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# CCD PHOTOMETRY OF THE OLD OPEN CLUSTER M67

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## ABSTRACT

We present a CCD photometric survey of the central one-half degree of the old open cluster, M67, in *U*, *B*, *V*, and *I* colors to magnitude $V=20$. Extensive comparison of our photometry with other published datasets shows excellent agreement, indicating that CCD photometry is capable of producing a uniform set of measurements consistent with the photometric system defined primarily by the Landolt standard sequence. The color–magnitude diagram of the cluster shows a well-defined main sequence extending at least to the limit of the photometry at $M_V=10.55$ and a substantial binary sequence. At least 38% of cluster stars are binaries. The current generation of theoretical isochrones cannot be fit to the observed sequences within the observational errors. We find a tendency for more massive members of the cluster to be more centrally concentrated, along with a turnover in the cluster luminosity function at low masses, which may be due to dynamical relaxation of the cluster. To the limit of our photometry, we find a mass of the cluster of 724 solar masses. In addition, we present a sample of stars of well-determined standard magnitudes that are suitable as photometric standards for further studies of this cluster and for general calibration of *UBVI* photometry using CCDs.

## 1. INTRODUCTION

With the exception of the Hyades and the Pleiades, few open clusters are as well studied as M67. It is easy to understand why. Not only is it a rich cluster, but its location, within 1 kpc of the Sun in a direction of low reddening and at high enough galactic latitude to minimize confusion with background stars, makes it possible to study its members from the giant branch to the lower main sequence with relative ease. In addition, its metallicity and its age, according to numerous determinations (most recently, Nissen *et al.* 1987; Gilliland & Brown 1992), are close to the accepted values for the Sun. The population of M67 thus serves as a paradigm sample for studies of the structure and evolution of Population I solar-age stars, just as the Hyades and Pleiades do for younger objects, and both the ensemble of stars in the cluster and its individual members have received considerable attention. Recent investigations of M67 have focused on its giants (Janes & Smith 1984), blue stragglers (Mathys 1992; Gilliland & Brown 1992; Mathieu & Latham 1986), spectroscopic binaries (Mathieu *et al.* 1990), and on stars which display low-amplitude solar-type oscillations (Gilliland & Brown 1988). Since the advent of CCDs, M67 has taken on additional utility as a convenient calibration field for *BVRI* photometry (Schild 1983), since a good range of colors can be imaged on a single frame near the central "dipper asterism" of the cluster.

Over the years, a number of broadband photometric surveys of the M67 region have been undertaken, most notable among them the pioneering photoelectric work of Johnson & Sandage (1955), Eggen & Sandage (1964), and the deep photographic work of Racine (1971). Racine noted that his photometry yielded "the most precise C–M diagram ever obtained for an old star cluster." His diagram show a clearly delineated main sequence and a giant branch, a photometric binary sequence 0.75 mag above the main sequence, and an absence of a notable white-dwarf sequence down to the limits of his photometry.

Two decades have passed since the last large-scale photometric survey of M67 was published, however, and certain developments suggested to us the usefulness of covering the region once again. One prime factor, of course, was the advent of CCDs, whose sensitivity and linearity have already been put to good use in deep studies of globular clusters. The depth, completeness, and consistency of existing photometry, it seemed evident, could be improved through systematic CCD imaging of the cluster, reduced by modern digital processing techniques. In the years since Racine's publication, Landolt's photoelectric *UBVRI* standards (Landolt 1983; Landolt 1973) have become de facto standards for broadband photometry, and though the accuracy of the published photometry is quite good in retrospect when compared with Landolt reference stars (Taylor & Joner 1985), no single study covers the cluster center exhaustively. Therefore a new deep survey with a single instrument seemed likely to produce a sample which could serve as a consistent standard reference for future research. Further, recent proper motion studies of the cluster (Girard *et al.* 1989; Sanders 1977) brought forth the need for photometry of those stars to which kinematic membership could be assigned yet which had not been included in earlier photometric studies.

Our objective, therefore, was to produce a deep *UBVI* survey of a region a half a degree on a side centered on the dipper asterism of M67, calibrated by the Landolt *UBVRI* standards, with associated equatorial coordinates and cross references to previous surveys, which would be useful for the future study of individual objects in the cluster. This new photometry would also be immediately applicable for comparison with theoretical isochrones, and for the investigation of the binary content, spatial distribution, and luminosity function of the cluster. The scope of our survey was limited primarily by the size of our detectors (512 $\times$512 chips were the largest available at the time) and the amount of observing time available. The resulting photometry should, in short, give us a fresh look at an old cluster.

## 2. PHOTOMETRY

### *2.1 Observations*

Observations were conducted using the Tektronix 512 $\times$512 CCD camera (the "Tek 2") on the 1 0.9 m telescope at Kitt Peak National Observatory on three nights spanning 1990 February 15–18 (UT). Except for the last hour of the final night, when high cirrus clouds moved in, the weather was exceptionally clear with seeing of 1–2 arcsec. The telescope was used with the $f/7.5$ secondary, producing an image scale of 0.77 arcsec/pixel (for 27 $\mu$ pixel) and a full field of 6.6 arcmin. In order to cover the entire central half-degree of the cluster, the field surrounding the central dipper asterism was partitioned into 25 overlapping fields, with centers offset north–south or east–west from each other by 5 arcmin to form a 5$\times$5 mosaic whose center frame included the asterism. During the 1990 spring run, all but 5 of the 25 fields were imaged.

A standard KPNO *UBVRI* filter set was used, the *U* filter consisting of a UG 2 with a copper-sulfate red block, the *B*, *V*, and *R* filters being the Harris set, and the *I* filter, the "nearly Mould." The procedure for each field was to take four 60 s exposures in *V* and *I*, four 120 s exposures in *B*, and one 900 s exposure in *U*. A series of images of the central field were taken several times each evening, both as a test of the internal repeatability of the measurements, and to provide a sequence of standard stars from which transformation and extinction corrections could be provided. In addition, a half-dozen or more standard stars from Landolt's (1983) list were observed several times a night over a wide range of airmasses (1.0 to at least 1.5) as a fundamental calibration source. Altogether, counting individual frames of Landolt objects and standard stars in the central field, about 100 standards were observed each night. A series of dome and skyflats were obtained every evening as well.

Additional observations were carried out on 1990 November 26/27 (UT) using a Tektronix 1024 CCD mounted on the KPNO 0.9 m telescope, the same telescope as used for the February run, now repositioned in a different dome a hundred feet to the east. The weather was clear and seeing was about 2 arcsec. Again the telescope was used at $f/7.5$, making the image scale 0.68 arcsec/pixel (24 $\mu$ pixel) and the full field of view 11.68 arcsec.

Two fields were imaged using the same *U*, *B*, and *V* filters as during the February run. A series of 60 and 120 s exposures were taken through the *B* and *V* filters, and a single 900 s exposure through the *U* filter. These two frames covered most of the area missed in the February run, and overlapped considerably the area already covered. Due to lack of time, no *I* frames were taken, nor were any standard stars outside the cluster observed.

One year later, on 1991 November 29 and 30, we obtained a few 15 s *I* images and 20 s *V* images using the same filters and configuration on the 0.9 m telescope as above, and a Tektronix 2048 CCD detector (T2K2) with 24 $\mu$ pixel giving a field of view of 23.36 arcmin. We used the short exposure images to get photometry on stars which were saturated on the longer exposure frames.

Preliminary processing of all CCD frames, to apply bias and flatfield corrections, was done with standard routines in the IRAF software package. For each evening, at least 20 flatfield exposures were available in each filter, *U*, *B*, *V*, *R*, and *I*, from dome illumination, and at least three frames each in *U*, *B*, and *V* using sky illumination. All well-exposed flatfield exposures in each filter were combined using the "avsigclip" procedure in IRAF. The dome flats were applied to all images, but for the *U*, *B*, and *V* images, the dome flats left slight residual patterns due presumably to the illumination or color balance problems. The IRAF sky illumination procedure was used with the sky frames to correct this problem. No residual patterns can be seen on the images.

The photometric reductions were made with a software package, SPS, developed at Boston University and the University of Hawaii (Janes & Heasley 1993). The SPS program is similar to several other photometry programs in using a point-spread-function (PSF) fitting procedure to calculate the magnitudes of all stars on a CCD image. Once a model PSF is computed, based on the observed image profiles of the brighter, relatively isolated stars on the frame, a map of the cross-correlation function between the PSF and the original image is used to identify all measurable stars on the frame. The magnitudes of stars in the list are computed by fitting the position and scale of the PSF to each star image in turn, in order of decreasing brightness. Once they have been measured, stars are subtracted to form an image of the residuals, which can be examined manually or searched automatically for additional stars. The zero point of the frame is set during the PSF calculation, through aperture photometry of the stars used to calculate the PSF. Extensive tests and comparisons of the SPS program are discussed by Janes & Heasley

(1993). These tests show that the program gives results consistent with those from other existing software packages.

### *2.2 Transformations*

Instrumental magnitudes for all measured stars were transformed to a standard system using fitting coefficients derived from observations of standard stars whose magnitudes have been well established in earlier studies. Our primary source of standard stars was the venerable list of equatorial standards compiled by Landolt (1983). For additional local standards on our cluster images, we chose stars in the dipper asterism near the center of M67, calibrating our instrumental magnitudes against published values from Joner & Taylor (1990) for $V-I$ and values of $B-V$ from Schild (1983). Both Joner and Taylor and Chevalier & Ilovaisky (1991) have noted a systematic error in Schild's $V$ magnitudes of 0.04 mag, a value we confirmed from our data. We found no systematic error in Schild's values for $B-V$, however, and therefore included them as $B-V$ standards in the cluster. Neither Schild nor Joner and Taylor listed values for $U$.

Transformation coefficients between instrumental and standard magnitudes were determined using the following equations, which are based on the discussion by Harris *et al.* (1983). In the following equations $u$, $b$, $v$, and $i$ are the instrumental magnitudes, $U$, $B$, $V$, and $I$ are the standard magnitudes, and $X$ is the airmass.

$$v=V+a_1+a_2X+a_3(B-V)+a_5(B-V)^2, \tag{1}$$

$$b=V+b_1+b_2X+b_3(B-V)-0.03X(B-V)+b_5(B-V)^2, \tag{2}$$

$$u=B+c_1+c_2X+c_3(U-B)+c_5(U-B)^2, \tag{3}$$

$$i=V+d_1+d_2X+d_3(V-I)+d_5(V-I)^2. \tag{4}$$

The derived coefficients are given in Table 1. The observing run in February is listed as nights 1–3 and the run in November is listed as nights 4 and 5. The zero points were derived independently for each night. Mean extinction coefficients were calculated for the observing run in February and were assumed for the run in November. The color terms and the color-squared terms are the means of all the nights within each observing run. It was found that the color-squared terms for the November observing run did not significantly improve the solutions. Note that for the November observing run a different CCD was used from the February run, which accounts for the differing zero points.

The standard deviations of the magnitudes of the stars used in transforming to the *UBVI* system for the February observing run were 0.015 in $V$, 0.013 in $B$, 0.018 in $U$, and 0.012 in $I$. Since independent standard star fields were not observed in the November run, 54 stars in common with both November and February datasets were used as internal standards for that run. Standard magnitudes for these stars were taken from the transformed February data. The standard deviations of fit for these 54 stars in the November data were 0.021 in $V$, 0.022 in $B$, and 0.030 in $U$. The slightly higher standard deviations are a result of using much fainter stars than are normally used as standard stars. $I$ frames were not taken in November.

TABLE 1. Transformation coefficients.

| | a | b | c | d |
|---|---|---|---|---|
| Feb. 1 | | | | |
| 1 | 4.5904±0.0045 | 4.5988±0.0044 | 6.2722±0.0087 | 5.4348±0.0037 |
| 2 | 0.1748±0.0086 | 0.2799±0.0083 | 0.5025±0.0534 | 0.0693±0.0086 |
| 3 | -0.0028±0.0115 | 0.9922±0.0116 | 1.0786±0.0421 | -0.9657±0.0093 |
| 5 | 0.0264±0.0082 | -0.0150±0.0081 | -0.0755±0.0451 | -0.0404±0.0078 |
| Feb. 2 | | | | |
| 1 | 4.6145±0.0045 | 4.6159±0.0045 | 6.3711±0.0079 | 5.4516±0.0037 |
| 2 | 0.1748±0.0086 | 0.2799±0.0083 | 0.5025±0.0534 | 0.0693±0.0086 |
| 3 | -0.0028±0.0115 | 0.9922±0.0116 | 1.0786±0.0421 | -0.9657±0.0093 |
| 5 | 0.0264±0.0082 | -0.0150±0.0081 | -0.0755±0.0451 | -0.0404±0.0078 |
| Feb. 3 | | | | |
| 1 | 4.5985±0.0042 | 4.6203±0.0043 | 6.4070±0.0077 | 5.4545±0.0036 |
| 2 | 0.1748±0.0086 | 0.2799±0.0083 | 0.5025±0.0534 | 0.0693±0.0086 |
| 3 | -0.0028±0.0115 | 0.9922±0.0116 | 1.0786±0.0421 | -0.9657±0.0093 |
| 5 | 0.0264±0.0082 | -0.0150±0.0081 | -0.0755±0.0451 | -0.0404±0.0078 |
| Nov. 1 | | | | |
| 1 | 4.0222±0.0095 | 4.1966±0.0106 | 6.0482±0.0076 | — |
| 2 | 0.1500±0.0000 | 0.2700±0.0000 | 0.5700±0.0000 | — |
| 3 | 0.0599±0.0099 | 0.9879±0.0110 | 0.9754±0.0123 | — |
| 5 | — | — | — | — |
| Nov. 2 | | | | |
| 1 | 4.0237±0.0137 | 4.1565±0.0134 | 6.0602±0.0168 | — |
| 2 | 0.1500±0.0000 | 0.2700±0.0000 | 0.5700±0.0000 | — |
| 3 | 0.0599±0.0099 | 0.9879±0.0110 | 0.9754±0.0123 | — |
| 5 | — | — | — | — |

To check for systematic errors in the fit to standard magnitudes, the magnitudes and colors of the dipper asterism stars were compared to studies done by Eggen & Sandage (1964), Racine (1971), Schild (1983), Joner & Taylor (1990), Chevalier & Ilovaisky (1991), and Gilliland *et al.* (1991). The residuals as compared to the different datasets are shown in Tables 2(a)–2(d). They are of the form of our values minus their values. Also given are the means and standard deviations about the means for each set of residuals. To make a meaningful comparison between our dataset and Schild's data, the latter was first compared with the Joner and Taylor data. The residuals in $V$ magnitude of the Joner and Taylor values minus the Schild values when plotted against $V$ magnitude showed a linear correlation. Joner and Taylor noted this discrepancy in their paper, but did not attempt any correction of the Schild data. We choose to correct the Schild data by deriving a least-squares solution to the residuals yielding the following relation:

$$V_{\mathrm{corr}}=0.9843V_{\mathrm{Schild}}+0.1514. \tag{5}$$

Schild's magnitudes were then adjusted to fit this line. The brightest stars had very little correction, but the fainter stars had corrections of up to 0.056 mag. All the corrections were in the direction of increasing the brightness of Schild's magnitudes.

The residuals in Tables 2(a)–2(d) demonstrate that our magnitudes agree quite well with those found by Eggen and Sandage, Chevalier and Ilovaisky, and Joner and Taylor. We therefore consider those studies, and our own, to represent a single uniform photometric system which is in good agreement with the system defined by Landolt's work. The standard deviations are within the range expected when comparing two independent datasets each

TABLE 2. Dipper–asterism residuals.

| Star | V Mag. | Schild | J & T | E & S | Racine | C & I | Gill. | Mean |
|---|---|---|---|---|---|---|---|---|
| F81 | 10.032 | 0.031 | 0.005 | 0.002 | 0.002 | 0.010 | — | 0.010 |
| F117 | 12.595 | -0.034 | -0.035 | -0.015 | -0.035 | -0.041 | -0.035 | -0.033 |
| F124 | 12.130 | 0.022 | 0.012 | -0.010 | 0.040 | 0.006 | -0.010 | 0.010 |
| F127 | 12.739 | -0.027 | -0.030 | -0.031 | -0.041 | -0.026 | -0.041 | -0.033 |
| F128 | 13.139 | 0.013 | -0.013 | -0.021 | -0.021 | -0.008 | -0.021 | -0.012 |
| F129 | 13.159 | -0.003 | 0.007 | -0.031 | -0.021 | -0.015 | -0.041 | -0.017 |
| F130 | 12.880 | 0.000 | 0.011 | 0.000 | 0.000 | -0.004 | -0.030 | -0.004 |
| F134 | 12.250 | 0.004 | -0.006 | -0.020 | 0.020 | 0.003 | -0.020 | -0.003 |
| F135 | 11.433 | -0.003 | -0.003 | -0.017 | 0.003 | 0.001 | -0.017 | -0.006 |
| | mean | 0.000 | -0.006 | -0.016 | -0.006 | -0.008 | -0.027 | -0.010 |
| | $\sigma$ | 0.020 | 0.016 | 0.011 | 0.025 | 0.016 | 0.011 | 0.015 |

| Star | B-V | Schild | E & S | Racine | C & I | Gill. | Mean |
|---|---|---|---|---|---|---|---|
| F81 | -0.067 | 0.031 | 0.006 | — | 0.019 | — | 0.019 |
| F117 | 0.788 | -0.012 | 0.018 | 0.018 | -0.006 | -0.012 | 0.001 |
| F124 | 0.458 | -0.008 | 0.008 | -0.002 | 0.000 | -0.002 | -0.001 |
| F127 | 0.575 | 0.022 | 0.015 | 0.045 | 0.018 | 0.005 | 0.021 |
| F128 | 0.578 | 0.001 | -0.002 | 0.028 | -0.002 | -0.002 | 0.005 |
| F129 | 0.591 | -0.010 | 0.011 | 0.041 | 0.002 | 0.011 | 0.011 |
| F130 | 0.466 | 0.017 | -0.004 | 0.046 | 0.013 | 0.006 | 0.016 |
| F134 | 0.579 | -0.010 | -0.001 | -0.001 | 0.000 | -0.011 | -0.005 |
| F135 | 1.067 | 0.016 | 0.007 | -0.003 | 0.010 | -0.023 | 0.001 |
| | mean | 0.005 | 0.006 | 0.022 | 0.006 | -0.004 | 0.008 |
| | $\sigma$ | 0.015 | 0.007 | 0.020 | 0.009 | 0.011 | 0.009 |

| Star | V-I | Schild | J & T | C & I | Mean |
|---|---|---|---|---|---|
| F81 | -0.049 | 0.019 | 0.019 | 0.019 | 0.019 |
| F117 | 0.908 | -0.004 | 0.007 | 0.016 | 0.006 |
| F124 | 0.566 | 0.001 | 0.006 | 0.010 | 0.006 |
| F127 | 0.665 | -0.007 | 0.014 | 0.016 | 0.008 |
| F128 | 0.694 | 0.000 | 0.066 | 0.040 | 0.035 |
| F129 | 0.670 | -0.066 | 0.009 | -0.005 | -0.021 |
| F130 | 0.576 | 0.000 | -0.004 | 0.022 | 0.006 |
| F134 | 0.697 | 0.013 | 0.028 | 0.024 | 0.022 |
| F135 | 1.082 | 0.013 | 0.029 | 0.023 | 0.022 |
| | mean | -0.003 | 0.019 | 0.018 | 0.011 |
| | $\sigma$ | 0.024 | 0.019 | 0.011 | 0.015 |

| Star | U-B | E & S | Racine | Gill. | Mean |
|---|---|---|---|---|---|
| F81 | -0.233 | 0.152 | — | — | 0.152 |
| F117 | 0.249 | -0.031 | -0.031 | -0.021 | -0.028 |
| F124 | -0.012 | -0.042 | -0.102 | -0.062 | -0.069 |
| F127 | 0.022 | -0.038 | -0.048 | -0.028 | -0.038 |
| F128 | 0.066 | 0.016 | 0.006 | 0.046 | 0.023 |
| F129 | 0.075 | 0.015 | -0.025 | 0.002 | 0.002 |
| F130 | 0.000 | -0.005 | -0.070 | 0.000 | -0.025 |
| F134 | 0.074 | 0.014 | -0.016 | 0.034 | 0.011 |
| F135 | 0.896 | -0.024 | -0.004 | -0.024 | -0.017 |
| | mean | 0.006 | -0.036 | -0.005 | 0.001 |
| | $\sigma$ | 0.056 | 0.034 | 0.033 | 0.059 |

with their own internal errors. Our data also agree very well with Schild's data after correcting for the linear shift within the published data. The magnitude shift seen in the residuals of our data as compared to Eggen and Sandage's will also account for the shift in our data as compared to Racine's and Gilliland's since they used the Eggen and Sandage data as standards. The somewhat larger residuals of our data when compared to Racine are also expected because of the larger internal errors inherent in his photographic photometry. We note that star F106, I11, was not used in the comparison because it has a close neighbor which can be separated by PSF fitting, but not with traditional photoelectric photometry. Chevalier and Ilovaisky, who also used a CCD, left star F106 out of their calibration for the same reason. Other stars used in the comparison also had companions, but the magnitude difference or the separation between the two stars was large enough not to affect the comparison.

Instrumental magnitudes for all stars on our images were transformed to the *UBVI* system by using Eqs. (1)–(4) and the derived transformation and extinction coefficients. The photometry for all stars is listed in Table 3. Stars with a $V$ magnitude greater than 12 are from our study, and stars with a $V$ magnitude less than 12 are taken from published sources. The stars with photometry taken from other sources have star numbers enclosed in parentheses, and the source of the photometry can be found in Table 4. In Table 3 we have introduced a new numbering system to account for the faint stars which did not have previously published photometry. Our numbering system begins in the northwest corner of the survey, and is in approximate order of right ascension. In order to avoid confusion with previous numbering systems we have begun numbering from 5001. Star numbers followed with an asterisk correspond to stars which fall on the photometric binary sequence in the color–magnitude diagram (see Sec. *4.3*). CCD pixel coordinates were converted to equatorial coordinates using standard reference stars from Girard *et al.* (1989). The conversion process included corrections for curvature of the coordinate system, and possible variations in the orientation of the CCD frames. The rms error in the fit of the reference stars was 0.3 arcsec. Columns 2 and 3 give the right ascension and declination of each star for the 1950.0 epoch. Columns 4–7 give the magnitudes of each star as determined by this study. The last column, titled comments, gives cross references to other studies. The first number in the comments column corresponds to Sanders (1977), a number preceded by a roman numeral comes from Eggen & Sandage (1964), a number preceded by a F comes from Fagerholm (1906), and numbers preceded with a G refer to Gilliland *et al.* (1991).

For the sake of completeness and to account for stars which were saturated on the CCD frames, the photometry for stars with a $V$ magnitude less than 12 was compiled from previously published sources and from several short exposure frames obtained in 1991 November. A list of these stars is given in Table 4, and they are also identified in Table 3 by parentheses around the star number. The stars for which the photometry is listed to a thousandth of a magnitude are based on $V$ and $V-I$ magnitudes determined using short exposures on images taken in 1991 November, and transformed to the standard system by using the previously determined photometry. The sources for the published data in column 7 are the following: ES for Eggen & Sandage (1964), JS for Janes & Smith (1984), G for Gilliland *et al.* (1991), M for Murray *et al.* (1965), and S for Sanders (1989). In order to facilitate easy cross referencing between our photometry and previous published photometry, Table 5 lists Sanders' number and the corresponding MMJ No. for each star in common. (A complete version of Tables 3–7 can be received by sending e-mail to kent@hyades.bu.edu.)

TABLE 3. Photometry.

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (6469) | 8 46 51.02 | 12 02 45.0 | 9.53 | 1.38 | — | 1.33 | 258, table 4 | 5031 | 8 47 47.02 | 12 10 06.1 | 15.368 | 0.501 | -0.053 | — | |
| (6470) | 8 47 12.90 | 11 52 86.0 | 9.84 | 1.36 | — | 1.30 | 364, table 4 | 5032 | 8 47 47.07 | 12 09 44.2 | 19.334 | 1.501 | — | — | |
| (6471) | 8 47 27.70 | 12 02 45.0 | 8.86 | 1.59 | — | 1.67 | 488, table 4 | 5033 | 8 47 47.84 | 12 02 42.4 | 15.532 | 0.667 | 0.126 | 0.810 | |
| (6472) | 8 47 34.04 | 12 06 34.9 | 9.98 | 1.10 | — | 1.09 | 494, table 4 | 5034 | 8 47 49.00 | 11 54 57.0 | 17.118 | 1.011 | 0.805 | 1.233 | |
| (6474) | 8 47 36.12 | 12 32 30.0 | 10.52 | 1.23 | — | 1.15 | 676, table 4 | 5035 | 8 47 49.66 | 11 47 20.1 | 19.424 | 1.110 | 0.655 | 1.192 | |
| 5001 | 8 47 44.81 | 11 59 37.9 | 19.400 | 1.475 | — | — | | 5036 | 8 47 48.57 | 12 01 36.5 | 18.132 | 1.252 | 1.076 | 1.455 | |
| 5002 | 8 47 45.00 | 11 57 28.4 | 19.868 | 1.458 | — | 2.184 | | 5037 | 8 47 49.90 | 11 47 18.9 | 19.537 | 0.981 | 0.589 | 1.265 | |
| 5003 | 8 47 44.38 | 12 04 43.5 | 16.814 | 1.078 | 1.086 | — | | 5038 | 8 47 48.50 | 12 05 10.9 | 19.445 | 0.889 | — | — | |
| 5004 | 8 47 44.65 | 12 01 44.6 | 18.133 | 1.416 | — | 1.692 | | 5039 | 8 47 49.12 | 12 00 16.9 | 14.422 | 0.656 | 0.122 | 0.763 | |
| 5005 | 8 47 45.47 | 11 53 28.3 | 17.502 | 0.619 | 0.026 | — | | 5040 | 8 47 49.41 | 11 59 46.8 | 19.561 | 1.072 | — | 1.293 | |
| 5006 | 8 47 45.44 | 11 55 34.6 | 20.222 | 1.407 | — | 2.038 | | 5041 | 8 47 50.31 | 11 51 11.4 | 12.629 | 0.594 | 0.065 | 0.703 | |
| 5007 | 8 47 44.56 | 12 06 25.4 | 18.576 | 1.407 | — | — | | 5042 | 8 47 49.76 | 11 57 40.6 | 12.856 | 0.531 | 0.025 | 0.665 | |
| 5008 | 8 47 45.14 | 12 01 02.1 | 20.369 | 0.513 | -0.218 | 0.848 | | 5043 | 8 47 48.60 | 12 12 30.1 | 19.198 | 1.603 | — | — | |
| 5009 | 8 47 44.77 | 12 06 13.9 | 19.670 | 0.706 | — | — | | 5044 | 8 47 48.85 | 12 10 06.9 | 16.571 | 0.619 | 0.054 | — | |
| 5010 | 8 47 46.45 | 11 48 32.8 | 18.064 | 0.532 | -0.114 | 0.670 | | 5045 | 8 47 50.58 | 11 51 49.2 | 20.636 | 0.852 | — | 0.957 | |
| 5011 | 8 47 45.19 | 12 04 03.2 | 20.702 | 0.052 | -1.101 | — | | 5046 | 8 47 50.17 | 11 57 48.8 | 18.491 | 1.396 | 0.871 | 1.827 | |
| 5012 | 8 47 46.55 | 11 48 53.1 | 16.856 | 0.839 | 0.281 | 0.984 | | 5047 | 8 47 50.54 | 11 56 38.5 | 15.650 | 0.860 | 0.497 | 0.944 | |
| 5013 | 8 47 46.23 | 11 53 27.6 | 16.540 | 0.927 | 0.691 | — | | 5048 | 8 47 49.98 | 12 05 25.6 | 18.305 | 1.406 | — | — | |
| 5014 | 8 47 45.48 | 12 02 32.8 | 19.444 | 1.179 | — | 1.399 | | 5049 | 8 47 50.83 | 11 56 10.1 | 20.215 | 1.498 | — | 2.497 | |
| 5015 | 8 47 46.12 | 11 55 13.7 | 19.496 | 0.928 | — | 1.192 | | 5050 | 8 47 51.49 | 11 49 07.0 | 19.918 | 1.217 | — | 1.765 | |
| 5016 | 8 47 46.43 | 11 53 41.3 | 17.033 | 1.034 | 0.892 | — | | 5051 | 8 47 51.70 | 11 48 51.7 | 15.234 | 0.782 | 0.342 | 0.895 | |
| 5017 | 8 47 45.61 | 12 03 28.9 | 21.239 | 0.200 | — | — | | 5052 | 8 47 52.01 | 11 48 21.4 | 16.200 | 0.982 | 0.776 | 1.065 | |
| 5018 | 8 47 46.19 | 12 00 35.4 | 20.721 | 0.507 | — | — | | 5053 | 8 47 52.10 | 11 48 13.3 | 18.715 | 1.525 | — | 1.908 | |
| 5019 | 8 47 45.86 | 12 04 41.9 | 18.858 | 0.670 | 0.176 | — | | 5054 | 8 47 50.17 | 12 10 28.8 | 18.144 | 0.669 | 0.184 | — | |
| 5020 | 8 47 46.59 | 11 56 33.9 | 19.731 | 0.647 | — | — | | 5055 | 8 47 51.00 | 12 01 49.6 | 20.176 | 0.257 | -0.379 | 0.591 | |
| 5021 | 8 47 46.10 | 12 05 24.1 | 18.162 | 0.769 | 0.114 | — | | 5056 | 8 47 50.73 | 12 05 08.3 | 17.047 | 1.191 | 1.234 | — | |
| 5022 | 8 47 47.14 | 11 54 32.5 | 19.132 | 1.371 | — | 2.008 | | 5057 | 8 47 50.99 | 12 03 39.5 | 18.428 | 1.219 | — | — | |
| 5023 | 8 47 46.84 | 12 02 32.3 | 16.895 | 1.134 | 1.089 | 1.298 | | 5058 | 8 47 50.93 | 12 06 26.0 | 17.174 | 0.571 | -0.215 | — | |
| 5024 | 8 47 48.16 | 11 50 25.1 | 19.207 | 1.196 | — | 1.383 | | 5059 | 8 47 52.01 | 11 54 30.2 | 12.712 | 0.913 | 0.555 | 0.966 | |
| 5025 | 8 47 46.95 | 12 04 41.4 | 17.165 | 1.167 | 1.114 | — | | 5060 | 8 47 52.58 | 11 58 21.5 | 15.442 | 0.835 | 0.426 | 0.898 | |
| 5026 | 8 47 47.28 | 12 04 05.6 | 17.126 | 1.102 | 0.968 | — | | 5061 | 8 47 52.49 | 12 00 10.2 | 13.025 | 0.574 | 0.049 | 0.700 | |
| 5027 | 8 47 48.30 | 11 53 57.9 | 19.534 | 0.642 | -0.064 | 0.812 | | 5062 | 8 47 52.83 | 11 56 31.5 | 20.163 | 1.379 | — | 2.077 | |
| 5028 | 8 47 47.10 | 12 08 11.6 | 18.277 | 0.842 | 0.538 | — | | 5063 | 8 47 52.63 | 11 59 19.6 | 19.198 | 1.614 | — | 2.008 | |
| 5029 | 8 47 48.48 | 11 52 46.7 | 20.722 | 0.642 | — | — | | 5064 | 8 47 52.66 | 11 59 15.2 | 14.632 | 0.813 | 0.369 | 0.877 | |
| 5030 | 8 47 47.66 | 12 02 32.7 | 18.319 | 1.136 | 0.937 | 1.361 | | 5065 | 8 47 51.45 | 12 13 39.9 | 16.683 | 1.229 | — | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5066 | 8 47 53.55 | 11 50 31.9 | 18.873 | 0.478 | -0.111 | 0.621 | | 5101 | 8 47 54.53 | 12 08 06.2 | 18.350 | 1.497 | — | — | |
| 5067 | 8 47 51.53 | 12 13 38.8 | 14.040 | 0.879 | 0.676 | — | | 5102 | 8 47 56.05 | 11 50 44.8 | 20.696 | 0.630 | -0.065 | 1.098 | |
| 5068 | 8 47 52.09 | 12 09 04.4 | 15.475 | 0.679 | 0.063 | — | | 5103 | 8 47 55.62 | 11 57 04.4 | 19.095 | 1.613 | — | 1.950 | |
| 5069 | 8 47 53.54 | 11 52 36.2 | 18.431 | 1.516 | 1.025 | — | | 5104 | 8 47 56.02 | 11 52 45.2 | 19.394 | 0.980 | 0.503 | 1.167 | |
| 5070 | 8 47 51.72 | 12 13 33.5 | 19.232 | 1.158 | — | — | | 5105 | 8 47 56.41 | 11 48 39.5 | 18.599 | 1.533 | — | 1.819 | |
| 5071 | 8 47 53.60 | 11 52 39.5 | 18.482 | 1.593 | 1.128 | 2.463 | | 5106 | 8 47 56.07 | 11 52 47.8 | 19.324 | 1.087 | 0.554 | 1.021 | |
| 5072 | 8 47 52.68 | 12 03 06.9 | 19.475 | 0.955 | — | — | | 5107 | 8 47 56.22 | 11 52 04.9 | 17.779 | 1.390 | 1.154 | — | |
| 5073 | 8 47 54.24 | 11 46 47.9 | 16.906 | 0.811 | 0.381 | 0.918 | | 5108 | 8 47 56.25 | 11 52 08.2 | 17.824 | 1.339 | 1.212 | 1.615 | |
| 5074 | 8 47 52.69 | 12 05 18.7 | 14.465 | 0.760 | 0.297 | — | | 5109 | 8 47 55.58 | 12 00 32.5 | 19.018 | 1.033 | 0.799 | 1.370 | |
| 5075 | 8 47 52.99 | 12 02 09.8 | 15.234 | 0.617 | 0.039 | 0.733 | | 5110 | 8 47 56.23 | 11 53 38.4 | 20.004 | 1.616 | — | 2.189 | |
| 5076 | 8 47 52.95 | 12 02 48.3 | 17.243 | 1.252 | 1.181 | 1.479 | | 5111 | 8 47 56.39 | 11 53 23.7 | 14.042 | 0.590 | 0.046 | — | |
| 5077 | 8 47 52.94 | 12 02 46.3 | 17.241 | 1.217 | 1.217 | — | | 5112* | 8 47 56.99 | 11 49 05.4 | 18.093 | 1.542 | 1.088 | 1.908 | |
| 5078 | 8 47 52.52 | 12 07 57.8 | 18.982 | 1.404 | — | — | | 5113 | 8 47 57.07 | 11 50 02.0 | 19.300 | 0.712 | -0.026 | 0.900 | |
| 5079 | 8 47 53.70 | 11 56 48.8 | 16.669 | 1.092 | 0.977 | 1.217 | | 5114* | 8 47 57.17 | 11 49 14.5 | 18.749 | 1.474 | 0.966 | 2.080 | |
| 5080 | 8 47 53.33 | 12 01 06.3 | 20.683 | 1.105 | — | 0.913 | | 5115 | 8 47 57.07 | 11 50 53.1 | 20.599 | 0.629 | — | 0.718 | |
| 5081 | 8 47 53.87 | 11 55 01.8 | 19.010 | 1.435 | — | 1.630 | | 5116 | 8 47 55.48 | 12 09 46.5 | 15.734 | 0.851 | 0.565 | — | |
| 5082 | 8 47 53.92 | 11 55 38.3 | 16.330 | 0.992 | 0.828 | 1.114 | | 5117 | 8 47 55.84 | 12 07 11.7 | 19.984 | 1.552 | — | — | |
| 5083 | 8 47 52.55 | 12 12 37.6 | 19.819 | 0.773 | — | — | | 5118 | 8 47 56.63 | 11 59 00.8 | 12.818 | 0.521 | -0.005 | 0.653 | |
| 5084 | 8 47 52.63 | 12 12 36.4 | 16.149 | 0.918 | 0.783 | — | | 5119 | 8 47 55.65 | 12 10 18.5 | 16.756 | 0.641 | 0.018 | — | |
| 5085 | 8 47 54.05 | 11 56 35.4 | 17.260 | 1.257 | 1.169 | 1.430 | | 5120 | 8 47 56.18 | 12 04 41.6 | 19.608 | 1.456 | — | — | |
| 5086 | 8 47 54.41 | 11 53 59.1 | 17.866 | 0.763 | 0.307 | 0.975 | | 5121* | 8 47 56.97 | 11 56 46.9 | 19.147 | 1.480 | — | 2.186 | |
| 5087 | 8 47 53.05 | 12 11 39.1 | 15.918 | 0.767 | 0.373 | — | | 5122 | 8 47 56.39 | 12 05 13.6 | 17.311 | 1.183 | 1.300 | — | |
| 5088 | 8 47 53.55 | 12 06 49.2 | 19.693 | 1.709 | — | — | | 5123 | 8 47 57.91 | 11 48 08.3 | 12.647 | 0.685 | 0.175 | 0.796 | |
| 5089 | 8 47 53.71 | 12 05 54.8 | 14.760 | 0.705 | 0.223 | — | | 5124 | 8 47 57.44 | 11 55 43.3 | 12.374 | 0.746 | 0.209 | 0.872 | |
| 5090 | 8 47 54.42 | 11 57 50.3 | 15.415 | 0.832 | 0.424 | 0.910 | | 5125 | 8 47 56.94 | 12 04 08.3 | 19.689 | 1.110 | — | — | |
| 5091 | 8 47 55.27 | 11 48 42.0 | 18.339 | 0.676 | 0.141 | 0.843 | | 5126 | 8 47 58.34 | 11 48 08.6 | 16.116 | 0.967 | 0.715 | 1.113 | |
| 5092 | 8 47 54.57 | 11 58 07.5 | 19.407 | 1.523 | — | 1.416 | | 5127 | 8 47 56.51 | 12 10 25.0 | 18.938 | 0.510 | -0.274 | — | |
| 5093* | 8 47 54.74 | 11 58 09.7 | 15.427 | 0.902 | 0.500 | 1.026 | | 5128 | 8 47 56.39 | 12 12 41.3 | 15.305 | 0.560 | -0.027 | — | |
| 5094 | 8 47 53.93 | 12 11 21.5 | 19.781 | 1.497 | — | — | | 5129 | 8 47 56.88 | 12 07 30.0 | 15.731 | 0.886 | 0.617 | — | |
| 5095 | 8 47 54.52 | 12 04 46.6 | 15.276 | 0.618 | 0.049 | — | | 5130 | 8 47 57.22 | 12 03 45.1 | 17.815 | 1.292 | — | — | |
| 5096 | 8 47 55.64 | 11 52 29.3 | 18.151 | 1.513 | 1.212 | — | | 5131 | 8 47 57.21 | 12 05 03.1 | 17.840 | 1.006 | 1.003 | — | |
| 5097 | 8 47 55.83 | 11 50 40.5 | 20.124 | 1.695 | — | 2.256 | | 5132 | 8 47 58.45 | 11 51 04.6 | 13.411 | 0.562 | 0.032 | 0.693 | |
| 5098 | 8 47 55.68 | 11 52 32.3 | 18.185 | 1.516 | 1.182 | 2.324 | | 5133 | 8 47 57.29 | 12 05 19.3 | 18.716 | 1.509 | — | — | |
| 5099 | 8 47 54.25 | 12 09 16.4 | 15.352 | 0.622 | 0.097 | — | | 5134 | 8 47 57.38 | 12 05 46.9 | 17.269 | 1.173 | 1.317 | — | |
| 5100 | 8 47 54.70 | 12 04 33.2 | 18.006 | 0.540 | -0.066 | — | | 5135 | 8 47 56.83 | 12 12 34.5 | 17.603 | 0.609 | 0.086 | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5136 | 8 47 59.00 | 11 48 59.4 | 19.569 | 1.530 | — | 2.307 | | 5170 | 8 48 02.38 | 11 50 04.2 | 19.879 | 0.900 | 0.290 | 0.694 | |
| 5137 | 8 47 58.00 | 12 03 10.7 | 20.497 | 0.249 | — | — | | 5171 | 8 48 01.18 | 12 06 34.4 | 17.863 | 1.258 | — | — | |
| 5138 | 8 47 58.10 | 12 04 57.9 | 17.868 | 0.820 | 0.488 | — | | 5172 | 8 48 01.29 | 12 06 50.3 | 15.851 | 0.907 | 0.676 | — | |
| 5139 | 8 47 59.54 | 11 49 19.5 | 18.170 | 1.378 | 1.245 | 1.620 | | 5173 | 8 48 01.28 | 12 07 18.0 | 17.573 | 1.219 | — | — | |
| 5140 | 8 47 58.31 | 12 03 41.7 | 16.843 | 1.090 | 1.010 | — | | 5174 | 8 48 01.67 | 12 03 17.1 | 14.426 | 1.029 | 0.929 | — | |
| (6473) | 8 47 59.49 | 11 47 04.8 | 11.57 | 0.68 | — | — | 590, table 4 | 5175 | 8 48 01.03 | 12 11 04.0 | 18.397 | 1.414 | — | — | |
| 5141 | 8 47 59.87 | 11 47 04.7 | 19.030 | 0.341 | — | — | | 5176 | 8 48 00.89 | 12 13 18.8 | 18.059 | 1.321 | — | — | |
| 5142 | 8 47 59.95 | 11 47 45.3 | 19.114 | 1.385 | — | 2.008 | | 5177 | 8 48 01.56 | 12 05 56.5 | 16.780 | 1.179 | 1.127 | — | |
| 5143 | 8 47 58.25 | 12 07 35.2 | 16.289 | 0.670 | 0.142 | — | | 5178 | 8 48 03.26 | 11 48 59.8 | 20.313 | 1.302 | — | 1.496 | |
| 5144 | 8 47 59.57 | 11 53 01.7 | 16.984 | 0.817 | 0.386 | -2.523 | | 5179 | 8 48 02.17 | 12 03 31.5 | 15.009 | 0.799 | 0.340 | — | |
| 5145 | 8 47 58.25 | 12 08 31.5 | 19.587 | 1.555 | — | — | | 5180 | 8 48 02.96 | 11 54 43.6 | 16.361 | 0.632 | -0.008 | 0.749 | |
| 5146 | 8 47 58.39 | 12 07 33.7 | 16.021 | 0.575 | -0.060 | — | | 5181 | 8 48 03.04 | 11 54 08.3 | 14.154 | 0.594 | 0.064 | 0.727 | |
| 5147 | 8 47 59.94 | 11 50 11.9 | 19.224 | 0.848 | 0.546 | 1.036 | | 5182 | 8 48 02.07 | 12 05 45.8 | 13.668 | 0.622 | 0.089 | — | |
| 5148 | 8 47 58.46 | 12 08 55.1 | 20.237 | 1.470 | — | — | | 5183 | 8 48 01.78 | 12 13 12.8 | 13.448 | 0.536 | 0.002 | — | |
| 5149 | 8 47 59.58 | 11 56 40.6 | 16.479 | 1.059 | 0.872 | 1.170 | | 5184 | 8 48 02.62 | 12 04 12.6 | 14.823 | 0.736 | 0.240 | — | |
| 5150 | 8 47 58.30 | 12 12 31.8 | 17.905 | 0.859 | 0.543 | — | | 5185 | 8 48 02.85 | 12 02 19.0 | 18.424 | 0.612 | — | 0.869 | |
| 5151 | 8 47 59.92 | 11 54 02.5 | 15.695 | 0.872 | 0.548 | 0.953 | | 5186 | 8 48 02.61 | 12 05 07.4 | 15.353 | 0.802 | 0.420 | — | |
| 5152* | 8 47 59.78 | 11 55 44.8 | 14.105 | 0.734 | 0.224 | 0.858 | | 5187 | 8 48 04.03 | 11 49 29.6 | 18.469 | 0.840 | 0.346 | 1.002 | |
| 5153 | 8 48 00.15 | 11 54 37.2 | 16.752 | 0.928 | 0.488 | 1.101 | | 5188 | 8 48 02.64 | 12 05 51.5 | 19.625 | 1.348 | — | — | |
| 5154 | 8 47 59.58 | 12 01 45.0 | 19.229 | 1.373 | — | 1.344 | | 5189 | 8 48 03.49 | 11 56 37.2 | 13.915 | 0.569 | 0.014 | 0.680 | |
| 5155 | 8 47 59.97 | 11 58 28.5 | 20.063 | 0.632 | -0.201 | 1.178 | | 5190 | 8 48 03.75 | 11 53 47.6 | 18.681 | 1.408 | — | 1.983 | |
| 5156 | 8 47 58.95 | 12 11 08.5 | 19.802 | 1.249 | — | — | | 5191 | 8 48 03.55 | 11 56 05.6 | 12.700 | 0.482 | -0.023 | 0.627 | |
| 5157* | 8 48 01.05 | 11 47 18.4 | 15.688 | 1.007 | 0.689 | 1.162 | | 5192* | 8 48 03.54 | 11 56 24.6 | 16.598 | 1.137 | 0.966 | 1.356 | |
| 5158 | 8 48 00.92 | 11 48 46.0 | 12.080 | 0.778 | 0.321 | 0.876 | | 5193 | 8 48 02.91 | 12 03 47.8 | 16.148 | 0.858 | 0.612 | — | |
| 5159 | 8 48 00.78 | 11 51 20.6 | 16.375 | 1.055 | 0.860 | 1.145 | | 5194 | 8 48 04.04 | 11 51 36.6 | 16.183 | 0.953 | 0.718 | 1.143 | |
| 5160 | 8 48 00.81 | 11 51 23.5 | 16.371 | 1.035 | 0.877 | 1.142 | | 5195 | 8 48 04.07 | 11 51 38.9 | 16.171 | 0.963 | 0.679 | 1.106 | |
| 5161 | 8 47 59.76 | 12 06 43.7 | 17.996 | 0.757 | 0.262 | — | | 5196 | 8 48 03.52 | 11 59 07.7 | 13.598 | 0.551 | -0.005 | 0.678 | |
| 5162 | 8 48 01.68 | 11 49 10.8 | 19.968 | 1.159 | -0.157 | 1.265 | | 5197 | 8 48 03.40 | 12 00 36.7 | 19.662 | 1.469 | — | 1.409 | |
| 5163 | 8 47 59.62 | 12 13 31.8 | 19.950 | 1.671 | — | — | | 5198 | 8 48 04.55 | 11 50 02.5 | 19.426 | 1.513 | — | 1.518 | |
| 5164 | 8 48 00.13 | 12 10 39.7 | 14.493 | 0.582 | -0.032 | — | | 5199 | 8 48 03.08 | 12 08 52.9 | 18.424 | 1.003 | — | — | |
| 5165 | 8 48 01.98 | 11 50 02.8 | 17.653 | 0.671 | 0.066 | 0.794 | | 5200 | 8 48 03.85 | 12 00 57.1 | 14.535 | 0.673 | 0.132 | 0.788 | |
| 5166 | 8 48 01.86 | 11 52 11.2 | 18.536 | 1.639 | — | 1.898 | | 5201 | 8 48 03.64 | 12 05 33.3 | 20.194 | 0.491 | — | — | |
| 5167 | 8 48 01.90 | 11 52 13.6 | 18.508 | 1.560 | 1.002 | 1.867 | | 5202 | 8 48 04.55 | 11 56 19.1 | 18.700 | 1.497 | — | 1.947 | |
| 5168 | 8 48 00.54 | 12 11 03.2 | 19.653 | 1.486 | — | — | | 5203 | 8 48 03.84 | 12 06 02.5 | 14.140 | 0.602 | 0.066 | — | |
| 5169 | 8 48 02.00 | 11 54 21.7 | 13.117 | 0.542 | 0.027 | 0.682 | | 5204 | 8 48 03.59 | 12 10 21.7 | 14.975 | 0.701 | 0.046 | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5205 | 8 48 05.45 | 11 51 50.9 | 19.646 | 1.451 | — | 1.578 | | 5240* | 8 48 07.62 | 12 00 42.1 | 18.315 | 1.512 | 1.021 | 2.047 | |
| 5206 | 8 48 05.34 | 11 53 38.8 | 18.825 | 1.330 | — | 1.391 | | 5241 | 8 48 06.82 | 12 10 30.9 | 19.942 | 0.494 | — | — | |
| 5208 | 8 48 05.58 | 11 50 58.6 | 18.725 | 0.387 | -0.122 | 0.627 | | 5242 | 8 48 06.92 | 12 11 06.5 | 21.091 | 1.389 | — | — | |
| 5209 | 8 48 04.56 | 12 02 51.7 | 19.908 | 1.499 | — | 1.437 | | 5243 | 8 48 08.19 | 11 56 17.9 | 14.693 | 0.632 | 0.230 | 0.778 | 753,I42 |
| 5210 | 8 48 05.40 | 11 53 40.1 | 17.690 | 1.223 | — | 1.218 | | 5244 | 8 48 07.40 | 12 06 19.7 | 17.503 | 1.301 | 1.258 | 1.452 | |
| 5211 | 8 48 05.46 | 11 53 41.6 | 19.183 | 0.957 | — | 1.249 | | 5245 | 8 48 08.01 | 12 00 00.0 | 19.378 | 1.031 | 0.324 | 1.129 | |
| 5212 | 8 48 05.14 | 11 57 29.4 | 18.187 | 0.702 | 0.116 | 0.897 | | 5246 | 8 48 08.09 | 11 59 55.0 | 15.599 | 0.804 | 0.453 | 0.829 | |
| 5213 | 8 48 04.10 | 12 09 42.9 | 14.264 | 0.699 | 0.309 | — | | 5247 | 8 48 08.04 | 12 01 39.6 | 18.564 | 1.570 | — | 2.759 | |
| 5214 | 8 48 04.07 | 12 11 01.8 | 15.467 | 0.833 | 0.423 | — | | 5248 | 8 48 07.54 | 12 08 11.0 | 12.803 | 0.547 | 0.017 | — | |
| 5215* | 8 48 05.99 | 11 50 06.0 | 17.966 | 1.474 | 0.951 | 1.901 | | 5249 | 8 48 09.05 | 11 51 17.9 | 13.703 | 0.561 | 0.039 | 0.670 | 733 |
| 5216 | 8 48 05.58 | 11 55 14.3 | 16.488 | 1.067 | 0.927 | 1.245 | | 5250 | 8 48 08.79 | 11 55 01.4 | 17.558 | 1.111 | 0.916 | 1.296 | |
| 5217 | 8 48 04.16 | 12 12 09.1 | 15.094 | 0.766 | 0.315 | — | | 5251 | 8 48 08.86 | 11 54 28.2 | 16.929 | 0.891 | 0.552 | 0.954 | |
| 5218 | 8 48 04.35 | 12 10 12.2 | 17.334 | 0.715 | 0.132 | — | | 5252 | 8 48 09.00 | 11 52 51.3 | 19.340 | 1.466 | -0.059 | 1.299 | |
| 5219 | 8 48 04.34 | 12 11 24.0 | 12.797 | 0.553 | -0.002 | — | | 5253 | 8 48 08.15 | 12 03 06.9 | 19.685 | 0.707 | 0.144 | 0.976 | |
| 5220 | 8 48 05.67 | 11 57 26.5 | 19.262 | 0.511 | -0.093 | 0.815 | | 5254 | 8 48 07.44 | 12 11 40.0 | 13.469 | 0.557 | 0.012 | — | |
| 5221 | 8 48 05.04 | 12 04 54.7 | 19.827 | 1.409 | — | — | | 5255 | 8 48 08.92 | 11 55 16.9 | 18.095 | 1.399 | 1.048 | 1.671 | |
| 5222 | 8 48 06.67 | 11 46 19.6 | 12.988 | 0.540 | — | 0.740 | | 5256 | 8 48 07.63 | 12 10 26.9 | 19.557 | 1.449 | — | — | |
| 5223* | 8 48 05.41 | 12 02 32.3 | 16.436 | 1.211 | 1.139 | 1.381 | | 5257 | 8 48 09.31 | 11 51 57.3 | 13.726 | 0.609 | 0.051 | 0.737 | |
| 5224 | 8 48 06.88 | 11 47 33.5 | 18.799 | 1.319 | 1.376 | 1.572 | | 5258 | 8 48 08.80 | 11 58 28.5 | 19.638 | 0.790 | 0.131 | 0.917 | |
| 5225 | 8 48 04.88 | 12 10 43.6 | 20.225 | 1.012 | — | — | | 5259 | 8 48 09.83 | 11 46 59.4 | 17.434 | 1.111 | — | 1.310 | |
| 5226 | 8 48 04.82 | 12 11 40.6 | 18.638 | 1.382 | — | — | | 5260 | 8 48 07.84 | 12 10 38.5 | 19.693 | 1.301 | — | — | |
| 5227 | 8 48 06.47 | 11 52 30.3 | 17.244 | 0.722 | 0.148 | 0.873 | | 5261 | 8 48 09.25 | 11 54 54.3 | 14.380 | 0.709 | 0.229 | 0.800 | 746,I46 |
| (6475) | 8 48 05.72 | 11 46 24.5 | 11.24 | 1.10 | — | 1.07 | 721, table 4 | 5262 | 8 48 07.83 | 12 12 25.6 | 17.385 | 0.815 | 0.255 | — | |
| 5228 | 8 48 05.79 | 12 00 28.3 | 12.931 | 0.851 | 0.404 | 0.933 | | 5263 | 8 48 09.04 | 11 58 49.6 | 13.285 | 0.575 | 0.062 | 0.692 | 760,I36 |
| 5229 | 8 48 05.50 | 12 05 39.4 | 14.055 | 0.578 | 0.035 | 0.687 | | 5264 | 8 48 09.35 | 11 55 49.2 | 13.640 | 0.659 | 0.140 | 0.717 | 750,I44 |
| 5230 | 8 48 05.63 | 12 04 54.6 | 18.143 | 1.134 | 0.814 | 1.210 | | 5265 | 8 48 08.98 | 12 01 02.3 | 15.415 | 0.811 | 0.387 | 0.888 | |
| 5231 | 8 48 07.00 | 11 58 47.3 | 18.562 | 1.467 | — | 1.881 | | 5266 | 8 48 09.09 | 12 00 54.9 | 18.696 | 1.122 | 0.789 | 1.318 | |
| 5232 | 8 48 06.16 | 12 08 44.4 | 20.892 | 1.690 | — | — | | 5267 | 8 48 08.33 | 12 10 04.2 | 16.057 | 0.917 | 0.802 | — | |
| 5233 | 8 48 06.43 | 12 06 46.6 | 16.196 | 0.998 | 0.858 | 1.072 | | 5268 | 8 48 08.75 | 12 05 26.1 | 16.137 | 0.714 | 0.148 | 0.806 | |
| 5234* | 8 48 07.09 | 12 01 25.2 | 18.409 | 1.443 | — | 1.933 | | 5269 | 8 48 09.21 | 12 00 13.0 | 15.186 | 0.762 | 0.320 | 0.840 | |
| 5235 | 8 48 07.00 | 12 03 12.4 | 18.330 | 1.430 | — | 1.718 | | 5270 | 8 48 08.85 | 12 05 27.2 | 17.203 | 0.783 | 0.537 | 0.880 | |
| 5236 | 8 48 08.08 | 11 50 56.0 | 18.165 | 0.529 | -0.156 | 0.749 | | 5271 | 8 48 10.05 | 11 52 44.1 | 15.361 | 0.630 | -0.033 | 0.820 | |
| 5237 | 8 48 07.92 | 11 53 27.8 | 19.132 | 0.579 | -0.135 | 0.817 | | 5272 | 8 48 08.67 | 12 09 26.1 | 17.656 | 0.708 | 0.231 | — | |
| 5238 | 8 48 06.44 | 12 11 57.5 | 18.819 | 0.622 | -0.190 | — | | 5273 | 8 48 10.62 | 11 47 57.2 | 19.073 | 1.490 | — | 2.020 | |
| 5239 | 8 48 07.58 | 11 59 25.6 | 12.846 | 0.501 | 0.013 | 0.602 | | 5274 | 8 48 09.88 | 12 03 13.0 | 19.676 | 1.543 | — | 2.263 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5275 | 8 48 10.68 | 11 55 28.8 | 17.372 | 1.277 | 1.285 | 1.466 | | 5309 | 8 48 12.76 | 12 04 46.6 | 19.245 | 1.526 | — | 2.567 | |
| 5276 | 8 48 09.63 | 12 08 02.0 | 14.551 | 1.071 | 1.045 | — | | 5310 | 8 48 12.79 | 12 08 06.2 | 14.996 | 0.734 | 0.273 | — | |
| 5277 | 8 48 11.63 | 11 46 52.3 | 13.382 | 0.548 | — | 0.718 | | 5311 | 8 48 13.41 | 12 02 01.7 | 18.454 | 1.023 | -0.481 | -0.837 | |
| 5278 | 8 48 09.57 | 12 11 39.5 | 17.160 | 0.781 | 0.486 | — | | 5312 | 8 48 12.72 | 12 10 31.4 | 13.153 | 0.548 | 0.025 | — | |
| 5279 | 8 48 10.05 | 12 06 30.7 | 15.114 | 0.810 | 0.399 | 0.960 | | 5313 | 8 48 14.33 | 11 53 26.3 | 13.361 | 0.733 | — | 0.766 | 741,I67 |
| 5280 | 8 48 11.64 | 11 47 56.9 | 19.581 | 0.458 | — | 0.682 | | 5314 | 8 48 13.38 | 12 06 30.4 | 13.402 | 0.557 | 0.093 | 0.675 | |
| 5281 | 8 48 11.27 | 11 52 54.3 | 17.807 | 1.339 | — | 1.598 | | 5315 | 8 48 13.07 | 12 10 20.9 | 18.709 | 0.783 | 0.143 | — | |
| 5282 | 8 48 09.69 | 12 11 52.5 | 15.301 | 0.815 | 0.419 | — | | 5316 | 8 48 13.69 | 12 05 12.3 | 18.465 | 0.863 | 0.574 | — | |
| 5283 | 8 48 10.57 | 12 02 25.4 | 13.551 | 0.569 | 0.043 | 0.666 | | 5317 | 8 48 14.32 | 11 59 22.5 | 15.696 | 0.902 | 0.636 | 0.956 | 764,I33 |
| 5284 | 8 48 10.12 | 12 07 44.4 | 12.844 | 0.522 | 0.019 | — | | 5318 | 8 48 13.96 | 12 03 38.2 | 12.862 | 0.941 | 0.686 | 0.981 | 794,IV77 |
| 5285 | 8 48 10.07 | 12 11 48.5 | 16.277 | 1.019 | 0.876 | — | | 5319 | 8 48 14.37 | 11 59 59.8 | 15.586 | 0.869 | 0.550 | 0.924 | 769,IV65 |
| 5286 | 8 48 12.13 | 11 47 52.5 | 19.372 | 1.477 | — | 1.801 | | 5320 | 8 48 13.37 | 12 11 56.2 | 15.807 | 0.884 | 0.601 | — | |
| 5287 | 8 48 10.89 | 12 02 38.2 | 15.322 | 0.518 | 0.021 | 0.661 | | 5321 | 8 48 13.62 | 12 09 43.2 | 20.700 | 0.713 | — | — | |
| 5288 | 8 48 11.01 | 12 01 32.7 | 19.026 | 1.003 | — | 1.188 | | 5322 | 8 48 13.79 | 12 09 20.7 | 19.057 | 1.409 | — | — | |
| 5289 | 8 48 12.10 | 11 49 11.2 | 19.869 | 0.736 | -0.090 | 0.941 | | 5323 | 8 48 13.65 | 12 11 06.5 | 19.391 | 1.512 | — | — | |
| 5290 | 8 48 10.70 | 12 08 05.6 | 15.905 | 1.024 | 0.738 | — | | 5324 | 8 48 14.18 | 12 05 11.2 | 19.577 | 1.423 | — | 2.292 | |
| 5291 | 8 48 11.72 | 11 57 08.7 | 18.708 | 1.527 | — | 1.941 | | 5325 | 8 48 13.66 | 12 11 48.3 | 20.036 | 1.020 | — | — | |
| 5292 | 8 48 11.36 | 12 01 17.3 | 15.989 | 0.823 | 0.351 | 0.981 | | 5326 | 8 48 14.37 | 12 04 07.6 | 19.682 | 1.577 | — | 2.293 | |
| 5293 | 8 48 12.60 | 11 47 39.0 | 20.146 | 0.083 | -0.414 | — | | 5327 | 8 48 13.85 | 12 10 16.4 | 16.108 | 0.613 | 0.094 | — | |
| 5294 | 8 48 12.50 | 11 49 24.4 | 14.098 | 0.602 | — | 0.708 | | 5328 | 8 48 14.78 | 11 59 35.1 | 13.762 | 0.583 | 0.115 | 0.689 | 766,I34 |
| 5295* | 8 48 12.12 | 11 56 30.6 | 16.280 | 1.128 | 1.089 | 1.313 | I43 | 5329 | 8 48 14.82 | 12 00 12.6 | 17.929 | 1.420 | -0.477 | -0.120 | |
| 5296 | 8 48 12.44 | 11 52 34.9 | 18.319 | 1.345 | — | 1.525 | | 5330 | 8 48 14.89 | 11 59 45.0 | 16.157 | 0.989 | 0.830 | 1.104 | |
| 5297 | 8 48 11.51 | 12 04 11.3 | 15.011 | 0.756 | 0.339 | 0.843 | | 5331 | 8 48 14.06 | 12 09 30.4 | 14.548 | 0.625 | 0.113 | — | |
| 5298 | 8 48 12.58 | 11 52 30.0 | 17.795 | 1.088 | 0.956 | 1.206 | | 5332 | 8 48 14.90 | 12 00 13.5 | 13.557 | 0.554 | 0.123 | 0.684 | 771,IV64 |
| 5299 | 8 48 11.16 | 12 09 42.4 | 18.779 | 1.548 | — | — | | 5333 | 8 48 14.66 | 12 02 54.4 | 20.301 | 0.239 | 0.027 | — | |
| 5300 | 8 48 11.41 | 12 07 09.6 | 17.913 | 1.469 | 1.215 | 1.626 | | 5334 | 8 48 15.13 | 11 57 28.3 | 13.488 | 0.627 | 0.126 | 0.735 | 758,I29 |
| (6477) | 8 48 11.49 | 12 03 30.3 | 12.04 | 0.60 | — | 0.671 | 792, table 4 | 5335 | 8 48 15.71 | 11 51 08.6 | 13.065 | 0.534 | -0.001 | 0.676 | 731 |
| 5301 | 8 48 11.79 | 12 05 07.6 | 13.637 | 0.561 | 0.091 | 0.674 | | 5336 | 8 48 15.74 | 11 50 38.5 | 12.964 | 1.107 | 0.912 | 1.218 | 729 |
| 5302 | 8 48 11.97 | 12 03 11.4 | 14.634 | 0.747 | 0.380 | 0.777 | | 5337 | 8 48 14.92 | 12 00 15.9 | 16.382 | 1.045 | 0.858 | 1.105 | |
| 5303 | 8 48 11.28 | 12 11 59.8 | 15.501 | 0.828 | 0.464 | — | | 5338 | 8 48 14.19 | 12 10 55.1 | 14.261 | 0.630 | 0.067 | — | |
| 5304 | 8 48 12.76 | 11 55 08.8 | 19.531 | 0.516 | -0.048 | 0.598 | | 5339 | 8 48 14.13 | 12 11 35.7 | 16.341 | 0.665 | 0.094 | — | |
| 5305 | 8 48 12.14 | 12 02 45.0 | 14.088 | 0.619 | 0.128 | 0.705 | | 5340 | 8 48 15.57 | 11 55 23.0 | 14.632 | 0.829 | 0.449 | 0.874 | 748,I47 |
| 5306 | 8 48 12.51 | 12 01 10.6 | 14.652 | 0.688 | 0.263 | 0.777 | | 5341 | 8 48 14.36 | 12 10 32.4 | 20.788 | 0.831 | — | — | |
| 5307 | 8 48 13.83 | 11 46 31.6 | 14.072 | 0.602 | 0.088 | 0.736 | | 5342 | 8 48 14.97 | 12 07 52.5 | 13.265 | 0.575 | 0.005 | — | |
| 5308 | 8 48 11.82 | 12 10 30.5 | 20.290 | 0.482 | — | — | | 5343 | 8 48 14.86 | 12 09 30.1 | 17.136 | 1.232 | 1.115 | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5344 | 8 48 15.53 | 12 02 27.8 | 19.829 | 0.278 | 0.360 | 0.561 | | 5378 | 8 48 18.19 | 11 59 07.8 | 15.515 | 0.570 | 0.055 | 0.722 | 762,I30 |
| 5345 | 8 48 15.20 | 12 06 08.2 | 15.830 | 0.801 | 0.300 | 1.019 | | 5379 | 8 48 17.56 | 12 07 22.0 | 17.165 | 0.649 | 0.054 | 0.777 | |
| 5346 | 8 48 15.64 | 12 02 28.6 | 14.823 | 0.698 | 0.308 | 0.818 | 785,IV58 | 5380 | 8 48 18.21 | 12 00 09.6 | 16.341 | 1.056 | 0.923 | 1.144 | |
| 5347 | 8 48 16.67 | 11 51 57.3 | 15.350 | 0.830 | 0.369 | 0.896 | 737 | 5381* | 8 48 17.93 | 12 03 48.8 | 18.593 | 1.447 | — | 1.995 | |
| 5348 | 8 48 16.81 | 11 50 53.7 | 12.620 | 0.721 | 0.304 | 0.777 | 730 | 5382 | 8 48 19.32 | 11 47 30.4 | 19.133 | 1.641 | — | 1.918 | |
| (6478) | 8 48 16.81 | 12 12 40.6 | 11.52 | 0.70 | — | — | 838, table 4 | 5383 | 8 48 17.61 | 12 07 56.2 | 19.476 | 0.922 | — | — | |
| 5349 | 8 48 15.66 | 12 07 55.3 | 15.681 | 0.901 | 0.560 | — | | 5384 | 8 48 18.15 | 12 02 16.6 | 17.315 | 1.139 | 1.089 | 1.358 | |
| 5350 | 8 48 15.96 | 12 05 48.0 | 12.782 | 0.813 | 0.396 | 0.893 | 806,IV81 | 5385 | 8 48 17.89 | 12 08 11.3 | 19.636 | 1.526 | — | — | |
| 5351 | 8 48 16.57 | 11 59 39.4 | 19.490 | 0.997 | — | 1.196 | | 5386 | 8 48 18.23 | 12 06 38.2 | 15.774 | 0.934 | 0.680 | 1.009 | |
| 5352 | 8 48 16.14 | 12 04 56.2 | 19.943 | 1.681 | — | 1.434 | | 5387* | 8 48 18.62 | 12 02 41.7 | 14.562 | 0.862 | 0.472 | 0.971 | 787,IV57 |
| 5353* | 8 48 17.71 | 11 47 02.6 | 17.288 | 1.321 | 1.063 | 1.617 | | 5388 | 8 48 19.17 | 11 57 03.1 | 12.673 | 0.620 | 0.158 | 0.726 | 756,I25 |
| 5354 | 8 48 17.23 | 11 53 13.6 | 13.482 | 0.551 | — | — | 740,I66 | 5389 | 8 48 19.63 | 11 51 47.2 | 13.374 | 0.554 | 0.010 | 0.691 | 736 |
| 5355 | 8 48 16.20 | 12 05 20.7 | 17.176 | 1.254 | 1.206 | 1.375 | | 5390 | 8 48 18.63 | 12 04 11.0 | 16.724 | 1.093 | 1.094 | 1.241 | |
| 5356 | 8 48 17.61 | 11 48 55.3 | 20.578 | 1.267 | — | — | | 5391 | 8 48 18.81 | 12 03 41.8 | 14.997 | 0.741 | 0.342 | 0.852 | 795,IV55 |
| 5357 | 8 48 16.67 | 12 00 08.8 | 14.636 | 0.678 | 0.232 | 0.787 | 770,IV63 | (6476) | 8 48 19.43 | 11 56 18.3 | 11.32 | 0.295 | — | 0.379 | 752, table 4 |
| 5358 | 8 48 16.68 | 12 02 21.7 | 17.776 | 0.803 | 0.381 | 0.981 | | 5392 | 8 48 19.52 | 11 57 33.1 | 16.169 | 0.747 | 0.277 | 0.828 | 759,I23 |
| 5359 | 8 48 17.23 | 11 55 51.1 | 19.284 | 1.102 | — | 0.994 | | 5393 | 8 48 19.91 | 11 53 39.1 | 14.537 | 0.587 | — | — | 742,I65 |
| 5360 | 8 48 16.56 | 12 04 27.4 | 14.792 | 0.719 | 0.255 | — | 802,IV78 | 5394 | 8 48 18.58 | 12 10 13.8 | 16.272 | 0.934 | 0.771 | — | |
| 5361 | 8 48 17.77 | 11 51 15.0 | 19.912 | 0.563 | — | 1.644 | | 5395 | 8 48 20.61 | 11 46 41.1 | 19.345 | 1.300 | — | 1.657 | |
| 5362 | 8 48 16.91 | 12 01 27.1 | 12.725 | 0.739 | 0.317 | 0.830 | 781,IV59 | 5396 | 8 48 18.62 | 12 11 37.1 | 14.280 | 0.893 | 0.730 | — | |
| 5363 | 8 48 17.09 | 11 59 37.4 | 16.754 | 1.123 | 1.095 | 1.258 | I32 | 5397 | 8 48 19.36 | 12 02 56.6 | 17.176 | 1.239 | 1.299 | 1.405 | |
| 5364 | 8 48 17.46 | 11 55 44.3 | 19.105 | 1.381 | — | 1.524 | | 5398 | 8 48 18.65 | 12 13 13.3 | 20.976 | 0.011 | — | — | |
| 5365 | 8 48 17.84 | 11 51 15.2 | 15.097 | 1.190 | 0.956 | 1.364 | 2201 | 5399 | 8 48 19.50 | 12 04 21.9 | 17.581 | 1.321 | 1.284 | 1.523 | |
| 5366 | 8 48 18.48 | 11 46 49.8 | 18.559 | 0.834 | 0.373 | 1.006 | | 5400 | 8 48 19.67 | 12 02 55.5 | 18.726 | 1.536 | — | 1.832 | |
| 5367 | 8 48 17.44 | 11 59 06.2 | 13.522 | 0.573 | 0.142 | 0.720 | 761,I31 | 5401 | 8 48 20.98 | 11 47 34.6 | 20.514 | 1.453 | — | 1.902 | |
| 5368 | 8 48 16.56 | 12 09 34.4 | 19.561 | 1.480 | — | — | | 5402 | 8 48 20.74 | 11 51 29.0 | 15.920 | 0.930 | 0.591 | 1.035 | 735 |
| 5369 | 8 48 17.36 | 12 00 49.8 | 16.783 | 0.537 | — | 1.320 | | 5403 | 8 48 19.72 | 12 03 40.9 | 15.997 | 0.780 | 0.348 | 0.922 | IV54 |
| 5370 | 8 48 17.42 | 12 00 43.3 | 14.742 | 0.740 | 0.372 | 0.886 | 2214,IV61 | 5404 | 8 48 20.21 | 12 02 04.2 | 17.801 | 1.234 | 1.274 | 1.364 | |
| 5371 | 8 48 17.41 | 12 00 50.4 | 12.687 | 0.631 | 0.167 | 0.711 | 775,IV60 | 5405 | 8 48 20.74 | 11 57 12.8 | 13.594 | 0.622 | 0.115 | 0.745 | 757,I24 |
| 5372 | 8 48 17.96 | 11 56 34.6 | 14.972 | 0.765 | 0.323 | 0.829 | 754,I26 | 5406 | 8 48 21.16 | 11 52 08.4 | 19.128 | 1.667 | — | 2.563 | |
| 5373 | 8 48 17.77 | 12 01 09.5 | 17.570 | 1.306 | 1.348 | 1.459 | | 5407 | 8 48 20.81 | 11 57 12.1 | 19.568 | 0.222 | — | — | |
| 5374 | 8 48 17.28 | 12 07 31.6 | 18.807 | 0.730 | — | — | | 5408 | 8 48 20.32 | 12 03 02.2 | 14.054 | 0.656 | 0.181 | 0.792 | 789,IV56 |
| 5375 | 8 48 17.15 | 12 09 19.7 | 19.745 | 1.385 | — | — | | 5409 | 8 48 20.20 | 12 05 30.9 | 19.685 | 0.906 | — | — | |
| 5376 | 8 48 17.36 | 12 07 32.2 | 14.971 | 0.750 | 0.366 | 0.884 | | 5410 | 8 48 20.59 | 12 00 52.2 | 15.687 | 0.948 | 0.625 | 1.041 | IV38 |
| 5377 | 8 48 17.99 | 12 00 17.4 | 13.312 | 0.589 | 0.112 | 0.733 | 773,IV62 | 5411 | 8 48 20.04 | 12 09 52.0 | 19.729 | 1.431 | — | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5412 | 8 48 20.75 | 12 03 42.4 | 13.894 | 0.535 | 0.101 | 0.748 | 796,IV53 | 5446 | 8 48 22.08 | 12 12 56.4 | 19.892 | 1.310 | — | — | |
| 5413 | 8 48 21.11 | 12 00 50.5 | 13.763 | 0.566 | 0.115 | 0.718 | 776,IV37 | 5447 | 8 48 24.01 | 11 51 22.2 | 20.454 | 0.477 | -0.272 | — | |
| 5414 | 8 48 21.69 | 11 55 02.5 | 14.052 | 0.703 | 0.215 | 0.787 | 747,I48 | 5448 | 8 48 24.38 | 11 46 34.0 | 19.595 | 1.564 | — | 1.805 | |
| 5415 | 8 48 20.33 | 12 10 55.5 | 19.601 | 1.395 | — | — | | 5449 | 8 48 22.37 | 12 10 20.8 | 17.974 | 0.954 | 0.682 | — | |
| 5416 | 8 48 22.21 | 11 49 10.9 | 20.635 | 0.326 | -0.480 | 0.788 | | 5450 | 8 48 22.94 | 12 04 12.5 | 18.690 | 0.541 | — | — | |
| 5417 | 8 48 21.28 | 12 00 43.4 | 19.370 | 0.369 | -0.049 | 0.717 | | 5451 | 8 48 23.04 | 12 04 18.3 | 12.595 | 0.637 | 0.150 | 0.843 | 1077,IV51 |
| 5418 | 8 48 20.96 | 12 06 34.6 | 20.184 | 1.431 | — | 1.563 | | 5452 | 8 48 22.80 | 12 09 52.9 | 17.286 | 1.175 | 1.110 | — | |
| 5419* | 8 48 21.33 | 12 03 48.4 | 15.750 | 0.981 | 0.814 | 1.153 | 797,IV52 | 5453 | 8 48 22.70 | 12 11 01.4 | 16.983 | 1.098 | 1.137 | — | |
| 5420 | 8 48 20.95 | 12 09 14.7 | 19.153 | 1.382 | — | — | | 5454 | 8 48 23.33 | 12 04 12.5 | 13.900 | 0.597 | 0.093 | 0.727 | 2224,IV50 |
| 5421* | 8 48 22.40 | 11 52 49.1 | 18.492 | 1.521 | 1.142 | 1.965 | | 5455 | 8 48 23.40 | 12 03 12.9 | 14.925 | 0.713 | 0.289 | 0.845 | 1067,IV39 |
| 5422 | 8 48 21.79 | 12 02 26.2 | 13.340 | 0.549 | 0.086 | 0.725 | 783,IV36 | 5456 | 8 48 24.00 | 11 57 02.8 | 18.124 | 1.480 | 1.133 | 1.691 | |
| 5423* | 8 48 23.07 | 11 47 18.7 | 19.110 | 1.414 | — | 2.175 | | 5457* | 8 48 23.87 | 12 01 12.4 | 15.793 | 0.880 | 0.444 | 1.101 | 1042,IV33 |
| 5424 | 8 48 21.63 | 12 04 26.9 | 15.094 | 0.721 | 0.326 | — | 801,IV49 | 5458 | 8 48 24.04 | 11 59 59.0 | 17.149 | 1.394 | 1.279 | 1.850 | |
| 5425 | 8 48 21.02 | 12 11 50.1 | 19.308 | 0.542 | -0.039 | — | | 5459 | 8 48 24.03 | 12 01 01.1 | 15.565 | 0.822 | 0.479 | 0.927 | 1039,IV32 |
| 5426 | 8 48 23.14 | 11 47 05.9 | 14.137 | 0.592 | 0.025 | 0.742 | | 5460 | 8 48 24.55 | 11 55 15.2 | 18.725 | 0.871 | 0.874 | 1.016 | |
| 5427 | 8 48 22.46 | 11 55 39.6 | 19.998 | 0.452 | -0.143 | — | | 5461 | 8 48 23.50 | 12 07 47.0 | 15.611 | 0.547 | -0.088 | — | |
| 5428 | 8 48 21.00 | 12 13 04.8 | 17.708 | 1.348 | — | — | | 5462 | 8 48 23.26 | 12 11 38.3 | 17.909 | 0.826 | 0.500 | — | |
| 5429 | 8 48 21.70 | 12 05 03.7 | 18.403 | 1.445 | — | 1.880 | | 5463 | 8 48 25.12 | 11 50 03.7 | 19.289 | 0.532 | -0.189 | 0.825 | |
| 5430 | 8 48 22.33 | 11 58 47.0 | 16.412 | 1.082 | 0.927 | 1.162 | | 5464 | 8 48 24.56 | 11 57 28.2 | 13.430 | 0.560 | 0.084 | 0.689 | 990,I20 |
| 5431 | 8 48 22.91 | 11 52 27.0 | 16.504 | 1.243 | — | — | I64 | 5466 | 8 48 24.37 | 12 00 49.4 | 17.316 | 1.242 | 0.998 | 1.458 | |
| 5432 | 8 48 22.90 | 11 53 04.4 | 15.609 | 0.950 | — | — | | 5467 | 8 48 23.56 | 12 10 51.2 | 15.793 | 0.881 | 0.601 | — | |
| 5433 | 8 48 23.19 | 11 49 42.9 | 20.552 | 0.610 | -0.154 | 0.899 | | 5468 | 8 48 24.06 | 12 05 36.3 | 16.730 | 0.634 | 0.076 | 0.805 | |
| 5434 | 8 48 23.42 | 11 48 10.6 | 13.422 | 0.541 | -0.012 | 0.695 | | 5469 | 8 48 23.69 | 12 10 09.3 | 14.760 | 0.689 | 0.189 | — | |
| 5435 | 8 48 22.16 | 12 05 35.1 | 18.361 | 1.513 | — | 2.144 | | 5470 | 8 48 23.99 | 12 06 52.3 | 15.771 | 0.896 | 0.677 | 1.003 | 1091,IV48 |
| (6484) | 8 48 23.70 | 11 59 25.7 | 11.55 | 0.41 | — | 0.514 | 1013, table 4 | 5471 | 8 48 24.42 | 12 02 09.6 | 13.795 | 0.586 | 0.090 | 0.699 | 1055,IV35 |
| 5436 | 8 48 23.70 | 11 48 59.6 | 19.656 | 0.796 | -0.191 | 0.955 | | 5472 | 8 48 24.54 | 12 00 48.0 | 14.848 | 0.716 | 0.111 | 0.821 | |
| 5437 | 8 48 23.07 | 11 56 59.7 | 15.864 | 0.770 | 0.284 | 0.917 | 983,I21 | 5473 | 8 48 25.43 | 11 51 00.5 | 20.197 | 0.856 | -0.171 | 1.046 | |
| 5438 | 8 48 23.81 | 11 48 41.9 | 19.396 | 1.738 | — | 2.326 | | 5474 | 8 48 24.79 | 11 59 54.2 | 13.994 | 0.717 | 0.277 | 0.796 | |
| 5439 | 8 48 22.23 | 12 07 47.4 | 20.112 | 0.510 | — | — | | 5475 | 8 48 24.68 | 12 01 43.8 | 18.176 | 1.237 | — | 1.774 | |
| 5440 | 8 48 21.92 | 12 13 13.7 | 17.041 | 0.175 | -0.592 | — | | 5476 | 8 48 23.83 | 12 12 22.1 | 13.639 | 0.562 | 0.000 | — | |
| 5441 | 8 48 23.27 | 11 57 44.2 | 15.376 | 0.835 | 0.472 | 0.896 | 993,I22 | 5477* | 8 48 25.91 | 11 48 44.1 | 16.935 | 1.341 | 1.210 | 1.548 | |
| 5442 | 8 48 23.96 | 11 49 42.4 | 19.817 | 1.049 | — | 1.484 | | 5478 | 8 48 25.14 | 11 59 37.2 | 13.372 | 0.563 | 0.070 | 0.680 | 1017,I14 |
| 5443 | 8 48 24.11 | 11 48 40.4 | 20.214 | 1.271 | — | 1.453 | | 5479 | 8 48 24.60 | 12 09 09.8 | 14.281 | 0.587 | 0.049 | — | |
| 5444 | 8 48 24.02 | 11 49 42.9 | 14.475 | 0.628 | 0.081 | 0.758 | 942 | 5480 | 8 48 25.03 | 12 04 30.8 | 17.644 | 1.306 | 1.295 | 1.547 | |
| 5445 | 8 48 22.32 | 12 10 00.0 | 20.652 | 0.826 | — | — | | 5481 | 8 48 26.25 | 11 50 07.2 | 16.556 | 0.605 | -0.060 | 0.798 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5482 | 8 48 25.06 | 12 04 56.0 | 17.042 | 1.198 | 1.227 | 1.329 | | 5518 | 8 48 28.13 | 11 58 31.6 | 15.107 | 0.777 | 0.340 | 0.883 | 1002,I13 |
| 5483 | 8 48 26.65 | 11 47 12.2 | 19.690 | 0.783 | 0.095 | 0.892 | | 5519 | 8 48 26.93 | 12 12 48.3 | 17.457 | 0.886 | 0.544 | — | |
| 5484 | 8 48 24.90 | 12 08 16.6 | 14.581 | 0.648 | 0.134 | — | | 5520 | 8 48 28.22 | 11 57 38.0 | 13.214 | 0.577 | 0.126 | 0.713 | 492 |
| 5485 | 8 48 25.84 | 11 57 33.5 | 14.564 | 0.684 | 0.215 | 0.796 | 991,I19 | 5521 | 8 48 27.52 | 12 06 51.1 | 17.839 | 0.800 | 0.301 | 0.940 | |
| 5486 | 8 48 26.39 | 11 51 20.2 | 19.009 | 1.222 | — | 1.365 | | 5522 | 8 48 28.12 | 11 59 51.5 | 13.898 | 0.575 | 0.070 | 0.688 | 1021,I7 |
| 5487 | 8 48 24.72 | 12 11 30.4 | 19.554 | 0.412 | -0.400 | — | | 5523 | 8 48 28.34 | 11 58 23.0 | 17.764 | 1.368 | 1.255 | 1.687 | |
| 5488 | 8 48 26.27 | 11 56 24.9 | 18.389 | 0.935 | 0.557 | 1.121 | | 5524 | 8 48 28.06 | 12 01 49.8 | 14.919 | 0.732 | 0.286 | 0.893 | 2222,IV23 |
| 5489 | 8 48 26.78 | 11 51 07.7 | 14.704 | 0.718 | 0.126 | 0.784 | 951,I158 | 5525 | 8 48 28.97 | 11 52 10.4 | 20.449 | 0.853 | — | 1.203 | |
| 5490 | 8 48 26.88 | 11 50 50.8 | 20.831 | 0.774 | — | — | | 5526 | 8 48 27.93 | 12 05 57.1 | 15.315 | 0.810 | 0.385 | 0.874 | 1090,IV45 |
| 5491 | 8 48 27.06 | 11 48 57.9 | 20.410 | 1.409 | — | 2.401 | | (6492) | 8 48 28.53 | 12 03 59.1 | 10.59 | 1.12 | — | 1.09 | 1074, table 4 |
| 5492 | 8 48 26.78 | 11 52 40.8 | 19.643 | 1.746 | — | 2.098 | | 5527 | 8 48 28.56 | 11 59 23.1 | 16.683 | 0.745 | 0.217 | 0.829 | |
| 5493 | 8 48 25.43 | 12 10 25.6 | 13.785 | 0.551 | -0.011 | — | | 5528 | 8 48 28.10 | 12 04 53.2 | 16.595 | 0.792 | 0.324 | 0.882 | |
| 5494 | 8 48 25.44 | 12 10 29.6 | 13.594 | 0.560 | 0.009 | — | | 5529* | 8 48 28.16 | 12 04 12.4 | 16.424 | 1.212 | 1.148 | 1.390 | |
| 5495 | 8 48 25.95 | 12 04 42.3 | 19.124 | 1.103 | — | 1.265 | | 5530 | 8 48 29.59 | 11 48 22.7 | 15.788 | 0.805 | 0.301 | 0.940 | 940 |
| 5496 | 8 48 27.06 | 11 53 10.7 | 20.712 | 1.103 | — | 2.943 | | 5531 | 8 48 29.71 | 11 46 29.4 | 17.445 | 1.506 | 0.812 | 2.400 | |
| 5497 | 8 48 27.32 | 11 51 17.0 | 16.351 | 0.630 | 0.072 | 0.790 | 952,I157 | 5532 | 8 48 28.10 | 12 05 39.7 | 14.199 | 0.666 | 0.147 | 0.717 | 1089,IV44 |
| 5498 | 8 48 25.85 | 12 10 43.5 | 20.233 | 1.492 | — | — | | 5533* | 8 48 29.39 | 11 50 54.5 | 15.979 | 0.986 | 0.697 | 1.149 | 949,I59 |
| 5499* | 8 48 26.79 | 12 00 15.6 | 16.025 | 1.077 | 0.998 | 1.223 | 1026 | 5534 | 8 48 28.54 | 12 01 51.4 | 13.664 | 0.568 | 0.084 | 0.694 | 1052,IV22 |
| 5500 | 8 48 26.53 | 12 04 43.2 | 16.585 | 1.095 | 1.049 | 1.180 | | 5535 | 8 48 28.88 | 11 58 32.9 | 19.341 | 0.432 | -0.022 | 0.790 | |
| 5501 | 8 48 26.47 | 12 05 50.8 | 16.369 | 1.030 | 0.913 | 1.134 | IV46 | 5536 | 8 48 27.99 | 12 10 07.4 | 19.247 | 1.486 | — | — | |
| 5502 | 8 48 25.99 | 12 12 47.1 | 16.118 | 0.916 | 0.704 | — | | 5537 | 8 48 28.71 | 12 03 09.7 | 19.186 | 1.438 | — | 1.912 | |
| 5504 | 8 48 27.32 | 11 58 27.6 | 18.450 | 1.503 | — | 2.139 | | 5538 | 8 48 29.32 | 11 57 32.7 | 19.436 | 0.886 | 0.697 | 1.033 | |
| 5505 | 8 48 27.50 | 11 57 10.2 | 15.141 | 0.878 | 0.606 | 0.852 | 985,I18 | 5539 | 8 48 28.74 | 12 05 09.0 | 15.562 | 0.849 | 0.520 | 0.920 | 1085,IV43 |
| 5506 | 8 48 26.59 | 12 08 26.5 | 18.819 | 1.308 | — | — | | 5540 | 8 48 28.93 | 12 05 24.1 | 20.501 | 0.613 | — | — | |
| 5507 | 8 48 27.42 | 11 59 59.5 | 18.081 | 1.052 | 1.081 | 1.196 | | 5541 | 8 48 28.73 | 12 08 17.6 | 14.477 | 0.658 | 0.100 | — | |
| 5508 | 8 48 27.53 | 12 00 07.3 | 13.779 | 0.588 | 0.106 | 0.701 | 1025,IV9 | 5542 | 8 48 29.20 | 12 02 56.9 | 13.790 | 1.051 | 0.716 | 1.199 | 1063,IV25 |
| 5509 | 8 48 28.70 | 11 47 14.7 | 19.345 | 1.461 | — | 2.499 | | 5543 | 8 48 30.08 | 11 53 18.6 | 19.934 | 2.184 | — | 1.165 | |
| 5511* | 8 48 27.64 | 12 01 18.6 | 15.447 | 0.958 | 0.733 | 1.062 | 1044 | 5544 | 8 48 29.47 | 12 01 54.9 | 12.286 | 0.676 | 0.190 | 0.741 | 1053 |
| 5512 | 8 48 26.67 | 12 13 13.6 | 20.107 | 1.389 | — | — | | 5545 | 8 48 30.16 | 11 53 57.2 | 19.511 | 0.902 | — | 1.043 | |
| 5513 | 8 48 27.07 | 12 08 37.6 | 15.798 | 0.841 | — | — | | 5546 | 8 48 29.47 | 12 02 35.1 | 13.626 | 0.568 | 0.050 | 0.687 | 1061,IV24 |
| 5514 | 8 48 27.70 | 12 01 17.7 | 18.746 | 0.743 | 0.866 | — | | 5547 | 8 48 29.59 | 12 01 15.6 | 14.333 | 0.537 | 0.021 | 0.683 | 1043,IV16 |
| (6481) | 8 48 27.72 | 11 56 38.8 | 10.03 | -0.073 | — | — | 977, table 4 | 5548 | 8 48 28.96 | 12 09 09.7 | 16.921 | 1.143 | 1.038 | — | |
| 5515 | 8 48 28.20 | 11 55 32.0 | 19.847 | 0.959 | — | 0.799 | | 5549 | 8 48 29.02 | 12 09 09.1 | 16.931 | 1.112 | 1.013 | — | |
| 5516 | 8 48 28.61 | 11 50 53.0 | 20.102 | 0.406 | 0.012 | 0.749 | | 5550 | 8 48 30.11 | 11 58 30.5 | 18.518 | 1.476 | — | 1.807 | G147 |
| 5517 | 8 48 27.92 | 11 59 43.4 | 14.867 | 0.726 | — | 0.805 | 2213 | 5551 | 8 48 30.42 | 11 55 53.3 | 15.341 | 0.824 | 0.348 | 0.873 | 2202 |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5552 | 8 48 30.42 | 11 55 57.7 | 15.742 | 0.903 | 0.576 | 0.960 | 974 | 5586 | 8 48 31.59 | 12 04 15.7 | 12.831 | 0.567 | 0.109 | 0.685 | 1076,IV30 |
| 5553* | 8 48 29.83 | 12 02 46.1 | 18.314 | 1.677 | — | 1.964 | | 5587 | 8 48 32.83 | 11 51 28.1 | 20.396 | 1.636 | — | 1.195 | |
| (6480) | 8 48 30.30 | 11 56 17.3 | 11.078 | 0.43 | — | 0.534 | 975, table 4 | 5588 | 8 48 31.66 | 12 05 20.7 | 15.474 | 0.856 | 0.539 | 0.944 | 1086,IV42 |
| 5554 | 8 48 30.39 | 11 56 20.2 | 12.839 | 0.532 | 0.069 | 0.667 | G501 | 5589 | 8 48 33.29 | 11 46 30.7 | 16.902 | 1.170 | 1.030 | 1.291 | |
| 5555* | 8 48 30.88 | 11 50 49.6 | 17.413 | 1.421 | 1.166 | 1.653 | | 5590 | 8 48 32.41 | 11 57 24.4 | 19.817 | 1.581 | — | 2.192 | G167 |
| 5556 | 8 48 30.47 | 11 55 52.3 | 19.632 | 1.186 | — | 0.625 | | 5591 | 8 48 32.65 | 11 56 46.4 | 12.418 | 0.734 | 0.280 | 0.848 | 2206,I228,G17 |
| 5557 | 8 48 30.59 | 11 56 41.0 | 18.745 | 0.788 | 0.299 | 0.983 | G146 | 5593 | 8 48 31.41 | 12 12 52.7 | 20.362 | 0.416 | — | — | |
| 5558 | 8 48 29.70 | 12 08 51.2 | 15.217 | 0.813 | 0.232 | — | | 5594 | 8 48 32.77 | 11 56 58.6 | 14.160 | 0.708 | 0.254 | 0.814 | 981,I227,G79 |
| 5559 | 8 48 30.30 | 12 01 57.2 | 13.409 | 0.584 | 0.077 | 0.683 | 2221,IV21,G59 | 5595 | 8 48 33.18 | 11 53 53.5 | 14.513 | 0.706 | 0.167 | 0.791 | 963 |
| 5560 | 8 48 29.75 | 12 08 50.7 | 15.258 | 0.752 | 0.283 | — | | (6486) | 8 48 33.00 | 11 59 33.1 | 10.30 | 1.26 | — | 1.23 | 1016, table 4 |
| 5561 | 8 48 30.53 | 12 00 07.5 | 17.430 | 1.284 | 1.426 | 1.467 | G128 | 5596 | 8 48 33.01 | 11 56 39.2 | 16.612 | 1.658 | — | — | |
| 5562 | 8 48 30.68 | 11 58 40.9 | 12.805 | 0.572 | 0.077 | 0.660 | 1003,I12,F93,G34 | 5597 | 8 48 32.66 | 12 01 56.0 | 13.173 | 0.578 | 0.068 | 0.685 | 2220,IV19,G44 |
| 5563 | 8 48 30.71 | 12 00 16.8 | 15.377 | 0.848 | 0.472 | 0.897 | 1028,IV7,G98 | 5598 | 8 48 33.68 | 11 49 27.4 | 18.548 | 1.513 | — | 1.784 | |
| 5564 | 8 48 29.48 | 12 15 07.4 | 17.270 | 0.732 | — | — | | 5599* | 8 48 32.75 | 12 00 55.7 | 16.182 | 1.179 | 1.037 | 1.284 | IV10,G117 |
| 5565 | 8 48 30.51 | 12 04 23.3 | 17.962 | 1.268 | 1.303 | 1.360 | | 5600 | 8 48 33.61 | 11 50 53.2 | 13.562 | 0.567 | 0.056 | — | 948,I162 |
| 5566 | 8 48 30.91 | 12 00 09.7 | 17.716 | 1.398 | — | 1.633 | | 5601 | 8 48 32.38 | 12 05 32.1 | 13.549 | 0.621 | 0.194 | 0.701 | 1088,IV41 |
| 5567 | 8 48 30.94 | 12 00 38.0 | 14.164 | 0.608 | 0.109 | 0.732 | 1033,IV8,G73 | (6489) | 8 48 32.90 | 12 02 03.4 | 11.20 | 1.08 | — | 1.08 | 1054, table 4 |
| 5568 | 8 48 30.24 | 12 10 26.7 | 17.401 | 1.305 | — | — | | 5602* | 8 48 32.96 | 11 59 43.7 | 17.410 | 1.394 | — | 1.617 | |
| 5569 | 8 48 31.72 | 11 53 55.0 | 20.187 | 1.449 | — | 1.196 | | 5603 | 8 48 32.86 | 12 01 26.4 | 13.173 | 0.557 | 0.079 | 0.652 | G45 |
| 5570 | 8 48 32.25 | 11 48 15.0 | 19.638 | 1.650 | — | 2.293 | | 5605 | 8 48 31.66 | 12 15 35.6 | 18.335 | 1.390 | — | — | |
| 5571 | 8 48 31.36 | 11 58 48.4 | 12.651 | 0.517 | 0.043 | 0.607 | 1005,F95,G19 | 5606 | 8 48 33.91 | 11 48 55.5 | 17.564 | 1.320 | — | 1.460 | |
| 5573 | 8 48 31.22 | 12 01 31.3 | 12.823 | 0.565 | 0.081 | 0.680 | 1049,F94,G24 | 5608 | 8 48 33.30 | 11 57 20.2 | 13.928 | 0.574 | 0.098 | 0.724 | 987,G65 |
| (6482) | 8 48 31.96 | 11 56 40.8 | 9.72 | 1.37 | — | 1.36 | 978, table 4 | 5610 | 8 48 33.27 | 11 58 17.6 | 13.060 | 0.567 | 0.044 | 0.667 | 998,I11,F106,G44 |
| 5574 | 8 48 30.07 | 12 15 24.8 | 15.061 | 0.766 | — | — | | 5611 | 8 48 33.41 | 11 56 45.7 | 16.643 | 1.453 | — | — | |
| 5575 | 8 48 31.23 | 12 02 19.7 | 19.281 | 0.628 | -0.106 | 0.832 | G155 | 5612 | 8 48 32.47 | 12 07 55.5 | 17.838 | 1.623 | — | — | |
| 5576 | 8 48 30.28 | 12 14 39.9 | 18.150 | 1.124 | — | — | | 5614 | 8 48 32.95 | 12 03 22.0 | 17.470 | 1.352 | 1.307 | 1.508 | |
| 5577 | 8 48 31.59 | 11 59 32.6 | 14.321 | 0.520 | -0.027 | 0.659 | 1015,I6,G84 | 5615* | 8 48 33.69 | 11 55 46.5 | 15.371 | 0.887 | 0.371 | 1.090 | 972,I50 |
| 5578 | 8 48 31.29 | 12 03 14.9 | 15.028 | 0.747 | 0.323 | 0.814 | 1068 | 5616 | 8 48 34.13 | 11 50 43.5 | 20.658 | 0.899 | — | — | |
| 5579 | 8 48 32.19 | 11 53 12.8 | 20.796 | 1.063 | — | 1.121 | | 5617 | 8 48 32.46 | 12 11 45.5 | 18.708 | 0.183 | -0.608 | — | |
| 5580 | 8 48 31.50 | 12 02 13.1 | 13.015 | 0.854 | 0.441 | 0.917 | 1056,IV221,G53 | 5618 | 8 48 34.25 | 11 50 59.8 | 18.593 | 1.339 | 1.165 | 1.654 | |
| 5581 | 8 48 30.91 | 12 09 54.8 | 13.909 | 0.531 | -0.183 | — | | 5619 | 8 48 32.41 | 12 13 14.5 | 20.042 | 0.726 | — | — | |
| 5582 | 8 48 30.52 | 12 15 15.9 | 17.598 | 1.409 | — | — | | 5620* | 8 48 33.66 | 11 58 11.7 | 15.779 | 1.068 | — | 1.171 | I10,G108 |
| 5583 | 8 48 32.24 | 11 55 49.8 | 13.491 | 0.630 | 0.045 | 0.707 | 973,I49 | (6495) | 8 48 33.92 | 12 29 27.6 | 9.37 | 1.48 | — | 1.50 | 1135, table 4 |
| 5584 | 8 48 31.43 | 12 05 30.9 | 19.118 | 1.650 | — | 2.090 | | 5621 | 8 48 34.39 | 11 49 51.4 | 19.876 | 1.953 | — | 2.408 | |
| 5585 | 8 48 30.99 | 12 10 41.1 | 18.856 | 1.225 | — | — | | 5622 | 8 48 34.08 | 11 54 11.7 | 13.257 | 0.603 | 0.069 | 0.661 | 964,I60 |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5623 | 8 48 34.28 | 11 52 46.6 | 15.920 | 0.935 | 0.629 | 0.999 | 960,I63 | 5658* | 8 48 35.48 | 11 56 29.6 | 16.567 | 1.156 | 1.024 | 1.376 | G124 |
| 5624 | 8 48 33.94 | 11 57 11.2 | 12.730 | 0.554 | 0.079 | 0.690 | 986,F111,G41 | 5659 | 8 48 34.96 | 12 02 55.0 | 19.194 | 0.698 | 0.205 | 0.862 | |
| 5625 | 8 48 33.63 | 12 01 22.6 | 13.511 | 0.571 | 0.038 | 0.691 | 1046,IV12,G56 | 5660 | 8 48 34.10 | 12 13 18.2 | 16.936 | 1.117 | — | — | |
| 5626* | 8 48 34.41 | 11 52 21.2 | 16.782 | 1.266 | 1.103 | 1.487 | | 5661* | 8 48 36.39 | 11 47 27.1 | 16.735 | 1.314 | 1.144 | 1.458 | |
| 5627 | 8 48 34.91 | 11 46 35.6 | 16.212 | 1.032 | 0.689 | 1.075 | | 5662 | 8 48 34.42 | 12 11 49.7 | 19.421 | 1.593 | — | — | |
| 5628 | 8 48 33.19 | 12 07 37.7 | 18.898 | 1.560 | — | — | | 5663 | 8 48 34.69 | 12 09 28.3 | 12.313 | 0.989 | 0.687 | — | |
| 5629 | 8 48 34.32 | 11 54 42.2 | 13.393 | 0.578 | 0.042 | 0.673 | 967,I56 | 5665 | 8 48 35.80 | 11 58 20.4 | 16.280 | 1.003 | 0.561 | 1.059 | |
| 5630 | 8 48 34.67 | 11 50 27.1 | 21.326 | 1.507 | — | 2.577 | | 5666 | 8 48 35.58 | 12 00 56.3 | 15.677 | 0.859 | 0.554 | 0.960 | 1038,G103 |
| 5631 | 8 48 32.85 | 12 12 17.7 | 20.353 | 0.990 | — | — | | 5667 | 8 48 35.84 | 11 58 17.5 | 12.126 | 0.458 | -0.008 | 0.562 | 997,F124,G13 |
| 5632 | 8 48 34.10 | 11 58 02.2 | 19.513 | 0.783 | — | 1.010 | G160 | 5668 | 8 48 36.13 | 11 55 44.7 | 20.899 | 0.516 | — | 1.043 | |
| 5633 | 8 48 34.69 | 11 51 53.8 | 14.054 | 0.561 | 0.010 | 0.691 | 956,I167 | 5669 | 8 48 35.79 | 11 59 54.8 | 16.876 | 1.055 | — | 1.097 | |
| 5634 | 8 48 34.67 | 11 52 23.5 | 19.983 | 1.359 | — | 2.025 | | 5670 | 8 48 35.82 | 11 59 57.9 | 18.612 | -0.113 | -0.896 | — | G152 |
| 5635 | 8 48 32.70 | 12 16 08.3 | 16.769 | 1.083 | — | — | | 5671 | 8 48 35.54 | 12 03 27.9 | 13.898 | 0.625 | 0.120 | 0.742 | 1070,IV27 |
| 5636 | 8 48 34.76 | 11 52 28.9 | 16.079 | 0.617 | 0.000 | 0.750 | 959,I164 | 5675 | 8 48 36.06 | 11 57 58.9 | 12.755 | 0.559 | 0.022 | 0.681 | 995,F127,G27 |
| 5637 | 8 48 33.81 | 12 03 42.7 | 18.305 | 0.897 | 0.480 | 0.975 | | 5677 | 8 48 35.49 | 12 05 33.5 | 17.758 | 0.595 | 0.067 | 0.736 | |
| 5638 | 8 48 34.44 | 11 56 39.9 | 18.535 | 1.489 | — | 1.289 | | 5678* | 8 48 36.21 | 11 57 37.0 | 17.718 | 1.473 | — | 1.758 | G138 |
| 5639 | 8 48 34.14 | 12 01 36.7 | 14.292 | 0.658 | 0.100 | 0.779 | 1050,IV15,G78 | 5679 | 8 48 36.28 | 11 57 09.6 | 13.145 | 0.566 | 0.071 | 0.700 | 2205,I198,F128,G48 |
| 5640 | 8 48 35.06 | 11 51 32.8 | 13.735 | 0.569 | 0.029 | 0.671 | 954,I168 | (6483) | 8 48 37.50 | 11 57 23.4 | 11.44 | 1.06 | — | 1.05 | 989, table 4 |
| 5641 | 8 48 35.13 | 11 51 34.0 | 19.006 | 1.737 | 0.322 | 0.507 | | 5680 | 8 48 36.81 | 11 50 57.5 | 13.687 | 0.552 | 0.038 | — | 950,I169 |
| 5642 | 8 48 35.15 | 11 51 31.8 | 17.596 | 0.405 | 0.017 | — | | 5683 | 8 48 35.91 | 12 02 18.8 | 14.303 | 0.675 | 0.115 | 0.758 | 1057,IV17,G85 |
| 5643 | 8 48 34.61 | 11 58 19.8 | 12.596 | 0.783 | 0.253 | 0.908 | 999,F117,G37 | 5684 | 8 48 37.10 | 11 48 15.2 | 17.784 | 0.473 | -0.147 | 0.669 | |
| 5644 | 8 48 34.43 | 12 00 38.6 | 12.647 | 0.608 | 0.054 | 0.723 | 1034,F115,G25 | 5685 | 8 48 36.01 | 12 01 40.4 | 13.933 | 0.605 | 0.048 | 0.692 | 1051,IV11,G72 |
| 5645 | 8 48 35.44 | 11 48 57.7 | 20.814 | 1.159 | — | 1.585 | | 5687 | 8 48 36.49 | 11 57 22.0 | 13.183 | 0.574 | 0.069 | 0.693 | I199,F129,G49 |
| 5646* | 8 48 34.45 | 12 01 31.4 | 15.606 | 1.030 | 0.848 | 1.136 | 2217,IV14,G102 | 5688 | 8 48 36.52 | 11 57 33.6 | 12.891 | 0.448 | 0.007 | 0.586 | 2204,F130,G28 |
| 5647 | 8 48 33.98 | 12 07 23.7 | 18.952 | 1.361 | — | — | | (6493) | 8 48 36.62 | 12 04 43.3 | 11.251 | 0.415 | — | 0.529 | 1082, table 4 |
| 5648 | 8 48 35.41 | 11 51 29.9 | 19.733 | 0.321 | — | — | | 5691* | 8 48 36.62 | 11 56 42.5 | 15.828 | 1.016 | 0.750 | 1.168 | 979,F132a,G107 |
| 5649 | 8 48 35.64 | 11 49 23.5 | 19.953 | 1.371 | — | 1.646 | | 5692 | 8 48 36.00 | 12 04 05.2 | 13.837 | 0.598 | 0.098 | 0.658 | 1075 |
| 5650 | 8 48 34.92 | 11 58 38.3 | 18.722 | 1.508 | — | 1.863 | G150 | 5694 | 8 48 36.85 | 11 54 52.2 | 20.655 | 1.457 | — | 2.151 | |
| 5651 | 8 48 34.64 | 12 02 35.8 | 13.051 | 0.877 | 0.423 | 0.937 | 1060,IV18,G51 | 5695 | 8 48 36.76 | 11 56 19.7 | 13.095 | 0.608 | 0.109 | 0.718 | 976,F132,G46 |
| 5652 | 8 48 35.81 | 11 49 14.1 | 19.955 | 1.500 | — | 2.690 | | 5696 | 8 48 35.24 | 12 14 51.4 | 15.546 | 0.743 | — | — | |
| 5653 | 8 48 35.10 | 11 59 11.8 | 13.666 | 0.560 | 0.022 | 0.698 | 1009,I5,G64 | 5697 | 8 48 36.61 | 11 59 48.7 | 18.607 | 1.550 | — | 1.961 | G151 |
| 5654 | 8 48 34.90 | 12 01 22.8 | 12.540 | 0.591 | 0.066 | 0.703 | 1045,F119,G20 | 5698 | 8 48 37.59 | 11 50 25.9 | 13.626 | 0.473 | -0.094 | — | 946 |
| 5655 | 8 48 34.63 | 12 05 35.3 | 16.814 | 1.231 | 1.256 | 1.414 | | 5699 | 8 48 37.17 | 11 57 09.9 | 12.260 | 0.569 | 0.074 | 0.707 | 984,F134,G16 |
| 5656 | 8 48 34.51 | 12 07 06.9 | 14.134 | 0.640 | 0.132 | 0.718 | 1093,IV47 | 5700 | 8 48 37.37 | 11 55 18.0 | 17.026 | 1.219 | 1.167 | 1.315 | |
| 5657 | 8 48 35.12 | 12 00 41.5 | 13.854 | 0.572 | 0.053 | 0.692 | 1035,G71 | 5701 | 8 48 37.47 | 11 54 23.1 | 20.723 | 1.283 | — | 1.410 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5702 | 8 48 37.23 | 11 59 25.5 | 19.173 | 0.936 | — | 1.069 | G154 | (6485) | 8 48 38.71 | 11 59 19.0 | 10.48 | 1.11 | — | 1.08 | 1010, table 4 |
| 5704 | 8 48 37.82 | 11 54 34.9 | 14.481 | 0.670 | 0.146 | 0.740 | 966,I57 | 5740 | 8 48 38.75 | 12 01 13.1 | 18.943 | 1.370 | — | 1.485 | G157 |
| 5705 | 8 48 37.74 | 11 55 22.3 | 14.177 | 0.665 | 0.134 | 0.777 | 969,I54 | 5741 | 8 48 38.86 | 12 00 30.4 | 13.260 | 0.464 | -0.024 | 0.593 | 1031,IV6,G47 |
| 5706 | 8 48 38.26 | 11 49 16.8 | 19.319 | 1.472 | — | 2.109 | | 5743 | 8 48 38.06 | 12 11 36.1 | 17.160 | 1.516 | — | — | |
| 5707 | 8 48 38.16 | 11 51 55.9 | 19.046 | 1.494 | — | 1.938 | | 5744 | 8 48 39.90 | 11 50 09.8 | 14.528 | 0.665 | 0.109 | — | 945 |
| 5708* | 8 48 37.28 | 12 02 44.8 | 18.651 | 1.621 | — | 2.060 | | 5745* | 8 48 39.43 | 11 56 03.5 | 18.431 | 1.532 | 0.897 | 2.003 | |
| 5709 | 8 48 37.52 | 12 00 19.8 | 15.214 | 0.793 | 0.265 | 0.881 | 1029,G99 | 5746 | 8 48 39.22 | 11 59 04.4 | 16.417 | 1.022 | — | 1.158 | G118 |
| 5710 | 8 48 37.97 | 11 55 02.3 | 16.678 | 1.119 | 1.020 | 1.219 | I55 | 5747 | 8 48 40.30 | 11 46 26.9 | 16.571 | 0.820 | 0.289 | 0.968 | |
| 5711 | 8 48 37.11 | 12 05 31.7 | 16.253 | 1.015 | — | 1.142 | IV40 | 5748 | 8 48 39.19 | 11 59 43.8 | 14.335 | 0.807 | 0.265 | 0.997 | 1019,F6,G80 |
| 5712 | 8 48 36.47 | 12 14 01.7 | 19.897 | 1.444 | — | — | | 5749 | 8 48 38.01 | 12 14 20.7 | 17.628 | 0.293 | — | — | |
| 5713 | 8 48 36.34 | 12 16 48.9 | 15.814 | 0.680 | — | — | | 5750 | 8 48 38.64 | 12 07 39.7 | 19.059 | 1.285 | — | — | |
| 5715 | 8 48 38.14 | 11 55 56.2 | 17.440 | 0.769 | 0.492 | 0.894 | | 5751 | 8 48 39.88 | 11 52 58.4 | 20.374 | 0.315 | 0.211 | 0.886 | |
| 5716 | 8 48 37.99 | 11 57 58.2 | 13.183 | 0.581 | 0.047 | 0.687 | 994,I9,G52 | 5752 | 8 48 40.28 | 11 48 17.5 | 20.619 | 0.747 | — | 0.731 | |
| (6491) | 8 48 37.60 | 12 03 55.1 | 11.315 | 0.61 | — | 0.720 | 1072, table 4 | 5753 | 8 48 38.97 | 12 05 22.4 | 14.160 | 0.638 | — | 0.713 | 1087 |
| 5718 | 8 48 37.62 | 12 02 59.3 | 14.040 | 0.660 | — | 0.759 | 1064 | 5754 | 8 48 39.41 | 12 00 23.2 | 16.224 | 1.004 | 0.728 | 1.089 | G116 |
| 5719 | 8 48 38.26 | 11 55 26.2 | 16.362 | 1.059 | — | 1.122 | 970,I53 | 5755 | 8 48 38.86 | 12 08 54.0 | 19.160 | 1.459 | — | — | |
| 5720 | 8 48 38.60 | 11 52 15.3 | 17.455 | 1.309 | 1.105 | 1.460 | | (6488) | 8 48 39.66 | 12 01 06.6 | 11.52 | 0.87 | — | 0.91 | 1040, table 4 |
| 5721 | 8 48 38.05 | 11 59 45.2 | 15.708 | 0.907 | 0.507 | 1.013 | I4,G111 | 5756 | 8 48 39.74 | 11 58 33.4 | 12.835 | 0.783 | 0.296 | 0.854 | 1000,G40 |
| 5722 | 8 48 37.21 | 12 10 22.1 | 14.148 | 0.639 | 0.034 | — | | 5760 | 8 48 39.98 | 11 58 29.1 | 13.767 | 0.574 | -0.047 | 0.714 | 2209a,G68 |
| 5723 | 8 48 38.53 | 11 54 53.1 | 18.736 | 0.663 | -0.056 | 0.747 | | 5761 | 8 48 38.76 | 12 13 11.4 | 17.977 | 0.963 | — | — | |
| 5724 | 8 48 38.83 | 11 51 47.4 | 19.486 | 1.801 | — | 2.025 | | 5762 | 8 48 40.58 | 11 52 08.4 | 18.132 | 0.931 | 0.529 | 1.051 | |
| 5725 | 8 48 37.78 | 12 04 26.2 | 15.267 | 0.818 | — | 0.868 | 1079,IV29 | 5763 | 8 48 40.05 | 11 58 26.7 | 13.477 | 0.614 | 0.093 | 0.731 | 2209b,G62 |
| 5726 | 8 48 39.15 | 11 48 15.3 | 16.891 | 1.375 | 1.266 | 1.635 | | 5764 | 8 48 40.00 | 11 59 39.3 | 12.834 | 0.568 | 0.010 | 0.681 | 1018,F145,G35 |
| 5727 | 8 48 38.97 | 11 52 23.7 | 16.155 | 0.828 | 0.255 | 0.932 | 959,I165 | 5765 | 8 48 38.82 | 12 14 10.0 | 19.024 | 1.300 | — | — | |
| 5728 | 8 48 37.55 | 12 10 05.3 | 18.673 | 1.607 | — | — | | 5766 | 8 48 40.06 | 11 59 44.1 | 17.026 | 1.221 | — | 1.308 | G125 |
| 5729 | 8 48 39.05 | 11 52 22.7 | 20.363 | 1.724 | — | 0.139 | | 5767 | 8 48 39.35 | 12 08 42.5 | 18.999 | 1.508 | — | — | |
| 5730 | 8 48 39.22 | 11 50 32.4 | 14.916 | 0.735 | 0.242 | 0.837 | 947,I170 | 5768 | 8 48 40.23 | 11 58 45.8 | 14.928 | 0.759 | 0.231 | 0.810 | 1004,F149a,G94 |
| 5731 | 8 48 37.84 | 12 07 35.4 | 19.388 | 1.537 | — | 1.839 | | 5769 | 8 48 40.67 | 11 54 23.6 | 14.695 | 0.761 | 0.240 | 0.855 | 965,I58 |
| 5732 | 8 48 37.80 | 12 08 17.2 | 18.972 | 0.771 | — | — | | 5770 | 8 48 40.27 | 12 01 07.9 | 15.055 | 0.797 | 0.202 | 0.866 | 2216,IV239,G93 |
| 5733 | 8 48 38.27 | 12 02 46.5 | 13.289 | 0.594 | -0.011 | 0.693 | 1062,IV26 | 5771 | 8 48 41.26 | 11 49 34.0 | 15.209 | 0.786 | 0.310 | 0.873 | 941 |
| 5734 | 8 48 38.43 | 12 02 07.0 | 16.501 | 1.081 | 0.894 | 1.167 | G119 | 5772 | 8 48 41.04 | 11 52 35.1 | 19.693 | 0.949 | — | 1.130 | |
| 5735 | 8 48 38.41 | 12 02 35.6 | 16.179 | 0.631 | 0.036 | 0.754 | G113 | 5773 | 8 48 38.97 | 12 17 22.7 | 19.680 | 1.440 | — | — | |
| 5737 | 8 48 37.87 | 12 10 26.0 | 13.836 | 0.642 | -0.016 | — | | 5776 | 8 48 40.94 | 11 57 00.4 | 14.122 | 0.606 | 0.065 | 0.714 | 982,I51,G76 |
| 5738 | 8 48 39.00 | 11 57 25.5 | 20.417 | 1.231 | — | 1.136 | G209 | 5777 | 8 48 40.76 | 11 59 21.4 | 14.516 | 0.737 | 0.179 | 0.874 | 1012,I3,G86 |
| 5739 | 8 48 38.82 | 12 00 06.7 | 12.718 | 0.553 | -0.026 | 0.685 | 1024,IV4,G36 | 5780 | 8 48 39.76 | 12 12 48.3 | 14.981 | 0.781 | — | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5781 | 8 48 40.86 | 12 00 18.2 | 13.242 | 0.596 | 0.059 | 0.697 | 1027,IV5,G57 | 5814 | 8 48 41.85 | 12 09 08.8 | 16.723 | 0.585 | -0.101 | — | |
| 5782 | 8 48 40.18 | 12 08 17.0 | 19.080 | 0.536 | — | — | | 5815 | 8 48 43.71 | 11 47 08.0 | 18.331 | 0.451 | -0.296 | 0.685 | |
| 5783 | 8 48 39.76 | 12 13 29.7 | 20.555 | 0.306 | — | — | | 5816 | 8 48 43.71 | 11 47 33.5 | 17.491 | 0.944 | 0.566 | 1.017 | |
| 5784 | 8 48 40.66 | 12 03 06.7 | 19.187 | 1.525 | — | 2.017 | | 5817 | 8 48 43.26 | 11 53 16.3 | 16.623 | 0.594 | -0.008 | 0.736 | 962 |
| 5786 | 8 48 41.71 | 11 52 14.3 | 20.147 | 1.772 | — | 2.238 | | 5818 | 8 48 43.53 | 11 51 16.9 | 20.211 | 0.697 | 0.519 | 1.135 | |
| 5787 | 8 48 40.07 | 12 12 14.3 | 19.778 | 1.541 | — | — | | 5819 | 8 48 42.32 | 12 08 26.8 | 14.460 | 0.812 | 0.233 | — | |
| 5788 | 8 48 41.19 | 11 59 31.0 | 14.183 | 0.711 | 0.210 | 0.831 | 1014,I2,G77 | 5820 | 8 48 43.22 | 11 58 50.5 | 14.746 | 0.467 | -0.081 | 0.645 | 1006,F149b,G89 |
| 5789 | 8 48 41.98 | 11 50 16.4 | 17.908 | 0.640 | 0.014 | — | | 5821 | 8 48 42.50 | 12 07 29.7 | 15.850 | 1.128 | 0.733 | — | III79 |
| 5790 | 8 48 41.30 | 11 58 51.7 | 12.533 | 0.589 | 0.082 | 0.694 | 1007,F149,G21 | 5822 | 8 48 41.98 | 12 15 00.5 | 19.916 | 0.714 | — | — | |
| 5791 | 8 48 39.77 | 12 17 15.3 | 15.794 | 0.903 | — | — | | 5823 | 8 48 43.97 | 11 51 20.6 | 17.957 | 1.438 | 1.098 | 1.673 | |
| 5792* | 8 48 41.40 | 12 00 12.4 | 17.653 | 1.527 | — | 1.727 | G133 | 5824 | 8 48 44.03 | 11 53 52.4 | 18.589 | 1.674 | — | 1.907 | |
| (6494) | 8 48 42.01 | 12 05 09.4 | 10.48 | 1.10 | — | — | 1084, table 4 | 5825 | 8 48 43.26 | 12 04 44.1 | 12.756 | 0.592 | — | 0.687 | 1083 |
| (6479) | 8 48 42.41 | 11 55 08.2 | 11.28 | 0.13 | — | 0.179 | 968, table 4 | 5826 | 8 48 43.34 | 12 04 20.0 | 14.174 | 0.656 | — | 0.733 | 1078,III36 |
| 5793 | 8 48 42.42 | 11 48 18.6 | 19.284 | 0.942 | -0.267 | 1.272 | | 5827 | 8 48 44.39 | 11 53 13.2 | 16.981 | 1.280 | 1.153 | 1.416 | |
| 5794 | 8 48 42.52 | 11 49 54.7 | 13.695 | 0.552 | 0.002 | — | 944 | 5828 | 8 48 44.66 | 11 49 49.5 | 14.960 | 0.759 | 0.249 | 0.898 | 943 |
| 5795 | 8 48 41.37 | 12 03 56.3 | 13.259 | 0.619 | — | 0.695 | 1073,IV28 | 5829 | 8 48 43.84 | 12 01 29.5 | 14.411 | 0.685 | 0.084 | 0.777 | 1048,III9,G83 |
| 5796 | 8 48 42.16 | 11 54 42.1 | 18.083 | 0.864 | 0.303 | 0.954 | | 5831 | 8 48 43.74 | 12 03 03.7 | 14.645 | 0.800 | — | 0.873 | 1065,III16 |
| 5797 | 8 48 42.48 | 11 51 30.1 | 13.949 | 0.849 | 0.455 | 0.897 | 953,I166 | 5832 | 8 48 45.03 | 11 47 35.9 | 19.623 | 1.537 | — | 2.137 | |
| 5798 | 8 48 41.75 | 12 00 03.1 | 16.185 | 1.000 | 0.604 | 1.153 | G114 | 5833 | 8 48 44.05 | 12 00 45.0 | 12.784 | 0.487 | -0.009 | 0.600 | 1036,III2,G33 |
| 5799 | 8 48 42.46 | 11 52 04.8 | 16.628 | 0.662 | -0.070 | 0.886 | | 5835* | 8 48 44.29 | 11 58 07.0 | 14.972 | 0.891 | 0.460 | 0.995 | 996,II8,G91 |
| 5800 | 8 48 41.44 | 12 04 33.3 | 15.556 | 0.895 | — | 0.912 | 1081 | 5836 | 8 48 43.43 | 12 08 47.8 | 15.797 | 0.870 | 0.362 | — | |
| (6487) | 8 48 42.75 | 11 59 58.0 | 10.544 | 0.57 | — | 0.627 | 1023, table 4 | 5837* | 8 48 44.48 | 11 56 51.5 | 15.809 | 1.006 | 0.672 | 1.127 | 1232,II23,G112 |
| 5801 | 8 48 42.78 | 11 48 40.6 | 20.757 | 0.784 | — | — | | 5838 | 8 48 43.68 | 12 06 58.5 | 13.308 | 0.631 | 0.659 | 0.733 | 1092,III43 |
| 5802 | 8 48 41.27 | 12 06 56.2 | 17.941 | 1.440 | — | 1.619 | | 5839 | 8 48 43.89 | 12 04 37.2 | 16.666 | 1.134 | — | 1.209 | |
| 5803 | 8 48 41.86 | 12 00 26.4 | 13.233 | 0.566 | 0.026 | 0.688 | 1030,IV3,G50 | 5840 | 8 48 43.68 | 12 08 53.5 | 19.669 | 0.661 | — | — | |
| 5804 | 8 48 42.45 | 11 53 56.6 | 16.600 | 1.141 | 1.106 | 1.188 | I59 | 5841 | 8 48 44.90 | 11 54 26.4 | 15.474 | 0.864 | 0.459 | 0.943 | 1215,II31 |
| 5805 | 8 48 42.96 | 11 48 27.0 | 18.406 | 0.856 | 0.044 | 0.963 | | 5842 | 8 48 44.16 | 12 03 35.1 | 12.808 | 0.589 | — | 0.681 | 1071 |
| 5806 | 8 48 42.41 | 11 55 14.3 | 18.036 | 0.589 | -0.098 | — | | 5843 | 8 48 45.37 | 11 49 08.9 | 18.124 | 1.450 | 1.029 | 2.321 | |
| 5807 | 8 48 41.94 | 12 01 13.0 | 14.718 | 0.729 | 0.185 | 0.832 | 1041,IV1,G88 | 5844 | 8 48 44.62 | 11 59 19.8 | 13.821 | 0.627 | 0.053 | 0.803 | 1011,II1,G66 |
| 5808 | 8 48 40.90 | 12 14 14.7 | 13.766 | 1.013 | 0.520 | — | | (6503) | 8 48 44.87 | 12 01 50.7 | 10.55 | 1.12 | — | 1.09 | 1279, table 4 |
| 5810 | 8 48 42.55 | 11 55 39.3 | 15.296 | 0.603 | -0.029 | 0.732 | 971,I52 | 5845 | 8 48 45.18 | 11 53 29.5 | 15.727 | 0.560 | -0.049 | 0.689 | 1210,II32 |
| 5811 | 8 48 42.84 | 11 53 40.9 | 18.231 | 1.469 | 1.215 | 1.752 | | 5846 | 8 48 45.25 | 11 54 05.0 | 17.773 | 0.659 | 0.023 | 0.785 | |
| (6490) | 8 48 42.88 | 12 03 10.1 | 10.99 | 0.11 | — | 0.128 | 1066, table 4 | 5847* | 8 48 44.90 | 11 59 00.6 | 15.736 | 0.992 | 0.620 | 1.109 | 1253,II2,G105 |
| 5812 | 8 48 42.60 | 11 57 00.8 | 17.145 | 1.200 | 0.997 | 1.328 | G127 | 5848 | 8 48 43.55 | 12 15 39.4 | 12.253 | 0.623 | — | — | |
| 5813 | 8 48 42.43 | 12 00 37.8 | 13.480 | 0.573 | 0.036 | 0.700 | 1032,IV2,G54 | 5849 | 8 48 45.58 | 11 51 51.9 | 19.497 | 0.507 | 0.002 | 0.650 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (6499) | 8 48 45.83 | 11 58 34.5 | 9.69 | 1.36 | — | 1.33 | 1250, table 4 | 5890 | 8 48 47.66 | 11 48 11.9 | 19.473 | 1.675 | — | 1.358 | |
| 5850 | 8 48 46.03 | 11 46 29.6 | 12.777 | 0.548 | -0.003 | — | | 5891 | 8 48 47.09 | 11 55 15.7 | 17.558 | 1.331 | 1.222 | 1.469 | |
| 5852 | 8 48 44.04 | 12 10 32.4 | 18.946 | 1.492 | — | — | | 5892 | 8 48 46.27 | 12 05 20.2 | 19.720 | 0.997 | — | 1.021 | |
| 5853 | 8 48 44.67 | 12 03 17.6 | 12.677 | 0.684 | — | 0.761 | 1069,III17 | 5893 | 8 48 45.93 | 12 10 39.2 | 15.439 | 0.946 | 0.645 | — | |
| 5855 | 8 48 45.32 | 11 56 45.3 | 12.934 | 0.917 | 0.562 | 0.972 | 1231,II22,G42 | 5894 | 8 48 45.77 | 12 12 49.3 | 17.892 | 0.899 | — | — | |
| 5856 | 8 48 44.86 | 12 02 31.5 | 17.598 | 1.355 | — | 1.548 | G136 | 5895 | 8 48 46.40 | 12 06 41.0 | 19.665 | 1.634 | — | 2.090 | |
| 5857 | 8 48 44.82 | 12 03 30.1 | 14.991 | 0.798 | — | 0.911 | 1297,III18 | 5896 | 8 48 47.20 | 11 57 08.4 | 12.650 | 0.574 | 0.018 | 0.700 | 1234,II20,G22 |
| 5858 | 8 48 46.20 | 11 47 52.2 | 20.594 | 0.683 | -0.229 | — | | 5897 | 8 48 47.20 | 11 57 14.3 | 19.407 | 0.855 | — | 0.051 | |
| 5859 | 8 48 43.99 | 12 14 35.2 | 13.015 | 0.750 | 0.141 | — | | 5898 | 8 48 47.97 | 11 49 33.9 | 16.904 | 1.197 | 1.061 | 1.363 | |
| 5861 | 8 48 45.73 | 11 56 24.2 | 17.798 | 1.443 | 1.210 | 1.575 | G134 | 5899 | 8 48 46.96 | 12 01 56.8 | 19.925 | 1.533 | — | 2.272 | G170 |
| 5862 | 8 48 46.63 | 11 47 28.3 | 16.183 | 1.001 | 0.762 | 1.102 | | 5900 | 8 48 48.25 | 11 47 30.9 | 13.290 | 0.573 | 0.024 | 0.682 | 1189 |
| 5863 | 8 48 46.11 | 11 55 07.6 | 13.148 | 0.597 | 0.042 | 0.685 | 1219,II30 | 5901* | 8 48 47.17 | 12 01 08.8 | 16.627 | 1.290 | 1.181 | 1.414 | G122 |
| 5864 | 8 48 45.23 | 12 05 31.6 | 12.868 | 0.603 | — | 0.691 | 1308,III40 | 5902 | 8 48 47.62 | 11 57 31.1 | 20.399 | 1.440 | — | 1.730 | G176 |
| 5866 | 8 48 46.77 | 11 47 16.4 | 21.170 | 0.777 | — | 2.737 | | 5903 | 8 48 47.03 | 12 04 35.9 | 13.709 | 0.601 | 0.020 | 0.695 | 1303 |
| 5868* | 8 48 46.41 | 11 53 01.2 | 18.600 | 1.556 | — | 2.043 | | 5904 | 8 48 47.72 | 11 56 26.6 | 15.514 | 0.865 | 0.495 | 0.941 | 1229,II21,G101 |
| 5869 | 8 48 45.77 | 12 01 40.5 | 14.401 | 0.775 | 0.285 | 0.861 | 1278,III10,G87 | 5905 | 8 48 46.49 | 12 12 34.4 | 16.421 | 0.755 | — | — | |
| 5870 | 8 48 46.88 | 11 49 01.8 | 19.763 | 0.900 | 0.561 | 0.815 | | 5906 | 8 48 48.01 | 11 54 38.4 | 18.986 | 1.172 | — | 1.304 | |
| 5871 | 8 48 45.73 | 12 02 47.9 | 13.329 | 0.495 | -0.085 | 0.640 | 2223,III15 | 5907 | 8 48 47.89 | 11 56 42.4 | 19.674 | 1.340 | — | 1.493 | G165 |
| 5872 | 8 48 46.28 | 11 56 23.6 | 19.053 | 1.376 | — | 1.781 | G153 | 5908 | 8 48 46.30 | 12 15 36.1 | 14.737 | 0.744 | — | — | |
| 5873 | 8 48 45.84 | 12 02 26.7 | 14.115 | 0.640 | 0.066 | 0.744 | 1283,III13,G69 | (6501) | 8 48 48.51 | 12 00 09.9 | 11.063 | 0.19 | — | 0.262 | 1263, table 4 |
| 5874 | 8 48 44.79 | 12 15 33.8 | 17.319 | 0.763 | — | — | | 5909 | 8 48 48.57 | 11 48 41.9 | 18.050 | 1.415 | 1.078 | 1.670 | |
| 5875 | 8 48 46.31 | 11 58 19.3 | 17.720 | 1.338 | 1.246 | 1.599 | G135 | 5910 | 8 48 47.41 | 12 03 15.2 | 14.889 | 0.756 | 0.205 | 0.879 | 1294,III19 |
| 5876 | 8 48 44.82 | 12 16 52.0 | 17.838 | 1.310 | — | — | | 5911* | 8 48 48.49 | 11 50 35.0 | 18.323 | 1.513 | 0.986 | 2.066 | |
| 5877 | 8 48 46.37 | 12 00 16.0 | 12.110 | 1.006 | 0.718 | 1.029 | 1264a ,G15 | 5912 | 8 48 46.47 | 12 16 39.1 | 19.371 | 1.519 | — | — | |
| 5878* | 8 48 46.30 | 12 01 23.5 | 15.796 | 1.090 | 0.866 | 1.157 | III8,G109 | 5913* | 8 48 48.11 | 11 57 44.8 | 16.409 | 1.116 | 0.967 | 1.296 | II9,G121 |
| 5879 | 8 48 46.20 | 12 02 39.9 | 14.901 | 0.762 | 0.256 | 0.840 | 1289,III14,G92 | 5914 | 8 48 47.30 | 12 08 01.7 | 17.067 | 0.648 | -0.075 | — | |
| 5880 | 8 48 46.82 | 11 55 20.4 | 19.045 | 0.953 | 0.738 | 1.239 | | 5915 | 8 48 48.14 | 11 58 13.0 | 16.255 | 1.030 | 0.789 | 1.142 | II11,G115 |
| 5881* | 8 48 46.56 | 11 59 05.1 | 15.921 | 1.076 | 0.934 | 1.223 | II3,G110 | 5916 | 8 48 48.34 | 11 55 39.8 | 17.875 | 1.386 | 1.260 | 1.585 | |
| 5882 | 8 48 46.48 | 12 00 12.5 | 13.349 | 0.590 | 0.045 | 0.739 | 1264b,G55 | 5917 | 8 48 47.80 | 12 02 34.4 | 14.030 | 0.608 | 0.056 | 0.747 | 1287,III20,G67 |
| 5883 | 8 48 45.67 | 12 10 20.1 | 18.628 | 1.465 | — | — | | 5918 | 8 48 47.18 | 12 10 12.8 | 16.978 | 0.679 | -0.010 | — | |
| 5884 | 8 48 46.49 | 12 00 30.9 | 12.725 | 0.587 | 0.062 | 0.704 | 2212,III1,G26 | 5919 | 8 48 47.53 | 12 06 15.0 | 17.352 | 1.285 | 1.090 | 1.422 | |
| 5885 | 8 48 46.78 | 11 57 08.0 | 19.529 | 0.674 | — | — | | 5920 | 8 48 47.40 | 12 08 14.9 | 19.055 | 1.391 | — | — | |
| 5886 | 8 48 46.60 | 12 00 10.2 | 15.781 | 0.981 | 0.819 | 0.965 | G502 | 5921 | 8 48 47.73 | 12 04 44.5 | 16.646 | 0.701 | 0.171 | 0.855 | |
| 5887 | 8 48 47.60 | 11 48 19.5 | 19.637 | 1.479 | — | 1.325 | | 5922 | 8 48 48.33 | 11 58 03.5 | 14.623 | 0.685 | 0.151 | 0.833 | 1246,II10,G90 |
| 5888 | 8 48 45.85 | 12 09 42.4 | 14.038 | 0.533 | -0.050 | — | | 5923 | 8 48 47.37 | 12 09 18.5 | 16.828 | 0.713 | 0.059 | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5924 | 8 48 47.74 | 12 04 50.8 | 15.444 | 0.852 | — | — | 1304 | 5964 | 8 48 50.21 | 11 57 11.4 | 14.980 | 0.877 | 0.484 | 0.951 | 1235,II18,G95 |
| 5925 | 8 48 48.05 | 12 01 21.4 | 12.664 | 0.598 | 0.066 | 0.685 | 1274,III7,G31 | 5965 | 8 48 49.90 | 12 02 01.5 | 20.841 | 0.966 | — | — | G224 |
| 5926 | 8 48 47.79 | 12 04 29.7 | 13.076 | 0.564 | 0.014 | 0.668 | 1302,III37 | 5966 | 8 48 50.48 | 11 55 07.3 | 14.590 | 0.684 | 0.170 | 0.754 | 1218 |
| 5927 | 8 48 48.33 | 11 59 19.0 | 12.777 | 0.822 | 0.332 | 0.882 | 2208,II6,G39 | 5967 | 8 48 50.84 | 11 51 38.6 | 18.871 | 0.918 | 0.434 | 1.035 | |
| 5928 | 8 48 48.32 | 11 59 39.9 | 18.210 | 0.493 | — | 0.805 | | 5968 | 8 48 49.10 | 12 12 40.2 | 15.786 | 0.677 | — | — | |
| 5929 | 8 48 48.38 | 11 59 10.2 | 12.648 | 0.617 | 0.070 | 0.728 | 2207,II5,G30 | 5969 | 8 48 50.19 | 12 01 01.7 | 12.909 | 0.534 | -0.028 | 0.665 | 1271,III6,G32 |
| 5930* | 8 48 48.59 | 11 57 17.6 | 19.265 | 1.647 | — | 2.241 | G156 | 5972 | 8 48 50.15 | 12 02 12.4 | 13.717 | 0.547 | 0.013 | 0.689 | 1281,III24,G63 |
| 5931 | 8 48 47.14 | 12 15 08.3 | 17.239 | 0.686 | -0.022 | — | | 5973 | 8 48 50.88 | 11 53 35.7 | 19.656 | -0.098 | -0.763 | -0.189 | |
| 5932 | 8 48 47.87 | 12 06 26.7 | 13.698 | 0.635 | 0.091 | 0.739 | 1314,III42 | 5975 | 8 48 50.10 | 12 03 49.0 | 17.595 | 1.023 | 0.661 | 1.158 | |
| 5933 | 8 48 47.96 | 12 05 24.2 | 19.947 | 1.658 | — | 2.289 | | 5978* | 8 48 50.47 | 12 00 24.8 | 15.550 | 0.978 | 0.738 | 1.083 | 1266,III4,G106 |
| 5937 | 8 48 48.50 | 11 59 41.9 | 14.191 | 0.625 | 0.045 | 0.736 | 1260,II4,G75 | 5979 | 8 48 50.81 | 11 56 55.4 | 18.024 | 1.425 | 1.401 | 1.747 | G142 |
| 5939 | 8 48 48.00 | 12 07 11.6 | 18.599 | 0.841 | 0.407 | 1.038 | | 5980 | 8 48 51.08 | 11 54 04.6 | 17.099 | 1.244 | 1.173 | 1.400 | |
| 5940 | 8 48 48.47 | 12 01 58.4 | 12.257 | 0.260 | 0.020 | 0.335 | 1280,III12,G11 | 5981* | 8 48 51.58 | 11 51 04.8 | 14.413 | 0.715 | 0.124 | 0.909 | 1203,II68 |
| 5941 | 8 48 47.24 | 12 17 11.1 | 16.295 | 1.449 | — | — | | 5982 | 8 48 51.64 | 11 50 50.1 | 17.135 | 1.233 | 1.084 | 1.355 | |
| 5942 | 8 48 49.70 | 11 47 45.3 | 20.160 | 1.206 | — | 1.537 | | 5983 | 8 48 51.17 | 11 57 29.7 | 16.707 | 0.694 | 0.141 | 0.808 | G120 |
| 5943 | 8 48 48.57 | 12 01 48.7 | 15.761 | 0.904 | 0.546 | 0.973 | G104 | 5984 | 8 48 51.66 | 11 52 28.3 | 17.886 | 0.496 | -0.215 | 0.708 | |
| 5944 | 8 48 49.26 | 11 53 39.5 | 19.921 | 1.678 | — | 2.145 | | 5985 | 8 48 51.04 | 12 01 49.4 | 19.851 | 1.583 | — | 1.486 | G184 |
| 5945 | 8 48 49.72 | 11 49 51.8 | 16.215 | 1.020 | 0.726 | 1.217 | | 5986 | 8 48 51.11 | 12 01 43.6 | 19.521 | 1.348 | — | 2.190 | G159 |
| 5946 | 8 48 49.52 | 11 53 17.2 | 20.236 | 0.430 | -0.310 | 0.651 | | 5987 | 8 48 49.90 | 12 16 34.5 | 16.391 | 0.739 | — | — | |
| 5948 | 8 48 49.32 | 11 57 17.6 | 15.244 | 0.792 | 0.323 | 0.913 | 1236,II19,G97 | 5988 | 8 48 50.82 | 12 06 33.3 | 18.858 | 1.475 | — | 1.893 | |
| 5949 | 8 48 48.68 | 12 05 02.7 | 15.167 | 0.807 | 0.276 | 0.870 | 1307,III39 | 5989 | 8 48 52.21 | 11 50 13.7 | 13.939 | 0.583 | 0.012 | 0.742 | 1201 |
| 5950 | 8 48 48.29 | 12 10 18.8 | 18.355 | 1.470 | — | — | | 5990 | 8 48 51.36 | 12 01 37.2 | 19.830 | 0.741 | — | 0.861 | G168 |
| 5951 | 8 48 49.14 | 12 00 09.2 | 12.767 | 0.577 | 0.014 | 0.719 | III3,G23 | 5991 | 8 48 52.29 | 11 50 58.6 | 19.093 | 1.567 | — | 1.720 | |
| 5952 | 8 48 48.95 | 12 02 33.9 | 15.263 | 0.820 | 0.343 | 0.924 | 1286,III21,G96 | 5992 | 8 48 51.76 | 12 00 09.5 | 13.663 | 0.585 | 0.043 | 0.691 | 1262,III5,G60 |
| 5954 | 8 48 49.69 | 11 54 45.1 | 21.214 | 0.252 | — | — | | 5993 | 8 48 51.97 | 11 57 51.6 | 12.722 | 0.683 | 0.134 | 0.807 | 1242,II17,G29 |
| 5955 | 8 48 47.96 | 12 15 45.1 | 17.290 | 0.946 | 1.958 | — | | 5994 | 8 48 51.41 | 12 06 10.7 | 20.186 | 0.666 | -0.204 | 0.626 | |
| 5956 | 8 48 48.76 | 12 06 05.5 | 15.801 | 0.914 | 0.576 | 0.989 | 1311,III41 | 5995 | 8 48 52.01 | 11 59 05.0 | 14.486 | 0.666 | 0.116 | 0.774 | 1255,II7,G81 |
| 5957 | 8 48 49.64 | 11 57 34.0 | 18.126 | 1.432 | 1.309 | 1.678 | G141 | 5996 | 8 48 51.19 | 12 09 14.6 | 12.826 | 0.775 | 0.278 | — | |
| 5958 | 8 48 50.45 | 11 48 29.6 | 19.972 | 1.514 | — | 2.427 | | 5997 | 8 48 51.62 | 12 04 52.9 | 12.230 | 0.993 | 0.681 | 1.002 | 1305 |
| 5959 | 8 48 50.52 | 11 49 14.4 | 13.186 | 0.559 | -0.002 | 0.698 | | 5998 | 8 48 51.36 | 12 08 31.3 | 18.999 | 1.530 | — | — | |
| 5960 | 8 48 49.13 | 12 06 02.0 | 18.762 | 1.513 | — | 1.864 | | 5999* | 8 48 53.11 | 11 48 10.2 | 14.865 | 0.829 | 0.401 | 0.949 | |
| 5961 | 8 48 49.53 | 12 03 02.9 | 13.198 | 0.620 | 0.047 | 0.737 | 1292,III22 | 6000 | 8 48 51.58 | 12 08 28.1 | 20.072 | 1.123 | — | — | |
| 5962 | 8 48 49.00 | 12 10 59.2 | 13.864 | 0.660 | 0.045 | — | | 6001 | 8 48 52.05 | 12 05 53.3 | 20.137 | 1.555 | — | 2.138 | |
| 5963 | 8 48 50.07 | 11 58 13.7 | 14.220 | 0.621 | 0.088 | 0.734 | 1248,II12,G82 | 6002 | 8 48 53.29 | 11 51 49.9 | 19.651 | 1.222 | — | 1.354 | |
| (6504) | 8 48 50.20 | 12 02 28.4 | 10.940 | 0.22 | — | 0.318 | 1284, table 4 | 6003 | 8 48 53.69 | 11 47 27.4 | 16.410 | 0.584 | -0.048 | 0.746 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6004 | 8 48 52.01 | 12 08 00.1 | 19.572 | 0.548 | — | — | | 6038 | 8 48 55.28 | 11 54 53.6 | 16.452 | 1.070 | 0.919 | 1.159 | |
| 6005 | 8 48 52.64 | 12 01 17.1 | 15.571 | 0.863 | 0.456 | 0.950 | 2215,III25,G100 | 6039 | 8 48 54.99 | 11 59 13.5 | 13.673 | 0.660 | 0.128 | 0.728 | 1256,II13,G70 |
| 6006 | 8 48 53.79 | 11 48 20.7 | 12.278 | 0.385 | -0.034 | 0.501 | | 6040 | 8 48 53.65 | 12 16 36.4 | 17.299 | 1.032 | — | — | |
| 6007* | 8 48 53.01 | 11 57 51.0 | 19.453 | 1.619 | — | 2.268 | G163 | 6041 | 8 48 55.58 | 11 53 29.0 | 15.658 | 0.484 | -0.082 | 0.634 | 1209,II37 |
| 6008 | 8 48 52.37 | 12 05 45.6 | 15.158 | 0.832 | 0.352 | 0.866 | 1309,III44 | 6042 | 8 48 53.70 | 12 16 29.9 | 13.799 | 0.629 | — | — | |
| 6009 | 8 48 52.18 | 12 08 08.9 | 14.001 | 0.617 | -0.008 | — | | 6043 | 8 48 55.66 | 11 53 46.4 | 16.593 | 1.117 | 0.900 | 1.178 | |
| 6010 | 8 48 53.20 | 11 58 13.8 | 14.044 | 0.619 | 0.064 | 0.778 | 1247,II6,G74 | 6044 | 8 48 55.23 | 11 59 01.5 | 17.181 | 1.271 | 1.203 | 1.376 | G126 |
| 6011 | 8 48 52.01 | 12 14 12.1 | 19.220 | 1.429 | — | — | | 6045 | 8 48 54.04 | 12 13 23.4 | 18.458 | 1.338 | — | — | |
| 6012 | 8 48 53.06 | 12 02 50.1 | 20.477 | 0.940 | — | — | | 6046 | 8 48 55.52 | 11 56 19.5 | 15.319 | 0.820 | 0.421 | 0.863 | 1227,II27 |
| 6013 | 8 48 53.51 | 11 57 39.9 | 17.950 | 0.982 | 0.645 | 1.089 | G144 | 6047 | 8 48 55.14 | 12 01 22.0 | 12.219 | 0.567 | 0.080 | 0.653 | 1273,III27,G14 |
| 6014 | 8 48 54.20 | 11 49 50.1 | 17.718 | 0.505 | -0.080 | 0.692 | | 6048* | 8 48 54.91 | 12 04 23.5 | 15.465 | 0.966 | 0.612 | 1.056 | 1301,III48 |
| 6015 | 8 48 52.85 | 12 06 08.3 | 15.511 | 0.867 | 0.442 | 0.935 | 1312,III45 | 6049 | 8 48 55.80 | 11 54 13.1 | 14.346 | 0.643 | 0.085 | 0.752 | 1214,II35 |
| 6016 | 8 48 52.57 | 12 09 54.8 | 19.424 | 1.329 | — | — | | 6050 | 8 48 55.27 | 12 03 03.9 | 12.094 | 1.007 | 0.731 | 1.016 | 1293,III35 |
| 6017 | 8 48 52.40 | 12 12 07.4 | 18.573 | 1.098 | — | — | | 6051 | 8 48 55.31 | 12 05 45.0 | 20.935 | 0.319 | — | 0.708 | |
| 6018 | 8 48 53.31 | 12 01 23.3 | 12.562 | 0.593 | 0.113 | 0.688 | 1275,III26,G18 | 6052 | 8 48 56.40 | 11 53 40.6 | 20.466 | 0.943 | -0.165 | — | |
| 6019 | 8 48 52.93 | 12 06 18.3 | 13.213 | 0.600 | 0.021 | 0.679 | 1313,III46 | 6053 | 8 48 54.91 | 12 11 51.0 | 18.262 | 1.199 | — | — | |
| 6020 | 8 48 52.27 | 12 14 34.1 | 18.408 | 1.419 | — | — | | 6054 | 8 48 55.89 | 12 01 47.7 | 21.080 | 0.569 | — | — | G196 |
| 6021 | 8 48 54.41 | 11 52 48.2 | 16.520 | 1.099 | 0.898 | 1.268 | | 6055 | 8 48 55.14 | 12 12 15.8 | 14.645 | 0.747 | — | — | |
| 6022 | 8 48 52.77 | 12 12 43.4 | 18.775 | 1.522 | — | — | | 6056 | 8 48 56.63 | 11 54 29.9 | 19.449 | 1.323 | — | 1.519 | |
| 6023 | 8 48 54.88 | 11 47 27.1 | 18.907 | 1.555 | — | 1.949 | | 6057 | 8 48 56.03 | 12 02 31.7 | 19.658 | 1.682 | — | 2.383 | |
| 6024* | 8 48 54.58 | 11 51 15.8 | 17.792 | 1.541 | 1.036 | 1.828 | | 6058 | 8 48 56.41 | 11 57 56.1 | 13.794 | 0.590 | 0.071 | 0.703 | 1244,II24,G61 |
| 6025 | 8 48 53.41 | 12 05 34.7 | 18.852 | 1.576 | — | 1.932 | | 6059 | 8 48 56.57 | 11 56 09.9 | 19.685 | 0.450 | -0.207 | — | |
| 6026 | 8 48 53.49 | 12 05 15.9 | 18.854 | 1.539 | 0.799 | 1.856 | | 6060 | 8 48 55.94 | 12 04 01.6 | 13.754 | 0.597 | 0.045 | 0.670 | 1300,III49 |
| 6027 | 8 48 53.74 | 12 02 15.2 | 13.333 | 0.564 | 0.067 | 0.699 | 1282,III33,G58 | 6061 | 8 48 56.53 | 11 57 19.0 | 20.534 | -0.140 | — | — | |
| 6028 | 8 48 53.37 | 12 08 02.7 | 14.438 | 0.706 | 0.123 | — | | 6062 | 8 48 55.10 | 12 14 38.3 | 18.062 | 0.794 | — | — | |
| 6029 | 8 48 54.85 | 11 50 19.4 | 16.632 | 0.942 | 0.638 | 1.050 | | 6063 | 8 48 57.41 | 11 49 25.5 | 16.475 | 0.931 | 0.343 | 1.002 | |
| 6030 | 8 48 52.94 | 12 14 40.1 | 13.748 | 0.605 | — | — | | 6064 | 8 48 55.18 | 12 17 14.9 | 15.770 | 0.937 | — | — | |
| (6507) | 8 48 52.95 | 12 10 20.7 | 11.103 | 0.85 | — | 0.855 | 1327, table 4 | 6065 | 8 48 56.74 | 12 00 23.8 | 13.763 | 0.592 | 0.052 | 0.660 | 1265,III28 |
| 6031 | 8 48 54.73 | 11 53 55.4 | 14.114 | 0.600 | 0.053 | 0.716 | 1213,II34 | 6066 | 8 48 55.40 | 12 16 49.4 | 19.688 | 1.589 | — | — | |
| 6032 | 8 48 53.25 | 12 12 06.8 | 15.211 | 0.623 | -0.142 | — | | 6067* | 8 48 56.54 | 12 03 25.1 | 16.788 | 1.292 | 1.249 | 1.472 | |
| 6033 | 8 48 53.63 | 12 10 06.4 | 17.103 | 1.093 | — | — | | 6068 | 8 48 57.26 | 11 56 11.3 | 14.901 | 0.733 | 0.230 | 0.817 | 1223,II28 |
| 6034 | 8 48 53.76 | 12 10 07.5 | 12.911 | 1.000 | 0.743 | — | | 6069 | 8 48 55.79 | 12 15 46.7 | 15.459 | 0.875 | — | — | |
| 6035 | 8 48 55.50 | 11 49 05.2 | 18.037 | 1.149 | 0.807 | 1.266 | | 6070 | 8 48 56.09 | 12 13 09.8 | 12.695 | 0.584 | — | — | |
| 6036 | 8 48 53.84 | 12 09 20.9 | 18.249 | 0.682 | 0.146 | — | | 6071 | 8 48 56.94 | 12 04 00.3 | 16.373 | 0.864 | 0.314 | 0.944 | 1299,III50 |
| 6037 | 8 48 53.78 | 12 12 43.3 | 13.037 | 0.667 | — | — | | 6072 | 8 48 58.32 | 11 47 25.3 | 18.087 | 1.473 | 1.207 | 1.653 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6073 | 8 48 57.44 | 11 58 54.4 | 14.067 | 0.643 | 0.094 | 0.729 | 1252,II14 | 6104 | 8 48 58.60 | 12 10 49.6 | 14.079 | 0.658 | 0.011 | — | |
| 6074 | 8 48 57.45 | 11 59 17.7 | 19.518 | 0.661 | 0.020 | 0.999 | | 6105 | 8 48 59.73 | 11 58 14.4 | 19.922 | 1.010 | — | 1.106 | |
| 6075 | 8 48 56.70 | 12 09 02.8 | 15.930 | 1.072 | 0.849 | — | | 6106 | 8 48 59.87 | 11 56 55.7 | 16.201 | 0.838 | 0.378 | 0.909 | 1233 |
| 6076 | 8 48 57.94 | 11 54 55.6 | 12.690 | 0.564 | 0.042 | 0.675 | 1216,II36 | 6107 | 8 48 59.97 | 11 57 42.9 | 12.750 | 0.758 | 0.241 | 0.822 | 1239 |
| 6077 | 8 48 57.07 | 12 05 47.5 | 12.760 | 0.580 | 0.010 | 0.650 | 1310,III47 | 6108 | 8 49 00.67 | 11 53 09.9 | 13.214 | 0.556 | 0.032 | 0.690 | |
| 6078 | 8 48 58.70 | 11 48 06.5 | 16.673 | 1.101 | 0.989 | 1.208 | | 6109 | 8 49 00.99 | 11 50 16.8 | 13.534 | 0.540 | 0.030 | 0.670 | |
| 6079 | 8 48 56.50 | 12 16 05.6 | 16.164 | 0.554 | — | — | | 6110 | 8 48 59.35 | 12 12 14.2 | 13.629 | 0.659 | — | — | |
| 6080 | 8 48 57.81 | 12 00 56.0 | 14.934 | 0.758 | 0.283 | 0.791 | 1269,III30 | 6111 | 8 48 58.98 | 12 17 00.2 | 18.359 | 0.964 | 0.394 | — | |
| (6502) | 8 48 58.23 | 12 01 26.0 | 11.63 | 1.05 | — | — | 1277, table 4 | 6112 | 8 49 00.73 | 11 56 19.8 | 13.338 | 0.575 | -0.007 | 0.667 | 1226,II53 |
| 6081 | 8 48 58.36 | 11 55 47.3 | 17.427 | 0.884 | 0.451 | 1.028 | | 6113 | 8 49 00.36 | 12 01 03.6 | 20.205 | 0.481 | 0.046 | 1.080 | |
| 6082 | 8 48 59.17 | 11 47 46.0 | 14.141 | 0.709 | 0.183 | 0.802 | | 6114 | 8 49 00.70 | 11 58 04.5 | 12.934 | 0.919 | 0.549 | 0.940 | 1245 |
| 6083 | 8 48 56.78 | 12 17 08.2 | 18.685 | 1.189 | — | — | | 6115 | 8 49 00.81 | 11 57 49.4 | 18.302 | 1.479 | 1.196 | 1.760 | |
| 6084* | 8 48 58.51 | 11 57 17.1 | 15.505 | 1.098 | 0.905 | 1.097 | 2203,II26,G39 | (6500) | 8 49 01.00 | 11 59 04.4 | 11.52 | 1.05 | — | — | 1254, table 4 |
| 6085 | 8 48 58.01 | 12 03 48.4 | 16.008 | 0.678 | 0.046 | 0.764 | 1298,III51 | 6116 | 8 48 59.26 | 12 16 41.8 | 18.610 | 1.006 | — | — | |
| 6086 | 8 48 57.08 | 12 15 05.8 | 18.592 | 1.506 | — | — | | 6117 | 8 48 59.98 | 12 09 09.6 | 19.708 | 0.647 | — | — | |
| 6087 | 8 48 58.03 | 12 04 15.0 | 19.787 | 0.874 | 0.278 | 0.884 | | 6118 | 8 49 01.54 | 11 53 29.1 | 17.118 | 0.625 | -0.019 | 0.751 | |
| 6088 | 8 48 59.01 | 11 52 18.0 | 15.124 | 0.848 | 0.478 | 0.918 | 1206,II66 | 6119 | 8 49 01.83 | 11 50 03.1 | 14.387 | 0.598 | -0.049 | 0.720 | |
| 6089 | 8 48 58.36 | 12 01 10.3 | 12.514 | 0.598 | 0.046 | 0.697 | 1272,III31 | 6120 | 8 49 00.89 | 12 03 12.4 | 19.964 | 0.971 | -0.044 | 1.213 | |
| 6090 | 8 48 58.63 | 11 57 55.0 | 12.368 | 0.581 | -0.041 | 0.722 | 1243,II25 | 6121 | 8 49 02.37 | 11 46 42.4 | 19.270 | 1.511 | — | 2.011 | |
| 6091 | 8 48 58.96 | 11 55 56.0 | 18.802 | 1.011 | 0.582 | 1.056 | | 6122 | 8 49 00.44 | 12 10 11.6 | 18.086 | 1.469 | — | — | |
| 6092 | 8 48 57.41 | 12 17 01.6 | 16.933 | 0.913 | 0.957 | — | | 6123 | 8 49 00.99 | 12 03 52.0 | 15.915 | 0.841 | 0.341 | 0.869 | |
| (6497) | 8 48 59.52 | 11 55 44.9 | 10.76 | 1.13 | — | 1.10 | 1221, table 4 | 6124 | 8 49 02.19 | 11 51 47.3 | 20.695 | 0.489 | -0.145 | — | |
| 6093 | 8 48 59.54 | 11 52 05.3 | 21.306 | 0.839 | — | 1.075 | | (6496) | 8 49 02.19 | 11 47 36.2 | 11.26 | 0.62 | — | — | 1190, table 4 |
| 6094 | 8 48 59.21 | 11 56 35.7 | 17.176 | 0.933 | 0.560 | 1.063 | | 6125 | 8 49 01.96 | 11 55 28.1 | 13.371 | 0.572 | 0.026 | 0.648 | 1220,II56 |
| 6095 | 8 48 58.01 | 12 11 47.2 | 17.998 | 1.005 | — | — | | 6126 | 8 49 01.66 | 11 59 53.2 | 20.924 | -0.185 | — | — | |
| (6505) | 8 48 58.23 | 12 02 41.3 | 11.33 | 1.07 | — | — | 1288, table 4 | 6127 | 8 49 01.03 | 12 08 14.0 | 13.584 | 0.594 | 0.003 | — | |
| 6096 | 8 48 58.41 | 12 07 23.5 | 15.914 | 0.980 | 0.602 | 1.022 | | 6128* | 8 49 01.31 | 12 05 53.9 | 18.720 | 1.600 | — | 2.150 | |
| 6097 | 8 48 59.48 | 11 54 29.9 | 20.907 | 0.715 | — | — | | 6129* | 8 49 01.54 | 12 05 13.0 | 16.929 | 1.346 | 1.271 | 1.513 | |
| (6506) | 8 48 59.68 | 12 08 00.8 | 10.58 | 1.10 | — | 1.08 | 1316, table 4 | 6130 | 8 49 02.03 | 11 59 52.0 | 15.943 | 0.623 | 0.095 | 0.645 | 1261,II15 |
| 6098 | 8 48 59.85 | 11 50 04.4 | 18.580 | 1.549 | — | 1.931 | | 6131 | 8 49 01.30 | 12 09 11.6 | 16.990 | 1.332 | — | — | |
| 6099 | 8 48 58.09 | 12 11 47.3 | 18.007 | 0.988 | — | — | | 6132 | 8 49 01.34 | 12 08 41.7 | 18.806 | 1.316 | — | — | |
| 6100 | 8 48 58.60 | 12 05 58.2 | 17.371 | 1.308 | 1.166 | 1.441 | | 6133 | 8 49 02.65 | 11 54 03.8 | 16.784 | 1.245 | 1.152 | 1.373 | II64 |
| 6101 | 8 48 59.02 | 12 02 20.5 | 17.690 | 1.469 | — | — | | 6134 | 8 49 02.38 | 11 57 45.2 | 13.381 | 0.572 | 0.036 | 0.687 | 1240,II43,F164,G7 |
| 6102 | 8 48 59.39 | 12 00 10.6 | 15.720 | 0.921 | 0.596 | 0.971 | III29 | 6135 | 8 49 02.62 | 11 56 16.9 | 12.831 | 0.504 | -0.071 | 0.625 | 1225,II54 |
| 6103 | 8 48 59.73 | 11 56 33.3 | 13.079 | 0.559 | 0.025 | 0.667 | 1230 | 6136 | 8 49 01.92 | 12 04 58.8 | 17.872 | 1.354 | 1.221 | 1.501 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6137 | 8 49 03.48 | 11 48 01.3 | 16.059 | 0.874 | 0.524 | 0.957 | | 6171 | 8 49 04.60 | 12 09 38.6 | 15.383 | 0.990 | 0.585 | — | |
| 6138* | 8 49 02.88 | 11 56 31.0 | 18.557 | 1.535 | — | 2.007 | | 6172 | 8 49 06.72 | 11 47 51.5 | 13.419 | 0.445 | -0.076 | 0.618 | |
| 6139 | 8 49 03.11 | 11 53 49.0 | 15.320 | 0.782 | 0.359 | 0.899 | 1212 | 6173 | 8 49 06.51 | 11 51 07.7 | 18.791 | 0.743 | -0.018 | 0.821 | |
| 6140 | 8 49 01.92 | 12 09 22.6 | 19.101 | 1.248 | — | — | | 6174 | 8 49 05.29 | 12 06 11.9 | 17.500 | 0.590 | -0.031 | 0.739 | |
| 6141 | 8 49 01.98 | 12 12 14.9 | 14.918 | 0.701 | — | — | | 6175 | 8 49 06.11 | 11 56 19.2 | 13.776 | 0.608 | 0.060 | 0.736 | 1224b |
| 6142 | 8 49 03.38 | 11 56 01.0 | 14.671 | 0.694 | 0.124 | 0.770 | 1222,II55 | 6176 | 8 49 06.20 | 11 56 16.0 | 13.505 | 0.630 | 0.080 | 0.693 | 1224a |
| 6143 | 8 49 03.85 | 11 51 54.4 | 20.218 | 1.334 | — | 1.880 | | 6177 | 8 49 05.87 | 12 00 50.0 | 12.647 | 0.581 | 0.103 | 0.734 | 1268 |
| 6144* | 8 49 03.38 | 11 58 28.3 | 14.314 | 0.783 | 0.269 | 0.877 | 1249,II42 | 6178 | 8 49 05.49 | 12 06 51.2 | 18.813 | 1.460 | — | 1.867 | |
| 6145 | 8 49 03.32 | 12 01 55.6 | 18.556 | 1.319 | — | — | | 6180 | 8 49 07.14 | 11 48 20.3 | 13.303 | 0.459 | -0.111 | 0.633 | |
| 6146 | 8 49 03.67 | 12 00 00.1 | 19.620 | 1.380 | — | 1.954 | | 6182 | 8 49 05.85 | 12 05 32.2 | 20.076 | 0.960 | — | — | |
| 6147 | 8 49 04.08 | 11 56 04.5 | 19.245 | 1.342 | — | 1.558 | | 6183 | 8 49 05.79 | 12 06 37.1 | 18.355 | 0.688 | — | — | |
| 6148 | 8 49 04.21 | 11 54 37.6 | 18.119 | 1.282 | 1.443 | 1.525 | | 6184 | 8 49 05.74 | 12 08 04.1 | 15.894 | 0.932 | 0.557 | 0.945 | |
| 6149 | 8 49 04.48 | 11 53 42.2 | 14.047 | 0.602 | 0.051 | 0.719 | | 6185 | 8 49 07.35 | 11 48 36.2 | 19.449 | 1.006 | 0.465 | 1.050 | |
| 6150 | 8 49 03.83 | 12 03 21.1 | 18.715 | 1.548 | — | 1.914 | | 6186 | 8 49 07.32 | 11 50 54.0 | 19.588 | 1.754 | — | 2.065 | |
| 6151 | 8 49 03.87 | 12 03 02.1 | 20.034 | 0.585 | 0.116 | 1.106 | | 6187 | 8 49 07.04 | 11 55 47.5 | 17.219 | 1.331 | — | — | |
| 6152 | 8 49 04.56 | 11 54 50.3 | 17.181 | 1.274 | 1.141 | 1.390 | | 6188 | 8 49 06.47 | 12 02 50.1 | 15.714 | 0.649 | 0.036 | 0.781 | |
| 6153 | 8 49 03.50 | 12 07 55.2 | 20.157 | 0.724 | — | — | | 6189 | 8 49 05.65 | 12 14 16.6 | 17.372 | 1.055 | — | — | |
| 6154 | 8 49 03.62 | 12 06 37.0 | 19.234 | 0.720 | -0.278 | 0.909 | | 6190 | 8 49 06.93 | 11 59 05.3 | 15.896 | 1.185 | 1.081 | 1.323 | 1451,II40 |
| 6155 | 8 49 03.45 | 12 10 52.6 | 18.974 | 1.165 | — | — | | 6192 | 8 49 07.66 | 11 50 14.9 | 18.546 | 0.625 | -0.098 | 0.718 | |
| 6156 | 8 49 03.22 | 12 13 41.5 | 17.139 | 0.729 | — | — | | 6193 | 8 49 06.62 | 12 04 41.4 | 16.672 | 1.136 | 1.014 | 1.291 | |
| 6157 | 8 49 05.20 | 11 50 40.0 | 20.209 | 0.784 | -0.215 | 0.647 | | 6194 | 8 49 08.01 | 11 48 05.1 | 14.136 | 0.514 | -0.111 | — | |
| 6158 | 8 49 04.22 | 12 02 30.6 | 12.505 | 0.663 | 0.103 | 0.764 | 1285,III53 | 6195 | 8 49 06.77 | 12 03 27.4 | 15.843 | 0.958 | 0.625 | 0.997 | 1296,III55 |
| 6159 | 8 49 03.70 | 12 09 40.9 | 20.052 | 0.707 | — | — | | 6197 | 8 49 07.13 | 11 59 48.2 | 20.379 | 1.692 | — | 1.819 | |
| 6160 | 8 49 04.62 | 11 58 54.3 | 14.790 | 0.750 | 0.211 | 0.851 | 1251,II41 | 6198* | 8 49 08.18 | 11 48 38.3 | 15.774 | 1.013 | 0.625 | 1.189 | |
| 6161 | 8 49 04.98 | 11 54 59.0 | 15.289 | 0.828 | 0.392 | 0.873 | 1217,II60 | 6199* | 8 49 07.60 | 11 56 09.3 | 14.901 | 0.910 | 0.564 | 1.020 | 1436,II58 |
| 6162 | 8 49 03.52 | 12 12 56.8 | 17.991 | 1.382 | — | — | | 6200 | 8 49 08.26 | 11 48 37.1 | 19.607 | 1.474 | — | 1.011 | |
| 6163 | 8 49 03.98 | 12 10 50.2 | 15.389 | 0.879 | 0.341 | — | | 6201 | 8 49 07.18 | 12 02 34.7 | 17.815 | 0.544 | -0.053 | 0.725 | |
| 6164 | 8 49 05.14 | 11 58 28.4 | 17.255 | 0.880 | 0.507 | 0.964 | | 6202 | 8 49 07.41 | 12 01 45.7 | 20.269 | 0.874 | -0.042 | — | |
| 6165 | 8 49 05.07 | 12 00 02.9 | 20.862 | 0.314 | — | — | | 6203 | 8 49 06.79 | 12 13 45.1 | 16.742 | 0.689 | — | — | |
| 6166 | 8 49 05.02 | 12 01 02.4 | 12.729 | 0.577 | 0.079 | 0.704 | 1270 | 6204 | 8 49 06.75 | 12 15 10.0 | 18.281 | 1.422 | — | — | |
| 6167* | 8 49 05.83 | 11 51 16.7 | 14.622 | 0.808 | 0.374 | 0.916 | | 6205 | 8 49 07.29 | 12 09 08.8 | 12.809 | 0.603 | -0.003 | — | |
| (6498) | 8 49 06.15 | 11 57 25.7 | 10.78 | 0.94 | — | 0.96 | 1237, table 4 | 6206 | 8 49 08.88 | 11 50 42.4 | 20.222 | 0.936 | -0.399 | 0.927 | |
| 6168 | 8 49 06.27 | 11 48 25.5 | 18.880 | 0.407 | -0.112 | 0.649 | | 6207 | 8 49 08.37 | 11 57 10.4 | 18.666 | 1.535 | 1.146 | 1.842 | |
| 6169 | 8 49 04.65 | 12 08 10.1 | 12.906 | 0.970 | 0.577 | — | | 6208 | 8 49 07.86 | 12 05 04.2 | 20.258 | 1.752 | — | 2.216 | |
| 6170 | 8 49 05.82 | 11 54 28.0 | 18.535 | 1.499 | 0.840 | 1.837 | | 6209 | 8 49 07.99 | 12 03 39.2 | 20.262 | 0.607 | -0.222 | — | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6210 | 8 49 07.02 | 12 15 18.8 | 18.252 | 0.628 | -0.014 | — | | 6246 | 8 49 11.30 | 11 54 05.3 | 19.511 | 1.648 | — | 2.063 | |
| 6211* | 8 49 07.65 | 12 07 27.7 | 16.018 | 1.148 | 0.988 | 1.230 | | 6247* | 8 49 11.43 | 11 52 44.6 | 18.979 | 1.486 | 0.327 | 2.189 | |
| 6212 | 8 49 07.15 | 12 16 10.0 | 13.448 | 0.613 | — | — | | 6248 | 8 49 10.83 | 12 04 25.0 | 15.752 | 0.927 | 0.574 | 0.951 | 1472,III64 |
| 6213 | 8 49 09.13 | 11 52 12.2 | 13.388 | 0.577 | 0.032 | 0.708 | | (6509) | 8 49 10.95 | 11 51 45.4 | 11.721 | 0.51 | — | 0.782 | 1425, table 4 |
| 6214 | 8 49 08.89 | 11 55 26.8 | 15.677 | 0.867 | 0.472 | 0.920 | | 6249 | 8 49 10.62 | 12 07 38.4 | 20.246 | 1.431 | — | 1.448 | |
| 6215 | 8 49 08.49 | 12 00 38.2 | 17.230 | 1.505 | — | — | | 6250 | 8 49 11.67 | 11 54 59.0 | 16.095 | 1.014 | 0.748 | 1.120 | II62 |
| 6216* | 8 49 08.86 | 11 57 54.8 | 15.975 | 1.105 | 0.923 | 1.208 | II49 | 6251 | 8 49 12.10 | 11 50 32.2 | 14.628 | 0.694 | 0.134 | 0.779 | |
| 6218 | 8 49 09.53 | 11 49 50.8 | 12.690 | 0.569 | 0.000 | 0.686 | | 6252 | 8 49 12.20 | 11 50 22.6 | 14.115 | 0.632 | 0.093 | — | |
| 6219 | 8 49 09.01 | 11 57 53.8 | 20.482 | 0.566 | — | — | | 6253 | 8 49 11.63 | 11 58 02.1 | 18.817 | 1.557 | — | 1.870 | |
| 6220 | 8 49 09.75 | 11 49 17.4 | 20.489 | 0.902 | -0.353 | 0.918 | | 6254 | 8 49 11.52 | 11 59 57.2 | 13.898 | 0.700 | 0.151 | 0.746 | 1457,II44 |
| 6221 | 8 49 08.64 | 12 03 30.2 | 18.024 | 1.431 | — | — | | 6255 | 8 49 11.42 | 12 05 29.7 | 16.919 | 0.881 | 0.420 | 0.949 | |
| 6222 | 8 49 08.65 | 12 05 14.1 | 15.323 | 0.568 | -0.039 | 0.715 | 1476,III66 | 6256 | 8 49 12.08 | 11 57 20.3 | 21.038 | 1.180 | — | — | |
| 6223 | 8 49 09.08 | 12 01 06.3 | 16.074 | 0.961 | 0.463 | 0.993 | 1460,III56 | 6257 | 8 49 11.05 | 12 13 11.1 | 19.621 | 1.412 | — | — | |
| 6224 | 8 49 09.29 | 11 59 39.8 | 12.705 | 0.575 | 0.041 | 0.663 | 1456 | 6258 | 8 49 12.60 | 11 54 20.2 | 20.010 | 1.598 | — | 2.307 | |
| 6225 | 8 49 08.17 | 12 14 29.8 | 18.724 | 1.422 | — | — | | 6259 | 8 49 12.03 | 12 01 33.9 | 12.920 | 0.983 | 0.692 | 1.014 | |
| 6226 | 8 49 09.17 | 12 02 17.2 | 18.089 | 1.470 | — | — | | 6260 | 8 49 12.82 | 11 52 03.2 | 18.415 | 1.026 | 1.119 | 1.328 | |
| 6227 | 8 49 08.85 | 12 07 59.0 | 20.746 | 0.715 | -0.258 | 1.310 | | 6261 | 8 49 12.83 | 11 52 05.8 | 18.333 | 1.195 | 1.161 | 1.091 | |
| 6228 | 8 49 08.23 | 12 15 41.8 | 12.688 | 0.622 | — | — | | 6262 | 8 49 11.73 | 12 06 07.6 | 16.295 | 1.424 | 1.213 | — | |
| 6229 | 8 49 09.99 | 11 54 47.0 | 16.251 | 0.993 | 0.765 | 1.109 | 1433,II61 | (6511) | 8 49 11.90 | 12 02 45.6 | 10.600 | 0.34 | — | 0.283 | 1466, table 4 |
| 6230 | 8 49 09.16 | 12 05 38.5 | 14.593 | 0.718 | 0.144 | 0.747 | 1477,III69 | 6263* | 8 49 11.97 | 12 05 07.7 | 15.584 | 0.946 | 0.570 | 1.071 | 1475,III68 |
| 6231 | 8 49 09.13 | 12 07 36.3 | 14.504 | 0.846 | 0.369 | — | | 6264 | 8 49 11.93 | 12 05 07.0 | 19.727 | 0.840 | — | 1.351 | |
| 6232 | 8 49 08.64 | 12 14 54.2 | 13.904 | 0.637 | -0.025 | — | | 6265 | 8 49 12.54 | 11 58 44.0 | 14.381 | 0.656 | 0.112 | 0.738 | 1449,II48 |
| 6233* | 8 49 09.99 | 11 58 31.2 | 18.740 | 1.575 | 1.031 | 2.077 | | 6266 | 8 49 13.11 | 11 51 45.6 | 18.627 | 0.598 | -0.016 | 0.817 | |
| 6234 | 8 49 10.93 | 11 47 36.6 | 16.760 | 0.957 | 0.624 | 1.180 | | 6267 | 8 49 12.48 | 11 59 31.6 | 13.960 | 0.612 | 0.071 | 0.684 | 1453,II45 |
| 6235 | 8 49 09.80 | 12 01 32.7 | 20.618 | 0.683 | -0.249 | 0.829 | | 6268 | 8 49 13.12 | 11 51 48.3 | 18.612 | 0.659 | -0.050 | 0.788 | |
| 6236 | 8 49 10.90 | 11 49 53.2 | 16.575 | 0.951 | 0.627 | 1.068 | | 6269 | 8 49 12.08 | 12 04 54.8 | 15.055 | 0.775 | 0.304 | 0.827 | 1473,III67 |
| 6237 | 8 49 11.37 | 11 46 51.5 | 14.100 | 0.549 | 0.037 | 0.728 | | 6270 | 8 49 12.71 | 11 58 13.6 | 16.648 | 1.176 | 1.088 | 1.341 | |
| 6238 | 8 49 10.44 | 11 59 05.1 | 18.912 | 0.525 | -0.176 | 0.639 | | 6271 | 8 49 13.57 | 11 50 27.4 | 19.648 | 1.769 | — | 2.378 | |
| 6239 | 8 49 11.08 | 11 52 09.0 | 14.093 | 0.689 | 1.104 | 0.806 | | 6272 | 8 49 13.41 | 11 52 48.4 | 19.312 | 1.542 | — | 1.996 | |
| 6240 | 8 49 10.25 | 12 02 27.3 | 20.731 | 1.111 | — | 2.229 | | 6273 | 8 49 12.53 | 12 08 33.6 | 18.772 | 1.156 | 0.107 | 0.978 | |
| 6241 | 8 49 11.21 | 11 50 58.6 | 14.386 | 0.650 | 0.076 | 0.726 | | 6274 | 8 49 12.17 | 12 14 10.1 | 14.228 | 0.658 | -0.041 | — | |
| 6242 | 8 49 09.71 | 12 09 36.7 | 19.023 | 1.574 | — | 1.976 | | 6275 | 8 49 13.03 | 12 05 39.4 | 18.063 | 1.419 | 1.576 | 1.692 | |
| 6243 | 8 49 11.29 | 11 52 52.5 | 17.898 | 1.477 | 0.915 | 1.977 | | 6276 | 8 49 13.51 | 12 00 09.1 | 18.780 | 1.440 | 0.315 | 1.398 | |
| 6244 | 8 49 11.30 | 11 52 54.0 | 18.027 | 1.441 | — | 2.071 | | 6277 | 8 49 13.97 | 11 54 57.3 | 17.840 | 1.449 | 1.111 | — | |
| 6245 | 8 49 11.82 | 11 47 37.7 | 18.075 | 0.530 | -0.194 | 0.752 | | 6278* | 8 49 13.84 | 11 57 04.9 | 15.472 | 0.909 | 0.524 | 1.077 | 1439,II52 |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6279 | 8 49 12.69 | 12 11 30.6 | 17.800 | 1.024 | — | — | | 6313 | 8 49 15.49 | 12 04 16.9 | 12.790 | 0.584 | 0.080 | 0.675 | |
| 6280 | 8 49 14.47 | 11 50 04.2 | 16.297 | 0.950 | 0.609 | 1.058 | | 6314 | 8 49 16.79 | 11 49 39.0 | 18.779 | 1.479 | 0.865 | 1.903 | |
| 6281 | 8 49 12.97 | 12 09 20.9 | 18.315 | 1.338 | 0.586 | 0.746 | | 6315* | 8 49 15.84 | 12 01 53.7 | 18.067 | 1.496 | — | 1.850 | |
| 6282 | 8 49 12.47 | 12 15 46.5 | 17.435 | 0.846 | — | — | | 6316 | 8 49 16.30 | 11 59 32.7 | 17.461 | 0.872 | 0.442 | 0.946 | |
| 6283 | 8 49 14.67 | 11 49 59.2 | 17.576 | 0.535 | -0.055 | 0.710 | | 6317 | 8 49 16.96 | 11 52 27.1 | 18.426 | 1.559 | 0.604 | 1.854 | |
| 6284 | 8 49 13.02 | 12 11 29.9 | 17.799 | 1.015 | 0.851 | — | | 6318 | 8 49 15.99 | 12 04 24.3 | 19.255 | 1.516 | — | 2.154 | |
| 6285 | 8 49 13.45 | 12 06 34.9 | 19.722 | 0.732 | -0.318 | 0.837 | | 6319 | 8 49 16.40 | 12 02 54.3 | 17.414 | 1.535 | 1.171 | 2.044 | |
| 6286* | 8 49 14.03 | 11 59 35.1 | 16.054 | 1.057 | 0.836 | 1.187 | II46 | 6320 | 8 49 17.10 | 11 54 19.1 | 20.031 | 0.646 | — | — | |
| 6287 | 8 49 14.07 | 11 59 42.4 | 18.955 | 0.487 | -0.239 | 0.755 | | 6321 | 8 49 16.39 | 12 03 48.4 | 15.224 | 0.807 | 0.349 | 0.857 | |
| 6288 | 8 49 13.91 | 12 01 56.7 | 19.823 | 1.650 | — | 2.153 | | 6322 | 8 49 16.16 | 12 07 26.2 | 14.340 | 0.682 | 0.134 | 0.756 | 1483 |
| 6289 | 8 49 13.20 | 12 10 44.3 | 18.841 | 1.235 | — | 1.089 | | 6323 | 8 49 17.57 | 11 51 03.2 | 19.725 | 0.858 | 0.074 | 0.851 | |
| 6290* | 8 49 14.81 | 11 51 38.5 | 19.180 | 1.464 | — | 2.207 | | 6324 | 8 49 17.93 | 11 48 28.0 | 18.345 | 0.403 | -0.206 | 0.589 | |
| 6291 | 8 49 13.36 | 12 10 56.9 | 19.265 | 1.415 | — | 1.234 | | 6325 | 8 49 17.92 | 11 50 53.8 | 19.112 | 0.514 | -0.178 | 0.817 | |
| 6292 | 8 49 14.72 | 11 54 26.4 | 19.493 | 1.570 | — | — | | 6326 | 8 49 17.44 | 11 58 53.5 | 19.817 | 1.820 | — | 2.117 | |
| 6293 | 8 49 14.48 | 11 58 11.9 | 12.429 | 0.618 | 0.063 | 0.722 | 1447,II51 | 6327 | 8 49 18.46 | 11 47 28.7 | 18.583 | 1.298 | — | 1.788 | |
| 6295 | 8 49 14.42 | 11 59 18.8 | 19.789 | 0.992 | — | 1.466 | | 6328 | 8 49 18.17 | 11 52 13.2 | 19.109 | 1.206 | 0.576 | 1.359 | |
| 6296 | 8 49 14.83 | 11 55 08.1 | 18.706 | 1.391 | — | — | | 6329 | 8 49 18.67 | 11 47 20.7 | 14.741 | 0.649 | 0.051 | 0.810 | |
| 6297 | 8 49 14.82 | 11 55 31.4 | 18.627 | 1.167 | 1.099 | — | | 6330 | 8 49 17.40 | 12 05 07.4 | 18.985 | 1.435 | — | — | |
| 6298 | 8 49 15.04 | 11 53 08.0 | 14.712 | 0.699 | 0.203 | — | | 6331 | 8 49 17.47 | 12 07 29.2 | 20.340 | 1.089 | — | 1.496 | |
| 6299 | 8 49 14.94 | 11 55 08.7 | 16.735 | 0.919 | 0.448 | — | | 6332 | 8 49 18.08 | 12 00 27.5 | 13.355 | 0.577 | 0.036 | 0.686 | 1458,III59 |
| 6300 | 8 49 14.69 | 11 59 53.0 | 17.685 | 1.089 | 1.139 | 1.165 | | 6333 | 8 49 17.89 | 12 05 19.5 | 17.770 | 0.610 | -0.289 | 1.632 | |
| 6301 | 8 49 15.05 | 11 55 26.9 | 16.690 | 0.740 | 0.196 | — | | 6334 | 8 49 18.96 | 11 54 20.0 | 18.395 | 1.283 | — | — | |
| 6302 | 8 49 15.35 | 11 52 05.1 | 19.498 | 1.284 | — | 1.566 | | 6335 | 8 49 18.92 | 11 54 56.5 | 18.579 | 1.527 | — | — | |
| 6303 | 8 49 14.73 | 11 59 33.9 | 15.530 | 0.891 | 0.542 | 0.920 | 1455,II47 | 6336 | 8 49 18.73 | 11 57 23.0 | 13.151 | 0.572 | 0.016 | 0.683 | 1441,II122 |
| 6304 | 8 49 14.86 | 11 58 11.2 | 19.493 | 0.266 | 0.254 | — | | 6337 | 8 49 19.52 | 11 48 48.0 | 20.170 | 0.715 | -0.090 | 0.710 | |
| 6305 | 8 49 14.47 | 12 03 34.4 | 15.240 | 0.843 | 0.394 | 0.871 | | 6338 | 8 49 18.95 | 11 56 23.1 | 15.994 | 0.709 | 0.162 | 0.855 | |
| 6306 | 8 49 14.68 | 12 01 21.6 | 14.318 | 0.674 | 0.143 | 0.797 | | 6339 | 8 49 19.32 | 11 51 48.4 | 18.871 | 1.330 | — | 1.619 | |
| 6307 | 8 49 15.27 | 11 54 48.1 | 17.730 | 1.448 | 1.166 | — | | 6340 | 8 49 19.31 | 11 53 59.6 | 15.262 | 0.802 | 0.274 | — | |
| 6308 | 8 49 14.72 | 12 02 09.0 | 19.524 | 1.267 | — | 1.387 | | 6341 | 8 49 18.27 | 12 06 53.6 | 14.786 | 0.711 | — | — | |
| 6309 | 8 49 13.68 | 12 16 00.8 | 19.523 | 1.138 | — | — | | 6342 | 8 49 19.45 | 11 53 57.1 | 16.381 | 1.063 | 0.906 | — | |
| 6310 | 8 49 15.02 | 12 00 29.0 | 19.811 | 0.644 | -0.327 | 0.902 | | 6343 | 8 49 19.59 | 11 52 42.9 | 12.699 | 0.561 | 0.002 | 0.695 | |
| 6311 | 8 49 14.88 | 12 02 33.3 | 15.154 | 0.819 | 0.363 | 0.870 | 1465,III60 | 6344 | 8 49 19.50 | 11 55 41.7 | 19.727 | 1.737 | — | — | |
| 6312 | 8 49 16.53 | 11 48 23.3 | 18.985 | 1.502 | — | 1.627 | | 6345* | 8 49 20.34 | 11 47 19.0 | 16.204 | 1.156 | 0.871 | 1.264 | |
| (6513) | 8 49 15.32 | 12 37 12.0 | 10.02 | 1.23 | — | 1.25 | 1533, table 4 | 6346 | 8 49 19.95 | 11 52 42.6 | 19.555 | 0.499 | — | — | |
| (6512) | 8 49 15.35 | 12 06 24.0 | 10.55 | 1.10 | — | 1.06 | 1479, table 4 | 6347 | 8 49 19.44 | 11 59 07.3 | 14.578 | 0.672 | 0.115 | 0.746 | 1452,II125 |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6348 | 8 49 19.28 | 12 02 55.5 | 19.239 | 1.346 | — | — | | 6383 | 8 49 25.24 | 11 48 17.7 | 17.262 | 1.294 | 0.922 | 1.549 | |
| 6349 | 8 49 20.02 | 11 54 28.4 | 17.481 | 1.056 | 0.907 | — | | 6384 | 8 49 24.38 | 11 59 29.8 | 14.710 | 0.736 | 0.211 | 0.779 | |
| 6350 | 8 49 19.97 | 11 56 21.1 | 17.562 | 1.376 | 1.186 | — | | 6385 | 8 49 24.28 | 12 01 17.8 | 16.548 | 1.081 | 0.925 | 1.188 | |
| 6351 | 8 49 20.28 | 11 53 26.0 | 20.200 | 1.479 | — | — | | 6386 | 8 49 24.67 | 11 56 57.8 | 20.826 | 0.170 | — | — | |
| 6352 | 8 49 20.49 | 11 54 14.9 | 17.598 | 1.328 | 1.126 | — | | 6387 | 8 49 24.54 | 11 59 35.2 | 13.762 | 0.581 | -0.015 | 0.673 | 2211 |
| 6353 | 8 49 20.63 | 11 55 09.0 | 20.473 | 0.856 | — | — | | 6388 | 8 49 25.50 | 11 50 07.0 | 15.051 | 0.775 | 0.278 | 0.856 | |
| 6354 | 8 49 19.90 | 12 04 48.9 | 17.190 | 0.622 | -0.022 | 0.725 | | 6389 | 8 49 24.25 | 12 06 59.8 | 13.094 | 0.749 | 0.208 | 0.826 | 1482 |
| 6355 | 8 49 20.12 | 12 06 02.4 | 16.525 | 0.616 | 0.023 | 0.724 | | 6390 | 8 49 24.33 | 12 06 54.1 | 19.862 | 0.913 | — | — | |
| 6356 | 8 49 21.64 | 11 48 02.0 | 19.240 | 0.552 | -0.201 | 0.607 | | 6391 | 8 49 24.47 | 12 06 06.2 | 20.564 | 1.129 | — | — | |
| 6357 | 8 49 20.89 | 11 58 57.3 | 15.016 | 0.780 | 0.278 | 0.836 | 1450,II126 | 6392 | 8 49 25.06 | 11 59 20.5 | 18.784 | 0.700 | 0.111 | 0.871 | |
| 6358 | 8 49 20.97 | 11 58 50.8 | 19.836 | 0.520 | -0.243 | 0.545 | | 6393 | 8 49 25.97 | 11 49 27.1 | 20.104 | 1.423 | — | 1.441 | |
| 6359 | 8 49 21.81 | 11 50 10.0 | 15.561 | 0.698 | 0.164 | 0.765 | | 6394 | 8 49 25.97 | 11 49 31.6 | 17.787 | 0.881 | 0.370 | 0.958 | |
| 6360 | 8 49 20.94 | 12 04 28.7 | 18.632 | 1.496 | — | 1.848 | | 6395 | 8 49 25.57 | 11 58 05.5 | 14.036 | 0.615 | 0.050 | 0.718 | 1446 |
| 6361 | 8 49 21.47 | 11 58 03.1 | 15.589 | 0.779 | 0.314 | 0.835 | 1445,II124 | 6396 | 8 49 26.71 | 11 47 06.5 | 17.505 | 1.534 | — | 2.312 | |
| 6362 | 8 49 21.82 | 11 53 43.8 | 13.701 | 0.596 | -0.049 | — | | (6510) | 8 49 26.73 | 11 55 25.2 | 10.70 | 0.11 | — | — | 1434, table 4 |
| 6363 | 8 49 22.46 | 11 48 50.2 | 14.689 | 0.720 | 0.130 | 0.808 | | 6397 | 8 49 25.99 | 11 56 30.6 | 17.156 | 0.950 | 0.562 | 1.030 | |
| 6364 | 8 49 22.37 | 11 50 00.1 | 13.414 | 0.567 | 0.000 | 0.686 | | 6398 | 8 49 26.64 | 11 49 49.6 | 16.692 | 0.642 | 0.013 | 0.782 | |
| 6365 | 8 49 21.46 | 12 02 18.8 | 19.029 | 0.737 | — | — | | 6399 | 8 49 25.94 | 11 58 44.1 | 17.498 | 1.304 | 1.241 | 1.502 | |
| 6366 | 8 49 21.49 | 12 07 04.1 | 19.740 | 1.557 | — | — | | 6400 | 8 49 26.59 | 11 56 05.6 | 18.847 | 1.304 | — | — | |
| 6367 | 8 49 22.46 | 11 59 27.2 | 18.680 | 0.741 | -0.082 | 0.776 | | 6401 | 8 49 25.81 | 12 06 48.5 | 17.358 | 1.625 | 0.847 | — | |
| 6368 | 8 49 22.43 | 12 04 15.2 | 20.871 | 0.458 | — | 1.219 | | 6402 | 8 49 26.19 | 12 04 17.9 | 19.107 | 1.517 | — | 2.419 | |
| 6369 | 8 49 23.03 | 11 57 53.6 | 19.709 | 1.766 | — | 1.859 | | 6403 | 8 49 26.32 | 12 04 18.0 | 16.243 | 1.357 | 1.192 | 1.562 | |
| 6370 | 8 49 23.24 | 11 58 28.3 | 14.765 | 0.614 | 0.054 | 0.735 | 1448 | 6404 | 8 49 26.26 | 12 06 19.6 | 18.359 | 1.474 | — | 1.888 | |
| 6371 | 8 49 23.06 | 12 00 44.7 | 13.410 | 0.582 | 0.034 | 0.680 | | (6508) | 8 49 27.14 | 11 43 09.3 | 10.93 | 1.15 | — | 1.14 | 1402, table 4 |
| 6372 | 8 49 23.00 | 12 04 28.7 | 20.174 | 1.414 | — | 1.854 | | 6405 | 8 49 27.44 | 11 51 51.4 | 14.234 | 0.618 | 0.064 | 0.732 | |
| 6373 | 8 49 23.18 | 12 02 50.7 | 19.369 | 1.416 | — | 2.068 | | 6406 | 8 49 27.57 | 11 51 49.8 | 18.982 | 0.933 | — | — | |
| 6374 | 8 49 23.31 | 12 01 41.4 | 13.220 | 0.604 | 0.075 | 0.699 | | 6407 | 8 49 28.02 | 11 46 36.9 | 19.679 | 0.858 | 0.704 | 1.061 | |
| 6375 | 8 49 23.80 | 11 56 54.5 | 16.367 | 0.640 | 0.044 | 0.841 | | 6408 | 8 49 27.32 | 11 56 57.3 | 12.889 | 0.817 | 0.310 | 0.870 | 1438 |
| 6376 | 8 49 23.28 | 12 03 24.7 | 17.562 | 1.592 | 1.112 | 2.017 | | 6409 | 8 49 27.44 | 12 00 03.9 | 18.536 | 1.508 | — | 1.849 | |
| 6377 | 8 49 24.56 | 11 48 40.9 | 15.256 | 0.617 | -0.016 | 0.792 | | 6410 | 8 49 27.02 | 12 07 35.3 | 19.681 | 0.908 | — | — | |
| 6378 | 8 49 23.49 | 12 02 33.6 | 19.291 | 0.534 | -0.095 | 0.708 | | 6411 | 8 49 28.60 | 11 48 58.0 | 17.816 | 1.404 | 0.969 | 1.587 | |
| 6379 | 8 49 24.56 | 11 50 50.3 | 16.512 | 1.079 | 0.871 | 1.236 | | 6412 | 8 49 28.76 | 11 48 14.2 | 19.588 | 1.438 | — | 2.127 | |
| 6380 | 8 49 23.76 | 12 01 09.3 | 13.833 | 0.615 | 0.035 | 0.687 | | 6413 | 8 49 27.09 | 12 08 54.8 | 17.952 | 0.448 | -0.207 | 0.713 | |
| 6381 | 8 49 24.35 | 11 55 07.9 | 20.053 | 0.567 | -0.368 | — | | 6414 | 8 49 27.16 | 12 08 47.7 | 17.197 | 1.142 | 0.963 | 1.296 | |
| 6382* | 8 49 24.08 | 12 02 24.3 | 19.533 | 1.562 | — | 2.263 | | 6415* | 8 49 29.04 | 11 48 24.2 | 17.803 | 1.426 | 1.167 | 1.745 | |

TABLE 3. (continued)

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments | MMJ# | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I | comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6416 | 8 49 28.50 | 11 55 49.8 | 19.490 | 0.584 | -0.252 | — | | 6444 | 8 49 29.82 | 12 07 01.3 | 20.859 | 1.127 | — | — | |
| 6417 | 8 49 28.20 | 12 00 48.4 | 17.373 | 1.306 | 1.170 | 1.404 | | 6445 | 8 49 29.52 | 12 11 32.8 | 21.053 | 1.039 | — | 1.610 | |
| 6418 | 8 49 27.40 | 12 11 10.9 | 19.511 | 0.440 | -0.058 | 1.701 | | 6446 | 8 49 30.16 | 12 04 49.8 | 19.620 | 1.661 | — | 2.066 | |
| 6419 | 8 49 27.93 | 12 04 57.8 | 15.803 | 0.858 | 0.409 | 0.894 | | 6447 | 8 49 29.65 | 12 12 23.1 | 19.188 | 0.540 | — | 0.561 | |
| 6420 | 8 49 27.59 | 12 11 12.2 | 20.830 | 0.544 | — | — | | 6448 | 8 49 29.71 | 12 11 59.5 | 16.101 | 0.519 | — | 0.643 | |
| 6421 | 8 49 28.03 | 12 06 34.9 | 20.940 | 0.630 | — | 1.558 | | (6515) | 8 49 30.02 | 11 30 57.0 | 10.12 | 1.30 | — | 1.27 | 1557, table 4 |
| 6422* | 8 49 28.92 | 11 56 48.3 | 18.556 | 1.474 | 1.161 | 2.048 | | 6449 | 8 49 31.74 | 11 47 22.5 | 20.069 | 0.600 | -0.232 | 0.860 | |
| 6423 | 8 49 28.37 | 12 03 52.9 | 14.120 | 0.724 | 0.198 | 0.812 | 1470 | 6450 | 8 49 31.87 | 11 47 07.9 | 16.477 | 0.579 | -0.051 | 0.773 | |
| 6424* | 8 49 29.46 | 11 50 33.3 | 18.352 | 1.606 | 1.151 | 2.023 | | 6451 | 8 49 31.94 | 11 47 07.1 | 19.901 | 1.601 | — | — | |
| 6425 | 8 49 29.66 | 11 49 03.6 | 18.991 | 0.829 | 0.310 | 1.100 | | 6452* | 8 49 31.61 | 11 51 16.3 | 16.061 | 1.010 | 0.698 | 1.165 | |
| 6426 | 8 49 28.38 | 12 06 17.0 | 15.392 | 0.591 | — | 0.693 | | 6453 | 8 49 30.51 | 12 08 59.4 | 17.383 | 1.064 | 0.894 | 1.154 | |
| 6427 | 8 49 28.84 | 12 01 05.8 | 17.150 | 1.139 | 0.786 | 1.370 | | 6454 | 8 49 30.75 | 12 06 57.3 | 20.309 | 0.540 | -0.025 | 1.038 | |
| 6428 | 8 49 28.45 | 12 06 55.8 | 18.380 | 1.105 | 0.977 | 1.330 | | 6455 | 8 49 31.76 | 11 54 23.7 | 18.128 | 0.739 | 0.119 | — | |
| 6429 | 8 49 29.92 | 11 49 36.4 | 18.939 | 0.959 | 0.387 | 1.072 | | 6456 | 8 49 30.55 | 12 09 57.8 | 19.866 | 1.883 | — | 2.079 | |
| 6430 | 8 49 29.39 | 11 57 20.7 | 13.457 | 0.514 | -0.064 | 0.614 | | 6457 | 8 49 30.43 | 12 11 42.0 | 20.711 | 1.388 | — | 2.208 | |
| 6431 | 8 49 29.73 | 11 53 22.1 | 20.020 | 1.186 | — | — | | 6458 | 8 49 31.17 | 12 03 02.4 | 17.439 | 1.430 | 0.857 | 2.242 | |
| 6432 | 8 49 29.12 | 12 01 53.3 | 20.199 | 0.595 | -0.275 | 0.915 | | 6459 | 8 49 31.77 | 11 57 51.4 | 15.010 | 0.748 | 0.204 | 0.834 | |
| 6433 | 8 49 28.46 | 12 11 38.3 | 20.867 | 0.744 | — | 0.802 | | 6460 | 8 49 31.28 | 12 04 21.1 | 14.537 | 0.684 | 0.136 | 0.768 | 1616 |
| 6434 | 8 49 29.83 | 11 54 28.4 | 16.650 | 0.573 | -0.149 | — | | 6461 | 8 49 31.20 | 12 07 11.7 | 15.925 | 0.654 | -0.044 | 0.735 | |
| 6435 | 8 49 28.78 | 12 08 17.8 | 19.792 | 1.333 | — | 1.402 | | 6462 | 8 49 31.97 | 11 57 53.7 | 18.942 | 1.554 | 0.526 | — | |
| 6436 | 8 49 28.91 | 12 08 20.3 | 17.914 | 1.088 | 0.957 | 1.255 | | 6463 | 8 49 32.84 | 11 47 18.7 | 17.963 | 1.526 | 1.077 | 2.079 | |
| 6437 | 8 49 29.20 | 12 08 33.0 | 17.636 | 1.366 | 1.095 | 1.636 | | 6464 | 8 49 31.22 | 12 07 48.4 | 17.996 | 0.882 | 0.312 | 0.912 | |
| 6438 | 8 49 30.43 | 11 53 24.6 | 18.265 | 1.415 | 1.123 | — | | 6465 | 8 49 32.33 | 11 55 32.7 | 16.672 | 1.124 | 0.960 | — | |
| 6439 | 8 49 30.70 | 11 50 17.1 | 18.868 | 0.530 | -0.168 | 0.665 | | 6466 | 8 49 31.42 | 12 08 45.5 | 20.218 | 0.878 | — | 0.993 | |
| 6440 | 8 49 30.64 | 11 52 43.2 | 20.369 | 1.282 | — | 1.526 | | 6467 | 8 49 32.67 | 11 53 49.5 | 13.517 | 0.536 | -0.045 | — | |
| 6441* | 8 49 30.36 | 11 57 52.4 | 15.807 | 0.969 | 0.487 | 1.119 | | 6468 | 8 49 33.09 | 11 52 29.0 | 16.919 | 1.676 | 1.066 | 2.664 | |
| 6442 | 8 49 31.00 | 11 51 22.8 | 19.224 | 0.685 | -0.085 | 0.826 | | (6516) | 8 49 34.57 | 11 55 46.7 | 10.47 | 1.12 | — | 1.04 | 1592, table 4 |
| 6443 | 8 49 30.17 | 12 02 11.5 | 14.248 | 0.775 | 0.260 | 0.833 | 1608 | (6514) | 8 49 46.90 | 11 26 53.1 | 8.74 | 1.67 | — | 2.06 | 1553, table 4 |

TABLE 4. Bright stars.

| MMJ# | α (1950.0) | δ (1950.0) | V | B-V | V-I | Source | Comments |
|---|---|---|---|---|---|---|---|
| 6469 | 8 46 51.02 | 12 02 45.0 | 9.53 | 1.38 | 1.33 | JS | 258 |
| 6470 | 8 47 12.90 | 11 52 86.0 | 9.84 | 1.36 | 1.30 | JS | 364 |
| 6471 | 8 47 27.70 | 12 02 45.0 | 8.86 | 1.59 | 1.67 | JS | 488 |
| 6472 | 8 47 34.04 | 12 06 34.9 | 9.98 | 1.10 | 1.09 | JS | 494 |
| 6473 | 8 47 59.49 | 11 47 04.8 | 11.57 | 0.68 | — | M | 590 |
| 6474 | 8 47 36.12 | 12 32 30.0 | 10.52 | 1.23 | 1.15 | JS | 676 |
| 6475 | 8 48 05.72 | 11 46 24.5 | 11.24 | 1.10 | 1.07 | JS | 721 |
| 6476 | 8 48 19.43 | 11 56 18.3 | 11.32 | 0.295 | 0.379 | ES | 752 |
| 6477 | 8 48 11.49 | 12 03 30.3 | 12.04 | 0.60 | 0.671 | ES | 792 |
| 6478 | 8 48 16.81 | 12 12 40.6 | 11.52 | 0.70 | — | M | 838 |
| 6479 | 8 48 42.41 | 11 55 08.2 | 11.28 | 0.13 | 0.179 | ES | 968 |
| 6480 | 8 48 30.30 | 11 56 17.3 | 11.078 | 0.43 | 0.534 | S | 975 |
| 6481 | 8 48 27.72 | 11 56 38.8 | 10.03 | -0.073 | — | ES | 977 |
| 6482 | 8 48 31.96 | 11 56 40.8 | 9.72 | 1.37 | 1.36 | JS | 978 |
| 6483 | 8 48 37.50 | 11 57 23.4 | 11.44 | 1.06 | 1.05 | JS | 989 |
| 6484 | 8 48 23.70 | 11 59 25.7 | 11.55 | 0.41 | 0.514 | ES | 1013 |
| 6485 | 8 48 38.71 | 11 59 19.0 | 10.48 | 1.11 | 1.08 | JS | 1010 |
| 6486 | 8 48 33.00 | 11 59 33.1 | 10.30 | 1.26 | 1.23 | JS | 1016 |
| 6487 | 8 48 42.75 | 11 59 58.0 | 10.544 | 0.57 | 0.627 | G | 1023 |
| 6488 | 8 48 39.66 | 12 01 06.6 | 11.52 | 0.87 | 0.91 | JS | 1040 |
| 6489 | 8 48 32.90 | 12 02 03.4 | 11.20 | 1.08 | 1.08 | JS | 1054 |
| 6490 | 8 48 42.88 | 12 03 10.1 | 10.99 | 0.11 | 0.128 | ES | 1066 |
| 6491 | 8 48 37.60 | 12 03 55.1 | 11.315 | 0.61 | 0.720 | S | 1072 |
| 6492 | 8 48 28.53 | 12 03 59.1 | 10.59 | 1.12 | 1.09 | JS | 1074 |
| 6493 | 8 48 36.62 | 12 04 43.3 | 11.251 | 0.415 | 0.529 | ES | 1082 |
| 6494 | 8 48 42.01 | 12 05 09.4 | 10.48 | 1.10 | — | S | 1084 |
| 6495 | 8 48 33.92 | 12 29 27.6 | 9.37 | 1.48 | 1.50 | JS | 1135 |
| 6496 | 8 49 02.19 | 11 47 36.2 | 11.26 | 0.62 | — | M | 1190 |
| 6497 | 8 48 59.52 | 11 55 44.9 | 10.76 | 1.13 | 1.10 | JS | 1221 |
| 6498 | 8 49 06.15 | 11 57 25.7 | 10.78 | 0.94 | 0.96 | JS | 1237 |
| 6499 | 8 48 45.83 | 11 58 34.5 | 9.69 | 1.36 | 1.33 | JS | 1250 |
| 6500 | 8 49 01.00 | 11 59 04.0 | 11.52 | 1.05 | — | JS | 1254 |
| 6501 | 8 48 48.51 | 12 00 09.9 | 11.063 | 0.19 | 0.262 | G | 1263 |
| 6502 | 8 48 58.23 | 12 01 26.0 | 11.63 | 1.05 | — | JS | 1277 |
| 6503 | 8 48 44.87 | 12 01 50.7 | 10.55 | 1.12 | 1.09 | JS | 1279 |
| 6504 | 8 48 50.20 | 12 02 28.4 | 10.940 | 0.22 | 0.318 | G | 1284 |
| 6505 | 8 48 58.23 | 12 02 41.3 | 11.33 | 1.07 | — | JS | 1288 |
| 6506 | 8 48 59.68 | 12 08 00.8 | 10.58 | 1.10 | 1.08 | JS | 1316 |
| 6507 | 8 48 52.95 | 12 10 20.7 | 11.103 | 0.85 | 0.855 | M | 1327 |
| 6508 | 8 49 27.14 | 11 43 09.3 | 10.93 | 1.15 | 1.14 | JS | 1402 |
| 6509 | 8 49 10.95 | 11 51 45.4 | 11.721 | 0.51 | 0.782 | M | 1425 |
| 6510 | 8 49 26.73 | 11 55 25.2 | 10.70 | 0.11 | — | ES | 1434 |
| 6511 | 8 49 11.90 | 12 02 45.6 | 10.600 | 0.34 | 0.283 | M | 1466 |
| 6512 | 8 49 15.35 | 12 06 24.0 | 10.55 | 1.10 | 1.06 | JS | 1479 |
| 6513 | 8 49 15.32 | 12 37 12.0 | 10.02 | 1.23 | 1.25 | JS | 1533 |
| 6514 | 8 49 46.90 | 11 26 53.1 | 8.74 | 1.67 | 2.06 | JS | 1553 |
| 6515 | 8 49 30.02 | 11 30 57.0 | 10.12 | 1.30 | 1.27 | JS | 1557 |
| 6516 | 8 49 34.57 | 11 55 46.7 | 10.47 | 1.12 | 1.04 | JS | 1592 |

The photometry of stars located on overlapping frames was compared, in order to check the zero point shifts of the frames relative to one another and to evaluate the random errors of the photometry. For each filter the mean zero point and mean rms deviation were found and are given in Table 6, along with the number of frames used in the comparison. Table 6 shows that the zero points match very well.

Another test of the internal errors of the photometry was to examine the errors associated with the solution of the least-squares fit for stars which occur on more than three separate frames, most of the stars with multiple observations are located on the central frame or in the regions of overlap between frames. Figure 1 shows a plot of the standard deviations of the magnitude measurements vs $V$ magnitude and $B-V$ colors. As expected, the errors increase with fainter magnitudes and the $U-B$ colors show the greatest errors.

### *2.3 Comparison with Previous Studies*

We have compared our transformed magnitudes to previously published photometry from five independent studies. The five studies span a period of almost 30 yr, several types of detectors, and various sets of standard stars. Eggan & Sandage (1964) used photoelectric photometry calibrated by standards within M67 which in turn had been calibrated by $UBV$ standards of Johnson & Morgan (1953). Racine's (1971) photographic photometry and Gilliland's CCD photometry were both calibrated against Eggen and Sandage stars. The Chevalier & Ilovaisky (1991) CCD photometry was referenced to the Joner and Taylor stars. And Sanders (1989) used photoelectric photometry calibrated with Landolt standard stars. Our magnitudes are tabulated to the nearest thousandth of a magnitude, but in all the studies except for Chevalier & Ilovaisky (1991) the magnitudes were tabulated only to the nearest hundredth of a magnitude.

The results of these comparisons are shown in Figs. 2–6 where the residuals are in the sense: our photometry minus the previously published values. We also list the mean and the standard deviation of the residuals about the mean.

The only systematic variations between datasets in Figs. 2–6 appear in the residuals of $B-V$ with respect to the $B-V$ color in the comparison with Gilliland and with Sanders. Sanders used Landolt stars as standards, but his published photometry was a combination of photometry from up to five previous sources, so the origin of the systematic trend in his $B-V$ data cannot be traced. A comparison of the $B-V$ residuals vs $B-V$ color between Gilliland, and Chevalier and Ilovaisky, shows the same linear shift with $B-V$ color as in Fig. 4, indicating that the problem lies in the Gilliland data. The best agreement is between our data and the Chevalier and Ilovaisky data, both of which are based on CCD photometry using the Joner and Taylor stars for standards. The zero point differences between datasets are within the range expected when accounting for internal and roundoff errors, and the standard deviations are those expected for adding independent datasets each with standard deviations on the order of 0.01 mag.

## 3. A NEW STANDARD SEQUENCE

In recent years, M67 has increasingly been used as a source of photometric standard stars. Schild (1983), and Taylor & Joner (1985) set up stellar photometric sequences in the dipper asterism to be used in CCD photometry, since at that time the existing Landolt (1983) standards were too sparse and mostly too bright to be convenient for CCD work, and since M67 provides the opportunity to image stars with a wide range of colors on a single frame. The usefulness of M67 as a standard star field, however, has been limited somewhat by the fact that Taylor and Joner observed only in $V$, $R$, and $I$, and by the reported discrepancies in some of Schild's data. Landolt's latest compilation of faint $UBVRI$ standard (1992) has eased the situation a great deal, but a standard sequence in M67 is still desirable, not only as a quick reference field for general photometry but also for future studies of the cluster itself.

TABLE 5. Sanders to MMJ cross references.

| Sanders | MMJ# | Sanders | MMJ# | Sanders | MMJ# | Sanders | MMJ# | Sanders | MMJ# | Sanders | MMJ# |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 492 | 5520 | 948 | 5600 | 1015 | 5577 | 1081 | 5800 | 1252 | 6073 | 1441 | 6336 |
| 729 | 5336 | 949 | 5533 | 1017 | 5478 | 1083 | 5825 | 1253 | 5847 | 1445 | 6361 |
| 730 | 5348 | 950 | 5680 | 1018 | 5764 | 1085 | 5539 | 1255 | 5995 | 1446 | 6395 |
| 731 | 5335 | 951 | 5489 | 1019 | 5748 | 1086 | 5588 | 1256 | 6039 | 1447 | 6293 |
| 733 | 5249 | 952 | 5497 | 1021 | 5522 | 1087 | 5753 | 1260 | 5937 | 1448 | 6370 |
| 735 | 5402 | 953 | 5797 | 1024 | 5739 | 1088 | 5601 | 1261 | 6130 | 1449 | 6265 |
| 736 | 5389 | 954 | 5640 | 1025 | 5508 | 1089 | 5532 | 1262 | 5992 | 1450 | 6357 |
| 737 | 5347 | 956 | 5633 | 1026 | 5499 | 1090 | 5526 | 1264a | 5877 | 1451 | 6190 |
| 740 | 5354 | 959 | 5636 | 1027 | 5781 | 1091 | 5470 | 1264b | 5882 | 1452 | 6347 |
| 741 | 5313 | 959 | 5727 | 1028 | 5563 | 1092 | 5838 | 1265 | 6065 | 1453 | 6267 |
| 742 | 5393 | 960 | 5623 | 1029 | 5709 | 1093 | 5656 | 1266 | 5978 | 1455 | 6303 |
| 746 | 5261 | 962 | 5817 | 1030 | 5803 | 1189 | 5900 | 1268 | 6177 | 1456 | 6224 |
| 747 | 5414 | 963 | 5595 | 1031 | 5741 | 1201 | 5989 | 1269 | 6080 | 1457 | 6254 |
| 748 | 5340 | 964 | 5622 | 1032 | 5813 | 1203 | 5981 | 1270 | 6166 | 1458 | 6332 |
| 750 | 5264 | 965 | 5769 | 1033 | 5567 | 1206 | 6088 | 1271 | 5969 | 1460 | 6223 |
| 753 | 5243 | 966 | 5704 | 1034 | 5644 | 1209 | 6041 | 1272 | 6089 | 1465 | 6311 |
| 754 | 5372 | 967 | 5629 | 1035 | 5657 | 1210 | 5845 | 1273 | 6047 | 1470 | 6423 |
| 756 | 5388 | 969 | 5705 | 1036 | 5833 | 1212 | 6139 | 1274 | 5925 | 1472 | 6248 |
| 757 | 5405 | 970 | 5719 | 1038 | 5666 | 1213 | 6031 | 1275 | 6018 | 1473 | 6269 |
| 758 | 5334 | 971 | 5810 | 1039 | 5459 | 1214 | 6049 | 1278 | 5869 | 1475 | 6263 |
| 759 | 5392 | 972 | 5615 | 1041 | 5807 | 1215 | 5841 | 1280 | 5940 | 1476 | 6222 |
| 760 | 5263 | 973 | 5583 | 1042 | 5457 | 1216 | 6076 | 1281 | 5972 | 1477 | 6230 |
| 761 | 5367 | 974 | 5552 | 1043 | 5547 | 1217 | 6161 | 1282 | 6027 | 1482 | 6389 |
| 762 | 5378 | 976 | 5695 | 1044 | 5511 | 1218 | 5966 | 1283 | 5873 | 1483 | 6322 |
| 764 | 5317 | 979 | 5691 | 1045 | 5654 | 1219 | 5863 | 1285 | 6158 | 1608 | 6443 |
| 766 | 5328 | 981 | 5594 | 1046 | 5625 | 1220 | 6125 | 1286 | 5952 | 1616 | 6460 |
| 769 | 5319 | 982 | 5776 | 1048 | 5829 | 1222 | 6142 | 1287 | 5917 | 2201 | 5365 |
| 770 | 5357 | 983 | 5437 | 1049 | 5573 | 1223 | 6068 | 1289 | 5879 | 2202 | 5551 |
| 771 | 5332 | 984 | 5699 | 1050 | 5639 | 1224a | 6176 | 1292 | 5961 | 2203 | 6084 |
| 773 | 5377 | 985 | 5505 | 1051 | 5685 | 1224b | 6175 | 1293 | 6050 | 2204 | 5688 |
| 775 | 5371 | 986 | 5624 | 1052 | 5534 | 1225 | 6135 | 1294 | 5910 | 2205 | 5679 |
| 776 | 5413 | 987 | 5608 | 1053 | 5544 | 1226 | 6112 | 1296 | 6195 | 2206 | 5591 |
| 781 | 5362 | 990 | 5464 | 1055 | 5471 | 1227 | 6046 | 1297 | 5857 | 2207 | 5929 |
| 783 | 5422 | 991 | 5485 | 1056 | 5580 | 1229 | 5904 | 1298 | 6085 | 2208 | 5927 |
| 785 | 5346 | 993 | 5441 | 1057 | 5683 | 1230 | 6103 | 1299 | 6071 | 2209a | 5760 |
| 787 | 5387 | 994 | 5716 | 1060 | 5651 | 1231 | 5855 | 1300 | 6060 | 2209b | 5763 |
| 789 | 5408 | 995 | 5675 | 1061 | 5546 | 1232 | 5837 | 1301 | 6048 | 2211 | 6387 |
| 794 | 5318 | 996 | 5835 | 1062 | 5733 | 1233 | 6106 | 1302 | 5926 | 2212 | 5884 |
| 795 | 5391 | 997 | 5667 | 1063 | 5542 | 1234 | 5896 | 1304 | 5924 | 2213 | 5517 |
| 796 | 5412 | 998 | 5610 | 1064 | 5718 | 1235 | 5964 | 1305 | 5997 | 2214 | 5370 |
| 797 | 5419 | 999 | 5643 | 1065 | 5831 | 1236 | 5948 | 1307 | 5949 | 2215 | 6005 |
| 801 | 5424 | 1000 | 5756 | 1067 | 5455 | 1239 | 6107 | 1308 | 5864 | 2216 | 5770 |
| 802 | 5360 | 1002 | 5518 | 1068 | 5578 | 1240 | 6134 | 1309 | 6008 | 2217 | 5646 |
| 806 | 5350 | 1003 | 5562 | 1069 | 5853 | 1242 | 5993 | 1310 | 6077 | 2220 | 5597 |
| 940 | 5530 | 1004 | 5768 | 1070 | 5671 | 1243 | 6090 | 1311 | 5956 | 2221 | 5559 |
| 941 | 5771 | 1005 | 5571 | 1071 | 5842 | 1244 | 6058 | 1312 | 6015 | 2222 | 5524 |
| 942 | 5444 | 1006 | 5820 | 1073 | 5795 | 1245 | 6114 | 1313 | 6019 | 2223 | 5871 |
| 943 | 5828 | 1007 | 5790 | 1075 | 5692 | 1246 | 5922 | 1314 | 5932 | 2224 | 5454 |
| 944 | 5794 | 1009 | 5653 | 1076 | 5586 | 1247 | 6010 | 1433 | 6229 | | |
| 945 | 5744 | 1011 | 5844 | 1077 | 5451 | 1248 | 5963 | 1436 | 6199 | | |
| 946 | 5698 | 1012 | 5777 | 1078 | 5826 | 1249 | 6144 | 1438 | 6408 | | |
| 947 | 5730 | 1014 | 5788 | 1079 | 5725 | 1251 | 6160 | 1439 | 6278 | | |

We have selected a sample of stars in the cluster which appear to be suitable standards based on the following criteria.

(1) The star is brighter than $m_V = 14.0$.

(2) The star is located within 5 arcmin of the center of the cluster, (defined to be at $\alpha = 8$ 48 42.75 and $\delta = 11$ 59 58.0, 1950.0).

TABLE 6. Frame-to-frame residuals.

| | V | B | U | I |
|---|---|---|---|---|
| Zero Pt. | 0.002 | 0.002 | -0.001 | 0.000 |
| rms dev. | 0.012 | 0.011 | 0.038 | 0.016 |
| # frames | 35 | 35 | 35 | 27 |

(3) Magnitudes for the star were measured on at least 4 separate frames in this study.

(4) Published photometry from at least 2 other sources exists for the star.

(5) Mean $V$ and $B-V$ magnitudes derived from the available data have standard deviations of less than 15 mmag.

(6) The star is not listed as a known variable. Criteria 3, 4, and 5 provide some check against this, but sensitive time series studies (Gilliland & Brown 1988; Gilliland *et al.* 1991; Gilliland & Brown 1992) have identified a number of short period variable stars in M67. We have used those studies as a check against low-level variability. For instance, our star 5855, Gilliland's No. 42, is listed as having

TABLE 7. Standard stars.

| MMJ# | Fig ID | α (1950.0) | δ (1950.0) | V | B-V | U-B | V-I |
|---|---|---|---|---|---|---|---|
| 6505 | 1 | 8 48 58.23 | 12 02 41.3 | 11.328 | 1.072 | 0.910 | — |
| 6504 | 2 | 8 48 50.20 | 12 02 28.4 | 10.968 | 0.238 | 0.214 | 0.318 |
| 5871 | 3 | 8 48 45.73 | 12 02 47.9 | 13.316 | 0.494 | -0.016 | 0.640 |
| 6503 | 4 | 8 48 44.87 | 12 01 50.7 | 10.553 | 1.121 | 1.014 | 1.090 |
| 6489 | 5 | 8 48 32.90 | 12 02 03.4 | 11.184 | 1.077 | 0.939 | 1.080 |
| 5559 | 6 | 8 48 30.30 | 12 01 57.2 | 13.403 | 0.575 | 0.068 | 0.683 |
| 5534 | 7 | 8 48 28.54 | 12 01 51.4 | 13.669 | 0.562 | 0.079 | 0.694 |
| 5573 | 8 | 8 48 31.22 | 12 01 31.3 | 12.812 | 0.563 | 0.091 | 0.680 |
| 5813 | 9 | 8 48 42.43 | 12 00 37.8 | 13.499 | 0.569 | 0.060 | 0.700 |
| 5781 | 10 | 8 48 40.86 | 12 00 18.2 | 13.259 | 0.596 | 0.056 | 0.697 |
| 5739 | 11 | 8 48 38.82 | 12 00 06.7 | 12.711 | 0.565 | 0.004 | 0.678 |
| 6487 | 12 | 8 48 42.75 | 11 59 58.0 | 10.512 | 0.584 | 0.044 | 0.627 |
| 5844 | 13 | 8 48 44.62 | 11 59 19.8 | 13.830 | 0.636 | 0.084 | 0.803 |
| 6485 | 14 | 8 48 38.71 | 11 59 19.0 | 10.479 | 1.104 | 1.003 | 1.070 |
| 6486 | 15 | 8 48 33.00 | 11 59 33.1 | 10.305 | 1.264 | 1.320 | 1.221 |
| 5522 | 16 | 8 48 28.12 | 11 59 51.5 | 13.903 | 0.578 | 0.064 | 0.688 |
| 6499 | 17 | 8 48 45.83 | 11 58 34.5 | 9.685 | 1.357 | 1.464 | 1.330 |
| 5571 | 18 | 8 48 31.36 | 11 58 48.4 | 12.668 | 0.507 | 0.057 | 0.599 |
| 5562 | 19 | 8 48 30.68 | 11 58 40.9 | 12.821 | 0.566 | 0.081 | 0.655 |
| 5667 | 20 | 8 48 35.84 | 11 58 17.5 | 12.125 | 0.459 | 0.021 | 0.556 |
| 5675 | 21 | 8 48 36.06 | 11 57 58.9 | 12.770 | 0.559 | 0.036 | 0.661 |
| 5688 | 22 | 8 48 36.52 | 11 57 33.6 | 12.895 | 0.454 | 0.007 | 0.568 |
| 6483 | 23 | 8 48 37.50 | 11 57 23.4 | 13.186 | 0.577 | 0.068 | 0.682 |
| 5679 | 24 | 8 48 36.28 | 11 57 09.6 | 13.154 | 0.574 | 0.049 | 0.675 |
| 5624 | 25 | 8 48 33.94 | 11 57 11.2 | 12.728 | 0.564 | 0.065 | 0.685 |
| 5896 | 26 | 8 48 47.20 | 11 57 08.4 | 12.649 | 0.577 | 0.029 | 0.700 |
| 5695 | 27 | 8 48 36.76 | 11 56 19.7 | 13.097 | 0.609 | 0.080 | 0.709 |
| 6482 | 28 | 8 48 31.96 | 11 56 40.8 | 9.711 | 1.373 | 1.539 | 1.352 |
| 6481 | 29 | 8 48 27.72 | 11 56 38.8 | 10.027 | -0.086 | -0.385 | -0.068 |
| 5464 | 30 | 8 48 24.56 | 11 57 28.2 | 13.424 | 0.576 | 0.038 | 0.689 |

a variability of 0.0028 mag. It meets our criteria 1–5, but has been excluded from our list.

The stars fitting the above criterion are listed in Table 7. The star numbers in column 1 refer to Table 3, while column 2 numbers are only to identify stars in the finding chart, Fig. 7. The finding chart, Fig. 7, is a 30 s exposure through a $V$ filter with north up and east to the left. The star number given on the chart refers to the star nearest the number.

As we noted earlier, our measurements seem to be on the same photometric system as other studies, and since we have deliberately chosen stars for which the internal errors are small, the tabulated values are simple means of our data combined with published data from Eggen & Sandage (1964), Janes & Smith (1984), Gilliland *et al.* (1991), Racine (1971), Chevalier & Ilovaisky (1991), and Joner & Taylor (1990). All data except Racine's were weighted equally. Due to the higher scatter in Racine's photographic magnitudes, his photometry was weighted half as much as the rest. For $U-B$ and $V-I$ colors all available data were used. The stars in the sample span a range of colors from $B-V$ of $-0.09$ to 1.37 as well as $V$ magnitudes from 9.69 to 13.90. Subsets of this set of standards should thus be useful regardless of telescope configuration or CCD size. Further work to investigate possible low-level light variations, of the kind found by Gilliland *et al.* (1991) would still be of value to confirm the constancy of these standards, however.

## 4. DATA ANALYSIS

### *4.1 Color–Magnitude and Color–Color Diagrams*

A $V$, $B-V$ color–magnitude diagram, for all 1468 stars listed in Table 3, is shown in Fig. 8. A distinct main sequence extends to the limit of the photometry at $V=20$th magnitude. Because of the large area covered by the survey, the color–magnitude diagram also includes a large number of field stars, especially at fainter magnitudes. A visual comparison between our color–magnitude diagram and the color–magnitude diagram of Gilliland *et al.* (1991), gives the appearance that Gilliland's diagram has a slightly tighter main-sequence ridge line. This is to be expected since Gilliland's random errors are smaller than ours, and in the outer regions of our survey most stars were only observed once. Further, our much larger field also means the cluster sequences are contaminated with many field stars.

The main sequence is more readily apparent when looking at the $V$ vs $V-I$ plot in Fig. 9. There are fewer stars in Fig. 9 than Fig. 8 because the $I$ band was not observed during the November observing run, and some fields were missed near the outer edge of the cluster.

Figure 10 is the color–magnitude diagram of the stars which Girard *et al.* (1989) found to be proper motion members of the cluster at the 90% probability level. To the limit of the proper motions near $m_V=16$, almost all stars in the region are cluster members, since only a few of the brighter stars in Fig. 8 are missing from Fig. 10. However, there are no stars below the main sequence in Fig. 10, so the large number of faint stars below the main sequence in Figs. 8 and 9 are presumably nonmembers.

The $U-B$, $B-V$ two-color diagram for M67 main-sequence stars is shown in Fig. 11. The diagram includes only stars with $V$ magnitudes between 14 and 18 that are within 0.2 mag of the main sequence. While some cluster members may have been excluded, the large majority of stars in Fig. 11 should be cluster members. Also shown in Fig. 11 is the Schmidt-Kaler (1982) empirical two-color curve shifted to fit the observed sequence. The same stars on the main sequence between $V$ magnitudes of 14 and 18, are also shown in a $B-V$ vs $V-I$ diagram in Fig. 12.

Using the reddening line coefficients given by Crawford & Mandwewala (1976) it was not possible to match the Schmidt-Kaler line and the observed cluster sequence without adding an ultraviolet excess $\delta(U-B)=0.025$ to the reddening of $E(B-V)=0.05$. The estimated errors in reddening and ultraviolet excess are 0.01 mag each.

The value of $E(B-V)=0.05$ found here is consistent with other reddening estimates found for the cluster. Eggen & Sandage (1964) derived a value of 0.06, Racine (1971) found a value of 0.09, Nissen *et al.* (1987) using *uvbyHβ* photometry found a value of 0.032, and Taylor (1978), in an exhaustive analysis, found $E(B-V)=0.053 \pm 0.005$. For the $U-B$ color excess Janes & Smith (1984), using DDO photometry, found a $\delta(U-B)=0.056\pm0.006$ for giant branch stars.

The metallicity for the cluster can be estimated using $\delta(U-B)$ at $B-V=0.6$. Cameron (1985) fit a second-order polynomial through data from clusters with known metallicity and $\delta(U-B)_{0.6}$ to find a relation between [Fe/H] and $\delta(U-B)_{0.6}$. Using Cameron's relation and $\delta(U-B)=0.025$ the metallicity of M67 is $[Fe/H]=-0.05$, a value consistent with Janes & Smith (1984), who found $[Fe/H]=-0.05\pm0.03$, and Hobbs & Thorburn

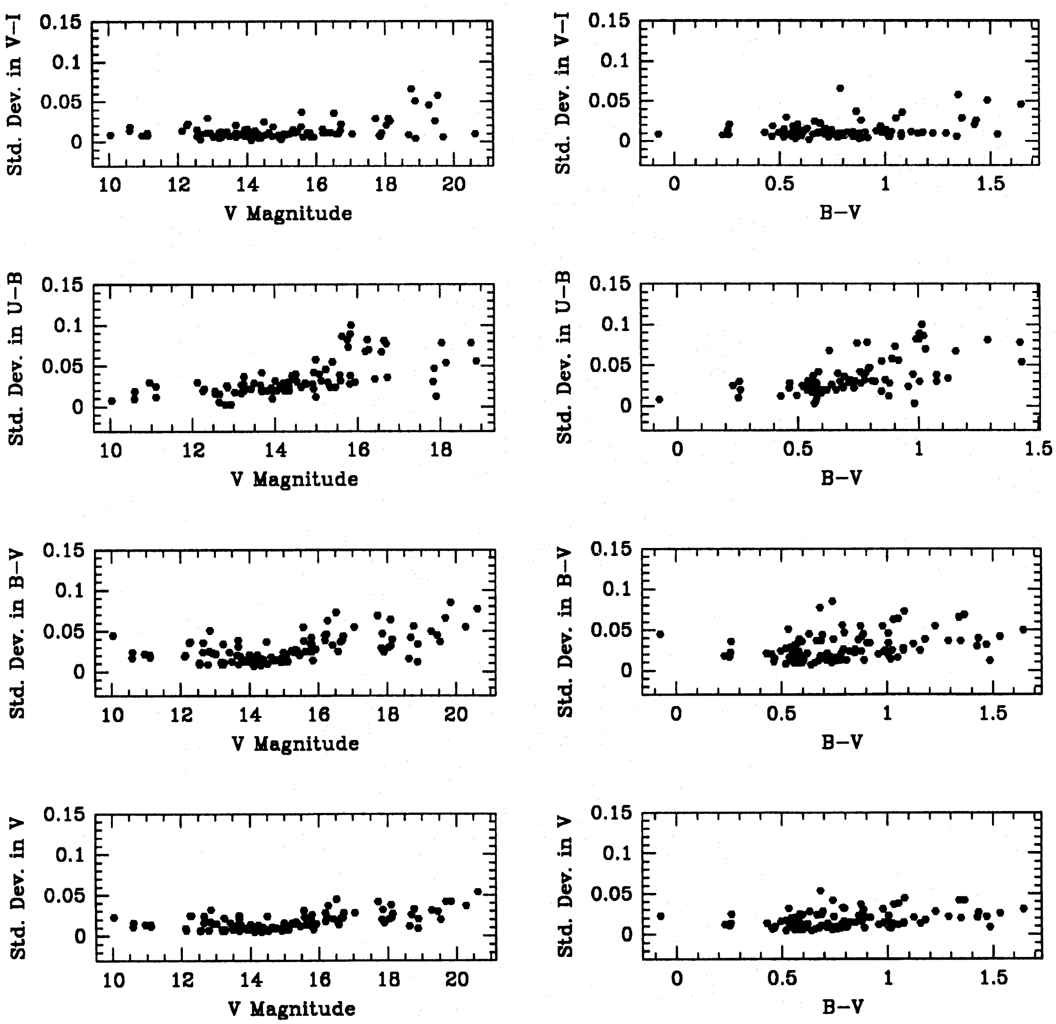


FIG. 1. Plot of the standard deviations in $V$ magnitude and $B-V$, $U-B$, and $V-I$ colors vs both $V$ magnitude and $B-V$ color for stars in which more than one measurement was obtained.

(1991) who used spectra of five stars near the cluster turnoff point to derive a value of $[Fe/H]=-0.04\pm0.12$.

### 4.2 *Isochrones*

Having specified the reddening and metallicity of M67, we can determine the age and distance modulus of the cluster by fitting isochrones to the data. We first compared our photometry with the theoretical isochrones of Castellani *et al.* (1992, hereafter referred to as C92). The C92 isochrones are based on computed stellar models with $Z=0.02$, $Y=0.27$, and $\alpha=1.6$ determined by a comparison with standard solar data. Transformations to the $V$, $B-V$ plane were based on the CCD-compatible color–temperature relations defined for stars of solar temperature or cooler by Arribas & Martinez (1989) and for stars of higher temperature by Buser & Kurucz (1978). Bolometric corrections for these transformations were taken from VandenBerg (1983).

Figure 13 shows our data near the turnoff point as well as the 3, 4, and 6 billion yr isochrones from C92, matched to our data using $E(B-V)=0.05$. From the fitting, a distance modulus of $(m-M)_V=9.60$ is appropriate, along with a cluster age (from the main sequence turnoff) between 3 and 4 billion yr. However, none of the isochrones matches the red giant branch, the theoretical isochrones being bluer than the observed colors. The observed colors of the clump stars, like those of the giants, are redder than theoretical predictions.

Castellani *et al.* (1992) defined two methods for determining a cluster's age from its color–magnitude diagram. The first method is to use the difference in magnitudes between the $B-V$ color of the turnoff and the color of the red giant branch at the level of the clump stars; the second method is the $V$ magnitude difference between the brightest point of the turnoff and the clump stars. We derive an age of 3.6 billion yr from the $B-V$ color difference using the color of the turnoff as $B-V=0.53$ and the color of the red giant branch at the clump of $B-V=1.09$. An age of

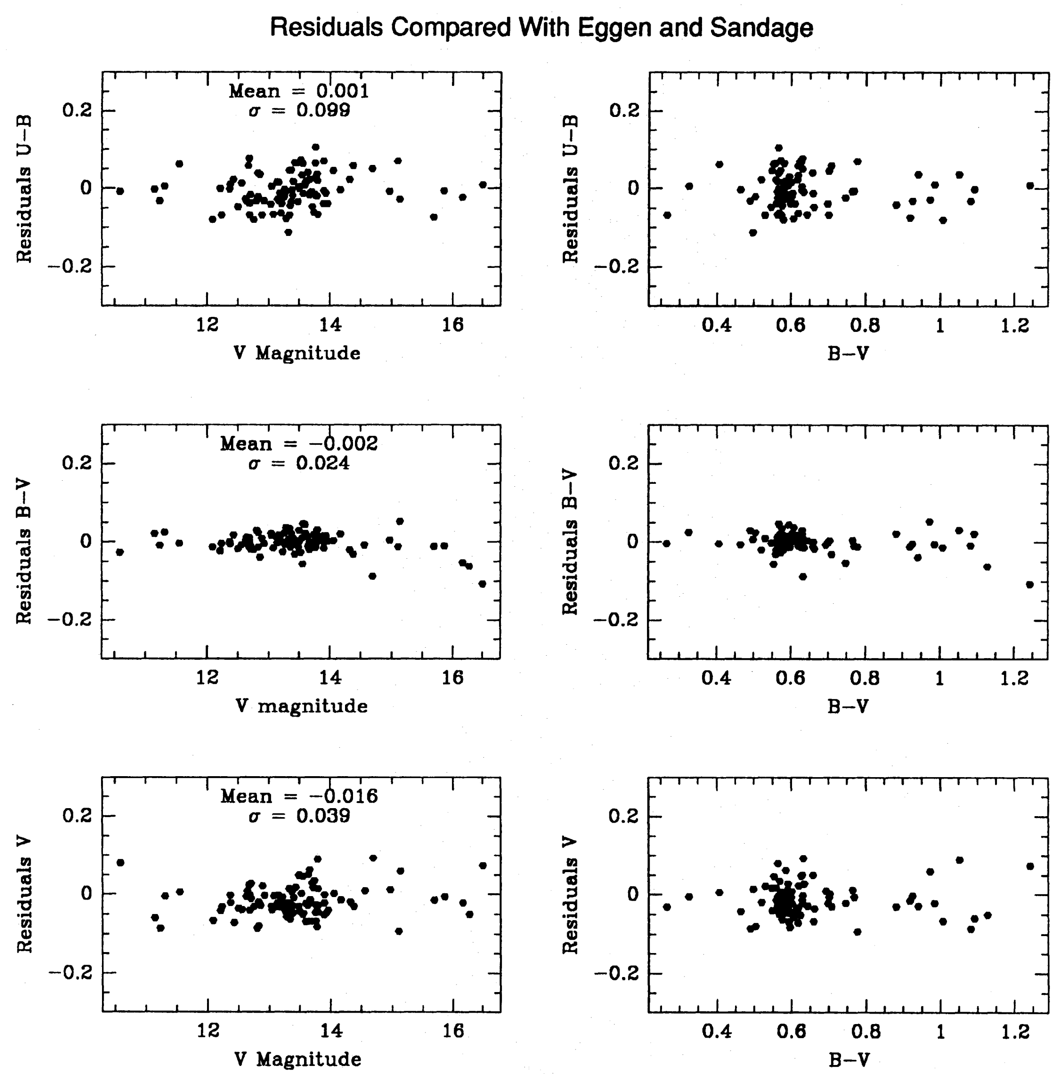


FIG. 2. Comparison of the residuals obtained when comparing our photometry and that of Eggen & Sandage (1964). The residuals are in the form of ours minus theirs. Also given is the mean and the standard deviation about the mean.

3.4 billion yr was derived using the $V$ magnitude difference between the clump stars at $V=10.55$ and the turnoff at $V=12.63$. Though the locations of the turnoff color and brightest $V$ magnitude at the turnoff are poorly defined because of confusion with the binary star sequence, these ages do agree well with the age determined by straightforward isochrone fitting.

A second comparison was made with isochrones from VandenBerg (1985, hereafter referred to a V85). The V85 solar-type models were computed with $Y=0.25$, $Z=0.0169$, and $\alpha=1.6$, the color–temperature relations were taken from unpublished Kurucz calculations, see V85, and the bolometric corrections from VandenBerg & Bell (1985) as well as Buser & Kurucz (1978). As suggested by VandenBerg, a correction was added to the model stars redder than $B-V=0.4$. Both the corrected isochrones and the original isochrones were fit to our data, using the same color excess as used in the comparison with the C92 models.

The best fit to VandenBerg's models is achieved by interpolating between his 5 and 6 billion yr isochrones, from which we determine a distance modulus of $(m-M)_V=9.6$ and an age of 5.5 billion yr. The poor match to the data shows that a color correction to the isochrones is indeed necessary, as the isochrone is too blue for most of the main sequence. In Fig. 14 the corrected 5 billion year old isochrone was matched to the data, but it still deviates from the lower main sequence. None of the V85 isochrones fit the hook region near the turnoff.

As a check on the color temperature relations the V85 5 billion year old isochrone was matched to the $V$, $V-I$ color–magnitude diagram, (Fig. 15). The same distance modulus was used and the $E(B-V)=0.05$ was converted to $E(V-I)=0.065$ by using the ratio of $E(V-I)/$

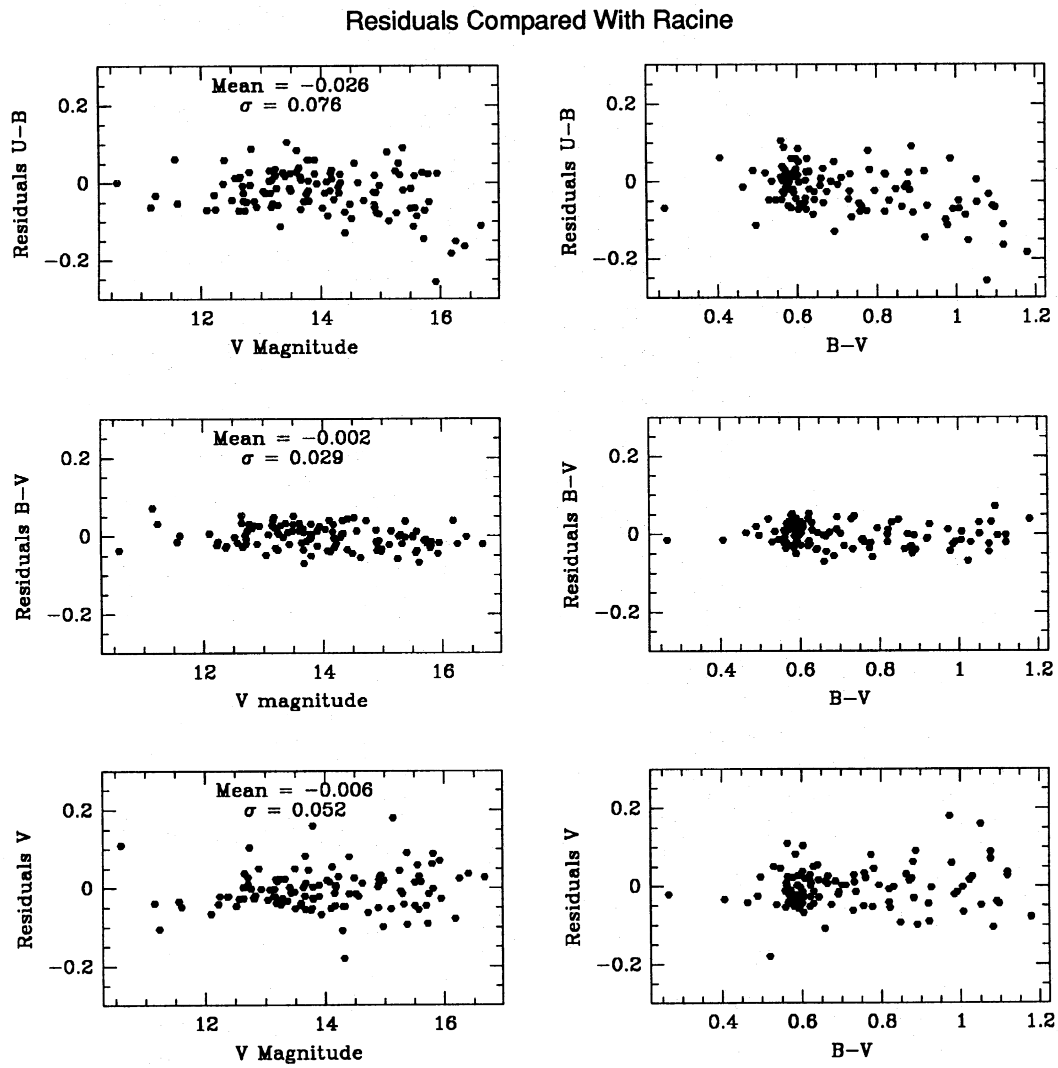


FIG. 3. Comparison of the residuals obtained when comparing our photometry and that of Racine (1971) (see Fig. 2).

$E(B-V)=1.3$ as determined by Dean (1978). The fit is noticeably worse than that for the $V$, $B-V$ color–magnitude diagram. The red end of the subgiant branch does not fit well and the theoretical main sequence is too red. The best fit in the $V$, $V-I$ color–magnitude diagram was found by using a 6 billion year old isochrone and a corrected distance modulus $(V-M_V)=9.85$.

In their earlier study of M67, Hobbs & Thorburn (1991) found an age of 5.2 billion yr by taking the effective temperatures derived from spectra of stars in the turnoff region and matching them to new unpublished isochrones of VandenBerg. Nissen & Twarog (1987), using *uvbyHβ* photometry and an $E(b-y)$ of 0.023, found an age of 5 billion yr and a distance modulus of $9.61\pm0.04$. VandenBerg, using the isochrones from V85 and $E(B-V)$ of 0.06, determined an age of 5 billion yr and a distance modulus, $(m-M)_V=9.50$. Demarque *et al.* (1992) using the revised Yale isochrones with new opacities and color–temperature relations found an age of $4.0^{+1.0}_{-0.5}$ billion yr by using a $E(B-V)=0.06$ and $(m-M)_V=9.60$. Gilliland & Brown (1992), using their own evolutionary models, found an age of 4 billion yr by adopting the reddening values and distance modulus of Nissen & Twarog (1987).

### *4.3 Main Sequence and Binary Sequence*

The distribution of stars across the main sequence in the $V$ vs $V-I$ color–magnitude diagram was determined by modeling the main sequence as four straight line segments between $V$ magnitudes of 14 and 20 and taking the perpendicular distance of each star from the line segments. Figure 16 shows the number of stars vs distance from the main sequence in 0.1 mag bins, where a positive distance indicates a star is above the main sequence and a negative distance represents one below the main sequence.

The peak in the distribution at 0.7 mag above the main sequence is the expected position for main-sequence binary

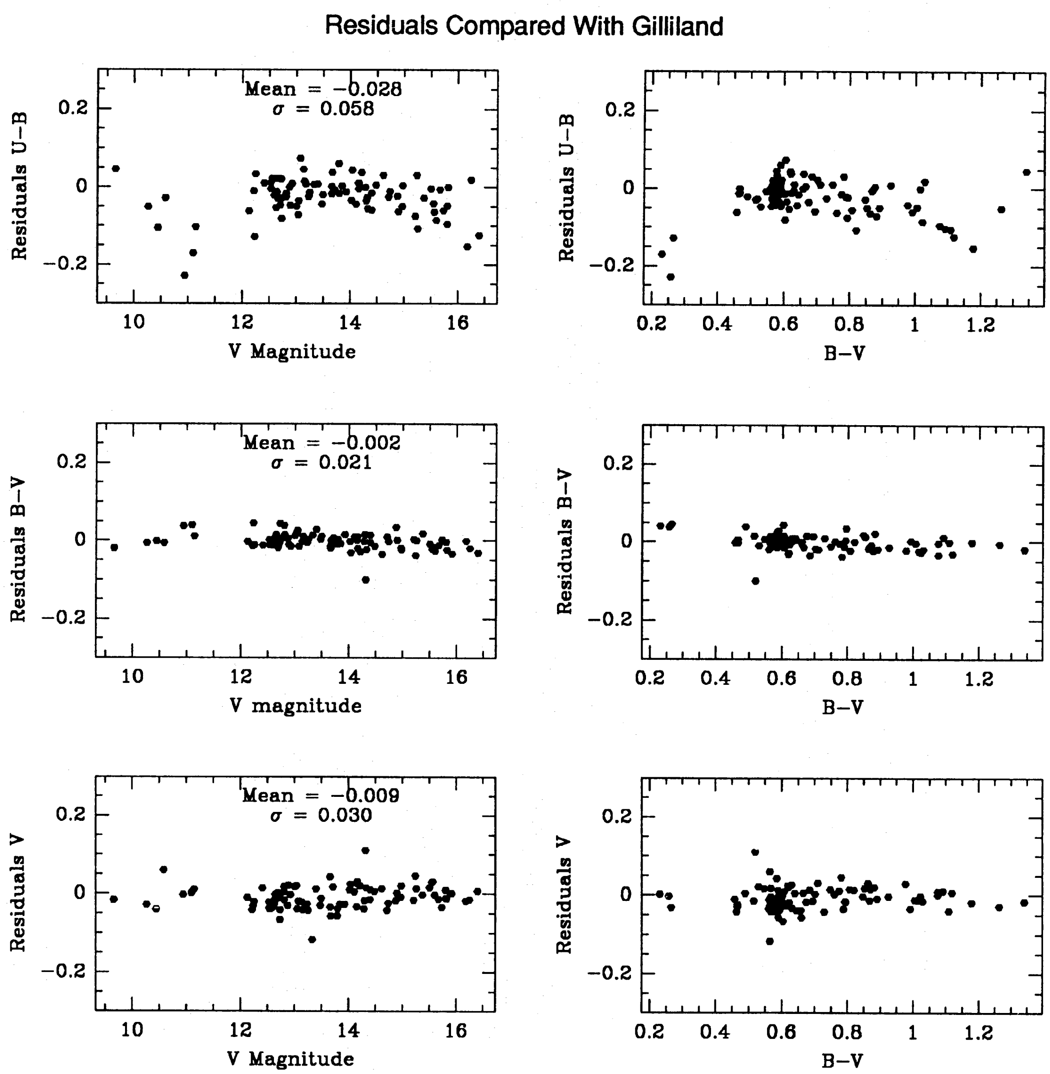


FIG. 4. Comparison of the residuals obtained when comparing our photometry and that of Gilliland *et al.* (1991) (see Fig. 2).

stars with components of equal mass (Maeder 1968). Binaries with components of unequal mass lie in the region between the main sequence and binary sequence. Below the main sequence are fainter, more distant field stars which are also present in the main sequence and binary sequence peaks. To estimate the extent of field-star contamination to these peaks, a polynomial was fit through the background distribution. It is shown as the dotted line in Fig. 16. A simple estimate of the percentage of equal mass component binaries can then be made by comparing the number within the binary sequence to the total number of stars. This gives an estimate of 22% of the cluster members being binary stars, but since binaries of low mass ratios are not detected in this way, this percentage is a lower limit.

To better account for the low-mass-ratio binaries, a Gaussian function was fit to the main sequence to account for the single star population. This is shown as the dashed line in Fig. 16. The standard deviation of the fit to the Gaussian was 0.076 mag, a value which includes both errors in the photometry and the errors incurred by approximating the main sequence as a series of line segments. The difference between the raw curve and the two "contaminant" distributions, i.e., the field stars and the single main-sequence stars, gives an estimate to the number of binary stars. Dividing the number of binary stars by the total number of stars yields a binary or unresolved visual double frequency of 38%. However, this method still does not account for binary stars in which the mass ratio is so low that the system appears to lie on the main sequence. As a comparison, Stauffer (1984) found by photometric means that the Pleiades had a binary frequency of 26% and spectroscopic studies by Abt & Levy (1976) on G field stars found a binary frequency of 57%.

Some of the uncertainty here can be resolved by further spectroscopic observations of the stars in the photometric binary sequence, although even these studies are sensitive primarily to systems of nearly equal mass.

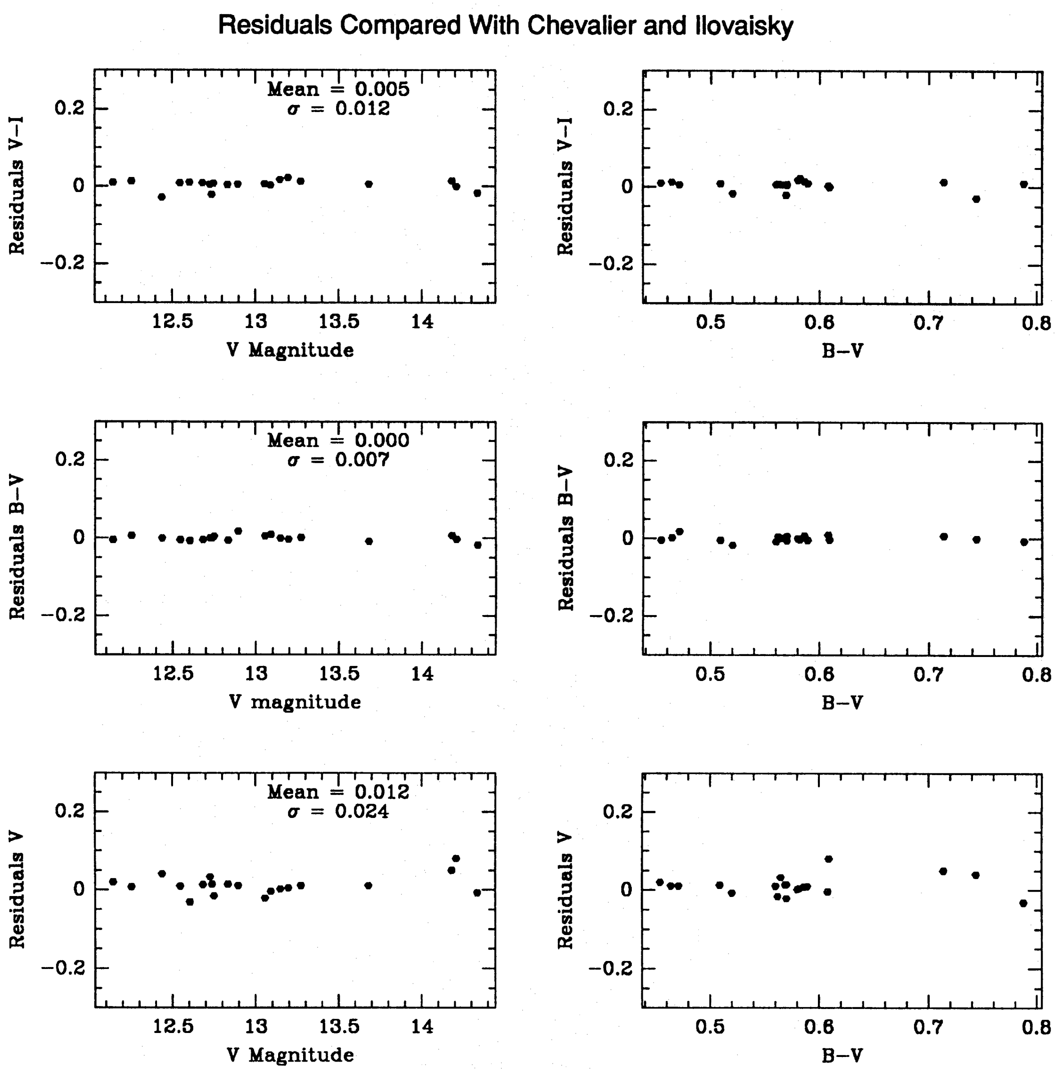


FIG. 5. Comparison of the residuals obtained when comparing our photometry and that of the Chevalier & Ilovaisky (1991) (see Fig. 2).

### 4.4 *The Stellar Density Profiles of M67*

Because our study did not reach the edge of the cluster, a full analysis of the structure of the cluster was not possible. However, a simple investigation of the spatial distribution of stars in M67 was undertaken. This was done by taking annuli with a width of 100 pixel centered on the cluster center (defined as the centroid of all star positions within a radius of 1000 pixel of the origin of our central frame) and counting the numbers of stars falling within each annulus. In the outer regions, where a full annulus could not be fit, the counts were corrected by the fraction of the annulus falling outside the region we observed. The resulting radial density distribution is shown in Fig. 17, where the error bars were calculated assuming that the number of stars in a bin was governed by Poisson statistics. The average volume density of stars within the cluster can be calculated using the true distance modulus of 9.45 the two-dimensional distribution of Fig. 17, and the assumption of a spherical distribution of stars. The density at the edge of the cluster was used as the background field-star density and was subtracted from the other regions. For the inner region of the cluster, bounded by the sharp inflection of the distribution at 350 pixel on Fig. 17, we derive an average density of 59.67 stars/pc$^3$ and a mean separation of 0.159 pc. If, alternately, we calculate the density at the edge of the cluster, taken to be at a distance of 11.55 arcmin, we find an average density of 11.04 stars/pc$^3$ with a mean separation of 0.289 pc.

To further investigate whether there is any tendency for mass segregation in a cluster of this age, the color–magnitude diagram was split up into 7 bins, starting with the giant branch and working down the main sequence. Blue stragglers and members of the photometric binary sequence were plotted separately as well. Figure 18 shows a plot of the log of the surface density vs the log of the distance from the cluster center for the stars in each of

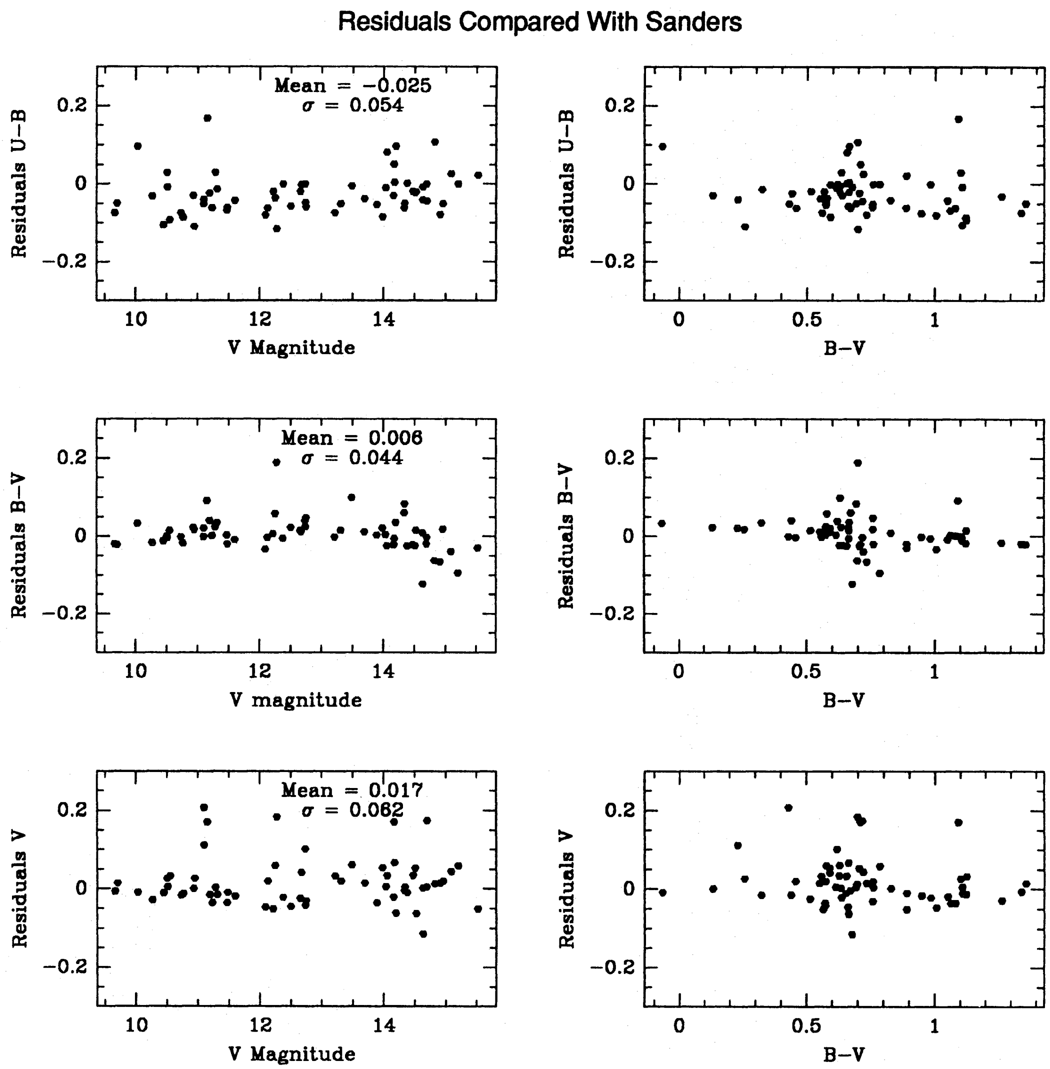


FIG. 6. Comparison of the residuals obtained when comparing our photometry and that of Sanders (1989) (see Fig. 2).

these groups. The stars with the greatest change in density over the range of our study are the blue stragglers, binaries, and giant stars. On the lower main sequence the density of stars is more nearly constant.

Mathieu (1983, 1985) has studied the dynamics of M67 using the proper motion of Sanders (1977) to determine cluster membership. Mathieu's work extends to a radius of 23 arcmin, nearly twice the limit of our study, He concludes that even with this increased radius, up to 15% of the cluster members may have been outside his study, making it difficult to distinguish a true distribution of field stars in the dataset, and therefore making it difficult to correct for field contamination. Nevertheless Mathieu found that the less massive components did tend to have a somewhat lower central concentration then the giants and blue stragglers. In a more recent study, Mathieu & Latham (1986) have shown that the cumulative distribution of blue stragglers and binaries is well fit by a theoretical isotropic equipartition 2 $\mathscr{M}_\odot$ King model, and that blue stragglers in M67 show a significantly higher central concentration than single stars. Our data seem to bear this out, though we cannot attach much statistical significance to any further apparent differences in concentration of stars of different mass, especially between the faint and the bright end of the main sequence.

### *4.5 The Luminosity Function and Total Cluster Mass*

Determining the number of stars as a function of luminosity in a cluster is a difficult procedure because of the presence of background stars in the same line of sight. In his photographic survey, Racine (1971) used a comparison field outside the cluster to determine the amount of field-star contamination. Francic (1989) used proper motion studies to determine membership. Neither method was suitable for this study, since our fields did not go out even to the cluster edge, and since the available proper motion data does not go faint enough. Instead, we applied a sta-

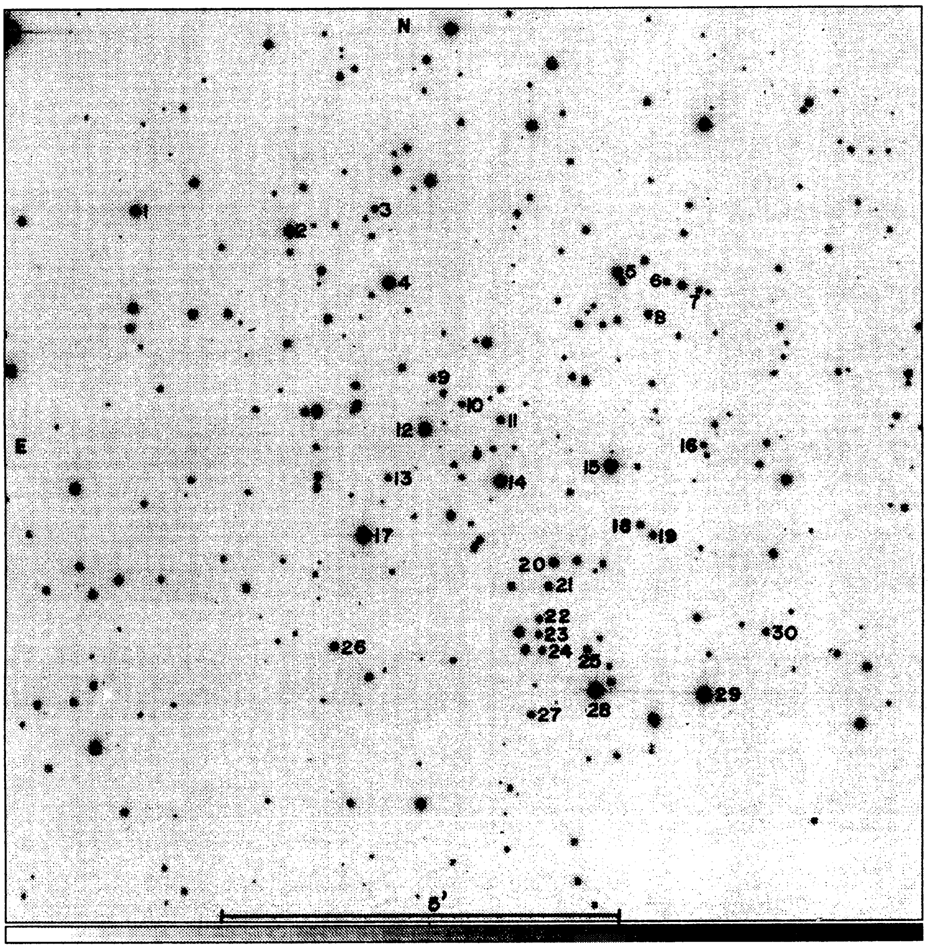


FIG. 7. Finding chart to locate standard stars in Table 7. North is up, east is to the left, and the scale of the image is given by the arrow at the bottom. The numbers in the figure correspond to the star closest to the number and refer to column 2 in Table 7.

tistical correction to our data based on the distribution of stars in the color–magnitude diagram. The method involved counting the number of field stars of a given magnitude within a region just blue of the main sequence and equal in area to that covered by the main sequence. The resulting brightness distribution of field stars was then used to correct the raw data to determine the number of main-sequence stars within each magnitude bin.

The agreement with published luminosity functions is quite good, and a comparison of our luminosity function with Francic's is shown in Fig. 19.

Despite this observational consistency, the luminosity function of M67 does not resemble those found for young clusters or for field stars, which all continue to increase toward fainter magnitudes. This turnover in the luminosity function was first noted by van den Bergh & Sher (1960). The age of M67 may indeed be the critical factor in producing the anomalous turnover. Francic (1989) determined a relaxation time for M67 of 17.4 million yr, during which an equipartition of energy among the stars will be established. Accordingly, the lower-mass stars will attain higher velocities and will more easily escape from the cluster, evaporating, on the average, on a time scale of 100 crossing times (Spitzer & Harm 1958). During the 5 billion yr life of the cluster, some 290 crossing times have elapsed, more than enough time to modify profoundly the distribution of low-mass stars in the cluster.

But it is also likely that a systematic selection bias affects all the results, including ours, to some degree. Mathieu (1983) points out that if the sample of stars does not extend to the edge of the cluster, it will undersample the low-mass stars which are not as centrally concentrated. Further, stars of low luminosity may sometimes escape detection if they happen to be close to a star of higher luminosity, while the converse is not the case.

We determined the total mass of the cluster by separating the main sequence into bins of absolute magnitude, and assigning a mass to each bin according to the calibration in Schmidt-Kaler (1982). For all stars above the main sequence we assumed a mass of 1.2 solar masses, based on the corrected turnoff color and the assumption that the stars above the main sequence are all of relatively the same

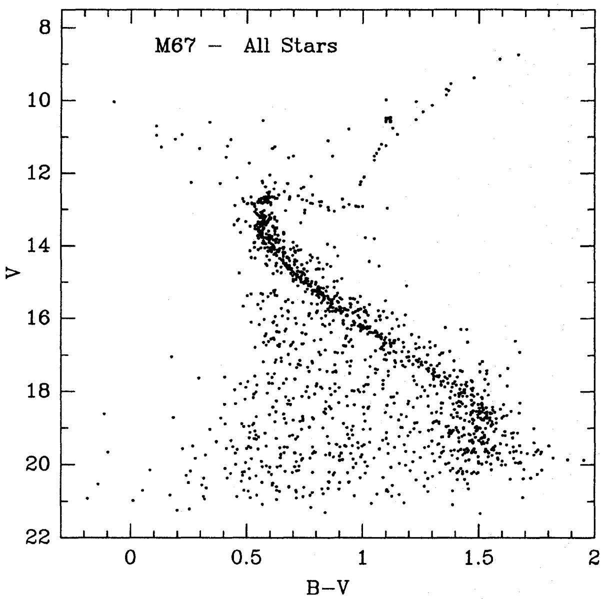


FIG. 8. Color–magnitude diagram of $V$ vs $B-V$ for all stars listed in Table 3. The stars with $V$ magnitude brighter than 12 are taken from outside sources which are listed in Table 4. Note the binary sequence at 0.7 mag above the main sequence, and the stars below the main sequence which are presumably field stars.

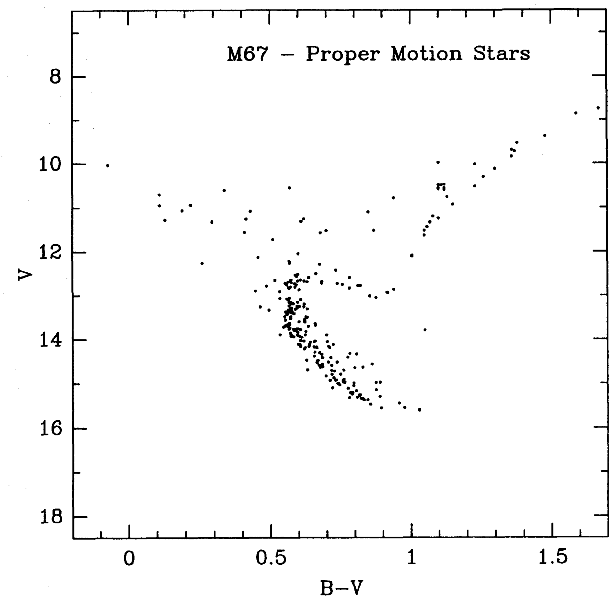


FIG. 10. Color–magnitude diagram of proper motion members determined by Girard *et al.* (1989). The lack of stars below the main sequence shows that stars at these locations on Figs. 8 and 9 are most likely field stars.

mass. To account for the binary sequence a line was drawn between the main sequence and the binary sequence 0.7 mag above the main sequence. Stars which fell above the line were considered to have twice the mass of the stars on the main sequence. Using these procedures, we derived a total mass of 802 solar masses. To correct for field-star contamination, the mass attributed to the field-star distribution was subtracted from the calculated mass of the cluster. This gives a mass for M67 of 724 solar masses. Mathieu (1983), studying an area much larger than ours, but to a brighter limiting magnitude, found a mass for the

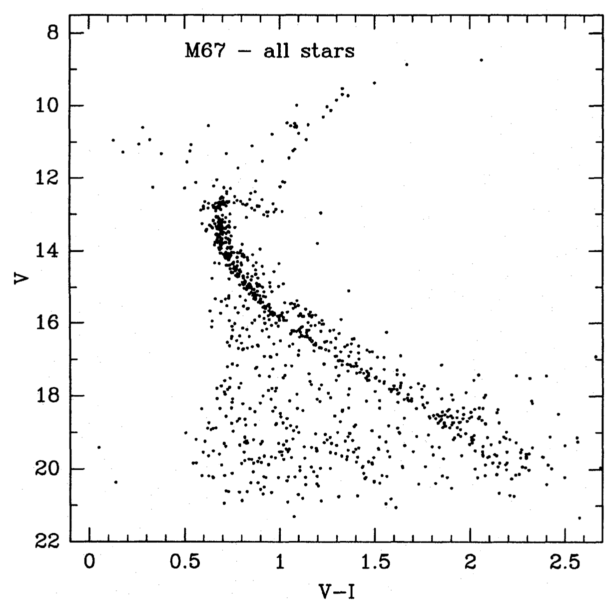


FIG. 9. Color–magnitude diagram of $V$ vs $V-I$ for all stars listed in Table 3. The stars with $V$ magnitude less than 12 are taken from outside sources which are listed in Table 4. Note that the main sequence is still visible to the limit of the photometry and the well-defined binary sequence.

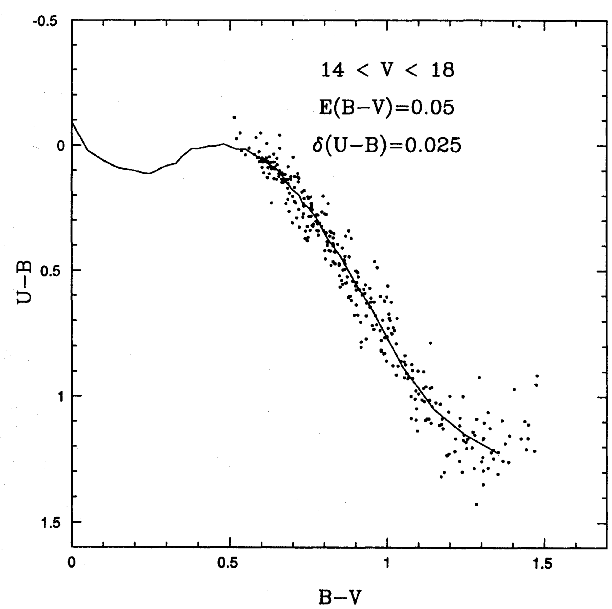


FIG. 11. Color–color diagram of main sequence stars with $V$ magnitudes between 14 and 18. The solid line is an empirical curve of Schmidt-Kaler shifted to best match the data. The values of color excess and $\delta(U-B)$ were derived from the shift of the empirical curve which best matched the data.

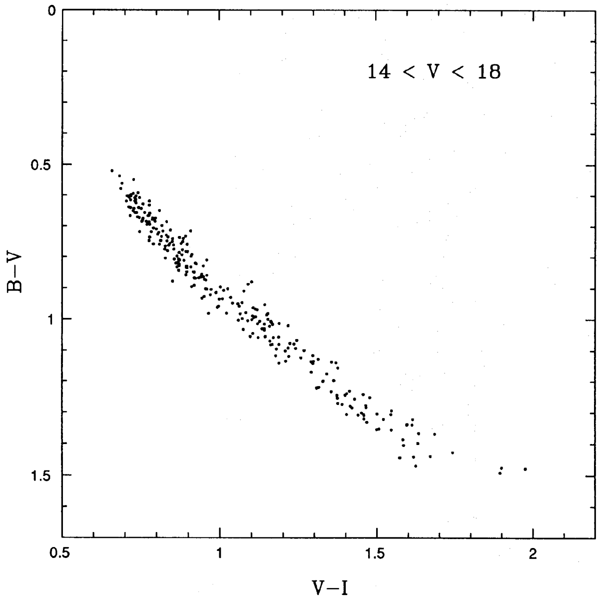


FIG. 12. Color–color diagram with $B-V$ vs $V-I$ colors. Note the spread in stars is less than in Fig. 11 due to the errors in the photometry being less for $V-I$ as compared to $U-B$.

cluster of 903 solar masses, and Francic (1989) found a mass for the cluster of 553 solar masses.

## 5. CONCLUSIONS

From a mosaic of CCD images of the M67 cluster we have derived the following information.

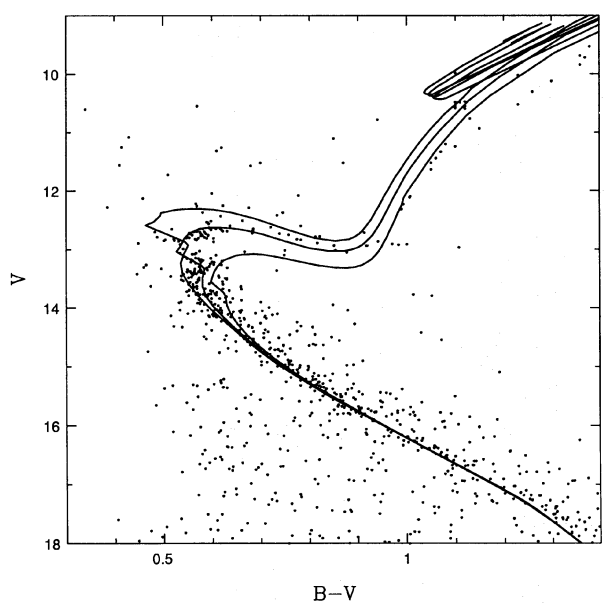


FIG. 13. Isochrones of Castellani *et al.* (1992) of 3, 4, and 6 billion yr, and our data near the turnoff point. The isochrones were shifted using $E(B-V)=0.05$ and a distance modulus of $(V-M_V)=9.6$ was determined. The main sequence turnoff falls halfway between 3 and 4 billion year old isochrones.

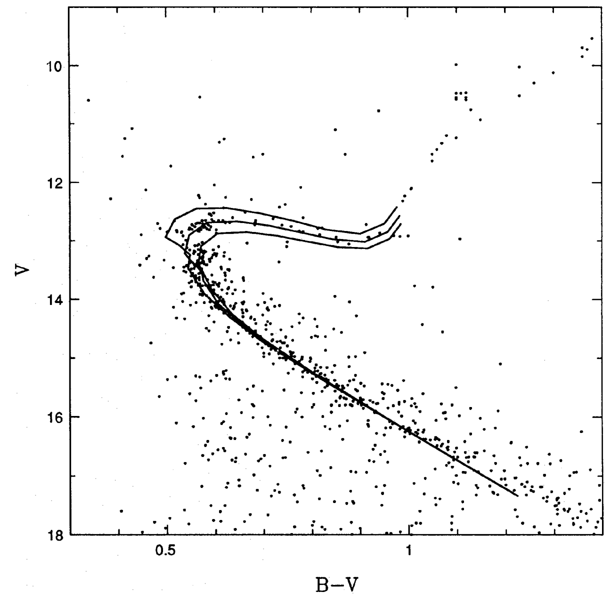


FIG. 14. Isochrones of VandenBerg (1985) of 4, 5, and 6 billion yr, and our data near the turnoff point. The isochrones were shifted using $E(B-V)=0.05$ and a distance modulus of $(V-M_V)=9.6$ was determined. The best fit of the subgiant branch is obtained with the 5 billion year old isochrone. None of the isochrones match the turnoff region.

(1) We have tabulated $U$, $B$, $V$, and $I$ colors for 1468 stars within 15 arcmin of the center of M67. The photometry is presented with equatorial coordinates for each star and cross references to other studies to make it handy and

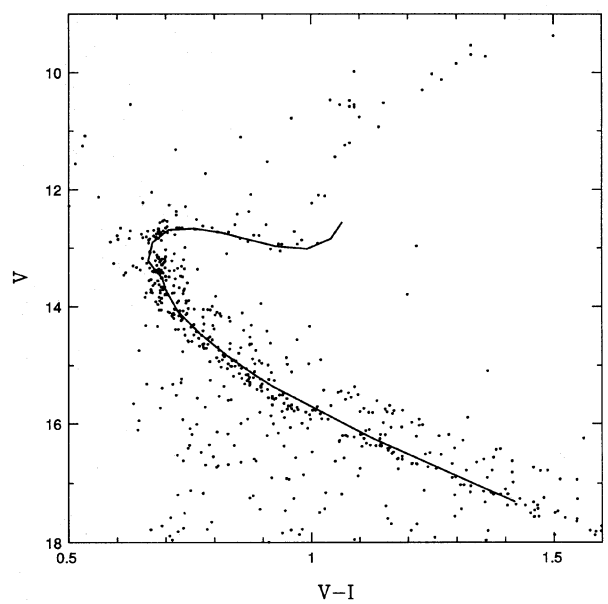


FIG. 15. 5 billion year old Isochrone of VandenBerg (1985) compared to the $V$, $V-I$ color–magnitude diagram using parameters determined from the $V$, $B-V$ color–magnitude diagram. The $B-V$ color excess of 0.05 was converted to a $V-I$ color excess of 0.065. The distance modulus was left as 9.6. Note that the distance modulus should be increased which would also change the age determination of the cluster. The good fit of the isochrone to the subgiant and giant branch in Fig. 14 does not exist in this diagram.

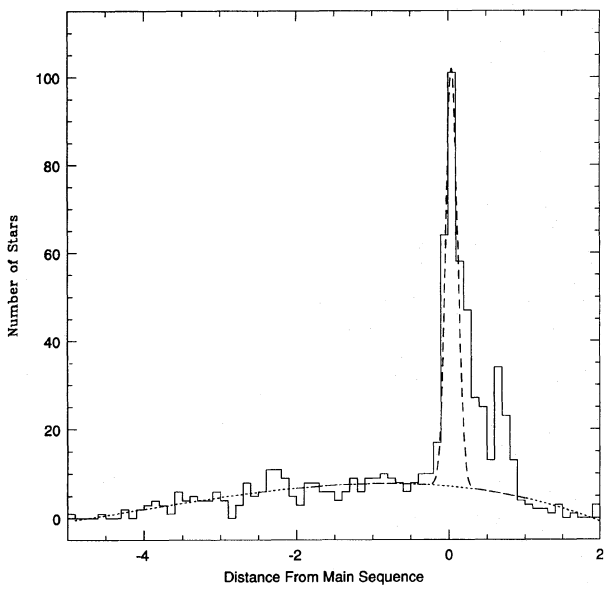


FIG. 16. A plot of the distance a star is from the main sequence on the $V$, $V-I$ color–magnitude diagram. The secondary peak at 0.7 mag in the distribution is caused by the near equal mass binaries. The dashed line is a Gaussian fit to the distribution of stars along the main sequence. The dotted line is a fit through the background distribution of field stars. From this diagram the cluster was found to have a high proportion of binary stars.

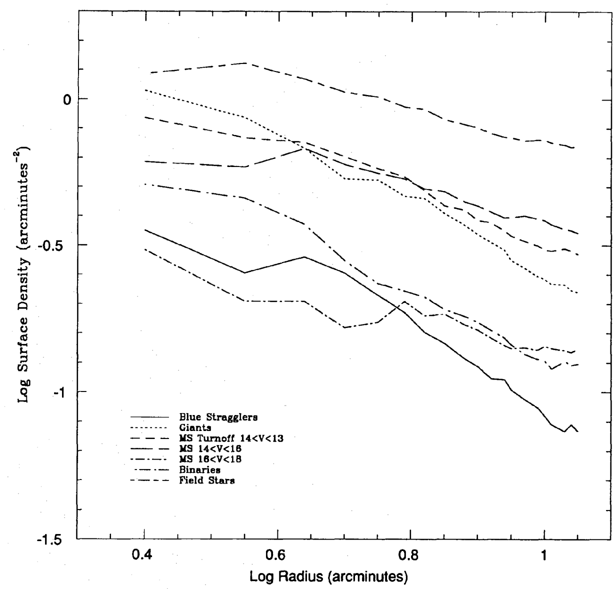


FIG. 18. A comparison of the change in surface density for different groups of stars. Notice that the greatest change in surface density occurs for the blue stragglers, giants, and binaries. The field stars and lower main-sequence stars all show fairly flat distributions.

useful for further research on the cluster. A comparison with previous studies shows that the photometry fits well into the standard system defined by the Landolt (1973, 1992), with a rms error of, typical 10 to 20 mmag, depending on color.

(2) We present a sample of stars suitable for use as internal standards in the cluster and as a standard calibration for general CCD photometry.

(3) Based on color–color plots of the cluster, we derive

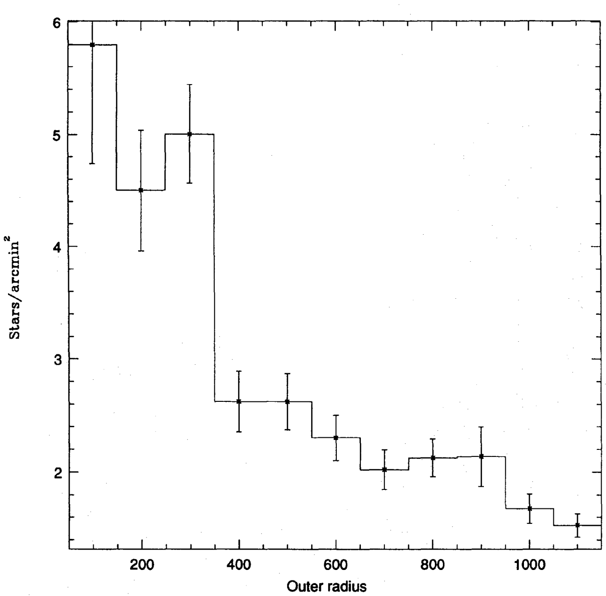


FIG. 17. A plot showing the variation in the stellar surface density with distance. The density was determined using annuli of 100 pixel width centered on the cluster center, and counting the number of stars within each annulus and dividing by the area of the annulus.

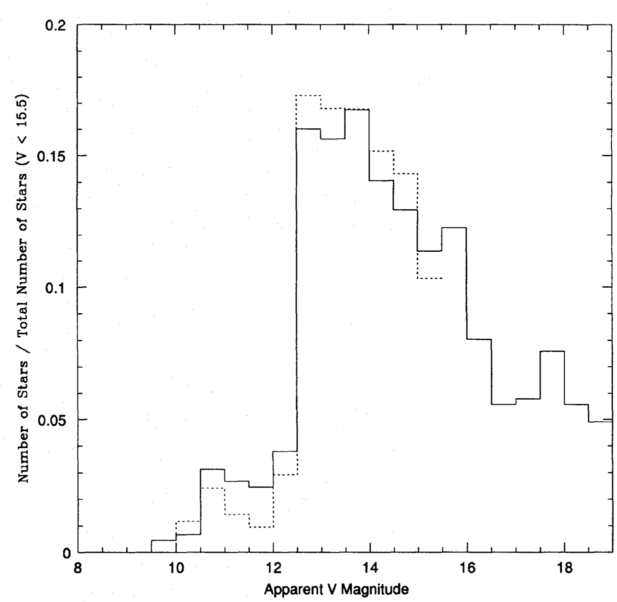


FIG. 19. The luminosity function of M67 is shown as the solid line. The luminosity function of Francic (1989) is given as the dotted line. The distribution was normalized to the number of stars with $V<15.5$. The stars in Table 3 were used to create this diagram, but a statistical correction determined from the color–magnitude diagram was applied to the totals in order to account for field-star contamination.

a reddening, E($B-V$), of 0.05±0.01, and a metallicity, [Fe/H]=−0.05±0.03.

(4) The color–magnitude diagram of M67 shows a well-defined binary sequence, from which we find at least 38% of the stars in the cluster are binary systems. The stars on this photometric binary sequence merit further spectroscopic study to investigate the characteristics (mass ratio, eccentricity distribution) in a sample of solar age.

(5) From cluster fitting to theoretical isochrones, we derive ages between 3 and 5 billion yr. None of the current isochrones fit our data consistently, pointing out the need for further work on the models to remove or explain the discrepancy.

(6) The stellar density profile of M67 indicates a tendency for more massive cluster members to concentrate toward the center. This, along with an observed turnover in the luminosity function of the cluster at low mass, may indicate the effect of dynamical relaxation on the cluster. Such conclusions, however, are subject to several sources of systematic bias, and further studies of the low-mass end of the main sequence, covering a larger region in space and incorporating proper-motion and/or radial velocity measurements of cluster membership, will be of value for reducing these problems.

Because of its low reddening and moderate distance modulus, M67 will continue to be an object of great interest for a wide variety of studies. The current study shows that much can be learned as our sample becomes more internally consistent and extends to lower luminosity. At the same time, the new photometry raises problems which may be addressed even better with large-format CCDs and mosaics of CCDs, with astrometry spanning a wider range in time and brightness, and with spectroscopy of the faint single stars and binaries on the cluster main sequence.

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