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A SURVEY OF CA II H AND K CHROMOSPHERIC EMISSION IN SOUTHERN SOLAR-TYPE STARS

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ABSTRACT

More than 800 southern stars within 50 pc have been observed for chromospheric emission in the cores of the Ca II H and K lines. Most of the sample targets were selected to be G dwarfs on the basis of colors and spectral types. The bimodal distribution in stellar activity first noted in a sample of northern stars by Vaughan and Preston in 1980 is confirmed, and the percentage of active stars, about 30%, is remarkably consistent between the northern and southern surveys. This is especially compelling given that we have used an entirely different instrumental setup and stellar sample than used in the previous study. Comparisons to the Sun, a relatively inactive star, show that most nearby solar-type stars have a similar activity level, and presumably a similar age. We identify two additional subsamples of stars—a very active group, and a very inactive group. The very active group may be made up of young stars near the Sun, accounting for only a few percent of the sample, and appears to be less than ~0.1 Gyr old. Included in this high-activity tail of the distribution, however, is a subset of very close binaries of the RS CVn or W UMa types. The remaining members of this population may be undetected close binaries or very young single stars. The very inactive group of stars, contributing ~5%–10% to the total sample, may be those caught during a Maunder Minimum type phase. If the observations of the survey stars are considered to be a sequence of snapshots of the Sun during its life, we might expect that the Sun will spend about 10% of the remainder of its main sequence life in a Maunder Minimum phase. © *1996 American Astronomical Society.*

1. INTRODUCTION

We report here on a portion of a broad effort to identify and characterize the solar-type stars within 50 pc. Our ultimate goals are astrophysical and concern Galactic studies, such as stellar multiplicity fractions and star formation rates, based upon rich datasets including thousands of stars. With present technology, it is possible to detect low-mass companions orbiting solar-type stars (Duquennoy & Mayor 1991), to estimate their ages based upon stellar activity observations (Baliunas *et al.* 1995a), and to determine accurate and precise abundances for them (Boesgaard & Friel 1990). While complete characterization of all the solar-type stars within 50 pc will take some time to complete, we present here observations of chromospheric emission in a sample of more than 800 southern stars.

We use the H and K lines of Ca II as indicators of chromospheric emission (CE), as has been done for many years at Mount Wilson (Baliunas *et al.* 1995a). An important product of the Mount Wilson effort has been a survey of CE among northern late-type dwarfs within 25 pc (Vaughan & Preston 1980, hereafter referred to as VP), which initially included about 500 stars. Recent work has expanded this sample to ~800 nearby stars (Baliunas *et al.* 1995b). VP's results have spawned many efforts to better understand the nature of activity in stars like the Sun because they found a bimodal distribution in which most stars had weak CE (as the Sun does), some active ones had high levels of CE, and very few had intermediate levels. This "gap" suggested that either the star formation rate has been nonuniform (so that stars with ages corresponding to moderate CE are missing from the solar neighborhood), or that the activity–age relation has several phases (so that stars spend little time in the phase corresponding to intermediate CE). Soderblom *et al.* (1991) showed that a monotonic activity–age relation appears to exist, but that it is not now possible to distinguish between these two explanations for the gap in the distribution. Hartmann *et al.* (1984) presented evidence that the gap may be due simply to a statistical fluctuation in the sample, and that there may have been small-scale changes in the local star formation rate in the past.

The solar-type portion of the VP sample, which we define as those stars with $0.50 \leq (B-V) \leq 1.00$, included 176 stars and was analyzed in detail by Soderblom (1985, hereafter

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referred to as Paper I) for CE and rotation. A survey of CE using an independent sample with different instrumentation provides a means of ensuring that VP's results were not a fluke of their sample or an artifact of their instrument or data analysis. One of our goals, then, is to confirm or refute the famous Vaughan–Preston gap. A larger sample is also useful in assessing any further structure in the CE distribution of the stellar population. Finally, a survey such as this also provides a means of identifying previously unknown active, and potentially young, stars that are interesting in themselves. We will remark on some aspects of these active stars in the following pages.

We began this work in order to supply targets for what is now called Project Phoenix and which started as SETI/MOP (NASA's SETI Microwave Observing Project) and then became HRMS [the High-Resolution Microwave Survey, described in Tarter & Klein (1995)]. Like any other observing program, SETI is limited in the number of stars that can be examined in the time available, so it is appropriate to apply strategies that can improve the *a priori* chances of a successful detection. Our rationale (Latham & Soderblom 1993; Soderblom & Latham 1993; Henry *et al.* 1995) is that old, single, solar-type stars offer the best chances for detections of extraterrestrial intelligence. Companionship is determined from radial velocity variations and age from the strength of CE. For the purposes of SETI it is sufficient to simply distinguish between young stars and old stars at a coarse level. We would eventually like to be able to use these observations to make more precise estimates of the ages of stars, but a highly accurate calibration for that does not yet exist. Complicating factors in determining such calibrations include cyclic and extracyclic activity over periods of decades, and rotation over months (Baliunas & Jastrow 1990; Baliunas *et al.* 1995a).

2. SAMPLES

For our original purposes of supplying a target list for SETI observations, we wished to have a final sample of about 1000 stars. We estimated that about half of the starting sample would be too young and about half would have close companions, so that we wanted to start with a sample of 4000 to 5000 stars. Moreover, for a variety of reasons (Henry *et al.* 1995) we limited ourselves to G0 V to K2 V in spectral type, or, more precisely, 0.50–1.00 in $(B-V)$. A simple extrapolation of the contents of the catalog of Woolley *et al.* (1970) showed that we needed to go to a radius of about 50 pc to get ~5000 stars in the starting sample. This turned out to be convenient because the Sun at 50 pc would have an apparent magnitude of ~9 in V. This apparent magnitude is roughly the limit for completeness of the *Hipparcos* mission, and is also the limiting magnitude for the instrument at Mount Wilson that is used for the HK measurements of the northern stars.

The *Hipparcos* data will allow us to define a volume-limited sample, but those observations are not yet available. Meanwhile, it is possible to determine many of the stars that will fall within that volume-limited sample by using existing observations. Three of the samples discussed below, the "Primary," "Secondary," and "Best and Brightest" samples, include many of the southern, solar-type stars within 50 pc. A fourth sample, the "Nearby" sample, includes the nearest stars, within 8 pc.

2.1 The Primary and Secondary Samples

The Primary Sample of 650 stars has been selected using a combination of the two-dimensional MK spectral types for stars included in the extensive work of Houk and collaborators (Houk & Cowley 1975; Houk 1978; Houk 1982; Houk & Smith-Moore 1988), and the Strömgren photometric observations of Olsen (1988, and references therein, 1993). The Houk work includes all stars in the Henry Draper (HD) Catalog, which is nearly complete to $V \approx 9$. The Olsen sample contains stars extracted from the HD Catalog with HD spectral types of G0 or G5, and of any luminosity class. Generally, the Olsen sample is of somewhat earlier type than the Houk sample because K0 type stars were not included, in order to avoid having a large number of evolved stars in the final sample. The Olsen sample is not as complete as the Houk sample for our purposes because (1) the range in spectral type is restricted, (2) the spectral types in the HD Catalog are only approximate, thereby missing misclassified G stars, and (3) very bright stars were excluded (α Cen, for example). The resulting Primary Sample, which includes stars present in both the Houk and Olsen samples, therefore contains biases that favor the more massive, early-type stars, but we do not believe that significant biases are present with respect to age or any age-related quantity.

From the Houk catalogs, stars south of $-25°$ (2000.0 coordinates) with types G0 to K2, classes IV/V or V, and with HD magnitude < 9.0, were chosen. For stars like the Sun (M_V=4.85), this corresponds to a distance of 68 pc, with correspondingly lesser distances for later spectral types. Targets from the same part of the sky were taken from the Olsen work, once evolved stars were eliminated by using the Strömgren colors. For comparison, the *Third Catalog of Nearby Stars* (Gliese & Jahreiss 1991) lists 281 stars with $(B-V)$= 0.50–1.00 and M_V=3.0–7.0 (comparable to masses of 1.50–0.75 $M_\odot$, Henry & McCarthy 1993), and with trigonometric parallaxes $\pi_{\rm trig} \geqslant 0.050$ (the catalog appears to be complete for solar-type stars to 20 pc). Assuming this stellar density carries to 50 pc, we then expect ~1300 solar-type stars in the southern portion of the sky included in the present report. Thus, we estimate that our sample of 650 targets south of $-25°$ is about 50% of the total number of southern, solar-type stars. The overlap of the Houk and Olsen samples, although incomplete, provides us with a robust Primary Sample of stars that is certainly solar-type because the two selection techniques, two-dimensional spectral types and Strömgren photometry, provide independent confirmation. Some additional stars that we expect to fall into the missing 50% were taken from the Houk data and constitute the Secondary Sample. A supplemental set of 121 targets was observed from this sample.

TABLE 1. Budget of survey observations.

	N (Total)	N (Primary)	Reasons Targets Lost
Observations	1016	673	
	−20	−14	cosmic ray in necessary window
	−6	−2	HK features outside dither region
	−2	−0	noisy, low quality data
	−1	−1	contaminated spectrum
S_{CTIO} values	987	656	
	−16	−0	special observations for HD 98800 program
	−5	−0	S_{CTIO} < 0.180
	−3	−1	S_{CTIO} > 0.600
	−2	−2	discordant S_{CTIO} values for an object
S_{MW} values	961	653	
	−7	−4	star too blue: $(B-V) < 0.50$
	−1	−1	star too red: $(B-V) > 1.20$
	−5	−1	photometry not available
log R′ values	948	647	
	−133	−20	duplicate observations of stars
Individual Stars	815	627	final sample

2.2 The Best and Brightest and Nearby Samples

The Best and Brightest Sample is a more exclusive sample chosen to meet these criteria: $\pi_{trig} \geq 0.050$, any declination, $(B-V)=0.55$–0.75, $M_V=3.5$–7.0. These stars are termed the "Best & Brightest" because they are very similar to the Sun in color [$(B-V)_{\odot}=0.656$, Campbell 1984] and are within 20 pc. Targets in this sample should also fall in the Primary Sample, but stars in the northern hemisphere do not yet have types determined by Houk, and some are too bright to have been observed by Olsen's group.

Finally, the Nearby Sample includes stars with $\pi_{trig} \geq 0.125$, $(B-V)=0.40$–1.20, and $\delta < +40°$, the practical observing limit of the telescope used at CTIO. Data used to define this sample and the Best and Brightest Sample have been taken from the *Third Catalog of Nearby Stars* (Gliese & Jahreiss 1991). There are, of course, many program stars that fall into several of the samples. Table 1 gives details of the total number of observations, and those specifically for stars in the Primary Sample. Table 2 lists the final number of stars with $\log R'_{HK}$ values for each sample, and compares the southern survey to northern surveys of CE.

3. OBSERVATIONS AND DATA ANALYSIS

The observations reported here were obtained using the Cassegrain Spectrograph on the 1.5 m telescope at Cerro Tololo InterAmerican Observatory (CTIO). Two observing runs of good weather in 1992 December (5 nights) and 1993 June/July (6 nights) allowed us to make all of the observations planned. Use of a GEC CCD, a 3″ slit, and grating 47 (in second order) yielded a dispersion of 0.82 Å per pixel and resolution of ~1.6 Å from 3720 to 4180 Å, which included the Ca II H (3968.470 Å) and K (3933.664 Å) lines. Observations were typically 1–10 min long.

The part of the spectrum centered on the H and K lines used in the present analysis is illustrated in detail in Fig. 1. These representative spectra include stars ranging from weak CE (HD 141885) to strong CE (HD 217343), indicated by the filling in of the H and K lines. These particular stars were selected because they have $(B-V)=0.646$–0.664, similar to the Sun's $(B-V)_{\odot}=0.656$. For comparison, the Sun's CE level, and hence spectrum in this wavelength region, is similar to that of HD 78429.

Figure 2 illustrates spectra for the twenty most active stars included in the Primary and Secondary Samples. These were selected by their high $\log R'_{HK}$ values, after sifting for stars with $(B-V)=0.50$–1.00 with high quality photometry [no $(B-V)$ errors larger than 0.10 mag]. Note that several of the stars, HD 123732, 119022, 54579, and 195521, have distinctly "washed out" features, presumably due to very fast rotation. In these cases, the emission features in the cores of the H and K lines are smoothed out by the rapid rotation. These stars will be discussed in Sec. *4.4*.

3.1 Derivation of the S_{CTIO} Values

The spectra were reduced using the facilities within IRAF, yielding intensity versus wavelength, properly flux-calibrated in a relative sense. It was not necessary to flux

TABLE 2. Northern and southern chromospheric emission surveys.

Survey	Source of Targets	Sample	Color Range	Sky Coverage	# Stars with log R′
Vaughan & Preston (1980)	Woolley *et al.* (1970)	*all*	$0.40 \leq (B-V) \leq 1.80$	north of 0°	486
Soderblom (1985)	Vaughan & Preston (1980)	*all*	$0.50 \leq (B-V) \leq 1.00$	north of 0°	176
this study	Houk spectra + Olsen photometry	Primary (P)	$0.50 \leq (B-V) \leq 1.00$	south of −25°	627
	Houk spectra only	Secondary (S)	$0.50 \leq (B-V) \leq 1.00$	south of −25°	119
	Gliese & Jahreiss (1991)	Best & Brightest (B)	$0.55 \leq (B-V) \leq 0.75$	south of +40°	70
	Gliese & Jahreiss (1991)	Nearby (N)	$0.50 \leq (B-V) \leq 1.20$	south of +40°	27
	Mount Wilson Program	Calibration (C)	$0.48 \leq (B-V) \leq 1.00$	south of 0°	22
	other targets	Extra (X)	$0.50 \leq (B-V) \leq 0.80$	south of −40°	3
	distinct targets	*all*			815

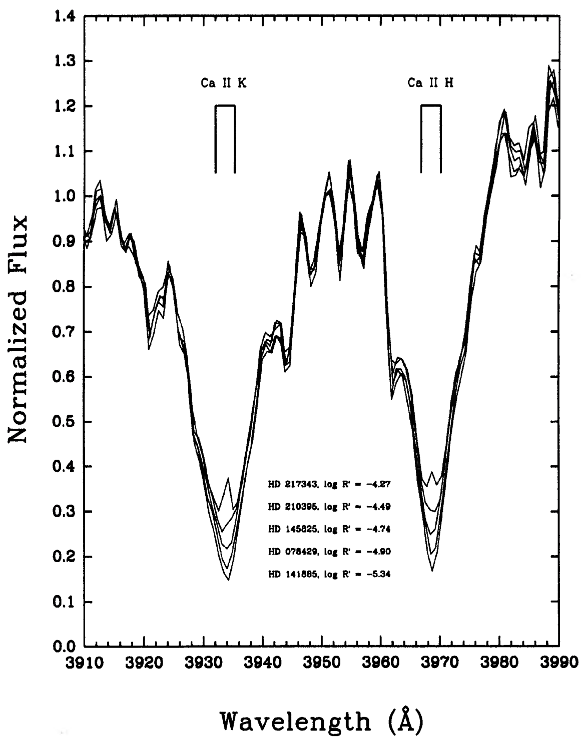

FIG. 1. Spectra illustrating chromospheric emission levels in solar-type stars. The 3.28 Å wide portions of the spectra at the Ca II H and K lines used to determine the level of CE are labeled. Five spectra for stars similar in color to the Sun are plotted to illustrate the sensitivity to different levels of CE.

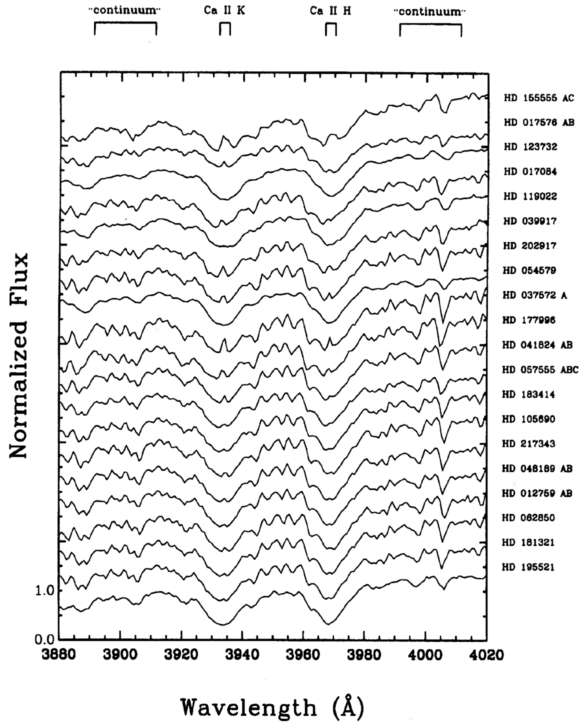

FIG. 2. The "top 20" most active targets in the Primary and Secondary Samples. The 3.28 Å wide portions of the spectra at the Ca II H and K lines and the 20 Å continuum windows used to determine the level of CE are labeled. Each spectrum has been normalized at 3950 Å and is offset from the one below it by 0.5. Several of the stars, discussed in the text, have washed-out features.

calibrate the spectra absolutely for our purposes since the derived indices are relative measures of the depths of the H and K lines versus pseudo-continuum windows on either side of the lines.

Each spectrum was first checked for signal saturation and cosmic rays falling in spectral regions used to determined the CE indices. In an effort to save time at the telescope during this large program (more than 1000 spectra were acquired), duplicate exposures were not taken. Instead, we chose to sacrifice those spectra (20 in all) in which cosmic rays made the spectra unsalvageable because they fell in windows required to derive the desired CE indices (see below). Once these poor quality spectra were eliminated, each remaining spectrum was bias subtracted, sky subtracted, and flat fielded. The number of bad pixels was small enough in the region of the chip used that they were left uncorrected. The spectra were then extracted using appropriate apertures, and the wavelength calibration accomplished using He-Ar lamp exposures taken at the beginning and end of each night.

The next step was to measure the flux in the centers of both lines relative to the "continuum" to derive an index of HK emission, $S_{\rm CTIO}$. The original technique used to derive the $S_{\rm MW}$ values acquired at Mount Wilson is described in detail in Vaughan *et al.* (1978). Briefly, the sum of the flux in two windows each ~1 Å wide and centered on the H and K lines is ratioed to the sum of 20 Å wide windows on either side of the lines, centered at 3901 and 4001 Å.

In this study we did not use a four-channel photon-counting spectrophotometer as used at Mount Wilson, but straightforward CCD spectroscopy. In order to measure the HK flux relative to the nearby continuum for our spectra, we mimicked the Mount Wilson technique by summing the fluxes in the central cores of the H and K lines and ratioing this sum to the sum of fluxes in the two 20 Å windows. Because our spectroscopic resolution is coarser than that at Mount Wilson, (they utilized an instrument specially designed for measuring CE at the H and K lines), we adopted wider windows in the cores of the lines. Our windows are 4 pixels, or 3.28 Å wide, whereas the Mount Wilson index, $S_{\rm MW}$ is based upon a triangular window with FWHP $=1.09$ Å. The windows adopted in this study are illustrated at the top of Fig. 2. In order to assure accurate positioning of the windows in the centers of the H and K lines, given flexure in the spectrograph and radial velocities that slide the spectra on the chip, the windows were dithered in units of half a pixel and then each was inspected individually to line them up. Final conversion from our $S_{\rm CTIO}$ values to the $S_{\rm MW}$ system was accomplished by observing stars included in the Mount Wilson program that are south of $\delta=0°$.

Random errors in the $S_{\rm CTIO}$ values can be estimated from the 17 nonstandard stars that have three or more observations (82 individual observations in all). In general, the errors are 0.005 or less, amounting to $\leqslant 2\%$, with two of the 17 stars having errors of almost 0.010. This is identical to the observational error reported for observations of northern stars ($\leqslant 2\%$, see Paper I, and references therein).

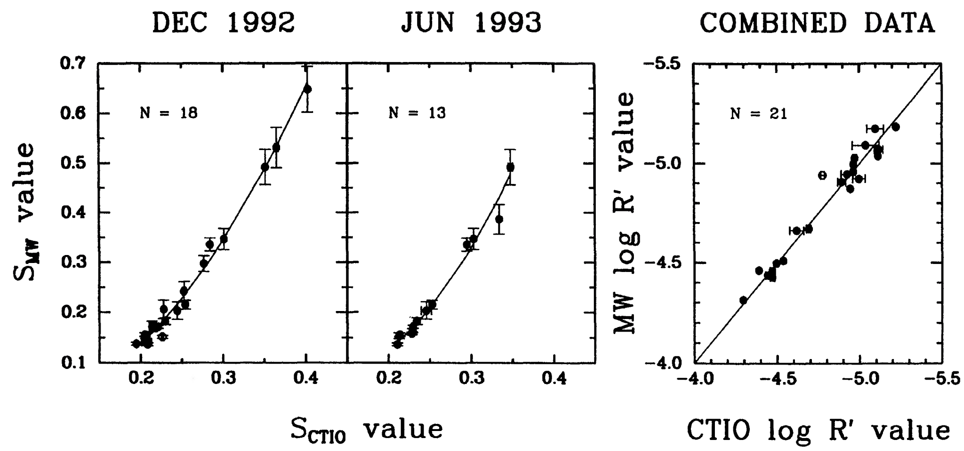

FIG. 3. Calibration curves for the Mount Wilson standard stars are shown for each observing run in the left two panels. The rightmost panel compares the Mount Wilson log R'_{HK} values with those determined from the CTIO program.

3.2 Converting S_{CTIO} to S_{MW}

The relations between S_{CTIO} and S_{MW} for the calibration stars are shown for each observing run in the two left panels of Fig. 3, and the observations of the standard stars are listed in Table 3. Separate conversions were derived for each observing run:

$$\text{1992 Dec:}\quad S_{MW}=(5.10942\times S^2_{CTIO})-(0.48096\times S_{CTIO})+0.02878;$$

and

$$\text{1993 June:}\quad S_{MW}=(7.57057\times S^2_{CTIO})-(1.76879\times S_{CTIO})+0.17746.$$

These relations are valid for the range $0.18\leq S_{CTIO}\leq 0.40$ (corresponding to $0.10\leq S_{MW}\leq 0.65$ for both observing runs). While the calibration is explicitly defined only up to $S_{CTIO}=0.40$, we have extrapolated it to $S_{CTIO}=0.60$ in order to evaluate the CE of a few more active stars. Unfortunately, there were not any well-observed standards available with $S_{MW}>0.65$, corresponding to $S_{CTIO}>0.40$.

Only stars observed more than 100 times in the Mount Wilson program were used as standards. In nearly every case, the scatter in S_{CTIO} for stars with multiple measurements is significantly lower than errors in the S_{MW} values. This simply indicates that there is more intrinsic variability in the stars than the size of errors on our measurements, and that our technique could accurately monitor stellar CE. In the

TABLE 3. Standard star data and observations.

	Catalog Data		Mount Wilson Data				CTIO Data				
HD (1)	Sp Type (2)	Ref (3)	S (4)	#obs (5)	#mth (6)	log R′ (7)	S (Dec 92) (8)	#obs (9)	S (Jun 93) (10)	#obs (11)	log R′ (12)
001835	G3 V	H	0.3466 0.0213	1736	132	−4.437	0.3013	2	0.3030	1	−4.441 0.013
003443 AB	K1 V + G	H	0.1823 0.0068	484	101	−4.907	0.2299	2	0.2344	1	−4.893 0.025
003795	G3/5 V	H	0.1557 0.0038	704	95	−5.038	0.2050	2	0.2134	1	−5.113 0.005
009562	G2 IV	I	0.1365 0.0028	2356	123	−5.174	0.2083	2	0.2105	2	−5.097 0.051
010700	G8 V	H	0.1712 0.0032	1385	120	−4.959	0.2210 0.0012	3	0.2295 0.0018	4	−4.962 0.013
011131	G0	I	0.3355 0.0132	165	8	−4.428	0.2843	2	0.2949	2	−4.470 0.013
016673	F8 V	G	0.2151 0.0089	1384	123	−4.662	0.2543	2	0.2528	1	−4.618 0.043
017925	K1 V	H	0.6478 0.0455	1598	129	−4.314	0.4021	2		0	−4.295
022049	K2 V	G	0.4919 0.0357	3803	130	−4.458	0.3512	2	0.3476 0.0025	3	−4.469 0.014
023249	K0 IVe	G	0.1374 0.0030	1035	121	−5.184	0.1948	1		0	−5.223
026965	K1 Ve	G	0.2060 0.0185	919	118	−4.873	0.2280	1		0	−4.944
030495	G3 V	H	0.2973 0.0159	869	113	−4.510	0.2765	1		0	−4.535
038392	K2 V	G	0.5314 0.0404	117	13	−4.497	0.3649 0.0019	3		0	−4.495 0.005
038393	F6 V	G	0.1514 0.0029	126	13	−4.941	0.2264 0.0013	3		0	−4.774 0.011
045067	F8 V	I	0.1409 0.0024	2473	139	−5.092	0.2070 0.0059	4		0	−5.038 0.082
076151	G3 V	G	0.2422 0.0192	1288	132	−4.670	0.2525 0.0020	5		0	−4.691 0.013
081809 AB	G2 V J	G	0.1720 0.0105	1031	123	−4.923	0.2138 0.0036	5		0	−4.997 0.039
115617	G5 V	H	0.1633 0.0044	1172	62	−4.997		0	0.2290 0.0012	3	−4.963 0.010
152391	G8 V	G	0.3867 0.0299	2338	130	−4.461		0	0.3338	2	−4.388
158614 AB	G8 IV-V J	G	0.1581 0.0026	953	64	−5.028		0	0.2283 0.0013	3	−4.972 0.012
219834 AC	G5 IV J	G	0.1538 0.0056	1290	114	−5.070	0.2063	2	0.2126 0.0006	3	−5.117 0.026
219834 B	K2 V	G	0.2033 0.0172	1010	103	−4.946	0.2446	2	0.2458 0.0064	3	−4.925 0.036

Column (3): G = Gliese and Jahreiss 1991; H = Houk *et al.* 1975, 1978, 1982, 1988; I = Hipparcos Input Catalog (INCA), Turon, C. *et al.* 1992 rightmost panel of Fig. 3 we compare the Mount Wilson log R'_{HK} values to our final log R'_{HK} values, with observations for both seasons combined. In only one case, HD 38393, is there a deviation from equal values by more than 3σ. This inconsistency may be due to the fact that this is the earliest type standard star observed, with a type of F6 V. This point, shown with an open circle on the plots, has been discarded from the calibration. Utilizing the same 82 observations of 17 stars used to determined errors in S_{CTIO}, we estimate random errors of 5% or less in S_{MW} for all but one of the stars.

3.3 Calculating the log R'_{HK} Values

The S index depends on both the chromospheric and photospheric radiation, while we are interested in measuring only the chromospheric component. In order to remove the photospheric contribution, which is a strong function of stellar temperature [measured quantitatively using $(B-V)$], we calibrate the photospheric flux as described in detail in the Appendix of Noyes *et al.* (1984). As illustrated in the rightmost panel of Fig. 3, the conversion has been made self-consistently, given the good match between our log R'_{HK} values and those of the Mount Wilson program for the standard stars. As anticipated, the systematic offset, -0.0009, is negligible for the 21 log R'_{HK} values compared (HD 38393 was excluded), even though different sets of standards were used for the two observing runs.

A comparison of the same log R'_{HK} values for the standard stars reveals a mean absolute difference in the MW and CTIO log R'_{HK} values equal to 0.038, indicative of the accuracy of the conversion of a single measurement based upon the standard stars. This is to be compared to a random error of 0.019 in the final log R'_{HK} values estimated from the 17 program stars with three or more observations. A final, systematic error was discovered when individual histograms were generated for each observing run. There is a more prevalent tail of very active stars in the June sample and a slightly more robust tail of inactive stars in the December sample. The shift between datasets is less than 0.03 in the median log R'_{HK} values for the two samples. We do not believe that this is due to any real difference in the two portions of the complete sample, but illustrates the systematic accuracy of our calibration technique from season to season. Adding these three sources of error in quadrature, our final error in the derived log R'_{HK} values for the program stars is 0.052, or roughly 1%.

4. DISCUSSION

Table 4 (this table can also be found in the AAS CD-ROM Series, Vol. 1, 1996) lists the observational results for stars in this survey. In column 1, care was taken to list accurate identifications (HD numbers) for the target stars, especially for multiple systems. The fundamental reference used to confirm HD numbers and assign multiplicity was INCA (The *Hipparcos* Input Catalog), where all but 12 of these stars are listed. In INCA, components in multiple systems are listed individually if their separation is greater than 10″, which is the effective cutoff of the *Hipparcos* detection system. "Close" multiples, those with separations less than 10″, are denoted "AB" in INCA, whereas a primary with a secondary more distant than this cutoff is listed as component "A" in the catalog ("B" components are usually not listed in INCA because they are not bright enough to meet the mission cutoffs).

Changes in identification in Table 4 from the INCA multiplicity coding system have been made using checks against the observing log sheets and several catalogs. At the telescope, where we used a 3″ slit, we were able to cleanly split sources with separations greater than 5″ unless both components of a binary fell in the slit (in the interest of time while observing, we did not change the slit orientation on the sky). As a rule, composite spectra were obtained for systems with separations less than 5″. In three binaries with separations greater than 5″, HD 14758 AB [9.9″], 81639AB [7.0″], and 143215AB [6.5″], both components fell squarely in the slit and the spectra were combined during the reduction process. In addition, cross checks for unseen components not listed in INCA (e.g., close spectroscopic binaries) were made against Batten *et al.* (1989), Duquennoy & Mayor (1991), Gliese (1969), and Gliese & Jahreiss (1979, 1991).

Notes for the stars in Table 4 are given in cases where the HD number does not match that listed in INCA, or when a "C" and/or "D" component is included in the spectrum. For those systems where "A" or "B" is listed in the identification but no notes are given, the reader is referred to INCA or the reference listed in column 4. The 12 targets that are not found in INCA are flagged in column 2 by a "0." We note that the multiplicity indicated is that defined by INCA, and companions in some cases may not be true companions. Also, there are undoubtedly many companions not listed. Systematic radial velocity, speckle, and imaging surveys are required to establish the true multiplicity fractions.

All 650 stars in the Primary Sample (denoted by "P" in column 5) were observed at least once. Although a small subset of stars could not have final log R'_{HK} values derived (see Table 1), all of the targets are listed so that the entire sample can be extracted from Table 4. Designations in column 5 of the table are as follows:

P—Primary Sample,

S—Secondary Sample,

B—Best and Brightest Sample,

N—Nearby Sample,

C—calibration stars,

X—other stars.

The "X" stars are either companions to program stars or were part of our observations for the HD 98800 program (Soderblom *et al.* 1996). Codes for the columns of Table 4, and notes on individual targets are given after the table.

TABLE 4. Chromospheric activity observations.*

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
000023				P	7.533	0.022	0.570	0.009	Ig	121192		0.233	0.193	−4.78	1	
000024				P	8.146	0.031	0.606	0.015	Ig	121392		0.294	0.329	−4.43	1	
000105				P	7.512	0.002	0.595	0.008	Ig	121392		0.307	0.363	−4.36	1	
000564				P	8.20	0.35	0.66	0.10	Ig	121192		0.233	0.194	−4.83	1	
000870				P	7.224	0.004	0.775	0.002	Ig	121192		0.268	0.267	−4.68	1	
001002				P	6.460	0.030	0.640	0.020	Ig	121492	ray				0	
001108				P	8.573	0.031	0.695	0.015	Ig	121392		0.236	0.199	−4.83	1	
001237				P	6.586	0.001	0.749	0.004	Ig	121392		0.317	0.391	−4.44	1	
001273 AB	3	P=411d	B	BP	6.840	0.005	0.655	0.026	Ig	121392	ray				0	
001320				P	7.952	0.007	0.651	0.003	Ig	121192		0.228	0.184	−4.87	1	
001466				P	7.468	0.031	0.553	0.015	Ig	121392		0.301	0.347	−4.36	1	
001530				P	8.118	0.004	0.661	0.002	Ig	121492		0.220	0.170	−4.94	1	
001581				BNP	4.226	0.005	0.576	0.010	Ig	062793		0.235	0.179	−4.85	7	−4.839 0.022
001581				BNP	4.226	0.005	0.576	0.010	Ig	062893		0.234	0.178	−4.85		
001581				BNP	4.226	0.005	0.576	0.010	Ig	062993		0.236	0.182	−4.83		
001581				BNP	4.226	0.005	0.576	0.010	Ig	063093		0.238	0.185	−4.82		
001581				BNP	4.226	0.005	0.576	0.010	Ig	070193		0.234	0.179	−4.85		
001581				BNP	4.226	0.005	0.576	0.010	Ig	070293		0.232	0.174	−4.87		
001581				BNP	4.226	0.005	0.576	0.010	Ig	121492		0.229	0.187	−4.81		
001620 AB		s=0.3	I	P	8.510	0.001	0.714	0.003	Ig	121492		0.247	0.222	−4.76	1	
001706 AB		s=3.7	I	P	8.40	0.35	0.80	0.49	Ip	121492		0.192	0.125	−5.25	1	
001835	*			C	6.388	0.008	0.659	0.004	Ig	062993	cal	0.303	0.337	−4.45	3	see Table 3
001835				C	6.388	0.008	0.659	0.004	Ig	121092	cal	0.300	0.343	−4.44		
001835				C	6.388	0.008	0.659	0.004	Ig	121392	cal	0.303	0.352	−4.43		
001854	0			P	7.6	0.0	0.6	0.0	S	062793		0.235	0.179	−4.86	2	−4.879
001854				P	7.6	0.0	0.6	0.0	S	121492		0.221	0.173	−4.90		
001926				P	7.881	0.031	0.579	0.004	Ig	121492		0.225	0.180	−4.84	1	
002070 AB	3	P=115d	B	P	6.811	0.003	0.596	0.005	Ig	121492		0.212	0.156	−4.99	1	
002098				P	7.564	0.003	0.616	0.003	Ig	121492		0.216	0.164	−4.96	1	
002151				BN	2.82	0.05	0.618	0.008	Ig	062793		0.220	0.154	−5.02	6	−4.996 0.052
002151				BN	2.82	0.05	0.618	0.008	Ig	062893		0.226	0.164	−4.96		
002151				BN	2.82	0.05	0.618	0.008	Ig	062993		0.217	0.151	−5.05		
002151				BN	2.82	0.05	0.618	0.008	Ig	063093		0.230	0.171	−4.92		
002151				BN	2.82	0.05	0.618	0.008	Ig	070193		0.223	0.159	−4.99		
002151				BN	2.82	0.05	0.618	0.008	Ig	070293		0.217	0.151	−5.05		
003047				P	7.273	0.031	0.609	0.015	Ig	121192		0.201	0.138	−5.14	1	
003074 A	2	s=5.3	I	P	6.405	0.003	0.617	0.004	Ig	121492		0.214	0.159	−4.99	1	
003277				P	7.449	0.004	0.726	0.002	Ig	121492		0.228	0.185	−4.90	1	
003405 AC	*	triple		P	6.784	0.031	0.639	0.003	Ig	121492		0.316	0.388	−4.36	1	
003443 AB		a=0.7	W	BC	5.572	0.005	0.715	0.004	Ig	062993	cal	0.234	0.179	−4.92	3	see Table 3
003443 AB				BC	5.572	0.005	0.715	0.004	Ig	121092	cal	0.229	0.187	−4.88		
003443 AB				BC	5.572	0.005	0.715	0.004	Ig	121392	cal	0.231	0.190	−4.87		
003460 AB		s=0.1	I	P	6.990	0.006	0.723	0.001	Ig	121492		0.199	0.136	−5.18	1	
003611				P	7.369	0.031	0.611	0.007	Ig	121192		0.200	0.138	−5.15	1	
003795				C	6.137	0.006	0.718	0.010	Ig	062993	cal	0.213	0.145	−5.11	3	see Table 3
003795				C	6.137	0.006	0.718	0.010	Ig	121292	cal	0.205	0.146	−5.11		
003795				C	6.137	0.006	0.718	0.010	Ig	121392	cal	0.205	0.144	−5.12		
004152 A		s=22	J	P	7.743	0.015	0.754	0.005	Ig	121492		0.268	0.266	−4.67	1	
004208				P	7.785	0.006	0.664	0.004	Ig	121492		0.221	0.172	−4.93	1	
004308				BP	6.546	0.009	0.655	0.006	Ig	121192		0.209	0.152	−5.05	1	
004391	*			P	5.795	0.004	0.635	0.003	Ig	121492		0.273	0.279	−4.55	1	
004392				P	7.878	0.003	0.677	0.010	Ig	121492		0.219	0.168	−4.96	1	
004628 AB	*	s=2.7	H	N	5.742	0.013	0.890	0.008	Ig	063093		0.258	0.224	−4.87	3	−4.854 0.022
004628 AB				N	5.742	0.013	0.890	0.008	Ig	070193		0.266	0.242	−4.83		
004628 AB				N	5.742	0.013	0.890	0.008	Ig	070293		0.261	0.232	−4.86		
004863				P	8.285	0.031	0.571	0.015	Ig	121492		0.221	0.171	−4.88	1	
004975				P	7.136	0.031	0.593	0.004	Ig	121292		0.210	0.153	−5.01	1	
005190	1	s=22.4	I	X	6.673	0.031	0.518	0.006	Ig	121392		0.211	0.154	−4.96	1	
005208	1	s=22.4	I	P	7.394	0.031	0.676	0.004	Ig	121392		0.203	0.142	−5.13	1	
005303				P	7.60	0.0	0.71	0.0	S	062793	str	0.428	0.809	−4.03	1	
005303				P	7.60	0.0	0.71	0.0	S	121392	off					
006107				P	6.908	0.008	0.650	0.004	Ig	121092		0.216	0.164	−4.97	1	
006236				P	7.699	0.005	0.591	0.001	Ig	121192		0.209	0.151	−5.03	1	
006434				P	7.723	0.006	0.603	0.012	Ig	121292		0.223	0.175	−4.89	1	
007570				BP	4.959	0.004	0.571	0.007	Ig	121192		0.215	0.161	−4.95	1	
007678				P	8.20	0.35	0.67	0.10	Ig	121092		0.252	0.231	−4.70	1	
008076				P	7.646	0.031	0.622	0.003	Ig	121292		0.243	0.213	−4.73	1	
008535				P	7.697	0.005	0.553	0.009	Ig	121192		0.209	0.151	−5.00	1	
008638				P	8.302	0.009	0.684	0.011	Ig	121292		0.223	0.175	−4.92	1	
008821 AB		a=1.0	W	P	7.860	0.031	0.750	0.015	Ig	121192		0.262	0.253	−4.69	1	
009562				C	5.754	0.009	0.639	0.006	Ig	062893	cal	0.209	0.138	−5.16	4	see Table 3
009562				C	5.754	0.009	0.639	0.006	Ig	062993	cal	0.212	0.143	−5.12		
009562				C	5.754	0.009	0.639	0.006	Ig	121292	cal	0.210	0.153	−5.04		
009562				C	5.754	0.009	0.639	0.006	Ig	121392	cal	0.207	0.148	−5.08		
009608				P	8.190	0.002	0.570	0.002	Ig	121092		0.225	0.179	−4.85	2	−4.901
009608				P	8.190	0.002	0.570	0.002	Ig	121192		0.214	0.159	−4.96		
009934				P	7.851	0.001	0.556	0.012	Ig	121192		0.217	0.166	−4.91	1	
010180				P	7.40	0.40	0.63	0.05	Ig	121192		0.210	0.153	−5.04	1	
010360	2	a=7.8	W	N	5.90	0.0	0.80	0.0	G	062793	noi				5	−4.753 0.007
010360				N	5.90	0.0	0.80	0.0	G	062893		0.269	0.249	−4.74		
010360				N	5.90	0.0	0.80	0.0	G	062993		0.266	0.242	−4.76		
010360				N	5.90	0.0	0.80	0.0	G	063093		0.266	0.243	−4.76		
010360				N	5.90	0.0	0.80	0.0	G	070193		0.267	0.245	−4.75		
010360				N	5.90	0.0	0.80	0.0	G	070293		0.266	0.242	−4.76		
010361	2	a=7.8	W	N	5.80	0.0	0.86	0.0	G	062793	noi				5	−4.881 0.019
010361				N	5.80	0.0	0.86	0.0	G	062893		0.249	0.207	−4.90		
010361				N	5.80	0.0	0.86	0.0	G	062993		0.256	0.221	−4.86		
010361				N	5.80	0.0	0.86	0.0	G	063093		0.252	0.213	−4.88		
010361				N	5.80	0.0	0.86	0.0	G	070193		0.255	0.218	−4.87		
010361				N	5.80	0.0	0.86	0.0	G	070293		0.249	0.206	−4.90		

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
010370				P	7.90	0.35	0.69	0.10	Ig	121292		0.235	0.199	−4.82	1	
010476	*			N	5.242	0.010	0.836	0.008	Ig	063093		0.238	0.185	−4.95	3	−4.930 0.022
010476				N	5.242	0.010	0.836	0.008	Ig	070193		0.245	0.198	−4.91		
010476				N	5.242	0.010	0.836	0.008	Ig	070293		0.241	0.192	−4.93		
010700	*			BCN	3.495	0.010	0.727	0.007	Ig	062993	cal	0.231	0.173	−4.95	7	see Table 3
010700				BCN	3.495	0.010	0.727	0.007	Ig	063093	cal	0.229	0.169	−4.97		
010700				BCN	3.495	0.010	0.727	0.007	Ig	070193	cal	0.231	0.173	−4.95		
010700				BCN	3.495	0.010	0.727	0.007	Ig	070293	cal	0.228	0.167	−4.98		
010700				BCN	3.495	0.010	0.727	0.007	Ig	121092	cal	0.221	0.173	−4.95		
010700				BCN	3.495	0.010	0.727	0.007	Ig	121292	cal	0.220	0.170	−4.97		
010700				BCN	3.495	0.010	0.727	0.007	Ig	121392	cal	0.222	0.174	−4.95		
010800				P	5.869	0.012	0.620	0.006	Ig	121392		0.263	0.255	−4.60	1	
011131	*	s=183	I	C	6.750	0.031	0.610	0.015	Ig	062893	cal	0.295	0.315	−4.46	4	see Table 3
011131				C	6.750	0.031	0.610	0.015	Ig	062993	cal	0.295	0.314	−4.46		
011131				C	6.750	0.031	0.610	0.015	Ig	121292	cal	0.286	0.310	−4.47		
011131				C	6.750	0.031	0.610	0.015	Ig	121392	cal	0.282	0.300	−4.49		
011264				P	7.931	0.002	0.664	0.001	Ig	121392		0.216	0.163	−4.98	1	
012068 A		s=42	J	P	8.260	0.031	0.700	0.015	Ig	121292		0.214	0.160	−5.01	1	
012387				P	7.374	0.009	0.653	0.006	Ig	121092		0.226	0.180	−4.89	1	
012759 AB		s=1.0	I	P	7.295	0.002	0.694	0.004	Ig	121392		0.343	0.464	−4.30	1	
012951				P	6.858	0.031	0.576	0.015	Ig	121392		0.206	0.146	−5.06	1	
013445				P	6.119	0.001	0.812	0.015	Ig	121392		0.261	0.251	−4.74	1	
013724				P	7.901	0.031	0.667	0.015	Ig	121092		0.233	0.194	−4.83	1	
014398				P	8.097	0.031	0.646	0.015	Ig	121192		0.208	0.150	−5.06	1	
014412				BP	6.343	0.007	0.724	0.003	Ig	121292		0.233	0.194	−4.86	1	
014747				P	8.122	0.004	0.678	0.002	Ig	121192		0.212	0.156	−5.03	1	
014758 AB		s=9.9	I	P	7.899	0.031	0.644	0.015	Ig	121292		0.223	0.175	−4.91	1	
014882 AB		a=0.6	W	P	6.957	0.010	0.566	0.008	Ig	121292		0.268	0.266	−4.54	1	
015064 AB	3	P=142d	B	P	6.170	0.005	0.653	0.005	Ig	121092		0.216	0.164	−4.97	1	
016160 AC	*	triple		N	5.791	0.031	0.918	0.019	Ig	063093		0.267	0.246	−4.85	3	−4.847 0.004
016160 AC				N	5.791	0.031	0.918	0.019	Ig	070193		0.269	0.249	−4.84		
016160 AC				N	5.791	0.031	0.918	0.019	Ig	070293		0.268	0.247	−4.85		
016358				P	7.707	0.031	0.609	0.015	Ig	121292		0.212	0.156	−5.00	1	
016382 A	2	s=8.0	I	P	7.873	0.031	0.616	0.015	Ig	121192		0.211	0.155	−5.01	1	
016673				C	5.780	0.003	0.523	0.009	Ig	070293	cal	0.253	0.214	−4.67	3	see Table 3
016673				C	5.780	0.003	0.523	0.009	Ig	121092	cal	0.255	0.239	−4.59		
016673				C	5.780	0.003	0.523	0.009	Ig	121392	cal	0.253	0.235	−4.60		
017051				BP	5.400	0.004	0.561	0.007	Ig	121192		0.249	0.225	−4.65	1	
017084				P	8.060	0.030	0.745	0.020	Ig	121092		0.459	0.886	−4.02	1	
017134 AB		s=0.1	I	P	6.86	0.06	0.655	0.009	Ig	121292		0.220	0.170	−4.94	1	
017169				P	7.121	0.031	0.757	0.015	Ig	121292		0.257	0.244	−4.72	1	
017215 AB		s=0.5	I	P	7.762	0.005	0.700	0.002	Ig	121192		0.207	0.149	−5.08	1	
017289				P	7.444	0.031	0.588	0.003	Ig	121192		0.222	0.174	−4.88	1	
017321				P	7.790	0.031	0.609	0.015	Ig	121292		0.217	0.165	−4.95	1	
017322				P	7.637	0.003	0.580	0.001	Ig	121092		0.223	0.176	−4.86	1	
017576 AB		s=1.8	I	P	7.834	0.031	0.609	0.003	Ig	062893	str	0.588	1.757	−3.58	2	−3.626
017576 AB				P	7.834	0.031	0.609	0.003	Ig	121392	str	0.579	1.464	−3.67		
017925				C	6.041	0.014	0.862	0.015	Ig	121092	cal	0.403	0.664	−4.29	2	see Table 3
017925				C	6.041	0.014	0.862	0.015	Ig	121392	cal	0.401	0.659	−4.30		
017970				P	8.093	0.003	0.827	0.006	Ig	121392		0.214	0.160	−5.05	1	
018003				P	8.318	0.001	0.660	0.002	Ig	121192		0.208	0.149	−5.07	1	
018709				P	7.395	0.006	0.590	0.008	Ig	121192		0.214	0.160	−4.96	1	
018809				P	8.468	0.031	0.677	0.015	Ig	121392		0.330	0.426	−4.33	1	
018907				P	5.876	0.008	0.794	0.007	Ig	121292		0.181	0.109	−5.40	1	
019423				P	7.887	0.031	0.649	0.015	Ig	121192		0.215	0.162	−4.98	1	
019641				P	8.269	0.031	0.657	0.015	Ig	121092		0.227	0.184	−4.87	1	
020201				P	7.267	0.005	0.584	0.005	Ig	121192		0.217	0.164	−4.93	1	
020407				BP	6.762	0.002	0.586	0.014	Ig	121192		0.232	0.192	−4.79	1	
020766	1	s=309	I	BP	5.529	0.007	0.641	0.007	Ig	121192		0.253	0.234	−4.68	2	−4.646
020766				BP	5.529	0.007	0.641	0.007	Ig	121392		0.263	0.256	−4.62		
020782	*	s=249	I	P	7.380	0.031	0.650	0.015	Ig	121292		0.223	0.176	−4.91	1	
020794				BN	4.260	0.002	0.711	0.005	Ig	062793		0.227	0.166	−4.98	6	−4.977 0.007
020794				BN	4.260	0.002	0.711	0.005	Ig	062893		0.227	0.167	−4.98		
020794				BN	4.260	0.002	0.711	0.005	Ig	062993		0.228	0.168	−4.97		
020794				BN	4.260	0.002	0.711	0.005	Ig	063093		0.226	0.165	−4.99		
020794				BN	4.260	0.002	0.711	0.005	Ig	070193		0.227	0.167	−4.98		
020794				BN	4.260	0.002	0.711	0.005	Ig	070293		0.228	0.169	−4.97		
020807	1	s=309	I	BP	5.239	0.015	0.600	0.009	Ig	121192		0.230	0.188	−4.82	2	−4.787
020807				BP	5.239	0.015	0.600	0.009	Ig	121392		0.238	0.203	−4.76		
021058 AB		s=1.2	I	P	8.46	0.10	0.74	0.10	Ig	121392		0.262	0.254	−4.69	1	
021175 AB		s=2.1	I	P	6.901	0.008	0.840	0.010	Ig	121392		0.281	0.296	−4.68	1	
021411 A		s=10	J	BP	7.877	0.004	0.716	0.004	Ig	121292		0.248	0.224	−4.75	1	
021693				P	7.953	0.004	0.761	0.004	Ig	121192		0.234	0.196	−4.87	1	
021938				P	8.380	0.030	0.700	0.020	Ig	121092		0.227	0.182	−4.90	1	
022049	*			CN	3.726	0.002	0.881	0.007	Ig	063093	cal	0.350	0.486	−4.47	5	see Table 3
022049				CN	3.726	0.002	0.881	0.007	Ig	070193	cal	0.348	0.479	−4.47		
022049				CN	3.726	0.002	0.881	0.007	Ig	070293	cal	0.345	0.468	−4.48		
022049				CN	3.726	0.002	0.881	0.007	Ig	121092	cal	0.347	0.476	−4.48		
022049				CN	3.726	0.002	0.881	0.007	Ig	121392	cal	0.356	0.505	−4.45		
022705 A		s=14.6	J	P	7.621	0.031	0.594	0.015	Ig	121392		0.315	0.383	−4.33	1	
023079				P	7.118	0.001	0.583	0.009	Ig	121192		0.216	0.164	−4.94	1	
023249				C	3.528	0.003	0.915	0.018	Ig	121392	cal	0.195	0.129	−5.22	1	
023576				P	7.509	0.031	0.609	0.015	Ig	121392		0.215	0.161	−4.97	1	
024062				P	7.429	0.031	0.622	0.015	Ig	121192	str	0.195	0.129	−5.25	1	
024085				P	7.575	0.031	0.612	0.015	Ig	121192		0.212	0.156	−5.00	1	
024224				P	8.40	0.35	0.68	0.10	Ig	121192		0.289	0.316	−4.51	1	
024293	*			P	7.846	0.005	0.658	0.007	Ig	121192		0.221	0.172	−4.93	1	
024892				P	6.874	0.006	0.748	0.001	Ig	121292		0.197	0.133	−5.20	1	
025388				P	8.131	0.031	0.803	0.015	Ig	121092		0.194	0.128	−5.23	1	
025535 AB		s=1.5	I	P	6.734	0.005	0.628	0.004	Ig	121292		0.210	0.153	−5.04	1	

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TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
025546 AB		s=0.4	I	P	7.601	0.031	0.566	0.015	Ig	121292		0.284	0.305	−4.45	1	
025740				P	8.122	0.001	0.648	0.002	Ig	121392		0.194	0.127	−5.27	1	
025874 A		s=29	J	P	6.740	0.003	0.667	0.002	Ig	121192		0.222	0.173	−4.93	1	
025926 AB		s=0.7	I	P	7.698	0.031	0.637	0.015	Ig	121092		0.295	0.331	−4.45	1	
026491				P	6.373	0.003	0.636	0.003	Ig	121192		0.218	0.167	−4.95	1	
026965	*	triple		CN	4.426	0.011	0.820	0.001	Ig	121392	cal	0.228	0.185	−4.94	1	
027019 AB		a=0.3	W	P	6.780	0.001	0.577	0.002	Ig	121392		0.215	0.162	−4.94	1	
027358 AB		s=0.3	I	P	7.886	0.031	0.632	0.015	Ig	121192		0.214	0.160	−4.99	1	
027471				P	7.533	0.001	0.629	0.017	Ig	121192		0.205	0.144	−5.10	1	
027631				P	8.258	0.031	0.682	0.015	Ig	121092		0.224	0.177	−4.91	1	
027905				P	7.818	0.007	0.627	0.005	Ig	121292		0.219	0.169	−4.93	1	
028187				P	7.803	0.031	0.629	0.015	Ig	121292		0.216	0.163	−4.97	1	
028388				P	7.860	0.031	0.752	0.015	Ig	121292		0.198	0.134	−5.19	1	
028453				P	7.149	0.031	0.601	0.015	Ig	121092		0.207	0.147	−5.06	1	
028701				P	7.850	0.031	0.650	0.015	Ig	121192		0.219	0.168	−4.95	1	
028904				P	8.260	0.031	0.640	0.015	Ig	121192		0.293	0.325	−4.46	1	
029231				P	7.611	0.005	0.776	0.002	Ig	121092		0.267	0.264	−4.69	1	
029303				P	8.606	0.031	0.629	0.015	Ig	121192		0.267	0.265	−4.58	1	
029813				P	7.743	0.004	0.621	0.001	Ig	121292		0.220	0.170	−4.92	1	
030003 AB		a=1.9	W	BP	6.529	0.004	0.677	0.007	Ig	121192		0.232	0.193	−4.84	1	
030278				P	7.610	0.004	0.746	0.002	Ig	121192		0.223	0.175	−4.95	1	
030495				BC	5.491	0.007	0.632	0.006	Ig	121392	cal	0.276	0.286	−4.54	1	
030774				P	7.905	0.031	0.70	0.10	Ig	121292		0.306	0.360	−4.45	1	
030966				P	8.50	0.11	0.76	0.10	Ig	121092		0.205	0.145	−5.12	1	
031027 AB		s=2.1	I	P	7.644	0.002	0.846	0.002	Ig	121192		0.231	0.190	−4.94	1	
031392				P	7.612	0.002	0.792	0.003	Ig	121292		0.258	0.244	−4.75	1	
031532 AB		s=0.1	I	P	6.816	0.003	0.615	0.003	Ig	121192		0.208	0.150	−5.05	1	
032778 A				BP	7.023	0.031	0.636	0.015	Ig	121192		0.226	0.181	−4.87	1	
033473 A				P	6.760	0.031	0.669	0.015	Ig	121392		0.197	0.133	−5.21	1	
034297				P	7.325	0.002	0.652	0.003	Ig	121192		0.220	0.171	−4.93	1	
034327 A		s=25.6	J	P	7.114	0.031	0.636	0.001	Ig	121192		0.205	0.145	−5.10	1	
034599				P	8.34	0.08	0.67	0.10	Ig	121392		0.276	0.284	−4.56	1	
034962				P	8.50	0.35	0.73	0.10	Ig	121192		0.306	0.359	−4.47	1	
035676				P	8.075	0.009	0.728	0.003	Ig	121092		0.304	0.355	−4.48	1	
035854				S	7.725	0.008	0.946	0.004	Ig	121492		0.274	0.280	−4.81	1	
035974				P	7.189	0.031	0.604	0.015	Ig	121292		0.207	0.148	−5.06	1	
036435				P	6.988	0.004	0.755	0.017	Ig	121192		0.319	0.395	−4.44	1	
036516				P	7.90	0.35	0.66	0.10	Ig	121292		0.225	0.179	−4.90	1	
036889				S	7.372	0.002	0.670	0.002	Ig	121492		0.201	0.139	−5.16	1	
037213				P	8.222	0.002	0.707	0.002	Ig	121292		0.202	0.140	−5.15	1	
037572 A		s=17.8	I	P	7.955	0.008	0.845	0.005	Ig	121392		0.475	0.952	−4.10	1	
037630				S	8.320	0.031	0.827	0.015	Ig	121492	ray				0	
037655				BP	7.434	0.003	0.600	0.006	Ig	121392		0.207	0.148	−5.06	1	
037706 AB		s=5.0	I	P	7.334	0.005	0.769	0.016	Ig	121392		0.243	0.213	−4.82	1	
037962				P	7.850	0.001	0.648	0.005	Ig	121292		0.232	0.193	−4.83	1	
038283				P	6.702	0.031	0.584	0.007	Ig	121192		0.213	0.158	−4.97	1	
038392	0	s=96.3	G	C	6.13	0.0	0.94	0.0	G	121092	cal	0.367	0.541	−4.49	3	see Table 3
038392				C	6.13	0.0	0.94	0.0	G	121392	cal	0.364	0.529	−4.50		
038392				C	6.13	0.0	0.94	0.0	G	121492	cal	0.364	0.531	−4.50		
038393	*	s=96.3	G	C	3.590	0.011	0.481	0.011	Ig	121092	cal	0.227	0.183	−4.77	3	see Table 3
038393				C	3.590	0.011	0.481	0.011	Ig	121392	cal	0.227	0.183	−4.77		
038393				C	3.590	0.011	0.481	0.011	Ig	121492	cal	0.225	0.179	−4.79		
038397				P	8.18	0.10	0.60	0.10	Ig	121092		0.333	0.436	−4.26	1	
038467				S	8.268	0.001	0.672	0.003	Ig	121492		0.208	0.149	−5.07	1	
038973				P	6.628	0.001	0.594	0.009	Ig	121392		0.223	0.175	−4.88	1	
039091				P	5.651	0.007	0.600	0.003	Ig	121192		0.214	0.160	−4.97	1	
039427				S	8.713	0.013	0.678	0.013	Ig	121492		0.238	0.203	−4.80	1	
039601				P	8.166	0.004	0.781	0.003	Ig	121092		0.194	0.128	−5.23	1	
039917				S	7.867	0.049	0.813	0.017	Ig	121492		0.480	0.975	−4.05	1	
040129 AB		s=0.3	I	P	8.30	0.35	0.80	0.49	Ip	121392		0.273	0.277	−4.68	1	
041004				S	8.653	0.027	0.887	0.013	Ig	121492		0.296	0.335	−4.66	1	
041700	*	triple		P	6.349	0.001	0.517	0.005	Ig	121392		0.299	0.342	−4.35	1	
041824 AB		a=2.9	W	P	6.601	0.031	0.712	0.005	Ig	121392		0.388	0.612	−4.17	1	
042286				P	8.454	0.001	0.844	0.003	Ig	121192		0.239	0.206	−4.89	1	
042287				P	7.833	0.031	0.596	0.015	Ig	121192		0.262	0.254	−4.59	1	
042490				P	8.10	0.35	0.73	0.10	Ig	121192		0.197	0.133	−5.21	1	
043180				P	8.50	0.28	0.67	0.10	Ig	121092		0.241	0.210	−4.77	1	
043834				BP	5.080	0.004	0.714	0.015	Ig	121192		0.223	0.175	−4.94	1	
044105	1	s=33.7	I	X	7.760	0.030	0.460	0.040	Ig	121192	pht	0.234	0.196		0	
044120	1	s=33.7	I	P	6.444	0.001	0.593	0.015	Ig	121192		0.212	0.156	−4.99	1	
044135				P	8.144	0.031	0.632	0.015	Ig	121292	str	0.322	0.405	−4.33	1	
044310				S	8.681	0.031	0.837	0.015	Ig	121492		0.211	0.155	−5.07	1	
044594				P	6.606	0.002	0.657	0.006	Ig	121092		0.222	0.174	−4.92	1	
044665 A	2	s=6.5	I	P	8.37	0.0	0.74	0.0	S	121092		0.224	0.177	−4.94	1	
044665 B	2	s=6.5	I	X	0.0	0.0	0.0	0.0		121092	pht	0.346	0.476		0	
045067				C	5.869	0.002	0.564	0.009	Ig	121192	cal	0.198	0.134	−5.16	4	see Table 3
045067				C	5.869	0.002	0.564	0.009	Ig	121192	cal	0.211	0.155	−4.98		
045067				C	5.869	0.002	0.564	0.009	Ig	121392	cal	0.210	0.153	−5.00		
045067				C	5.869	0.002	0.564	0.009	Ig	121492	cal	0.209	0.151	−5.01		
045133				S	8.20	0.35	0.69	0.10	Ig	121492		0.201	0.139	−5.16	1	
045184				P	6.380	0.004	0.626	0.007	Ig	121292		0.222	0.173	−4.91	1	
045228 A		s=70	J	P	7.855	0.015	0.710	0.010	Ig	121392		0.198	0.134	−5.20	1	
045270 A		s=16	J	P	6.526	0.031	0.614	0.001	Ig	121192		0.322	0.402	−4.32	1	
045289				P	6.651	0.011	0.673	0.004	Ig	121092		0.214	0.159	−5.01	1	
045345				S	8.90	0.35	0.70	0.10	Ig	121492	ray				0	
045364				P	8.083	0.031	0.719	0.015	Ig	121292		0.221	0.173	−4.95	1	
045665				S	8.40	0.35	0.69	0.10	Ig	121492		0.289	0.317	−4.51	1	
046816	*			P	8.18	0.09	1.23	0.12	Ip	121292	pht	0.210	0.153		0	
047186				S	7.633	0.003	0.714	0.002	Ig	121492		0.221	0.173	−4.95	1	
047283 AB		s=0.2	I	P	7.231	0.031	0.629	0.015	Ig	121292		0.246	0.219	−4.72	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	$\log R'_{HK}$ (15)	N (16)	Mean (17)
047391				P	7.643	0.016	0.703	0.005	Ig	121292		0.218	0.167	−4.98	1	
047948 AB		s=4.8	I	S	8.30	0.35	0.80	0.49	Ip	121492		0.192	0.125	−5.25	1	
048189 AB		s=2.4	I	P	6.184	0.006	0.624	0.005	Ig	121192		0.331	0.430	−4.29	1	
048969				P	8.530	0.004	0.685	0.013	Ig	121092		0.224	0.178	−4.91	1	
049134				P	8.57	0.08	0.87	0.15	Ip	121192		0.309	0.368	−4.59	1	
050177				P	7.90	0.35	0.66	0.10	Ig	121292		0.199	0.135	−5.19	1	
050499				P	7.210	0.031	0.611	0.015	Ig	121292		0.207	0.148	−5.06	1	
050806				P	6.037	0.006	0.708	0.005	Ig	121292		0.195	0.129	−5.24	1	
051608				P	8.160	0.003	0.771	0.020	Ig	121192		0.221	0.173	−4.97	1	
051633 AB	*	s=1.3	I	P	7.60	0.35	1.10	0.49	Ip	121292		0.259	0.247	−5.07	1	
051929				P	7.411	0.003	0.585	0.012	Ig	121292		0.224	0.177	−4.86	1	
052063				P	7.691	0.031	0.612	0.004	Ig	121192		0.206	0.147	−5.07	1	
052491				P	8.480	0.030	0.580	0.040	Ig	121292		0.254	0.236	−4.63	1	
052698				S	6.712	0.006	0.882	0.022	Ig	121492		0.298	0.340	−4.64	1	
052897 AB		s=4.9	I	S	8.70	0.35	0.50	0.49	Ip	121492		0.232	0.192	−4.74	1	
053143				P	6.821	0.013	0.786	0.024	Ig	121192		0.307	0.362	−4.52	1	
053705	1	s=21.6		BP	5.559	0.031	0.624	0.009	Ig	121092		0.219	0.169	−4.93	1	
053706	1	s=21.6	I	X	6.826	0.035	0.779	0.020	Ig	121092		0.217	0.166	−5.01	1	
054579				P	8.031	0.031	0.606	0.015	Ig	121292	str	0.395	0.636	−4.07	1	
055296				S	8.379	0.003	0.697	0.002	Ig	121492		0.197	0.132	−5.22	1	
055720				P	7.508	0.003	0.705	0.001	Ig	121092	ray				0	
056259				S	8.80	0.35	0.72	0.10	Ig	121492		0.192	0.125	−5.29	1	
056451				P	7.865	0.003	0.591	0.002	Ig	121292		0.209	0.152	−5.02	1	
056662				P	7.667	0.017	0.604	0.007	Ig	121192		0.223	0.176	−4.88	1	
056972				S	8.60	0.35	0.69	0.10	Ig	121492		0.204	0.144	−5.12	1	
057062				S	9.70	0.35	0.70	0.10	Ig	121492		0.187	0.118	−5.37	1	
057334				P	7.524	0.031	0.556	0.015	Ig	121192		0.218	0.167	−4.90	1	
057555 ABC	*	triple		P	7.880	0.030	0.650	0.042	Ig	121192	str	0.358	0.510	−4.22	1	
059099	1	s=17.1		X	7.019	0.015	0.486	0.014	Ig	121392	pht	0.233	0.195		0	
059100	1	s=17.1	I	P	8.172	0.013	0.634	0.006	Ig	121292		0.214	0.161	−4.99	2	−4.979
059100				P	8.172	0.013	0.634	0.006	Ig	121392		0.216	0.163	−4.97		
059468				BP	6.726	0.002	0.694	0.014	Ig	121092		0.221	0.172	−4.95	1	
059741				S	10.30	0.35	0.69	0.10	Ig	121492		0.199	0.136	−5.18	1	
059967				P	6.643	0.001	0.635	0.009	Ig	121292		0.315	0.384	−4.36	1	
060683	0			P	8.0	0.0	0.4	0.0	S	121292	pht	0.210	0.153		0	
060837				S	8.576	0.031	0.923	0.015	Ig	121492	low	0.170			0	
061005				P	8.20	0.35	0.68	0.10	Ig	121292		0.352	0.492	−4.26	1	
061033				P	7.586	0.004	0.724	0.001	Ig	121092		0.340	0.454	−4.34	1	
061986				P	8.680	0.003	0.626	0.003	Ig	121292		0.229	0.186	−4.84	1	
062061				P	7.518	0.003	0.584	0.003	Ig	121192		0.212	0.157	−4.98	1	
062848				P	6.689	0.006	0.550	0.007	Ig	121092		0.286	0.310	−4.43	1	
062850				P	7.201	0.014	0.637	0.005	Ig	121092		0.330	0.427	−4.30	1	
062911 AB		s=1.9	I	P	8.391	0.006	0.793	0.003	Ig	121292		0.320	0.398	−4.47	1	
063077 A	*	s=914	G	BP	5.363	0.002	0.589	0.012	Ig	121292		0.224	0.178	−4.86	1	
063637				P	7.517	0.001	0.647	0.005	Ig	121292		0.200	0.137	−5.17	1	
064184				P	7.501	0.001	0.675	0.001	Ig	121092		0.227	0.184	−4.88	1	
065721				P	7.948	0.005	0.739	0.002	Ig	121292		0.266	0.261	−4.67	1	
065723				S	7.005	0.010	0.979	0.002	Ig	121492	low	0.134			0	
065907 A	*	triple		BP	5.595	0.006	0.573	0.009	Ig	121092		0.231	0.191	−4.79	1	
066039				P	7.735	0.031	0.576	0.015	Ig	121192		0.253	0.233	−4.64	1	
066078				S	8.008	0.021	0.778	0.002	Ig	121492		0.246	0.220	−4.80	1	
066653				P	7.523	0.009	0.655	0.005	Ig	121192		0.252	0.231	−4.69	1	
067199				S	7.180	0.005	0.872	0.002	Ig	121492		0.277	0.289	−4.72	1	
067458				BP	6.798	0.006	0.600	0.004	Ig	121292		0.216	0.164	−4.95	1	
067581	0			S	8.73	0.0	0.60	0.0	S	121492		0.202	0.140	−5.12	1	
067907				S	8.594	0.008	0.712	0.006	Ig	121492		0.188	0.118	−5.36	1	
068785				P	8.195	0.009	0.619	0.002	Ig	121192		0.228	0.184	−4.85	1	
068978 A	*	triple		P	6.697	0.030	0.618	0.004	Ig	121292		0.227	0.183	−4.86	1	
069565 A		s=11.8	J	S	7.20	0.35	0.77	0.10	Ig	121492		0.183	0.112	−5.39	1	
069655				P	6.631	0.001	0.579	0.007	Ig	121092		0.224	0.178	−4.85	1	
070889				P	7.106	0.031	0.576	0.015	Ig	121292		0.227	0.183	−4.83	1	
071334				BP	7.797	0.006	0.643	0.027	Ig	121292		0.214	0.161	−4.99	1	
071835				P	8.40	0.35	0.78	0.10	Ig	121292		0.233	0.195	−4.89	1	
072234				P	7.20	0.40	0.68	0.05	Ig	121192		0.202	0.140	−5.15	1	
072579				P	8.220	0.031	0.790	0.015	Ig	121092		0.217	0.165	−5.01	1	
072673				P	6.381	0.007	0.780	0.010	Ig	121292		0.225	0.179	−4.95	1	
072687				P	8.225	0.041	0.69	0.10	Ig	121292		0.318	0.393	−4.39	1	
072954 AB		a=0.2	W	P	6.425	0.002	0.752	0.001	Ig	121292		0.190	0.122	−5.30	1	
073121				P	6.459	0.006	0.578	0.006	Ig	121092		0.209	0.151	−5.02	1	
073256				P	8.068	0.015	0.784	0.002	Ig	121292		0.313	0.378	−4.49	1	
073524				BP	6.534	0.005	0.598	0.004	Ig	121092		0.212	0.156	−4.99	1	
073744				P	7.605	0.006	0.607	0.006	Ig	121192		0.228	0.185	−4.84	1	
074385 A		s=45"	G	S	8.130	0.008	0.904	0.002	Ig	121492		0.332	0.433	−4.55	1	
074497 AB		a=0.4	W	P	7.845	0.002	0.661	0.008	Ig	121192		0.235	0.198	−4.81	1	
074576				S	6.561	0.008	0.917	0.022	Ig	121492		0.424	0.742	−4.31	1	
074698				P	7.782	0.031	0.665	0.010	Ig	121192		0.212	0.156	−5.03	1	
074842				P	7.206	0.001	0.743	0.002	Ig	121092		0.284	0.304	−4.58	1	
074885				P	8.206	0.004	0.763	0.002	Ig	121392	ray				0	
074957				P	8.119	0.003	0.593	0.007	Ig	121192		0.222	0.174	−4.88	1	
075070				P	8.20	0.35	0.59	0.10	Ig	121192		0.217	0.165	−4.94	1	
075289				P	6.358	0.031	0.578	0.003	Ig	121092		0.210	0.154	−5.00	1	
075519				P	7.98	0.12	0.69	0.10	Ig	121092		0.322	0.404	−4.37	1	
076151				BC	6.000	0.002	0.661	0.012	Ig	121092	cal	0.253	0.235	−4.69	5	see Table 3
076151				BC	6.000	0.002	0.661	0.012	Ig	121192	cal	0.255	0.238	−4.68		
076151				BC	6.000	0.002	0.661	0.012	Ig	121292	cal	0.250	0.227	−4.71		
076151				BC	6.000	0.002	0.661	0.012	Ig	121392	cal	0.253	0.235	−4.69		
076151				BC	6.000	0.002	0.661	0.012	Ig	121492	cal	0.252	0.231	−4.70		
076668 AB		s=0.7	I	P	6.846	0.006	0.616	0.004	Ig	121392		0.212	0.156	−5.00	1	
077137 AB	3	P=3d	B	P	6.87	0.0	0.69	0.0	G	121292		0.406	0.674	−4.10	1	
077425				P	8.194	0.031	0.631	0.015	Ig	121192		0.214	0.159	−4.99	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
077902				P	7.10	0.35	0.64	0.10	Ig	121092		0.197	0.132	−5.22	1	
078429				P	7.307	0.001	0.664	0.004	Ig	121092		0.225	0.179	−4.90	1	
078643 AB		s=1.6	I	P	6.767	0.006	0.575	0.007	Ig	121292		0.201	0.138	−5.13	1	
078747				P	7.719	0.004	0.575	0.018	Ig	121292		0.218	0.167	−4.91	1	
079601				P	8.018	0.003	0.582	0.022	Ig	121092		0.225	0.179	−4.85	1	
079985				P	7.90	0.40	0.65	0.05	Ig	121192		0.202	0.139	−5.15	1	
080542				P	7.50	0.35	0.64	0.10	Ig	121292		0.256	0.240	−4.66	1	
081110				P	8.20	0.35	0.67	0.10	Ig	121292		0.234	0.196	−4.83	1	
081133				P	7.204	0.031	0.558	0.015	Ig	121292		0.229	0.186	−4.80	1	
081174				P	8.00	0.35	0.75	0.10	Ig	121192		0.197	0.132	−5.21	1	
081221 AB		s=0.9	I	P	8.269	0.031	0.652	0.015	Ig	121192		0.238	0.204	−4.78	1	
081485 A	2	s=9.2	I	P	7.8	0.0	0.7	0.0	S	121192		0.287	0.311	−4.53	1	
081639 AB		s=7.0	I	P	8.101	0.006	0.718	0.002	Ig	121192		0.224	0.177	−4.93	1	
081809 AB		s=0.4	I	C	5.375	0.006	0.642	0.018	Ig	121092	cal	0.219	0.168	−4.95	5	see Table 3
081809 AB				C	5.375	0.006	0.642	0.018	Ig	121192	cal	0.212	0.157	−5.01		
081809 AB				C	5.375	0.006	0.642	0.018	Ig	121292	cal	0.212	0.156	−5.02		
081809 AB				C	5.375	0.006	0.642	0.018	Ig	121392	cal	0.210	0.153	−5.04		
081809 AB				C	5.375	0.006	0.642	0.018	Ig	121492	cal	0.216	0.164	−4.97		
082082				P	7.195	0.004	0.605	0.001	Ig	121392		0.219	0.168	−4.92	1	
082114 A		s=20	J	P	7.060	0.031	0.620	0.015	Ig	121192		0.206	0.146	−5.08	2	−5.105
082114 A				P	7.060	0.031	0.620	0.015	Ig	121392		0.202	0.141	−5.13		
082455				P	8.649	0.003	0.656	0.012	Ig	121392	ray				0	
082561				P	8.431	0.002	0.707	0.002	Ig	121292		0.214	0.159	−5.02	1	
082597 A		s=10.1	J	S	8.40	0.35	0.69	0.10	Ig	121492		0.204	0.143	−5.13	1	
082798	*			P	7.252	0.002	0.663	0.007	Ig	121392		0.204	0.143	−5.12	1	
083517				P	7.77	0.06	0.68	0.10	Ig	121392		0.221	0.172	−4.94	1	
083529 AB		s=4.5	I	P	6.980	0.030	0.590	0.042	Ig	121392		0.212	0.157	−4.99	1	
084089				P	8.160	0.001	0.593	0.003	Ig	121392		0.217	0.165	−4.93	1	
084273				P	8.45	0.06	0.70	0.10	Ig	121392		0.294	0.330	−4.50	1	
084330 AB		s=3.2	I	P	7.03	0.35	0.68	0.10	Ig	121392		0.280	0.296	−4.55	1	
084612	1	s=12.3	I	P	8.043	0.004	0.517	0.004	Ig	121392		0.223	0.176	−4.83	1	
084627	1	s=12.3	I	X	8.215	0.005	0.530	0.015	Ig	121392		0.226	0.182	−4.81	1	
084742				P	7.940	0.031	0.573	0.015	Ig	121392		0.215	0.162	−4.94	1	
084991				P	7.405	0.031	0.588	0.015	Ig	121392		0.222	0.174	−4.88	1	
085228 AB		s=1.4	I	S	7.921	0.003	0.894	0.008	Ig	121492		0.260	0.249	−4.82	1	
085390				S	8.543	0.004	0.855	0.003	Ig	121492		0.234	0.195	−4.93	1	
086819				P	7.378	0.031	0.580	0.002	Ig	121392		0.214	0.159	−4.96	1	
087320				P	8.106	0.003	0.678	0.001	Ig	121392		0.222	0.174	−4.93	1	
088201				P	7.452	0.012	0.558	0.007	Ig	121392		0.291	0.321	−4.41	1	
088218 AB		s=2.0	I	P	6.139	0.006	0.615	0.009	Ig	121392		0.205	0.144	−5.09	1	
088429				P	8.38	0.10	0.63	0.10	Ig	121392		0.208	0.150	−5.06	1	
088742				BP	6.377	0.003	0.592	0.001	Ig	121392		0.246	0.219	−4.69	1	
088746 A	2	s=5.3	I	S	8.180	0.003	0.798	0.007	Ig	121492		0.269	0.268	−4.70	1	
089090				P	7.219	0.014	0.544	0.008	Ig	121392		0.220	0.170	−4.88	1	
089391				S	7.940	0.031	0.940	0.015	Ig	121492	low	0.157			0	
089441				P	7.70	0.35	0.65	0.10	Ig	121392		0.285	0.306	−4.50	1	
090156				P	6.940	0.031	0.650	0.015	Ig	121392		0.218	0.166	−4.96	1	
090712				P	7.516	0.031	0.606	0.015	Ig	121392		0.288	0.315	−4.46	1	
091682				S	8.506	0.003	0.696	0.003	Ig	121492		0.213	0.158	−5.02	1	
092987				P	7.022	0.003	0.641	0.001	Ig	121392		0.213	0.158	−5.01	1	
093385				P	7.40	0.35	0.65	0.10	Ig	121392		0.213	0.158	−5.01	1	
093745				P	7.487	0.003	0.596	0.002	Ig	121392		0.203	0.142	−5.10	1	
094181				P	7.973	0.031	0.546	0.015	Ig	121392	ray				0	
094527				P	8.50	0.13	0.76	0.10	Ig	121392		0.253	0.235	−4.75	1	
095091 AB		s=0.4	I	P	7.856	0.031	0.659	0.015	Ig	121392		0.213	0.158	−5.01	1	
095521				P	7.592	0.005	0.637	0.002	Ig	121392		0.229	0.186	−4.85	1	
095610	0			P	8.31	0.0	0.55	0.0	S	062893		0.237	0.183	−4.81	1	
096423				P	7.237	0.004	0.680	0.002	Ig	062893		0.225	0.163	−4.99	1	
096700				P	6.523	0.008	0.606	0.009	Ig	062893		0.228	0.169	−4.92	1	
097343				P	7.052	0.004	0.760	0.006	Ig	062893		0.227	0.166	−5.00	1	
097998				P	7.358	0.002	0.626	0.007	Ig	062893		0.240	0.189	−4.83	1	
098222				P	8.178	0.001	0.668	0.001	Ig	062893		0.240	0.188	−4.86	1	
098231 ABCD	*	quadruple		BN	3.786	0.031	0.606	0.015	Ig	070193		0.320	0.386	−4.34	1	
098800 ABCD	*	quadruple		X	8.520	0.030	1.200	0.042	Ig	062893	spc	1.073			0	
098800 ABCD				X	8.520	0.030	1.200	0.042	Ig	063093	spc	1.114				
098800 ABCD				X	8.520	0.030	1.200	0.042	Ig	070193	spc	1.152				
098800 ABCD				X	8.520	0.030	1.200	0.042	Ig	070293	spc	1.152				
099076				P	8.512	0.007	0.792	0.004	Ig	062893		0.277	0.269	−4.69	1	
099240				P	8.14	0.10	0.70	0.10	Ig	062893		0.262	0.234	−4.71	1	
100395 AB		s=2.2	I	P	6.678	0.001	0.593	0.005	Ig	062893		0.221	0.156	−4.99	1	
100555				P	8.167	0.009	0.726	0.005	Ig	062893		0.244	0.197	−4.85	1	
100623 A	*	s=16.2	G	P	5.964	0.002	0.811	0.007	Ig	062893		0.251	0.210	−4.86	1	
100850				P	8.029	0.031	0.661	0.015	Ig	063093		0.217	0.150	−5.07	1	
101530				P	8.075	0.031	0.606	0.015	Ig	063093		0.243	0.194	−4.80	1	
101614				P	6.859	0.004	0.588	0.011	Ig	062993		0.242	0.194	−4.79	1	
101959				P	6.975	0.002	0.552	0.007	Ig	063093		0.241	0.190	−4.78	1	
101976				P	8.40	0.35	0.62	0.10	Ig	062993	ray				0	
102238				P	8.00	0.35	0.68	0.10	Ig	063093		0.231	0.174	−4.93	1	
102365 A	*	s=25.4	G	BP	4.892	0.003	0.664	0.004	Ig	062993		0.228	0.168	−4.95	1	
102438				BP	6.481	0.001	0.681	0.001	Ig	063093		0.233	0.177	−4.92	1	
102540				P	7.099	0.002	0.756	0.003	Ig	063093		0.212	0.143	−5.13	1	
102902				P	7.340	0.031	0.740	0.015	Ig	063093		0.212	0.143	−5.13	1	
102982	0			P	0.0	0.0	0.0	0.0		062993	pht	0.486	1.104		0	
103493 AB		s=3.2	I	P	6.705	0.012	0.646	0.010	Ig	062993		0.262	0.233	−4.68	1	
103742	1	s=18.3	I	P	7.800	0.031	0.670	0.015	Ig	063093		0.309	0.354	−4.43	1	
103743	1	s=18.3	I	P	7.630	0.031	0.640	0.015	Ig	063093		0.324	0.398	−4.34	1	
103760				P	8.23	0.08	0.67	0.10	Ig	063093		0.236	0.181	−4.89	1	
104212				S	8.374	0.002	0.647	0.012	Ig	070193		0.218	0.152	−5.05	1	
104471 AB		a=1.2	W	P	6.905	0.007	0.586	0.006	Ig	063093		0.291	0.304	−4.47	1	
104551				S	8.80	0.35	0.65	0.10	Ig	070193		0.286	0.292	−4.53	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
104982				P	7.784	0.003	0.651	0.004	Ig	063093		0.230	0.170	−4.94	1	
105113 A	2	s=6.6	I	P	6.485	0.003	0.623	0.008	Ig	063093		0.218	0.151	−5.05	1	
105115				S	6.90	0.35	0.98	0.15	Ip	070193	low	0.163			0	
105119				P	7.151	0.005	0.553	0.006	Ig	063093		0.216	0.149	−5.02	1	
105690				P	8.175	0.010	0.707	0.003	Ig	062993		0.355	0.503	−4.27	1	
105837				P	7.526	0.002	0.570	0.018	Ig	062993		0.243	0.195	−4.77	1	
106489				P	7.486	0.006	0.649	0.001	Ig	062993		0.286	0.290	−4.54	1	
106506				P	8.40	0.35	0.58	0.10	Ig	063093		0.421	0.774	−3.95	1	
106552 AB		s=2.7	I	P	8.30	0.35	0.70	0.49	Ip	062993		0.222	0.158	−5.03	1	
106742				S	6.974	0.007	0.600	0.001	Ig	070193		0.202	0.129	−5.23	1	
107022				P	8.407	0.001	0.685	0.007	Ig	062993		0.242	0.192	−4.85	1	
107076				P	7.951	0.031	0.606	0.015	Ig	062993		0.246	0.200	−4.77	1	
107263				S	7.667	0.001	0.546	0.009	Ig	070193		0.228	0.168	−4.89	1	
107692				P	6.705	0.003	0.639	0.002	Ig	062793		0.253	0.215	−4.74	1	
107976 A	2	s=5.3	I	S	7.250	0.030	0.380	0.042	Ig	070193	ray				0	
108147				P	6.986	0.007	0.537	0.010	Ig	063093		0.240	0.188	−4.78	1	
108309				P	6.246	0.001	0.674	0.002	Ig	062793		0.229	0.170	−4.95	1	
108500				P	6.820	0.031	0.670	0.015	Ig	063093		0.281	0.278	−4.58	2	−4.551
108500				P	6.820	0.031	0.670	0.015	Ig	063093		0.291	0.303	−4.52		
108581				X	9.241	0.002	1.218	0.009	Ig	062993	spc	0.512			0	
108581				X	9.241	0.002	1.218	0.009	Ig	070193	spc	0.503				
109200				P	7.132	0.004	0.836	0.010	Ig	063093		0.250	0.209	−4.87	1	
109409 AB		s=1.0	I	S	5.770	0.002	0.683	0.002	Ig	070193		0.212	0.143	−5.12	1	
109591				P	7.885	0.001	0.666	0.001	Ig	062793		0.227	0.167	−4.96	1	
110143				P	7.026	0.001	0.604	0.002	Ig	062793		0.283	0.283	−4.52	1	
110420				P	8.40	0.08	0.76	0.10	Ig	063093		0.274	0.262	−4.68	1	
110619				P	7.527	0.006	0.664	0.006	Ig	063093		0.243	0.194	−4.83	1	
110875 A	2	s=6.6	I	P	7.637	0.031	0.681	0.015	Ig	063093		0.255	0.218	−4.75	1	
111232				P	7.592	0.004	0.701	0.003	Ig	063093		0.227	0.166	−4.98	1	
111234 A	*	triple		P	8.36	0.09	0.67	0.10	Ig	063093		0.217	0.150	−5.07	1	
111564				P	7.614	0.004	0.603	0.008	Ig	063093		0.224	0.160	−4.97	1	
111567				P	8.10	0.35	0.70	0.10	Ig	062993		0.221	0.156	−5.03	1	
112608 AB		s=4.1	I	P	8.014	0.004	0.605	0.001	Ig	063093		0.277	0.268	−4.56	1	
113083				P	8.043	0.005	0.550	0.020	Ig	063093	off				0	
113283				P	7.125	0.005	0.694	0.015	Ig	063093		0.280	0.275	−4.60	1	
113376				P	8.476	0.031	0.735	0.005	Ig	062993		0.233	0.176	−4.94	1	
113478 A		s=35.3	J	P	8.10	0.35	0.61	0.10	Ig	063093		0.220	0.155	−5.01	1	
113553				P	7.90	0.35	0.69	0.10	Ig	062993		0.342	0.460	−4.30	1	
114260 AB	3	P=20d	D	B	7.356	0.006	0.718	0.015	Ig	070293		0.232	0.175	−4.94	1	
114613				B	4.849	0.001	0.693	0.017	Ig	070293		0.219	0.153	−5.05	1	
114630 A		s=25.8"	G	P	6.177	0.032	0.592	0.011	Ig	062993		0.316	0.374	−4.34	1	
114729				P	6.680	0.004	0.616	0.009	Ig	063093		0.218	0.151	−5.04	1	
114853				P	6.925	0.001	0.643	0.001	Ig	062793		0.233	0.176	−4.90	1	
115053				P	7.791	0.031	0.795	0.015	Ig	062793	ray				0	
115311 AB		a=0.3	W	P	8.060	0.031	0.740	0.015	Ig	063093		0.239	0.188	−4.89	1	
115383	*			B	5.209	0.011	0.585	0.007	Ig	070293		0.316	0.375	−4.34	1	
115617	*			BC	4.739	0.008	0.709	0.007	Ig	062793	cal	0.229	0.169	−4.97	3	see Table 3
115617				BC	4.739	0.008	0.709	0.007	Ig	062893	cal	0.230	0.172	−4.95		
115617				BC	4.739	0.008	0.709	0.007	Ig	070293	cal	0.228	0.168	−4.97		
115674				P	7.891	0.014	0.667	0.002	Ig	063093		0.246	0.200	−4.81	1	
115863 AB		s=4.6	I	P	7.370	0.004	0.582	0.008	Ig	062993		0.234	0.178	−4.86	1	
117105				P	7.202	0.003	0.583	0.010	Ig	063093		0.228	0.167	−4.92	1	
117207				P	7.258	0.001	0.724	0.002	Ig	063093		0.226	0.164	−5.00	1	
117618				P	7.179	0.031	0.604	0.015	Ig	062793		0.231	0.172	−4.90	1	
117854				P	7.535	0.002	0.642	0.011	Ig	062993		0.222	0.158	−5.01	1	
117939				P	7.288	0.007	0.669	0.006	Ig	063093		0.242	0.193	−4.84	1	
118465 AB		s=2.4	I	P	7.191	0.002	0.689	0.002	Ig	063093		0.296	0.317	−4.51	1	
118475				P	6.969	0.007	0.618	0.005	Ig	062993		0.225	0.163	−4.96	1	
118972				P	6.932	0.007	0.855	0.007	Ig	063093		0.362	0.530	−4.39	1	
119022				P	7.70	0.40	0.78	0.05	Ig	062993		0.454	0.935	−4.03	1	
119251	0			P	7.5	0.0	0.7	0.0	S	062793		0.232	0.175	−4.93	1	
120237 A		s=11.6		P	6.564	0.031	0.561	0.006	Ig	063093		0.246	0.200	−4.75	1	
120368				P	7.923	0.031	0.709	0.015	Ig	063093		0.305	0.342	−4.48	1	
120467				X	8.162	0.006	1.257	0.026	Ig	062993	spc	0.426			0	
120467				X	8.162	0.006	1.257	0.026	Ig	070193	spc	0.434				
120559				P	7.975	0.003	0.663	0.010	Ig	062993		0.228	0.168	−4.96	1	
120690				B	6.435	0.001	0.703	0.005	Ig	070293		0.253	0.214	−4.78	1	
121384 A		s=33	G	P	6.007	0.031	0.780	0.015	Ig	062993		0.203	0.130	−5.22	1	
121504 A		s=23.2	J	P	7.540	0.002	0.593	0.002	Ig	062993		0.251	0.210	−4.73	1	
121849				P	8.158	0.009	0.686	0.004	Ig	063093		0.227	0.165	−4.98	1	
122341				P	7.798	0.031	0.612	0.015	Ig	063093		0.223	0.159	−4.99	1	
122613 ABC	*	triple		P	8.30	0.35	0.20	0.49	Ip	062793	pht	0.274	0.261		0	
122683 A				S	7.101	0.031	0.724	0.015	Ig	070193		0.257	0.223	−4.76	1	
122742 AB	3	P=9.9y	B	B	6.288	0.005	0.733	0.003	Ig	070293		0.240	0.189	−4.89	1	
123227 AB		s=1.4	I	S	6.453	0.003	0.660	0.005	Ig	070193		0.223	0.160	−5.00	1	
123651				P	8.173	0.009	0.572	0.004	Ig	062793		0.246	0.201	−4.74	1	
123732				P	7.563	0.031	0.594	0.015	Ig	062793	str	0.431	0.820	−3.93	1	
124077				S	8.598	0.002	0.528	0.003	Ig	070193		0.230	0.170	−4.86	1	
124239 AB		s=1.0	I	P	7.587	0.031	0.564	0.001	Ig	063093		0.250	0.208	−4.71	1	
124364				P	8.229	0.005	0.670	0.002	Ig	062793		0.246	0.201	−4.81	1	
124580				P	6.312	0.010	0.596	0.004	Ig	062793		0.279	0.274	−4.54	1	
124584				P	7.292	0.010	0.590	0.005	Ig	062893		0.228	0.168	−4.92	1	
124784				P	8.77	0.24	0.58	0.35	Ip	062793		0.340	0.453	−4.23	1	
125566				P	8.155	0.003	0.725	0.002	Ig	062793		0.212	0.143	−5.13	1	
125881				P	7.257	0.008	0.595	0.008	Ig	062893		0.245	0.199	−4.77	1	
125968				P	7.758	0.003	0.658	0.003	Ig	063093		0.238	0.185	−4.87	1	
126053				B	6.268	0.008	0.639	0.006	Ig	070293		0.238	0.186	−4.86	1	
126351				P	8.160	0.031	0.566	0.015	Ig	063093		0.248	0.204	−4.73	1	
126525				BP	7.829	0.009	0.682	0.020	Ig	062893		0.232	0.175	−4.93	1	
126935 A		s=11.0	J	S	7.841	0.031	0.626	0.015	Ig	070193		0.250	0.209	−4.75	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
127024				P	8.214	0.005	0.637	0.002	Ig	062893		0.264	0.237	−4.66	1	
127974				P	7.954	0.031	0.576	0.015	Ig	062793		0.231	0.173	−4.88	1	
128400				P	6.733	0.031	0.707	0.006	Ig	062793		0.289	0.300	−4.56	1	
128620	1*	triple		BN	0.010	0.030	0.710	0.040	Ig	062893		0.228	0.167	−4.97	7	−5.002 0.023
128620				BN	0.010	0.030	0.710	0.040	Ig	062993		0.229	0.169	−4.97		
128620				BN	0.010	0.030	0.710	0.040	Ig	063093		0.225	0.162	−5.00		
128620				BN	0.010	0.030	0.710	0.040	Ig	070193	str	0.221	0.157	−5.03		
128620				BN	0.010	0.030	0.710	0.040	Ig	070293		0.224	0.161	−5.01		
128620				BN	0.010	0.030	0.710	0.040	Ig	070293		0.223	0.160	−5.01		
128620				BN	0.010	0.030	0.710	0.040	Ig	070293		0.223	0.160	−5.02		
128621	1*	triple		N	1.350	0.030	0.900	0.020	Ig	062893		0.251	0.211	−4.92	7	−4.923 0.015
128621				N	1.350	0.030	0.900	0.020	Ig	062993		0.247	0.203	−4.94		
128621				N	1.350	0.030	0.900	0.020	Ig	063093		0.253	0.215	−4.91		
128621				N	1.350	0.030	0.900	0.020	Ig	070193		0.254	0.217	−4.90		
128621				N	1.350	0.030	0.900	0.020	Ig	070293		0.250	0.208	−4.92		
128621				N	1.350	0.030	0.900	0.020	Ig	070293		0.248	0.204	−4.94		
128621				N	1.350	0.030	0.900	0.020	Ig	070293		0.247	0.203	−4.94		
128674 A		s=90	J	P	7.391	0.031	0.672	0.006	Ig	062893		0.238	0.185	−4.87	1	
128760				S	8.115	0.001	0.568	0.001	Ig	070193		0.230	0.172	−4.88	1	
129010				S	7.460	0.031	0.591	0.015	Ig	070193		0.203	0.130	−5.22	1	
129946				P	8.39	0.16	0.71	0.10	Ig	063093		0.278	0.271	−4.62	1	
130940 AB		a=1.4	W	P	6.982	0.009	0.580	0.008	Ig	062893		0.254	0.217	−4.69	1	
130948				B	5.863	0.007	0.576	0.016	Ig	070293		0.293	0.309	−4.45	1	
131078 AB		s=0.6	I	P	8.152	0.001	0.699	0.003	Ig	062793		0.231	0.173	−4.94	1	
131117				S	6.289	0.001	0.605	0.006	Ig	070193		0.211	0.142	−5.11	1	
131156 A	2	a=4.9	W	BN	4.70	0.0	0.73	0.0	G	070193		0.346	0.473	−4.32	2	−4.323
131156 A				BN	4.70	0.0	0.73	0.0	G	070293		0.345	0.470	−4.32		
131156 B	2	a=4.9	W	N	6.97	0.0	1.16	0.0	G	070193	ray				0	
131156 B				N	6.97	0.0	1.16	0.0	G	070293	hgh	0.648				
131588				P	8.398	0.001	0.633	0.004	Ig	063093		0.242	0.193	−4.82	1	
131923				P	6.347	0.002	0.708	0.002	Ig	062793		0.236	0.182	−4.90	1	
131977	*	triple		N	5.723	0.031	1.024	0.015	Ig	070193		0.405	0.703	−4.49	2	−4.484
131977				N	5.723	0.031	1.024	0.015	Ig	070293		0.408	0.715	−4.48		
132173				P	7.676	0.001	0.554	0.015	Ig	063093		0.294	0.312	−4.43	1	
132648				P	7.739	0.001	0.721	0.003	Ig	062793		0.241	0.192	−4.87	1	
132996				P	7.772	0.002	0.613	0.008	Ig	063093		0.226	0.164	−4.95	1	
133295				P	7.191	0.031	0.574	0.015	Ig	063093		0.289	0.297	−4.47	1	
133412				X	9.537	0.043	1.210	0.008	Ig	070193	spc	0.518			0	
133412				X	9.537	0.043	1.210	0.008	Ig	070293	spc	0.535				
133822 AB	3	P=18d	B	P	7.730	0.031	0.730	0.015	Ig	062793		0.339	0.448	−4.35	1	
134060				P	6.293	0.002	0.623	0.003	Ig	062893		0.227	0.166	−4.95	1	
134330	1	s=49.9	I	P	7.603	0.005	0.720	0.015	Ig	062793		0.248	0.204	−4.82	1	
134331	1	s=49.9	I	P	7.009	0.003	0.619	0.003	Ig	062793		0.241	0.191	−4.82	1	
134664				P	7.83	0.06	0.66	0.10	Ig	063093		0.234	0.178	−4.90	1	
134702				P	8.48	0.09	0.68	0.10	Ig	063093		0.241	0.191	−4.85	1	
136061				P	7.916	0.015	0.695	0.005	Ig	062893		0.277	0.268	−4.62	1	
136352				BP	5.652	0.001	0.639	0.003	Ig	062793		0.232	0.175	−4.91	1	
136466 AB		s=0.7	I	B	7.685	0.004	0.722	0.047	Ig	070293		0.227	0.166	−4.99	1	
136894 A		s=14.0	J	P	7.680	0.041	0.79	0.10	Ig	063093		0.229	0.170	−4.99	1	
137676				P	7.673	0.009	0.770	0.005	Ig	062793		0.212	0.143	−5.13	1	
138549				P	7.957	0.031	0.717	0.004	Ig	062993		0.240	0.189	−4.88	1	
139105 AB		s=2.0	I	P	8.54	0.19	0.71	0.10	Ig	062993		0.252	0.213	−4.78	1	
139503				S	8.435	0.031	0.627	0.015	Ig	070193		0.207	0.136	−5.18	1	
140538 AB		s=4.2	I	B	5.865	0.005	0.684	0.002	Ig	070293		0.243	0.195	−4.84	1	
140690 AB		s=0.2	I	P	8.089	0.031	0.659	0.015	Ig	062793		0.233	0.177	−4.91	1	
140785				P	7.376	0.001	0.660	0.004	Ig	062793		0.219	0.153	−5.04	1	
140901 A		s=14.9	G	B	6.010	0.012	0.715	0.006	Ig	070293		0.262	0.234	−4.72	1	
141004				B	4.422	0.010	0.604	0.008	Ig	070293		0.227	0.166	−4.94	1	
141366				S	8.06	0.10	0.67	0.10	Ig	070193	ray				0	
141382				S	8.71	0.06	0.66	0.13	Ip	070193		0.219	0.153	−5.05	1	
141747 AB		s=0.8	I	P	7.548	0.031	0.621	0.015	Ig	062893		0.253	0.214	−4.73	1	
141885				S	7.736	0.031	0.652	0.015	Ig	070193		0.196	0.122	−5.34	1	
141943	0			P	7.5	0.0	0.9	0.0	S	062793		0.388	0.631	−4.36	1	
142033				P	8.00	0.35	0.67	0.10	Ig	062893		0.326	0.407	−4.35	1	
142137				S	8.00	0.40	0.63	0.05	Ig	070193		0.218	0.152	−5.04	1	
142415				P	7.324	0.003	0.621	0.002	Ig	062893		0.262	0.234	−4.66	1	
142921				P	7.953	0.002	0.622	0.004	Ig	062893		0.233	0.176	−4.89	1	
143098				P	7.656	0.031	0.686	0.015	Ig	062993		0.275	0.265	−4.62	1	
143102				S	7.881	0.003	0.740	0.007	Ig	070193		0.209	0.139	−5.16	1	
143114				P	7.352	0.031	0.621	0.015	Ig	062993		0.239	0.186	−4.84	1	
143215 AB		s=6.5	I	S	7.49	0.35	0.60	0.49	Ip	070193		0.295	0.313	−4.45	1	
143337				P	8.013	0.003	0.639	0.002	Ig	062993		0.230	0.172	−4.93	1	
143846				P	7.858	0.004	0.600	0.002	Ig	062993		0.239	0.187	−4.82	1	
143885				S	8.60	0.35	0.66	0.10	Ig	070193		0.205	0.132	−5.22	1	
144009				P	7.226	0.016	0.714	0.017	Ig	062893		0.245	0.198	−4.84	1	
144179 AB	*	triple		P	7.840	0.002	0.818	0.003	Ig	063093		0.248	0.204	−4.88	1	
144259 AB		s=0.1	I	S	7.215	0.031	0.735	0.015	Ig	070193		0.255	0.218	−4.78	1	
144503 AB		s=2.5	I	S	7.60	0.35	0.90	0.49	Ip	070193		0.241	0.191	−4.97	1	
144628				S	7.109	0.001	0.856	0.004	Ig	070193		0.242	0.193	−4.94	1	
144988				P	7.175	0.031	0.616	0.015	Ig	063093		0.206	0.135	−5.18	1	
145377				S	8.12	0.08	0.69	0.13	Ip	070193		0.257	0.223	−4.74	1	
145417				P	7.531	0.001	0.815	0.006	Ig	062893		0.221	0.157	−5.06	1	
145523	0			P	7.82	0.0	0.58	0.0	S	062893		0.317	0.377	−4.33	1	
145598				P	8.655	0.005	0.661	0.008	Ig	062893		0.228	0.168	−4.95	1	
145666				P	7.800	0.031	0.603	0.005	Ig	062893		0.246	0.200	−4.77	1	
145825				P	6.550	0.007	0.646	0.006	Ig	063093		0.254	0.216	−4.74	1	
145927				P	8.40	0.35	0.67	0.10	Ig	062893		0.236	0.182	−4.88	1	
146070				P	7.539	0.031	0.624	0.015	Ig	063093		0.241	0.190	−4.82	1	
146124				S	7.635	0.032	0.760	0.006	Ig	070293		0.277	0.268	−4.67	1	
146481				P	7.092	0.002	0.649	0.011	Ig	062893		0.215	0.147	−5.08	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
146775				P	7.676	0.003	0.616	0.002	Ig	063093		0.234	0.178	−4.88	1	
146817				P	7.716	0.006	0.666	0.001	Ig	062793		0.227	0.166	−4.97	1	
146851				P	8.36	0.13	0.94	0.15	Ip	063093		0.268	0.248	−4.87	1	
147127				P	8.313	0.010	0.690	0.001	Ig	062893		0.229	0.169	−4.96	1	
147513 A	*	s=347	I	BP	5.385	0.009	0.625	0.008	Ig	062993		0.286	0.291	−4.52	1	
147584 AB	3	P=13d	B	BP	4.900	0.004	0.555	0.016	Ig	062893		0.271	0.254	−4.56	1	
147633 AB		a=1.7	W	P	7.10	0.35	0.30	0.49	Ip	062793	con				0	
147743				S	8.396	0.003	0.622	0.015	Ig	070293		0.206	0.135	−5.18	1	
147873	*			S	7.963	0.031	0.588	0.015	Ig	070293		0.202	0.129	−5.24	1	
147936 AB		s=0.9	I	P	7.602	0.041	0.75	0.10	Ig	062993		0.226	0.165	−5.00	1	
148156				S	7.704	0.031	0.559	0.015	Ig	070293		0.227	0.166	−4.91	1	
148587				P	7.386	0.007	0.587	0.013	Ig	062893		0.229	0.169	−4.91	1	
148704 AB	3	P=32d	B	P	7.244	0.007	0.858	0.011	Ig	062993		0.243	0.195	−4.93	1	
149612				P	7.022	0.004	0.616	0.006	Ig	062893		0.244	0.197	−4.79	1	
149894				P	8.218	0.031	0.64	0.10	Ig	062993		0.230	0.171	−4.93	1	
149981				P	7.589	0.031	0.642	0.015	Ig	062993		0.218	0.151	−5.06	1	
150248				P	7.026	0.002	0.653	0.001	Ig	062793		0.236	0.181	−4.88	1	
150437				S	7.857	0.005	0.683	0.005	Ig	070293		0.225	0.162	−4.99	1	
150474				P	7.142	0.031	0.76	0.10	Ig	062993		0.209	0.138	−5.16	1	
150689				S	7.50	0.35	0.96	0.15	Ip	070293		0.424	0.787	−4.34	1	
150698				S	6.725	0.031	0.674	0.015	Ig	070293		0.207	0.136	−5.19	1	
151337				S	7.378	0.005	0.901	0.023	Ig	070293		0.194	0.120	−5.27	1	
151598				P	8.228	0.011	0.673	0.002	Ig	062793		0.315	0.373	−4.40	1	
151770				P	8.69	0.24	0.70	0.10	Ig	062993		0.466	1.000	−3.92	1	
151928				S	8.289	0.031	0.588	0.015	Ig	070293		0.214	0.145	−5.07	1	
152260				S	6.916	0.012	0.532	0.003	Ig	070293		0.217	0.151	−4.99	1	
152322				P	8.014	0.031	0.609	0.015	Ig	062893		0.241	0.191	−4.81	1	
152391				C	6.634	0.009	0.749	0.011	Ig	062793	cal	0.334	0.432	−4.39	2	see Table 3
152391				C	6.634	0.009	0.749	0.011	Ig	062993	cal	0.333	0.429	−4.39		
153075				P	7.007	0.004	0.581	0.015	Ig	062893		0.231	0.173	−4.88	1	
153330				P	7.721	0.031	0.690	0.015	Ig	062993		0.273	0.258	−4.64	1	
153386				P	7.464	0.031	0.583	0.001	Ig	062893		0.217	0.149	−5.03	1	
153421				P	8.152	0.034	0.567	0.018	Ig	062993		0.234	0.177	−4.85	1	
153631 AB	3	P=387d	D	B	7.124	0.006	0.608	0.004	Ig	070293		0.223	0.160	−4.98	1	
154007 AB	0	s=3.4	J	S	0.0	0.0	0.0	0.0		070293	pht	0.229	0.170		0	
154088				S	6.576	0.002	0.814	0.034	Ig	070293		0.229	0.169	−5.00	1	
154195 A	*	s=25.3	I	S	0.0	0.0	0.0	0.0		070293	pht	0.234	0.178		0	
154195 B	*	s=25.3	I	X	0.0	0.0	0.0	0.0		070293	pht	0.233	0.176		0	
154682				P	7.693	0.031	0.617	0.015	Ig	062993		0.223	0.160	−4.98	1	
154857				P	7.246	0.031	0.699	0.001	Ig	062893		0.211	0.142	−5.14	1	
155114				P	7.530	0.031	0.637	0.015	Ig	062793		0.277	0.268	−4.58	1	
155284 A	2	s=7.0	I	P	8.90	0.35	0.70	0.49	Ip	062893		0.251	0.211	−4.78	1	
155555 AC	*	triple		P	6.670	0.031	0.800	0.015	Ig	062893	hgh	0.640			0	
155826 AB		s=0.1	I	P	5.955	0.005	0.580	0.004	Ig	062993		0.230	0.170	−4.90	1	
155885	2*	triple		N	5.11	0.0	0.86	0.0	G	062893		0.312	0.362	−4.59	5	−4.569 0.039
155885				N	5.11	0.0	0.86	0.0	G	062993		0.312	0.363	−4.59		
155885				N	5.11	0.0	0.86	0.0	G	063093		0.311	0.360	−4.59		
155885				N	5.11	0.0	0.86	0.0	G	070193		0.334	0.431	−4.50		
155885				N	5.11	0.0	0.86	0.0	G	070293		0.315	0.371	−4.58		
155886	2*	triple		N	5.07	0.0	0.85	0.0	G	062893		0.310	0.357	−4.59	5	−4.577 0.014
155886				N	5.07	0.0	0.85	0.0	G	062993		0.310	0.357	−4.59		
155886				N	5.07	0.0	0.85	0.0	G	063093		0.309	0.355	−4.59		
155886				N	5.07	0.0	0.85	0.0	G	070193		0.315	0.372	−4.56		
155886				N	5.07	0.0	0.85	0.0	G	070293		0.317	0.376	−4.56		
155918				P	7.000	0.008	0.607	0.014	Ig	062893		0.243	0.196	−4.79	1	
156026	*	triple		N	6.327	0.009	1.144	0.020	Ig	070193		0.497	1.167	−4.45	2	−4.447
156026				N	6.327	0.009	1.144	0.020	Ig	070293		0.504	1.208	−4.44		
156062				S	8.231	0.031	0.594	0.015	Ig	070293		0.223	0.159	−4.97	1	
156274 A	2	a=10.4	W	NP	5.33	0.0	0.77	0.0	G	062793		0.235	0.179	−4.94	6	−4.941 0.014
156274 A				NP	5.33	0.0	0.77	0.0	G	062893		0.237	0.184	−4.92		
156274 A				NP	5.33	0.0	0.77	0.0	G	062993		0.236	0.182	−4.93		
156274 A				NP	5.33	0.0	0.77	0.0	G	063093		0.235	0.179	−4.94		
156274 A				NP	5.33	0.0	0.77	0.0	G	070193		0.232	0.175	−4.96		
156274 A				NP	5.33	0.0	0.77	0.0	G	070293		0.233	0.176	−4.95		
156384 AB		a=1.8	W	N	5.910	0.008	1.082	0.027	Ig	070193		0.357	0.511	−4.72	2	−4.721
156384 AB				N	5.910	0.008	1.082	0.027	Ig	070293		0.355	0.504	−4.72		
156411				P	6.673	0.005	0.614	0.008	Ig	062793		0.210	0.140	−5.13	1	
156643				P	7.786	0.001	0.627	0.009	Ig	062893		0.234	0.179	−4.88	1	
157075 A		s=10.4	J	S	8.020	0.031	0.536	0.015	Ig	070293		0.230	0.170	−4.87	1	
157338				P	6.918	0.001	0.575	0.011	Ig	062993		0.227	0.167	−4.91	1	
157750				P	8.026	0.005	0.670	0.015	Ig	062993		0.283	0.283	−4.57	1	
157830				P	7.925	0.041	0.70	0.10	Ig	062993		0.244	0.197	−4.84	1	
158198				P	8.521	0.031	0.675	0.015	Ig	062993		0.298	0.324	−4.49	1	
158469				S	7.935	0.031	0.556	0.015	Ig	070193		0.222	0.158	−4.96	1	
158614 AB		a=1.0	W	BC	5.314	0.002	0.715	0.013	Ig	062793	cal	0.229	0.169	−4.97	3	see Table 3
158614 AB				BC	5.314	0.002	0.715	0.013	Ig	062993	cal	0.227	0.166	−4.98		
158614 AB				BC	5.314	0.002	0.715	0.013	Ig	070293	cal	0.229	0.170	−4.96		
158630				P	7.616	0.014	0.600	0.009	Ig	062893		0.236	0.181	−4.85	1	
158651				P	7.50	0.35	0.60	0.10	Ig	062893		0.217	0.149	−5.04	1	
158783				P	7.094	0.031	0.667	0.005	Ig	062893		0.233	0.177	−4.91	1	
159656 AB	3	P=10d	B	P	7.165	0.005	0.641	0.008	Ig	062793		0.279	0.274	−4.57	1	
159704 AB		s=1.4	I	P	6.684	0.004	0.757	0.016	Ig	062993		0.236	0.181	−4.93	1	
159784				S	8.308	0.004	0.582	0.004	Ig	070193		0.204	0.132	−5.20	1	
159868				P	7.244	0.006	0.714	0.012	Ig	062793		0.215	0.148	−5.09	1	
160001				P	7.427	0.031	0.632	0.015	Ig	062993		0.246	0.201	−4.79	1	
160113				P	7.292	0.002	0.677	0.002	Ig	062793		0.216	0.149	−5.08	1	
160411				S	7.83	0.11	0.63	0.10	Ig	070193		0.205	0.132	−5.21	1	
160691				B	5.127	0.006	0.694	0.015	Ig	070193		0.223	0.159	−5.02	1	
160859				P	7.519	0.004	0.617	0.003	Ig	062893		0.238	0.185	−4.84	1	
161050				P	7.156	0.031	0.594	0.001	Ig	062893		0.223	0.159	−4.97	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
161297				P	8.057	0.002	0.608	0.018	Ig	062893	ray				0	
161476 A	2	s=5.4	I	P	8.138	0.003	0.642	0.004	Ig	062893		0.231	0.173	−4.92	1	
161515				P	8.00	0.35	0.67	0.10	Ig	062793		0.205	0.133	−5.21	1	
161612				S	7.201	0.012	0.685	0.022	Ig	070193		0.229	0.170	−4.95	1	
161784				S	7.80	0.40	0.60	0.05	Ig	070193		0.219	0.153	−5.02	1	
163029 AB		s=3.5	I	S	8.10	0.35	0.80	0.49	Ip	070193		0.478	1.063	−4.00	1	
163272				P	7.396	0.031	0.612	0.015	Ig	062993		0.226	0.165	−4.95	1	
163693				P	8.50	0.35	0.71	0.10	Ig	062793		0.239	0.187	−4.88	1	
163840 AB	3	P=2.4y	G	B	6.301	0.031	0.642	0.006	Ig	070293		0.240	0.189	−4.84	1	
163874				P	7.277	0.031	0.588	0.015	Ig	062993		0.215	0.147	−5.06	1	
164328 AB		s=0.2	I	P	8.20	0.35	0.70	0.49	Ip	062793		0.248	0.204	−4.81	1	
164427 A		s=28.9	G	P	6.882	0.031	0.624	0.015	Ig	062793		0.227	0.166	−4.95	1	
164444 AB		s=0.3	I	S	7.820	0.031	0.619	0.001	Ig	070193		0.222	0.158	−5.00	1	
165185				BP	5.90	0.08	0.615	0.008	Ig	062993		0.302	0.333	−4.43	1	
165269				S	7.316	0.031	0.611	0.015	Ig	070193		0.221	0.157	−5.00	1	
165271				S	7.644	0.003	0.655	0.007	Ig	070193		0.209	0.138	−5.16	1	
165341 AB		a=4.5	W	N	4.026	0.020	0.860	0.010	Ig	070193		0.297	0.319	−4.65	2	−4.637
165341 AB				N	4.026	0.020	0.860	0.010	Ig	070293		0.305	0.342	−4.62		
165385				S	8.20	0.35	0.58	0.10	Ig	070193		0.217	0.151	−5.02	1	
165401				B	6.800	0.005	0.610	0.013	Ig	070293	off				0	
165499				BP	5.473	0.005	0.592	0.007	Ig	062893		0.229	0.169	−4.91	1	
165882				S	7.80	0.40	0.81	0.05	Ig	070193	low	0.176			0	
165896 ABC	*	triple		P	7.600	0.030	0.650	0.042	Ig	062993		0.236	0.182	−4.88	1	
166553 AB		s=1.4	I	P	7.30	0.35	0.64	0.10	Ig	062993		0.222	0.157	−5.01	1	
166653 AB		s=2.0	I	P	7.30	0.35	0.64	0.10	Ig	062793		0.260	0.229	−4.69	1	
167425 A	2	s=7.5	I	P	6.173	0.003	0.584	0.004	Ig	062893		0.267	0.245	−4.61	1	
168871				P	6.448	0.004	0.593	0.001	Ig	062793		0.225	0.162	−4.95	1	
169383				P	7.970	0.031	0.600	0.015	Ig	062793		0.220	0.155	−5.00	1	
169586				P	6.764	0.031	0.553	0.015	Ig	062993		0.225	0.163	−4.92	1	
170038				P	8.051	0.031	0.627	0.015	Ig	062993		0.245	0.199	−4.79	1	
170121 AB		s=2.8	I	P	7.420	0.031	0.599	0.015	Ig	062993		0.232	0.174	−4.89	1	
170525				P	6.421	0.008	0.688	0.003	Ig	062793		0.219	0.154	−5.05	1	
170768				P	8.40	0.35	0.67	0.10	Ig	062993		0.224	0.161	−5.00	1	
171595 AB		s=0.2	I	P	7.90	0.35	0.20	0.49	Ip	062993	pht	0.254	0.217		0	
171665				P	7.433	0.006	0.687	0.005	Ig	062993		0.228	0.168	−4.97	1	
172051				B	5.858	0.007	0.673	0.002	Ig	070293		0.236	0.181	−4.89	1	
172513				P	7.98	0.05	0.71	0.10	Ig	062993		0.245	0.199	−4.83	1	
173427 AB		a=0.4	W	P	8.23	0.09	0.66	0.10	Ig	062993		0.323	0.395	−4.36	1	
174429				P	8.49	0.08	0.80	0.13	Ip	062793		0.583	1.718	−3.78	1	
175073				P	7.980	0.019	0.857	0.003	Ig	062993		0.281	0.278	−4.73	1	
175345 A	2	s=5.4	I	P	7.368	0.031	0.569	0.015	Ig	062993	ray				0	
175626				S	8.030	0.031	0.637	0.015	Ig	070193		0.218	0.151	−5.05	1	
175854				S	7.580	0.031	0.321	0.015	Ig	070193	pht	0.281	0.277		0	
175897				P	8.40	0.35	0.61	0.10	Ig	062793	str	0.470	1.018	−3.84	1	
176463				P	7.80	0.40	0.65	0.05	Ig	062793		0.222	0.158	−5.01	1	
176790				P	8.20	0.35	0.71	0.10	Ig	062793		0.229	0.169	−4.96	1	
177122				P	8.222	0.031	0.591	0.015	Ig	062993		0.236	0.181	−4.85	1	
177409				P	7.50	0.40	0.63	0.05	Ig	062893		0.238	0.186	−4.85	1	
177474 AB	*	a=1.9	W	P	4.23	0.06	0.523	0.010	Ig	062993		0.227	0.165	−4.89	1	
177565				BP	6.154	0.003	0.705	0.014	Ig	062993		0.242	0.194	−4.85	1	
177996				S	7.869	0.002	0.862	0.003	Ig	070193		0.439	0.861	−4.17	1	
178076 A	2	s=9.0	I	P	7.82	0.06	0.87	0.15	Ip	062993		0.330	0.419	−4.53	1	
178428 AB	*	P=22d	B	B	6.086	0.031	0.702	0.015	Ig	070293		0.231	0.173	−4.94	1	
179058 AB		a=0.5	W	P	8.002	0.031	0.588	0.015	Ig	062993		0.226	0.164	−4.94	1	
179140 AB		s=0.5	I	S	7.229	0.006	0.627	0.002	Ig	070193		0.219	0.153	−5.03	1	
179325				P	8.220	0.030	0.680	0.040	Ig	062993		0.217	0.150	−5.07	1	
179699				S	8.029	0.031	0.596	0.015	Ig	070193		0.210	0.140	−5.12	1	
179814				S	8.024	0.005	0.550	0.002	Ig	070193		0.220	0.155	−4.97	1	
180445				P	8.51	0.07	0.76	0.10	Ig	062993		0.499	1.182	−3.90	1	
180702 AB		a=0.5	W	P	6.939	0.001	0.579	0.001	Ig	062993		0.227	0.165	−4.93	1	
180748 AB		s=1.3	I	P	7.782	0.005	0.699	0.003	Ig	062993		0.239	0.187	−4.88	1	
180751				S	7.999	0.002	0.570	0.002	Ig	070193		0.220	0.154	−4.99	1	
180909				S	7.671	0.003	0.716	0.006	Ig	070193		0.211	0.141	−5.14	1	
181177				P	8.10	0.40	0.65	0.05	Ig	062893		0.225	0.162	−4.98	1	
181199 A	*	s=13.8	I	P	8.174	0.031	0.656	0.015	Ig	062993		0.241	0.191	−4.84	1	
181321				P	6.479	0.004	0.628	0.002	Ig	062993		0.330	0.419	−4.31	1	
181428				P	7.098	0.004	0.568	0.011	Ig	063093		0.223	0.159	−4.96	1	
181544				P	7.097	0.006	0.571	0.011	Ig	063093		0.225	0.163	−4.93	1	
181720				P	7.845	0.007	0.599	0.019	Ig	063093		0.220	0.155	−5.00	1	
182466	0*			P	8.3	0.0	0.7	0.0	S	062793		0.237	0.184	−4.89	1	
183216				P	7.132	0.008	0.599	0.005	Ig	063093		0.266	0.243	−4.62	1	
183414				P	7.920	0.031	0.660	0.015	Ig	062893		0.355	0.502	−4.23	1	
183505				P	8.157	0.002	0.672	0.002	Ig	062893		0.246	0.200	−4.81	1	
184588				S	8.006	0.003	0.550	0.006	Ig	070193		0.267	0.244	−4.59	1	
185454 AB		s=1.7	I	P	7.482	0.004	0.711	0.009	Ig	062893		0.238	0.185	−4.89	1	
185523 A		s=19.7	I	P	7.554	0.031	0.641	0.009	Ig	062893		0.233	0.177	−4.90	1	
185615				P	8.20	0.35	0.75	0.10	Ig	063093		0.228	0.169	−4.98	1	
185975				P	8.111	0.031	0.689	0.015	Ig	062893		0.218	0.152	−5.06	1	
186085				P	8.378	0.002	0.679	0.007	Ig	062893		0.230	0.171	−4.95	1	
186651				P	7.116	0.007	0.564	0.009	Ig	062793		0.238	0.185	−4.81	1	
186853				P	7.701	0.031	0.669	0.015	Ig	062893		0.248	0.205	−4.79	1	
187085				P	7.225	0.031	0.571	0.015	Ig	062893		0.226	0.164	−4.93	1	
187101				S	8.023	0.031	0.584	0.004	Ig	070193		0.226	0.164	−4.94	1	
187154				P	7.772	0.031	0.624	0.015	Ig	062893		0.288	0.296	−4.51	1	
188298				S	8.477	0.031	0.657	0.015	Ig	070193		0.270	0.252	−4.63	1	
188432				P	8.054	0.031	0.656	0.015	Ig	062893		0.231	0.173	−4.93	1	
188480				S	8.219	0.004	0.535	0.008	Ig	070293		0.306	0.346	−4.35	1	
188641				P	7.344	0.003	0.626	0.014	Ig	062893		0.223	0.160	−4.99	1	
188659				S	8.117	0.031	0.524	0.015	Ig	070193		0.227	0.166	−4.89	1	
188748				P	8.156	0.031	0.678	0.015	Ig	062893		0.230	0.170	−4.95	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
189406				S	8.430	0.031	0.580	0.015	Ig	070293		0.210	0.140	−5.11	1	
189567				BP	6.078	0.002	0.648	0.006	Ig	062893		0.238	0.185	−4.86	1	
189931				P	6.930	0.030	0.600	0.020	Ig	063093		0.263	0.236	−4.64	1	
190067				B	7.166	0.001	0.714	0.003	Ig	070293		0.249	0.206	−4.81	1	
190102				P	8.176	0.031	0.626	0.015	Ig	063093		0.310	0.358	−4.39	1	
190220 A	2	s=6.8	I	P	8.28	0.35	0.68	0.10	Ig	062793		0.228	0.168	−4.96	1	
190248				N	3.554	0.004	0.751	0.021	Ig	062893		0.228	0.167	−4.99	5	−4.999 0.018
190248				N	3.554	0.004	0.751	0.021	Ig	062993		0.227	0.167	−4.99		
190248				N	3.554	0.004	0.751	0.021	Ig	063093		0.229	0.169	−4.98		
190248				N	3.554	0.004	0.751	0.021	Ig	070193		0.223	0.160	−5.03		
190248				N	3.554	0.004	0.751	0.021	Ig	070293		0.226	0.164	−5.00		
190406 AB	*			B	5.788	0.006	0.600	0.005	Ig	070293		0.248	0.205	−4.75	1	
190422				P	6.249	0.003	0.530	0.005	Ig	062793		0.302	0.333	−4.38	1	
190528				P	8.07	0.06	0.66	0.10	Ig	063093		0.313	0.366	−4.41	1	
190580				S	6.468	0.005	0.682	0.004	Ig	070293		0.207	0.136	−5.18	1	
190647				S	7.772	0.001	0.743	0.002	Ig	070293		0.218	0.152	−5.07	1	
191408 A	2	s=7.1	I	N	5.315	0.005	0.868	0.018	Ig	062893		0.237	0.183	−4.98	3	−4.988 0.013
191408 A				N	5.315	0.005	0.868	0.018	Ig	062993		0.236	0.182	−4.98		
191408 A				N	5.315	0.005	0.868	0.018	Ig	063093		0.233	0.176	−5.00		
191408 A				N	5.315	0.005	0.868	0.018	Ig	070193	off					
191408 A				N	5.315	0.005	0.868	0.018	Ig	070293	off					
191408 A				N	5.315	0.005	0.868	0.018	Ig	070293	off					
191760				S	8.30	0.35	0.69	0.10	Ig	070293		0.206	0.134	−5.20	1	
192417				P	8.20	0.35	0.68	0.10	Ig	062893	ray				0	
192614 AB		s=2.2	I	P	7.512	0.003	0.689	0.004	Ig	063093		0.266	0.243	−4.68	1	
193193				P	7.202	0.004	0.594	0.008	Ig	063093		0.220	0.155	−5.00	1	
193307				P	6.264	0.003	0.549	0.008	Ig	062793		0.227	0.167	−4.90	1	
193464				P	7.485	0.031	0.586	0.015	Ig	063093		0.298	0.323	−4.43	1	
194460 AB	0	s=2.8	J	P	8.0	0.0	1.0	0.0	S	063093		0.220	0.154	−5.17	1	
194640				BP	6.612	0.002	0.724	0.014	Ig	063093		0.237	0.184	−4.90	1	
195145				P	8.665	0.007	0.738	0.002	Ig	062893		0.230	0.171	−4.96	1	
195289				S	7.862	0.031	0.612	0.006	Ig	070293	str	0.272	0.256	−4.59	1	
195521				P	6.804	0.002	0.666	0.004	Ig	062793		0.336	0.439	−4.31	1	
195962				P	8.321	0.003	0.653	0.002	Ig	062893		0.232	0.174	−4.92	1	
196050				S	7.508	0.031	0.667	0.010	Ig	070293		0.220	0.154	−5.04	1	
196141				P	8.20	0.35	0.68	0.10	Ig	062793		0.307	0.347	−4.45	1	
196254				P	8.051	0.031	0.566	0.015	Ig	063093		0.236	0.181	−4.83	1	
196390				P	7.334	0.006	0.626	0.002	Ig	062793		0.247	0.203	−4.78	1	
196531				P	7.951	0.004	0.541	0.011	Ig	063093		0.230	0.170	−4.87	1	
196761				B	6.363	0.005	0.719	0.005	Ig	070293		0.234	0.178	−4.93	1	
196877				X	8.827	0.012	1.324	0.012	Ig	062993	spc	0.494			0	
196877				X	8.827	0.012	1.324	0.012	Ig	070193	ray					
196877				X	8.827	0.012	1.324	0.012	Ig	070293	spc	0.468				
197214				P	6.948	0.008	0.671	0.004	Ig	063093		0.239	0.188	−4.86	1	
197239				P	8.20	0.35	0.70	0.10	Ig	062793		0.245	0.199	−4.83	1	
198678				P	7.627	0.031	0.646	0.015	Ig	062893		0.228	0.168	−4.95	1	
198943 AB		s=2.0	I	P	7.958	0.031	0.646	0.015	Ig	062793		0.257	0.223	−4.71	1	
199017				P	8.240	0.031	0.702	0.015	Ig	063093		0.234	0.177	−4.92	1	
199065 AB		s=4.0	I	P	7.80	0.35	0.80	0.49	Ip	062793		0.307	0.348	−4.55	1	
199190				P	6.870	0.001	0.627	0.007	Ig	062893		0.220	0.155	−5.02	1	
199288				BP	6.516	0.003	0.587	0.012	Ig	063093		0.239	0.186	−4.82	1	
199509				P	6.988	0.001	0.618	0.013	Ig	063093		0.243	0.194	−4.81	1	
199604				P	8.556	0.008	0.568	0.017	Ig	063093		0.230	0.170	−4.89	1	
199918				P	7.687	0.031	0.627	0.015	Ig	063093		0.238	0.185	−4.85	1	
200334 AB	3	P=20d	B	P	7.051	0.012	0.582	0.007	Ig	063093		0.220	0.155	−4.99	1	
200525 AB	*	triple		P	5.670	0.030	0.590	0.042	Ig	063093		0.282	0.280	−4.52	1	
200538				P	7.719	0.031	0.606	0.015	Ig	063093		0.225	0.163	−4.96	1	
201091	*			N	5.200	0.031	1.069	0.015	Ig	070193	str	0.557	1.544	−4.21	2	−4.300
201091				N	5.200	0.031	1.069	0.015	Ig	070293		0.471	1.025	−4.39		
201247 AB		s=3.5	I	P	7.075	0.031	0.687	0.015	Ig	062993		0.320	0.386	−4.40	1	
201989				P	7.375	0.001	0.689	0.002	Ig	062993		0.279	0.274	−4.60	1	
202628				P	6.747	0.001	0.637	0.001	Ig	062993		0.254	0.217	−4.73	1	
202707				P	8.144	0.031	0.676	0.015	Ig	062993		0.213	0.144	−5.11	1	
202732				P	7.881	0.031	0.687	0.015	Ig	062993		0.319	0.384	−4.40	1	
202871				P	8.224	0.007	0.561	0.006	Ig	062893		0.247	0.203	−4.73	1	
202917				P	8.560	0.031	0.690	0.015	Ig	062893		0.414	0.743	−4.06	1	
202940 ABC	*	triple		BP	6.558	0.003	0.737	0.018	Ig	062993		0.240	0.189	−4.89	2	−4.870
202940 ABC				BP	6.558	0.003	0.737	0.018	Ig	070293		0.245	0.198	−4.85		
202960				P	8.333	0.031	0.609	0.015	Ig	062993	ray				0	
202982 AB		s=2.4	I	P	8.10	0.35	0.10	0.49	Ip	062993	pht	0.302	0.333		0	
202996				P	7.456	0.031	0.614	0.015	Ig	062893		0.292	0.306	−4.48	1	
203019				P	7.842	0.010	0.687	0.005	Ig	063093		0.327	0.409	−4.36	1	
203244				P	6.973	0.004	0.723	0.008	Ig	063093		0.327	0.407	−4.39	1	
203277 AB		s=1.2	I	P	7.661	0.001	0.642	0.002	Ig	062893		0.222	0.157	−5.01	1	
204108 AB		s=1.5	I	P	8.332	0.031	0.654	0.015	Ig	062993		0.236	0.182	−4.88	1	
204287				P	7.334	0.004	0.663	0.004	Ig	062893		0.223	0.159	−5.01	1	
205067				P	7.620	0.019	0.656	0.006	Ig	062993		0.225	0.162	−4.99	1	
205156				P	8.125	0.008	0.622	0.009	Ig	062893		0.236	0.181	−4.87	1	
205158				S	7.851	0.031	0.616	0.010	Ig	070193		0.210	0.139	−5.14	1	
205536				P	7.066	0.007	0.755	0.002	Ig	062993		0.234	0.179	−4.94	1	
205545 AB		s=0.2	I	P	8.028	0.031	0.699	0.015	Ig	062993		0.300	0.329	−4.50	1	
205891				P	8.075	0.031	0.684	0.015	Ig	062993		0.235	0.179	−4.90	1	
205905				P	6.739	0.006	0.623	0.005	Ig	062993		0.280	0.275	−4.55	1	
206025				S	7.632	0.009	0.555	0.001	Ig	070193		0.215	0.147	−5.04	1	
206255				S	7.50	0.35	0.70	0.10	Ig	070193		0.213	0.144	−5.11	1	
206395				S	6.666	0.010	0.546	0.004	Ig	070193		0.225	0.162	−4.92	1	
206667				P	8.038	0.011	0.568	0.015	Ig	062893		0.277	0.268	−4.54	1	
206860				B	5.945	0.010	0.587	0.003	Ig	070293		0.299	0.325	−4.42	1	
207043				P	7.60	0.40	0.67	0.05	Ig	062893		0.279	0.274	−4.59	1	
207129	*			BP	5.579	0.007	0.601	0.003	Ig	062893		0.241	0.192	−4.80	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
207377				P	7.90	0.35	0.73	0.10	Ig	062893		0.279	0.272	−4.63	1	
207450				P	7.449	0.003	0.573	0.003	Ig	062993		0.276	0.267	−4.54	1	
207700				P	7.434	0.006	0.696	0.005	Ig	062993		0.233	0.176	−4.92	1	
208487				P	7.470	0.007	0.568	0.009	Ig	062993		0.229	0.169	−4.90	1	
208998				P	7.112	0.014	0.572	0.011	Ig	062893		0.223	0.160	−4.95	1	
209100				N	4.688	0.008	1.056	0.016	Ig	063093		0.394	0.656	−4.57	3	−4.559 0.008
209100				N	4.688	0.008	1.056	0.016	Ig	070193		0.400	0.680	−4.55		
209100				N	4.688	0.008	1.056	0.016	Ig	070293		0.397	0.667	−4.56		
209234				P	7.882	0.031	0.617	0.015	Ig	062993		0.305	0.341	−4.42	1	
209653				P	6.991	0.003	0.588	0.011	Ig	062993		0.227	0.167	−4.92	1	
209659				S	8.187	0.031	0.609	0.015	Ig	063093		0.214	0.146	−5.07	1	
209733				S	8.80	0.35	0.62	0.10	Ig	063093		0.267	0.245	−4.63	1	
210193				P	7.834	0.005	0.660	0.002	Ig	062893		0.239	0.187	−4.86	1	
210272				P	7.216	0.006	0.663	0.005	Ig	062993		0.218	0.152	−5.05	1	
210349 AB		s=1.3	I	P	7.532	0.031	0.636	0.015	Ig	121292		0.251	0.230	−4.69	1	
210395				S	7.984	0.031	0.646	0.015	Ig	063093		0.294	0.311	−4.49	1	
210918				P	6.226	0.007	0.648	0.006	Ig	062793		0.228	0.168	−4.95	1	
211366				S	8.581	0.002	0.659	0.002	Ig	063093		0.233	0.175	−4.91	1	
211415 AB		s=3.4	I	BP	5.363	0.007	0.614	0.015	Ig	062793		0.235	0.181	−4.86	1	
211467				P	8.609	0.002	0.717	0.002	Ig	121292		0.221	0.173	−4.95	1	
211998 AB		s=0.1	I	P	5.280	0.030	0.660	0.042	Ig	062793		0.203	0.130	−5.24	1	
212036				P	8.505	0.003	0.676	0.002	Ig	062793		0.235	0.179	−4.90	1	
212146				P	8.192	0.002	0.752	0.004	Ig	121292		0.236	0.199	−4.85	1	
212168 A	*	s=20.4	I	P	6.117	0.004	0.599	0.002	Ig	062793		0.231	0.173	−4.89	1	
212231				P	7.860	0.030	0.610	0.020	Ig	121292		0.212	0.157	−4.99	1	
212330	*			B	5.310	0.010	0.665	0.012	Ig	070293		0.216	0.149	−5.07	1	
212708				S	7.476	0.004	0.730	0.001	Ig	063093		0.231	0.173	−4.96	1	
212801				S	7.75	0.15	0.73	0.10	Ig	063093		0.207	0.136	−5.18	1	
213240 A		s=19.8	J	P	6.797	0.005	0.603	0.005	Ig	121392		0.211	0.155	−5.00	1	
213401				P	7.890	0.031	0.669	0.015	Ig	121492		0.234	0.196	−4.83	1	
213591				P	8.014	0.031	0.584	0.015	Ig	121492	ray				0	
213628				P	7.795	0.008	0.721	0.003	Ig	121292		0.228	0.184	−4.90	1	
213885				S	8.00	0.40	0.62	0.05	Ig	063093		0.232	0.174	−4.90	1	
213941				P	7.580	0.005	0.670	0.007	Ig	121492		0.226	0.181	−4.89	1	
214067				P	8.205	0.001	0.739	0.005	Ig	121292		0.219	0.168	−4.98	1	
214385				P	7.863	0.005	0.640	0.001	Ig	121292		0.226	0.181	−4.88	1	
214691				P	8.103	0.006	0.735	0.002	Ig	121492		0.214	0.159	−5.03	1	
214759				S	7.391	0.002	0.789	0.028	Ig	063093		0.237	0.183	−4.93	1	
214953 A	2	s=7.8	I	BP	5.988	0.031	0.584	0.003	Ig	121392		0.221	0.172	−4.89	1	
215456				P	6.633	0.011	0.636	0.006	Ig	121392		0.206	0.146	−5.09	1	
215532				P	8.313	0.031	0.742	0.015	Ig	121492		0.263	0.255	−4.68	1	
215641				P	7.580	0.002	0.744	0.003	Ig	121292		0.293	0.326	−4.54	1	
215657				P	7.215	0.004	0.598	0.005	Ig	121392		0.286	0.310	−4.46	1	
215768				P	7.496	0.031	0.604	0.015	Ig	121392		0.290	0.318	−4.45	1	
216000				P	7.656	0.031	0.609	0.015	Ig	121492		0.231	0.190	−4.82	1	
216008				P	8.208	0.004	0.640	0.001	Ig	121392		0.223	0.176	−4.90	1	
216054				P	7.769	0.001	0.741	0.003	Ig	121392		0.221	0.172	−4.96	1	
216316	*			P	7.597	0.031	0.588	0.001	Ig	062793	dis	0.223			0	
216316				P	7.597	0.031	0.588	0.001	Ig	121492	dis	0.181				
216435				S	6.027	0.001	0.621	0.005	Ig	063093		0.222	0.157	−5.00	1	
216531				P	8.294	0.003	0.590	0.009	Ig	121392		0.233	0.193	−4.79	1	
216770				P	8.111	0.004	0.821	0.004	Ig	121292		0.244	0.216	−4.84	1	
216803				N	6.482	0.005	1.094	0.006	Ig	063093		0.551	1.498	−4.26	3	−4.272 0.016
216803				N	6.482	0.005	1.094	0.006	Ig	070193		0.536	1.407	−4.29		
216803				N	6.482	0.005	1.094	0.006	Ig	070293		0.551	1.502	−4.26		
216970	*	s=59.7	I	S	9.40	0.35	0.74	0.10	Ig	063093		0.296	0.318	−4.55	1	
217004 A	2	s=8.9	I	P	7.604	0.031	0.679	0.015	Ig	121292		0.199	0.135	−5.19	1	
217014				B	5.469	0.013	0.666	0.007	Ig	070293		0.227	0.166	−4.97	1	
217084 AB		a=0.4	W	P	7.666	0.005	0.644	0.005	Ig	121392		0.225	0.179	−4.89	1	
217343				P	7.483	0.002	0.655	0.003	Ig	121292		0.342	0.463	−4.27	1	
217487 A	2	s=8.0	I	P	8.162	0.006	0.827	0.002	Ig	121392	str	0.300	0.345	−4.58	1	
217816 AB		s=3.2	I	S	8.121	0.004	0.503	0.002	Ig	063093		0.233	0.177	−4.81	1	
217958				S	8.06	0.07	0.68	0.10	Ig	063093		0.227	0.165	−4.98	1	
218205	*	triple		P	7.667	0.031	0.646	0.015	Ig	121392		0.260	0.248	−4.64	1	
218379 AB		s=0.1	I	P	7.223	0.009	0.634	0.003	Ig	062793		0.221	0.156	−5.02	1	
218484				S	8.218	0.003	0.587	0.002	Ig	070193		0.216	0.148	−5.05	1	
218511				X	8.332	0.029	1.201	0.001	Ig	062993	spc	0.668			0	
218511				X	8.332	0.029	1.201	0.001	Ig	070193	spc	0.648				
218861				S	8.30	0.35	0.79	0.10	Ig	070193		0.205	0.133	−5.19	1	
219048				P	6.901	0.001	0.733	0.004	Ig	121492		0.199	0.135	−5.19	1	
219077				P	6.118	0.003	0.790	0.008	Ig	121492		0.196	0.130	−5.22	1	
219249				P	7.957	0.004	0.695	0.006	Ig	121492		0.227	0.183	−4.89	1	
219610 AB		s=0.4	I	P	7.755	0.031	0.694	0.015	Ig	121392		0.201	0.139	−5.16	1	
219709 A		s=35.1	J	S	7.501	0.004	0.632	0.003	Ig	070193		0.270	0.252	−4.62	1	
219834 AC	*	triple		C	5.200	0.003	0.787	0.004	Ig	062793	cal	0.213	0.144	−5.12	5	see Table 3
219834 AC				C	5.200	0.003	0.787	0.004	Ig	062893	cal	0.213	0.144	−5.12		
219834 AC				C	5.200	0.003	0.787	0.004	Ig	070293	cal	0.212	0.143	−5.13		
219834 AC				C	5.200	0.003	0.787	0.004	Ig	121292	cal	0.210	0.153	−5.07		
219834 AC				C	5.200	0.003	0.787	0.004	Ig	121392	cal	0.203	0.141	−5.14		
219834 B	*	triple		C	7.549	0.016	0.895	0.001	Ig	062793	cal	0.243	0.195	−4.96	5	see Table 3
219834 B				C	7.549	0.016	0.895	0.001	Ig	062893	cal	0.241	0.191	−4.97		
219834 B				C	7.549	0.016	0.895	0.001	Ig	070293	cal	0.253	0.215	−4.90		
219834 B				C	7.549	0.016	0.895	0.001	Ig	121292	cal	0.247	0.221	−4.89		
219834 B				C	7.549	0.016	0.895	0.001	Ig	121392	cal	0.243	0.213	−4.91		
220367				P	6.874	0.005	0.541	0.011	Ig	121492		0.217	0.165	−4.91	1	
220507				P	7.599	0.031	0.692	0.001	Ig	121492		0.215	0.161	−5.00	1	
220928				S	8.268	0.031	0.593	0.015	Ig	070193		0.224	0.161	−4.96	1	
221231 A		s=36.3		P	7.100	0.002	0.595	0.003	Ig	121492		0.276	0.284	−4.51	1	
221343				P	8.30	0.35	0.65	0.10	Ig	121492		0.255	0.239	−4.67	1	
221420				S	5.810	0.002	0.681	0.002	Ig	070193		0.215	0.147	−5.09	1	

TABLE 4. (continued)

HD (1)	Notes (2)	Mult (3)	Ref (4)	Sample (5)	V (6)	σ (7)	(B−V) (8)	σ (9)	Ref (10)	UT Date (11)	flag (12)	S_{CTIO} (13)	S_{MW} (14)	log R'_{HK} (15)	N (16)	Mean (17)
221503 A	*	triple		X	8.594	0.009	1.290	0.010	Ig	062993	spc	0.881			0	
221503 A				X	8.594	0.009	1.290	0.010	Ig	070193	spc	0.921				
222259 A	2*	s=5.1	I	P	8.0	0.0	0.8	0.0	S	121492		0.457	0.876	−4.09	1	
222259 B	2*	s=5.1	I	X	0.0	0.0	0.0	0.0		121492	hgh	0.761			0	
222335				S	7.180	0.001	0.802	0.012	Ig	070193		0.272	0.256	−4.73	1	
222480				S	7.107	0.009	0.667	0.005	Ig	070193		0.224	0.161	−4.99	1	
222595				P	7.990	0.003	0.704	0.002	Ig	121492		0.238	0.203	−4.81	1	
222668 A		s=38.2	J	P	7.30	0.35	0.76	0.10	Ig	121492		0.190	0.122	−5.30	1	
222669				P	7.691	0.031	0.637	0.015	Ig	121492		0.230	0.188	−4.84	1	
223171				P	6.885	0.005	0.659	0.003	Ig	121392		0.212	0.156	−5.02	1	
223515 AB		s=2.5	I	P	7.876	0.003	0.839	0.002	Ig	121292	str	0.300	0.344	−4.59	1	
223537				P	8.029	0.031	0.666	0.015	Ig	121492		0.322	0.403	−4.36	1	
223551 AB		a=0.8	W	P	7.602	0.001	0.764	0.002	Ig	121492		0.300	0.344	−4.52	1	
223641				P	7.846	0.005	0.735	0.003	Ig	121292		0.199	0.135	−5.19	1	
223691				P	7.846	0.005	0.719	0.002	Ig	062793		0.205	0.133	−5.20	1	
223913 A		s=12.3	J	P	6.649	0.031	0.589	0.001	Ig	121492		0.273	0.278	−4.52	1	
223957				S	7.843	0.031	0.607	0.015	Ig	070193		0.271	0.254	−4.60	1	
224022				P	6.020	0.001	0.572	0.002	Ig	121392		0.213	0.158	−4.97	1	
224319				P	8.512	0.006	0.635	0.004	Ig	062793		0.297	0.319	−4.47	1	
224319				P	8.512	0.006	0.635	0.004	Ig	121492	ray					
224393				P	8.208	0.001	0.613	0.009	Ig	121492		0.231	0.190	−4.82	1	
224538				S	8.064	0.031	0.581	0.006	Ig	070193		0.226	0.164	−4.93	1	
224783 AB		s=3.7	I	P	7.403	0.031	0.551	0.015	Ig	121492		0.222	0.173	−4.86	1	
225118				P	8.243	0.005	0.780	0.010	Ig	062793		0.304	0.339	−4.55	1	
225297				P	7.732	0.008	0.537	0.005	Ig	121392		0.221	0.173	−4.86	1	
225299				P	8.130	0.031	0.710	0.015	Ig	121492		0.228	0.185	−4.89	1	

*Table 4 can also be found in the AAS CD-ROM Series, Vol. 1, 1996

column (2)
0 = target not listed in INCA
1 = double target listed as A and B in INCA, but components have different HD numbers
2 = target listed as AB in INCA, but split in this survey
3 = target listed as single in INCA, but with orbits in references B, D or G (see column 4 notes below)
* = note given at end of table

column (3)
P = period in d(ays) or y(ears)
s = separation in arcseconds
a = semimajor axis of orbit in arcseconds

column (4)
B = Batten, Fletcher & MacCarthy 1989 (BFM89)
D = Duquennoy & Mayor 1991
G = Gliese 1969 (G69); Gliese & Jahreiss 1979, 1991 (GJ91)
H = Heintz 1984, 1994
I = Hipparcos Input Catalog 1992 (INCA)
J = Jeffers, van den Bos & Greeby 1963 (IDS)
W = Worley & Heintz 1983 (WH83)

column (5)
B = Best & Brightest
C = Calibration
N = Nearby
P = Primary
S = Secondary
X = Extra

column (10)
Ig = INCA, good data with $(B-V)$ error ≤ 0.10 mag
Ip = INCA, poor data with $(B-V)$ error > 0.10 mag, only value available
G = Gliese & Jahreiss 1991
S = SIMBAD
blank = no value available

column (12)
cal = calibration star
con = contaminated spectrum
hgh = very high S_{CTIO} value (> 0.600)
low = very low S_{CTIO} value (< 0.180)
noi = noisy spectrum
off = minima of H and K lines out of dithering window
pht = no $(B-V)$ photometry available, or $(B-V)$ out of sample range (0.50 to 1.00 for all samples)
There are only 4 stars with $(B-V) = 0.40$ to 0.49: 1 Primary, 1 Calibration, 2 Extra targets.
ray = cosmic ray in necessary window
spc = special target
str = strange spectrum

NOTES ON INDIVIDUAL STARS

001835: Probably single. INCA lists as component A, but no companion listed in GJ91.

003405: Triple, observed AC. A-C orbit P=3.7d (BFM89). AC-B sep=330″(G69).

004391: Probably single. INCA lists as component A, but no companion listed in GJ91.

004628: Probably double, observed AB. Heintz (1984, 1994) reports astrometric perturbation, and probable optical identification in 1971 and 1978.

010476: Probably single. INCA lists as component A, but no companion listed in GJ91.

010700: Probably single. INCA lists as component A, but no companion listed in GJ91. Heintz (1994) reports no perturbation over 50 years.

011131: Double, observed the secondary. INCA lists as component B. A is HD 11171.

016160: At least triple – observed AC. A-B sep=165″ (G69), C is astrometric companion to A. Companion imaged by Golimowski et al. (1995) may not be C, but a fourth component, D.

020782: Double, observed the primary. INCA lists as component A. B is HD 20781.

TABLE 4. (continued)

022049: Probably single. Astrometric orbit noted in INCA is likely to be erroneous. Heintz (1993) reports no perturbation over 44 years.

024293: Probably single. INCA lists as component B, but possible companion binary, HD 23817AB, is known to have a different systemic radial velocity (G69).

026965: Triple, observed A. A-B sep=84$''$ (GJ69), BC orbit a=6.9$''$(WH83).

038393: Double, observed the primary. INCA lists as component A. B is HD 38392.

041700: Triple, observed C. AB is HD 41742AB. A-B sep=4.8$''$ (INCA), AB-C sep=196$''$ (INCA).

046816: Single. (B−V) = 1.23; value too red for conversion of S_{MW} to log $R'_{\rm HK}$ (adopted cutoff was 1.20).

051633: Double, observed AB. (B−V) = 1.10; value too red for conversion of S_{MW} to log $R'_{\rm HK}$ (adopted cutoff was 1.00).

057555: Triple, observed ABC. A-BC sep=2.4 (IDS), B-C sep=0.3$''$(IDS).

063077: Double, observed A. INCA lists as single, but GJ91 lists companion B.

065907: Triple, observed A. A-BC sep=61$''$ (G69), B-C sep=2.3$''$(G69).

068978: Triple, observed A. A-B sep=12$''$ (IDS), A-C sep=18$''$ (IDS).

082798: Probably single. INCA lists as component A, but no companion listed in INCA or IDS. This star is not in GJ91.

098230/1: Quadruple, observed ABCD. INCA lists as AB, but there are four components in the system (Heintz 1967). AC is HD 98231, orbit P=669d (BFM89). BD is HD 98230, orbit P=4.0d (Heintz 1967).

098800: Quadruple, observed ABCD. INCA lists as AB, but there are four components in the system (Torres et al 1995). ABCD is HD 98800.

100623: Double, observed A. INCA lists as single, but GJ91 lists companion B.

102365: Double, observed A. INCA lists as single, but GJ91 lists companion B.

111234: Triple, observed A. A-B sep=33.6$''$ (IDS), B-C sep=6.0$''$(IDS).

115383: Single. INCA lists as A, and a companion is listed in GJ69 at 34.3$''$. The companion is optical, checked at the telescope by the first author during another project.

115617: Probably single. INCA lists as component A, but no companion listed in GJ91.

122613: Triple, observed ABC. A-B sep=0.8 (INCA), AB-C sep=8.1$''$(INCA).

128620/128621: Triple, observed A and B. This is the α Centauri system. A-B orbit P=79.9y (WH83), C is Proxima at 7849$''$(G69).

131977: Triple, observed A. A-BC sep=22$''$ (G69), B-C orbit a=0.1$''$(Mariotti et al 1990). BC is HD 131976AB.

144179: Triple, observed AB. A-B orbit a=0.8$''$ (WH83). AB-C sep=10$''$(GJ91).

147513: Double, observed A. INCA lists as single, but GJ91 lists companion B.

147873: Possibly single. INCA lists as component A, but no companion listed in INCA or IDS. This star is not in GJ91.

154195: Double, observed A and B. Two stars of similar brightness in the system. The southern one, component A, has the spectrum of a solar-type star, while the northern one has a spectrum too red for a solar-type star. INCA lists delta V = 0.5, but identical photometry for both components (V = 8.377 ± .031, B−V = 0.607 ± .015). S values for both stars are accurate, but no log $R'_{\rm HK}$ possible due to photometry confusion.

155555: Triple, observed AC. AC orbit P=1.7d (BFM89). AC-B sep=33$''$(IDS).

155885/155886/156026: Triple, observed A, B and C. A-B orbit a=13.9 (WH83). AB-C sep=732$''$ (INCA).

165896: Triple, probably observed ABC, although the field is quite crowded and contamination possible. A-B sep=4.7 (IDS), A-C sep=6.0 (IDS). This star is not in GJ91.

177474: Double, observed AB. INCA lists as AB. B is HD 177475.

178428: Double, observed AB. INCA lists as A, but A-B orbit P=21.9d (BFM89).

181199: Double, observed A. INCA lists both stars in the system as HD 181199, although they are separated by 13.8$''$.

182466: Probably single. IDS lists four components in the "system." 182466 is supposedly B. A is HD 182509. INCA lists A as type K4 III and very small proper motions. IDS lists B with large motions. It is unlikely that the two stars (or any of the others listed in IDS) are physically associated. This star is not in GJ91.

190406: Probably at least double, probably observed AB. INCA lists as A. No companions were found in INCA and GJ91, but four companions are listed in IDS. At least one is a likely companion (sep=3.7$''$), another is certainly not. The other two are unknown.

200525: Possibly triple, observed AB. Component B uncertain with A-B sep=few tenths of an arcsecond (GJ91), AB-C sep=7$''$ (GJ91).

201091: Double, observed A. B is HD 201092.

202940: Triple, observed ABC. A-C orbit P=21.3d (BFM89), A-B sep=3.2$''$ (INCA).

207129: Probably single. INCA lists as component A, but no companion listed in GJ91.

212168: Double, observed A. INCA lists both stars in the system as HD 212168, although they are separated by 20.4$''$.

212330: Probably single. INCA lists as component A, but no companion listed in GJ91.

216316: Highly discordant S_{CTIO} values for unknown reason – possible misidentification?

216970: Double, observed B. A is HD 216986.

TABLE . (continued)

218205: Triple, observed C. AB is HD 218227AB. AB-C sep=160″(INCA), A-B sep=1.1″ (INCA).

219834: Triple, observed AC and B. A-C orbit P=6.4y (BFM89), A-B sep=14.4″ (INCA).

221503: Triple, observed A. A-BC sep=336″ (GJ91), B-C sep=few tenths of an arcsecond (GJ91).

222259: Double, observed A (southern component) and B. Composite target AB included in both Houk and Olsen lists. INCA lists as AB, delta V = 1.5, V_{AB} = 7.89 ± 0.35, $(B-V)_{AB}$ = 0.74 ± 0.10. SIMBAD photometry used for component A, no photometry available for component B.

4.1 Comparison of the Northern and Southern Samples

After extracting the $S_{\rm CTIO}$ value from each spectrum, the conversion to $S_{\rm MW}$ was made, and the $\log R'_{\rm HK}$ value derived. If more than one observation was taken, the mean value, $\langle \log R'_{\rm HK} \rangle$ is listed in column 17 of Table 4.

Figure 4(a) illustrates the histogram of final $S_{\rm MW}$ values for the Primary and Secondary targets, including more than 750 solar-type stars. Over the past 400 years, $S_{\rm MW}$ for the Sun has ranged from 0.145 to 0.215, from Maunder Minimum to single observations at the peak of the 11-year solar cycle (Baliunas *et al.* 1995b). This range is illustrated at the top of the figure by the outer set of arrows. The inner set of arrows shows the range in $S_{\rm MW}$ for monthly averages for the Sun in its "normal" state (i.e., not in Maunder Minimum), 0.160 to 0.205. The mean solar value over the last three solar cycles is 0.179 (Baliunas *et al.* 1995a). Figure 4(b) shows the northern sample of Paper I, plotted at the same scale. This sample is the subset of stars with $(B-V)$=0.50 to 1.00 from the northern VP survey (see Table 2), and contains only about one-quarter the number of stars as in the southern survey. In both samples, most stars have low $S_{\rm MW}$ values like the Sun, indicative of relatively little CE.

Converting $S_{\rm MW}$ to $\log R'_{\rm HK}$ allows us to extract the chromospheric emission component in the H and K lines, and removes the color term in the $S_{\rm MW}$ value. The histogram of $\log R'_{\rm HK}$ shown in Fig. 5(a) for stars in the Primary and Secondary Samples is therefore a better way to evaluate the sample in detail. Again for comparison, the range of values for solar monthly means, $\log R'_{\rm HK}=-4.78$ to -5.00 (mean$=-4.89$), is shown by the inner set of arrows, and the extrema are shown with the outer arrows (Baliunas *et al.* 1995a). Also shown at the top of the figure are representative ages for the stars derived using the CE–age relation of Donahue (1993), discussed in Sec. *4.3*. Figure 5(b) again shows the northern sample of Paper I, plotted at the same scale.

The individual points that comprise the histogram of Fig. 5(a) are shown in Fig. 6, which illustrates $\log R'_{\rm HK}$ values versus $(B-V)$ color, split into the two observing runs. [One target, HD 51633AB, has low quality color data, $(B-V)$

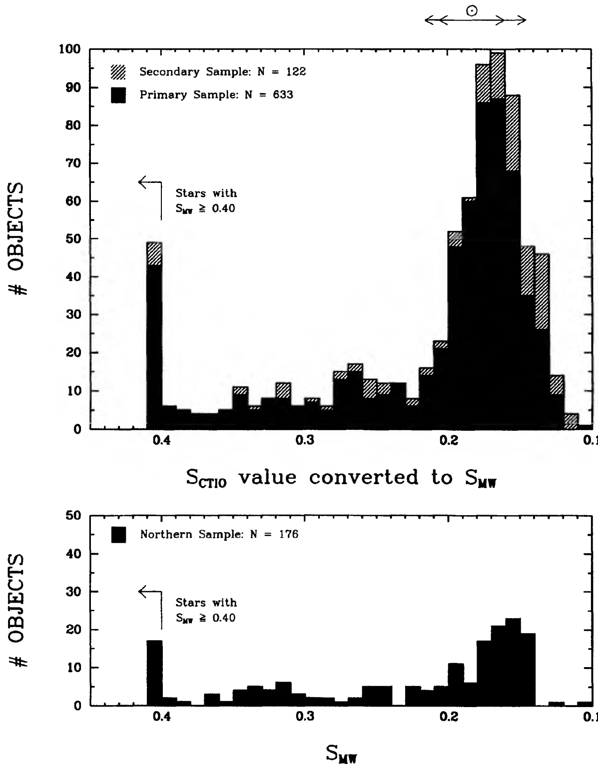


FIG. 4. Histograms of S values for the Southern (Primary and Secondary Samples, top panel) and Northern (bottom panel) Surveys. All stars with $S_{\rm MW}\geqslant 0.40$ are included in the single left-most bin. Shown for comparison in the top panel is the range of $S_{\rm MW}$ for the Sun.

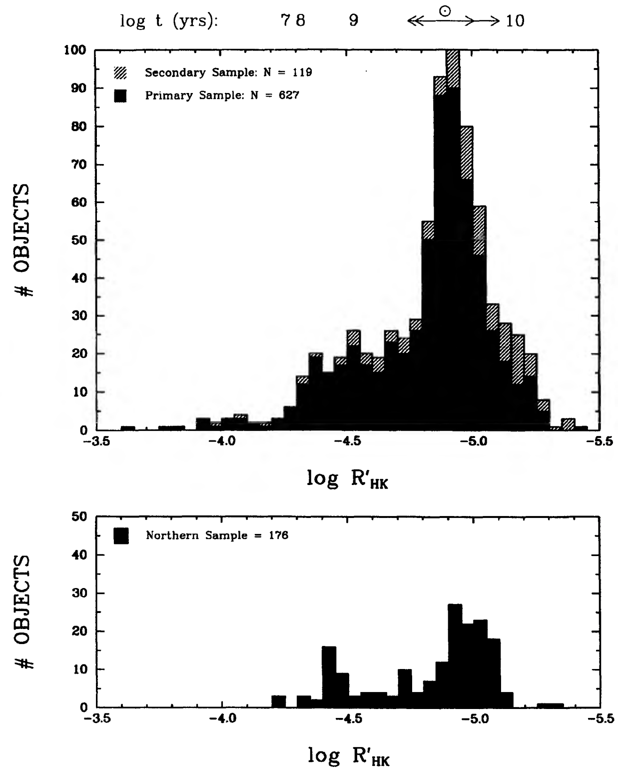


FIG. 5. Histograms of $\log R'_{\rm HK}$ values for the Southern (Primary and Secondary Samples, top panel) and Northern Surveys (bottom panel). Shown for comparison in the top panel is the range of $\log R'_{\rm HK}$ for the Sun. Also shown are representative ages derived using the CE–age relation of Donahue (1993).

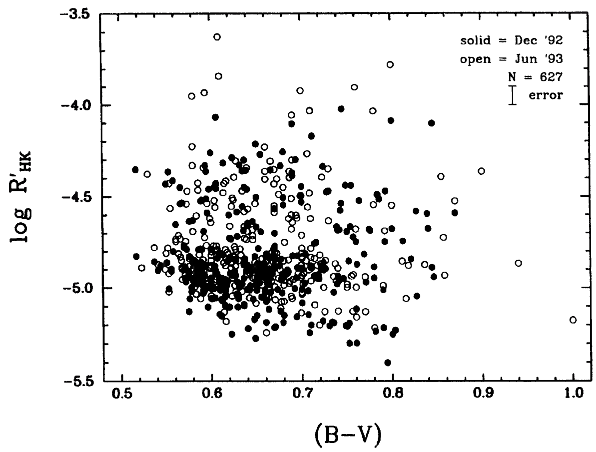


FIG. 6. log $R'_{\rm HK}$ vs $(B-V)$ plot for the Southern Survey (Primary Sample only). Solid points are for stars observed in 1992 December, while open points are for those observed in 1993 June. The representative error in log $R'_{\rm HK}$, ±0.052, based upon three sources of error discussed in the text, is shown in the upper right.

=1.10±0.49, *and falls off the figure at log* $R'_{\rm HK}=-5.07$.] The favoring of early-G dwarfs in the sample mentioned earlier is evident in the figure. Nonetheless, we do not believe a bias is present that favors active or inactive stars.

Figure 7 provides a comparison of the Primary Sample in the southern survey to the northern sample of Paper I. The sample has been truncated at $(B-V)=0.90$ because there are only two stars in the southern sample between $(B-V)=0.90$ and 1.00. Several conclusions are immediately obvious from this illustration. The bimodal character of both samples is clear, although the "VP gap" apparent at log $R'_{\rm HK}\approx-4.75$ is more of a transition zone than a gap. We are led to the conclusion that the zone is, indeed, a real feature of the distribution of CE for stars like the Sun, but that there is not a complete absence of stars at any intermediate log $R'_{\rm HK}$ value. Why some stars fall in the gap, and whether they cross it, is discussed further in the next section.

Perhaps more important, the agreement in the proportion of active and inactive stars in the two samples is remarkable. The fraction of stars above log $R'_{\rm HK}=-4.75$ in the southern sample is 29.6%±2.2%, while in the north it is 29.5%±4.5%.

There appears to be an additional transition zone in the active stars near log $R'_{\rm HK}=-4.20$, perhaps defining a third population of *very* active stars. This potential third class of objects is evident because of the large number of stars included in the southern survey, and was perhaps missed in the north simply because of the smaller sample. Alternately, it is possible that VP systematically avoided very active stars in their study. It is important to note, however, that 8 of the 16 very active stars in the Primary Sample have imprecise $(B-V)$ values (errors in $(B-V)\geqslant0.10$ mag, or no error estimates available). Inaccurate colors will lead to erroneous log $R'_{\rm HK}$ values, so the sample of very active stars is likely to be smaller. Nonetheless, not all of the objects have poor photometry, so there is probably a small sample of very active, potentially very young solar-type stars near the Sun. What kind of objects these stars are is discussed in Sec. *4.4.*

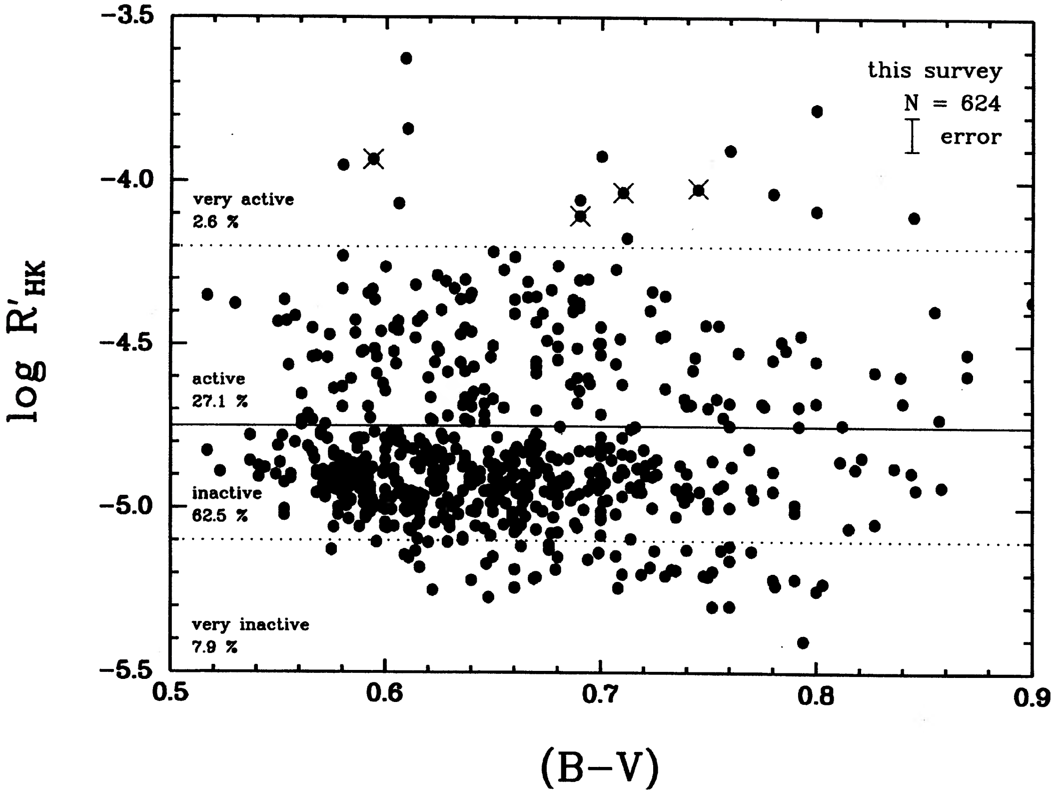
4.2 How Many Populations are There?

In an attempt to characterize the sample formally, we fit Gaussians to the distribution illustrated in Fig. 5(a). It is clear from the figure that a single Gaussian is a poor fit, so we selected three double-Gaussian models to represent the data. The results are given in Table 5 and illustrated in Fig. 8. In all three cases the distribution was assumed to be zero at −3.50 and −5.50, and toward the active end points were only fit up to −4.20 because there are very few stars are beyond that, possibly forming a third population as noted above.

The first model, illustrated by a dotted line in Fig. 8, incorporated a broad Gaussian overlapped by a very narrow Gaussian that produced the sharp peak between −4.80 to −5.05. The fit was poor, with only a 9% confidence level in the probability distribution function for χ^2. This function describes the probability that a random set of data points would yield a value of χ^2 as large or larger when compared with the parent function (i.e., worse fits). In this case, only 9% of the time would the fit be worse than the one attempted. We then adopted a bimodal distribution that split the distribution with peaks at roughly −4.9 and −4.5. While the fit, shown by the light solid line in Fig. 8, was slightly improved (confidence level 13%), the maximum in the sharp peak was pulled down by an overabundance of stars with log $R'_{\rm HK}<-5.10$. The difficulty arises in fitting simultaneously these stars and the sharp peak near −4.9. We were led to the conclusion that the distribution of CE in nearby solar-type stars, even when the very active stars were not fit, is more complicated than a double Gaussian.

A closer look at the individual points [Fig. 7(a)] comprising the histogram of Figs. 5(a) and 8 leads us to a possible solution. In addition to the small, very active group of stars at log $R'_{\rm HK}>-4.20$, there may be another class of very inactive stars with log $R'_{\rm HK}<-5.10$. In the third model attempt, shown by the heavy solid line in Fig. 8, the distribution was truncated at −5.10, and the fit was much improved, with a confidence level of 73%. The sharp peak remains in the same location as for the previous fit, log $R'_{\rm HK}=-4.93$, but the peak is higher and the FWHM narrower. The difference between the observed distribution and the fit is shown in the bottom panel, and shows the excess of stars at log $R'_{\rm HK}<-5.10$.

Here we discuss three possible explanations for the excess stars found at very low CE levels. These stars might have a different metallicity from those that make up the bulk of the sample. If substantially different features were present in the windows used to determine the continuum values in the reduction process, it would be possible to have very low log $R'_{\rm HK}$ values. The second possibility is that these stars could be very old stars with enduring low levels of CE. In that case, however, we might expect them to again show evidence of low metal abundance, and a comparison of log $R'_{\rm HK}$ values in known Pop II stars should confirm the low level of CE. The most intriguing possibility is that the excess of very inactive stars are those that have entered a phase similar to the Sun's Maunder Minimum phase.



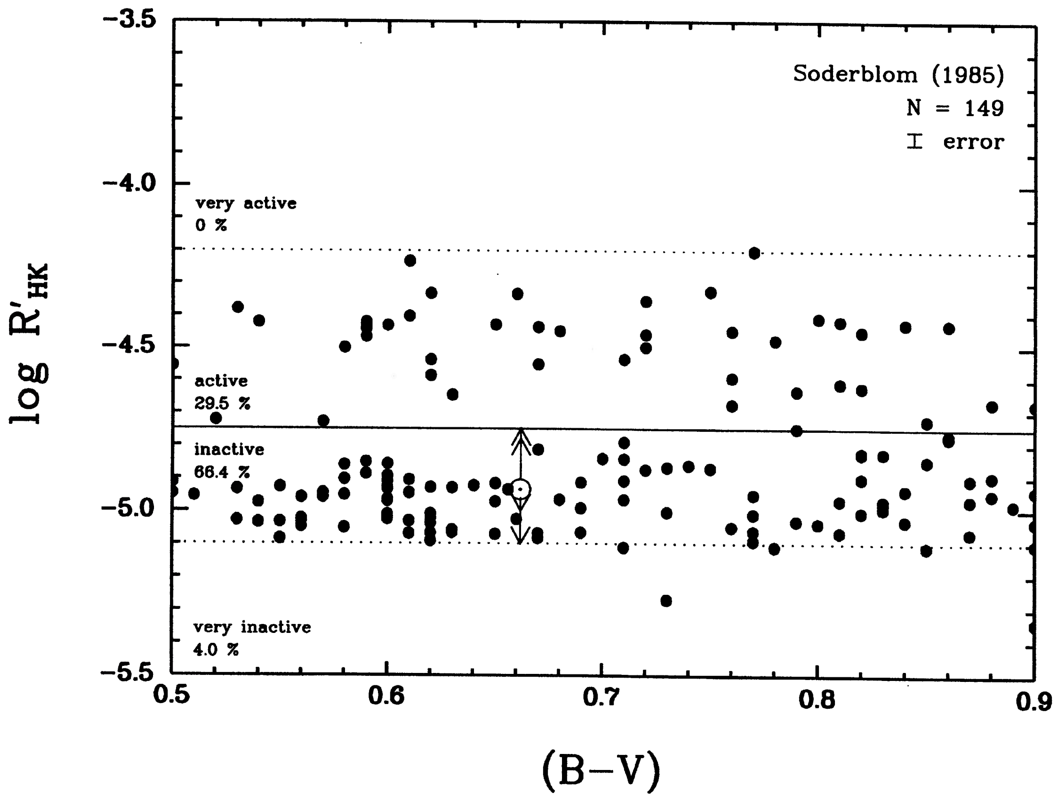


FIG. 7. Comparison of the log R'_{HK} vs $(B-V)$ distributions for the Southern (Primary Sample only, top panel) and Northern Surveys (bottom panel). Note the matching division in the samples at log $R'_{HK}=-4.75$, and the potential secondary divisions in the southern sample at log $R'_{HK}=-4.20$ and -5.10. In the top panel, the representative error in log R'_{HK}, ±0.052, based upon three sources of error discussed in the text, is shown in the upper right. Points with crosses are known active binaries such as RS CVn and W UMa types. In the bottom panel, the representative error has been taken as quoted in Soderblom (1991). Also shown for comparison is the range of log R'_{HK} for the Sun.

TABLE 5. Fits to $\log R'_{HK}$ distribution.

	broad peak + narrow peak	bimodal, full range	bimodal, truncated
Limits	−5.50, −4.20	−5.50, −4.20	−5.10, −4.20
ν	23	23	17
χ^2	32.43	30.82	13.06
χ^2_ν	1.41	1.34	0.77
$P(\chi^2)$	9.2%	12.7%	73.2%
Center 1	−4.93	−4.93	−4.93
Peak 1	71.6	75.8	82.4
FWHM 1	0.205	0.270	0.236
Center 2	−4.68	−4.49	−4.52
Peak 2	19.5	19.8	19.9
FWHM 2	0.677	0.345	0.381

The first two possibilities can be ruled out photometrically, spectroscopically, and by comparison to $\log R'_{HK}$ values for old stars. Three subsamples of our stars, with $\log R'_{HK}$ values in the bins −4.80 to −4.84, −5.02 to −5.10, and −5.10 to −5.40, have been selected for comparison. We began with ~50 stars in each group, but quickly pared the sample down to ~10 by enforcing the requirement that they have $(B-V)$ and $(U-B)$ colors from a single source, Nicolet (1978). First, if the very inactive stars are members of a lower metallicity population, rather than in a Maunder Minimum type phase, they would be found systematically to lie above and to the left of the stars in the control samples in the $(U-B)$ vs $(B-V)$ diagram. As shown in Fig. 9, this is not the case, since the three samples are virtually indistinguishable. For comparison, we also show a sample of high velocity (and presumably older, metal poor) stars from Soderblom *et al.* 1991 which is found to lie up and to the left of the other three samples. Again, the data for these HD stars have been taken from Nicolet (1978). Most of these Pop II stars are members of the old disk population, although a few are from the halo.

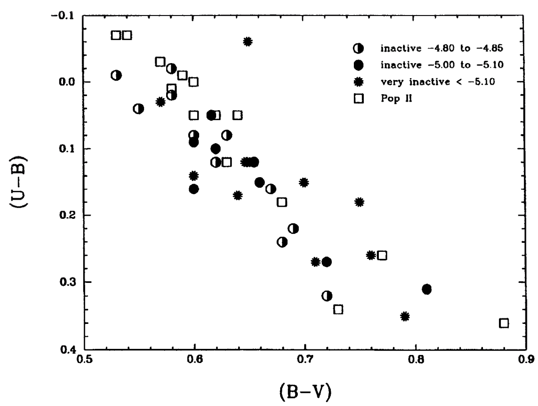


FIG. 9. The $(U-B)$ vs $(B-V)$ diagram for the very inactive population (starred points) and two control groups from the Southern Survey. The fourth group of stars includes high-velocity Pop II stars from Soderblom *et al.* (1991), noticeably above and to the left of the other three samples.

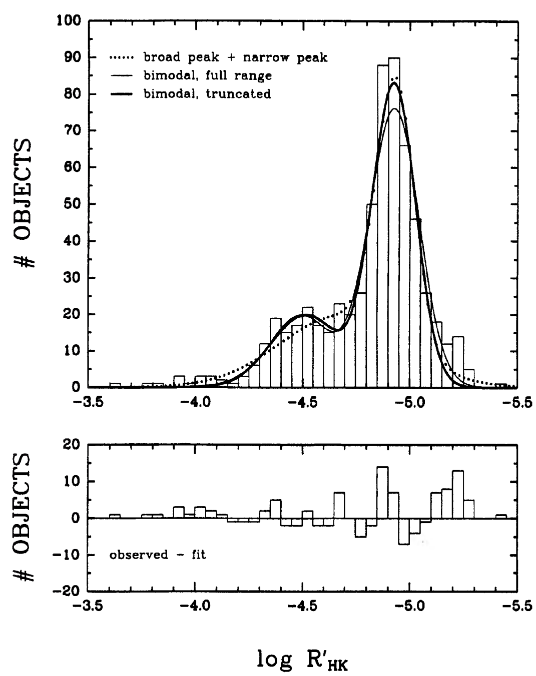


FIG. 8. Fits of three double-Gaussian model populations to the distribution of CE in the Primary Sample of solar-type stars. Details of the fits are given in Table 5. In the top panel, the heavy solid line represents the adopted fit (bimodal, truncated), with the stars possibly in a Maunder Minimum type phase shown as excess for $\log R'_{HK} < -5.10$. The lower panel shows the difference between the data and the adopted fit.

Second, inspection of spectra for stars in the three groups revealed no systematic difference in the continuum windows, thereby ruling out the possibility that the low R'_{HK} values were driven by low metallicity spectral features in the windows. In principle, the C_{RV} index described by Soon *et al.* (1993) might also be used to check the metallicity of these stars. However, the index is typically derived from data acquired with the Mount Wilson instrumentation, which is fundamentally different from what was used for this survey, and it is unlikely that its application here would be advantageous. We note that the direct comparison of the spectra did reveal a few stars with curious features. In the $\log R'_{HK} = -5.02$ to −5.10 group, HD 145417 had distinctly broad Ca II features and deep features in the continuum windows. In the very inactive group, HD 211998AB had washed-out features across the spectrum, perhaps due to a close third component in the system. This system in particular warrants further investigation, as it is the point in Fig. 9 at (0.65, −0.06), separated from all the others.

Finally, a direct comparison between the $\log R'_{HK}$ values of the high velocity stars of Soderblom *et al.* (1991) and the distribution of stars found in this survey further refutes the hypothesis that the low CE tail of the distribution represents a group of old and/or metal-poor stars. The 38 stars of their Table 7 have a mean $\log R'_{HK} = -4.90 \pm 0.26$, firmly placed in the center of the bulk of the sample presented here, not at low CE levels. Only five of these stars have $\log R'_{HK} < -5.10$. Therefore, the presumably old, high-velocity stars do not have anomalously low levels of CE, so the stars comprising the low CE tail in our sample must not be the same sort of Pop II stars.

We are left with the possibility that these targets comprise a small sample of solar-type stars that are in a phase of very low activity similar to the Maunder Minimum seen in the Sun in the 17th and 18th centuries. It is important to emphasize that the Maunder Minimum phase in the Sun appears to be a temporary phenomenon between phases of cyclic activity, and is not enduring inactivity due to advanced age. The arguments above support this scenario, since the very inactive stars to not appear to be old. Ultimately, long-term monitoring of the Ca II H and K lines would reveal if these stars are in a Maunder Minimum type phase.

We conclude that there are certainly two populations of stars in the sample, active and inactive. It also appears that there are two additional groups of stars at very high and very low levels of activity.

4.3 Estimating Ages for Individual Stars

Given the range of CE observed in the Sun, it is clear that it is difficult to assign an accurate age to a solar-type star in this survey because we have only a snapshot of the activity level. We simply do not known what specific phase of variability has been sampled. For example, the Sun's $\log R'_{HK}$ value ranges from -5.10 in Maunder Minimum to -4.75 for individual measurements at solar maximum. These values correspond to ages of 8.0 and 2.2 Gyr using the CE–age relation of Donahue (1993):

$$\log t = 10.725 - 1.334\ R_5 + 0.4085\ R_5^2 - 0.0522\ R_5^3,$$

where t is the age in years, and R_5 is defined as $R'_{HK} \times 10^5$. Nonetheless, we estimate that 90% of the time, we can tell from a single observation on which side of the transition zone in $\log R'_{HK}$ a star will fall, because few stars "jump" the zone. This is supported by studies of single stars that have been followed for decades. Of the 112 stars with sequences of S_{MW} observations given in Baliunas *et al.* (1995a), only $\sim$10% even slip into the zone, let alone jump it. [In this analysis we have assumed that the zone spans $\log R'_{HK} = -4.70$ to -4.80, and have determined the S_{MW} values required to produce $\log R'_{HK}$ values in that range at various $(B-V)$ colors.] The Sun does not cross the zone either, and only slips into the edge of it for a brief time near solar maximum. In addition, the $\log R'_{HK}$ values of stars in binaries (assumed to be coeval) are rarely found to be on opposite sides of the zone. Baliunas *et al.* (1995b) have found that out of 22 binaries, only one has components clearly on opposite sides of the zone, while there are two others with secondaries that slip into the zone, but do not reach the other side. Apparently, a few stars may have instantaneous measurements placing them in the zone a small fraction of the time, but most do not even approach it, and those that do, do so only briefly when their CE measurements are at the extrema of their variations. Perhaps most encouraging in the effort to estimate ages from CE, 15 of the 22 binary pairs have age estimates differing by less than 0.5 Gyr.

4.4 Very Active Stars with $\log R'_{HK} > -4.25$

Here we characterize the very active stars found during the course of the survey. In the initial cut, we wish to evaluate only those stars which are certain to be very active, so we restrict our sample to those with high quality color data, i.e., only those targets with $(B-V)$ errors less than 0.10 mag, the same criterion used to plot the spectra of Fig. 2. Recall that the $(B-V)$ color is required to calculate the $\log R'_{HK}$ value, and while redder stars may have high S_{MW} values, they may not necessarily have $\log R'_{HK}$ values indicating that they fall in the "very active" class.

We select a cutoff of $\log R'_{HK} > -4.20$, corresponding to our adopted second zone in Fig. 7(a), yielding ten stars (eight in the Primary Sample, and two in the Secondary Sample). To this sample we have added HD 155555AC, which has an S_{CTIO} value so high (0.640) that it is past the range of even the extrapolated portion of the S_{CTIO} to S_{MW} calibration. The $(B-V)$ color is well known, however, so this star is certainly very active, but has no $\log R'_{HK}$ value because it is "off the scale." This sample of 11 surely active stars is listed in the top portion of Table 6.

A literature search confirms that the stars are very active. Many have been detected by UV and x-ray satellites. Half are known variable stars, while some have been studied extensively and are known to be RS CVn or W UMa type binaries. In Fig. 2 the spectra of HD 123732, 119022, and 54579 show obviously "washed out" Ca II H and K features. HD 123732 is a W UMa star with an orbital period of 0.39 days, while the other two are prime targets for further detailed work to determine if they are close binaries. The active binaries are indicated with crosses over the points on Fig. 7(a) because they are, in fact, slightly evolved stars with significant CE, not unevolved solar-type stars. This indicates that the Houk spectral types may not fully discriminate between unevolved and slightly evolved stars. Several other close systems may also be revealed if these sample standouts are studied in depth. It is presently unknown whether the remaining stars are highly active because they are in close binaries or because they are very young.

To this set, we add a dozen more targets that do not meet the criteria listed above, but which are probably very active, listed in the lower half of Table 6. For these stars, the $(B-V)$ photometry is poor or unavailable. This sample of stars also shows evidence of youth from the available literature data, again including UV and x-ray detected sources and close binaries. In the full sample listed in Table 6 there are two cases, HD 155555AB and 174429, where a target has been classified as very young in one paper and as a close binary in another, illustrating the need for follow-up observations to clarify their status.

4.5 The Sun's Life

One way to look at this survey of solar-type stars is as if more than 600 snapshots of the Sun were taken throughout its life. In general, the Sun moves from the top to the bottom of Fig. 7(a). The very active population is small and short-lived, indicating that the Sun would spend very little of its life in this phase—only a few percent, or a fraction of a Gyr. Because the Sun is a typical star compared to those included in this sample, we would expect that it would spend about one-third of its life in the active state, and two-thirds in the inactive state. As noted above, once the Sun crosses the transition region at $\log R'_{HK} = -4.75$, after 3–4 Gyr, it is unlikely to return. The remainder of its time will be spent as we see it now, with occasional slips to Maunder Minimum, perhaps only 5% of its total lifetime, but 10% of what remains today.

TABLE 6. Very active stars in the survey.

HD	Sample	Houk type	$(B-V)$	σ	S_{CTIO}	S_{MW}	log R'_{HK}	Var Name	Satellite Detections	Notes	References
155555 AC	P	K1 VP	0.800	.015	0.640			V824 Ara	Exosat, Rosat	PMS/Pleiades age, not RS CVn; Sco-Cen member?	MB; RGP
										RS CVn, P_{orb} = 1.68 d	SHZNEF
017576 AB	P	G0 V	0.609	.003	0.584	1.611	−3.63		TD1	hot subdwarf companion dominates UV	O
123732	P	G0 V	0.594	.015	0.431	0.820	−3.93	V759 Cen		P_{orb} = 0.39 d; W UMa type	SCMG; B
017084	P	G5/8 V + (G)	0.745	.020	0.459	0.886	−4.02	UX For	Einstein, Rosat	active binary (not RS CVn), P_{orb} = 0.95 d	SHZNEF
119022	P	G2 IV/V	0.78	.05	0.454	0.935	−4.03		Einstein		
039917	S	G8 V	0.813	.017	0.480	0.975	−4.05	SZ Pic		RS CVn, P_{phot} = 2.44 d	SHZNEF
202917	P	G5 V	0.690	.015	0.414	0.743	−4.06				
054579	P	G0 V	0.606	.015	0.395	0.636	−4.07	NSV 3420			
037572 A	P	K0 V	0.845	.005	0.475	0.952	−4.10				
177996	S	K1 V	0.862	.003	0.439	0.861	−4.17				
041824 AB	P	G6 V	0.712	.005	0.388	0.612	−4.17	NSV 2827	Einstein, Rosat, TD1	IRAS IR excess; triple?; P_{orb} = 463.5 y	SB; KMR; WH
174429	P	K0 VP	0.80	.13	0.583	1.718	−3.78	PZ Tel		PMS, Pleiades group member, single; P_{orb} = 0.94 d	RGP; ICTL
175897	P	G0 V	0.61	.10	0.470	1.018	−3.84				
180445	P	G8 V	0.76	.10	0.499	1.182	−3.90				
151770	P	G3/5 V	0.70	.10	0.466	1.000	−3.92				
106506	P	F8/G0 (V)	0.58	.10	0.421	0.774	−3.95				
163029 AB	S	K0 V	0.80	.49	0.478	1.063	−4.00				
005303	P	G2/5 V + F0	0.71	.0	0.428	0.809	−4.03	CF Tuc	Einstein, IRAS, Rosat	RS CVn, P_{orb} = 2.80 d; IRAS IR excess	SHZNEF; BSPFO
222259 A	P	G5/8 IV (+ F)	0.8	.0	0.457	0.876	−4.09		Rosat		
077137 AB	P	G5 V	0.69	.0	0.406	0.674	−4.10	TY Pix	IRAS, Rosat	RS CVn, P_{orb} = 3.20 d	SHZNEF
222259 B	X	see 222259 A	0	.0	0.761					primary has log R′ = −4.09	
131156 B	N	not listed	1.16	.0	0.648				Einstein, TD1	primary has log R′ = −4.32, ξ Boo	
102982	P	G3 V	0	.0	0.486	1.104					

References for Table 6: B = Bond 1970; BSPFO = Busso et al. 1988; ICTL = Innis et al. 1990; KMR = Kviz et al. 1987; MB = Martin & Brandner 1995; O = Olsen 1980; RGP = Randich et al. 1993; SB = Stencel & Backman 1991; SCMG = Sistero et al. 1990; SHZNEF = Strassmeier et al. 1988; WH = Worley & Heintz 1983

We must emphasize, however, that other studies place the amount of time in Maunder Minimum at up to 30% (Baliunas & Jastrow 1990, and references therein), and that further work is required to reconcile the two values.

5. CONCLUSIONS

The more than 1000 spectra we have obtained for over 800 stars during this survey provide a rich dataset useful for studies of chromospheric emission and related properties. We have been able to confirm the feature (whether a gap or a transition zone) in CE for solar-type stars discovered by Vaughan & Preston in 1980. This zone separates the chromospherically active stars from the ~70% of stars that are relatively inactive, like the Sun. Given (1) that the southern survey was done using an entirely different observation method than was used in the VP survey, (2) the large size of the sample, and (3) the quality of the two-population fits to the distribution, it seems fairly clear that the feature is real. Recent work by Baliunas *et al.* 1995a and Donahue *et al.* 1995 is yielding further evidence that stars on opposite sides of the zone do, indeed, exhibit qualitatively different types of CE. In the former, it appears that several stars at the top edge of the zone tend to have dual activity cycles, whereas in the latter, it has been found that significant growth and decay of active regions starts below the zone. In both cases, few stars are found with such attributes on the other side of the zone.

We have also identified a possible second transition zone in the population at $\log R'_{\rm HK} \approx -4.20$ which separates very active stars from merely active ones. This population of stars includes many known close binary systems of the RS CVn and W UMa types, and several potential new additions to these classes of exotic objects. Finally, we have uncovered a population of solar-type stars that may be currently in a Maunder Minimum type phase, accounting for ~5%–10% of the total sample.

Given the large samples of both active and inactive stars, we are poised to conduct two studies examining the relative space motions and multiplicities of the populations. Both studies can be done in collaboration with the CORAVEL radial velocity team, which is observing the southern portion of solar-type stars within 50 pc for velocities, and monitoring them for velocity variability. Additional work on multiplicity can be accomplished with speckle work in the southern hemisphere, which will not only detect companions in orbits a few to tens of AU in size, but will permit characterization of any companions found. Because CE is a function of age, the subsets of active and inactive stars can be searched to discover if the multiplicity fraction changes with time, for which there is some evidence from recent work (see Mathieu 1994, and references therein). The sample of active stars provides a critical snapshot in time between the pre-main sequence population, which may be made up of nearly 100% multiples, and that of solar-type stars in the solar neighborhood, where only ~60% are in multiple systems.

Finally, once the parallax and color data from the *Hipparcos* mission are available, future efforts will lead to the expansion of the sample to include all solar-type stars within 50 pc. We anticipate that the final sample of stars over the entire sky will number ~5000. The stars in this sizable sample will ultimately have high-quality parallax, color, chromospheric emission, and multiplicity data, and will allow us to make detailed comparisons of our Sun to its neighbors in the Galaxy.

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