | | |
| 7509 | Apr 29 1966 | | | | 2.51 | +0.80 | +0.82 |
| | 30 1966 | | | | 2.52 | +0.79 | +0.82 |
| | May 5 1966 | | | | 2.62 | +0.79 | +0.73 |
| | 15 1966 | | | | 2.50 | +0.76 | +0.72 |
| | 21 1966 | 6.44 | +1.57 | +1.52 | | | |
| | 22 1966 | | | | 2.52 | +0.73 | +0.70 |
| | 27 1966 | 6.55 | +1.59 | +1.50 | | | |
| | 29 1966 | | | | 2.52 | +0.76 | +0.74 |
| | June 21 1966 | | | | 2.45 | +0.75 | +0.70 |
| | 22 1966 | 6.33 | +1.62 | +1.56 | | | |
| 7523 | Aug 15 1964 | 6.15 | +1.61 | +1.86 | | | |
| | 16 1964 | 6.17 | +1.60 | +1.90 | | | |
| | Sept 1 1964 | 6.32 | +1.62 | +1.88 | | | |
| | 2 1964 | 6.36 | +1.62 | +1.84 | | | |
| | Apr 29 1966 | | | | 3.53 | +0.62 | +0.115 |
| | 30 1966 | | | | 3.54 | +0.63 | +0.115 |
| | May 15 1966 | | | | 3.54 | +0.66 | +0.18 |
| | 21 1966 | 6.77 | +1.60 | +1.77 | | | |
| | 29 1966 | | | | 3.59 | +0.66 | +0.10 |
| | June 22 1966 | 6.48 | +1.63 | +1.90 | | | |

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TABLE 2 (CONT'D)

| HR/Name | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| 7564 | June 9 1966 | | | | $0^{m}.76$ | $+1^{m}.22$ | $+2^{m}.25$ |
| $\chi$ Cyg | 21 1966 | | | | 0.57 | +1.46 | +2.64 |
| 7645 | May 12 1966 | $5^{m}.28$ | $+1^{m}.59$ | $+1^{m}.81$ | | | |
| VZ Sge | 26 1966 | | | | 2.11 | +0.65 | +0.20 |
| | June 9 1966 | | | | 2.34 | +0.64 | +0.12 |
| 7886 | Aug 13 1964 | 6.16 | +1.38 | +0.96 | | | |
| EU Del | 14 1964 | 6.19 | +1.37 | +0.98 | | | |
| | May 26 1966 | | | | 1.12 | +0.43 | +1.38 |
| | June 9 1966 | | | | 1.08 | +0.90 | +1.50 |
| 7941 | May 26 1966 | | | | 1.86 | +0.88 | +1.39 |
| U Del | | | | | | | |
| 8262 | Nov 25 1965 | 5.98 | +1.57 | +1.00 | | | |
| W Cyg | Dec 1 1965 | 6.00 | +1.56 | +1.00 | | | |
| | 23 1965 | 5.83 | +1.58 | +1.03 | | | |
| | May 20 1966 | | | | 0.85 | +0.93 | +1.31 |
| | 29 1966 | | | | 0.74 | +0.89 | +1.22 |
| | June 21 1966 | | | | 0.65 | +0.92 | +1.33 |
| | 22 1966 | 5.49 | +1.67 | +1.26 | | | |
| 8297 | June 14 1966 | | | | 2.71 | +0.45 | +0.02 |
| V400 Cyg | 21 1966 | | | | 2.60 | +0.43 | +0.17 |
| 8298 | Nov 25 1965 | 6.18 | +1.56 | +1.43 | | | |
| | Dec 1 1965 | 6.20 | +1.54 | - | | | |
| | 23 1965 | 6.01 | +1.53 | +1.49 | | | |
| | June 21 1966 | | | | 2.24 | +0.76 | +0.78 |
| | 22 1966 | 6.25 | +1.57 | +1.55 | | | |
| 8383 | June 21 1966 | | | | 2.88 | +0.59 | -0.03 |
| VV Cep | | | | | | | |
| 8421 | Aug 12 1964 | 6.09 | +1.58 | +1.68 | | | |
| | 13 1964 | 6.15 | +1.60 | +1.73 | | | |
| | 14 1964 | 6.18 | +1.58 | +1.72 | | | |
| | Sept 1 1965 | 6.12 | +1.60 | +1.76 | | | |
| | 2 1965 | 6.13 | +1.61 | +1.73 | | | |
| | Nov 25 1965 | 6.14 | +1.61 | +1.71 | | | |
| | 26 1965 | 6.13 | +1.60 | +1.74 | | | |
| | 27 1965 | 6.10 | +1.62 | +1.74 | | | |
| | 30 1965 | 6.12 | +1.62 | +1.68 | | | |
| | Dec 1 1965 | 6.10 | +1.61 | +1.77 | | | |
| | Jan 5 1966 | | | | 2.48 | +0.66 | +0.28 |
| | June 21 1966 | | | | 2.93 | +0.65 | +0.20 |
| | 22 1966 | 6.23 | +1.50 | +1.93 | | | |
| 8714 | Nov 27 1965 | 6.23 | +1.80 | +1.85 | | | |
| | 30 1965 | 6.24 | +1.78 | +1.86 | | | |
| | Dec 1 1965 | 6.22 | +1.76 | +1.86 | | | |
| | 23 1965 | 6.12 | +1.77 | - | | | |
| 8989 | Nov 26 1965 | 6.51 | +1.83 | +2.04 | | | |
| | 27 1965 | 6.49 | +1.88 | +2.06 | | | |
| | 30 1965 | 6.48 | +1.87 | +2.01 | | | |
| | Dec 1 1965 | 6.46 | +1.85 | +2.06 | | | |
| | 23 1965 | 6.55 | +1.88 | +2.00 | | | |
| | June 21 1966 | | | | 3.56 | +0.53 | -0.22 |
| | 22 1966 | 6.47 | +1.88 | +2.08 | | | |
| 8992 | Jan 6 1966 | | | | 0.56 | +2.39 | +3.06 |
| R Aqr | | | | | | | |
| 9004 | Nov 26 1965 | 4.94 | +2.53 | +2.78 | | | |
| TX Psc | 27 1965 | 4.94 | +2.56 | +2.76 | | | |
| | Dec 1 1965 | 4.97 | +2.52 | +2.74 | | | |
| | 23 1965 | 4.92 | +2.54 | +2.80 | | | |
| 9030 | Dec 22 1961 | $5^{m}.90$ | $+1^{m}.62$ | $+1^{m}.71$ | | | |
| | 26 1961 | 5.82 | +1.65 | +1.78 | | | |
| | Nov 26 1965 | 5.73 | +1.64 | +1.76 | | | |
| | 27 1965 | 5.74 | +1.65 | +1.76 | | | |
| 9066 | Jan 18 1966 | | | | $1^{m}.58$ | $+2^{m}.78$ | $+3^{m}.48$ |
| R Cas | June 21 1966 | | | | 0.20 | +1.00 | +1.72 |

TABLE 3

OBSERVATIONS OF ADDITIONAL VARIABLE STARS

| Star | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| FF Aql | May 14 1966 | | | | $4^{\rm m}.45$ | $+0^{\rm m}.19$ | $-1^{\rm m}.53$ |
| η Aql | May 17 1966 | | | | 3.17 | +0.24 | -1.43 |
| R Boo | Mar 14 1966 | | | | 3.85 | +0.965 | +1.14 |
| | 20 1966 | $8^{\rm m}.81$ | $+1^{\rm m}.39$ | $+0^{\rm m}.59$ | | | |
| | 27 1966 | 9.14 | +1.36 | +0.43 | | | |
| | 29 1966 | | | | 3.97 | +1.13 | +1.61 |
| | Apr 14 1966 | 9.98 | +1.30 | +0.16 | | | |
| | May 25 1966 | 11.52 | +1.34 | -0.13 | | | |
| | 26 1966 | | | | 4.59 | +1.55 | +2.56 |
| | June 15 1966 | | | | 4.66 | +1.56 | +2.57 |
| RV Boo | Feb 16 1966 | | | | 2.30 | +1.18 | +1.91 |
| | Mar 20 1966 | 8.32 | +1.56 | +0.80 | | | |
| | 27 1966 | 8.18 | +1.53 | +0.72 | | | |
| | 29 1966 | | | | 2.32 | +1.20 | +2.02 |
| | Apr 14 1966 | 8.37 | +1.45 | +0.56 | | | |
| | May 20 1966 | | | | 2.13 | +1.10 | +2.02 |
| | 21 1966 | 8.06 | +1.47 | +0.68 | | | |
| | 22 1966 | | | | 2.18 | +1.12 | +2.02 |
| RW Boo | Mar 14 1966 | | | | 2.70 | +1.02 | +1.64 |
| | 20 1966 | 8.04 | +1.41 | +0.87 | | | |
| | 27 1966 | 7.82 | +1.41 | +0.83 | | | |
| | 29 1966 | | | | 2.66 | +1.02 | +1.61 |
| | Apr 14 1966 | 7.96 | +1.34 | +0.77 | | | |
| | May 20 1966 | | | | 2.58 | +0.88 | +1.62 |
| | 21 1966 | 7.75 | +1.34 | +0.89 | | | |
| | 22 1966 | | | | 2.62 | +0.91 | +1.63 |
| RU Cam | Mar 30 1966 | | | | 7.34 | +0.20 | -1.31 |
| | Apr 1 1966 | | | | 7.34 | +0.19 | -1.32 |
| RV Cam | Dec 30 1965 | 8.07 | +1.47 | +1.30 | | | |
| | Jan 5 1966 | | | | 2.76 | +0.985 | +1.55 |
| | 18 1966 | | | | 2.80 | +0.97 | +1.47 |
| Z Cnc | Jan 8 1966 | | | | 3.52 | +1.08 | +1.62 |
| | Feb 8 1966 | 8.28 | +1.57 | +1.10 | | | |
| | Mar 27 1966 | 8.80 | +1.51 | +0.94 | | | |
| | 29 1966 | | | | 3.44 | +1.08 | +1.78 |
| | Apr 27 1966 | | | | 3.48 | +1.13 | +1.98 |
| T CVn | Apr 14 1966 | 9.90 | +1.47 | +0.73 | | | |
| | 26 1966 | 10.18 | +1.54 | +0.74 | | | |
| | May 14 1966 | | | | 4.51 | +1.12 | +1.91 |
| | 21 1966 | 10.03 | +1.50 | +0.69 | | | |
| | 29 1966 | | | | 4.41 | +1.14 | +1.76 |
| TT CVn | May 15 1966 | | | | 7.01 | +0.28 | -0.83 |
| | 29 1966 | | | | 6.87 | +0.27 | -0.84 |
| | June 21 1966 | | | | 7.00 | +0.30 | -0.74 |
| SY Com | Jan 8 1966 | | | | 5.05 | +1.06 | +1.91 |
| | Mar 27 1966 | 10.61 | +1.44 | +0.84 | | | |
| | 29 1966 | | | | 5.20 | +1.04 | +1.24 |
| | Apr 26 1966 | 10.52 | +1.41 | +0.83 | | | |
| | 28 1966 | | | | 5.17 | +1.08 | +1.66 |
| | May 14 1966 | | | | 5.12 | +1.07 | +1.67 |
| | 21 1966 | 10.44 | +1.40 | +0.79 | | | |
| S Cr B | Mar 14 1966 | | | | 2.10 | +0.80 | +0.72 |
| | 20 1966 | 6.10 | +1.35 | +0.83 | | | |
| | 27 1966 | 5.99 | +1.33 | +0.72 | | | |
| | 29 1966 | | | | 1.91 | +0.84 | +0.86 |
| | Apr 14 1966 | 6.39 | +1.30 | +0.52 | | | |

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TABLE 3 (CONT'D)

| Star | Date | | | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|---|---|
| S Cr B | May | 20 | 1966 | | | | $1^m.99$ | $+1^m.17$ | $+1^m.93$ |
| | | 21 | 1966 | $7^m.97$ | $+1^m.25$ | $0^m.00$ | | | |
| | | 24 | 1966 | 8.08 | +1.37 | +0.09 | | | |
| | | 26 | 1966 | | | | 2.12 | +1.30 | +2.00 |
| | June | 16 | 1966 | | | | 2.34 | +1.38 | +2.24 |
| X Cyg | May | 15 | 1966 | | | | 4.89 | +0.25 | -1.26 |
| | June | 22 | 1966 | | | | 5.08 | +0.285 | -1.10 |
| RT Cyg | May | 15 | 1966 | | | | 4.76 | +0.49 | -0.725 |
| | | 21 | 1966 | 7.13 | +1.68 | +1.28 | | | |
| | | 29 | 1966 | | | | 4.78 | +0.57 | -0.42 |
| | June | 9 | 1966 | | | | 4.80 | +0.635 | -0.06 |
| | | 21 | 1966 | | | | 4.81 | +0.73 | +0.44 |
| CD Cyg | May | 15 | 1966 | | | | 7.05 | +0.31 | -0.82 |
| | | 29 | 1966 | | | | 7.02 | +0.29 | -0.94 |
| | June | 22 | 1966 | | | | 7.21 | +0.32 | -0.71 |
| TX Dra | Mar | 30 | 1966 | | | | 3.50 | +0.745 | +0.66 |
| | | 31 | 1966 | 7.39 | +1.60 | +6.58 | | | |
| | Apr | 1 | 1966 | | | | 3.50 | +0.74 | +0.63 |
| | | 14 | 1966 | 7.14 | +1.61 | +1.55 | | | |
| | | 28 | 1966 | 7.39 | +1.65 | +1.57 | | | |
| | | 29 | 1966 | | | | 3.54 | +0.75 | +0.63 |
| | | 30 | 1966 | | | | 3.57 | +0.75 | +0.65 |
| | May | 15 | 1966 | | | | 3.57 | +0.77 | +0.79 |
| | | 21 | 1966 | 7.49 | +1.59 | +1.39 | | | |
| | | 27 | 1966 | 7.34 | +1.61 | +1.54 | | | |
| | | 29 | 1966 | | | | 3.50 | +0.74 | +0.60 |
| SX Her | May | 12 | 1966 | 8.15 | +1.54 | +1.32 | | | |
| | | 14 | 1966 | | | | 6.43 | +0.33 | -1.00 |
| | | 20 | 1966 | | | | 6.46 | +0.305 | -1.01 |
| | | 21 | 1966 | 8.25 | +1.54 | +1.22 | | | |
| | | 24 | 1966 | 8.29 | +1.56 | +1.25 | | | |
| | | 26 | 1966 | | | | 6.46 | +0.34 | -0.94 |
| | June | 9 | 1966 | | | | 6.40 | +0.30 | -1.07 |
| AC Her | May | 12 | 1966 | 7.44 | +0.84 | +0.82 | | | |
| | | 14 | 1966 | | | | 6.50 | +0.22 | -1.39 |
| Z Leo | Jan | 6 | 1966 | | | | 6.19 | +0.66 | +0.01 |
| | | 8 | 1966 | | | | 6.20 | +0.65 | +0.01 |
| | | 13 | 1966 | 9.20 | +1.64 | +1.89 | | | |
| AI Leo | Mar | 20 | 1966 | 9.21 | +1.66 | +1.68 | | | |
| | | 27 | 1966 | 9.17 | +1.68 | +1.62 | | | |
| | | 29 | 1966 | | | | 5.56 | +0.695 | +0.38 |
| | Apr | 14 | 1966 | 8.96 | +1.70 | +1.65 | | | |
| | | 25 | 1966 | 8.86 | +1.69 | +1.79 | | | |
| | | 28 | 1966 | | | | 5.55 | +0.75 | +0.25 |
| | May | 5 | 1966 | | | | 5.35 | +0.72 | +0.39 |
| | | 21 | 1966 | 8.72 | +1.71 | +1.78 | | | |
| | | 22 | 1966 | | | | 5.54 | +0.66 | +0.23 |
| | June | 8 | 1966 | | | | 5.38 | +0.765 | +0.41 |
| AK Leo | Mar | 20 | 1966 | 8.81 | +1.51 | +1.46 | | | |
| | | 27 | 1966 | 8.80 | +1.53 | +1.46 | | | |
| | | 29 | 1966 | | | | 5.00 | +0.775 | +0.59 |
| | Apr | 14 | 1966 | 8.57 | +1.54 | +1.44 | | | |
| | | 25 | 1966 | 8.68 | +1.50 | +1.49 | | | |
| | | 28 | 1966 | | | | 4.82 | +0.79 | +0.60 |
| | May | 5 | 1966 | | | | 4.90 | +0.79 | +0.77 |
| | | 14 | 1966 | | | | 5.02 | +0.82 | +0.69 |
| | | 21 | 1966 | 8.75 | +1.48 | +1.36 | | | |
| | | 22 | 1966 | | | | 5.12 | +0.76 | +0.60 |

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TABLE 3 (CONT'D)

| Star | Date | | | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|---|---|
| R LMi | Dec | 23 | 1965 | $7^m.05$ | $+1^m.32$ | $+0^m.55$ | | | |
| | Jan | 3 | 1966 | | | | 1.44 | +1.16 | +1.99 |
| | | 5 | 1966 | | | | 1.45 | +1.16 | +1.84 |
| | | 18 | 1966 | | | | 1.54 | +1.24 | +1.91 |
| | Mar | 20 | 1966 | 8.96 | +1.53 | +0.01 | | | |
| | | 30 | 1966 | | | | 1.87 | +1.71 | +2.60 |
| | | 31 | 1966 | 9.16 | +1.59 | +0.02 | | | |
| | Apr | 1 | 1966 | | | | 1.96 | +1.665 | +2.58 |
| | | 14 | 1966 | 9.51 | +1.55 | -0.10 | | | |
| | | 25 | 1966 | 9.76 | +1.66 | +0.03 | | | |
| | | 27 | 1966 | | | | 2.26 | +1.83 | +2.80 |
| | | 28 | 1966 | 9.84 | +1.66 | +0.16 | | | |
| | May | 1 | 1966 | 9.93 | +1.73 | +0.08 | | | |
| | | 15 | 1966 | | | | 2.26 | +1.85 | +3.04 |
| R Lyn | Dec | 23 | 1965 | 7.56 | +2.02 | +1.48 | | | |
| | Jan | 3 | 1966 | | | | 4.02 | +0.67 | +0.47 |
| | | 5 | 1966 | | | | 4.00 | +0.64 | +0.52 |
| | | 13 | 1966 | 8.01 | +2.04 | +1.51 | | | |
| | | 18 | 1966 | | | | 4.02 | +0.70 | +1.33 |
| | Mar | 30 | 1966 | | | | 4.34 | +1.16 | +2.28 |
| | | 31 | 1966 | 13.15 | +2.42 | - | | | |
| | Apr | 1 | 1966 | | | | 4.31 | +1.14 | +2.27 |
| Y Lyn | Dec | 23 | 1965 | 7.01 | +1.71 | +1.09 | | | |
| | | 30 | 1965 | 7.03 | +1.70 | +1.09 | | | |
| | Jan | 3 | 1966 | | | | 1.80 | +1.01 | +1.56 |
| | | 5 | 1966 | | | | 1.78 | +1.00 | +1.62 |
| | | 13 | 1966 | 7.07 | +1.77 | +1.16 | | | |
| | | 18 | 1966 | | | | 1.79 | +0.48 | +1.63 |
| | Mar | 31 | 1966 | 6.93 | +1.75 | +1.21 | | | |
| | Apr | 1 | 1966 | | | | 1.70 | +0.99 | +1.62 |
| | | 14 | 1966 | 7.05 | +1.71 | +1.04 | | | |
| | | 28 | 1966 | 7.05 | +1.69 | - | | | |
| | | 29 | 1966 | | | | 1.84 | +0.96 | +1.64 |
| W Lyn | May | 15 | 1966 | | | | 5.92 | +1.40 | +2.28 |
| | | 29 | 1966 | | | | 5.64 | +1.23 | +1.96 |
| TT Per | Dec | 23 | 1966 | 8.21 | +1.57 | +1.07 | | | |
| | Jan | 5 | 1966 | | | | 2.94 | +1.03 | +1.57 |
| | | 13 | 1966 | 8.30 | +1.60 | +1.16 | | | |
| | | 18 | 1966 | | | | 3.04 | +1.05 | +1.58 |
| R Sge | May | 12 | 1966 | 9.39 | +1.10 | +1.03 | | | |
| | | 14 | 1966 | | | | 7.95 | +0.14 | -1.78 |
| | | 24 | 1966 | 9.09 | +0.75 | +0.57 | | | |
| | | 26 | 1966 | | | | 8.08 | +0.225 | -1.46 |
| R Set | May | 12 | 1966 | 5.16 | +1.42 | +1.46 | | | |
| | | 14 | 1966 | | | | 3.53 | +0.30 | -1.04 |
| | | 24 | 1966 | 5.42 | +1.41 | +1.63 | | | |
| | | 26 | 1966 | | | | 3.62 | +0.335 | -0.87 |
| | June | 9 | 1966 | | | | 4.13 | +0.355 | -0.76 |
| R UMa | Mar | 30 | 1966 | | | | 3.73 | +1.72 | +2.80 |
| | | 31 | 1966 | 11.28 | +1.77 | +0.46 | | | |
| | Apr | 1 | 1966 | | | | 3.72 | +1.78 | +2.78 |
| | | 28 | 1966 | 8.98 | +1.38 | +0.83 | | | |
| | | 29 | 1966 | | | | 3.27 | +1.13 | +1.72 |
| | | 30 | 1966 | | | | 3.23 | +1.08 | +1.65 |
| | May | 1 | 1966 | 8.50 | +1.39 | +0.89 | | | |
| | | 15 | 1966 | | | | 3.18 | +0.84 | +0.72 |
| | | 27 | 1966 | 6.97 | +1.43 | +1.02 | | | |
| | | 28 | 1966 | | | | 2.02 | -0.77 | +0.69 |
| | | 29 | 1966 | | | | 3.04 | +0.77 | +0.67 |
| Z UMa | Jan | 3 | 1966 | | | | 2.76 | +1.15 | +1.85 |
| | | 13 | 1966 | 8.01 | +1.41 | +0.76 | | | |

TABLE 3 (CONT'D)

| Star | Date | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|
| Z UMa | Jan 18 1966 | | | | 2$^{m}$.61 | +1$^{m}$.01 | +1$^{m}$.62 |
| | Mar 14 1966 | | | | 2.56 | +0.94 | +1.38 |
| | 30 1966 | | | | 2.84 | +0.955 | +1.45 |
| | 31 1966 | 7$^{m}$.88 | +1$^{m}$.60 | +1$^{m}$.01 | | | |
| | Apr 1 1966 | | | | 2.94 | +0.975 | +1.46 |
| | 14 1966 | 8.19 | +1.57 | +0.85 | | | |
| | 28 1966 | 8.62 | +1.61 | +0.89 | | | |
| | 29 1966 | | | | 3.09 | +1.06 | +1.69 |
| | 30 1966 | | | | 3.06 | +1.075 | +1.78 |
| | May 15 1966 | | | | 3.14 | +1.18 | +2.12 |
| | 21 1966 | 9.19 | +1.42 | +0.54 | | | |
| | 22 1966 | | | | 3.08 | +1.23 | +2.15 |
| | 29 1966 | | | | 3.02 | +1.235 | +2.20 |
| | 30 1966 | 9.18 | +1.45 | +0.58 | | | |
| RY UMa | Dec 23 1965 | 7.74 | +1.74 | +1.95 | | | |
| | Jan 3 1966 | | | | 4.35 | +0.67 | +0.29 |
| | 13 1966 | 7.94 | +1.75 | +2.00 | | | |
| | Mar 14 1966 | | | | 4.42 | +0.63 | +0.05 |
| | 30 1966 | | | | 4.33 | +0.645 | -0.15 |
| | 31 1966 | 7.29 | +1.79 | +2.15 | | | |
| | Apr 1 1966 | | | | 4.34 | +0.61 | -0.18 |
| | 14 1966 | 7.20 | +1.80 | +2.19 | | | |
| | 29 1966 | | | | 4.28 | +0.585 | -0.24 |
| | 30 1966 | | | | 4.30 | +0.565 | -0.27 |
| | May 1 1966 | 7.19 | +1.81 | +2.22 | | | |
| | 15 1966 | | | | 4.36 | +0.56 | -0.36 |
| | 21 1966 | 6.97 | +1.80 | +2.12 | | | |
| | 22 1966 | | | | 4.29 | +0.57 | -0.36 |
| | June 9 1966 | | | | 4.10 | +0.565 | -0.31 |
| ST UMa | Dec 23 1965 | 6.47 | +1.66 | +1.56 | | | |
| | Jan 4 1966 | | | | 2.73 | +0.725 | +0.415 |
| | 13 1966 | 6.31 | +1.70 | +1.65 | | | |
| | Mar 14 1966 | | | | 2.52 | +0.66 | +0.23 |
| | 30 1966 | | | | 2.59 | +0.675 | +0.315 |
| | 31 1966 | 6.05 | +1.69 | +1.71 | | | |
| | Apr 1 1966 | | | | 2.62 | +0.675 | +0.29 |
| | 14 1966 | 6.29 | +1.64 | +1.50 | | | |
| | 28 1966 | 6.40 | +1.62 | +1.55 | | | |
| | 29 1966 | | | | 2.60 | +0.71 | +0.53 |
| | 30 1966 | | | | 2.62 | +0.70 | +0.53 |
| | May 1 1966 | 6.40 | +1.64 | +1.54 | | | |
| | 20 1966 | | | | 2.73 | +0.70 | +0.435 |
| | 21 1966 | 6.29 | +1.63 | +1.51 | | | |
| | 29 1966 | | | | 2.60 | +0.69 | +0.40 |
| | 30 1966 | 6.23 | +1.67 | +1.63 | | | |
| TV UMa | Dec 23 1965 | 7.02 | +1.53 | +1.42 | | | |
| | Jan 13 1966 | 6.94 | +1.56 | +1.46 | | | |
| | 18 1966 | | | | 2.94 | +0.785 | +0.845 |
| | Mar 30 1966 | | | | 2.97 | +0.78 | +0.825 |
| | 31 1966 | 7.06 | +1.50 | +1.35 | | | |
| | Apr 1 1966 | | | | 2.96 | +0.81 | +0.87 |
| | 14 1966 | 7.36 | +1.47 | +1.17 | | | |
| | 28 1966 | 7.16 | +1.53 | +1.41 | | | |
| | 29 1966 | | | | 2.94 | +0.79 | +0.88 |
| | May 1 1966 | 7.10 | +1.57 | +1.40 | | | |
| | 15 1966 | | | | 2.98 | +0.77 | +0.735 |
| | 21 1966 | 7.02 | +1.50 | +1.44 | | | |
| VW UMa | Dec 23 1965 | 6.91 | +1.70 | +1.86 | | | |
| | Jan 4 1966 | | | | 3.85 | +0.655 | +0.11 |
| | 18 1966 | | | | 3.86 | +0.665 | +0.21 |
| | Mar 14 1966 | | | | 3.85 | +0.66 | +0.17 |
| | 30 1966 | | | | 3.85 | +0.65 | +0.19 |
| | 31 1966 | 7.17 | +1.70 | +1.85 | | | |
| | Apr 1 1966 | | | | 3.92 | +0.67 | +0.17 |
| | 14 1966 | 7.36 | +1.64 | +1.62 | | | |

TABLE 3 (CONT'D)

| Star | Date | | | $V_E$ | B-V | U-B | (102) | (65,62) | (102,65) |
|---|---|---|---|---|---|---|---|---|---|
| VW UMa | Apr | 28 | 1966 | $7^{m}.23$ | $+1^{m}.67$ | $+1^{m}.82$ | | | |
| | | 30 | 1966 | | | | $3^{m}.33$ | $+0^{m}.68$ | $+0^{m}.19$ |
| | May | 1 | 1966 | 7.17 | +1.69 | +1.82 | | | |
| | | 15 | 1966 | | | | 3.78 | +0.65 | +0.13 |
| | | 21 | 1966 | 7.09 | +1.69 | +1.67 | | | |
| | | 22 | 1966 | | | | 3.79 | +0.65 | +0.20 |
| V UMi | Jan | 13 | 1966 | 8.16 | +1.59 | +1.44 | | | |
| | Mar | 30 | 1966 | | | | 4.10 | +0.715 | +0.49 |
| | | 31 | 1966 | 7.80 | +1.53 | +1.61 | | | |
| | Apr | 1 | 1966 | | | | 4.15 | +0.71 | +0.47 |
| | | 14 | 1966 | 7.74 | +1.53 | +1.44 | | | |
| | | 28 | 1966 | 7.95 | +1.58 | +1.51 | | | |
| | | 29 | 1966 | | | | 4.12 | +0.75 | +0.61 |
| | | 30 | 1966 | | | | 4.16 | +0.75 | +0.62 |
| | May | 1 | 1966 | 8.07 | +1.51 | +1.51 | | | |
| | | 15 | 1966 | | | | 4.20 | +0.75 | +0.74 |
| | | 21 | 1966 | 8.15 | +1.58 | +1.22 | | | |
| | | 27 | 1966 | 8.23 | +1.57 | +1.30 | | | |
| TY Vir | May | 14 | 1966 | | | | 6.77 | +0.26 | -1.185 |
| | | 24 | 1966 | 8.24 | +1.33 | +1.25 | | | |
| | | 26 | 1966 | | | | 6.85 | +0.24 | -1.18 |
| BK Vir | Jan | 8 | 1966 | | | | 1.57 | +1.42 | +2.34 |
| | Mar | 14 | 1966 | | | | 1.64 | +1.36 | +2.14 |
| | | 27 | 1966 | 7.98 | +1.58 | +0.67 | | | |
| | | 29 | 1966 | | | | 1.88 | +1.32 | +2.20 |
| | Apr | 14 | 1966 | 7.60 | +1.49 | +0.59 | | | |
| | | 25 | 1966 | 7.46 | +1.54 | +0.78 | | | |
| | | 27 | 1966 | | | | 1.61 | +1.26 | +2.03 |
| | May | 21 | 1966 | 7.77 | +1.54 | +0.57 | | | |
| | | 22 | 1966 | | | | 1.83 | +1.30 | +2.07 |
| CE Vir | Jan | 6 | 1966 | | | | 7.08 | +0.30 | -1.07 |
| | Feb | 15 | 1966 | | | | 7.18 | +0.30 | -1.105 |
| | Mar | 29 | 1966 | | | | 7.18 | +0.305 | -1.08 |
| | May | 12 | 1966 | 8.55 | +1.39 | +1.44 | | | |
| | | 14 | 1966 | | | | 7.11 | +0.35 | -1.105 |
| | | 25 | 1966 | 9.00 | +1.45 | +1.55 | | | |
| | | 26 | 1966 | | | | 7.41 | +0.35 | -0.98 |
| | June | 16 | 1966 | | | | 7.56 | +0.385 | -0.77 |
| CI Vir | Jan | 8 | 1966 | | | | 4.73 | +0.98 | +1.40 |
| | Mar | 14 | 1966 | | | | 4.76 | +0.89 | +1.18 |
| | | 27 | 1966 | 9.30 | +1.51 | +1.22 | | | |
| | | 28 | 1966 | 9.21 | +1.49 | +1.22 | | | |
| | | 29 | 1966 | | | | 4.74 | +0.89 | +1.15 |
| | Apr | 14 | 1966 | 9.39 | +1.43 | +1.01 | | | |
| | | 25 | 1966 | 9.57 | +1.72 | +0.83 | | | |
| | | 27 | 1966 | | | | 4.89 | +0.99 | +1.35 |
| | May | 21 | 1966 | 9.29 | +1.46 | +1.02 | | | |
| | | 26 | 1966 | | | | 4.74 | +0.93 | +1.24 |
| CN Vir | Jan | 8 | 1966 | | | | 4.89 | +0.745 | +0.43 |
| | Mar | 28 | 1966 | 8.60 | +1.59 | +1.57 | | | |
| | | 29 | 1966 | | | | 4.97 | +0.725 | +0.505 |
| | Apr | 14 | 1966 | 8.24 | +1.63 | +1.66 | | | |
| | | 25 | 1966 | 8.28 | +1.61 | +1.70 | | | |
| | | 27 | 1966 | | | | 4.98 | +0.73 | +0.355 |
| | May | 14 | 1966 | | | | 5.01 | +0.74 | +0.41 |
| | | 21 | 1966 | 8.39 | +1.60 | +1.54 | | | |
| | | 22 | 1966 | | | | 5.14 | +0.71 | +0.285 |
| CO Vir | Jan | 8 | 1966 | | | | 3.98 | +0.90 | +1.23 |
| | Mar | 29 | 1966 | | | | 4.12 | +0.925 | +1.38 |
| | Apr | 14 | 1966 | 9.54 | +1.24 | +1.30 | | | |
| | | 27 | 1966 | | | | 3.80 | +0.885 | +1.12 |
| | May | 14 | 1966 | | | | 4.10 | +0.03 | +1.09 |
| | | 21 | 1966 | (8.49 | +1.48 | +1.02) | | | |
| | | 22 | 1966 | | | | 4.24 | +0.80 | +1.01 |

(102), (65,62), (102,65): The magnitude from the deflections through the (102) filter, the magnitude difference of the deflections through the (65) and (62) filters, and the magnitude difference between the deflections through the (102) and (65) filters, respectively.

*n,n:* The number of *UBV* and (65,62,102) observations, respectively.

*E*(102,65): The adopted reddening.

$\delta$(65,62): The difference, discussed in the text, between the observed and computed values of (65,62) in the sense observed *minus* calculated.

Many of the stars that are listed in the *BSC* with magnitudes brighter than 5.5 were included in a previous discussion of K- and M-type giants (Eggen 1966), but in most cases the *UBV* results given here are the result of an independent series of measures. Stars previously known or here found to be variable are identified in the second column

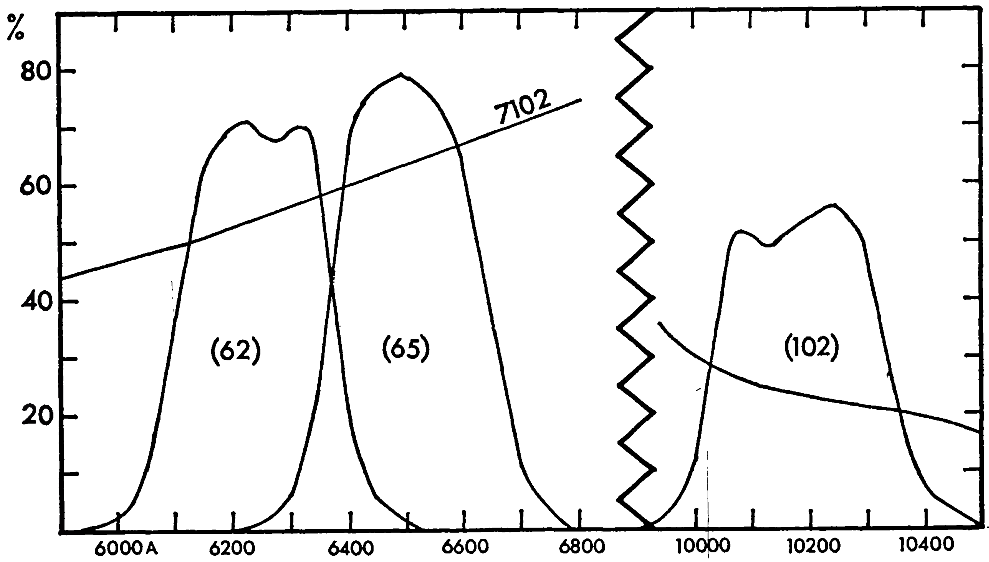



FIG. 1.—Transmission characteristics of the narrow-band filters and response curve of the 7102 photomultiplier.

of Table 1 by "Var." and the individual observations are given in Table 2. Several known variables, not in the *BSC*, were also observed occasionally and the results are given in Table 3. The variations of magnitudes and colors during the cycle for a few of the better-observed variables are shown in Figure 2. The variation of $(U - B)$ is omitted from Figure 2 to avoid crowding but is shown for a few variables in the $(U - B, B - V)$ diagram of Figure 3.

## II. THE NARROW-BAND COLOR SYSTEM

The relationships between the continuum colors (102,65) and the TiO affected colors (102,62), and $(R - I)_J$ on the broad-band system used by Johnson (Johnson 1964, 1965; Iriarte, Johnson, Mitchell, and Wisniewski 1965) are shown in Figure 4. Because stars redder than (102,65) $\approx -0.1$ mag are variable (see § IX), the relationships are defined for the redder stars using only dwarfs; the observations of the main-sequence stars on the present system will be discussed in the second paper of this series. Because of the differences in the strengths of the TiO band heads included in the wide-band filters, some scatter is expected in Figure 4, especially in the correlation of $(R - I)_J$ with (102,65), which avoids the TiO bands. The magnitude differences (102)-$I_J$, plotted in

Figure 5, show a considerable scatter which may be partly caused by slight variability of some of the giants and partly by varying amounts of TiO absorption in $I_J$. However, for the present purpose values of $(102) = I_J + 0.15$ mag are of sufficient accuracy.

## III. REDDENING

The interstellar reddening $E(B - V)$ will be important for a few of the stars in Table 1. In the present discussion the values of $E(B - V)$ have been determined from B-type stars in the region of the red stars; all available photometric results for B-type stars (i.e., Hiltner 1956; Mendoza 1958; Crawford 1963; Eggen 1967) have been used. Values of $E(102,65)$ and $A(102)$ were interpolated from the results published by Johnson (1966, Table 5) for the following regions:

| | $E(102,65)/E(B-V)$ | $A(102)/E(102,65)$ |
|---|---|---|
| Perseus | 1.30 (1.20) | 0.9 (1.4) |
| NGC 2244 | 1.40 | 2.7 |
| Cygnus | 1.24 (1.22) | 1.3 (1.4) |
| Cepheus | 1.22 (1.20) | 3.0 (1.4) |

Values from the spectrophotometry by Whiteoak (1966) are given in parentheses. For the present purposes $E(102,65)/E(B - V) = 1.25$ and $A(102)/E(102,65) = 1.5$ will be adopted. The values of $E(65,62)$ are less than 10 per cent of $E(B - V)$ and have only been applied when $E(B - V)$ exceeds 0.1 mag.

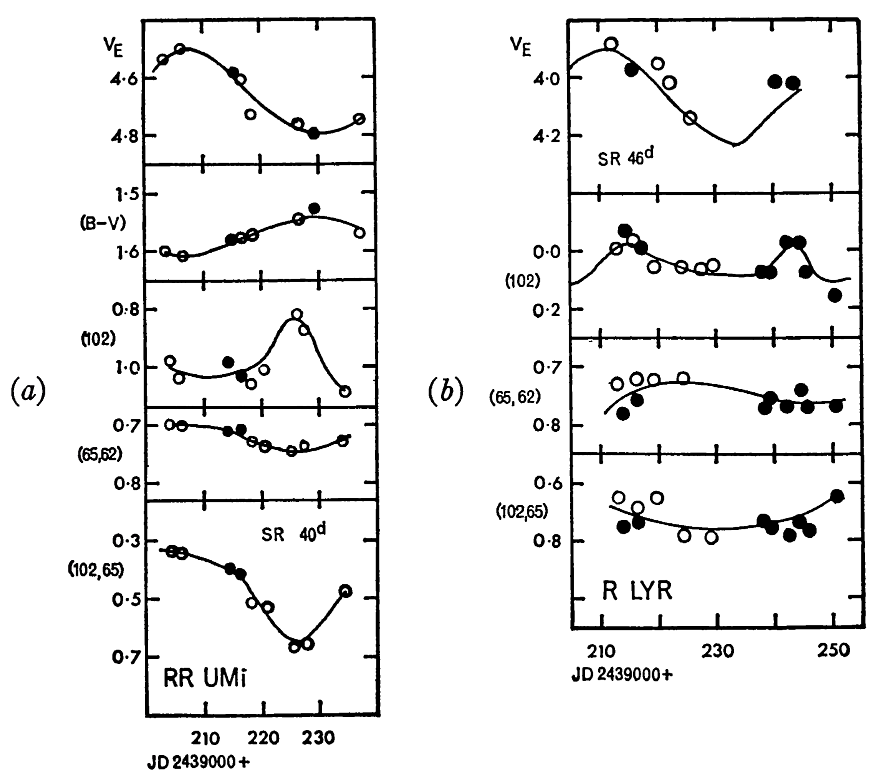
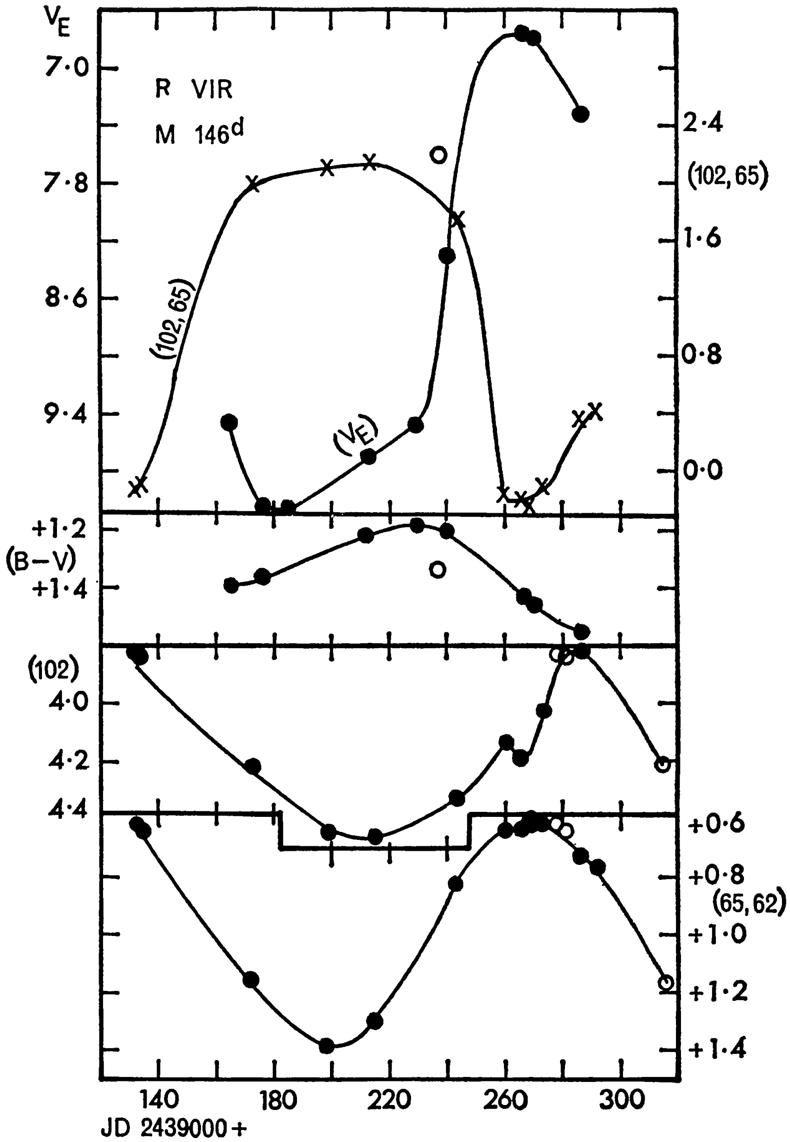



FIG. 2.—Light and color variations for some of the variables in Tables 2 and 3



VE
7·0
7·8
8·6
9·4
R VIR
M 146d
(102, 65)
(VE)
2·4
(102, 65)
1·6
0·8
0·0
+1·2
(B−V)
+1·4
(102)
4·0
4·2
4·4
+0·6
+0·8
(65, 62)
+1·0
+1·2
+1·4
140
180
220
260
300
JD 2439000+


FIG. 2(*c*)

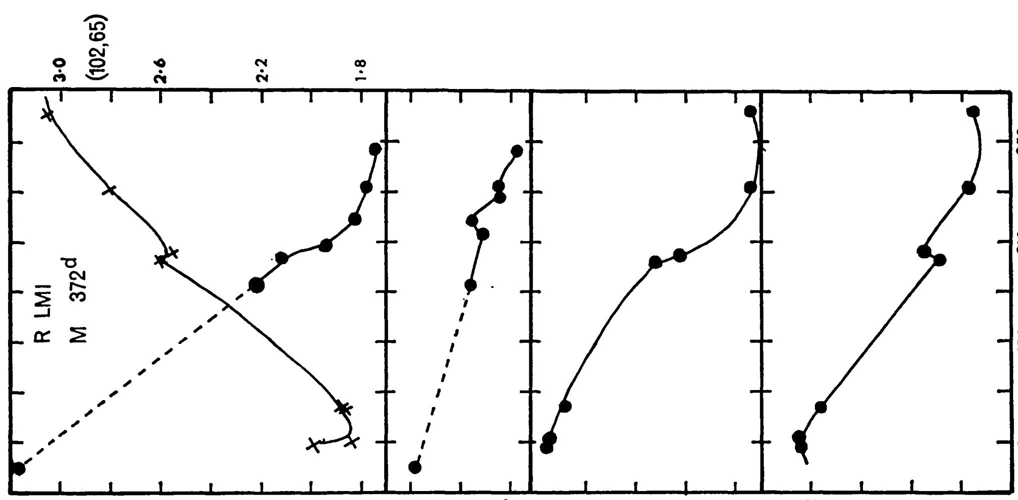



FIG. 2(*d*)

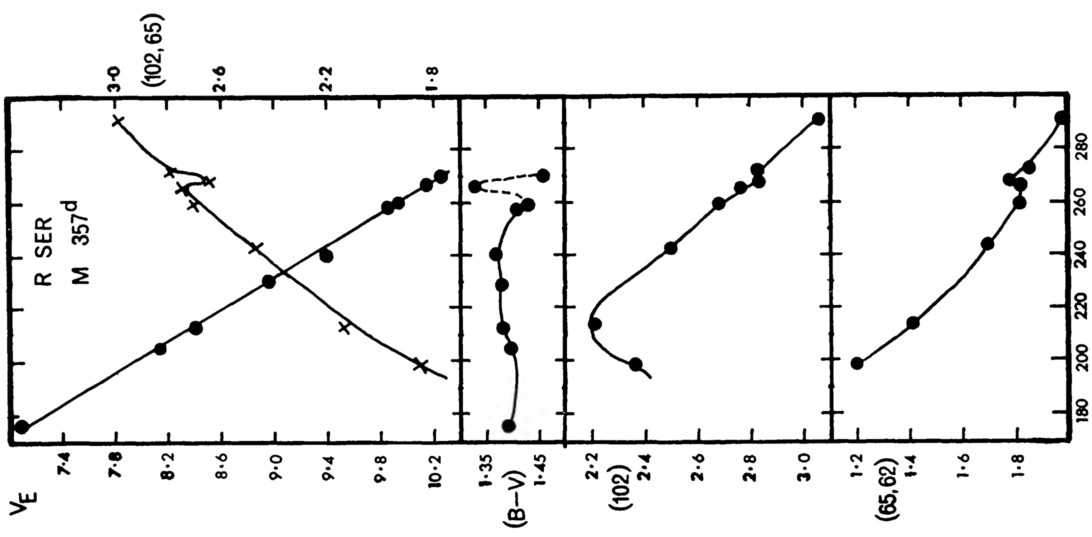



FIG. 2(*e*)

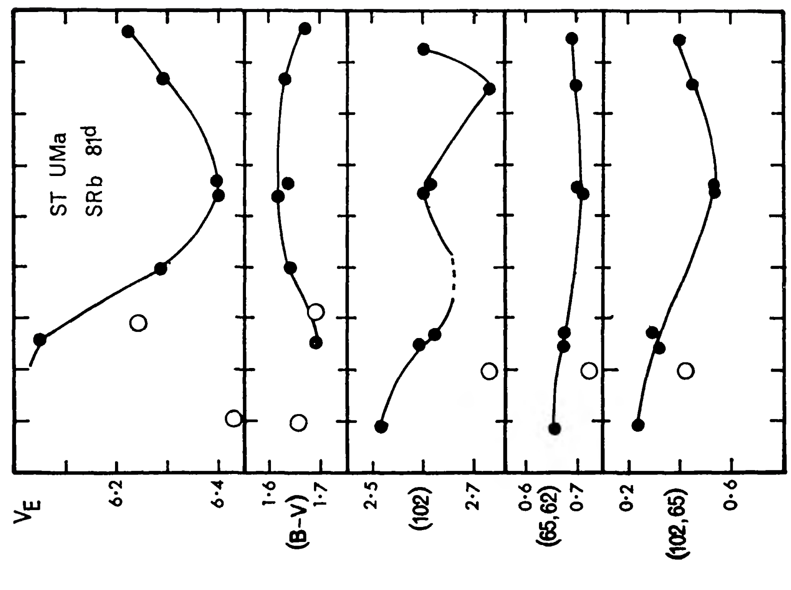
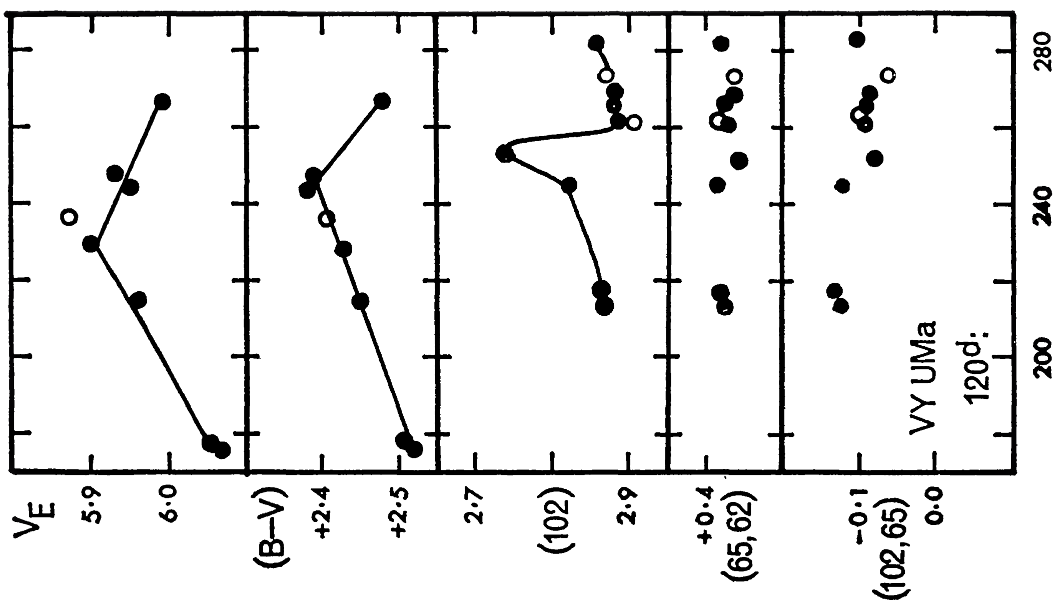
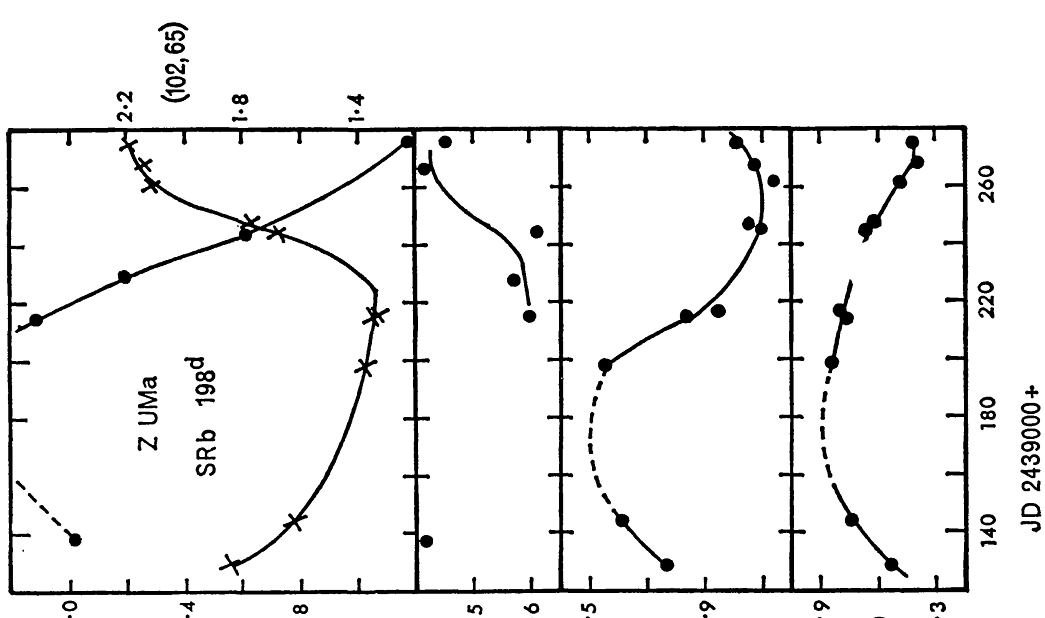



FIG. 2(*f*)



VY UMa
120d:
JD 2439000+
VE
(B–V)
(102)
(65,62)
(102,65)
5·9
6·0
+2·4
+2·5
2·7
2·9
+0·4
−0·1
0·0
200
240
280


FIG. 2(*h*)



Z UMa
SRb 198d
JD 2439000+
VE
B–V
102
(65,62)
(102,65)
8·0
8·4
8·8
1·5
1·6
2·5
2·9
0·9
1·3
2·2
1·8
1·4
140
180
220
260


FIG. 2(*g*)

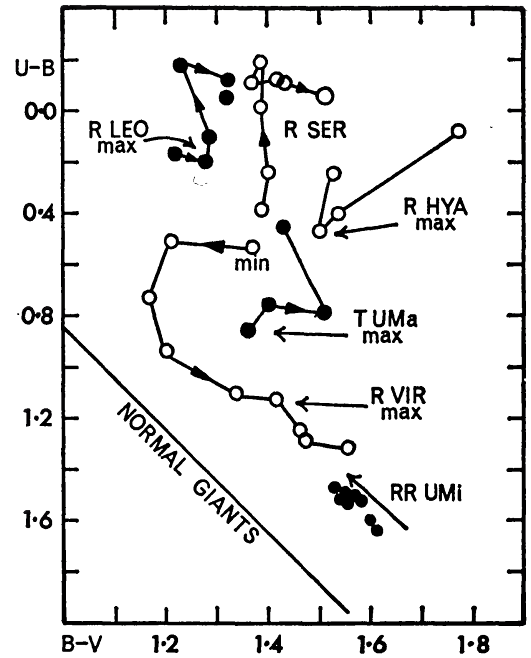



FIG. 3.—The paths of several variables from Tables 2 and 3 in the $(U - B, B - V)$ plane

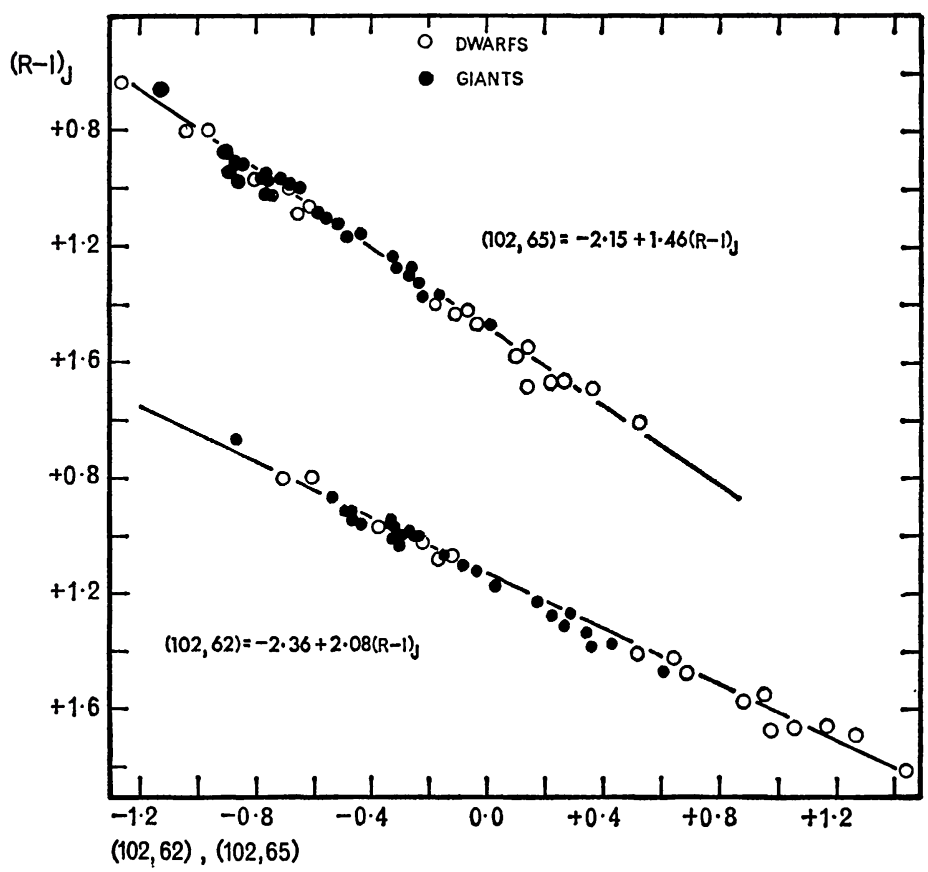



FIG. 4.—Relationship of $(R - I)_J$ to (102,65) and to (102,62)

## IV. LUMINOSITY

In a previous discussion of *UBV* photometry of the brighter K- and M-type giants (Eggen 1966) a number of field stars were selected, by a motion criterion, as probable members of the Hyades group. Some of these stars are listed in Table 4 together with the luminosities derived from the group parallaxes; the values of (102) and (102,65) indicated by asterisks have been transformed from the $(R,I)$ photometry of Johnson (Iriarte *et al.* 1965) using Figures 4 and 5. The modulus, $m - M$, derived from the group parallax is listed for five variables in Table 4, light and color curves for two of these objects are shown in Figure 2, *a* and *b*, and the individual observations of the remaining are given in Table 2. With the exception of HR 5080 (R Hya), the stars in Table 4 are shown in the $M$(102), (102,65) plane in Figure 6. Two probable variables, HR 46 (Table 2) and HR 1003, for each of which only one red-infrared observation is available, are indicated by crossed circles and the variables HR 2742 (VZ Cam), HR 5589 (RR UMi), HR 7157 (R Lyr), and HR 8262 (W Cyg) are indicated by the extremities of the observed light and color variation.

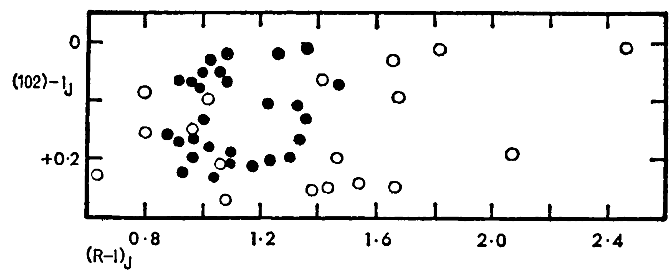



FIG. 5.—Relationship between (102) and $I_J$. Symbols are the same as those in Fig. 4

TABLE 4

MEMBERS OF THE HYADES GROUP

| HR | MAGNITUDE | | | | |
|---|---|---|---|---|---|
| | (102) | (65,62) | (102,65) | $E$(102,65) | $M$(102) |
| 46 | 2.23 | +0.57 | −0.065 | +0.04 | −3.7 |
| 941 | 2.7* | ............ | −1.42* | .00 | +0.1 |
| 951 | 3.3* | ............ | −1.43* | .00 | 0.0 |
| 1003 | 0.73 | + .60 | +0.01 | .00 | −4.0 |
| 1409 | 2.59 | + .225 | −1.43 | .00 | −0.5 Hyades Cl. |
| 1457 | −1.16 | + .405 | −0.775 | .00 | −2.5 |
| 2742 | Table 2 | ............ | ............ | + .05 | $(m-M)=6.5$ |
| 2993 | 2.5 | ............ | −0.73* | + .02 | −3.7 |
| 3427/8 | 5.67 | + .215 | −1.50 | + .02 | +0.2 Praesepe Cl. |
| 4450 | 2.5* | ............ | −1.42* | .00 | −0.8 |
| 4831 | 3.5* | ............ | −1.33* | + .03 | −1.2 |
| 5068 | 3.6* | ............ | −1.38* | + .01 | −0.6 |
| 5080 | Table 2 | ............ | ............ | + .06 | $(m-M)=6.3$ |
| 5370 | 3.5* | ............ | −1.37* | + .02 | −0.7 |
| 5589 | Fig. 2, *a* | ............ | ............ | + .04 | $(m-M)=5.3$ |
| 5705 | 1.6* | ............ | −0.88* | .00 | −2.1 |
| 6072 | 2.8* | ............ | −1.30* | + .02 | −0.9 |
| 7157 | Fig. 2, *b* | ............ | ............ | .00 | $(m-M)=4.6$ |
| 8128 | 2.83 | +0.565 | −0.30 | + .02 | −3.3 |
| 8262 | Table 2 | ............ | ............ | + .15 | $(m-M)=6.4$ |
| 8748 | 3.1* | ............ | −1.00* | +0.04 | −1.9 |

7K

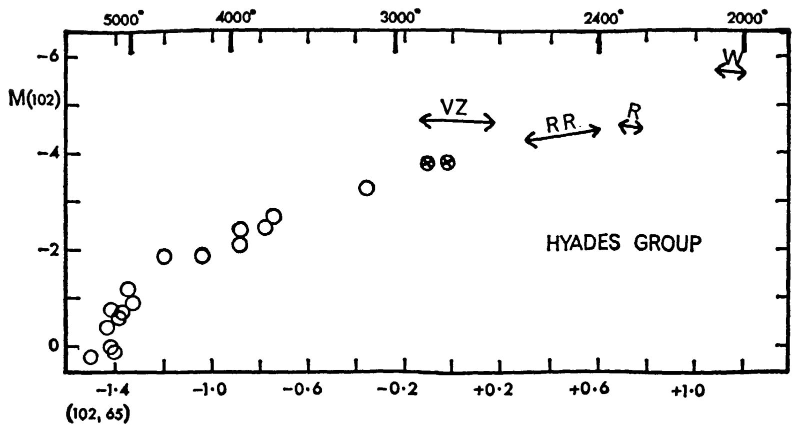



FIG. 6.—The $M(102)$, (102,65) relation for Hyades group stars in Table 4. The crossed circles represent two probable variables; the known variables, VZ Cam, RR UMi, R Lyr, and W Cyg, are represented by arrows connecting the extreme values of the observed variation.

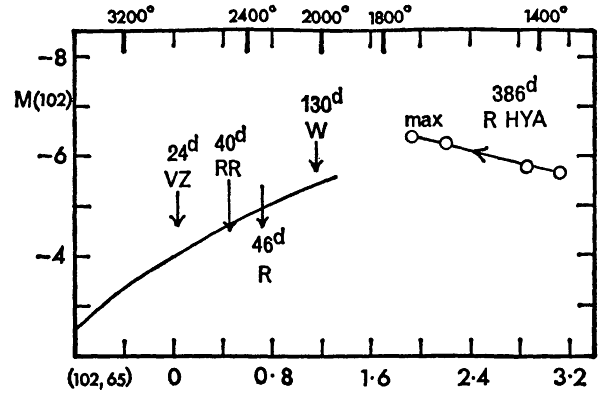



FIG. 7.—Variable stars in the Hyades group

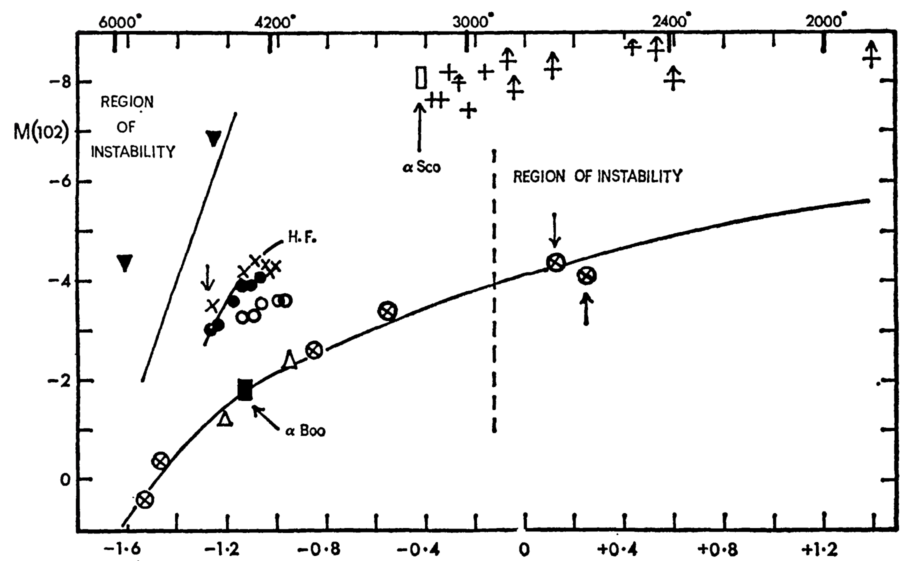



FIG. 8.—The continuous curve represents the mean $M(102)$, (102,65) relation for Hyades group stars from Fig. 6. The crossed circles represent members of the Wolf 630 group (Table 5), the open triangles represent the old cluster M67, the plus signs represent the supergiant members of the Perseus double cluster, the inverted triangles represent the classical cepheids (§ IX), and the filled circles (M92), open circles (M5), and crosses (M13) represent halo globular clusters; arrows indicate known variables with clusters and groups. The regions of instability are discussed in § IX. The continuous curve terminating at H.F. (helium flash) is the computed track for a model of 1.3 $M_\odot$ with an initial composition of $(X,Y,Z) = (0.900, 0.099, 0.001)$.

The mean $M(102)$, (102,65) relation and the medium values of the variables from Figure 6 are repeated in Figure 7 where the observations of the longer period variable R Hya (HR 5080, Table 2) are also shown. Observations of R Hya near maximum, but not near minimum were obtained.

The mean $M(102)$, (102,65) relation of Figure 6 is also repeated in Figure 8 where red-giant members of several galactic and globular clusters listed in Table 5 are also shown as follows (the globular cluster stars contain the reddest known stars that are resolvable from the cluster centers):

1. *Perseus double cluster.*—The numbering is that of Wildey (1964, Table 4). The

TABLE 5

CLUSTER STARS

| | (102) | (65,62) | (102,65) | $\eta$ | $E(B-V)$ | $M(102)$ | Note |
|---|---|---|---|---|---|---|---|
| Perseus Cl.: | | | | | | | |
| 1 | 5.17 | +0.55 | +0.21 | 2 | +0.35 | −7.4 | |
| 4 | 4.24 | +0.565 | +0.27 | 2 | + .32 | −8.3 | |
| 16 | 4.57 | +0.76 | +1.03 | 1 | + .62 | −8.0 | BU Per (365±d) |
| 19 | 4.75 | +0.59 | +0.39 | 2 | + .36 | −7.8 | T Per (326d) |
| 21 | 4.16 | +0.60 | +0.36 | 2 | + .41 | −8.4 | AD Per (320d) |
| 23 | 4.61 | +0.51 | +0.17 | 2 | + .30 | −8.0 | FZ Per (Var?) |
| 24 | 4.38 | +0.535 | +0.13 | 2 | + .47 | −8.2 | |
| 27 | 3.74 | +0.71 | +0.85 | 2 | + .31 | −8.8 | SU Per (470d) |
| 29 | 3.90 | +0.75 | +0.96 | 2 | + .46 | −8.7 | RS Per (152d) |
| 30 | 4.06 | +1.075 | +1.84 | 2 | + .51 | −8.5 | S Per (850±d) |
| 33 | 4.83 | +0.515 | +0.065 | 2 | + .44 | −7.7 | |
| 34 | 4.84 | +0.50 | +0.095 | 2 | + .55 | −7.7 | |
| 45 | 4.25 | +0.64 | +0.54 | 2 | + .71 | −8.3 | |
| M67: | | | | | | | |
| 170 | 8.30 | +0.325 | −1.15 | 1 | + .03 | −1.2 | |
| 1465 | 7.06 | +0.425 | −0.89 | 2 | + .03 | −2.4 | |
| Wolf 630: | | | | | | | |
| HR 48 | 2.04* | ........... | −0.54* | ..... | .0 | −3.4 | |
| HR 1318 | 3.43* | ........... | −1.46* | ..... | .0 | −0.4 | |
| HR 1556 | 1.75 | +0.61 | +0.14 | 1 | + .05 | −4.4 | |
| HR 2717 | 1.99 | +0.69 | +0.26 | 1 | .......... | −4.2 | BQ Gem |
| | 1.91 | +0.64 | +0.05 | 1 | .......... | −4.3 | |
| HR 2905 | 2.04 | +0.40 | −0.84 | 1 | .......... | −2.6 | |
| HR 4247 | 2.57* | ........... | −1.53* | ..... | .......... | +0.4 | |
| M92: | | | | | | | |
| 3-13 | 10.52 | +0.27 | −1.06 | 2 | .00 | −4.1 | |
| 3-65 | 11.03 | +0.23 | −1.17 | 2 | .00 | −3.6 | |
| 7-18 | 10.70 | +0.26 | −1.14 | 2 | .00 | −3.9 | |
| 10-14 | 11.51 | +0.24 | −1.25 | 1 | .00 | −3.1 | |
| 10-49 | 10.70 | +0.235 | −1.10 | 1 | .00 | −3.9 | |
| 12-8 | 11.50 | +0.225 | −1.24 | 1 | .00 | −3.1 | |
| M5: | | | | | | | |
| 1-68 | 10.90 | +0.30 | −1.06 | 2 | .00 | −3.5 | |
| 3-78 | 11.14 | +0.28 | −1.14 | 2 | .00 | −3.3 | |
| Perseus Cl.: | | | | | | | |
| 4-19 | 11.12 | +0.285 | −1.095 | 2 | .00 | −3.3 | |
| 4-47 | 10.80 | +0.295 | −0.995 | 2 | .00 | −3.6 | |
| 3-3 | 10.82 | +0.37 | −0.48 | 2 | .00 | −3.6 | |
| M13: | | | | | | | |
| 1-48 | 10.30 | +0.27 | −1.09 | 1 | .00 | −4.4 | |
| 2-67 | 10.32 | +0.27 | −1.04 | 1 | .00 | −4.3 | |
| 3-65 | 10.46 | +0.30 | −1.12 | 1 | .00 | −4.2 | |
| 4-25 | 10.34 | +0.28 | −1.04 | 1 | .00 | −4.3 | |
| 4-48 | 10.40 | +0.27 | −1.01 | 1 | .00 | −4.3 | |
| Var. No. 11 | 11.12 | +0.22 | −1.25 | 1 | 0.00 | −3.5 | 92d |

listed values of $E(B-V)$ are from Wildey (1964, Table 12) but the indicated range is probably too great and the values $E(B-V) = 0.36$, $E(102,65) = 0.45$, have been adopted for all cluster members for reasons discussed below in § VI. The variables are indicated in Figure 8 by arrow-tipped plus signs; the stars not known to be variables are indicated by plus signs.

2. *M67.*—The two reddest giants in M67, No. 170 (Johnson and Sandage 1955) and No. 1465 (Murray 1967), are shown as open triangles. The reddening of $E(B-V) = +0.03$, $E(102,65) = +0.04$ and modulus of 9.4 are taken from Eggen and Sandage (1964).

3. *Wolf 630 group.*—The members of this group, selected by a motion criterion, are listed elsewhere (Eggen 1965). The values of (102) and (102,65) indicated in Table 5 by an asterisk are transformed from the $(R,I)$ photometry by Iriarte *et al.* (1965) using Figures 4 and 5. The group members are shown as crossed circles in Figure 8 where the variables HR 1556 (Table 2) and HR 2717 (BQ Gem) are indicated by arrows.

4. *M92.*—The star numbers, reddening and modulus, 11.6 mag, are those given by Sandage and Walker (1966). The cluster members are shown in Figure 8 by filled circles. Three-color *UBV* observations were also obtained for the following stars:

| No. | $V_B$ | $B-V$ | $U-B$ | *n* (Tel.) |
|---|---|---|---|---|
| 3-13....... | 12.19 | +1.37 | +1.22 | 2(200) |
| 3-65....... | 12.35 | +1.13 | +0.75 | 2(200) |
| 10-49....... | 12.22 | +1.28 | +0.84 | 2(100) |

5. *M5.*—The star numbers, reddening and modulus, 14.4 mag, are from Arp (1962). The stars are indicated in Figure 8 by open circles. Three-color *UBV* photometry was obtained for the following stars:

| No. | $V_B$ | $B-V$ | $U-B$ | *n* (Tel.) |
|---|---|---|---|---|
| 1-68........ | 12.46 | +1.42 | +1.36 | 2(100) |
| 3-78........ | 12.56 | +1.31 | +1.18 | 1(100) |
| 4-19........ | 12.60 | +1.34 | +1.30 | 2(100) |
| 4-47........ | 12.38 | +1.41 | +1.26 | 2(100) |

6. *M13.*—The star numbers are from Arp and Johnson (1955). The reddening and modulus, 14.7 mag, are from Sandage (1954). The stars are shown as crosses in Figure 8 and the variable No. 11 ($95^d$) is indicated by an arrow.

The stars in Figure 8, with the exception of those in M13, are also shown in the $(M_V, B-V)$ plane in Figure 9, where the symbols are the same as in Figure 8 except small dots have been used to indicate the non-variable Hyades group stars (Table 4) and lines, connecting the extremities of magnitude and color to represent the variable stars.

It is apparent from Figure 8 that the disk giants define a tight relationship between $M(102)$ and (102,65). This relation has been further tested by the stars in Table 6 for which values of $M_V$ are available from the measured H- and K-emission widths (Wilson and Bappu 1957, Wilson 1965) and which are not included in Tables 4 and 5. The values of $M(102)$ obtained from the moduli, $m-M$, indicated by the H- and K-emission widths are designated "OCW" and those obtained from the mean relation in Figure 8 and the values of (102,65) in Tables 1 and 2 are designated "OJE." For the seven variable stars included it was assumed that the luminosity from the H- and K-emission widths

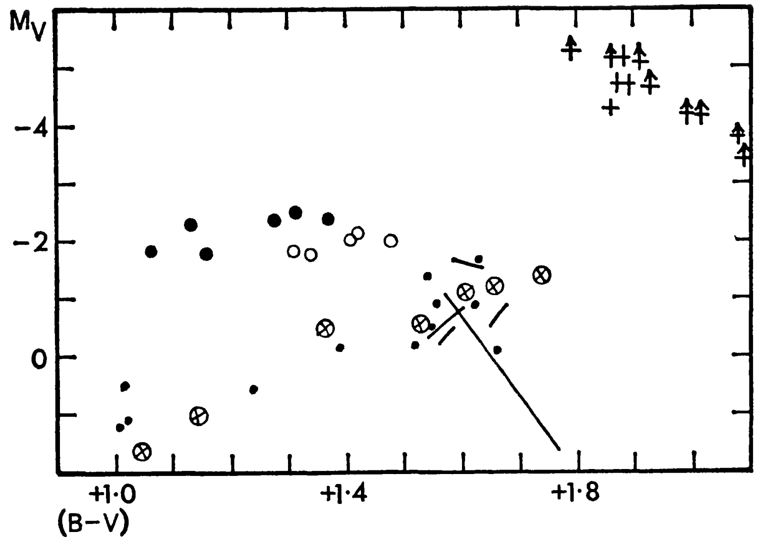



FIG. 9.—The positions in the ($M_V$, $B - V$) plane of some of the stars in Fig. 8. The symbols used are those in Fig. 8 except that small dots have been used to indicate the non-variable Hyades group members and lines, connecting the extremities of observed magnitude and color to represent the variable stars.

TABLE 6

COMPARISON OF PHOTOMETRIC AND SPECTROSCOPIC LUMINOSITIES

| HR | *M*(102) | | |
|---|---|---|---|
| | OJE | OCW | Δ |
| 337 | −2.9 | −3.1 | +0.2 |
| 911 | −3.3 | −3.7 | +0.4 |
| 921 (Var) | −4.4 | −4.7 | +0.3 |
| 1845 (Var)* | −8.0 | −8.4 | +0.04 |
| 2286 (Var) | −3.8 | −4.0 | +0.2 |
| 2609 | −3.2 | −3.5 | +0.3 |
| 2905 | −2.5 | −2.5 | 0.0 |
| 3705 | −2.6 | −2.6 | 0.0 |
| 3870 | −4.0 | −4.6 | +0.6 |
| 3950 | −3.1 | −3.4 | +0.3 |
| 4069 | −2.8 | −1.6 | (−1.2) |
| 4299 | −2.7 | −3.3 | +0.6 |
| 4434 | −2.8 | −2.3 | −0.5 |
| 4517 | −2.7 | −2.1 | −0.6 |
| 4765 (Var) | −3.7 | −3.9 | +0.2 |
| 4910 | −3.7 | −2.9 | −0.8 |
| 5154 | −3.2 | −3.5 | +0.3 |
| 5299 (Var) | −4.7 | −3.9 | −0.8 |
| 5300 | −3.1 | −3.2 | +0.1 |
| 6056 | −2.7 | −2.4 | −0.3 |
| 6128 (Var) | −3.8 | −2.5 | (−1.3) |
| 6134† | −7.7 | −7.7 | 0.0 |
| 6146 (Var) | −5.8 | −6.2 | +0.4 |
| 6337 | −3.3 | −3.6 | +0.3 |
| 7405 | −2.5 | −2.9 | +0.4 |
| 8416 | −4.4 | −4.7 | +0.3 |

* 1845 = 119 Tau, luminosity class Ib.
† 6134 = α Sco, luminosity class Ib.

refers to the median value and for the supergiants, $\alpha$ Sco (HR 6134), and 119 (CE) Tau (HR 1845), the value of $M(102)$ was read from the Perseus double cluster members in Figure 8. The mean difference and the average deviation (A.D.) of (OJE − OCW) in Table 6, excluding the two large values, is +0.1 ± 0.33 (A.D.) mag, which can more than be accounted for by Wilson and Bappu's estimate of 0.4 mag as the *probable error* of the H- and K-emission width determinations. The two discordant stars are HR 4069 ($\mu$ UMa), which is a spectroscopic binary with a period near 230 days, and HR 6128, which has $UVW = (-133, -70, -21)$ and which may belong to a population like that of 47 Tuc or $\sigma$ Pup (Eggen 1964*a*, *b*) for which the H- and K-emission widths give anomalous results (Eggen 1966).

Although the disk population giants form a well-defined $M(102)$, (102,65) relation in Figure 8, the halo giants represented by the brightest globular cluster stars depart markedly from this relation. In the classification scheme of Deutsch (1955) and Kinman (1959) M5 is of type A and M92 is of type C, with the former containing stars whose ratio of heavy elements to hydrogen is about 10 per cent of that in the disk stars, whereas in the latter it is nearer 1 per cent. Most stellar models for globular-cluster giants agree that a lower metal abundance produces a higher luminosity at the same effective temperature. For example Hoyle and Schwarzschild (1955) found that a change of the metal-to-hydrogen ratio, at the tip of the giant branch, from 0 to about $10^{-5}$ lowered the luminosity by about 1 mag. The fact that the brightest stars in M5 and M92 are the same temperature in Figure 8 is then understandable as a result of the greater line blanketing in the latter. However the cluster M13 presents an anomaly for it is classified as of type A (like M5) on the basis of the stellar metallic lines (Kinman 1959), whereas it falls in with M92 (type C) in Figure 8. The two reddest cluster giants, away from the dense nucleus of M3 (type A), give, in the mean, (102) = 11.0 mag, (102,65) = −0.93 mag, which, with a reddening of $E(B-V) = 0.00$ and $m - M = 15.4$ mag (Sandage 1964), places them as a slight extension to the red of M92 (type C) and M13 (type A) in Figure 8. If the adopted moduli are all correct, M5 shows the only deviation from the $M(102)$, (102,65) relation defined by the observed globular clusters. The continuous curve terminating at H.F. (helium flash) in Figure 8 is the computed track for a model of $1.3M_\odot$ with an initial computation of $(X,Y,Z) = (0.900, 0.099, 0.001)$ (Schwarzschild and Selberg 1962); the conversion from $M$(bol.) to $M(102)$ was made through the relation $M(102) = M(\text{bol.}) + 1$ mag determined from $\alpha$ Boo and $\alpha$ Tau. The computed value of $T_e$ at the helium flash agrees well with the black-body values at the tip of the giant branch.

## V. TEMPERATURES

The black-body colors (65,62) and (102,65) given in Table 7 were computed from tables of black-body radiation functions (Pivoronsky and Nagel 1961) and the sensitivity functions of the photomultiplier and transmission of the filters given in Figure 1. The comparison between these temperatures and values derived by Petit and Nicholson (1928) from interferometric determinations of the stellar radii and/or thermocouple observations is as follows:

| | (102,65)(mag) | $T_e$ (° K) | Table 8 (° K) |
|---|---|---|---|
| Sun | −1.65 | 5800 | 6000 |
| $\alpha$ Boo | −1.13 | 4150 | 4450 |
| $\alpha$ Tau | −0.78 | 3750 | 3750 |
| $\beta$ Peg | −0.24 | 3380 | 2800 |
| R Cnc (Max) | +1.4: | 2300 | 1900: |
| R Hya (Max) | +1.8: | 2300 | 1700: |
| R LMi (Max) | +1.8: | 2300 | 1700: |
| R Leo (Min) | +3.2: | 1800 | 1350: |
| R LMi (Min) | +3.1: | 1800 | 1400: |

Eggen

The run of the differences, amounting to some 20 per cent lower temperatures for the cooler stars from the black-body assumption, is similar to that found by Johnson (1964) using energy curves constructed from broad-band photometry to 9 $\mu$. A more complete discussion of these differences may be possible when orbital elements for the eclipsing binary LP 101-16 (Eggen and Sandage 1967), for which (102,65) = +0.32 mag, becomes available.

### VI. TiO ABSORPTION

The relationship between (102,65) and (65,62) for main-sequence stars of the Hyades group (which will be discussed in Paper II) is shown in Figure 10. This relation is linear from (102,65) = −1.1 to +1.2, and can be represented by the following:

$$\text{Hyades dwarfs: } (65,62) = 0.76 + 0.40(102,65) \text{ mag} .$$

There is a change of slope at (102,65) = −1.1 with the bluer stars showing a very slow decrease of (65,62) with increasing temperature.

The Hyades-group giants in Table 4 for which (102,65) and (65,62) are both available

TABLE 7

BLACK-BODY COLORS

| $T_e$ (° K) | MAGNITUDE (65,62) | MAGNITUDE (102,65) | $T_e$ (° K) | MAGNITUDE (65,62) | MAGNITUDE (102,65) |
|---|---|---|---|---|---|
| 1000........ | +1.155 | +5.50 | 3200........ | +0.40 | −0.40 |
| 1200........ | +0.935 | +3.78 | 3400........ | + .385 | −0.56 |
| 1400........ | +0.82 | +2.95 | 3600........ | + .365 | −0.70 |
| 1600........ | +0.735 | +2.25 | 3800........ | + .35 | −0.81 |
| 1800........ | +0.67 | +1.67 | 4000........ | + .33 | −0.92 |
| 2000........ | +0.605 | +1.20 | 4200........ | + .325 | −1.03 |
| 2200........ | +0.555 | +0.80 | 4400........ | + .31 | −1.11 |
| 2400........ | +0.52 | +0.58 | 4600........ | + .305 | −1.19 |
| 2600........ | +0.475 | +0.20 | 4800........ | + .305 | −1.27 |
| 2800........ | +0.45 | −0.02 | 5000........ | + .30 | −1.34 |
| 3000........ | +0.42 | −0.23 | 6000........ | +0.28 | −1.65 |

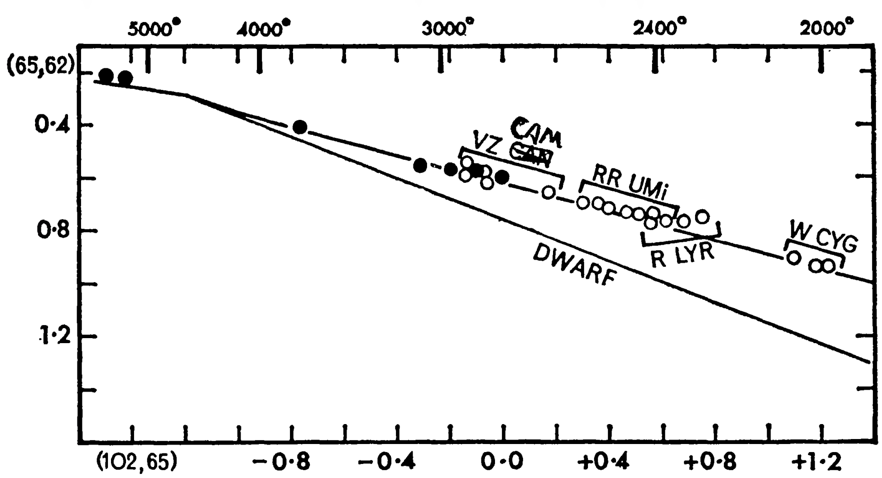



**FIG. 10.**—The (102,65), (65,62) relation for stars in the Hyades group (VZ CAN in figure should read VZ CAM).

are also shown in Figure 10, where the individual observations of variable stars (except HR 5080 = R Hya) are shown as open circles. These giants define the relation

$$\text{Hyades giants: } (65,62) = +0.63 + 0.27(102,65) \text{ mag},$$

which intersects the relation for dwarfs near (102,65) = −1.0. Apparently the value of (102,65) = −1.0 is near the onset of TiO absorption in both giants and dwarfs. The spectral types of some bright stars with colors in this region are as follows:

| HR | (102,65)(mag) | Sp. | HR | (102,65)(mag) | Sp. |
|---|---|---|---|---|---|
| 6973 | −1.34 | K3 III | Gmb 1618 | −0.96 | M0 V |
| 8085 | −1.26 | K5 V | 5064 | − .92 | M0 III |
| 4404 | −1.16 | K4 III | 5200 | − .91 | K5 III |
| 5340 | −1.13 | K2 IIIp | 4371 | − .89 | M0 III |
| 5844 | −1.09 | M0 III | 2905 | − .88 | M0 III |
| 8086 | −1.04 | K7 V | 3705 | −0.84 | M0 III |
| 3305 | −0.93 | K5 III | | | |

The black-body colors (65,62) from Table 8, for values of (102,65) redder than −1.1, fit the relation:

$$\text{Black body: } (65,62) = +0.44 + 0.13(102,65) \text{ mag}.$$

This relation is shown in Figure 11 together with those for the giants and dwarfs of the Hyades group. Over the entire range from (102,65) = −1.0 + 1.4 the TiO absorption (in mags) in the dwarfs, at a given temperature, is more than twice that of the giants.

The globular cluster stars in Table 5 are shown in the (102,65), (65,62) plane in Figure 18*c;* filled circles (M92), open circles (M5), and crosses (M13).

Smak (1964) has measured, in several stars, the intensity of the TiO absorption for the strongest group of bands in the blue region of the spectrum λλ4584, 4626, 4667 and λλ4761, 4804, 4847 and combined them into one value for the absorption, in magnitudes, of the first group. These values of δ TiO are compared in Table 8 with the difference between the black-body and the observed values for (65,62). The values of Δ(65,62) refer to the TiO absorption in the band head at λ6250. The first part of Table 8 contains the constant stars and the variables of small amplitude, which Smak observed at random phases. The observed values of (65,62) and those computed for black bodies from (102,65) represent mean from all the observations in Tables 1 and 2 and therefore, in the case of

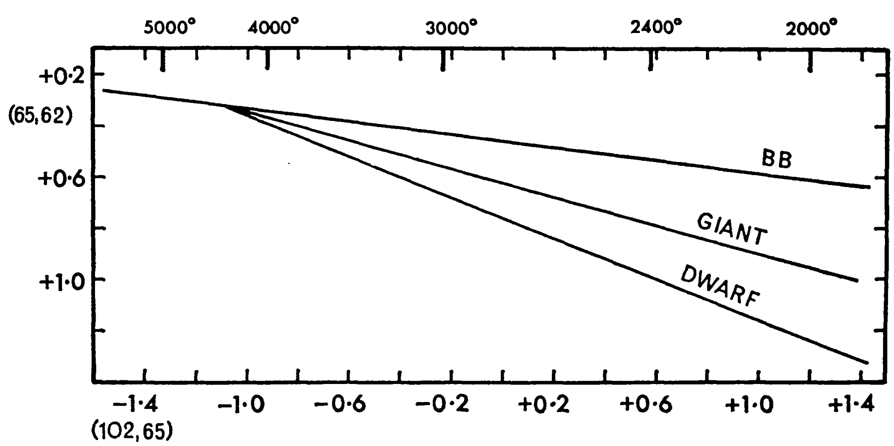



FIG. 11.—The (102,65) (65,62) relations for dwarfs, giants, and black bodies (BB)

small amplitude variables, are indicated by colons. A few long-period variables were observed near the same phase in both programs; these results are given at the end of Table 8.

The two determinations of the TiO absorption are compared in Figure 12, and although (1) they refer to different band heads, (2) the values of Δ are based on black-body colors, and (3) the values of δ are referred to a "quasi-continuum," they follow the one-to-one relationship indicated by the full line. One discordant value, for R Vir near minimum light, which will be discussed in more detail in § IX, depends on a value of δ obtained from a "poor" plate and has low weight (Smak 1964).

TABLE 8

TiO Absorptions

| | (102,65) | (65,62) Obs. | (65,62) Comp. | (65,62) Δ | Smak $\delta_{TiO}$ |
|---|---|---|---|---|---|
| HR 867 | +1.31 | +0.91: | +0.61 | 0.30: | 0.33 |
| 2091 | +0.10 | +0.61 | + .46 | .15 | .13 |
| 2717 | +0.15 | +0.65: | + .52 | .13: | .19 |
| 2905 | −0.88 | +0.40 | + .32 | .08 | .06 |
| 3950 | −0.56 | +0.48 | + .37 | .11 | .11 |
| 4267 | +1.14: | +0.87: | + .59 | .28: | .37 |
| 4362 | −0.26 | +0.54 | + .41 | .13 | .13 |
| 4371 | −0.89 | +0.42 | + .32 | .10 | .08 |
| 4483 | +0.38: | +0.70: | + .49 | .21: | .19 |
| 5200 | −0.91 | +0.38 | + .32 | .06 | .07 |
| 7405 | −0.86 | +0.43 | + .33 | .10 | .06 |
| T CVn (min) | +1.86 | +1.16 | − .68 | .48 | .49 |
| R UMa (max) | +0.72 | +0.84 | + .53 | .31 | .32 |
| R Vir (max) | −0.20 | +0.60 | + .42 | .18 | .19 |
| R Vir (+30$^d$) | +0.90 | +0.90 | + .55 | .35 | .37 |
| (−65$^d$) | +2.00 | +1.10 | +0.58 | 0.52 | 0.37: |

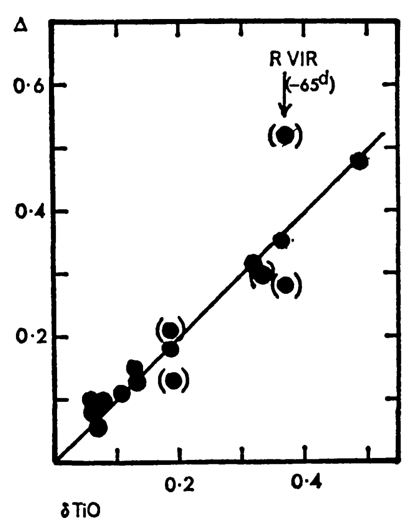



Fig. 12.—Comparison between values of the TiO absorption (Δ) determined in § VI and δ TiO determined by Smak from spectra. The straight line represents a one-to-one relation.

The adopted relation for Hyades giants, (65,62) = +0.63 + 0.27 (102,65) mag, gives the following residuals for stars in Table 5 with (102,65) redder than −1.1 mag; $\delta$ (65,62) is the difference, in the sense O − C, between the observed and computed values:

| HR | $E$(102,65) (mag) | (102,65) (mag) | $\delta$(65,62) (0.01 mag) |
|---|---|---|---|
| 46........ | +0.05 | −0.11 | −3 |
| 1003........ | .00 | +0.01 | +3 |
| 1457........ | .00 | −0.78 | −1.5 |
| 2742........ | + .05 | +0.02 | [+1.5(2), +2, +4] |
| 5589........ | + .04 | +0.45 | [−1(2), −2(3), −2.5, −3, −5, −5.5] |
| 7157........ | .00 | +0.73 | [−4, −4.5, −6, −6.5(2), −7(3), −7.5, −8(2), −10] |
| 8128........ | + .02 | −0.32 | +1.5 |
| 8262........ | +0.15 | +1.14 | (−1, −2.5, −3) |

Values of $\delta$(65,62) are given for individual observations of the variable stars. The largest negative values of $\delta$(65,62) for the variables occur near light (visual) minimum $\simeq$ light (102) maximum. Near median light (102), when the stars are their hottest, they apparently are most similar, in the (65,62), (102,65) relation, to non-variable stars. In other words, the (65,62), (102,65) relation defined throughout a cycle of a variable star has a greater slope than that defined by non-variable stars. This result might have been expected because of the sensitivity of the TiO strengths to *both* radius and temperature changes but, as seen in the next section, the supergiants follow the same (65,62), (102,65) relation as the giants.

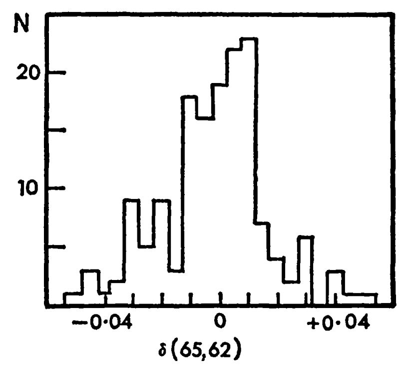



FIG. 13.—The distribution of the differences, $\delta$(65,62) for the stars in Table 1. The differences between the observed values (65,62) and those computed from the relation (65,62) = +0.63 + 0.27 (102,65) mag are in the sense of observed minus computed.

Values of (65,62) have been computed for all of the stars with listed values of (102,65) in Table 1; the listed values were first corrected for $E(102,65) = 1.25\ E(B - V)$. The residuals, $\delta$ (65,62), are listed in the tenth column of Table 1. The distribution of these residuals is shown in Figure 13; the slight displacement toward positive values of the peak of the distribution may result from a slightly (0.01 mag) incorrect zero point for the adopted (65,62), (102,65) relation. However, the asymmetry in the distribution is unlikely to be caused by random errors in the reddening corrections and probably represents a slight but real variation in TiO absorption at a given temperature. Negative values of $\delta$(65,62) result from computed values that are too large so they represent TiO absorptions that are less than the average of those in the Hyades group members. Perhaps the spread in values of $\delta$(65,62) could be caused by a slight variation from star to star in either the strength (abundance) or width (microturbulence) of the closely packed lines making up the bandhead. On the other hand, the values of $\delta(65,62)$ are not correlated with space velocity and stars with the same motion, as in the Hyades group tabulated above, present nearly the whole observed spread in residuals. Although the largest residuals, omitted from Figure 13, of $\delta(65,62) = 0.11$ mag (HR 4333, 5512, 7568) all occur for redder stars, there is little or no dependence of $\delta(65,62)$ on temperature for the remaining objects in Table 1.

### VII. SUPERGIANTS

One half the values of $E(B - V)$ for the late-type supergiants in the double Perseus cluster, given in Table 5, lie between $+0.3$ and $+0.4$ mag and give the mean value of $+0.34$ mag, whereas the remaining values are greater than $+0.4$ mag. These reddenings

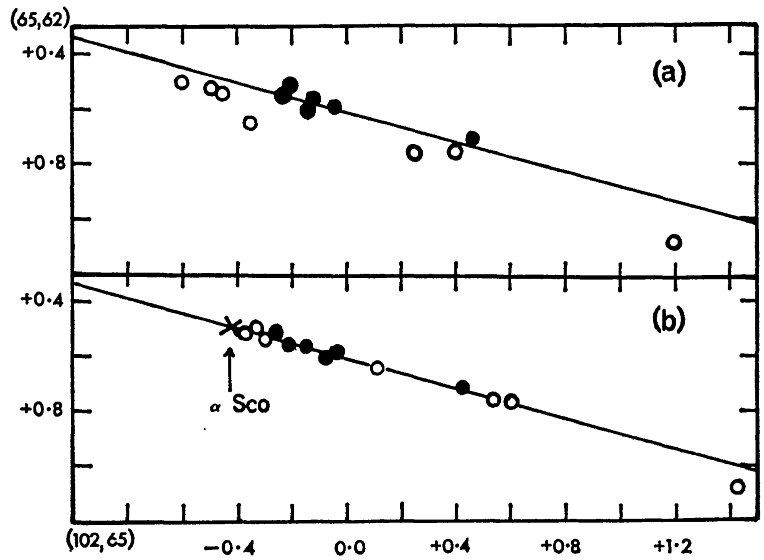



FIG. 14.—(*a*) The straight line represents the (102,65), (65,62) relation for giants. The filled circles represent the members of the Perseus double cluster (Table 5) for which $E(B - V)$ is between $+0.3$ and $+0.4$ mag (Wildey 1964), and the open circles represent those with larger values of $E(B - V)$; (*b*) the same as (*a*) except $E(B - V) = +0.34$ mag has been assumed for all stars.

were derived by Wildey (1964) from the colors of faint neighboring stars to the supergiants; in general these neighboring stars had values of $(B - V)_0$ from about $+0.2$ mag to $> +1$ mag. Serkowski (1958) finds, for the early-type supergiants, a mean reddening of $E(B - V) = +0.57$ mag at the cluster's center near $b = -3\overset{\circ}{.}0$. The studies by Schmidt-Kaler (1961) and Fernie (1963) indicate that $E(B - V)$ for supergiant M-type stars is approximately 0.8 that for B-type stars having the same total absorption. The values of (102,65), corrected for $1.25\, E(B - V)$ with $E(B - V)$ taken from Table 5, and (65,62) are shown in Figure 14, *a*, where the continuum line represents the (102,65), (65,62) relation for giants. The filled circles represent the stars in Table 5 with measured values of $E(B - V)$ between $+0.3$ and 0.4 mag, whereas the open circles represent those with $E(B - V) > +0.4$ mag. Figure 14, *b*, contains the same stars but with the mean value of $E(B - V) = +0.34$ mag, $E(102,65) = +0.42$ mag, adopted for all stars. Apparently the mean reddening of $E(B - V) = +0.34$ mag, which places all of these stars, of spectral types M0–M4, Ia–Ib (Bidelman 1947) on the (102,65), (65,62) relation, is more correct than the range of reddenings given in Table 5. This result would indicate that, although the giants have one-half of the TiO absorption of dwarfs at the same temperature, the supergiants have the same TiO absorption as giants. A check on this result is available in α Sco (HR 6134) of type M1 Iab, which may be part of the "Upper

Centaurus" division of what is sometimes referred to as the "Scorpio-Centaurus" association. Two B-type stars of this association, in the neighborhood of α Sco, are as follows:

| HR | Name | V | B−V | U−B | Sp. | E(B−V) | $l^{II}$ | $b^{II}$ |
|---|---|---|---|---|---|---|---|---|
| 6165..... | τ Sco | 2.82 | −0.25 | −1.04 | B0 V | +0.04 | 351°57 | +12°8 |
| 6134..... | α Sco | ........ | ........ | ........ | ........ | ........ | 351.9 | +15.1 |
| 6141..... | 22 Sco | 4.79 | −0.12 | −0.70 | B2 V | +0.08 | 353.1 | +15.8 |

The photometry is by Hardie and Crawford (1961). The mean reddening of $E(B-V) = +0.06$ mag, $E(102,65) = +0.08$ mag, together with the results in Table 1, leads to $(102)_0 = -1.8$ mag, $(65,62) + 0.49$ mag, and $(102,65)_0 = -0.41$ mag. The resulting position of α Sco in the (102,65), (65,62) plane is shown by a cross in Figure 14. The B-type stars in the association indicate a distance modulus of 5.9–6.3 mag, placing α Sco among the supergiants of the double Perseus cluster in Figure 8.

The variable TV Gem (HR 2190, SR $183^d$) and BU Gem (HR 2197, Irr.) are of types M1 Iab and M1 Ia, respectively, and also provide a determination of the TiO absorption in supergiants. They are located in the region of the I Gem association. A few of the early-type stars in the region are as follows: the photometry and most of the spectral types from Hardie, Seyfert, and Gulledge (1960) and the values of $M_V$ are from Blaauw (1963, Table 3 for stars above the main sequence and Table 4 for the main-sequence stars):

| | 1900 | | E(B−V) | Sp. Type | $M_V$ | m−M | $V_r$ (km/sec) |
|---|---|---|---|---|---|---|---|
| | α | δ | | | | | |
| BU Gem (HR 1297).. | $6^h06^m3$ | +22°56′ | .......... | M1 Ia | ........ | ........ | +20 |
| TV Gem (HR 2190)... | 6 05.8 | +21 54 | .......... | M1 Iab | ........ | ........ | +17 |
| HD41831............ | 6 02.3 | +22 14 | +0.40 | B3 V | −2.0 | 10.0 | ........ |
| HD42087............ | 6 03.7 | +21 08 | + .47 | B2 51b | −5.7 | 10.1 | +16 |
| HD42088............ | 6 03.7 | +20 31 | + .37 | O6 | −4.1 | 10.4 | +23 |
| HD42400............ | 6 05.4 | +20 56 | + .40 | B5 II | −4.4 | 10.0 | +10 |
| HD252321........... | 6 03.1 | +22 14 | +0.33 | B1 V | −2.6 | 10.7 | ........ |
| Mean............ | | | +0.40 | | | 10.2 | |
| HD40589............ | 5 4.7 | +27 35 | +0.45 | B9 Ib: | −5.5 | 10.3 | +17 |
| HD41117............ | 5 58.0 | +20 08 | (+ .45) | B2 Ia | −6.8 | 10.1 | +17 |
| HD43384............ | 6 10.8 | +23 40 | (0.55) | B3 Ib: | −5.7 | 10.3 | +13 |

Three stars in a somewhat wider region are also listed. The mean reddening, $E(B-V)$, for the stars near the variables is +0.40 mag or $E(102,65) = +0.50$ mag. If the variables are at the same distance as the early-type stars, we find a mean $M(102) = -8.0$, $(102,65) = -0.30$ and $(65,62) = +0.55$ for TV Gem, and $M(102) = -7.8$, $(102,65)_0 = 0.04$ and $(65,62) = 0.59$ for BU Gem, placing them near α Sco in both Figures 8 and 14. The mean radial velocity of the B-type stars is +16 km/sec compared with +17 for TV Gem and +20 for BU Gem. The association is in the galactic plane in the anticenter (galactic) direction, and the radial velocity is a direct measure of the U-velocity vector (Eggen 1961, Fig. 18).

The position in Figure 14 of another high-luminosity star, CE Tau (HR 1845, M2), confirms the result that supergiants populate the (102,65), (65,62) relation defined by

Hyades giants. Early-type stars in the region of CE Tau give a reddening of $E(102,65) = 0.30$, giving, from Table 2, $(102,65)_0$, $(65,62) = (-0.26, +0.52)$.

## VIII. CARBON STARS

The carbon stars from Table 1 are listed in Table 9 together with the mean values of (102,65), (65,62) and (102) from Table 2. The values of $E(102,65)$ have been obtained from values of $E(B - V)$ estimated from neighboring early-type stars and an assumed luminosity for the carbon stars of $M(102) = -4.5$ mag. The assumed value of $M(102) =$

TABLE 9

CARBON STARS FOR TABLE 1

| HR | Name | (102) (mag) | (65,62) (mag) | (102,65) (mag) | $b$ | $E$ (mag) | $(102,65)_0$ (mag) | Sp | $U$ | $V$ | $W$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1648... | W Ori | 2.23 | +0.46 | +0.11 | −23° | +0.06 | +0.05 | C5 | +12 | −12 | − 8 |
| 1977... | Y Tau | 3.23 | + .49 | + .25 | − 4 | + .07 | + .18 | C7e | +15 | − 9 | −12 |
| 2308... | BL Ori | 3.20 | + .435 | − .045 | + 1 | + .07 | − .115 | C6 | +12 | − 6 | − 6 |
| 3541... | X Cnc | 3.00 | + .445 | .00 | +35 | + .04 | − .04 | C5 | + 1 | + 2 | − 1 |
| 4195... | VY UMa | 2.86 | + .43 | + .095 | +45 | .05 | − .145 | C6 | − 7 | − 4 | + 1 |
| 4846... | Y CVn | 1.81 | + .43 | + .13 | +71 | + .06 | + .07 | C5 | − 1 | + 4 | −14 |
| 7220... | V Agl | 2.88 | + .52 | + .35 | − 5 | { .00 | + .35 | C6 | ...... | ...... | ..... |
| | | | | | | + .30 | + .05 | ...... | −29 | +20 | −40 |
| 8297... | V460 Cyg | 2.66 | +0.44 | +0.08 | − 5 | +0.25 | −0.17 | C6 | ...... | ...... | ..... |

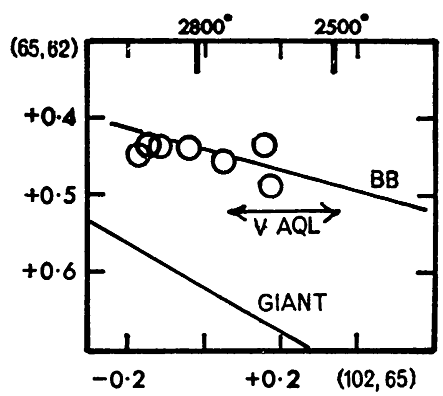



FIG. 15.—The carbon stars in the (102,65), (65,62) plane

−4.5 mag was also used in deriving the *UVW* vectors of the space motion, and it corresponds to the luminosity of the giants with the mean value of $(102,65) = -0.02$ mag for the carbon stars. The carbon stars may be brighter than the giants, but observations of Magellanic Cloud members are needed to decide the issue.

The distribution of the carbon stars in the (65,62), (102,65) plane is shown in Figure 15 where black-body (BB) and giant relations are reproduced from Figure 11. The carbon stars contain no TiO bands and the clustering near the black-body relation in Figure 15 is therefore expected. The only spectral features of the carbon stars that might affect the values of (65,62) or (102,65) are strong H$\alpha$ emission, which would affect the (65) magnitude, and the (4,0) system of band heads of CN at $\lambda\lambda$6246, 6260, 6268, which lie near the peak transmission of the (62) filter. However, with the exception of V Aql, for which the value of (65,62) is about 0.07 mag too large if the estimate of $E(B - V) = +0.24$ mag is correct, the stars in Figure 15 are apparently little affected.

Bouigue (1954) has derived vibrational temperatures for nine of the stars in Table 9. The mean value is 2500° ± 150° (A.D.) compared to the black-body value of 2800° K.

## IX. VARIABLE STARS

*Absorption of TiO.*—The (102,65), (62,65) relation for giants was only taken to (102,65) = +1.2 mag in Figure 10. This relation is reproduced in Figure 16, where the values at various phases of R Vir (Fig. 2, *c*) are also shown; the phase in days from maximum light (102) is also marked. During the decrease in light (102) R Vir extends the linear (102,65), (62,65) relation to about (102,65) = +2 mag but then indicates a discontinuity with an apparent collapse of the temperature scale. During increasing light (102) there are large negative values of Δ(65,62) as was also seen for the short-period, smaller-amplitude variables in Figure 10 (§ VI). The discontinuity in the (102,65), (62,65) relation is also shown by R Hya, for which the four observations during increas-

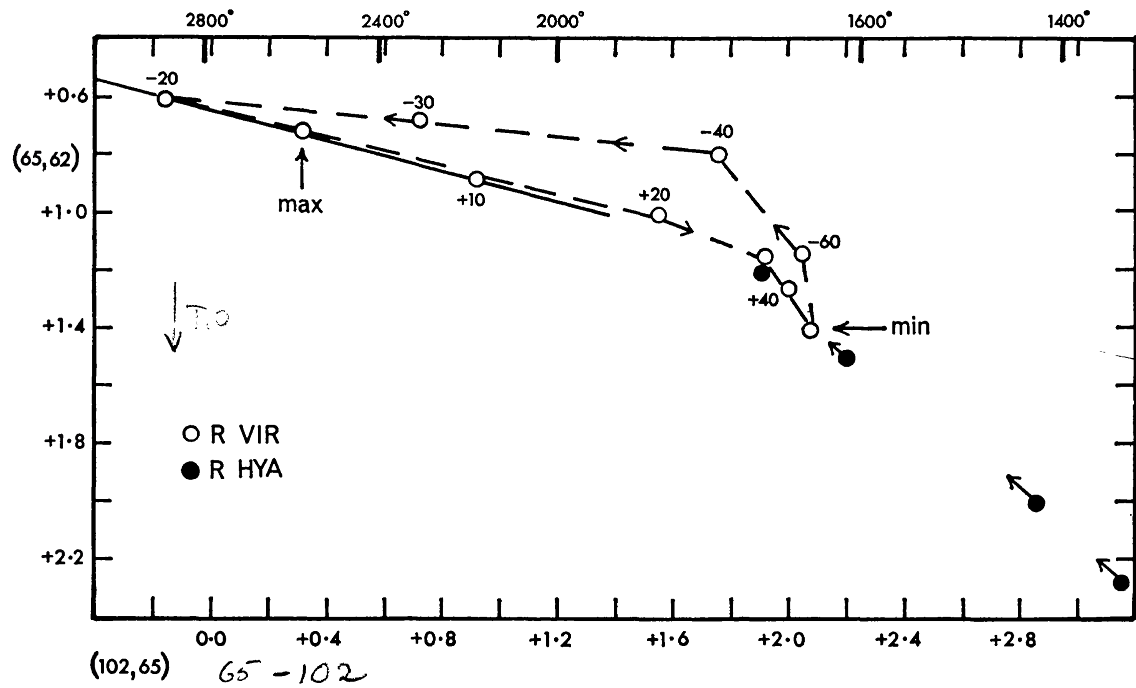



FIG. 16.—The variables R Vir and R Hya in the (102,65), (65,62) plane. Maximum and minimum light (102) and phase in days from maximum are indicated for R Vir.

ing light (102) from Table 2 are shown as filled circles in Figure 16. A distortion of the (102,65) scale near +2 mag could result from (*a*) contamination of one of the filter band passes by molecular absorption or, for the (65) filter, intense Hα emission, or (*b*) saturation of the TiO absorption. However, the effect of saturation of the TiO absorption would lead to an apparent stretching of the temperature scale. There is a weak TiO band head near the edge of the (65) filter which at the low temperatures at minimum light of the variable might appreciably affect the (65) magnitude, but this again would apparently stretch the temperature scale both by increasing the (102,65) and decreasing the (65,62) colors. Strong Hα emission at minimum would affect the (65) magnitude, but the observational evidence is that the emission lines, when present, are strong at maximum and are invisible at minimum. The most likely possibility, if indeed the effect is an observational one, is that unknown bands appear at low temperatures in the λ10200 region and depress the (102) magnitude. The computed values of Δ(62,65) are near 0.75 mag for the minimum of R Vir and 1.6 mag for the reddest observed value of (102,65) for R Hya.

* Eggen's (102) also sees Pδ λ~10036 in emission

Figure 17 contains the relation (65,62) = +0.63 + 0.27(102,65) mag extended to (102,65) = +2 mag (continuous line). The observations of the long-period variable R LMi(372$^d$, Fig. 2, *d;* indicated by *filled circles*), and the semiregular variable ST UMa(81$^d$, Fig. 2, *f; open boxes*), confirm the form of the relation shown in Figure 16. Figure 17 also contains the observations made just after maximum light of the high velocity variable RT Cyg(190$^d$, Table 3). This later star is distinguished by the color and TiO absorption at maximum (102) light, (65,62), (102,65) = (+0.49, −0.725 mag); no reddening correction has been applied. As will be discussed later, the variables in the Hyades group and most of the field variables show a well-defined period–maximum temperature relation, but this is violated by both R Vir(146$^d$) and RT Cyg(190$^d$). Adopting a luminosity at maximum of $M(102) = -4.5$ mag for both objects leads to the following space motions:

| | *U* | *V* | *W* |
|---|---|---|---|
| R Vir. . . . . . . . . . . . | +62 | − 30 | −26 |
| RT Cyg. . . . . . . . . . | +77 | −112 | +13 |

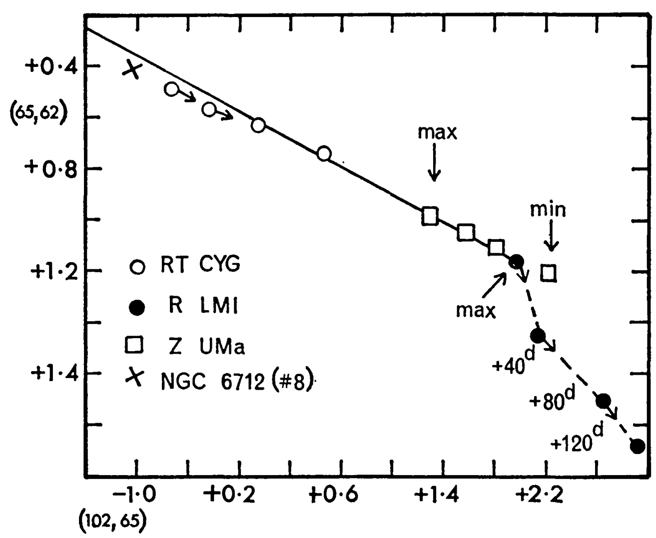



FIG. 17.—The position of some variables in the (102,65), (65,62) plane

Both variables are members of the old disk population. A more definitive discussion will be possible when observations of the 150$^d$–200$^d$ variables in 47 Tuc become available, but it is of interest to note that one observation near maximum light of variable No. 8(117$^d$) in the high-metal-content cluster NGC6712 gives (65,62), (102,65) = (+0.42, −0.40 mag). Adopting $E(B-V) = +0.48$ mag (Sandage and Smith 1966) gives $(102,65)_0 = -1.01$ mag; the variable is indicated by a cross in Figure 17. The observed value of (102) = 10.6 mag and Sandage and Smith's modulus of 14.2 mag leads to $M(102) = -4.5$ mag.

Attention should be called to the reddest variable observed, R Aur (Table 2). Near minimum light the values of (65,62), (102,65) $\simeq$ (+3.5, +3.5 mag) indicate that if the (102,65) scale is not distorted R Aur has a black-body temperature near 1300°.

*Instability region.*—There are only ten stars in Table 1 with (102,65) colors redder than −0.1 mag that are not known to vary from either previous or the present observations. It is quite likely that some of these apparently constant stars are in fact variables of the irregular type. The reddest star in Table 1 that is not known to be variable is the gM5 star HR 5512 with (102,65) = +1.08. The value of (102,65) = −0.1, which corresponds to a black-body temperature near 2900° K, is also at the edge of the instability region for the supergiants in the Perseus double cluster (Fig. 8).

The variables that are also members of the Hyades group, together with two other fairly well-observed objects (g Her and U Her) in Table 2 that have space motion vectors indicating that they are young disk stars (age $\simeq 5 \times 10^8$ years), show a well-defined period-color relation. The colors at minimum are almost exactly predicted by the relation (102,65)Min. = 3.5 mag + 2.6 log $P$. This relation covers the range from $24^d$(VZ Cam) to $400^d$(U Her). However the older disk objects, whose space motions fall outside the region of the $UV$ plane populated by the A-type stars, show considerable departures from this relation (e.g., R Vir and RT Cyg in the preceding subsection).

The young disk cepheids listed in Table 3 are as follows:

| | (102) (mag) | (65,62) (mag) | (102,65) (mag) | $E$(102,65) (mag) | $E$(65,62) (mag) | log $P$ |
|---|---|---|---|---|---|---|
| FF Aql.......... | 4.4 | +0.19 | −1.53 | +0.42 | +0.02 | 0.65 |
| $\eta$ Aql.......... | 3.2 | + .24 | −1.43 | + .32 | + .01 | 0.86 |
| X Cyg.......... | 5.0 | + .27 | −1.18 | + .39 | + .02 | 1.22 |
| CD Cyg......... | 7.0 | + .29 | −0.94 | +0.85 | +0.06 | 1.23 |
| | 7.1 | + .31 | −0.82 | ........... | ........... | ........... |
| | 7.2 | +0.32 | −0.71 | ........... | ........... | ........... |

The reddening values $E(102,65) = 1.25\,E(B-V)$ and $E(65,62) = 0.08\,E(B-V)$ were taken from Kraft (1961). The corrected values of $(65,62)_0$, $(102,65)_0$ are plotted in Figure 18, $a$, together with the black-body relation from Table 7. The positions of CD Cyg and $\eta$ Aql in the $M$(102), (102,65) plane are shown in Figure 8 and the red boundary of the instability region for young disk population cepheids is also indicated.

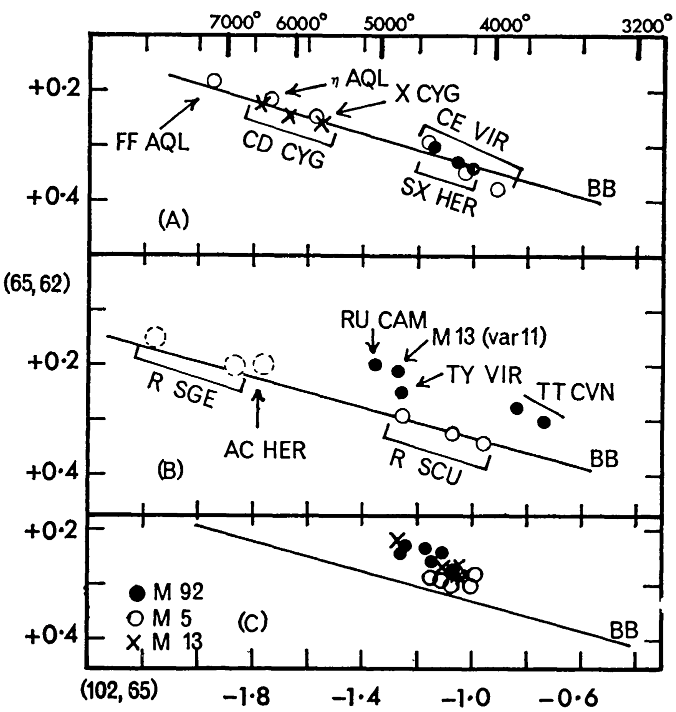



FIG. 18.—The position of some very young and some very old variables in the (102,65), (65,62) plane; see § IX.

Although some of the halo cepheids in globular clusters lie in the region of instability that is also populated by young disk cepheids (Sandage and Gratton 1963), there is not enough information available, covering the whole range of variables including RV Tau and SR types in globular clusters to completely define the region they occupy in the *M*(102), (102,65) plane. In addition to the semiregular variable No. 11 in M13 shown in Figure 8, there are also a few field variables in Table 3 that may be halo or old disk objects with (102,65) = −1 mag or bluer. These stars are listed in Table 10; the values of $E(B - V)$ have been, except for AC Her and R Sge, estimated from neighboring B-type stars.

TABLE 10

HALO OR OLD DISK VARIABLES NOT IN RED INSTABILITY REGION

| Star | P. | (102) (mag) | (65,62) (mag) | (102,65) (mag) | *b* | $E(B-V)$ (mag) | Sp. | Type | *M*(102) | *U* | *V* | *W* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RU Cam.. | $22^d$ | 7.3 | +0.95 | −1.315 | +29° | +0.03 | K(R) | CW | (−3.5) | (− 63 | − 52 | +100) |
| TT CVn.. | ..... | 6.9<br>7.0 | + .275<br>+ .30 | −0.835<br>−0.74 | +79 | + .03 | C1 | irr. | − 4 | − 65 | −150 | −130 |
| SX Her... | 103 | 6.45<br>6.4<br>6.45 | + .33<br>+ .30<br>+ .37 | −1.005<br>−1.07<br>−0.94 | +45 | + .05 | Gp. | SRd | −33 | −110 | −133 | + 35 |
| AC Her... | 75 | 6.5 | + .22 | −1.39 | +13 | (+ .2) | Fp(R) | RV(B) | (−3.5) | (+ 10 | − 38 | + 12) |
| R Sge..... | 71 | 7.95<br>8.1 | + .14<br>+ .225 | −1.78<br>−1.46 | −11 | (+ .3) | G0–K0 | RV(A) | (−3.5) | (− 71 | − 37 | − 20) |
| R Scu.... | 144 | 3.5<br>3.6<br>4.1 | + .30<br>+ .335<br>+ .355 | −1.04<br>−0.87<br>−0.76 | − 3 | + .16 | G8–K0 | RV(A) | −3.5 | − 66 | − 24 | + 27 |
| TY Vir... | 30 | 6.8 | + .25 | −1.18 | +54 | + .03 | G3p | SRd | −3.3 | +124 | −413 | + 6 |
| CE Vir.... | 67± | 7.15<br>7.4<br>7.55 | + .305<br>+ .35<br>+0.385 | −1.095<br>−0.98<br>−0.77 | +57 | +0.03 | K2 | SRd | −4.0 | +382<br>−0.5p | −336<br>− 03p | +143<br>+0.8p |

p = rad. vel.

The positions in the (102,65), (65,62) plane of the stars in Table 10 after correcting for reddining are shown in Figure 18, *a* and *b;* the reddening for the most heavily reddened stars R Sge and AC Her which are RV Tauri stars of types (A) and (B) (Preston, Krzeminsky, Smak, and Williams 1963), was obtained by fitting to the black-body (BB) relation under the assumption that, like R Scu, an RV Tauri variable of type (A), they fall on this relation. Although all three RV Tauri stars have values of (102,65) that do not differ appreciably from those of the young disk cepheids the space motions in Table 10 indicate that they are old disk objects. On the basis of their space motions the only certain members of the halo population in Table 10 are TY Vir and CE Vir which are both semiregular variables of type SRd. A third variable of this type, SX Her, which has been shown by Preston and Wallerstein (1963) to be similar to (*a*) TY Vir and (*b*) the giant members of halo globular cluster, has a space motion that does not clearly eliminate the possibility that it is an old disk population star. An apparent anomaly in Figure 18 is the fact that CE Vir, which is clearly a halo population star, and SX Her, which may be, both populate the black-body (102,65), (65,62) relation, whereas the halo object TY Vir and the variable in M13 definitely lie above this relation (Fig. 18, *b*) together with the old disk population objects TT CVn and RU Cam. However, the distribution of the globular cluster stars in Figure 18, *c*, which shows that those in the relatively metal-rich cluster M5 lie closer to the black-body relation than those in the metal-poor cluster M92, may indicate that the displacement from the black-body line is a result of differential blanketing effects. Observations of the stars in the metal-rich cluster 47 Tuc are needed to help in interpreting these results.

## X. SPACE MOTIONS

The space motions of stars in Table 1 for which values of (102) and (102,65) are available have been computed on the assumption that they populate the $M(102)$, (102,65) relation shown as a continuous curve in Figure 8; the only exceptions are the carbon stars in Table 9 and the known supergiants. In a few cases where either because of incompleteness in the observations of variable stars of large amplitude or because the

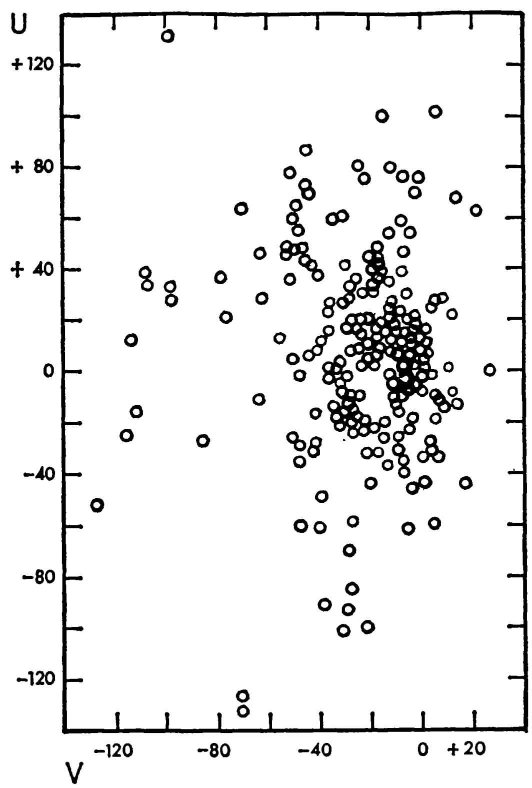



FIG. 19.—Distribution in the $UV$ plane of stars in Table 1

apparent reddening or the apparent motion data are untrustworthy, the luminosity and space motion in Table 1 are inclosed in parentheses.

The $UV$ vectors given without parentheses in Table 1 are plotted in Figure 19. The most obvious feature of Figure 19 is the high star density in the region of the $UV$ plane occupied by the A-type stars (Eggen 1963, Fig. 5) between $V \approx 0$ to $-30$ km/sec and $U \approx 0$ to $+40$ km/sec; this includes the Hyades group near $UV = (+40,-17)$. However, noticeably absent in this region of high star density are members of the Sirius group, $UV$ near $(-14,0)$, which are very numerous among the A-type stars. This absence of M-type giant members of the Sirius group was also noted previously (Eggen 1960) in a preliminary study of the brighter stars. Most of the stars discussed here are probably in evolutionary stages beyond that of core helium burning, and no detailed evolutionary models are available. It was previously noted (Eggen 1966) that in the red giants of the Hyades group as well as in the general field there was a marked discontinuity in the star density near $\log T_e \approx 3.6$, which marks the onset of helium burning in stars of medium mass. Evolution beyond this point may be very sensitive to small mass variations, and the absence of M-type stars in the Sirius group may therefore be a direct result of the fact that the members are slightly older than those in the Hyades group.

Another prominent feature of Figure 19, also noted in a preliminary study of the brighter stars (Eggen 1961), is the nearly equal division between stars whose motions are like those of the A-type stars ($\sim 5 \times 10^8$ years) and the older disk population objects that fall outside the limiting velocity ellipse of the A-type stars. Several groups of the older disk population stars are represented with the most densely populated one being the Wolf 630 group (Eggen 1965) with $V = -33$ km/sec and $U = 0$ to $-20$ km/sec. Two of the largest velocities represented in Figure 19 are for HR 3061 and 6128 at $(U,V) \sim (-130,-70)$. Three representative, probable members of the same group se-

TABLE 11

PROBABLE MEMBERS OF A GROUP WITH $(UV) = (-130,-70)$

| Star | $V_E$ (mag) | $B-V$ (mag) | $U-B$ (mag) | Sp. | $M_V$ (mag) | $U$ | $V$ | $W$ | Note |
|---|---|---|---|---|---|---|---|---|---|
| GC 1586... | 8.92 | +0.60 | −0.03 | G2V | +4.9 | −136 | −70 | −48 | $\delta(U-B)=+0.16$ mag |
| HR 3061... | 6.3 v | +1.58 | +1.58 | M4 | −1.1 | −129 | −70 | −10 | ..................... |
| GC 17302... | 7.34 | +1.66 | +1.50 | gM3 | −1.3 | −131 | −70 | −52 | Var? |
| HR 4849... | 5.67 | +0.99 | +0.74 | K1IV | +1.9 | −136 | −70 | +14 | ..................... |
| HR 6128... | 5.0 v | +1.75 | +2.06 | M2III | −1.1 | −133 | −70 | −21 | CN weak |

lected from a catalogue of high-velocity stars (Eggen 1964–1966) are listed in Table 11. All the probable group members in Table 11 lie on the evolved main sequence and supergiant-giant branches of the color-luminosity array for 47 Tuc; also, like members of 47 Tuc, the little evolved dwarf member of the group shows an intermediate value for the ultraviolet excess, $\delta(U - B) = +0.16$ mag.

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