A Survey of Stellar Families: Multiplicity of Solar-Type Stars

Deepak Raghavan^{1,2}, Harold A. McAlister¹, Todd J. Henry¹, David W. Latham³, Geoffrey W. Marcy⁴, Brian D. Mason⁵, Douglas R. Gies¹, Russel J. White¹, Theo A. ten Brummelaar⁶

ABSTRACT

We present the results of a comprehensive assessment of companions to solartype stars. A sample of 454 stars, including the Sun, was selected from the Hipparcos catalog with $\pi > 40$ mas, $\sigma_{\pi}/\pi < 0.05$, $0.5 \le B - V \le 1.0$ (\sim F6-K3), and constrained by absolute magnitude and color to exclude evolved stars. These criteria are equivalent to selecting all dwarf and subdwarf stars within 25 pc with V-band flux between 0.1 and 10 times that of the Sun, giving us a physical basis for the term "solar-type". New observational aspects of this work include surveys for (1) very close companions with long-baseline interferometry at the Center for High Angular Resolution Astronomy (CHARA) Array, (2) close companions with speckle interferometry, and (3) wide proper motion companions identified by blinking multi-epoch archival images. In addition, we include the results from extensive radial-velocity monitoring programs and evaluate companion information from various catalogs covering many different techniques. The results presented here include four new common proper motion companions discovered by blinking archival images. Additionally, the spectroscopic data searched reveal five new stellar companions. Our synthesis of results from many methods and sources results in a thorough evaluation of stellar and brown dwarf companions to nearby Sun-like stars.

 $^{^1\}mathrm{Center}$ for High Angular Resolution Astronomy, Georgia State University, P.O. Box 3969, Atlanta, GA 30302-3969

²raghavan@chara.gsu.edu

³Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138

⁴Department of Astronomy, University of California, Berkeley, CA 94720-3411

⁵US Naval Observatory, 3450 Massachusetts Avenue NW, Washington DC 20392-5420

⁶The CHARA Array, Mount Wilson Observatory, Mount Wilson, CA 91023

The overall observed fractions of single, double, triple, and higher order systems are $56\% \pm 2\%$, $33\% \pm 2\%$, $8\% \pm 1\%$, and $3\% \pm 1\%$, respectively, counting all confirmed stellar and brown dwarf companions. If all candidate, i.e., unconfirmed, companions identified are found to be real, the percentages would change to $54\% \pm 2\%$, $34\% \pm 2\%$, $9\% \pm 2\%$, and $3\% \pm 1\%$, respectively. Our completeness analysis indicates that only a few undiscovered companions remain in this well-studied sample, implying that the majority $(54\% \pm 2\%)$ of solar-type stars are single, in contrast to the results of prior multiplicity studies.

Our sample is large enough to enable a check of the multiplicity dependence on various physical parameters by analyzing appropriate subsamples. Bluer, more massive stars are seen as more likely to have companions than redder, less massive ones, consistent with the trend seen over the entire spectral range. Systems with larger interaction cross sections, i.e., those with more than two components or long orbital periods, are preferentially younger, suggesting that companions may be stripped over time by dynamical interactions. We confirm the planet-metallicity correlation (i.e., higher metallicity stars are more likely to host planets), but are unable to check it for brown dwarfs due to the paucity of such companions, implying that the brown dwarf desert extends over all separation regimes. We find no correlation between stellar companions and metallicity for B-V < 0.625, but among the redder subset, metal-poor stars ([Fe/H] < -0.3) are more likely to have companions with a 2.4σ significance.

The orbital-period distribution of companions is unimodal and roughly lognormal with a peak and median of about 300 years. The period-eccentricity relation shows the expected circularization for periods below 12 days, caused by tidal forces over the age of the Galaxy, followed by a roughly flat distribution. The mass-ratio distribution shows a preference for like-mass pairs, which occur more frequently in relatively close pairs. The fraction of planet hosts among single, binary, and multiple systems are statistically indistinguishable, suggesting that planets are as likely to form around single stars as they are around components of binary or multiple systems with sufficiently wide separations. This, along with the preference of long orbital periods among stellar systems, increases the space around stars conducive for planet formation, and perhaps life.

Subject headings: Stellar multiplicity - Binary stars - Solar-type stars - Solar neighborhood - Exoplanet systems - Brown dwarfs - Survey

1. Introduction

Our Sun is the only known star in the Universe that hosts a life-bearing planet. It is no surprise then that many astronomical programs are focused on developing a more comprehensive understanding of Sun-like stars. Paramount to this is an assessment of how often solar-type stars have stellar and substellar companions, and whether there any relationships between a star's tendency to have one or more of these companion types. This is the primary motivator of this effort, which is aimed at moving us a step closer to comprehending the availability of habitable space and the possibility of extraterrestrial life in the Universe. Additionally, statistical results from comprehensive multiplicity analyses can provide vital clues about star formation and evolution. The long-held belief that the majority of stars have stellar companions (e.g., Heintz 1969; Abt & Levy 1976; Duquennoy & Mayor 1991, hereafter DM91) has significant bearing on their formation mechanisms and needs to be tested as new observational data become available. Relationships identified between multiplicity and the physical parameters of stars such as mass (DM91, Henry & McCarthy 1990; Fischer & Marcy 1992; Mason et al. 1998a; Burgasser et al. 2003) and age (Mason et al. 1998b) also inform us about the formation and evolution of stars. Another valuable result of studying stellar multiplicity is the determination of dynamical masses of the component stars, enabling an observational basis for testing stellar structure and evolution models. Moreover, simply knowing whether a star is single or not is important for many astronomical efforts because calibration stars used in spectroscopic, photometric, and astrometric studies are often required to be single.

While many previous studies have investigated the multiplicity of solar-type stars (e.g., Abt & Levy 1976, DM91), an update is warranted for several reasons: (i) More accurate astrometry available from the *Hipparcos* catalog (Perryman & ESA 1997) enables the selection of a more accurate volume-limited sample, minimizing biases in the results. The DM91 sample was selected using the parallaxes in Gliese (1969) (hereafter referred to as CNS, i.e, the Catalogs of Nearby Stars, along with Gliese & Jahreiß (1979, 1991)), and we will show in § 2.3 that it was contaminated by parallax errors. (ii) The vast amount of attention garnered by nearby solar-type stars enables this study to build on this knowledge with targeted new observations, resulting in the most comprehensive assessment yet. (iii) The larger sample of this study compared to prior efforts not only increases the confidence in the results, but also enables analyses of various subsamples, resulting in an improved understanding of star formation and evolution. (iv) High-precision radial-velocity surveys (e.g., Marcy et al. 2004; Mayor et al. 2004; Butler et al. 2006) and high-contrast imaging efforts (e.g., Burgasser et al. 2003; Metchev & Hillenbrand 2009) since the prior studies yield observational results of substellar companions and enable us to better constrain our incompleteness analysis.

In § 2, we describe the sample selection process, present the resulting set of solar-type stars, discuss sample completeness and characteristics, and compare our sample to that of DM91, which represents the seminal work in this area. In § 3, we discuss the various sources and observational methods used to derive the list of companions. The synthesized multiplicity results of each system are presented in § 4, followed by a discussion of survey completeness, comparison with prior studies, and implications of our results in § 5.

2. The Sample of Solar-type Stars

The sample of stars studied in this work is comprised of 454 solar-type primary stars in the solar neighborhood (see Table 1), selected from the *Hipparcos* catalog. The distance limit for our sample is 25 pc from the Sun, corresponding to a Hipparcos parallax of $\pi \geq 40$ mas. Stars with parallax errors larger than 5% of the corresponding value are excluded from the sample (see § 2.1). Söderhjelm (1999) improved the precision and accuracy of several *Hipparcos* parallaxes for close binaries by combining *Hipparcos* and ground-based observations, and we utilize his results in place of the *Hipparcos* values, when available. To restrict the sample to solar-type stars, we require $0.5 \le B - V \le 1.0$, which roughly corresponds to spectral types F6-K3. To exclude significantly evolved stars while selecting all dwarfs and subdwarfs, we limit selection to a band within 2 magnitudes above and 1.5 magnitudes below the Cox (2000) main sequence. The larger band above the main sequence was chosen to minimize any biases against close binaries and multiple star systems. Figure 1 shows the sample and the selection criteria on an HR diagram. The two regions marked with an 'X' include no stars, and hence the above criteria are equivalent to selecting all dwarf stars with V-band fluxes of 10^{-1} to 10^{+1} that of the Sun, giving us a physical basis for the term "solar-type".

The above criteria select 462 stars from the *Hipparcos* catalog, nine of which are companions to other stars in the sample, yielding the final sample of 454 stars when the Sun is included. The *Hipparcos* astrometry was recently updated by (van Leeuwen 2007a,b), but our sample selection and much of the observational work were completed before they were available. However, the impact of these revisions on our survey is minimal. If we had selected our sample from van Leeuwen (2007b), 15 new stars would have been included and 18 sample stars would have been left out. Compared to the sample size, these differences are small and show no systematic effects. They are all due to parallax fluctuations within 2σ near the 40 mas limit.

Our volume limit yields a sufficiently large sample to produce robust multiplicity statistics and to enable the analyses of subsamples based on various physical characteristics. Moreover, solar-type stars in this volume of space have been extensively studied over many decades, allowing our work to benefit from those prior results. We will show in § 2.2 that the *Hipparcos* catalog is not constrained by magnitude limits for solar-type stars within 25 pc, resulting in a complete volume-limited sample.

The 12 stars above the magnitude selection limit in Figure 1 are likely evolved, as suggested by their spectral classes in Table 2. The table also lists the three stars that are too faint to be included in our sample. Two of these, plotted in Figure 1 below the cutoff are, in fact, M-dwarfs with erroneous $Hipparcos\ B-V$ values, as confirmed by their spectral types listed in the table and magnitudes in the Tycho-2 Catalog (Høg et al. 2000). The third star below the cutoff, far too faint to be included in the figure, is a nearby white dwarf. Note that the selection band we used around the main sequence was chosen to select all dwarfs and subdwarfs. While the spectral types listed in Table 1 do not include any of luminosity class VI, the sample nevertheless contains 31 stars with $[Fe/H] \le -0.50$ (see §5.3.1 for a tabulation of the metallicity values, and Jao et al. (2008) for a discussion of subdwarf spectral types). The four sample stars farthest below the main sequence in Figure 1 are also the four lowest metallicity stars in the sample with $[Fe/H] \le -0.95$, and no stars are excluded near this limit, indicating that the few subdwarfs within 25 pc are included in the sample.

2.1. Stars Excluded Due to Large Parallax Errors

While we chose the 5% error threshold to limit our sample to good-quality parallax measures, this raises the question of a potential bias, namely, could astrometric perturbations from close companions lead to relatively large errors in the *Hipparcos* astrometry, preferentially excluding these binaries from our study? Alternatively, the large errors could be due to the faintness of the sources, which would imply stars too far to fit within our volume-limit, so a closer inspection of these stars is warranted. Table 3 lists the 24 stars that were left out of the sample because their parallax errors were greater than 5% of the corresponding parallax value. Columns 13 and 14 list an alternate parallax and its corresponding error, estimated as identified by Column 15.

Five stars have parallaxes with better than 5% accuracy for a physically associated companion. One of these (HD 53706) is included in this work as a companion of HD 53705, while the remaining four are too distant to make the 40-mas cutoff. For an additional ten, our distance estimates using *Hipparcos* photometry yields parallaxes below 17 mas. While these estimates are crude, they nevertheless place these stars far beyond our distance limits, justifying their exclusion. It should be noted that these distance estimates assume that the stars are main-sequence dwarfs. If they are subdwarfs, their actual distances will be less

than the photometric estimates. However, only 7% of our sample is comprised of subdwarfs, and so any effect of this error on these 24 stars is minimal. Two more entries in the table (HD 139460 and 139461) represent a physically bound pair, of which HD 139461 is itself a spectroscopic binary with an M-dwarf companion. The spectral type measures of these stars from Gray et al. (2003) and the consistent mass estimates from Tokovinin & Gorynya (2001) place this system beyond the 25 pc limit. This leaves only seven stars that could possibly lie within the distance limit of our sample. Two of these (HD 23439 and 217580) have single-lined spectroscopic (SB1) companions and a third (HD 212697) has a common proper motion (CPM) companion. The implied multiplicity fraction is consistent with our overall results, so the effect of this possible bias is minimal.

2.2. Sample Completeness

The Hipparcos catalog contains astrometry of unprecedented quality of over 118000 stars. The faintest target that could be reached by the telescope was about V=12.4 mag (Perryman et al. 1995), but the catalog is complete to significantly brighter limits. The Hipparcos target list was selected based on two criteria. About 52000 "survey" stars were selected as a complete sample down to well-defined magnitude limits varying from 7.3–9.0 mag depending on spectral type and galactic latitude. Stars later than G5 were restricted to a limit brighter by 0.6 mag as compared to earlier type stars to preferentially select nearby A, F, and early G-type stars over distant red giants, which would otherwise have dominated the list (Turon et al. 1992a,b). The remaining 66 000 "faint" stars were selected down to about 12 mag from various proposals submitted to the Hipparcos Scientific Selection Committee (Turon et al. 1992b). Given that the current sample includes several stars fainter than the 7.3 mag limit to which the catalog is complete for all spectral types and galactic latitudes, a further analysis is warranted to ensure that our sample does not suffer from any brightness limits. Such limits, if present, would introduce the Malmquist bias, favoring the selection of binaries in our most distant bins.

First, we check the completeness of the Hipparcos catalog against the Tycho-2 Catalog, which is 99% complete down to V=11.0 mag (Høg et al. 2000). Figure 2 shows the V magnitude distributions of the two catalogs as well as the percentage of Tycho-2 stars that are also in the Hipparcos catalog. A few things are apparent from this figure. First, the linear slope on a logarithmic scale of the Tycho-2 catalog out to $V \sim 11$ confirms its completeness out to that limit. Similarly, the Hipparcos catalog is seen as complete out to about 7.5 mag, no surprise given the limits discussed above. Second, while the Tycho-2 distribution falls off rapidly beyond the peak, the Hipparcos distribution shows a moderated

fall. This is somewhat due to the graded *Hipparcos* limits based on spectral types and galactic latitudes, but mainly because of the selection of more than half of the *Hipparcos* stars fainter than the completeness limits based on their scientific rationale. Presumably, most nearby solar-type stars would have made this cut, not only because of their interest to various scientific investigations but also because most of these had existing ground-based parallax measurements, which the *Hipparcos* mission could verify and improve.

Figure 3 shows the distance distribution of the *Hipparcos* stars conforming to our sample selection criteria, but expanding the distance limit out to 35 pc. The dotted curve marks the expected distribution for a complete sample extrapolated from the 15-pc sample. This extrapolation makes two assumptions. First, it assumes that the space density of nearby stars is uniform, which is true for our sample of stars within 25 pc. Second, it assumes that the 15 pc sample is complete. This is justifiable because our subsample within 15 pc includes only two stars fainter than the 7.3 mag limit to which the Hipparcos catalog is complete for all spectral types and galactic latitudes. One of these is within the *Hipparcos* magnitude limit for its galactic latitude, given the specific magnitude limit definitions in Turon et al. (1992b), and the other is just 0.14 magnitudes fainter than the limit. Furthermore, these two stars are among the most intrinsically faint stars in the sample (spectral types K2.5 V and K3 V) and close to the limit of 15 pc (both are 14 pc away). Thus, the chances of any stars being left out of the 15-pc sample due to brightness limits are slim. Given this, Figure 3 suggests that the actual 25-pc sample is also complete and does not suffer from brightness limits as the actual distribution matches the expected one fairly well. The deficiency in the 23–25 pc bin is within a 1σ deviation for Poisson statistics and is made up in the very next distance bin, suggesting that it may be due to statistical scatter alone. While the overall profile of the curve shows the effects of brightness limits creeping in, they occur beyond the 25-pc limit of our sample. We will revisit this topic in § 5.2 using the multiplicity data gathered by this effort to show that the percentage of single stars is statistically equivalent for various distance-limited subsamples, consistent with the expectations of a complete volume-limited sample.

2.3. Comparison with the DM91 Sample

The DM91 multiplicity survey was based on a volume-limited sample of 164 solar-type stars, selected with parallaxes of 45 mas or greater, spectral types F7–G9, and spectral classes IV-V, V, or VI. Selecting a sample subject to these same criteria from the *Hipparcos* catalog results in 148 primaries, but only 92 of these overlap with the DM91 sample. This indicates that 72 stars (44%) of the DM91 sample are now known to lie outside their selection criteria

and 56 (38%) of the stars meeting their criteria were not included in their sample. The important question is whether these substantial differences introduce possible biases that would taint their multiplicity results. While the distribution of the CNS stars in Halbwachs et al. (2003) showed no systematic deviations from the main sequence when plotted using Hipparcos data, Figure 4 shows a preferential shift for the DM91 sample. The majority of stars that are now known to lie outside the DM91 criteria are elevated above the main sequence and even include evolved stars, demonstrating the need for an updated survey. Furthermore, a closer inspection of the Hipparcos stars matching the DM91 criteria reveals that several are erroneously included due to incorrect spectral type assignments in Hipparcos. Our sample selection, based on B - V color, mitigates this problem.

3. Survey Methods and Multiplicity Results

This multiplicity survey of solar-type stars synthesizes companion information from various imaging and spectroscopic observations and augments them with a thorough examination of reported companions in the various catalogs and publications. The closest companions are best revealed through radial-velocity searches, and this work benefits from a complementary effort by Latham et al. (2010), which reports radial velocities and their analyses for 344 of our sample stars and 38 companions. Additionally, high-precision measures of radial velocities gathered as part of the California and Carnegie Planet Search (CCPS, described in Butler et al. 1996) program were investigated to identify stellar companions. As seen in Figure 5, the excellent coverage of these high-precision data allow us to not only identify stellar companions of all masses, but also help constrain our incompleteness analysis (see § 5.1). An astrometric search for companions too wide for radial-velocity campaigns and too close for traditional visual techniques such as speckle interferometry was conducted through a systematic survey for separated fringe packet (SFP) binaries using the Center for High Angular Resolution Astronomy (CHARA) Array (ten Brummelaar et al. 2005). This effort, which yielded no new companion detections, is discussed in Raghavan et al. (2010a). Augmenting comprehensive prior efforts with several new observations, we now have speckle interferometry observations for every target in the sample. Finally, a systematic search for the widest of companions was conducted by blinking multi-epoch archival images (see $\S 3.1$).

Apart from the targeted observations mentioned above, our synthesis effort brings together information about previously known and suspected companions, which we evaluate individually. In § 3.2, we examine the astrometric companions discovered by the *Hippar*-

cos mission, § 3.3 assesses the CPM candidates in the Washington Double Star Catalog¹ (WDS) and the Fourth Catalog of Interferometric Measurements of Binary Stars² (hereafter INT4), § 3.4 addresses the resolved-pair and photocentric-motion visual binaries cataloged in the Sixth Catalog of Orbits of Visual Binary Stars³ (hereafter ORB6), and § 3.5 reviews the CPM as well as spectroscopic binaries listed in the CNS. Surveys for eclipsing binaries are fruitful in identifying short-period systems but generally pertain to stars beyond our volume limit. The few eclipsing binaries in the sample are discussed in § 3.6. Finally, brown dwarf companions are treated in § 3.7, and published planetary companions to stars in this sample are covered in § 3.8.

In assessing companions identified by the various methods, we assume that whenever such detections are consistent with one physical companion, only one companion exists. Sometimes this could be confirmed, as in the case of spectroscopic and visual orbits with the same orbital periods, but often, we relied solely on consistency. For example, does a slow linear drift in radial velocity over 20 years indicate a new companion, or is it measuring the effects of a known 250-year visual pair? The nature of hierarchical systems suggests that these two measurements are likely related to the same companion, and this is the assumption we make. Similarly, proper motion acceleration seen for one component of a visual or spectroscopic binary is assumed to not indicate an additional component. It is important to note that even if this approach misidentifies two different companions as one, a later rectification can only enhance the multiplicity order of binaries or higher-order systems, but will not affect the estimated percentage of single stars.

3.1. The Search for CPM Companions

Due to the proximity of the stars studied here, their proper motions are generally quite large (367 of the 453 stars have proper motions larger than 0".2 yr⁻¹). This, along with archival digitized images taken several years apart, facilitates the identification of CPM companions by blinking the images. The primary source of the archival images utilized in this effort is the multi-epoch STScI Digitized Sky Survey⁴ (DSS). In some cases, when the time interval between the two DSS images was not sufficient to easily detect the proper motion

 $^{^{1}}http://www.usno.navy.mil/USNO/astrometry/optical-IR-prod/wds/WDS/$

 $^{^{2}}http://www.usno.navy.mil/USNO/astrometry/optical-IR-prod/wds/int4$

 $^{^{3}}http://www.usno.navy.mil/USNO/astrometry/optical-IR-prod/wds/orb6$

⁴http://stdatu.stsci.edu/cgi-bin/dss_form

of the primary star, SuperCOSMOS Sky Survey (Hambly et al. 2001, SSS) images were used for the earlier epoch, significantly increasing the apparent motion seen upon blinking. Figure 6 shows the epoch-distribution of the images blinked. The earlier epoch distribution is bimodal, with 266 frames from 1949–1957 for predominantly northern hemisphere stars and 187 frames from 1974–1989 for mostly southern hemisphere stars. The later epoch is more tightly constrained, with all 453 frames obtained during 1984–2000. The resulting time interval between the pairs of images blinked varies from 1-49 years, with well over half of the intervals exceeding 28 years. Figure 7 illustrates this method with the two images blinked for HD 9826 (v And), allowing the identification of the CPM companion and the detection of two WDS entries as unrelated field stars with minimal proper motion. The effect of the target star's proper motion, while noticeable in these printed images, is readily apparent when they are blinked numerous times in quick succession. While we utilized image subtractions as an additional tool, our experience shows that a visual examination by blinking the images offers the most effective method for identifying candidate CPM companions. This technique is well suited for identifying companions with separations greater than $\sim 15-30''$ from the primary (depending on its brightness), as companions closer than this are often buried in the saturation around the bright primaries. However, in many instances, bright companions inside the saturation region can be identified by twin, comoving diffraction spikes.

3.1.1. CPM Companions Identified

To enable an effective search out to a linear radius of about 10 000 AU from each primary, we blinked 22' square images for systems closer than 20 pc and 15' square images for the more distant systems. The larger images were blinked as four sub-images of 15' square from each corner, allowing for a closer inspection. Figure 8 shows the distribution of the linear projected separation searched around each primary, illustrating that most systems were effectively searched out to a separation of $\sim 10\,000$ AU. While companions farther than this separation limit have been reported (e.g., Latham et al. 1991; Poveda et al. 1994), such wide companions are rare and are not often expected to survive dynamical interactions in clusters (Parker et al. 2009), so the range selected here enables an effective search of the region containing the vast majority of companions. Companions down to R=17 mag could be readily identified in the images used, as evidenced by the refuted candidate companion to HD 141004, which has R = 16.9 and was clearly seen above the background. In comparison, the apparent R magnitude of an M5 dwarf at 25 pc is 12.5 (Cox 2000), and the starbrown dwarf transition occurs at about R = 19.0 at 25 pc, estimated using data from Dahn et al. (2002). This implies that our search is sensitive to all but the lowest-mass stellar companions. Of the 453 image pairs blinked, 44 did not show a discernible motion of the primary and an additional 43 had marginally detectable motions. Hence, for 366 of the 453 targets investigated, this technique proved to be fully effective in identifying most CPM stellar companions, and somewhat effective for an additional 43.

The 366 primaries adequately inspected reveal 88 candidate companions in the vicinity of 79 primaries. These include a few previously reported CPM companions at wider separations than our systematic search, which we confirmed by blinking adequately large images. While CPM is necessary for a physical association, it is by no means sufficient. Accordingly, we confirm candidates as physical only if their (a) independently measured parallaxes and proper motions from the literature are consistent with the primaries' *Hipparcos* values, (b) existing or new photometry and/or spectral types indicate distances compatible with the primaries' Hipparcos parallaxes, (c) multiple resolved images show conclusive orbital motions, or (d) proximity to the primary and matching large proper motions (greater than $0''.5 \,\mathrm{vr}^{-1}$) argue for a physical association. Table 4 lists every candidate identified by this method, grouped by the ones confirmed as physical and those refuted by follow-up work. Table 5 lists the candidates confirmed or refuted by their photometric distance estimates, derived as described in Henry et al. (2004), along with their spectral types, proper motions, and photometry. The separations and position angles listed in Table 4 are approximate measurements from the more recent of the images blinked, whose epoch is also noted in the table. These measurements are generally good to within a few arcseconds and degrees, respectively, except for measurements between twin diffraction spikes, which typically have larger uncertainties. The separations are repeated in Table 5 to identify the star whose distance is estimated. Overall, this method led to the identification of 70 CPM companions, including four new discoveries. The new companions are identified in the archival images in Figure 9. In addition, while many of the entries in Table 4 were previously suspected CPM companions, we confirm their definitive physical association as documented by Column 5 of the table.

3.1.2. Linear Motions of Field Stars

In addition to identifying CPM companion candidates, we used the blink results to recognize many double star entries in catalogs such as the WDS as chance alignments of unrelated field stars. These stars show minimal motion upon blinking as is characteristic of distant field stars, or in a few cases, show motions in different directions than their primaries. Additionally, some close WDS pairs within the primary's saturation region were identified as field stars because their WDS measures demonstrated a linear change in relative separations, reflecting the differential proper motion between the two stars (see Figure 12 in Raghavan

et al. (2009) for an example). Table 6 lists the 298 WDS entries for the stars of this study that were identified as optical doubles because they do not share the primary's proper motion. All data except the primary name in Column 4 are from the WDS, and the astrometry listed in Columns 6–8 is for the most recent observation in the catalog as of 2008 July.

3.2. *Hipparcos* Double Stars

In addition to producing unprecedented astrometry, the *Hipparcos* mission identified many stellar companions, which we evaluate next for our sample stars. The primary identification of companions in the *Hipparcos* catalog is reported in field H59, with further details in the Double and Multiple Systems Annex. Potential companions are identified as one of five types by various multiplicity flags: C, G, O, and X, which are discussed in the subsections below, and V (photocentric movement due to the variability of one or more components), which was not assigned to any star of this survey. In addition to the multiplicity flag, field H61 of the main catalog lists an 'S' for suspected non-single stars, based on the astrometric fit obtained, although a satisfactory double star solution could not be obtained. Some of these correspond to the 'X' entries of field H59. Also, field H52 contains a 'D' (duplicityinduced variability) identifying photometric variability presumably caused by a companion. While H52 and H61 contribute 16 possible companions that are not identified by field H59, we do not consider them reliable companion detection indicators for this work unless there is an independent confirmation. There are several additional flags in the catalog that can imply a companion, such as H10, which contains a reference flag for components of double or multiple systems, and H62, which is a component designation for double or multiple systems. However, these indicators overlap with the flags discussed above in all cases, and are not discussed further because they do not contribute any new companions. The following subsections treat each of the companion indicators considered and describe the methods of this survey in evaluating their verity.

3.2.1. Component Solutions

These companions, identified by a 'C' in field H59, represent double stars resolved by *Hipparcos* as separated components that could be modeled as single stars, usually with an assumed common parallax. For these systems, field H61 gives an indication of the reliability, with a quality of A (good), B (fair), C (poor), or D (uncertain). Among the sample studied here, 62 stars were flagged as *Hipparcos* component solutions, 59 of which have independent supporting evidence. Of the remaining three, two (HD 64606 and 148704) are refuted by this

effort (see § 4.3) and one (HD 111312) remains a candidate binary. Table 7 lists all entries of this type identified by their HD and HIP names and the companion ID as in the *Annex*, along with the quality flag (field H61), the final status used in this effort, and the reason for this conclusion.

3.2.2. Accelerating Proper Motions

The Hipparcos catalog identifies many suspected companions because the proper motion of a presumed single star required higher-order terms to obtain an acceptable fit. The implied curvature in the proper motions of these stars was interpreted as the effect of an unseen companion, and these stars were accordingly flagged with a value of 'G' in field H59. In addition, significant differences between the *Hipparcos* proper motions, measured over approximately three years, and those from the Tycho-2 catalog, which contains the average of ground-based measures over a much longer time interval, can indicate the presence of an unseen companion (e.g., Makarov & Kaplan 2005; Frankowski et al. 2007, and references therein). This is because the *Hipparcos* measurements would be sensitive to deviations due to companions with periods of about 10 years, while the Tycho-2 measurements would average out the effects of such orbital motions and represent the transverse motion of the system. On the other hand, orbits of many decades to a few centuries will affect the Tycho-2 measurements, but hardly influence the *Hipparcos* data. Makarov & Kaplan (2005) followed this approach in identifying companions based on a 3.5σ difference between the proper motion in either coordinate from these two catalogs and estimated a minimum companion mass. Frankowski et al. (2007) developed a χ^2 test to minimize false identification of companions, and identified 3565 proper-motion binaries with a greater than 99.99% confidence level, which they estimate to be an order of magnitude better than that of Makarov & Kaplan (2005).

Table 8 lists the 91 stars from the current sample that either have a 'G' designation in Hipparcos field H59 (N=18), or have a greater than 3σ difference between the Hipparcos and Tycho-2 proper motions (N=73). The significance of the proper motion difference, listed in Column 8 of the table, is computed as the root-sum-squared of the difference in each axis divided by the corresponding larger error. Of the 18 entries in the table that have the Hipparcos 'G' designation, 16 have independent confirmation of a nearby companion or a greater than 3σ difference between the Hipparcos and Tycho-2 proper motions. The remaining two are retained as candidates because they meet the statistical criteria of Frankowski et al. (2007). Of the 73 stars with greater than a 3σ difference between the Hipparcos and Tycho-2 proper motions (but without a Hipparcos 'G' designation), 68 are considered phys-

ical because they have independent confirmations of a nearby companion (N=65) or meet the Frankowski et al. (2007) χ^2 test (N=3). The remaining five are retained as candidates for further investigation.

3.2.3. Orbital Solutions

Nineteen of the targets studied in this work have orbital solutions in the *Hipparcos* catalog, for which the *Hipparcos* data enabled the determination of at least one of the orbital parameters. Despite this evidence, we investigated each claim and found that three of them could in fact be refuted based on more recent studies, and one is retained as a candidate. Table 9 lists these stars along with their orbital periods from *Hipparcos*, the final status for our multiplicity statistics, and a corresponding reason for this conclusion.

3.2.4. Stochastic Solutions

Three of the sample stars have a stochastic solution designation in Hipparcos, implying that they had neither a satisfactory single nor double-star solution. The three stars are HD 21175, 200525, and 224930, all of which are confirmed to have companions (see § 4.3 for more details on the first two and § 3.4 for the third).

3.3. Speckle Interferometric Searches and the WDS and INT4 Catalogs

Building on comprehensive prior efforts (e.g., McAlister 1978a,b; McAlister et al. 1987, 1993; Hartkopf & McAlister 1984; Mason et al. 1998b; Hartkopf et al. 2008; Horch et al. 2008), we were able perform targeted speckle observations of 21 stars to ensure that every target on the list has at least one observation using this technique (Mason et al. 2010). While limited by Δ mag $\lesssim 3$, speckle interferometry offers an efficient way of splitting pairs down to the diffraction limits of ground-based telescopes. This, along with the systematic searches for visual pairs for centuries, has resulted in the recording of many measures for each pair in the WDS, enabling us to definitively confirm many suspected companions as physical associations and show others to be unrelated field stars. The primary catalogs utilized by us for this purpose are the WDS and the INT4 as of 2008 July. The WDS lists measurements of pairs with epoch, separation, and position angle from techniques such as visual micrometry, speckle interferometry, and long-baseline optical interferometry (LBOI). The INT4 documents the results from high-resolution searches. While there is a significant

overlap between these sources, the WDS includes historical observations which may not be of high precision, but nevertheless are very useful in significantly increasing the time baseline of measurements. On the other hand, the INT4 is useful in determining the status of many pairs, not only based on the measures of resolved pairs, but also because it includes the null results along with detection limits. The results from these techniques and catalogs are discussed in several sections. The linear motions of field stars were covered in § 3.1.2. Various other results are discussed throughout this work, including the evaluation of many Hipparcos pairs in § 3.2, and visual orbits derived from those measures in § 3.4. The WDS pairs that could be confirmed or refuted via photometric distance estimates are discussed next. Table 5 includes 23 confirmed and two refuted WDS pairs that were also seen upon blinking the archival images, and Table 10 lists the 12 additional WDS pairs that were confirmed using photometric distance estimates. Finally, the individual evaluation of other WDS entries and their corresponding results are discussed in § 4.3.

3.4. Visual Binaries in the ORB6 Catalog

The ORB6 catalog contains orbital solutions from the measurements of either relative separations between resolved pairs or photocentric motions of unresolved pairs. Orbits based on the explicit measurements of relative separations are coded with grades 1 (definitive) to 5 (indeterminate), those determined by visibility modulations measured by LBOI are coded with grade 8, and photocentric-motion orbits are flagged as grade 9. Table 11 lists the 98 orbits from this catalog for the stars of our sample, separated into the resolved and unresolved pairs. The first four columns identify the pair and are taken from the ORB6 catalog. Columns 5 & 6 from the WDS show the number of measurements of the pair and the time-span of these observations. Column 7 lists the orbital period from the ORB6 in days (d) or years (y), and is useful in matching spectroscopic orbits. Columns 8 & 9 list the orbit's grade and reference from the ORB6, and Column 10 identifies whether the orbit has a corresponding single-lined (1) or double-lined (2) spectroscopic orbit. Finally, Column 11 lists the status we adopt for the pair's physical association.

Orbits of grade 8 are robust solutions, typically combining spectroscopic and interferometric observations for short-period orbits. The quality of the other resolved-pair orbits degrades from 1–5, due to diminishing orbital coverage provided by measurements of the pair. Accordingly, there is a strong correlation between an orbit's grade and its period. While orbital solutions of grades 4–5 can potentially undergo significant revisions, the components are likely to be physically bound. Our investigation of the 72 individual systems found supporting evidence in all but one instance. We confirm physical associations due to one or

more of the following factors: the existence of matching spectroscopic orbits, the many WDS measurements demonstrating not only CPM but also curved orbital motion, and in the case of very long-period orbits, the WDS measures showing CPM and linear motions consistent with a small arc of the orbit. The lone exception, HD 32923, despite an orbit of grade 3 in ORB6, was refuted by follow-up investigations (see § 4.3). We also investigated each of the 26 photocentric orbits in Table 11 and found all but four to be physical associations, confirmed by matching spectroscopic orbits or definitive photocentric orbits presented in the references indicated. We refute three claims of photocentric orbits, flagged as 'NO' in Column 11, because their expected radial-velocity modulations are not seen by high-precision measurements (Abt & Biggs 1972; Nidever et al. 2002; Gontcharov 2006; Latham et al. 2010). One orbit, noted as 'MAY' in Column 11, is retained as a candidate for further investigation.

3.5. Companions Listed in the CNS

While the astrometry of the CNS catalog has been superseded by *Hipparcos* (as discussed in §2.3), the CNS also identified stellar components as either CPM pairs or ones with definitive or suggestive radial-velocity variations. For the stars studied here, the CNS listed 148 CPM companions and 50 suspected companions due to radial-velocity variations. Our investigations refuted six of the claimed CPM companions, and all remaining pairs were confirmed as physical due to supporting evidence from one or more of the methods described by this work. While most of the companions listed in this source are also present in the other sources checked, two wide companions (15' from HD 63077 and 20' from 137763) were identified solely based on their CNS entries, both of which were subsequently verified by blinking large-enough images and further confirmed by matching proper motions and parallaxes. The CNS, however, was not as accurate on claims of radial-velocity variations. The results of modern surveys have enabled us to refute 23 of these 50, while three more (HD 20010, 23484, 90839) remain candidates (see § 4.3). Table 12 lists the refuted companion claims. Columns 2 and 3 identify the specific companion claim (spectroscopic binary or radial-velocity variations). Column 4 lists the references we used to conclude that this star does not show any evidence of radial-velocity variations in high-precision, long-term campaigns and/or from independent measures over an extended time period.

3.6. Eclipsing Binaries

Most eclipsing binaries are more distant than our limit of 25 pc. Our search of the All Sky Automated Survey⁵ for variable stars and Malkov et al. (2006), a catalog of 6 330 eclipsing binaries, reveals only three potential companions to the stars of this study: HD 123, 9770, and 133640. While the latter two are real, HD 123 was later refuted by Griffin (1999) (see § 4.3). For HD 9770, Cutispoto et al. (1997) present an eclipsing light curve and a corresponding 11.4-hour orbit. HD 133640 is listed in Malkov et al. (2006) with a period of 6.4 hours, which matches that of the double-lined spectroscopic orbit.

3.7. Brown Dwarf Companions

Searches for field brown dwarfs in infrared surveys, particularly the 2MASS database (Skrutskie et al. 2006), over the last ten or so years have identified many such substellar objects (e.g., Kirkpatrick et al. 1999, 2000). These have been augmented by high-resolution, high-contrast searches for substellar companions to nearby solar-type stars (e.g., Liu et al. 2002; Potter et al. 2002; Luhman et al. 2007). While these efforts have revealed several hundred brown dwarfs, a far greater tally would be expected if the stellar mass function extends into the sub-stellar regime. The deficiency of field and companion brown dwarfs has given rise to the term "brown dwarf desert". To identify brown dwarf companions to the stars in our sample, we searched the publications and also used the Dwarf Archives⁶. an online source that maintains a comprehensive list of known brown dwarfs along with their spectral types and astrometric information. A search of the contents of this catalog as of 2009 November revealed 17 entries within half a degree of 15 sample stars. Eight of these entries are confirmed companions to seven stars (HD 3651, 79096, 97334, 130948, 137107, 190406, and 206860), at separations of 0".9-200" from their primaries. Further details of these substellar objects are included in the tables and figures discussed in §4.2, § 5.3.1, and § 5.3.8. A widely separated brown dwarf, about 27' from HD 145958, shows consistent proper motion and is hence retained as a candidate (see $\S 4.3$). The remaining eight entries, representing brown dwarfs 225"-30' from their primaries (HD 53927, 86728, 90508, 130948, 136202, 161198, 202751, and HIP 91605), were refuted as physical companions because they are 2–3 magnitudes fainter than expected for their spectral type at the primary's distance, or because their proper motion and/or parallax measures from the Dwarf Archives or from Faherty et al. (2009) were significantly different than the corresponding primary's

 $^{^{5}}http://archive.princeton.edu/$ asas/

 $^{^6}http://spider.ipac.caltech.edu/staff/davy/ARCHIVE/index.shtml$

value. These eight chance alignments of unassociated brown dwarfs are consistent with the expectation of random alignments of the 453 sample stars and the 752 brown dwarfs in the Dwarf Archives, assuming isotropic distributions, which is valid for these nearby objects. Finally, none of the substellar companions to our sample stars in the exoplanet catalogs has a minimum mass of over $13 \, \mathrm{M_{J}}$, and only three of 52 have minimum masses greater than $5 \, \mathrm{M_{J}}$, consistent with the expectations of the brown dwarf desert.

3.8. Planetary Companions

To complete our exhaustive search for companions, we extracted information on planetary companions from the two regularly updated online sources, namely, the Extrasolar Planets Encyclopedia⁷ and the CCPS program's website⁸. As of 2009 October, 52 planetary companions are known to orbit 35 stars of our sample, excluding the Sun. Their details are listed in Table 13 and the relevant discussions are covered in § 5. As discussed in § 4.3, two of the planetary candidates, one each around HD 143761 and 217107, might, in fact, be stellar companions. Every exoplanet belonging to our sample was discovered by radial-velocity measurements and one (HD 189733b) has complementary photometric observations of transiting events as well (Bouchy et al. 2005).

4. Synthesis of Results

4.1. Nomenclature

We follow the Washington Multiplicity Catalog⁹ (WMC) standards for naming stellar and brown dwarf companions as prescribed in Hartkopf & Mason (2004) and use the actual WDS designations when available. This hierarchical nomenclature designates components using a combination of uppercase and lowercase alphabets, and in the case of exceptionally complex systems, numbers as well. It is best understood by following the illustration of a fictitious example in Figure 10, which is adapted from a similar example in Hartkopf & Mason (2004) and described in the figure's caption. While this is not a perfect method, it adequately handles our evolving knowledge of components while capturing the hierarchical relationship

 $^{^{7}}http://exoplanet.eu/$

 $^{^8}http://exoplanets.org/$

 $^{^{9}}http://www.usno.navy.mil/USNO/astrometry/optical-IR-prod/wds/wmc$

between them. While the WMC standards were intended to cover companions of all types, a different de-facto standard has evolved for naming planetary companions, including some brown dwarf companions discovered by the planet search teams. This method attaches a lowercase alphabetic suffix, separated by a blank, to the host star's name for each substellar companion, starting with 'b' and incremented alphabetically in discovery sequence. Due to the wide acceptance of this standard, we follow this lowercase letter designation for the planetary companions.

4.2. Multiplicity Results for Each System

Table 13 lists each star of our sample along with its stellar and planetary companions, if any. This table only includes confirmed or candidate companions, leaving out components that are now known to be physically unrelated. Such refuted components are discussed in the preceding sections and in § 4.3. The stars of the current sample are listed in order of right ascension, immediately followed in subsequent lines by the stellar and planetary companions of that system. Note that six stars in this sample (identified by superscript 'a' in Column 6) are actually not the primary components of their systems, but are still listed first within their group. Their primaries (component A, F0-K2) are not included in our sample because they are not Hipparcos stars or do not satisfy our B-V color limits. Stellar companions are listed in order of proximity to the primary and planetary companions are listed directly under the star they orbit, also sequenced by proximity to the star. For ease of readability, the right ascension and declination (Columns 1 & 2) are only listed at the beginning of each group and correspond to the sample star. Column 3 lists the HD number of the star, when available, and Column 4 lists an alternate name of the star or the name of the planet. In the first line of each system, Column 5 lists an 'N' if this system has specific notes in §4.3. For systems without notes, the companions listed, or lack thereof, are fully explained in the preceding sections and do not require any further comments.

For the first line of each system, Column 6 identifies the component designation of the sample star according to the nomenclature described above, unless it has no companions, in which case the column is empty. For stellar companions, this column identifies the pair whose details are listed in Columns 7–15. The stellar components of the pair are each named according to the WMC standards. The components are separated by a comma, which is suppressed when both components are represented by uppercase alphabets (e.g., AB; AB,C; and Aa,Ab are valid pair designations). In some instances, a single component may represent more than one star. For example, consider a visual binary, the secondary of which is itself a single-lined spectroscopic binary. This system will have the sample star listed first, followed

by two pairs: AB representing the measurements of the visual binary, and Ba,Bb with details of the spectroscopic orbit. The B component of the AB pair hence identifies the spectroscopic binary and represents its center of light as observed by the visual observations. For planetary companions, this column is left empty. Column 7 lists the orbital period of the pair, when available from spectroscopic and/or visual orbit solutions, in hours (h), days (d), or years (y). Column 8 lists the angular separation measured between the components in arcseconds. It is the most recent measure from the WDS or other published references, or is our approximate measure from the archival images for new CPM companions. Column 9 lists the semi-major axis from orbital solutions when Column 8 is empty, or the projected linear separation corresponding to the angular separation in Column 8, in AU. Column 10 lists the status of companionship used for the multiplicity statistics derived here – 'Y' indicates a confirmed companion and 'M' implies an unconfirmed candidate. The next five columns list additional information about the techniques used to identify each companion as follows.

Column 11 corresponds to visual orbits and contains an 'O' for robust orbits of grade 1, 2, 3, or 8; 'P' for preliminary orbits of grade 4 or 5; and 'U' for unresolved photocentric-motion orbits (see § 3.4 and § 4.3 for details). Column 12 identifies spectroscopic companions as a '1' for single-lined orbits, '2' for double-lined orbits, and 'V' for radial-velocity variations indicating a companion, but without an orbital solution (see Latham et al. (2010) and § 4.3). Column 13 identifies CPM companions as close pairs with matching proper motions ('M'), pairs with evidence of orbital motion ('O') companions with matching proper motions and photometric distances ('P', see Tables 5 and 10), close pairs with published evidence of companionship ('R', see § 4.3), companions with matching proper motions and spectral type identifications that are consistent with the primary's distance ('S', see § 4.3), or pairs with independently-measured matching proper motions and trigonometric parallaxes ('T'). Column 14 identifies unresolved companions other than spectroscopic or visual ones such as eclipsing binaries ('E', see § 3.6), companions indicated by an overluminous star ('L', see §4.3), or implied by proper motion accelerations ('M', see §3.2.2). Finally, Column 15 identifies companions seen by CHARA LBOI as SFP ('S', Raghavan et al. 2010a) or as visibility-modulation binaries ('V', Raghavan et al. 2009, 2010b).

To identify the proficiency of various techniques in revealing companions and to illustrate the overlap among the various methods, Table 14 lists the number of confirmed companions found as visual binaries (VB, including resolved-pair and photocentric-motion binaries), spectroscopic binaries (SB, including single-lined, i.e., SB1, and double-lined, i.e., SB2, orbits, and radial-velocity variations without an orbit), CPM pairs (CP), and other techniques (OT, representing mostly accelerating proper motions, but including the few eclipsing binaries and over-luminous objects indicating unseen companions). Column 2 shows the total number of companions found by each of the above methods, Column 3 lists the number of

companions detected uniquely by each method, and the remaining columns show the overlap of companion detections by more than one method.

4.3. Notes on Individual Systems

Following are the notes on individual systems which are marked with an 'N' in Column 5 of Table 13. These systems require explanations about confirmed, refuted, or candidate companions beyond what is covered in the previous sections.

HD 123: Triple. This system is composed of a 107-year visual-orbit pair, the secondary of which was shown to be the more massive component from absolute astrometry (Griffin 1999), suggesting that it itself was an unresolved binary. Brettman et al. (1983) reported a periodic variation in the component's brightness over roughly a 1-day period, which Griffin (1999) later disproved based on *Hipparcos* photometry and instead showed it to be a spectroscopic binary with a 47.7-day period, estimating component masses of 0.98, 0.95, and 0.22 M_{\odot} for the three components.

HD 1237: Binary, one planet. In a systematic search for faint companions to planet hosts, Chauvin et al. (2006) discovered a CPM companion to this star using VLT NACO adaptive optics and demonstrated orbital motion. Chauvin et al. (2007) characterized the companion as $M4\pm1V$.

HD 3651: Binary, one planet. Luhman et al. (2007) reported the discovery of a T7.5 \pm 0.5 companion 43" away from this planet-host star using Spitzer IRAC images, and confirmed CPM using 2MASS images. The brown dwarf's infrared colors are consistent with the distance to the primary, confirming companionship. They estimate the companion's mass as $0.051 \pm 0.014 \,\mathrm{M}_{\odot}$ and age as 7 ± 3 Gyr by comparing luminosity with evolutionary tracks. This was the first substellar object imaged around an exoplanet host. An additional component listed in the WDS is clearly optical (see Table 6).

HD 4391: Triple. The WDS lists three measurements of a companion with separations ranging 10".0–16".6 over 98 years, and we discovered an additional companion 49" away by blinking archival images (see § 3.1.1). Our VRI images, obtained in 2007 July and October at the CTIO 0.9-m telescope, clearly reveal both companions, confirming CPM. The closer companion was saturated in all but one V-band image, but the differential photometry extracted from this image allowed confirmation as a companion (see Table 10). For the newly-discovered wider companion, our absolute VRI photometry along with 2MASS JHK_S magnitudes confirmed a physical association (see Table 5).

HD 4628: Single, candidate Binary. Heintz & Borgman (1984) detected a companion, 2".7 away, on 11 exposures over two nights, but did not see the companion on 164 other plates or on multiple visual checks with a micrometer. Their two observations about 25 days apart show evidence of variation in the companion's brightness by about 1 magnitude. Heintz (1994) notes an acceleration in proper motion for the primary and speculates that this might be caused by the companion reported earlier. Roberts et al. (2005) did not detect a companion using Adaptive Optics (AO) down to $\Delta I \lesssim 10$ and note that only a white dwarf companion could have escaped detection, while the flaring companion as seen by Heintz should have been detected. Moreover, the *Hipparcos* and Tycho-2 proper motions of HD 4628 match to within 2σ , and the INT4 lists several null results with speckle interferometry and adaptive optics. BDM and DR observed this target using the KPNO 4-m telescope in 2008 June, and while the separation was too wide and the Δm too large for speckle observations, the finder TV showed a faint source about 5" away at about 230°. Could this be the companion seen by Heintz after about 30 years of orbital motion? While a possibility, follow-up observations by Elliott Horch two days later with the WIYN 3.6m telescope on KPNO failed to identify the source. Additionally, 5-second exposures in VRI taken by TJH at the CTIO 0.9-m telescope in 2008 June also failed to identify any companion, although saturation around the primary could hide the companion in these images. Nidever et al. (2002) report that the primary shows no variations in its radial-velocity measurements. At this time, we do not have sufficient information to confirm or refute this companion, although, chances of a physical companion appear slim. The wider component listed in the WDS is clearly optical (see Table 6).

HD 4676: Binary. Boden et al. (1999) presented a visual orbit based on LBOI observations for this 14-day SB2 and derived component masses of $1.223 \pm 0.021 \,\mathrm{M}_{\odot}$ and $1.170 \pm 0.018 \,\mathrm{M}_{\odot}$. Earlier, Nadal et al. (1979) had speculated on the presence of a third companion based on temporal changes in the spectroscopic orbital elements. While this suspected companion has been mentioned in subsequent literature (Fekel 1981; Tokovinin et al. 2006), it was refuted by Boden et al. (1999) based on imaging and spectroscopic evidence. Two additional components listed in the WDS are clearly optical (see Table 6).

HD 9826: Binary, three planets. Lowrance et al. (2002) discovered an M4.5V companion, 55'' away from planet host v And and confirmed its physical association by demonstrating CPM and showing that its spectral type is consistent with its magnitudes at the primary's distance. Two additional components listed in the WDS are clearly optical (see Table 6).

HD 13445: *Binary, one planet*. This planet-host star with a 4 M_J planet exhibits a longterm trend in radial velocity, consistent with a stellar companion beyond 20 AU (Queloz et al. 2000). A significant difference between the *Hipparcos* and Tycho-2 proper motions (see

Table 8) also suggests a nearby unseen companion. Later work has resolved this companion and demonstrated orbital motion (Lagrange et al. 2006). The companion was initially misidentified as a T dwarf (Els et al. 2001) and later shown to be a white dwarf based on spectroscopy (Mugrauer & Neuhäuser 2005) and a dynamical analysis of astrometry and radial velocities (Lagrange et al. 2006).

HD 20010: Binary, candidate Triple. The secondary of a 5" CPM pair with a preliminary visual orbit is listed in the CNS as "RV-Var?". Eggen (1956) mentions that there is a strong evidence of variability, quoting van den Bos (1928), but this reference could not be found. With insufficient evidence to confirm or refute a physical association, the additional companion is retained as a candidate.

HD 20807: Binary. The wide CPM companion, HD 20766, lies 309" away and is confirmed by matching proper motions and parallax. Additionally, the WDS lists a single speckle interferometry measure of a companion in 1978, 0".046 away at 11° (Bonneau et al. 1980). However, Bonneau et al. failed to resolve the companion in 1979 and da Silva & Foy (1987) mention that the 1978 measure was in fact an artifact in the diffraction pattern of the telescope spider.

HD 21175: Binary. While this companion only has three ground-based measurements, they span more than 50 years and are consistent with a bound pair. The Hipparcos catalog also identifies this star as a suspected binary because the astrometry did not adequately fit either a single or binary solution (H59 = 'X'). Söderhjelm (1999) presents a visual orbit combining Hipparcos and ground-based measures, confirming a physical association.

HD 22049: Single, one planet. This is ϵ Eri, the well-studied exoplanet host. The WDS lists a single speckle resolution of a potential stellar companion, 0'.048 away (Blazit et al. 1977), significantly closer than the planet. However, 13 other attempts by speckle and AO have failed to resolve the companion (e.g., McAlister 1978a; Hartkopf & McAlister 1984; Oppenheimer et al. 2001). Presumably, the Blazit measure is spurious. The WDS lists 10 additional components, all of which were confirmed as optical by blinking archival images (see Table 6).

HD 23484: *Single*, candidate *Binary*. The CNS lists this as "RV-Var", but no radial-velocity data could be found in modern surveys. Catalogs (Abt & Biggs 1972; Duflot et al. 1995; Gontcharov 2006) list velocities with RMS scatter of about 3 km s⁻¹, but this could be due to measurement errors or zero-point variances. This candidate companion is retained as a candidate.

HD 24496: Binary. The two measurements with $\rho = 2''.6-2''.7$ and $\theta = 254^{\circ}-256^{\circ}$ listed in the WDS are by Wulff Heintz, nine years apart and consistent with a bound pair. The

first measure is based on observations over three nights and the second on observations over two additional nights. Given the quality of the observations ($\Delta m = 4-5$ measured) and the reasonably high proper motion of the primary, this is likely a physical companion, but one that could use new measurements.

HD 25680: Binary. A companion 0".2 away was discovered by McAlister et al. (1993) with speckle interferometry and confirmed by the same technique by Hartkopf et al. (2008). These measures show evidence of orbital motion, and given the 0".2 yr⁻¹ proper motion of the primary and an elapsed time of 15 years between them, this companion can be confirmed as physical. Due to the constant radial velocity of the primary (Latham et al. 2010), this might be close to a face-on orbit. The WDS lists another potential companion 177" away, which we also identified by blinking archival images. This candidate (HIP 19075) was however refuted based on its significantly different proper motion in Hipparcos from the corresponding value of the primary (see Table 4). The two additional WDS entries are clearly optical (see Table 6).

HD 26491: *Binary*. A comparison of *Hipparcos* and Tycho-2 proper motions shows a significant difference suggesting a companion (see § 3.2.2), which is confirmed by radial-velocity variations (Jones et al. 2002). A preliminary spectroscopic orbit exists (H. Jones 2008, private communication).

HD 32923: Single. The WDS lists 19 measurements at roughly 0".1 separation over 76 years, and Eggen (1956) even derived two preliminary visual orbits from these measures. However, Heintz & Borgman (1984) suggest that this is likely spurious and show that the observations are not consistent with orbital motion of any period. Three additional speckle observations exist since the Heintz & Borgman publication, from 1984–1987 (Tokovinin 1985; Tokovinin & Ismailov 1988; McAlister et al. 1993), but there are 17 null detections listed in the INT4 by speckle interferometry as well as by AO. This star has a stable radial velocity in Nidever et al. (2002) and Latham et al. (2010). It appears that these multiple, but sporadic, measures are spurious.

HD 35296: *Binary*. DM91 noted the primary of a 12' CPM pair as "SB", but one that was not confirmed by their work. Modern measures (Nidever et al. 2002; Latham et al. 2010) show this star to have a stable radial velocity, refuting the earlier claim.

HD 36705: Quadruple. The WDS lists two measures of this 10" pair (AB Dor AB), separated by 69 years and consistent with a bound pair. The first observation, by Rossiter (1955), measured a $\Delta m \sim 6$, explaining the lack of many more observations. Close et al. (2005) recovered this pair with AO at the VLT, and it is also seen in VRI images obtained by TJH in 2008 September at the CTIO 0.9-m telescope. While the photometric distance estimate varies from the primary's Hipparcos distance by 7σ (see Table 10), the V mag-

nitude from Rossiter (1955) is likely approximate. Given the high proper motion of the primary, the consistent measures over 79 years indicate a physical association. The 2MASS colors indicate an M-dwarf with a V magnitude estimate of about 12.0, in good agreement with the measure of Rossiter (1955) and consistent with the primary's *Hipparcos* distance. High-contrast AO efforts have split each of these components into binaries themselves. The primary was identified by *Hipparcos* as showing accelerating proper motion, indicating an unseen companion, and this is supported by the significant difference between *Hipparcos* and Tycho-2 proper motions (see § 3.2.2). The suspected companion has since been revealed by VLBI (Guirado et al. 1997), resolved by AO (Close et al. 2005), and confirmed as a physical association by photometry and spectroscopy (Close et al. 2005, 2007; Boccaletti et al. 2008, and references therein). Close et al. (2005) also split the secondary into a 0'.070 pair, which was later confirmed by Janson et al. (2007) who measured it 66.1 mas away at 238°.5.

HD 40397: Triple. The five measures in the WDS for AB between 1902 and 1932 are consistent with a bound pair. The measured $\Delta m \sim 7$ makes this a difficult target for classical techniques and out of the reach of speckle interferometry. Given that more than 70 years have passed since the latest measure, this is a good candidate for follow-up AO observations. This pair also has a wide CPM companion, NLTT 15867, which was confirmed by photometric distance estimates (see Table 10), and an additional WDS component, which is clearly optical (see Table 6).

HD 43834: Binary. Eggenberger et al. (2007) detected a companion, 3" away, three times over three years with AO at the VLT, demonstrating CPM and showing a hint of orbital motion. They also mention a linear trend in CORALIE radial velocities consistent with this companion, confirming a physical association, and estimate the companion to be M3.5-M6.5 with a mass of $0.14 \pm 0.01 M_{\odot}$.

HD 45270: Single, candidate Binary. The WDS lists three measurements spanning 43 years of a $\Delta m \sim 4$ companion separated by about 16", which are consistent with a bound pair. Curiously, no additional measurements exist. This companion was listed in the Hipparcos input catalog, but not resolved by Hipparcos. 2MASS lists a source near this candidate companion, but it is clearly not the same star because its infrared colors are more than three magnitudes fainter than the visual magnitude of 10.6 from the Hipparcos input catalog. No additional information was found on this companion and hence it is retained as a candidate.

HD 48189: *Binary*. The WDS lists 19 measurements over 105 years that are consistent with a bound pair. During this time, the separation has closed in from about 3" to about 0".3 and the position angle has changed by about 15°. Given the small projected separation of 6–60 AU, one might expect a greater change in position angle as evidence of orbital motion. The

change of only 15° indicates that the semimajor axis is larger than the observed separations, perhaps due to a high inclination. While a more robust confirmation is not available, the primary has moved about 9" during the measures, and the companion seems to be moving along with it, indicating a physical association.

HIP 36357: Triple, candidate Quadruple. The primary of this system, HD 58946, lies about 13' away, and its physical association is confirmed by matching parallax and proper motion. The primary has a closer companion, about 3" away, confirmed by greater than 11σ difference between Hipparcos and Tycho-2 proper motions (see Table 8) and five measurements in the WDS over 25 years which demonstrate CPM and orbital motion. Additionally, proper motion variations suggest an unseen companion to HIP 36357 as well, but one we could not confirm (see Table 8). Two wider WDS components are clearly optical (see Table 6).

HD 64606: Binary. For the primary of an SB1 pair, the WDS lists two measures of a $\Delta m \sim 4$ component separated by 4".9, one each from Hipparcos and Tycho. The Hipparcos solution is flagged as "poor" quality, and there is no independent confirmation of this companion. TJH observed this star using the CTIO 0.9-m telescope in 2008 September and obtained 1-second exposure images in VRI. No source was found at the expected position in those images, whereas a companion of $\Delta m \sim 4$ should easily have been seen above the background. While the SB1 pair is real, this astrometric detection is refuted.

HD 65907: Triple. LHS 1960 is a companion to this star, separated by about 60", and confirmed by photometric distance estimates (see Table 5). The WDS lists four measures of an additional companion to LHS 1960, observed 1930–1983, indicating that this component itself is a 3" CPM binary. No further evidence of companionship could be found, but given the high proper motion of the primary and the four consistent measurements by four different telescopes over 53 years, this system can be confirmed as a triple.

HD 68257: Quintuple, candidate Sextuple. The three brightest roughly solar-type components (ζ Cancri A, B, and C) are supported by over 1000 visual measurements each, corresponding to two visual orbits. Component C has been noted to have an irregular motion for most of its history and was identified as an SB1 with an orbit of 6302 ± 59 days (Griffin 2000), consistent with earlier astrometric orbits. However, earlier efforts (Heintz 1996) had noted a mass ratio for the C component binary of about 1, and with C being a G0 star, the non-detection was puzzling and attributed to the companion being a white dwarf or itself a binary. Hutchings et al. (2000) finally observed this pair (Ca,Cb) via AO observations at infrared wavelengths, designated Cb as an M2 dwarf based on its infrared colors, and argued on the basis of prior mass-ratio estimates that it itself is an unresolved binary (Cb1,Cb2). Richichi (2000) confirmed the presence of Cb via lunar occultation measures. While she

could not confirm its binary nature, her K-band photometry supported the binary M-dwarf hypothesis, for which she determined an upper-limit for projected separation of 20-30 mas. Further, Richichi reported the potential discovery of a sixth component in this system (Cb3). While seen just above her detection limit and hence retained as a candidate for this work, she nonetheless confirmed its presence by three independent data analysis methods and excluded it from being the unresolved companion Cb2 noted above due to its larger separation of at least 1.6 AU from the lunar occultations. She tentatively identified Cb3 as an M2–M4 dwarf. In addition to all this, we identified a potential wide companion, 372" away at 107°, which was later refuted (see Table 4), as were six additional WDS components, which are clearly optical (see Table 6).

HD 72760: *Binary*. This companion was suggested by a significant difference in *Hipparcos* and Tycho-2 proper motions. Recently, Metchev & Hillenbrand (2009) resolved the companion in a Palomar/Keck AO survey, confirmed companionship based on color and magnitude measurements, and estimated the companion's mass as $0.13 \,\mathrm{M}_{\odot}$.

HD 73350: Single. The WDS lists a B component 60" away and a C component about 10" from B. While the DSS images were taken over just a two-year interval, the SSS image provides a longer time baseline and helps confirm component B (HD 73351) as a field star (see Table 6). Component C is a CPM companion of B based on three consistent measures separated by over 100 years, and hence also physically unassociated with our sample star.

HD 73752: Binary. The CNS lists the primary of the 1".3 visual binary as "SB" and notes that there are suspected perturbations in its proper motion. The reference detailing the perturbations (Hirst 1943) presents a 35-year inner orbit, which is noted as very preliminary with several different orbits equally permissible. The author also states that systematic effects alone may explain the residuals. His 214-year outer orbit was later revised to 145 years by Heintz (1968), who also points out that the observed range of radial velocities could be ascribed to scatter. Adopting a parallax of 0".058, he derived a mass-sum of 1.1 M_{\odot} , and noted that at least one component must be over-luminous. If we adopt the HIP parallax of 50.2 mas, we get a mass-sum of 1.9 M_{\odot} , so the components are likely not over-luminous. Radial-velocity catalogs (Abt & Biggs 1972; Gontcharov 2006) list velocities in the range 40–48 km s⁻¹, but the differences could be due to zero-point offsets between observers. The early claim of a possible companion is not supported by subsequent observations, which in fact question it. While the visual binary is real, the third component is refuted. An additional wide component listed in the WDS is clearly optical (see Table 6).

HD 75767: Quadruple. Tokovinin et al. (2006) reported the discovery of a wide Δm =4.3 companion to a 10.3-day SB1 binary with NACO AO and confirmed CPM using a partial resolution in 2MASS images. This companion was independently discovered

by Fuhrmann et al. (2005), who obtained two observations four years apart, demonstrating CPM, and confirmed companionship by showing consistent radial velocity with the primary. Their spectra also enabled them to identify the companion itself as a double-lined binary, as evidenced by its H-alpha emission and near-infrared absorption lines appearing as pairs with an offset of about 21 km s⁻¹. Using composite-spectrum analysis, they derived spectral types of M3 and M4. Blinking archival images revealed a possible fifth companion 385" away, and its photometric distance estimate matches the primary's *Hipparcos* value within 2σ . However, the Lépine & Shara (2005) proper motions of the two stars are significantly different, indicating that this might be a comoving star perhaps born out of the same cloud as HD 75767, but one that is not gravitationally bound to it.

HD 79096: Quadruple. Wilson et al. (2001) discovered an L8V companion (Gl 337C) 43" from the SB2VB pair from 2MASS images. The two images, separated by 2.5 years, demonstrated CPM. They also showed that the magnitudes are consistent with the primary's distance to within 1σ , confirming companionship. Burgasser et al. (2005) later resolved Gl 337C as a nearly equal-magnitude binary separated by 0".53 \pm 0".03 at 291° \pm 8° using Lick natural guide star AO. Companionship was confirmed based on proximity and CPM, which was demonstrated by the absence of a source in 2MASS images at the expected position of a background star. Three other components listed in the WDS are clearly optical (see Table 6).

HD 86728: Binary, candidate Triple. Gizis et al. (2000) identified a wide CPM companion from 2MASS and confirmed it with a spectral type classification of M6.5. However, based on it being over-luminous ($M_K = 8.19$ using 2MASS magnitudes and Hipparcos parallax versus 9.60 for its spectral type) and having high activity (emission observed twice), they argued that it is an unresolved equal-mass binary, or even possibly a triple. We could not find any follow-up work confirming or refuting this claim, so while this system is confirmed as a binary, we retain the third component as a candidate. Additionally, the Dwarf Archives lists a brown dwarf about 25' away from the primary, but its photometric distance estimate suggests a distant field object.

HD 90839: *Binary*, candidate *Triple*. The CNS lists the primary of a wide CPM pair as "SB?" and the secondary (HD 237903, GJ 394) as "RV-Var". The primary is a constant velocity star (see Table 12), refuting the CNS claim, but the modern surveys did not observe the secondary. DM91 listed this companion with a constant velocity of 8.24–8.62 km s⁻¹ over 700 days. Heintz (1981) listed velocities of 7.7–8.4 km s⁻¹ over four days but noted that the coverage was too weak to definitively show velocity variations. He also noted that the spectrum had emission features. Wilson (1967) listed a velocity of 7.8 km s⁻¹ over three plates with a range of 7.7 km s⁻¹ and standard deviation of 3.1 km s⁻¹. Radial-velocity

catalogs (Abt & Biggs 1972; Duflot et al. 1995) list values that range over many km s⁻¹, but this could be due to zero-point differences between observers, and these catalogs do not note any variation. While the wide binary is confirmed based on matching parallax and proper motion and the primary's SB claim is refuted, the possible radial-velocity variation of the secondary is inconclusive and hence retained as a candidate. An additional WDS component is clearly optical (see Table 6).

HD 97334: Triple. Kirkpatrick et al. (2001) discovered an L4.5V CPM companion (Gl 417B) 90" away at 245° from the primary using 2MASS images and confirmed a physical association by demonstrating CPM and consistent parallaxes. Bouy et al. (2003) later resolved this brown dwarf into a binary (0".070 \pm 0".0028 at 79°.6 \pm 1°.2) using HST WFPC2. While companionship of this pair has not been established conclusively, proximity argues for a physical association. Three additional WDS components are clearly optical (see Table 6).

HD 98230: Quadruple. ξ UMa is a quadruple system composed of a 60-year visual binary, the primary of which is a SB1VB and the secondary is an SB1. Mason et al. (1995) reported a possible fifth companion detected via speckle interferometry near the secondary. While the single detection reported is quite convincing, this companion has never again been seen, despite multiple attempts. Our efforts with CHARA, while limited to $\Delta K \lesssim 2.5$, also failed to resolve any additional components. Given only one measure and about a dozen null results with the same technique, this new companion is likely a chance alignment of an unrelated star. An additional wide component listed in the WDS is clearly optical (see Table 6).

HD 100180: Binary, candidate Triple. The primary of the 15" CPM binary (see Table 5) has two speckle interferometry measurements of a close companion in the WDS, observed 0".035 away at 6".8 in 2001 and 0".122 at 355".8 in 2004. One of the two attempts by BDM and DR at the KPNO 4-m telescope in 2008 June resulted in an "uncertain" measure of 0".218 at 14".6. Given the 0".378 yr⁻¹ proper motion of the primary, these measures are consistent with a bound pair, but further observations are warranted to obtain a definitive confirmation, especially given the constant radial velocity reported by Nidever et al. (2002).

HD 100623: Binary. The WDS lists only a single measure of this large Δm companion discovered by Luyten in 1960. While the proximity and large magnitude difference make follow-up observations difficult, Henry et al. (2002) obtained spectra of this 15th magnitude companion and showed that it is a DC or DQ white-dwarf, not an M-dwarf as reported in the CNS. The second observation confirms CPM, and the spectral type and photometry are consistent with a physical association.

HD 102365: Binary. The companion, discovered by Luyten in 1960, is LHS 313 and

has a proper motion that matches the primary's 1".6 yr⁻¹. Hawley et al. (1996) identified the companion as M4V, which was recovered by 2MASS at a similar position angle and separation as Luyten's observation. Its infrared colors are consistent with an M4 dwarf at the primary's distance.

HD 103095: Single. The CNS and DM91 listed a companion with separation 2" at 175°. DM91 noted that the companion was flaring with magnitudes of 8.5–12 and also mentioned that it was normally not seen. The INT4 lists four null measurements with speckle interferometry and there are no radial-velocity variations. Three attempts by BDM and DR in 2008 June at the KPNO 4-m telescope failed to identify a companion. Recently, Schaefer et al. (2000) have shown that the brightness enhancements observed are likely due to superflares on the stellar surface rather than due to a companion.

HD 109358: Single. The WDS lists a single speckle measure of a companion 0".1 away (Bonneau & Foy 1980), but the INT4 has over 20 null speckle detections. BDM and DR failed to resolve the suspected companion in 2008 June at the KPNO 4-m telescope. Given the mention of telescope artifacts as being responsible for some detections by this observer (da Silva & Foy 1987), we side with the many null detections, including one by the same observer. Additionally, the CNS listed this star as "SB" and Abt & Levy (1976) presented a preliminary orbital solution. However, those claims were subsequently refuted (Morbey & Griffin 1987). The wide AB pair in the WDS is clearly optical, as seen on blinking the archival images (see Table 6).

HD 111312: Binary, candidate Triple. This is a 2.7-year SB2. The WDS lists a single speckle measure with a separation of 0'.089 at 90.6 in 2001 and the pair was seen again in 2006 with a separation of 0'.050 at 44.6 by BDM. These measurements are consistent with the spectroscopic binary and more observations are needed to develop a visual orbit. The WDS lists an additional companion, 2'.7 away with $\Delta m \sim 4$ based on Hipparcos and Tycho measures. The Hipparcos solution is flagged as "poor" quality, and there is no independent confirmation of this companion. Its orbital period, if real, would be too long to affect the velocities obtained over some 7 years. With no conclusive evidence to confirm or refute this companion, it is retained as a candidate requiring further observations.

HD 112758: Triple. This is a triple system with an inner SB1 pair and a wider visual component which was first resolved by van den Bos in 1945 and then again in 1960 with $\Delta m \sim 5$. McAlister et al. (1987) recovered this visual companion in 1983, and the three observations show evidence of orbital motion. The McAlister et al. measurement with speckle interferometry implies $\Delta m \lesssim 3$, suggesting that the companion may be variable. BDM and DR attempted to resolve this companion at the KPNO 4-m telescope in 2008 June, but could not see it, perhaps because of the large magnitude difference.

HD 113449: Binary. Hipparcos presents a photocentric orbit for this star with a period of about 231 days. Moore & Paddock (1950) noted this star as a radial-velocity variable, Gaidos et al. (2000) mentioned that the velocity changed by 20 km s⁻¹ over 10 months, and variations are also seen in the measurements reported in Latham et al. (2010). However, no definitive orbit exists. The companion was resolved at the Palomar 200-inch telescope with aperture masking in 2007 January, 35.65 ± 0.6 mas away at $225^{\circ}.2 \pm 0^{\circ}.5$ with $\Delta H \sim 1.6$, and confirmed at the Keck telescope more than a year later (M. Ireland 2008, private communication). With consistent astrometric and spectroscopic evidence, this is a bound pair.

HD 120136: Binary, one planet. τ Boo hosts a 4.13 M_J minimum-mass planet in a 3-day orbit. Additionally, 56 observations over 170 years in the WDS confirm a stellar companion based on CPM and orbital motion, which has a preliminary orbital solution (see Table 11). Wright et al. (2007) and references therein mention a longterm drift in radial velocity consistent with this visual companion.

HD 120780: Triple. The WDS lists two measures of a 6" pair 51 years apart and consistent with a bound system, but follow-up observations have been difficult due to a magnitude difference of ~ 5.5 . We obtained I-band images in 2006 July and 2007 June at the CTIO 0.9-m telescope. The companion was seen at both epochs about 5".6 away at 89° with $\Delta I \sim 3.3$. These three observations demonstrate CPM with a fast-moving primary (0".6 yr⁻¹), and, in fact, hint at orbital motion, confirming companionship. Additionally, Hipparcos identifies this star as an accelerating proper-motion binary, and the Tycho-2 proper motion differs from the Hipparcos value by a 19 σ significance (see Table 8). While the Tycho-2 proper motion, averaged over about 100 years, is no doubt affected by the wide pair mentioned above, whose orbital period could be about 1000 years, the Hipparcos observations are over some three years and indicate a closer companion.

HD 124850: Single, candidate Binary. The ORB6 catalog lists a photocentric orbit for this star with a period of 55 years and an inclination of 60°. The corresponding preliminary orbit was recently presented by Gontcharov & Kiyaeva (2010) by combining Hipparcos data with astrometric ground-based observational catalogs, but we do not find the motion convincing enough to confirm the companion. This star was not included in the Nidever et al. (2002) or Latham et al. (2010) survey, and radial-velocity catalogs (Abt & Biggs 1972; Duflot et al. 1995; de Medeiros & Mayor 1999; Gontcharov 2006) do not indicate variations. BDM and DR could not resolve any companion via speckle interferometry on the KPNO 4-m telescope in 2008 June. With inconclusive evidence to confirm or refute this companion, it is retained as a candidate.

HD 125276: Single, candidate Binary. The Hipparcos and Tycho-2 proper motions

differ by greater than a 3σ significance, suggesting an unseen companion (see Table 8). These proper motion variations could be due to a WDS and CNS companion, separated by 3"–8" over four measures between 1891 and 1936. Some of these measures indicate a $\Delta m \sim 8$, which might explain the several non-detections also included in the WDS. An attempt by BDM and DR at the KPNO 4-m telescope in 2008 June could not detect this companion. While the pair is too wide and too high in contrast for detection via speckle, the finder TV, sensitive to faint companions, did not reveal any source at the expected position. Without conclusive evidence to confirm or refute this companion, it is retained as a candidate. An additional WDS companion is clearly a background star as seen by blinking archival images (see Table 6).

HD 125455: *Binary*. This companion was discovered by Kuiper in 1937 and has measurements in 1960 and 1987 that are consistent with a bound system. The companion is LHS 2895 with a proper motion that matches the primary's, and its 2MASS colors indicate a late M-dwarf at approximately the primary's distance.

HD 128620: Triple. This is the closest known star system, α Centauri, which is composed of an SB2VB pair and a wide companion, Proxima Centauri, about 2° away. While the angular separation to Proxima is extreme for bound systems, it translates to a linear projected separation of 10000 AU, which is well within the limits of gravitationally bound pairs. Wertheimer & Laughlin (2006) used kinematic and radial-velocity data to show that Proxima Centauri is bound to α Centauri. A possible new substellar companion to Proxima Centauri was reported by Schultz et al. (1998) 0'.34 away using the HST FOS as a coronagraphic camera. In a follow-up effort, Golimowski & Schroeder (1998) used HST WFPC2 to show that the FOS feature seen was likely an instrumental effect and exclude any stellar or substellar companion within 0'.09-0'.85 of Proxima Centauri.

HD 130948: Triple. Potter et al. (2002) discovered a pair of brown dwarf companions using AO on the Gemini North 8-m telescope. They demonstrated CPM with observations over seven months and confirmed companionship based on their infrared colors, spectral-type of $dL2 \pm 2$ and a consistent age with the primary of less than 0.8 Gyr derived by comparing their position on an HR diagram with theoretical models. They also noted that the relative youth is consistent with the high X-ray activity, Li abundance, and fast rotation. The Dwarf Archives lists an additional brown dwarf 523" away from the primary, but its photometric distance estimate suggests a distant field object. An additional CNS claim of an SB companion was refuted by modern surveys (see Table 12).

HD 135204: *Binary*. A companion, 0".1 away, is listed in the WDS and CNS and confirmed by the 17 measurements in the WDS over 82 years which not only demonstrate CPM, but also orbital motion.

- **HD 137107**: *Triple*. Kirkpatrick et al. (2001) discovered a wide L8V companion (Gl 584C) to the SB2VB binary using 2MASS images and confirmed the physical association with additional measures and spectroscopy. Two additional WDS components are clearly optical (see Table 6).
- HD 137763: Quadruple. The primary of a 52" CPM binary is itself SB2, and also has a wide companion about 20' away that was first mentioned by CNS and confirmed by a spectral-type identification of M4.5 and a distance estimate of 21.6 ± 1.9 pc (Reid et al. 1995). Another wide WDS component is clearly optical (see Table 6).
- HD 140901: Binary. The WDS lists seven measures for this companion from 1897 to 1960 which are consistent with a bound system. We obtained VRI images at the CTIO 0.9-m telescope in 2006 July and 2007 July, which reveal the companion at the expected position, confirming CPM. The magnitude difference of over six makes photometry difficult, but given the large matching proper motion and proximity, this companion can be confirmed as physical. An additional WDS component is clearly optical, as seen when blinking the archival images (see Table 6).
- **HD 141272**: *Binary*. The WDS lists four micrometer observations of this pair over 56 years that are consistent with a bound system. Eisenbeiss et al. (2007) confirm companionship using photometry and spectroscopy, and derive an estimated mass for the dM3 \pm 0.5 companion of $0.26^{+0.07}_{-0.06}$ M_{\odot}.
- HD 143761: Single planet-host or binary with no known planets. ρ CrB definitely has a companion, but it is not clear whether it is planetary or stellar in nature. Hipparcos identified a photocentric orbit with a period of 78 days, exactly twice that of the planetary companion reported by Noyes et al. (1997). Gatewood et al. (2001) used Hipparcos and ground-based observations to conclude that the photocentric orbit is of the same period as the planet, and in fact the "planet" is an M-dwarf companion with a mass estimate of 0.14 M_{\odot} in a nearly face-on orbit. Bender et al. (2005) failed to identify such a companion using high-resolution infrared spectroscopy, and placed an upper limit on the companion's mass of 0.11–0.15 M_{\odot} . Baines et al. (2008) attempted to resolve this question with LBOI observations at the CHARA Array, and could not settle the issue once again. While interferometric visibilities did not perfectly fit a single-star solution, additional data are required for a definitive conclusion. This system has a stellar or planetary companion, but not both. Further observations are warranted. A WDS component is clearly optical (see Table 6).
- HD 144284: Binary. Mazeh et al. (2002) presented a 3-day SB2 orbit for this star using infrared spectroscopy to measure the faint companion, deriving a mass ratio of 0.380 ± 0.013 . Mayor & Mazeh (1987) had identified this system as a possible triple based on a 1.7

km s⁻¹ variation in the velocity semiamplitude between their solution and that of Luyten (1936). While the velocity semiamplitude does seem to vary for the different orbital solutions presented for this pair (Luyten 1936; Mazeh et al. 2002, DM91) and the Latham et al. (2010) SB1 orbital solution has residuals of up to 2 km s⁻¹ on each side, there is no obvious periodic pattern or longterm drift over the 4.8 years of velocity coverage. The most recent velocity measure of this star in Latham et al. (2010) is from 1990, so additional observations are warranted.

HD 144579: Binary. The proper motion of the primary is $0.574 \,\mathrm{yr^{-1}}$ and of the CPM candidate is $0.550 \,\mathrm{yr^{-1}}$ from the LSPM. The companion's distance estimate has a large uncertainty and differs from the primary's Hipparcos value by 1.5σ (see Table 5). Given the proximity of these two stars in the sky, the very large and similar proper motions, and similar distances, this appears to be a physical companion, as it has been previously recognized (DM91,CNS). The differences in the proper motions might indicate that the companion or the primary has a close unresolved companion and warrants further observations.

HD 145958: Binary, candidate Triple. The primary of a 4" visual binary has two additional possible companions, one of which was refuted by this effort and the other remains a candidate. The WDS lists a nearby companion, 0".2 away, detected by HAM in 1983. The INT4 catalog lists this as a weak detection and possibly spurious, and includes a null detection using the same technique. BDM and DR failed to resolve a companion at the KPNO 4-m telescope in 2008 June. Nidever et al. (2002) identifies this as a constant velocity star. Evidence seems to be mounting against this candidate companion, which is considered refuted for this work. Separately, the Dwarf Archives includes a T6 object about 27' away from this star. Looper et al. (2007) discovered this T dwarf in the 2MASS survey, obtained spectra, typing it as T6, and estimated its proper motion and distance, but did not suggest an association with HD 145958. Their proper motion and distance estimates are similar to the primary's corresponding values from van Leeuwen (2007b). While the projected linear separation is very large at about 40 000 AU, this could be a loosely bound companion to HD 145958, and is retained as a candidate. An additional wide component listed in the WDS is clearly optical (see Table 6).

HD 146361: Quintuple. See Raghavan et al. (2009) for a comprehensive treatment of all components of this system.

HD 147776: Binary, candidate Triple. The WDS lists three candidate companions, but the details actually correspond to four stars. The $\Delta m \sim 4$ component 103" away at 281° is clearly a field star, as seen by blinking the archival images (see Table 6). Three additional companions were reported by Sinachopoulos (1988) – 6".4 separation at 173° with $\Delta m \sim 3$, 9".7 separation at 14°, and 71".9 separation at 28°. The latter two components do

not have differential-magnitude measurements. Sinachopoulos measured these pairs using a 1.5-m telescope by combining 4–16 exposures of a few seconds each. The wide companion 72'' away should have been seen in the DSS images, but no stellar source was seen at the expected position. The closest star to this position in the 1995 DSS image is 83'' away at 15° and is clearly a field star. The other two sources seen by them would be buried in the saturation around the primary in the DSS images, so we obtained VRI frames in 2008 May and August at the CTIO 0.9-m telescope. The images clearly show a faint companion about 9'' away at 19° . This is likely the 9''.7 companion seen by Sinachopoulos (1988), exhibiting CPM, and given the proximity, is likely physical. The closest source seen by Sinachopoulos is not detected in the CTIO images and remains a candidate. Additionally, the CNS lists a companion for this star 3'' away at 281° in 1909. This is likely the same as the component measured by Burnham as listed in the WDS, which was seen 103'' away at 281° in 1909 and as discussed above, is clearly optical.

HD 148704: Binary. This is a 32-day SB2 binary for which Hipparcos and Tycho identified another companion 4".1 away at 221°. Our CTIO 0.9-m images obtained in 2008 October do not reveal any companion at the expected position, while a $\Delta m \sim 3$ companion as indicated by Hipparcos should have been seen above the tail of the primary's PSF. However, given the proper motion of the primary, a field star would have moved closer and possibly could be buried within the primary's PSF. Gray et al. (2006) list the spectral type of the companion as G9V and its coordinates imply a separation of 2".4 at 55°, the exact position where a field star would be fifteen years since the Hipparcos measure. The Gray et al. spectral type, along with the Tycho-2 V=10.5 imply a significantly larger distance to this star compared to the primary, enabling us to refute this candidate.

HD 149806: Binary. This companion was first reported by Rossiter (1955) 5".9 away at 22° and has two additional measurements in the WDS over the next 54 years, which are consistent with a bound system. While the photometric distance estimate is not a good match (see Table 10), the R magnitude listed is likely approximate. Given the moderate proper motion of the primary, the consistent measures over 54 years indicate a physical association. The 2MASS colors indicate an M-dwarf with a V magnitude estimate of about 12, in fair agreement with the measure of Rossiter (1955). BDM and DR attempted to observe this companion at the KPNO 4-m telescope in 2008 June. While the separation and Δ m are too large to be resolved using speckle, the finder image at the telescope showed a source at the expected position with a Δ m similar to those of prior observations.

HD 153557: Triple. The WDS lists 17 measurements over 95 years with separations of 1".9–4".9, which are consistent with a bound system, and given the 0".3 yr⁻¹ proper motion of the primary, imply a physical association. This pair also has a wider companion, HD

153525, about 2' away, which is confirmed by matching proper motion and parallax.

HD 165341: Binary. CNS lists component A of an 88-year SB2VB as a possible binary with a period of about 17 years, but this is inconsistent with modern measurements (Latham et al. 2010). Heintz (1988) presented a revised orbit of the SB2 and excluded the possibility of any additional companions with periods below 55 years, stating that the once suspected velocity variation of A is disallowed by the more precise recent measurements. The WDS lists 15 more components for this star, all of which are clearly optical (see Table 6).

HD 165908: Binary, candidate Triple. This is a 56-year VBO. Additionally, the WDS lists one speckle measure with a separation of 0″.228 at 50°.2 from Scardia et al. (2008), who list this new discovery as "faint". They also resolved the known VB companion about 1″ away, and noted it as "very faint". In the absence of additional measures that can help confirm CPM, this close companion is retained as a candidate. Five other components listed in the WDS are clearly optical (see Table 6).

HD 178428: *Binary*. The primary of a 22-day SB1 has a single 1987 measure listed in the WDS with a separation of 0".2. However, the INT4 lists six null results and attempts by BDM and DR at the KPNO 4-m telescope in 2008 June once again failed to reveal any visual companion. A wider component listed in the WDS is clearly optical (see Table 6).

HD 186408: Triple, one planet. This close companion to 16 Cyg A was first resolved 3" away by Turner et al. (2001) with AO at the Mount Wilson Observatory and confirmed by Patience et al. (2002), who demonstrated CPM and measured infrared magnitudes consistent with the primary's distance. Four velocity measures over 25 years show a slow drift (Latham et al. 2010), consistent with this companion. This system also has a wide companion, 16 Cyg B, which is a planet host. The WDS lists an additional source, 16" away from 16 Cyg B, but Patience et al. (2002) measured the infrared magnitudes of this candidate, demonstrating that it is a background star. This is the only planetary system in this study with more than two stars.

HD 190067: *Binary*. This companion was discovered by Turner et al. (2001) with AO at the Mount Wilson Observatory, but the single-epoch measure with no color information does not allow confirmation of a physical association. BDM and DR observed this star at the KPNO 4-m telescope in 2008 June. While the separation and Δm are too large for speckle observations, a stellar source was seen at the expected position, confirming CPM, and given the proximity to a large proper motion (0".6 yr⁻¹) primary, the physical association of this companion is very likely.

HD 190406: Binary. Liu et al. (2002) discovered a faint companion 0.8 from this star with AO at the Gemini North and Keck II telescopes and confirmed a physical association

by demonstrating CPM, consistent spectroscopy, and longterm radial-velocity trend. They determined a spectral type for the companion of L4.5 \pm 1.5, estimated its mass to be 55–78 $\rm M_{J}$ and age as 1–3 Gyr. This is the first substellar object imaged so close to a solar-type star and indicates that brown dwarfs can exist in extrasolar systems at positions comparable to the gas giants in our solar system. Eight additional WDS components are clearly optical (see Table 6).

HD 191499: Binary. The WDS lists 51 measurements of this companion between 1782 and 2003, which are consistent with a bound system. There is little evidence of orbital motion during the roughly 200 years of observations, possibly because the companion is near apastron in an eccentric orbit or the orbit is highly inclined. Hipparcos and Tycho-2 proper motions differ by 5.6σ , suggesting some orbital motion (see Table 8). The photometric distance estimate is not a very good match (see Table 10), but photometry would be tricky for this close pair as indicated by the large uncertainties of the 2MASS magnitudes. Given the evidence of consistent WDS measures, proper motion differences between Hipparcos and Tycho-2, and similar distance estimates, this pair likely has a physical association. An additional wide WDS component is clearly optical (see Table 6).

HD 195564: *Binary*. The WDS lists 16 measures over 110 years that are consistent with a bound pair. While proximity to the primary and $\Delta m \sim 5$ (from WDS) make photometry of the companion difficult, the proximity and CPM implied by the measures argue for a physical association. An additional wide WDS component is clearly optical (see Table 6).

HD 200525: Triple. The CNS and Hipparcos identified the closer pair as a possible binary (stochastic solution) and Goldin & Makarov (2006) derived a photocentric orbit using the Hipparcos intermediate astrometry data. Their orbital solutions using data from the two independent *Hipparcos* reduction methods, Fundamental Astronomy by Space Techniques (FAST) and the Northern Data Analysis Consortium (NDAC), are consistent. They tested their orbit determination method satisfactorily against 235 known binaries and derived a better than 99% confidence level based on simulations. The WDS lists four measurements from 1898 to 1932, during which time the separation reduced from about 1" to 0".16. The respective position angles of the measurements are consistent with a high-inclination orbit. Given these independent measurements leading to similar results, we conclude that while the orbital elements may be preliminary, this companion is physically bound. For the wider component, the WDS has five measures over 88 years that are also consistent with a bound pair. The companion is NLTT 50542 with a proper motion that matches the primary's, and the notes in the catalog recognize this component as gravitationally bound. 2MASS magnitudes have a large error, but are consistent with a mid-K dwarf companion at approximately the primary's distance.

HD 200560: Binary. The WDS has seven measures of a companion with separations 2".8–3".3 over 28 years, suggesting a bound system. This is especially significant given the primary's large proper motion of $0".4\,\mathrm{yr}^{-1}$. The companion, GJ 816.1B, is recognized in the CNS as bound, although no conclusive evidence is presented. The 2MASS photometry has large errors, and hence is not very useful. The Hipparcos and Tycho-2 proper motions are different by about 8σ , providing evidence of orbital motion and lending credibility to a physical association. The WDS lists this pair as the CD component of the B3V binary HD 200595 AB, but there is clearly no physical association between HD 200560 and HD 200595 as seen by blinking archival images. An additional wide WDS component is also clearly optical (see Table 6).

HD 202275: Binary. This is a 5.7-year SB2VB. Tokovinin et al. (2006) gives an additional orbit with a period of 5.7 days, which is in fact the former orbit listed with an incorrect unit (A. Tokovinin 2007, private communication). This system is a binary with mass estimates of 1.2 M_{\odot} and 1.1 M_{\odot} by Pourbaix (2000). An additional wide WDS component is clearly optical (see Table 6).

HD 206860: Binary. Luhman et al. (2007) reported the discovery of a T2.5 \pm 0.5 companion using Spitzer IRAC images and confirmed CPM using 2MASS images. The infrared colors are consistent with the distance to the primary, confirming companionship. By comparing the luminosity with evolutionary tracks, they estimate the companion's mass as $0.021 \pm 0.009 \,\mathrm{M}_{\odot}$ and age as $0.3 \pm 0.2 \,\mathrm{Gyr}$. An additional, potentially wide companion was identified 591" away by blinking archival images but refuted based on its photometric distance estimate (see Table 5).

HD 215648: *Binary*. A companion, 11" away, is listed in the WDS and CNS and confirmed by the 23 measurements in the WDS over 179 years which not only demonstrate CPM, but also orbital motion. A wider WDS component is clearly optical (see Table 6).

HD 217107: Single star with two planets or a binary with one planet. The WDS lists two measurements, fifteen years apart, of a companion 0".3 away from this star, which also hosts two planets. These speckle interferometry detections could however not be confirmed by the same technique on at least three other occasions, indicating that this pair might have a large or varying Δ m. Interestingly, the farther planet is one of the most widely separated planets reported, at least 5 AU from the star. Vogt et al. (2005) present orbital solutions with periods of 7–9 years, but mention that it could be three times larger. Wright et al. (2009) present an updated orbit with $P = 11.5 \pm 0.5$ years and $a = 5.27 \pm 0.36$ AU. At the 20-pc distance to the star, these separations are consistent with the speckle observations. Given the inconsistent measures, if we assume a ΔV near the speckle limit of about 3, the companion to the G8 IV-V primary (Gray et al. 2003) could be an early M-dwarf. The

mass-sum of such a binary is consistent with the Wright et al. (2009) orbital elements. Vogt et al. (2005) note that an AO image obtained with the Keck telescope did not reveal any stars beyond 0".1 from the primary, and Chauvin et al. (2006) confirm this null result with VLT and CFHT AO observations. The M-dwarf companion would also imply a significantly larger velocity semi-amplitude for the primary, but that possibility is not excluded by the orbital plot in Wright et al. (2009). While it appears that this "planetary" companion could be a star, further observations are warranted.

HD 220140: Triple. The WDS has five measurements over 100 years for the closer visual companion at separations of about 10" that are consistent with a bound pair. The companion is NLTT 56532 with a proper motion matching that of the primary and 2MASS colors consistent with an early M-dwarf at approximately the primary's distance. The wide CPM companion, 16' away, was first identified by Lépine & Shara (2005) and confirmed by Makarov et al. (2007) who show that the companion's trigonometric parallax is consistent with the primary's Hipparcos value. Their BVRI photometry along with 2MASS near-infrared magnitudes show that this star is over-luminous in the K_s band, confirming its suspected pre-main-sequence status, and enabling an age estimate of 12–20 Myr.

5. Analysis & Discussion

5.1. Survey Sensitivities and Completeness

Table 15 enumerates the coverage of the sample by various systematic searches and Figure 11 identifies the detection limits of the methods. The shortest-period systems are comprehensively covered by the radial-velocity surveys. The CCPS effort is sensitive down to planetary masses for periods of some 10 years and the Latham et al. (2010) survey is capable of identifying $K_1 \geq 1 \text{ km s}^{-1}$ with periods below 30 years¹⁰. The CHARA SFP detection space covers $\Delta K \leq 2.5$ for separations of 10–80 mas. These, and the following angular separations are converted into linear separations assuming a distance of 20 pc (the median distance of our sample) and translated into periods assuming a mass-sum of 1.5 M_{\odot} . Speckle interferometry, typically done on 4-m class telescopes, is sensitive to $\Delta V \leq 3$ and separations 30 mas to 2". AO and other visual searches for high-contrast binaries are done using telescopes of up to 10-m apertures and can detect $\Delta V \leq 2$ at 50 mas separation, improving to about 10 mag for 2"–10". While AO observations are not part of our systematic

 $^{^{10}}$ We assume e = 0.25, $i = 90^{\circ}$, and mass-sum = 1.5 M_☉ (the average value for all our pairs) in generating the curves plotted, which are truncated at the period limits mentioned above for the respective surveys.

efforts, their results from other searches (e.g., Turner et al. 2001; Liu et al. 2002; Luhman & Jayawardhana 2002; Potter et al. 2002; Roberts et al. 2005; Chauvin et al. 2006; Lagrange et al. 2006; Metchev & Hillenbrand 2009) are nevertheless included in our multiplicity results. Unfortunately, many of these studies only report companion detections, leaving the list of targets searched, and the corresponding null results, unpublished. Nevertheless, we were able to identify the results of AO searches around 82 of our sample stars from studies that published their target lists (Luhman & Jayawardhana 2002; Chauvin et al. 2006; Metchev & Hillenbrand 2009), or for which we could obtain unpublished null results (Turner et al. 2001), and their results are included in the last row of Table 15. Finally, the widest companions are detected by blinking archival images, capable of identifying roughly equal-magnitude binaries as close as 5" as twin diffraction spikes. At wider separations beyond 15"-30" (depending on the particular image), this technique can reveal companions with $R \leq 17$, i.e., all but the lowest mass stars. Figure 11 also shows the overlap of the actual pairs from our results with estimates of masses and periods as described in §5.3.1 and §5.3.3, respectively, highlighting the thorough coverage by the various techniques and validating the detection-limit estimates. This, along with the robust overlap of the detection space by multiple complementary techniques, suggests that our tally of companions is comprehensive and nearly complete. Next, we estimate the number of stellar and sub-stellar companions missed by this survey.

As seen in Column 4 of Table 15, our efforts added only a few new companions, underscoring the collective comprehensiveness of prior efforts. Moreover, the techniques employed are capable of detecting stellar companions of nearly all masses. We can thus estimate the number of stellar companions missed by simply extrapolating the number of new companions found by each technique (Column 4 of the table) to the full sample, accounting for their incomplete coverage. So, for example, the four new CPM companions found around 409 stars imply that one undetected companion might exist in the 45 stars not searched by this technique. Similarly, the radial-velocity techniques listed in the first two rows of Table 15 imply two spectroscopic companions missing from our tally. While these spectroscopic techniques are not sensitive to companions in nearly face-on orbits, the CCPS survey, in particular, should see a velocity trend from stellar companions in all but perfectly face-on orbits, which are highly improbable. Moreover, the dearth of short-period systems in general, and low-mass ones in particular, as seen in Figure 11, suggests that we are not missing many such companions. At longer periods, companions in face-on orbits should be detected by the visual techniques. The two new companions reported by AO searches (last row of Table 15) suggest that nine high-contrast companions might exist near the 371 stars not surveyed by these efforts. However, given that only six of at least 22 AO companions in our results were discovered by the references included in Table 15, most of these companions are expected to be counted in our results, and any further missing AO companions are expected to be covered by the estimates performed below.

Considering missing low-mass companions, Figure 11 identifies two possible gaps in the coverage of the parameter space for potential companions: the low-mass region between RV and AO and then again between AO and CPM. While these gaps suggest a few missing companions, they are nevertheless populated by some actual detections because of other techniques such as *Hipparcos* double stars, whose companions are investigated and included in our tally, but whose detection regions are not included in the plot. The dearth of low-mass companions was first established by radial-velocity surveys for $P \lesssim 5$ years, and extended to all separations by high-contrast visual searches (e.g., Gizis et al. 2001; Kirkpatrick et al. 2001; Lowrance et al. 2002; Burgasser et al. 2003; McCarthy & Zuckerman 2004; Neuhäuser & Guenther 2004; Grether & Lineweaver 2006; Kraus et al. 2006; Allen et al. 2007; Lépine & Bongiorno 2007; Looper et al. 2007; Metchev & Hillenbrand 2009). While many of these searches specifically targeted brown dwarf companions, they were more sensitive to, and often reported, the discovery of low-mass stellar companions as well. Additionally, a specific search for low-mass companions out to separations of 10000 AU around solar-type stars within 10 pc using 2MASS infrared images resulted in no new detections (D. Looper 2009, private communication). Consistent with these findings, our results include only only eight brown dwarf companions, found by high-resolution techniques such as coronagraphy, AO, and space-based observations (e.g. Potter et al. 2002; Bouy et al. 2003; Burgasser et al. 2005; Luhman et al. 2007). Moreover, while our CPM efforts using archival images are not sensitive to brown dwarfs, widely-separated substellar companions to nearby stars have effectively been identified using 2MASS infrared images (Kirkpatrick et al. 2001; Lowrance et al. 2002; Looper et al. 2007). While these efforts readily present new detections, null results often remain unpublished. Nevertheless, these searches using 2MASS infrared images have largely yielded null detections (D. Kirkpatrick 2009, private communication), suggesting a real shortage of low-mass companions. As noted above, the CCPS survey is specifically suited to identifying relatively long-period low-mass companions, or those in nearly faceon orbits, as low-amplitude temporal drifts in the radial-velocity measurements of the host stars. Our search of the CCPS data revealed 21 stars which have such drifts with RMS deviation from a uniform velocity of less than 0.1 km s⁻¹ over some 10 years. Fourteen of these have known stellar companions, many of which are close enough to cause the radialvelocity variations seen. The remaining seven stars do not have any known companions, implying undetected stellar or sub-stellar companions to presumed single stars. While some of these could turn out to be planets in long-period orbits, they could all be new stellar or brown dwarf companions. Added to the one missing CPM companion and two missing spectroscopic companions discussed above, we estimate that our survey might be missing about 10 companions to presumed single stars.

The extrapolation of new companions used above to estimate the number of companions missed by our survey is valid only if the stars not observed by a particular technique have, in general, been historically covered in equal measure as those observed by that technique. If the stars not surveyed by a given technique fall into a set of generally neglected stars, the approach used above would underestimate missing companions. We address this assumption next for the Latham et al. (2010) and CPM surveys, as these are the primary techniques yielding new discoveries from observations of a subset of the overall sample. The speckle and Hipparcos searches exhaustively covered the sample, and hence no extrapolation is necessary. We exclude the CCPS survey from this analysis because of the inherent bias in its sample selection, as it avoids known close binaries. The percentage of single stars among the 344 primaries observed by Latham et al. (2010) is $55\% \pm 4\%$, compared to $59\% \pm 7\%$ for the 109 stars not observed by this survey. These percentages agree to well within 1σ , indicating no deficit of historical attention for the stars excluded from the Latham et al. survey. Similarly, the fraction of single stars among the 409 stars explored by the CPM technique is $54\% \pm 3\%$, compared to $75\% \pm 13\%$ for the 44 unexplored stars, an agreement to 1.6 σ . While still consistent within expected statistical deviations, this is a larger departure than seen for the radial velocity survey. Moreover, stars not investigated for CPM companions exhibit low proper motion in archival images, a factor that could have contributed to their exclusion from some companion search efforts. However, even if we adopt the fraction of single stars from the surveyed subsets, this analysis suggests that 54% - 55% of Sun-like stars are likely to be single, consistent with the above estimate of about 10 missing companions in our survey.

Finally, we try another approach to estimate the number of missing companions. Rather than extrapolate new companions, we apply the fraction of detected companions found by each technique (Column 3 of Table 15) to the unsurveyed stars and estimate the number that would apply to presumed single stars. For example, the 70 companions discovered among 409 stars searched for CPM companions imply eight undiscovered companions in the 44 not searched. Given that 75% of these 44 stars do not have any observed companions from any technique, six of these eight missing companions may apply to presumed single stars. Because of the systematic reason for the exclusion of these 44 stars, i.e., these are not conducive to CPM searches by any efforts relying on archival images, this may be a better estimate than the one missing companion estimated by extrapolating new companions. However, some of these stars may be the same as the ones for which companions are suggested by the other subsets of the incompletion analysis, suggesting that about 10–15 companions may be missing from our results. Hence, the various approaches of estimating the incompletion of our survey yield consistent results, resulting in our estimate that about 13 presumed single stars may have yet undiscovered companions. Note that the extrapolation of total companions

discovered, as discussed above for CPM, could also be applied to the radial velocity and AO surveys listed in Table 15. However, there is no systematic reason for excluding targets from the Latham et al. (2010) survey or the AO surveys (other than declination limits, which by themselves do not suggest any bias impacting companion fractions). The missing companions implied by these extrapolations, 12 from the radial-velocity survey and 27 from the AO survey, are largely expected to have been discovered by other efforts using these techniques, as suggested by consistent multiplicity fractions among the surveyed and unobserved subsets discussed above. The consistent multiplicity results for various subsamples with distance and declination limits, covered in the next section, further improve confidence in our estimates of missing companions for the substantially larger sample.

5.2. Overall Multiplicity Statistics

Table 16 lists our overall multiplicity results for solar-type stars in the solar neighborhood and facilitates a comparison with the DM91 results. Our overall observed fractions of single, double, triple, and higher order systems are $56\% \pm 2\%$, $33\% \pm 2\%$, $8\% \pm 1\%$, and $3\% \pm 1\%$, respectively, counting all confirmed stellar and brown dwarf companions. If all candidate, i.e., unconfirmed, companions identified are found to be real, the percentages would change to $54\% \pm 2\%$, $34\% \pm 2\%$, $9\% \pm 2\%$, and $3\% \pm 1\%$, respectively. Based on the completeness analysis discussed in § 5.1, we conclude that $54\% \pm 2\%$ of solar-type stars are single, i.e, without stellar or brown dwarf companions¹¹.

We now return to the question about the completeness of our volume-limited sample, explored in § 2.2. As pointed out, if our sample suffered from *Hipparcos* magnitude limits, we would expect the percentage of single stars to drop with increasing distance, because a magnitude-limited sample would favor the inclusion of spatially unresolved binaries at farther distances. However, the multiplicity fractions for the 15, 20, and 23 pc subsamples and that of the full 25 pc sample, shown in the second section of Table 16, are all statistically equivalent. This is consistent with the expectations for a complete, volume-limited sample, enabling us to conclude that our sample does not suffer from any magnitude limitations.

¹¹These uncertainties are estimated using a bootstrap resampling analysis of 10 000 iterations. In each iteration, a random set of 454 stars is selected from our actual sample of 454 stars such that some stars may be selected more than once, while others may be excluded. This is the effect of the selection process, which does not disqualify a star from further random selections in a sample simply because of a prior random selection. The fractions of single, binary, triple, and higher order multiple systems are then computed for each sample. The distribution of these parameters for all 10 000 samples is roughly Gaussian with a peak corresponding to the value of the actual sample and a standard deviation representing its uncertainty.

Given the longstanding appreciation of the DM91 survey, we now compare our multiplicity fractions with their results, reproduced in the third section of Table 16. The comparison reveals several interesting facts. First, the percentage of triple and quadruple systems in the current study is roughly double that of DM91. Our results show that 25% of non-single stars are higher order multiples, compared to 13% in DM91, confirming their prediction that additional multiple systems were likely to be detected among nearby solar-type stars. Second, while the percentage of multiple systems has doubled, it has come solely at the expense of binary systems. It is indeed remarkable that despite almost twenty years of monitoring since DM91, the observed percentage of single stars before any incompleteness corrections has remained virtually unchanged – from 56.7% in DM91 to 56.4% in our study. Third, candidate companions have a smaller influence on our multiplicity statistics compared to DM91 -2%versus 7%. DM91 considered radial-velocity variations with $P(\chi^2) < 0.01$ as non-random variations suggesting unseen companions. While this metric has been subsequently used as an indication of companionship (Nordström et al. 2004), it alone is not reliable for this purpose (Latham et al. 2010). In contrast, in the current study, we individually inspect each candidate and use multiple methods and observations to confirm or refute the companions whenever possible, leaving us with fewer candidates. Fourth, DM91 made significant incompleteness corrections, estimating that only 43% of solar-type stars have companions with mass ratio q > 0.1. Further, they assume that many low-mass companions were missed, concluding that only one-third of solar-type stars are truly single, i.e., without companions with masses greater than 10 M_J. The significant detection gaps discussed in DM91 in the spectroscopic, visual, and low-mass regimes have been effectively plugged by our effort, as shown in Figure 11, resulting in our modest incompleteness correction discussed in the previous section. We thus believe that DM91 significantly overestimated the number of low-mass companions missed by their survey.

However, there are some systematic differences between our sample and that of DM91, whose possible effects we investigate next. The last section in Table 16 includes results from various subsamples to facilitate this analysis. The first two lines present the statistics from the 106 systems that are common to the two studies. While the DM91 results for this subsample are consistent with their overall results, the updated results for this subset show a 7% reduction in the percentage of single stars, a 1σ deviation. A check of the individual results indicates that while three of the DM91 companions to these stars have since been refuted, 17 new companions have been discovered to 15 of these stars. We explored several avenues to investigate a systematic cause for this difference, but failed to identify any such factor. First, the third row in this group lists the statistics for 10 000 randomly selected subsets of 106 stars from our sample, showing that their results are consistent with our overall numbers and suggesting that the difference for the particular set of 106 stars overlapping

with DM91 is just statistical scatter. Second, while our sample is all-sky, the DM91 sample was declination limited to north of -15° . To check whether stars in the southern hemisphere have been studied less completely, resulting in a greater percentage of presumed single stars, we checked the subsample of our study with declination north of -15° . The results, listed in the fourth row of this section in the table, indicate no such bias. A third factor could be the difference in the color ranges of the two samples. While our study includes stars with $0.5 \le B - V \le 1.0$, roughly corresponding to spectral types F6–K3, DM91 selected a narrower F7–G9 range. As later spectral types are known to have fewer companions (see § 5.3.2), this might be a factor. However, as shown in the last row of the table, a subsample of matching spectral types does not show a significant deviation from our overall results.

Finally, we examine whether the DM91 sample represents a particularly well-studied set of stars when compared to the non-DM91 stars in our sample. Of the 106 stars common to both surveys, 104 (98%) were observed for CPM companions. In comparison, $88\% \pm 5\%$ of the 347 sample stars not in the DM91 study were observed for CPM companions. The difference might be due the preferential selection of high proper-motion stars for groundbased parallax measurements that governed the selection of the DM91 sample, compared to the more comprehensive *Hipparcos* catalog used by this effort. Nevertheless, this difference might suggest moderately better coverage of the DM91 sample, but the companions possibly missed due to this effect were estimated in the previous section and are included in our results. Comparing the coverage of these subsamples by the Latham et al. (2010) survey, we find that 97% of the 106 common stars were observed by the Latham et al. survey, compared to 69% of the non-DM91 stars. Further analysis confirms that this is simply due to the declination limits of the DM91 ($\geq -15^{\circ}$) and Latham et al. ($\geq -40^{\circ}$) efforts, compared to our all-sky sample. Limiting the comparison to stars north of the DM91 declination limit, we find identical coverage of 97% by the Latham et al. (2010) effort for both subsets, i.e., the 106 common stars and the 201 non-DM91 stars. As discussed above, the declinationlimited subsample yields multiplicity fractions consistent with our overall results, confirming that our comprehensive synthesis of other efforts adequately covers the southern-hemisphere stars. Apparently, the differences in the particular subsample common to the DM91 and our survey are simply due to statistical scatter.

5.3. Orbital Elements and Multiplicity Dependence on Physical Parameters

5.3.1. Sources and Estimation of Physical Parameters

The analyses described in the following subsections require the estimation of physical parameters for the components of binaries and multiple systems, which are extracted from

publications or estimated as described here. Tables 17 and 18 list the physical parameters for the sample stars and companions, respectively, and their corresponding references. Masses for the primary stars are listed from dynamical estimates, when available. For other stars, the analyses below use interpolated mass estimates from spectral types using the relations in Cox (2000). For the companions, mass estimates and spectral types are extracted from the various discovery or characterization publications, when available. Otherwise, they are estimated using mass-ratios for double-lined spectroscopic binaries, or from multi-color photometry from catalogs, or using the Δ mag measures in the WDS along with the primary's spectral type. Metallicity and chromospheric activity estimates of the primary are adopted for all components of the system.

5.3.2. Multiplicity by Spectral Type and Color

Figure 12 shows the multiplicity fraction for stars and brown dwarfs. Most O-type stars seem to form in binary or multiple systems, with an estimated lower limit of 75% in clusters and associations having companions (Mason et al. 1998a, 2009). Studies of OB-associations also show that over 70% of B and A type stars have companions (Shatsky & Tokovinin 2002; Kobulnicky & Fryer 2007; Kouwenhoven et al. 2007). In sharp contrast, M-dwarfs have companions in significantly fewer numbers, with estimates ranging from 11% for companions 14–825 AU away (Reid & Gizis 1997) to 34%–42% (Henry & McCarthy 1990; Fischer & Marcy 1992). Finally, estimates for the lowest-mass stars and brown dwarfs suggest that only 10–30% have companions (Burgasser et al. 2003; Siegler et al. 2005; Allen et al. 2007; Maxted et al. 2008; Joergens 2008). Our results for F6–K3 stars are consistent with this overall trend, as seen by the thick solid-lines for the incompleteness-corrected fraction. Moreover, the thick dashed lines for two subsamples of our study show that this overall trend is present even within the range of solar-type stars. $50\% \pm 4\%$ of the blue subsample $(0.5 \le B - V \le 0.625, \text{ F6-G2}, N = 131)$ have companions, compared to only $41\% \pm 3\%$ for the red subsample $(0.625 < B - V \le 1.0, \text{ G2-K3}, N = 323)$.

5.3.3. Period Distribution

Figure 13 shows the period distribution of all 259 confirmed pairs, with an identification of the technique used to discover and/or characterize the system. To provide context, the axis at the top shows the semimajor axis corresponding to the period on the x-axis assuming a mass sum of $1.5 M_{\odot}$, the average value of all the confirmed pairs. When period estimates are not available from spectroscopic or visual orbits, we estimate them as follows. For CPM

companions with separation measurements, we estimate semimajor axes using the statistical relation $\log a'' = \log \rho'' + 0.13$ from DM91, where a is the angular semimajor axis and ρ is the projected angular separation, both in arcseconds. This, along with mass estimates as described in § 5.3.1 and Newton's generalization of Kepler's Third Law yields the period. For the remaining few unresolved pairs, we assume periods of 30–200 years for radial-velocity variables and 10–25 years for proper motion accelerations. The period distribution follows a roughly log-normal Gaussian profile with a mean of $\log P = 5.03$ and $\sigma_{\log P} = 2.28$, where P is in days. This average period is equivalent to 293 years, somewhat larger than Pluto's orbital period around the Sun. The median of the period distribution is 252 years, similar to the Gaussian peak. This compares with corrected mean and median values of 180 years from DM91. The larger value of the current survey is a result of more robust companion information for wide CPM companions. The similarity of the overall profile with the incompleteness-corrected DM91 plot suggests that most companions they estimated as missed have now been found. The shading in the figure shows the expected trend – the shortest-period systems are spectroscopic, followed by combined spectroscopic/visual orbits, then by visual binaries, and finally by CPM pairs. The robust overlap between the various techniques in all but the longest period bins underscores the absence of significant detection gaps in companion space and supports our earlier statements about the completeness of this survey. Binaries with periods longer than $\log P = 8$ are rare, and only 10 of the 259 confirmed pairs (4%) have estimated separations larger than 10000 AU. Although separations wider than this limit were not searched comprehensively, Figure 8 shows that separations of up to 14000 AU were searched for some systems, and 56% of the primaries were searched beyond 10 000 AU limit. The drop in the number of systems with companions thus appears to occur within our search space and hence is likely real. While binaries with separations ~ 0.1 pc have been reported (Latham et al. 1991), they are rare and unlikely to survive dynamical interactions in clusters (Parker et al. 2009). The few such extremely wide binaries in our sample might have formed outside clusters, which are the exception rather than the rule (e.g., Lada & Lada 2003). Looking at a closer limit, Lépine & Bongiorno (2007) concluded that at least 9.5% of Hipparcos stars within 100 pc have distant stellar companions with projected separations greater than 1000 AU. Our results for the *Hipparcos* solar-type stars within 25 pc show that 11.5% have companions with projected separations greater than 1000 AU, consistent with Lépine & Bongiorno's conclusions and suggesting that their companion search effort was fairly comprehensive.

5.3.4. Period-Eccentricity Relationship

Figure 14 shows the period-eccentricity relationship for the 127 pairs with estimates of these parameters from visual and/or spectroscopic orbital solutions. Pairs with orbital periods longer than the circularization limit of about 12 days have a roughly flat eccentricity distribution out to $e \sim 0.6$, independent of period, as shown by Figure 15. The deficiency of high eccentricities is likely due to dynamical interactions for short-period systems and the lack of measurements for long-period systems. The flat eccentricity distributions in Figure 15 are in contrast to the DM91 results, which showed a normal distribution for periods below 1000 days, and an f(e) = 2e distribution for longer-period systems. Pairs with periods below 12 days are circularized, with one notable exception. The 7-day SB2 pair HD 45088 Aa-Ab seems to have an unusually high eccentricity of 0.1471 ± 0.0034 for its short period, and the longer 600-year AB orbit has an eccentricity of 0.25. A possible explanation is that this system is relatively young and hence not yet circularized. The $\log R'_{HK}$ of the primary of -4.266 (Gray et al. 2003) is among the highest for the stars of this sample, suggesting relative youth, which is consistent with a high rotational-velocity and emission features in its spectra (Mishenina et al. 2008). However, the chromospheric activity and high rotation can also be explained by tidal interactions between the components of the short-period binary. An alternate explanation of the high eccentricity is the Kozai mechanism (Kozai 1962), which causes periodic oscillations in the eccentricity and inclination of inner orbit due to tidal forces from the wide companion. Another similar system, HD 223778, has an outer orbit with an large eccentricity of 0.55, and an inner orbit with a small eccentricity of 0.0174 ± 0.0035 . While low, the inner orbit's eccentricity is different from zero by a 5σ significance, suggesting that the Kozai mechanism could be at play in this system as well. In another observational support of the Kozai mechanism, Figure 14 shows that the upper-eccentricity envelope is dominated by components of triple systems, as also observed by DM91.

5.3.5. Mass-Ratio Distribution

Figure 16 shows the distribution of mass ratios (M_2/M_1) for binaries, pairs in higherorder multiple systems, and composite-mass pairs in multiple systems (see the figure caption for an example). These plots exclude 11 systems with components whose masses could not be estimated by the process described in § 5.3.1. The figure shows a roughly flat distribution for mass ratios 0.2–0.95. Binaries show a deficiency of low-mass companions, and Figure 17 illustrates the lack of low-mass, short-period companions. This parameter space is effectively covered by the CCPS and Latham et al. (2010) radial-velocity studies (see Figure 11), so the deficiency of such companions appears to be real, suggesting that short-period systems prefer higher mass ratios. The fraction of short-period (P < 100 days) systems increases from 0% for mass ratios below 0.2, to 4% for mass-ratios below 0.45, to 8% for mass ratios 0.45–0.9, and to 16\% for mass ratios above 0.9. Figure 16 shows that the preference for like-mass pairs applies to binaries and pairs in higher-order multiples (such as Aa, Ab in a Aa, Ab, B triple), but does not apply when the aggregate mass of a pair is compared with the third component (e.g., mass of Aa+Ab, compared to mass of B). Consistent with the above observations, like-mass pairs $(M_2/M_1 > 0.95)$ prefer relatively short periods – only six of 27 such pairs have periods longer than some 200 years and none have periods longer than about 1000 years, corresponding to about 115 AU. These results agree with predictions from hydrodynamical simulations (Bate et al. 2002), which show that gas around a protobinary preferentially accretes on to the lower-mass component. This is a consequence of the lowermass component sweeping a larger space, thereby aggregating more mass until the masses are roughly equal. These results contradict DM91's conclusions, which showed no preference for like-mass pairs. Figure 17 also shows that the majority of short-period pairs belong to triple systems. Of the 16 systems with periods below 100 days, seven are binaries and nine are the inner pairs of triple systems. These observations support predictions from hydrodynamical simulations, which suggest that many short-period pairs could have formed at wider separations and migrated closer as a result of dynamical interactions in unstable multiple systems or orbital decays due to gas accretion and/or the interaction of a binary with its circumbinary disk (Bate et al. 2002).

5.3.6. Multiplicity by Chromospheric Activity and Age

Multiplicity studies of young stars (Ghez et al. 1997; Kouwenhoven et al. 2007), nearby solar-type stars (Mason et al. 1998b), and aging stars in globular clusters (Sollima et al. 2007) show an anti-correlation between age and the fraction of stars with companions. To check this trend within our sample, we use chromospheric emission as measured by $\log R'_{\rm HK}$, an age indicator (Henry et al. 1996; Mason et al. 1998b; Mamajek & Hillenbrand 2008). We avoid the potential contamination from tidally-induced high activity in short-period binaries by excluding systems with orbital periods less than 12 days. The overall multiplicity fraction of the active ($\log R'_{\rm HK} \geq -4.75$) and inactive ($\log R'_{\rm HK} < -4.75$) subsamples are statistically equivalent. $40\% \pm 3\%$ of low activity (older) stars have companions, compared to $44\% \pm 4\%$ of high activity (younger) stars. Interestingly, there appears to be a relationship between age and the interaction cross-sections of systems, i.e., systems with more stellar components or those with long orbital periods are preferentially younger. Figure 18 shows the relationship between orbital period, chromospheric activity, and multiplicity order. Not surprisingly, all systems with P < 12 days are active, presumably because of tidal interactions. These

systems are excluded from any age-related analyses. Among systems that have no orbital periods shorter than 12 days, the active subset has a larger fraction of higher order multiples, i.e., 26% of the active systems are triples or higher order multiples compared to only 17% of low-activity systems. Consistent with this trend, only 32% of binaries are active, compared to 44% of higher order multiples. Also, the fraction of active single stars is 33%, virtually identical to the fraction for binaries. Thus, it appears that binaries tend to remain intact after dynamical interactions, but higher order multiples get disrupted, assuming that the formation rates of higher order multiples have not changed over time. Similarly, long period systems also tend to erode with age. For systems with $\log P < 8$ (i.e., periods below some 275 000 years or, assuming a mass-sum of 1.5 $\rm M_{\odot}$, semimajor axes less than 5 000 AU), only $33\% \pm 4\%$ are in the active subset. In comparison, $69\% \pm 23\%$ of systems with longer periods are active. Comparing these distributions using the KS test shows consistent results, but the sample sizes in many cases are too small to yield definitive answers. In summary, our results suggest that systems with more than two stellar components or those with long orbital periods tend to preferentially lose companions with age, likely due to dynamical interactions.

5.3.7. Multiplicity by Metallicity

Figure 19 shows the fraction of stars with stellar, brown dwarf, and planetary companions as a function of metallicity. The planet-metallicity correlation, first demonstrated by Fischer & Valenti (2005), is clearly seen in our volume-limited sample as well. Due to the dearth of brown dwarfs, testing whether similar correlations exist for these more massive substellar companions is a challenge. While none of the seven stars of our sample with confirmed brown dwarf companions has [Fe/H] < -0.3, the steady rise with metallicity seen for planets is not evident for brown dwarfs. While the fraction of stars with planets rises from 2% at $-0.3 \le [Fe/H] < -0.2$ to 40% for $0.2 \le [Fe/H] < 0.3$, the corresponding numbers for brown dwarf companions are constrained between 0%-3%, and are all statistically equivalent due to the small numbers. To generate a larger sample, we looked at all brown dwarfs in the Dwarf Archives with known stellar companions. Twenty-two such stars were found, and 13 of them have metallicity measurements. All but one of these stars have metallicity values between -0.4 and 0.3, and the exception has [Fe/H] = -0.69. With such small numbers and the above exception, we are not able to conclude anything specific about the correlation between a star's metallicity and its tendency to have brown dwarf companions, although the data hint a possible relationship.

Figure 19 illustrates two additional points. First, the population of solar-type stars in the solar neighborhood is metal-poor compared to the Sun. Seventy percent of the 414

stars with metallicity measurements are less abundant in heavy elements than the Sun. Second, while stars with [Fe/H] > -0.3 show no correlation between metallicity and the fraction of stars with stellar companions, stars with metallicities below this limit show a greater tendency to have stellar companions, which appears to increase with decreasing metallicity. While the implied anti-correlation for the individual bins in this region is not statistically significant and consistent with a flat distribution¹², the aggregate differences on either side of this limit are significant. Using Poisson uncertainties, our data suggest that $57\% \pm 9\%$ of stars with [Fe/H] < -0.3 have companions, compared to $39\% \pm 3\%$ of the higher metallicity stars. This result is in contrast to several recent multiplicity studies of K and M subdwarfs, which find a lower companion fraction for subdwarfs when compared to corresponding main-sequence stars (Riaz et al. 2008; Jao et al. 2009; Lodieu et al. 2009). However, these surveys targeted known subdwarfs, which are often initially identified by their sub-main sequence location on the H-R diagram, potentially excluding some binaries because they are elevated on the diagram. On the other hand, based on an analysis of short-period binaries, Grether & Lineweaver (2007) concluded that low-metallicity stars are more likely to have companions and further pointed out that this tendency is limited to relatively red stars (B-V>0.75). Our work confirms these conclusions. Splitting the analysis into red and blue subsets on either side of B-V=0.625 (the limit used in §5.3.2), we find no relationship between metallicity and the tendency to have stellar companions for B-V < 0.625. For the redder subset, however, the relationship shown in Figure 19 is not only repeated, but further accentuated. While the anti-correlation across the individual metallicity bins is still statistically insignificant, the aggregate percentage of stars with stellar companions is $63\% \pm 11\%$ for [Fe/H] < -0.3 and $35\% \pm 4\%$ for the higher metallicity subset. Although this interesting result is somewhat tentative, it may indicate that lower-metallicity clouds are more likely to fragment and form binary stars, as suggested by numerical simulations (Bate et al. 2003; Bate 2005; Machida et al. 2009). Because older-population stars are relatively metal-poor, these differences could appear to contradict the conclusion in §5.3.6, but there is no relationship between metallicity and chromospheric activity for our sample of stars.

5.3.8. The Hierarchy of Multiple Systems

Figure 20–22 show the hierarchy of triple systems, Figure 23 that of quadruple systems, and Figure 24 that of higher order systems. Candidate companions are connected via dotted lines and confirmed companions via solid lines. The figures identify the relationship between the hierarchical pairs and the period or separation as appropriate. When available, the

 $^{^{12}}$ Furthermore, all four stars with [Fe/H] < -0.9, excluded from the plot, are single.

components' spectral types from Table 1 and mass estimates from Tables 17 and 18 are also listed. The hierarchical order of multiple systems is clearly seen in our results. All confirmed multiple systems, excluding two outliers discussed below, have period ratios between any pair and the next level up ranging 23–33000. The corresponding semimajor axis ratios are 9– 1900. The outlier with the largest ratio is HD 133640, whose period and semimajor axis ratios of 251 000 and 5 300 are driven by the very short period of 6.4 hours for the inner pair. The outer pair is separated by about 2" and has a visual orbit of 246 years. The exception with the lowest ratio can be more informative about dynamical interactions among components. HD 4391 has a period ratio of five and a semimajor axis ratio of three. While this seems to be low-enough to raise questions about the dynamical stability of this system, it is composed of two CPM pairs with separations of 17" and 49", the wider of which was discovered by this effort. The estimates of semimajor axes from observed separations using the statistical relationship discussed in §5.3.3, and the resulting periods, are rough estimates useful for overall statistical analyses, but not accurate for individual systems. Hence, these ratios for this system are not meaningful and the observed projected separations can correspond to a whole host of stable orbital configurations.

The hierarchical relationships in the 33 confirmed triple systems suggests a strong preference for the tertiary component to orbit the more massive component. Twenty-five (76%) of these systems are like HD 40397 (G7+M4, M5) or HD 18143 (K2+K9, M7), where the plus symbol connects the close pair, and the comma delineates the wide component. Only eight (24%) of the systems have the two lower-mass components in a tight orbit, in orbit around a more distant primary (e.g. HD 65907: F9.5, M0+M5 and HD 101177: F9.5, K3+M2). Notably, both brown dwarf pairs in triple systems (HD 97334 and 130948; the third, HD 79096 is a quadruple system) are part of this minority, i.e., tight brown dwarf pairs are preferred rather than two brown dwarfs orbiting their host star in a planetary-system formation, consistent with the findings of Burgasser et al. (2005). These results might indicate a selection effect that the lower-mass components of binaries are less-often searched for companions. Alternatively, they may imply that the more massive cloud preferentially fragments in the formation of triple systems when the resulting components are stellar in nature.

All but two of the 13 systems with four or more components are based on a double-double relationship. Nested three level hierarchies for quadruple systems such as those for HD 9770 and HD 137763 appear rare. In instances when these systems are formed solely through fragmentation, these observables suggest that formation processes favor the fragmentation of both first-level clouds rather than the successive fragmentation of one cloud while its counterpart stays intact. In instances when the wider relationships are established via capture, these results suggest a binary-binary combination is more probable and stable than a triple-single combination.

5.3.9. Multiplicity in Exoplanet Systems

Contrary to earlier expectations, recent studies (e.g., Raghavan et al. 2006; Mugrauer & Neuhäuser 2009) have shown that planetary systems are quite common among binaries and multiple systems. In a comprehensive search for stellar companions to the then known exoplanet hosts, Raghavan et al. (2009) concluded that even against selection effects, as many as 23% (30 of 131) of the exoplanet systems also had stellar companions. A recent report by Mugrauer & Neuhäuser (2009) showed that 17% (43 of 250) of exoplanet hosts were members of binary or multiple systems. In comparison, 30% (11 of 36) exoplanet systems of this study have stellar companions. This represents the largest percentage of stellar companions in any sample yet of exoplanet systems, likely due to the thoroughness of companion detection in this sample of nearby Sun-like stars. This is however still smaller than the 46% of stars having companions in the overall sample, presumably because all the exoplanets discovered to-date are from surveys that avoid known spectroscopic binaries. One key question is whether binary and multiple systems are equally likely to form planets as are single stars. Our results show that $9\% \pm 2\%$ of the single stars have planets, compared to $7\% \pm 2\%$ of binaries and $3\% \pm 3\%$ of triples. These fractions are statistically equivalent, suggesting that single stars and stars with companions are equally likely to harbor planets. Moreover, while sufficiently short-period binaries will disrupt protoplanetary disks, hampering planet formation around either star (e.g., see Desidera & Barbieri 2007), Figure 13 shows that many binaries in this study have sufficiently long periods to foster planet formation around each stellar component.

6. Conclusion

We present the results of a comprehensive evaluation of the multiplicity of solar-type stars in the solar neighborhood. Our sample of 454 stars, including the Sun, is selected from the Hipparcos catalog based on the following criteria: $\pi_{\rm trig} > 40$ mas, $\sigma_{\pi}/\pi < 0.05$, $0.5 \le B-V \le 1.0$, and positioned on an HR diagram within a band extending 1.5 magnitudes below and 2 magnitudes above the main sequence. These criteria are equivalent to selecting all dwarf and subdwarf stars within 25 pc with V-band fluxes 0.1–10 times that of the Sun, providing a physical basis for the term "solar-type". Our analyses show that this selection is not magnitude limited and hence is a complete volume-limited sample (see § 2.2), minimizing selection effects. This work is an update to the seminal effort of DM91, utilizing a larger and more accurate sample. Despite DM91's intentions of selecting a complete volume-limited sample from Gliese (1969), updated Hipparcos results show that as many as 72 of their 164 stars are now known to lie outside their selection criteria and an additional 56 stars meeting

their selection criteria were left out (see $\S 2.3$), justifying this follow-up effort. See $\S 2$ for details on our sample selection and analyses.

Our results are based on targeted new observations to augment the vast amount of data available from extensive multiplicity studies of these stars using many different techniques, resulting in the most complete survey of companions yet (§ 5.1). Complementary publications (Latham et al. 2010; Raghavan et al. 2010a) report on systematic searches for spectroscopic companions, including four new detections, and LBOI searches for separated fringe packet binaries, respectively. The null result of the LBOI search shows that the gap between shortperiod spectroscopic systems and relatively long-period visual systems has been bridged due to long-standing spectroscopic campaigns and higher resolution visual techniques. The widest of companions were searched by blinking archival images, resulting in the identification of four new companions (§ 3.1). Targeted speckle interferometry observations augmented comprehensive historical programs, ensuring that every target in our sample was inspected by this high resolution technique. Additionally, we have individually evaluated companion entries in various catalogs including $Hipparcos(\S 3.2)$, WDS ($\S 3.3$), and CNS ($\S 3.5$) for stellar companions, the Dwarf Archives for brown dwarf companions (§ 3.7), and the exoplanet catalogs for planetary companions (§ 3.8). The CCPS data, obtained for planet searches, have been utilized here to identify new stellar companions, but yielded only one new companion, enhancing the robustness of our completeness analysis ($\S 5.1$).

The observed percentages of single, double, triple, and higher order systems, including stellar and brown dwarf components, are $56\% \pm 2\% : 33\% \pm 2\% : 8\% \pm 1\% : 3\% \pm 1\%$, and our incompleteness analysis suggests that $54\% \pm 2\%$ of solar-type stars in the solar neighborhood are single. This reverses previous expectations that only 43% of solar-type stars lack companions with masses greater than 0.1 M_{\odot} and only 33% are without companions more massive than 10 $M_{\rm J}$ (DM91). Our results double the percentage of triple and quadruple systems as compared to DM91, confirming their prediction that these additional companions were missed in their survey. Remarkably, the percentage of single stars is essentially unchanged since DM91 despite the comprehensive monitoring of nearby Sun-like stars, suggesting that their incompleteness analysis significantly overestimated missed companions.

Consistent with the overall trend of decreasing multiplicity ratios with increasing spectral types, we find that $50\% \pm 4\%$ of the F6–G2 subsample have companions, compared to $41\% \pm 3\%$ of the G2–K3 subsample (§ 5.3.2). The period distribution is unimodal and log-normal, with a median period of about 300 years (§ 5.3.3). While the profile of this distribution is similar to that of DM91, the median value in the prior study was 180 years, highlighting the improved completeness of wide pairs in the current survey. We are unable to reproduce the period-eccentricity relationships in DM91 for either the short-period or

long-period systems, but instead find no relationship between these parameters beyond the circularization for P < 12 days (§ 5.3.4). In another departure from DM91, our mass-ratio distribution shows a preference for like-mass pairs, which prefer relatively short orbital periods (§ 5.3.5). Our data also suggest that stars might lose companions with age, especially those with higher cross sections, i.e., systems with more than two components or with long orbital periods, suggesting that some companions are stripped away over time by dynamical interactions (§ 5.3.6). We confirm the planet-metallicity correlation and observe that most known brown dwarfs orbit relatively metal-rich stars, although the scarcity of such companions prevents us from making definitive conclusions. We see no relationship between a star's metallicity and its tendency to have stellar companions for B - V < 0.625. However, a preliminary but intriguing result is that stars redder than this limit are more likely to have companions when they are relatively metal poor (§ 5.3.7). Finally, our results show that planets are as likely to form around single stars as they are around components of binaries or multiple star systems (§ 5.3.9), at least when they are sufficiently widely-separated, increasing the real estate thought available for planets, and perhaps life.

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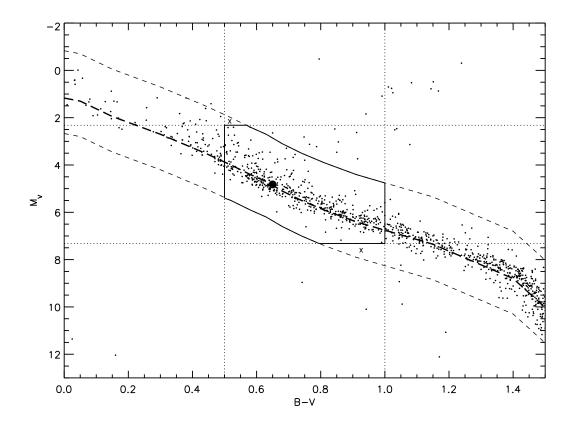


Fig. 1.— Volume-limited sample of solar-type stars from Hipparcos. The dots represent Hipparcos stars within our distance limit of 25 pc with parallax errors less than 5%. The long dashed line is the main sequence from Cox (2000), and the dashed lines 2 magnitudes above and 1.5 magnitudes below it identify the selection boundaries to limit spectral classes to IV, V, and VI. The dotted vertical lines mark the B-V color limits of the sample, and the dotted horizontal lines mark the magnitudes corresponding to one-tenth and ten times the V-band flux of the Sun. The two triangles marked by 'X' indicate regions without corresponding stars, confirming that the color-based selection is equivalent to a selection based on luminosity. The solid outline encloses the final sample of 462 stars (including nine companions to other sample stars), and the large filled circle marks the position of the Sun.

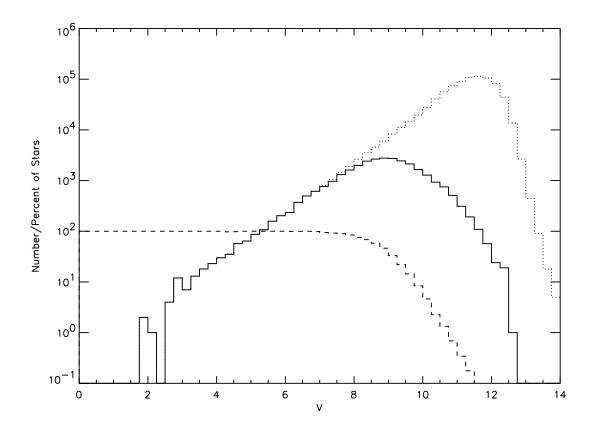


Fig. 2.— The V magnitude distributions of the Hipparcos and Tycho-2 catalogs. The solid line shows the Hipparcos distribution and the dotted line shows the Tycho-2 distribution. The number of stars is plotted on a logarithmic scale. The dashed line shows the percentage of Tycho-2 stars in each magnitude bin that are also included in the Hipparcos catalog and can be interpreted as the completeness of the Hipparcos catalog.

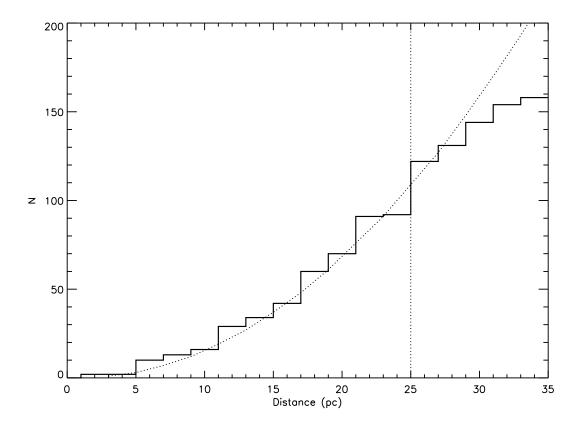


Fig. 3.— Distance distribution of the *Hipparcos* stars meeting our sample selection criteria, but expanding the distance limit out to 35 pc. The dotted curve shows the expected distribution of a complete sample, assuming completeness out to 15 pc. The vertical dotted line marks the distance limit of our sample.

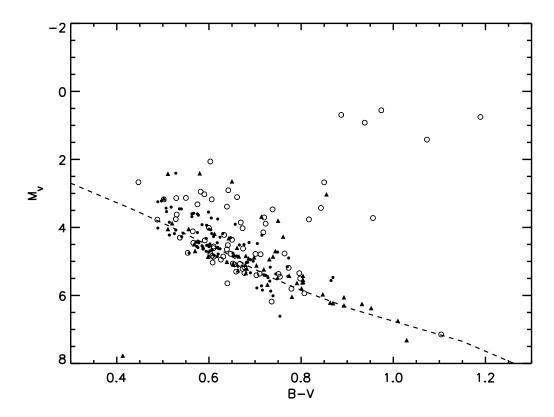


Fig. 4.— HR diagram for the DM91 sample from the CNS and *Hipparcos* catalogs. All points are plotted using magnitudes and parallaxes from *Hipparcos*. Filled circles represent DM91 sample stars that still match their criteria based on the *Hipparcos* data, while open circles identify DM91 sample stars that no longer meet their criteria. Filled triangles represent stars that were not part of the DM91 sample, but which meet their criteria based on *Hipparcos* data. The dashed line is the main sequence from Cox (2000).

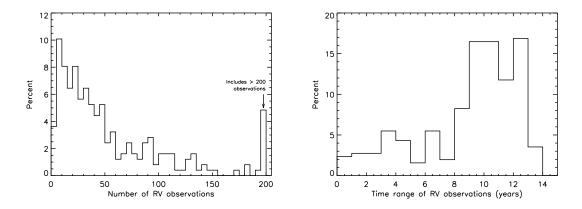


Fig. 5.— The distributions of the number of radial velocity measurements per star (left) and their time span (right) in the CCPS survey.

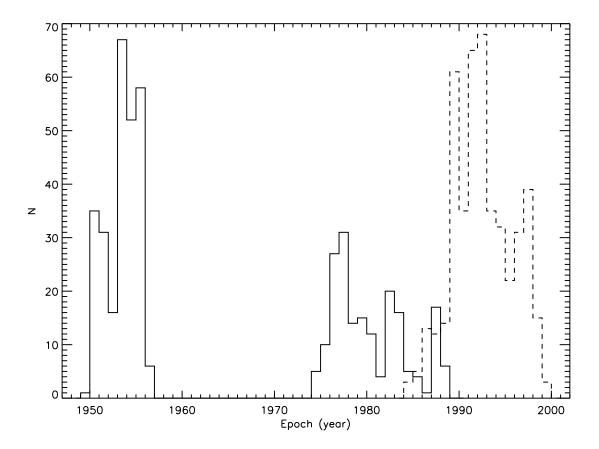


Fig. 6.— Epoch distribution of the images blinked to identify CPM companions. A pair of images from the DSS and/or SSS were blinked for each target, with the earlier epoch identified by the solid line and the later epoch by the dashed line.

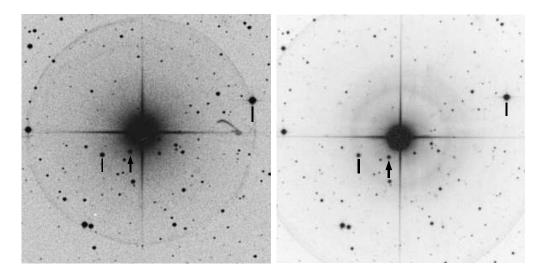


Fig. 7.— Example of the images blinked to identify CPM companions. The bright star at the center of these 10' square images from the DSS is HD 9826 (v And). North is up and east is to the left. The epoch of the left image is 1953.71 and for the right image is 1989.77. The arrow marks the CPM companion at a separation of 56" and the lines identify WDS entries that are field stars. The primary's proper motion is $\mu_{\alpha} \cos \delta = -0''.173 \,\mathrm{yr}^{-1}$ and $\mu_{\delta} = -0''.381 \,\mathrm{yr}^{-1}$ from Hipparcos.

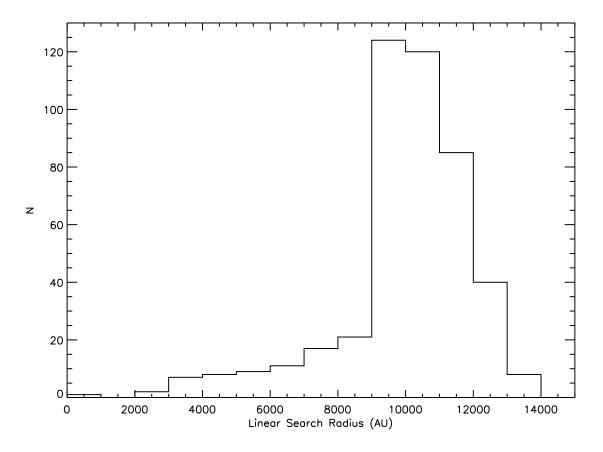


Fig. 8.— The distribution of the linear projected separation from the primary searched for CPM companions.

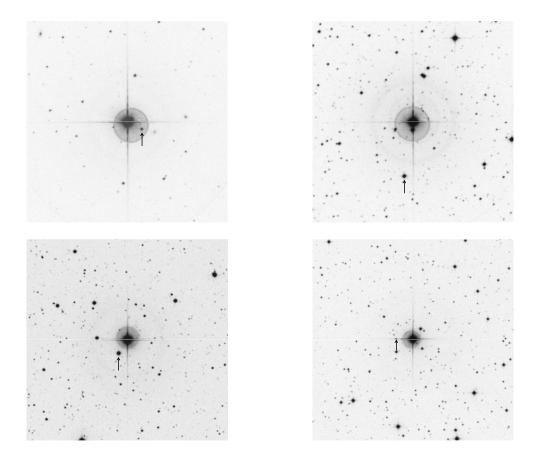


Fig. 9.— Archival images showing the new companions discovered. The primaries starting at the top-left image, going clockwise, are HD 4391, 43162, 218868, and 157347. In each image, the companion is marked by the arrow and the primary is the bright star at the center. The images are 10′ on each side and oriented with North up and East to the left.

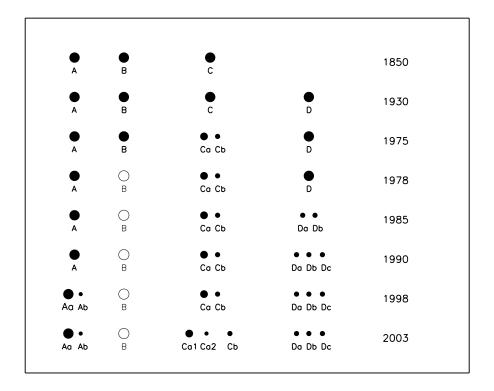


Fig. 10.— Companion nomenclature according to the WMC standards for a fictitious system that grows more complex over time. The following hypothetical events took place as components of this system were discovered. 1850: A telescopic inspection of this star reveals three visual components. The primary is designated as A and the companions are labeled B and C, respectively. 1930: A wide CPM companion is discovered and labeled D. 1975: Component C is split by speckle interferometry, and the components are named Ca and Cb, while C refers to the pair. 1978: A new measure of the AB pair shows that it is optical rather than physical, but the components names previously assigned are retained. 1985: Component D is split by speckle interferometry, and the components are named Da and Db. 1990: An additional speckle component is found in D and named Dc; 1998: AO reveals a faint source near A, which is identified as a brown dwarf companion by follow-up spectroscopy, splitting A into Aa, the stellar primary, and Ab, the brown dwarf. 2003: High-precision radial velocity measurements reveal a brown dwarf companion to Ca, splitting it into Ca1, the star, Ca2, the brown dwarf.

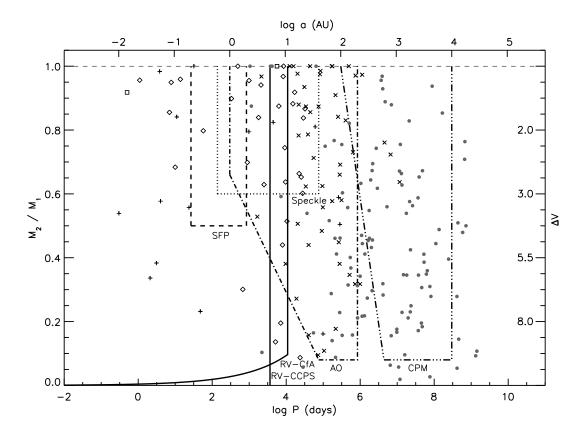


Fig. 11.— Detection limits of the various companion search methods by period and mass ratio. For convenience, the periods are converted to semi-major axes for our average mass-sum of 1.5 ${\rm M}_{\odot}$ and shown on the top, and the mass ratios are converted to approximate ΔV values for primaries G0–K0 and shown on the right. The solid vertical line at $\log P$ just above 3.5 (10 years) is the limit for spectroscopic companions from the CCPS efforts, which are capable of detecting any companions to the left of it. The solid curve turning vertical at about $\log P = 4$ (30 years) marks the limit of the Latham et al. (2010) spectroscopic survey. The dashed lines show the detection region of the CHARA SFP search, the dotted lines mark the boundary of speckle interferometric searches, the dash-dot lines demarcate the AO detection space, and the dash-triple-dot lines delineate the CPM search region. The assumptions for detection limits for each technique are outlined in the text. The overplotted points show the actual pairs found with estimates of periods and component masses. Plus signs identify spectroscopic orbits, crosses mark visual orbits, open diamonds show combined spectroscopic-visual solutions, filled circles identify CPM pairs and open squares show unresolved companions such as eclipsing binaries or overluminous sources.

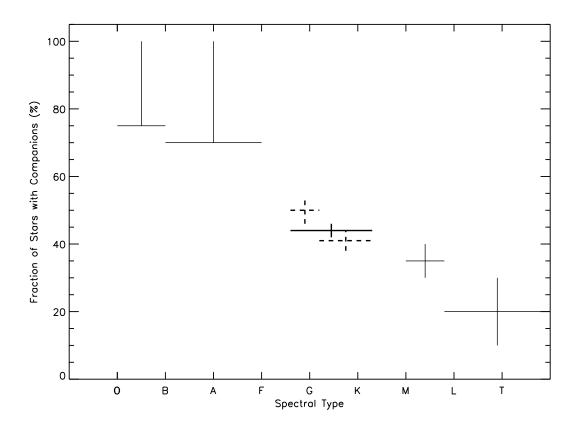


Fig. 12.— Multiplicity statistics by spectral type. The thin solid lines represent stars and brown dwarfs beyond the spectral range of this study, and their sources are listed in the text. For the FGK stars studied here, the thick dashed lines show our observed multiplicity fractions, i.e the percentage of stars with confirmed stellar or brown dwarf companions, for spectral types F6–G2 and G2–K3. The thick solid lines show the incompleteness-adjusted fraction for the entire F6–K3 sample. The uncertainties of the multiplicity fractions are estimated by bootstrap analysis as explained in § 5.2.

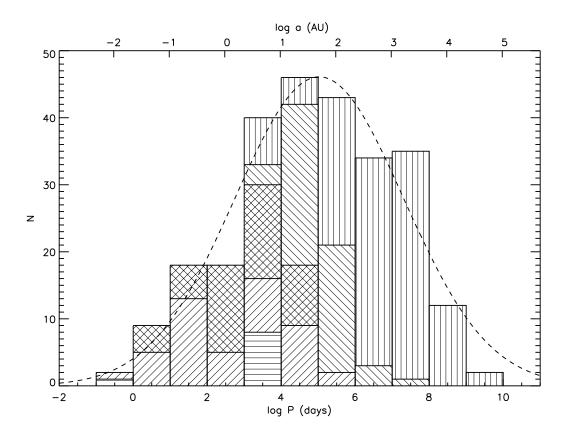


Fig. 13.— Period distribution for the 259 confirmed companions. The data are plotted by the companion detection method. Unresolved companions such as proper motion accelerations are identified by horizontal line shading, spectroscopic binaries by positively sloped lines, visual binaries by negatively sloped lines, companions found by both spectroscopic and visual techniques by crosshatching, and CPM pairs by vertical lines. The semimajor axes shown in AU at the top correspond to the periods on the x-axis for a system with a mass-sum of 1.5 M_{\odot} , the average value for all the pairs. The dashed curve shows a Gaussian fit to the distribution, with a peak at $\log P = 5.03$ and standard deviation of $\sigma_{\log P} = 2.28$.

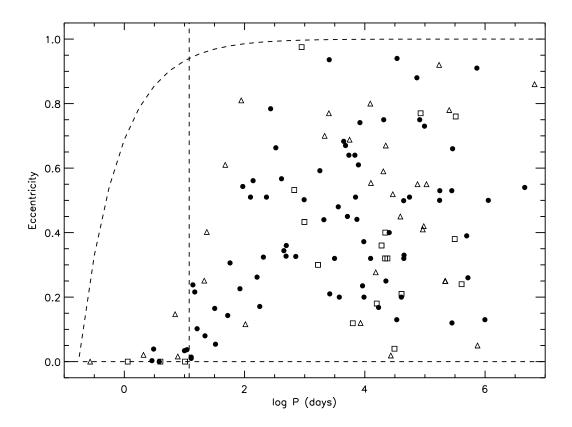


Fig. 14.— Period-eccentricity relationship for the 127 pairs with estimates of those parameters from visual and/or spectroscopic orbital solutions. Components of binaries are plotted as filled circles, of triples as open triangles, and of quadruple systems as open squares. The horizontal dashed line marks a zero-eccentricity limit and the vertical dashed line marks the 12-day period, which roughly corresponds to the circularization period for this population of stars. The exceptions with notable eccentricities to the left of this line are discussed in the text. The dashed curve represents a boundary, to the left of which pairs approaching periastron will pass within $1.5~\rm R_{\odot}$ and are hence likely to collide. The relation is derived assuming a mass-sum of $1.5~\rm M_{\odot}$, the average value for all the pairs.

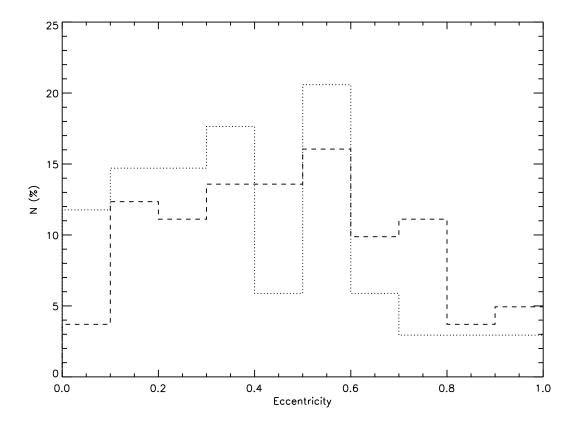


Fig. 15.— Eccentricity distribution for the 117 systems with periods longer than the 12-day circularization limit with estimated eccentricities from visual or spectroscopic solutions. The dotted line represents the 35 systems with periods below 1000 days, and the dashed line represents the 82 systems with periods longer than 1000 days.

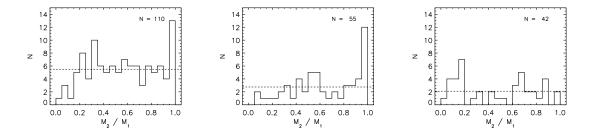


Fig. 16.— Mass-ratio distribution for binaries (left), pairs in higher-order multiple systems (middle), and composite-mass pairs in multiple systems (right). For example, in a triple system composed of a spectroscopic binary Aa,Ab and a visual binary AB, the $M_{\rm Aa}$ to $M_{\rm Ab}$ ratio is included in the middle panel and the $M_{\rm (Aa+Ab)}$ to $M_{\rm B}$ ratio is included in the right panel. The dashed lines mark the average value for each plot.

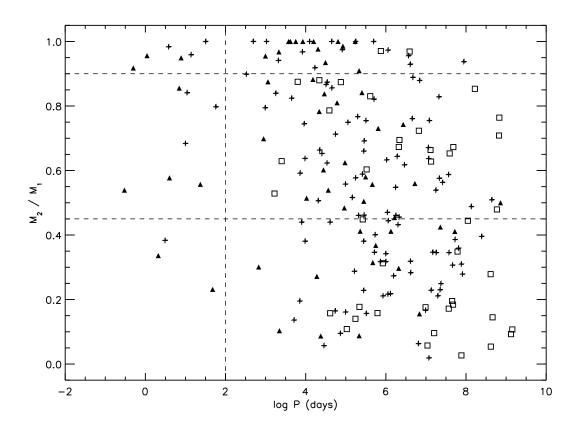


Fig. 17.— Mass-ratio – period relation. Plus signs represent binaries, filled triangles identify pairs in multiple systems, and open squares indicate composite-mass hierarchical pairs in multiples (see caption of Figure 16 for an example). The dotted lines are drawn to mark subdivisions for analysis, as described in the text.

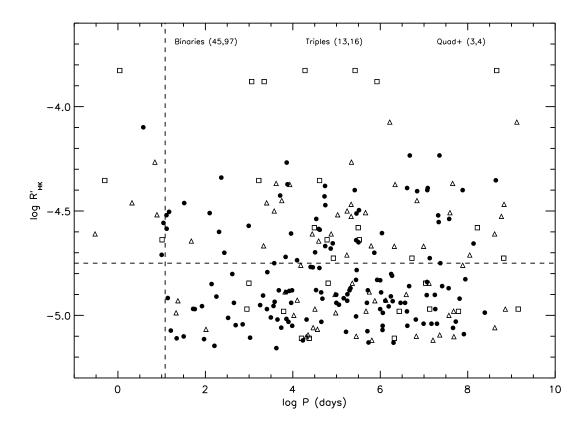


Fig. 18.— Plot of $\log R'_{\rm HK}$ and orbital period for binaries (filled circles), pairs in triple systems (open triangles), and in quadruple and higher order systems (open squares). The horizontal dashed line delineates what we consider to be active stars (above the line) from inactive stars. The vertical dashed line at P=12 days marks the tidal orbit-circularization limit. Systems to its left are likely to have enhanced activity due to tidal interactions independent of age. The numbers in parentheses at the top show the counts of active and inactive systems for binaries, triple and quadruple or higher order systems, excluding systems with periods less than 12 days. Because the plot includes each pair with its orbital period and the $\log R'_{\rm HK}$ of the primary, triples and higher-order multiples have more than one point along horizontal lines.

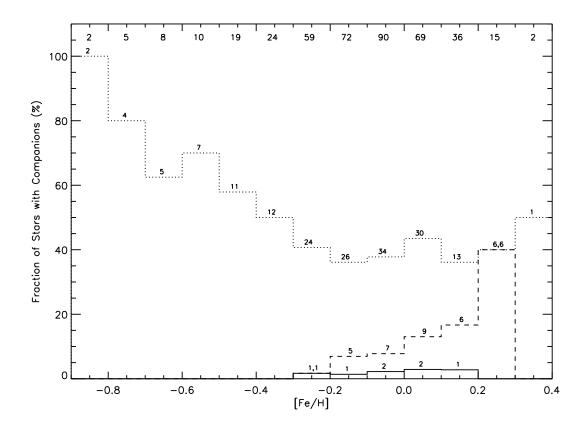


Fig. 19.— The fraction of stars with stellar (dotted line), brown dwarf (solid line), and planetary (dashed line) companions as a function of metallicity. The numbers at the top of the plot are the total number of stars in each 0.1 dex metallicity bin and the counts immediately above the histograms are the number of stars with the corresponding type of companion. Four stars with [Fe/H] < -0.9 are excluded from this plot, each of which is single with no known stellar or substellar companions.

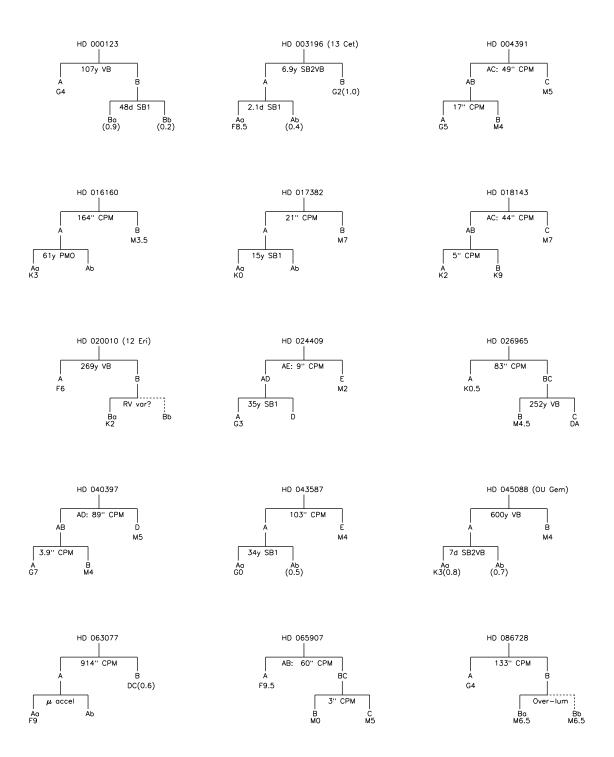


Fig. 20.— Mobile diagrams of triple systems (1 of 3). Solid lines connect confirmed companions and dashed lines connect candidate companions. Spectral types and/or mass estimates, in parenthesis in solar-mass units, are listed below each component, when available. See Tables 17 and 18 for the methods and references of the mass estimates.

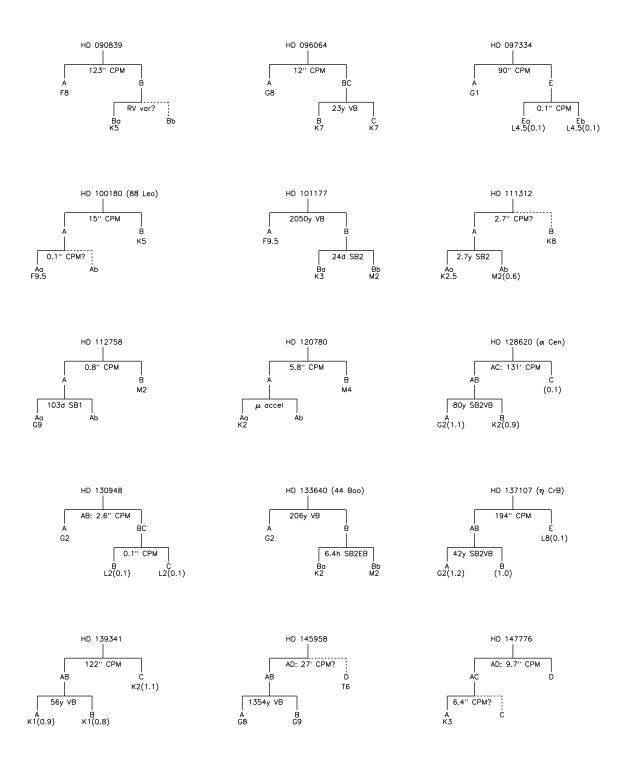


Fig. 21.— Mobile diagrams of triple systems (2 of 3). See caption under Figure 20 for a description of the format.

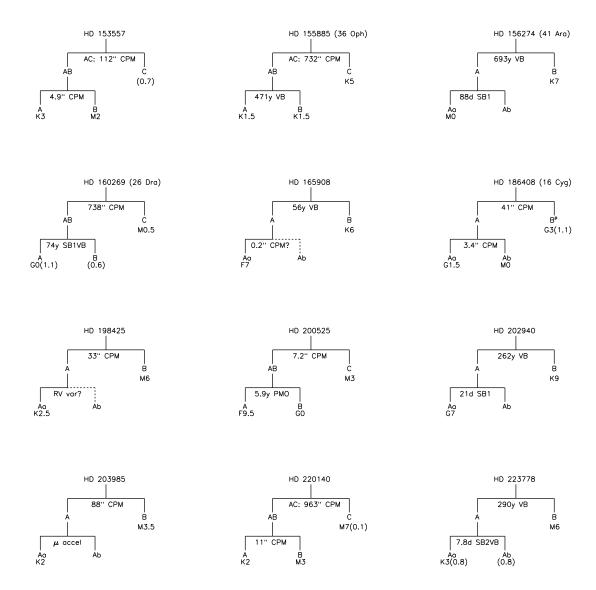


Fig. 22.— Mobile diagrams of triple systems (3 of 3). See caption under Figure 20 for a description of the format. The 'p' superscript for HD 186408 B indicates that it is a planet-host star.

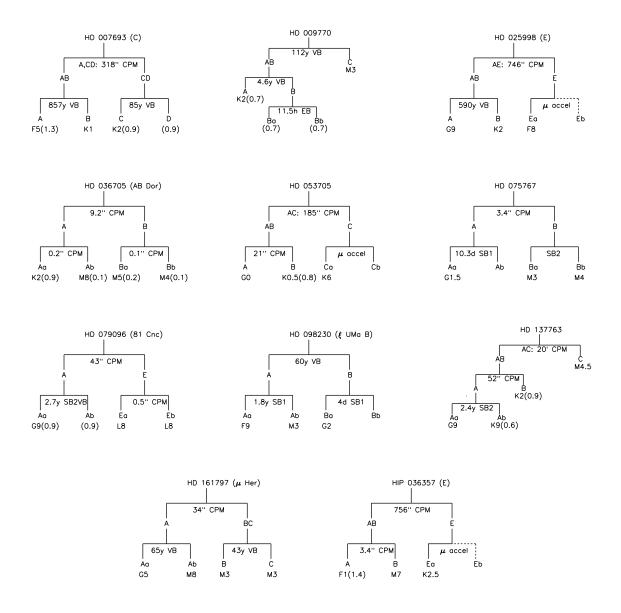


Fig. 23.— Mobile diagrams of quadruple systems. See caption under Figure 20 for a description of the format.

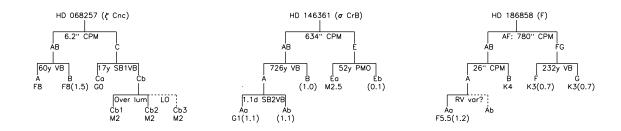


Fig. 24.— Mobile diagrams of quintuple and higher-order systems. See caption under Figure 20 for a description of the format.

Table 1. Volume-limited Sample of 454 Solar-type Stars

				Hipp	oarcos	Hippe	arcos	van Leeu	wen (2007b)		
R.A.	Decl.	HIP	$^{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B-V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Sun			0.650					G2 V	
00 02 10.16	$+27\ 04\ 56.1$	000171	224930	5.80	0.690	80.63	3.03	82.17	2.23	G3 V	1
00 06 15.81	$+58\ 26\ 12.2$	000518	000123	5.98	0.687	49.30	1.05	46.56	0.65	G5 V	1
00 06 36.78	$+29\ 01\ 17.4$	000544	000166	6.07	0.752	72.98	0.75	73.15	0.56	K0 V	1
$00\ 12\ 50.25$	-57 54 45.4	001031	000870	7.22	0.775	49.18	0.78	49.53	0.58	K0 V	2
00 16 12.68	$-79\ 51\ 04.3$	001292	001237	6.59	0.749	56.76	0.53	57.15	0.31	G8.5 V	2
00 16 53.89	$-52\ 39\ 04.1$	001349	001273	6.84	0.655	43.45	1.19	44.25	0.62	G5 V	2
00 18 41.87	$-08\ 03\ 10.8$	001499	001461	6.47	0.674	42.67	0.85	43.02	0.51	G0 V	1
00 20 00.41	$+38\ 13\ 38.6$	001598	001562	6.97	0.640	40.25	0.81	40.33	0.59	G0	1
00 20 04.26	$-64\ 52\ 29.2$	001599	001581	4.23	0.576	116.38	0.64	116.46	0.16	F9.5 V	2
$00\ 22\ 51.79$	$-12\ 12\ 34.0$	001803	001835	6.39	0.659	49.05	0.91	47.93	0.53	G5 V	2
$00\ 24\ 25.93$	$-27\ 01\ 36.4$	001936	002025	7.92	0.940	55.53	1.08	54.87	0.86	K3 V	2
$00\ 25\ 45.07$	$-77\ 15\ 15.3$	002021	002151	2.82	0.618	133.78	0.51	134.07	0.11	G0 V	2
00 35 14.88	$-03\ 35\ 34.2$	002762	003196	5.20	0.567	47.51	1.15	47.05	0.67	F8 V	1
$00\ 37\ 20.70$	$-24\ 46\ 02.2$	002941	003443	5.57	0.715	64.38	1.40	64.93	1.85	G7 V	2
00 39 21.81	$+21\ 15\ 01.7$	003093	003651	5.88	0.850	90.03	0.72	90.42	0.32	K0 V	1
$00\ 40\ 49.27$	$+40\ 11\ 13.8$	003206	003765	7.36	0.937	57.90	0.98	57.71	0.80	K2 V	1
$00\ 44\ 39.27$	$-65\ 38\ 58.3$	003497	004308	6.55	0.655	45.76	0.56	45.34	0.32	G6 V	2
$00\ 45\ 04.89$	$+01\ 47\ 07.9$	003535	004256	8.03	0.983	45.43	0.95	46.37	0.62	K2 V	1
$00\ 45\ 45.59$	$-47\ 33\ 07.2$	003583	004391	5.80	0.635	66.92	0.73	65.97	0.39	G5 V	2
$00\ 48\ 22.98$	$+05\ 16\ 50.2$	003765	004628	5.74	0.890	134.04	0.86	134.14	0.51	K2.5 V	2
$00\ 48\ 58.71$	$+16\ 56\ 26.3$	003810	004676	5.07	0.502	41.80	0.75	42.64	0.27	F8 V	1
$00\ 49\ 06.29$	$+57\ 48\ 54.7$	003821	004614	3.46	0.587	167.99	0.62	167.98	0.48	G0 V	1
$00\ 49\ 26.77$	$-23\ 12\ 44.9$	003850	004747	7.15	0.769	53.09	1.02	53.51	0.53	G9 V	2
$00\ 49\ 46.48$	$+70\ 26\ 58.1$	003876	004635	7.75	0.900	46.47	0.70	46.23	0.53	K0	1
$00\ 50\ 07.59$	$-10\ 38\ 39.6$	003909	004813	5.17	0.514	64.69	1.03	63.48	0.35	F7 IV-V	1
$00\ 51\ 10.85$	$-05\ 02\ 21.4$	003979	004915	6.98	0.663	45.27	0.97	46.47	0.66	G0	1
$00\ 53\ 01.13$	$-30\ 21\ 24.9$	004148	005133	7.15	0.936	71.01	0.78	70.56	0.61	K2.5 V	2
$00\ 53\ 04.20$	$+61\ 07\ 26.3$	004151	005015	4.80	0.540	53.85	0.60	53.35	0.33	F8 V	1
$01\ 08\ 16.39$	$+54\ 55\ 13.2$	005336	006582	5.17	0.704	132.40	0.60	132.38	0.82	K1 V	3
$01\ 15\ 00.99$	$-68\ 49\ 08.1$	005842	007693	7.22	1.000	47.36	1.25	46.20	0.82	K2+V	2
$01\ 15\ 11.12$	$-45\ 31\ 54.0$	005862	007570	4.97	0.571	66.43	0.64	66.16	0.24	F9 V	2
$01\ 16\ 29.25$	$+42\ 56\ 21.9$	005944	007590	6.59	0.594	42.30	0.75	43.11	0.45	G0- V	3
$01\ 21\ 59.12$	$+76\ 42\ 37.0$	006379	007924	7.17	0.826	59.46	0.59	59.49	0.46	K0	1
$01\ 29\ 04.90$	$+21\ 43\ 23.4$	006917	008997	7.74	0.966	43.16	0.93	42.13	0.68	K2.5 V	3
$01 \ 33 \ 15.81$	$-24\ 10\ 40.7$	007235	009540	6.97	0.766	51.27	0.88	52.49	0.46	G8.5 V	2
$01\ 34\ 33.26$	$+68\ 56\ 53.3$	007339	009407	6.52	0.686	47.65	0.60	48.41	0.40	G6.5 V	3
$01\ 35\ 01.01$	$-29\ 54\ 37.2$	007372	009770	7.11	0.909	42.29	1.47	46.24	3.07	K2 V	2
01 36 47.84	$+41\ 24\ 19.7$	007513	009826	4.10	0.536	74.25	0.72	74.12	0.19	F8 V	1
$01\ 37\ 35.47$	$-06\ 45\ 37.5$	007576	010008	7.66	0.797	42.35	0.96	41.75	0.74	G9 V	3
01 39 36.02	$+45\ 52\ 40.0$	007734	010086	6.60	0.690	46.73	0.80	46.79	0.60	G5 V	3
01 39 47.54	$-56\ 11\ 47.0$	007751	010360	5.76	0.880	122.75	1.41	127.84	2.19	K2 V	2

Table 1—Continued

				Hipp	oarcos	Hippe	arcos	van Leeu	wen (2007b)		
R.A.	Decl.	HIP	$^{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B-V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
01 41 47.14	+42 36 48.1	007918	010307	4.96	0.618	79.09	0.83	78.50	0.54	G1 V	3
$01\ 42\ 29.32$	$-53\ 44\ 27.0$	007978	010647	5.52	0.551	57.63	0.64	57.36	0.25	F9 V	2
$01\ 42\ 29.76$	$+20\ 16\ 06.6$	007981	010476	5.24	0.836	133.91	0.91	132.76	0.50	K0 V	3
$01\ 44\ 04.08$	$-15\ 56\ 14.9$	008102	010700	3.49	0.727	274.17	0.80	273.96	0.17	G8.5 V	2
$01\ 47\ 44.83$	$+63\ 51\ 09.0$	008362	010780	5.63	0.804	100.24	0.68	99.33	0.53	G9 V	3
$01\ 59\ 06.63$	$+33\ 12\ 34.9$	009269	012051	7.14	0.773	40.74	0.90	40.03	0.58	G9 V	3
$02\ 06\ 30.24$	$+24\ 20\ 02.4$	009829	012846	6.89	0.662	43.14	0.94	43.91	0.57	G2 V-	3
$02\ 10\ 25.93$	$-50\ 49\ 25.4$	010138	013445	6.12	0.812	91.63	0.61	92.74	0.32	K1 V	2
$02\ 17\ 03.23$	$+34\ 13\ 27.2$	010644	013974	4.84	0.607	92.20	0.84	92.73	0.39	G0 V	1
$02\ 18\ 01.44$	$+01\ 45\ 28.1$	010723	014214	5.60	0.588	40.04	0.92	41.06	0.49	G0 IV-	3
$02\ 18\ 58.50$	$-25\ 56\ 44.5$	010798	014412	6.33	0.724	78.88	0.72	78.93	0.35	G8 V	2
$02\ 22\ 32.55$	$-23\ 48\ 58.8$	011072	014802	5.19	0.608	45.60	0.82	45.53	0.82	G0 V	2
$02\ 36\ 04.89$	$+06\ 53\ 12.7$	012114	016160	5.79	0.918	138.72	1.04	139.27	0.45	K3 V	3
$02\ 36\ 41.76$	$-03\ 09\ 22.1$	012158	016287	8.10	0.944	41.09	1.25	41.44	0.97	K2.5 V	3
$02\ 40\ 12.42$	$-09\ 27\ 10.3$	012444	016673	5.79	0.524	46.42	0.82	45.96	0.41	F8 V	3
02 41 14.00	$-00\ 41\ 44.4$	012530	016765	5.72	0.511	46.24	1.31	44.27	0.84	F7 V	3
02 42 14.92	$+40\ 11\ 38.2$	012623	016739	4.91	0.582	40.52	1.25	41.34	0.43	F9 IV-V	3
$02\ 42\ 33.47$	$-50\ 48\ 01.1$	012653	017051	5.40	0.561	58.00	0.55	58.25	0.22	F9 V	2
02 44 11.99	$+49\ 13\ 42.4$	012777	016895	4.10	0.514	89.03	0.79	89.87	0.22	F7 V	1
02 48 09.14	$+27\ 04\ 07.1$	013081	017382	7.56	0.820	44.71	1.15	40.59	1.28	K0 V	3
02 52 32.13	$-12\ 46\ 11.0$	013402	017925	6.05	0.862	96.33	0.77	96.60	0.40	K1.5 V	2
02 55 39.06	$+26\ 52\ 23.6$	013642	018143	7.52	0.953	43.71	1.26	42.57	0.84	K2 IV	3
03 00 02.81	$+07\ 44\ 59.1$	013976	018632	7.97	0.926	42.66	1.22	41.00	1.12	K2.5 V	3
03 02 26.03	+26 36 33.3	014150	018803	6.62	0.696	47.25	0.89	48.45	0.47	G6 V	3
03 04 09.64	+61 42 21.0	014286	018757	6.64	0.634	43.74	0.84	41.27	0.58	G1.5 V	3
03 09 04.02	+49 36 47.8	014632	019373	4.05	0.595	94.93	0.67	94.87	0.23	F9.5 V	3
03 12 04.53	$-28\ 59\ 15.4$	014879	020010	3.80	0.543	70.86	0.67	70.24	0.45	F6 V	2
03 12 46.44	$-01\ 11\ 46.0$	014954	019994	5.07	0.575	44.69	0.75	44.29	0.28	F8.5 V	3
03 14 47.23	+08 58 50.9	015099	020165	7.83	0.861	44.96	1.09	44.15	0.83	K1 V	3
03 15 06.39	$-45\ 39\ 53.4$	015131	020407	6.75	0.586	41.05	0.59	41.34	0.40	G5 V	2
03 18 12.82	$-62\ 30\ 22.9$	015371	020807	5.24	0.600	82.79	0.53	83.11	0.19	G0 V	2
03 19 01.89	$-02\ 50\ 35.5$	015442	020619	7.05	0.655	40.52	0.98	39.65	0.74	G2 V	3
03 19 21.70	$+03\ 22\ 12.7$	015457	020630	4.84	0.681	109.18	0.78	109.41	0.27	G5 Vvar	1
03 19 55.65	-43 04 11.2	015510	020794	4.26	0.711	165.02	0.55	165.47	0.19	G8 V	2
03 21 54.76	+52 19 53.4	015673	232781	9.05	0.990	44.03	1.24	42.81	1.03	K3.5 V	3
03 23 35.26	$-40\ 04\ 35.0$	015799	021175	6.90	0.840	58.53	1.04	57.40	0.67	K1 V	2
03 32 55.84	$-40\ 04\ 39.0$ $-09\ 27\ 29.7$	016537	022049	3.72	0.840	310.75	0.85	310.94	0.16	K1 V K2 V	3
03 36 52.38	$-09\ 27\ 29.7$ $+00\ 24\ 06.0$	016357 016852	022484	$\frac{3.72}{4.29}$	0.575	72.89	0.33	71.62	0.10	F9 V	3 1
03 40 22.06	$-03\ 13\ 01.1$	010032 017147	022434	6.68	0.575	41.07	0.78	39.12	0.54 0.56	F9 V	1
03 43 55.34	$-03\ 13\ 01.1$ $-19\ 06\ 39.2$	017420	023356	7.10	0.927	71.17	0.80	71.69	0.67	K2.5 V	2
03 44 09.17	$-38\ 16\ 54.4$	017420	023484	6.99	0.870	61.63	0.67	62.39	0.52	K2.5 V K2 V	2
03 54 28.03	$-38\ 10\ 34.4$ $+16\ 36\ 57.8$	017439	023464	6.81	0.870 0.719	48.36	1.02	48.95	0.32 0.70	G7 V	3
05 54 28.03	+10 00 01.8	010207	024490	0.61	0.719	40.00	1.02	40.90	0.70	G/ V	J

Table 1—Continued

$ \begin{array}{c} R.A. & Decl. & IIIP & IIID & & & & & & & & & & & & & & & & $	-				Hipp	oarcos	Hippe	arcos	van Leeu	wen (2007b)		
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (12) (13) (13) (14) (15) (6) (7) (8) (9) (10) (11) (12) (12) (13) (13) (14) (15) (15) (15) (15) (15) (15) (15) (15	R.A.	Decl.	HIP	$_{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
03 55 0.8.4 +61 10 00.5 018324 024238 7.84 0.831 46.95 0.95 47.59 0.84 K2 V 3 3 61 1.52 +59 88 30.8 018413 024409 6.53 0.698 46.74 0.96 45.49 0.62 G3 V 3 3 04 02 36.74 -00 16 08.1 018859 025457 5.38 0.516 52.00 0.75 53.10 0.622 F7 V 3 3 04 03 15.00 +35 16 23.8 018915 025329 8.51 0.863 54.14 1.08 54.68 0.92 K3 Vp 3 04 07 21.54 -64 13 20.2 019933 026491 6.37 0.636 43.12 0.50 42.32 0.28 G1 V 2 04 08 36.62 +38 02 23.0 019335 025998 5.52 0.520 46.87 0.77 47.63 0.26 F8 V 3 04 09 35.04 +69 32 29.0 019325 025998 5.55 0.520 46.87 0.77 47.63 0.26 F8 V 3 04 15 28.00 0.620 59.0 0.620 59.79 0.84 80.80 0.22 K1 V 2 0.28 0.28 0.19 0.22 0.28 0.19 0.25 0.520 46.87 0.77 47.63 0.26 F8 V 3 04 09 35.04 +69 32 29.0 019325 025998 5.52 0.520 46.87 0.77 47.63 0.26 F8 V 3 04 15 28.00 +06 11 12.7 019859 026923 6.32 0.500 46.87 0.77 5.53 3 0.71 K2.5 V 3 04 15 28.80 +06 11 12.7 019859 026923 6.32 0.570 47.20 1.08 46.88 0.47 G0 IV-V 3 04 33 3.44 +27 41 14.6 021988 02983 8.00 0.907 44.74 0.99 45.61 0.81 K5 III 1 0.50 44 53 3.58 5.50 04 72.0 02122 030501 7.58 0.875 48.90 0.64 47.93 0.45 K2 V 2 0.44 73 6.29 -16 56 04.0 022263 030495 5.49 0.632 75.10 0.80 75.32 0.36 01.5 V 2 0.44 52 0.33 -3 50 62 7.5 022451 0.03076 7.49 0.901 5.559 0.71 5.63 5 0.48 K2 V 1 0.50 64 42.2 +14 26 46 0.23786 0.32855 7.74 0.804 41.70 1.14 42.24 0.92 G9 V 3 0.50 64 2.2 +14 26 46 4.0 23786 0.32955 7.74 0.804 41.70 1.14 42.24 0.92 G9 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 18 50.47 +10 5 56.6 0.24813 034411 4.69 0.630 7.90 0.90 7.91 7.02 8 G1 V 3 0.50 1	(J2000.0)	(J2000.0)	Name	Name	V	B-V	(mas)	(mas)	(mas)	(mas)	Type	Ref
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$												
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	03 55 03.84	+61 10 00.5	018324	024238	7.84	0.831	46.95	0.95	47.59	0.84	K2 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$03\ 56\ 11.52$	$+59\ 38\ 30.8$	018413	024409	6.53	0.698	46.74	0.96	45.49	0.62	G3 V	3
04 05 20.26	$04\ 02\ 36.74$	$-00\ 16\ 08.1$	018859	025457	5.38	0.516	52.00	0.75	53.10	0.32	F7 V	3
04 07 21.54	$04\ 03\ 15.00$	$+35\ 16\ 23.8$	018915	025329	8.51	0.863	54.14	1.08	54.68	0.92	K3 Vp	3
04 08 36.62 +38 02 23.0 019335 025998 5.52 0.520 46.87 0.77 47.63 0.26 F8 V 3 04 09 35.04 +69 32 29.0 019422 025665 7.70 0.952 54.17 0.79 53.33 0.71 K2.5 V 3 04 15 28.80 +06 11 12.7 019859 026923 6.32 0.570 47.20 1.08 46.88 0.47 G0 IV-V 3 04 45 38.54 +27 41 14.6 021988 029883 8.00 0.907 44.74 0.99 45.61 0.81 K5 III 1 04 47 36.29 -16 56 04.0 022263 030945 5.49 0.632 75.10 0.80 75.32 0.36 G1.5 V 2 04 49 52.33 -35 06 27.5 022451 030876 7.49 0.631 55.59 0.71 56.35 0.48 K2 V 1 05 02 17.06 -56 04 49.9 023437 032778 7.02 0.636 44.94 0.58 44.48	$04\ 05\ 20.26$	$+22\ 00\ 32.1$	019076	025680	5.90	0.620	59.79	0.84	59.04	0.33	G1 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 07\ 21.54$	$-64\ 13\ 20.2$	019233	026491	6.37	0.636	43.12	0.50	42.32	0.28	G1 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 08\ 36.62$	$+38\ 02\ 23.0$	019335	025998	5.52	0.520	46.87	0.77	47.63	0.26	F8 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 09\ 35.04$	$+69\ 32\ 29.0$	019422	025665	7.70	0.952	54.17	0.79	53.33	0.71	K2.5 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 15\ 16.32$	$-07\ 39\ 10.3$	019849	026965	4.43	0.820	198.24	0.84	200.62	0.23	K1 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 15\ 28.80$	$+06\ 11\ 12.7$	019859	026923	6.32	0.570	47.20	1.08	46.88	0.47	G0 IV-V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 43\ 35.44$	$+27\ 41\ 14.6$	021988	029883	8.00	0.907	44.74	0.99	45.61	0.81	K5~III	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 45\ 38.58$	$-50\ 04\ 27.2$	022122	030501	7.58	0.875	48.90	0.64	47.93	0.45	K2 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 47\ 36.29$	$-16\ 56\ 04.0$	022263	030495	5.49	0.632	75.10	0.80	75.32	0.36	G1.5 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$04\ 49\ 52.33$	$-35\ 06\ 27.5$	022451	030876	7.49	0.901	55.59	0.71	56.35	0.48	K2 V	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$05\ 02\ 17.06$	$-56\ 04\ 49.9$	023437	032778	7.02	0.636	44.94	0.58	44.48	0.36	G7 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	05 05 30.66	$-57\ 28\ 21.7$	023693	033262	4.71	0.526	85.83	0.46	85.87	0.18	F9 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$05\ 06\ 42.22$	$+14\ 26\ 46.4$	023786	032850	7.74	0.804	41.70	1.14	42.24	0.92	G9 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$05\ 07\ 27.01$	$+18\ 38\ 42.2$	023835	032923	4.91	0.657	63.02	0.93	64.79	0.33	G1 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	05 18 50.47	$-18\ 07\ 48.2$	024786	034721	5.96	0.572	40.11	0.76	39.96	0.40	F9- V	2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	05 19 08.47	$+40\ 05\ 56.6$	024813	034411	4.69	0.630	79.08	0.90	79.17	0.28	G1 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	05 22 33.53	$+79\ 13\ 52.1$	025110	033564	5.08	0.506	47.66	0.52	47.88		F7 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$05\ 22\ 37.49$	$+02\ 36\ 11.5$	025119	035112	7.76	0.980	50.24	1.52	49.44	1.17	K2.5 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$05\ 24\ 25.46$	$+17\ 23\ 00.7$	025278	035296	5.00	0.544	68.19	0.94	69.51	0.38	F8 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	05 26 14.74		025421	035854	7.70	0.946	55.76	0.76			K3- V	2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$												2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	05 28 44.83	$-65\ 26\ 54.9$	025647	036705	6.88	0.830	66.92	0.54			K2 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	05 36 56.85		026373	037572	7.95	0.845	41.90				K1.5 V	2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$												
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$											K0 V	
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05 58 21.54 -04 39 02.4 028267 040397 6.99 0.720 43.10 0.93 42.46 0.63 G7 V 3 06 06 40.48 +15 32 31.6 028954 041593 6.76 0.814 64.71 0.91 65.48 0.67 G9 V 3 06 10 14.47 -74 45 11.0 029271 043834 5.08 0.714 98.54 0.45 98.06 0.14 G7 V 2 06 12 00.57 +06 46 59.1 029432 042618 6.85 0.642 43.26 0.87 42.55 0.55 G3 V 3 06 13 12.50 +10 37 37.7 029525 042807 6.43 0.663 55.20 0.96 55.71 0.44 G5 V 3 06 13 45.30 -23 51 43.0 029568 043162 6.37 0.713 59.90 0.75 59.80 0.49 G6.5 V 2												
06 06 40.48 +15 32 31.6 028954 041593 6.76 0.814 64.71 0.91 65.48 0.67 G9 V 3 06 10 14.47 -74 45 11.0 029271 043834 5.08 0.714 98.54 0.45 98.06 0.14 G7 V 2 06 12 00.57 +06 46 59.1 029432 042618 6.85 0.642 43.26 0.87 42.55 0.55 G3 V 3 06 13 12.50 +10 37 37.7 029525 042807 6.43 0.663 55.20 0.96 55.71 0.44 G5 V 3 06 13 45.30 -23 51 43.0 029568 043162 6.37 0.713 59.90 0.75 59.80 0.49 G6.5 V 2												
06 10 14.47 -74 45 11.0 029271 043834 5.08 0.714 98.54 0.45 98.06 0.14 G7 V 2 06 12 00.57 +06 46 59.1 029432 042618 6.85 0.642 43.26 0.87 42.55 0.55 G3 V 3 06 13 12.50 +10 37 37.7 029525 042807 6.43 0.663 55.20 0.96 55.71 0.44 G5 V 3 06 13 45.30 -23 51 43.0 029568 043162 6.37 0.713 59.90 0.75 59.80 0.49 G6.5 V 2												
06 12 00.57 +06 46 59.1 029432 042618 6.85 0.642 43.26 0.87 42.55 0.55 G3 V 3 06 13 12.50 +10 37 37.7 029525 042807 6.43 0.663 55.20 0.96 55.71 0.44 G5 V 3 06 13 45.30 -23 51 43.0 029568 043162 6.37 0.713 59.90 0.75 59.80 0.49 G6.5 V 2												
06 13 12.50 +10 37 37.7 029525 042807 6.43 0.663 55.20 0.96 55.71 0.44 G5 V 3 06 13 45.30 -23 51 43.0 029568 043162 6.37 0.713 59.90 0.75 59.80 0.49 G6.5 V 2												
$06\ 13\ 45.30 -23\ 51\ 43.0 029568 043162 \qquad 6.37 0.713 \qquad 59.90 0.75 \qquad 59.80 \qquad 0.49 \qquad \text{G6.5 V} 2$												
	06 17 16.14	$+05\ 06\ 00.4$	029860	043587	5.70	0.610	51.76	0.78	51.95	0.40	G0 V	3

Table 1—Continued

				Hipp	parcos	Hippo	arcos	van Leeu	wen (2007b)		
R.A.	Decl.	HIP	$^{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B - V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	, ,	, ,		. ,	, ,	, ,	. ,	, ,	, ,	, ,	
06 22 30.94	-60 13 07.2	030314	045270	6.53	0.614	42.56	0.49	42.05	0.27	G0 Vp	2
$06\ 24\ 43.88$	$-28\ 46\ 48.4$	030503	045184	6.37	0.626	45.38	0.63	45.70	0.40	G1.5 V	2
$06\ 26\ 10.25$	$+18\ 45\ 24.8$	030630	045088	6.78	0.938	68.20	1.10	67.89	1.53	K3 V	3
$06\ 38\ 00.36$	$-61\ 32\ 00.2$	031711	048189	6.15	0.624	46.15	0.64	46.96	0.81	G1 V	2
$06\ 46\ 05.05$	$+32\ 33\ 20.4$	032423	263175	8.80	0.964	40.02	1.22	38.11	1.01	K3 V	3
$06\ 46\ 14.15$	$+79\ 33\ 53.3$	032439	046588	5.44	0.525	56.02	0.53	55.95	0.27	F8 V	3
$06\ 46\ 44.34$	$+43\ 34\ 38.7$	032480	048682	5.24	0.575	60.56	0.73	59.82	0.30	F9 V	3
$06\ 55\ 18.67$	$+25\ 22\ 32.5$	033277	050692	5.74	0.573	57.89	0.90	58.00	0.41	G0 V	3
$06\ 58\ 11.75$	$+22\ 28\ 33.2$	033537	051419	6.94	0.620	41.25	0.88	40.60	0.53	G5 V	3
$06\ 59\ 59.66$	$-61\ 20\ 10.3$	033690	053143	6.81	0.786	54.33	0.54	54.57	0.34	K0 IV-V	2
$07\ 01\ 13.74$	$-25\ 56\ 55.4$	033817	052698	6.71	0.882	68.42	0.72	68.27	0.61	K1 V	2
$07\ 01\ 38.59$	$+48\ 22\ 43.2$	033852	051866	7.98	0.986	48.96	0.97	49.79	0.84	K3 V	3
$07\ 03\ 30.46$	$+29\ 20\ 13.5$	034017	052711	5.93	0.595	52.37	0.84	52.27	0.41	G0 V	3
$07\ 03\ 57.32$	$-43\ 36\ 28.9$	034065	053705	5.56	0.624	61.54	1.05	60.55	1.04	G0 V	2
$07\ 08\ 04.24$	$+29\ 50\ 04.2$	034414	053927	8.32	0.907	44.92	1.43	44.93	0.97	K2.5 V	3
$07\ 09\ 35.39$	$+25\ 43\ 43.1$	034567	054371	7.09	0.700	40.68	1.02	39.73	0.54	G6 V	3
$07\ 15\ 50.14$	$+47\ 14\ 23.9$	035136	055575	5.54	0.576	59.31	0.69	59.20	0.33	F9 V	3
$07\ 17\ 29.56$	$-46\ 58\ 45.3$	035296	057095	6.70	0.975	67.69	0.86	68.52	0.56	K2.5 V	2
$07\ 27\ 25.47$	$-51\ 24\ 09.4$	036210	059468	6.72	0.694	44.43	0.53	44.10	0.36	G6.5 V	2
$07\ 29\ 01.77$	$+31\ 59\ 37.8$	036357		7.73	0.923	56.98	1.24	56.63	0.93	K2.5 V	3
$07\ 30\ 42.51$	$-37\ 20\ 21.7$	036515	059967	6.66	0.641	45.93	0.58	45.84	0.37	G2 V	2
$07\ 33\ 00.58$	$+37\ 01\ 47.4$	036704	059747	7.68	0.863	50.80	1.29	50.60	0.94	K1 V	3
$07 \ 34 \ 26.17$	$-06\ 53\ 48.0$	036827	060491	8.16	0.900	40.32	1.26	40.73	1.00	K2.5 V	3
07 39 59.33	$-03\ 35\ 51.0$	037349	061606	7.18	0.891	70.44	0.94	70.37	0.64	K3- V	3
$07\ 45\ 35.02$	$-34\ 10\ 20.5$	037853	063077	5.36	0.589	65.79	0.56	65.75	0.51	F9 V	2
$07\ 49\ 55.06$	$+27\ 21\ 47.4$	038228	063433	6.90	0.682	45.84	0.89	45.45	0.53	G5 V	3
$07\ 51\ 46.30$	$-13\ 53\ 52.9$	038382	064096	5.16	0.600	59.98	0.95	60.59	0.59	G0 V	2
$07\ 54\ 34.18$	$-01\ 24\ 44.1$	038625	064606	7.43	0.739	52.01	1.85	49.78	1.85	K0 V	3
$07\ 54\ 54.07$	$+19\ 14\ 10.8$	038657	064468	7.76	0.950	50.05	1.05	48.33	0.86	K2.5 V	3
$07\ 56\ 17.23$	$+80\ 15\ 55.9$	038784	062613	6.55	0.719	58.67	0.57	58.17	0.36	G8 V	1
$07\ 57\ 46.91$	$-60\ 18\ 11.1$	038908	065907	5.59	0.573	61.76	0.51	61.71	0.21	F9.5 V	2
07 59 33.93	$+20\ 50\ 38.0$	039064	065430	7.68	0.833	43.21	0.96	42.15	0.71	K0 V	3
08 00 32.13	$+29\ 12\ 44.5$	039157	065583	6.97	0.716	59.52	0.77	59.64	0.56	K0 V	3
08 02 31.19	$-66\ 01\ 15.4$	039342	067199	7.18	0.872	57.88	0.58	57.76	0.41	K2 V	2
$08\ 07\ 45.86$	$+21\ 34\ 54.5$	039780	067228	5.30	0.642	42.86	0.97	42.94	0.30	G2 IV	3
$08\ 11\ 38.64$	$+32\ 27\ 25.7$	040118	068017	6.78	0.679	46.05	0.92	45.90	0.55	G3 V	3
$08\ 12\ 12.73$	$+17\ 38\ 52.0$	040167	068257	4.67	0.531	$41.10^{\rm a}$	0.90^{a}	39.87	0.82	F8 V	3
08 18 23.95	$-12\ 37\ 55.8$	040693	069830	5.95	0.754	79.48	0.77	80.04	0.35	G8+ V	2
08 19 19.05	$+01\ 20\ 19.9$	040774		8.35	0.901	42.89	1.32	43.61	1.26	G5	1
$08\ 27\ 36.79$	$+45\ 39\ 10.8$	041484	071148	6.32	0.624	45.89	0.84	44.94	0.46	G1 V	3
08 32 51.50	$-31\ 30\ 03.1$	041926	072673	6.38	0.780	82.15	0.66	81.91	0.46	G9 V	2
08 34 31.65	$-00\ 43\ 33.8$	042074	072760	7.32	0.791	45.95	1.01	47.31	0.72	K0- V	3

Table 1—Continued

-				Hipp	parcos	Hippe	arcos	van Leeu	wen (2007b)		
R.A.	Decl.	HIP	$^{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B - V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	. ,	. ,	. ,	. ,			. ,	. ,	. ,	. ,	
08 37 50.29	-06 48 24.8	042333	073350	6.74	0.655	42.32	1.04	41.71	0.70	G5~V	3
$08 \ 39 \ 07.90$	$-22\ 39\ 42.8$	042430	073752	5.05	0.720	50.20	0.98	51.55	0.63	G5 IV	2
$08 \ 39 \ 11.70$	$+65\ 01\ 15.3$	042438	072905	5.63	0.618	70.07	0.71	69.66	0.37	G1.5 Vb	1
$08 \ 39 \ 50.79$	$+11\ 31\ 21.6$	042499	073667	7.61	0.832	53.98	1.04	55.13	0.71	K2 V	3
$08\ 42\ 07.52$	$-42\ 55\ 46.0$	042697	074385	8.11	0.904	44.73	0.79	43.73	0.55	K2+V	2
$08\ 43\ 18.03$	$-38\ 52\ 56.6$	042808	074576	6.58	0.917	89.78	0.56	89.76	0.37	K2.5 V	2
$08\ 52\ 16.39$	$+08\ 03\ 46.5$	043557	075767	6.57	0.640	41.42	1.19	41.64	1.03	G1.5 V	3
$08\ 52\ 35.81$	$+28\ 19\ 50.9$	043587	075732	5.96	0.869	79.80	0.84	81.03	0.75	K0 IV-V	3
$08\ 54\ 17.95$	$-05\ 26\ 04.1$	043726	076151	6.01	0.661	58.50	0.88	57.52	0.39	G3 V	2
$08\ 58\ 43.93$	$-16\ 07\ 57.8$	044075	076932	5.80	0.521	46.90	0.97	47.54	0.31	G2 V	2
09 08 51.07	$+33\ 52\ 56.0$	044897	078366	5.95	0.585	52.25	0.87	52.11	0.33	G0 IV-V	3
$09\ 12\ 17.55$	$+14\ 59\ 45.7$	045170	079096	6.49	0.731	48.83	0.92	49.11	0.54	G9 V	3
$09\ 14\ 20.54$	$+61\ 25\ 23.9$	045333	079028	5.18	0.605	51.12	0.72	51.10	0.32	G0 IV-V	3
$09\ 17\ 53.46$	$+28\ 33\ 37.9$	045617	079969	7.20	0.992	57.05	1.08	57.92	0.76	K3 V	3
$09\ 22\ 25.95$	$+40\ 12\ 03.8$	045963	080715	7.69	0.987	41.19	1.08	40.10	0.64	K2.5 V	3
09 30 28.09	$-32\ 06\ 12.2$	046626	082342	8.31	0.985	51.71	0.91	51.79	0.85	K3.5 V	2
09 32 25.57	$-11\ 11\ 04.7$	046816	082558	7.82	0.933	54.52	0.99	53.70	0.84	K0	1
09 32 43.76	$+26\ 59\ 18.7$	046843	082443	7.05	0.779	56.35	0.89	56.20	0.60	G9 V	3
09 35 39.50	$+35\ 48\ 36.5$	047080	082885	5.40	0.770	89.45	0.78	87.96	0.32	G8+ V	3
09 42 14.42	$-23\ 54\ 56.1$	047592	084117	4.93	0.534	67.19	0.73	66.61	0.21	F8 V	2
09 48 35.37	$+46\ 01\ 15.6$	048113	084737	5.08	0.619	54.26	0.74	54.44	0.28	G0 IV-V	3
10 01 00.66	$+31\ 55\ 25.2$	049081	086728	5.37	0.676	67.14	0.83	66.46	0.32	G4 V	3
10 04 37.66	$-11\ 43\ 46.9$	049366	087424	8.15	0.891	43.14	1.11	41.61	0.95	K2 V	2
10 08 43.14	$+34\ 14\ 32.1$	049699	087883	7.56	0.965	55.37	0.94	54.93	0.54	K2.5 V	3
10 13 24.73	$-33\ 01\ 54.2$	050075	088742	6.38	0.592	43.98	0.72	43.77	0.41	G0 V	2
10 17 14.54	$+23\ 06\ 22.4$	050384	089125	5.81	0.500	44.01	0.75	43.85	0.36	F6 V	3
10 18 51.95	+44 02 54.0	050505	089269	6.66	0.653	48.45	0.85	49.41	0.50	G4 V	3
10 23 55.27	$-29\ 38\ 43.9$	050921	090156	6.92	0.659	45.26	0.75	44.74	0.49	G5 V	2
10 28 03.88	$+48\ 47\ 05.6$	051248	090508	6.42	0.610	42.45	0.77	43.65	0.43	G0 V	3
10 30 37.58	+55 58 49.9	051459	090839	4.82	0.541	77.82	0.65	78.25	0.28	F8 V	3
10 31 21.82	$-53\ 42\ 55.7$	051523	091324	4.89	0.500	45.72	0.51	45.85	0.19	F9 V	2
10 35 11.27	+84 23 57.6	051819	090343	7.29	0.819	47.55	0.60	48.24	0.49	K0	1
10 36 32.38	$-12\ 13\ 48.4$	051933	091889	5.71	0.528	40.67	0.68	39.88	0.37	F8 V	2
10 42 13.32	$-13\ 47\ 15.8$	052369	092719	6.79	0.622	42.73	0.82	41.97	0.47	G1.5 V	$\overline{2}$
10 43 28.27	$-29\ 03\ 51.4$	052462	092945	7.72	0.873	46.36	0.84	46.73	0.69	K1.5 V	2
10 56 30.80	$+07\ 23\ 18.5$	053486	094765	7.37	0.920	56.98	1.03	57.79	0.87	K2.5 V	3
10 59 27.97	$+40\ 25\ 48.9$	053721	095128	5.03	0.624	71.04	0.66	71.11	0.25	G0 V	1
11 04 41.47	$-04\ 13\ 15.9$	054155	096064	7.64	0.770	40.57	1.40	38.06	0.99	G8+ V	3
11 04 41.47	$+38\ 25\ 35.9$	054426	096612	8.35	0.942	43.91	1.03	44.29	0.84	K3- V	3
11 12 01.19	$-26\ 08\ 12.0$	054704	097343	7.05	0.760	46.22	0.84	45.16	0.50	G8.5 V	2
11 12 32.35	$+35\ 48\ 50.7$	054745	097334	6.41	0.600	46.04	0.90	45.61	0.44	G1 V	3
11 14 33.16	$+25\ 42\ 37.4$	054906	097658	7.76	0.845	46.95	0.97	47.36	0.75	K1 V	3
11 11 00.10	120 12 01.4	00 1000	001000	1.10	0.040	10.00	0.01	11.00	0.10	171 A	9

Table 1—Continued

				Hipp	oarcos	Hippo	ircos	van Leei	ıwen (2007b)		
R.A.	Decl.	HIP	$_{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B-V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
11 18 10.95	+31 31 45.7	055203	098230	3.79	0.606	119.70 ^a	$0.80^{\rm a}$			G0 V	1
11 18 22.01	$-05\ 04\ 02.3$	055210	098281	7.29	0.732	45.48	1.00	46.36	0.64	G8 V	1
11 26 45.32	$+03\ 00\ 47.2$	055846	099491	6.49	0.778	56.59	1.40	56.35	0.75	K0 IV	1
11 31 44.95	$+14\ 21\ 52.2$	056242	100180	6.27	0.570	43.42	1.10	42.87	1.22	F9.5 V	3
11 34 29.49	$-32\ 49\ 52.8$	056452	100623	5.96	0.811	104.84	0.81	104.61	0.37	K0- V	2
11 38 44.90	$+45\ 06\ 30.3$	056809	101177	6.29	0.566	42.94	0.95	43.01	0.73	F9.5 V	3
11 38 59.72	$+42\ 19\ 43.7$	056829	101206	8.22	0.980	50.61	1.15	50.19	1.03	K5 V	1
11 41 03.02	$+34\ 12\ 05.9$	056997	101501	5.31	0.723	104.81	0.72	104.04	0.26	G8 V	3
11 46 31.07	$-40\ 30\ 01.3$	057443	102365	4.89	0.664	108.23	0.70	108.45	0.22	G2 V	2
11 47 15.81	$-30\ 17\ 11.4$	057507	102438	6.48	0.681	56.26	0.77	57.23	0.41	G6 V	2
11 50 41.72	$+01\ 45\ 53.0$	057757	102870	3.59	0.518	91.74	0.77	91.50	0.22	F8 V	1
11 52 58.77	+37 43 07.2	057939	103095	6.42	0.754	109.21	0.78	109.99	0.41	K1 V	3
11 59 10.01	$-20\ 21\ 13.6$	058451	104067	7.92	0.974	48.04	1.03	47.47	0.90	K3- V	2
12 00 44.45	$-10\ 26\ 45.6$	058576	104304	5.54	0.760	77.48	0.80	78.35	0.31	G8 IV-V	3
12 09 37.26	$+40\ 15\ 07.4$	059280	105631	7.46	0.794	41.07	0.98	40.77	0.66	G9 V	3
12 30 50.14	+53 04 35.8	061053	108954	6.20	0.568	45.58	0.62	45.92	0.35	F9 V	3
12 33 31.38	$-68\ 45\ 20.9$	061291	109200	7.13	0.836	61.83	0.63	61.82	0.48	K1 V	2
12 33 44.54	+41 21 26.9	061317	109358	4.24	0.588	119.46	0.83	118.49	0.20	G0 V	3
12 41 44.52	+55 43 28.8	061946	110463	8.27	0.955	43.06	0.82	42.78	0.81	K3 V	1
12 44 14.55	+51 45 33.5	062145	110833	7.01	0.936	66.40	0.78	67.20	0.66	K3 V	1
12 44 59.41	+39 16 44.1	062207	110897	5.95	0.557	57.57	0.64	57.55	0.32	F9 V	3
12 45 14.41	$-57\ 21\ 28.8$	062229	110810	7.82	0.937	49.71	0.95	48.79	0.88	K2+ V	2
12 48 32.31	$-15\ 43\ 10.1$	062505	111312	7.93	0.946	47.19	1.93	41.96	3.00	K2.5 V	$\overline{2}$
12 48 47.05	$+24\ 50\ 24.8$	062523	111395	6.29	0.703	58.23	0.99	59.06	0.45	G7 V	3
12 59 01.56	$-09\ 50\ 02.7$	063366	112758	7.54	0.769	47.60	0.86	47.87	0.90	K2 V	3
12 59 32.78	+41 59 12.4	063406	112914	8.60	0.940	41.36	1.48	39.71	1.00	K3- V	3
13 03 49.66	-05 09 42.5	063742	113449	7.69	0.847	45.20	1.27	46.10	0.81	K1 V	3
13 11 52.39	$+27\ 52\ 41.5$	064394	114710	4.23	0.572	109.23	0.72	109.54	0.17	G0 V	1
13 12 03.18	$-37\ 48\ 10.9$	064408	114613	4.85	0.693	48.83	0.79	48.38	0.29	G4 IV	2
13 12 43.79	$-02\ 15\ 54.1$	064457	114783	7.56	0.930	48.95	1.06	48.78	0.59	K1 V	3
13 13 52.23	$-45\ 11\ 08.9$	064550	114853	6.93	0.643	40.87	0.84	40.95	0.56	G1.5 V	2
13 15 26.45	$-87\ 33\ 38.5$	064690	113283	7.11	0.710	40.52	0.56	40.70	0.38	G5 V	$\overline{2}$
13 16 46.52	+09 25 27.0	064792	115383	5.19	0.585	55.71	0.85	56.95	0.26	G0 Vs	1
13 16 51.05	+17 01 01.9	064797	115404	6.49	0.926	89.07	0.99	90.32	0.74	K2.5 V	3
13 18 24.31	$-18\ 18\ 40.3$	064924	115617	4.74	0.709	117.30	0.71	116.89	0.22	G7 V	2
13 23 39.15	$+02\ 43\ 24.0$	065352	116442	7.06	0.780	62.41	1.41	64.73	1.33	G9 V	3
13 25 45.53	$+56\ 58\ 13.8$	065515	116956	7.29	0.804	45.76	0.72	46.31	0.51	G9 V	3
13 25 59.86	$+63\ 15\ 40.6$	065530	117043	6.50	0.739	46.86	0.55	47.24	0.31	G6 V	1
13 28 25.81	$+13\ 46\ 43.6$	065721	117176	4.97	0.733 0.714	55.22	0.73	55.60	0.24	G5 V	1
13 41 04.17	$-34\ 27\ 51.0$	066765	118972	6.92	0.855	64.08	0.81	63.88	0.49	K0 V	2
13 41 13.40	+56 43 37.8	066781	119332	7.77	0.830	42.12	0.76	40.59	0.53	K0 IV-V	1
13 47 15.74	$+17\ 27\ 24.9$	067275	120136	4.50	0.508	64.12	0.70	64.03	0.19	F7 V	1
10 11 10.14	1 1 2 1 2 1 2 1 3	001210	120100	1.00	0.000	01.14	0.10	0 2.00	0.10	- 1 V	

Table 1—Continued

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					Hipp	oarcos	Hippe	arcos	van Leeu	wen (2007b)		
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (13) (14) (15) (6) (7) (8) (9) (10) (11) (12) (12) (13) (14) (15) (15) (16) (16) (17) (18) (19) (10) (11) (12) (12) (13) (14) (15) (14) (15) (15) (15) (15) (15) (15) (15) (15	R.A.	Decl.	HIP				π	σ_{π}	π	σ_{π}	Spec	
13 51 20.33	` ,	,		Name	V		` /	(mas)	\ /	(mas)	Type	Ref
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-											
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	13 51 20.33	$-24\ 23\ 25.3$	067620	120690	6.43	0.703	50.20	0.85	51.35		G5+ V	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$13\ 51\ 40.40$	$-57\ 26\ 08.4$	067655	120559	7.97	0.663	40.02	1.00	39.42		G7 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$13\ 52\ 35.87$	$-50\ 55\ 18.3$	067742	120780	7.37	0.891	60.86	0.95	58.55	0.68	K2 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$13\ 54\ 41.08$	$+18\ 23\ 51.8$	067927	121370	2.68	0.580	88.17	0.75	87.75	1.24	G0 IV	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$13\ 55\ 49.99$	$+14\ 03\ 23.4$	068030	121560	6.16	0.518	41.28	0.79	40.22	0.37	F6 V	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 03\ 32.35$	$+10\ 47\ 12.4$	068682	122742	6.27	0.733	60.24	0.78	58.88	0.62	G6 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 11\ 46.17$	$-12\ 36\ 42.4$	069357	124106	7.93	0.865	43.35	1.40	42.76	1.22	K1 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 12\ 45.24$	$-03\ 19\ 12.3$	069414	124292	7.05	0.733	44.89	1.01	45.35	0.54	G8+ V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 15\ 38.68$	$-45\ 00\ 02.7$	069671	124580	6.31	0.596	47.51	0.78	47.13	0.42	G0 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 16\ 00.87$	$-06\ 00\ 02.0$	069701	124850	4.07	0.511	46.74	0.87	44.97	0.19	F7 V	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 19\ 00.90$	$-25\ 48\ 55.5$	069965	125276	5.87	0.518	56.23	0.94	55.45	0.82	F9 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 19\ 34.86$	$-05\ 09\ 04.3$	070016	125455	7.58	0.867	48.12	1.11	47.89	0.81	K1 V	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 23\ 15.28$	$+01\ 14\ 29.6$	070319	126053	6.25	0.639	56.82	1.04	58.17	0.53	G1.5 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 29\ 22.30$	$+80\ 48\ 35.5$	070857	128642	6.88	0.774	51.04	0.58	50.27	0.48	G5	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 29\ 36.81$	$+41\ 47\ 45.3$	070873	127334	6.36	0.702	42.43	0.59	42.12	0.38	G5 V	3
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 33\ 28.87$	$+52\ 54\ 31.6$	071181	128165	7.24	0.997	74.50	0.69	75.65	0.42	K3 V	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	14 36 00.56		071395	128311	7.48	0.973	60.35	0.99	60.60	0.83	K3- V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 39 36.50	$-60\ 50\ 02.3$	071683	128620	-0.01	0.710	742.12	1.40	754.81	4.11	G2 V	2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 40 31.11	$-16\ 12\ 33.4$	071743	128987	7.24	0.710	42.43	0.97	42.23	0.54	G8 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$14\ 41\ 52.46$	$-75\ 08\ 22.1$	071855	128400	6.73	0.707	49.15	0.64	50.01	0.43	G5 V	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	14 45 24.18	$+13\ 50\ 46.7$	072146	130004	7.87	0.931	51.20	0.98	52.92	0.82	K2.5 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		$+02\ 42\ 11.6$	072312	130307	7.76	0.893	50.84	1.04	51.62	0.79	K2.5 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 49 23.72	$-67\ 14\ 09.5$	072493	130042	7.26	0.836	41.69	1.24	40.11	0.89	K1 V	2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 50 15.81	$+23\ 54\ 42.6$	072567	130948	5.86	0.576	55.73	0.80	55.03		G2 V	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 51 23.38	$+19\ 06\ 01.7$	072659	131156		0.720	149.26	0.76	148.98	0.48	G7 V	3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$14\ 53\ 23.77$	+19 09 10.1	072848	131511	6.00	0.841		0.81	86.88		K0 V	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 53 41.57	$+23\ 20\ 42.6$	072875	131582	8.65	0.934	43.66	1.20	42.47	1.12	K3 V	1
$\begin{array}{cccccccccccccccccccccccccccccccccccc$												
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			073100	132254	5.63	0.533	40.25	0.54	39.83	0.26	F8- V	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	14 58 08.80	$-48\ 51\ 46.8$	073241	131923	6.34	0.708	40.79	0.86	41.93	0.83	G4 V	
15 10 44.74 -61 25 20.3 074273 134060 6.29 0.623 41.41 0.77 41.32 0.45 G0 V 2 15 13 50.89 -01 21 05.0 074537 135204 6.58 0.763 57.80 0.85 56.59 0.49 G9 V 3 15 15 59.17 +00 47 46.9 074702 135599 6.92 0.830 64.19 0.97 63.11 0.70 K0 V 3 15 19 18.80 +01 45 55.5 074975 136202 5.04 0.540 40.46 0.81 39.40 0.29 F8 III-IV 1 15 21 48.15 -48 19 03.5 075181 136352 5.65 0.639 68.70 0.79 67.51 0.39 G2- V 2 15 22 36.69 -10 39 40.0 075253 136713 7.97 0.970 45.83 1.41 45.22 1.12 K3 IV-V 3	15 03 47.30	$+47\ 39\ 14.6$	073695	133640	4.83	0.647	78.39	1.03	79.95	1.56		1
15 13 50.89 -01 21 05.0 074537 135204 6.58 0.763 57.80 0.85 56.59 0.49 G9 V 3 15 15 59.17 +00 47 46.9 074702 135599 6.92 0.830 64.19 0.97 63.11 0.70 K0 V 3 15 19 18.80 +01 45 55.5 074975 136202 5.04 0.540 40.46 0.81 39.40 0.29 F8 III-IV 1 15 21 48.15 -48 19 03.5 075181 136352 5.65 0.639 68.70 0.79 67.51 0.39 G2- V 2 15 22 36.69 -10 39 40.0 075253 136713 7.97 0.970 45.83 1.41 45.22 1.12 K3 IV-V 3												
15 15 59.17 +00 47 46.9 074702 135599 6.92 0.830 64.19 0.97 63.11 0.70 K0 V 3 15 19 18.80 +01 45 55.5 074975 136202 5.04 0.540 40.46 0.81 39.40 0.29 F8 III-IV 1 15 21 48.15 -48 19 03.5 075181 136352 5.65 0.639 68.70 0.79 67.51 0.39 G2- V 2 15 22 36.69 -10 39 40.0 075253 136713 7.97 0.970 45.83 1.41 45.22 1.12 K3 IV-V 3												
15 19 18.80 +01 45 55.5 074975 136202 5.04 0.540 40.46 0.81 39.40 0.29 F8 III-IV 1 15 21 48.15 -48 19 03.5 075181 136352 5.65 0.639 68.70 0.79 67.51 0.39 G2- V 2 15 22 36.69 -10 39 40.0 075253 136713 7.97 0.970 45.83 1.41 45.22 1.12 K3 IV-V 3												
15 21 48.15												
$15\ 22\ 36.69\ -10\ 39\ 40.0\ 075253\ 136713\ 7.97\ 0.970\ 45.83\ 1.41\ 45.22\ 1.12\ \text{K3 IV-V}\ 3$												
10 11 10 10 10 10 10 10 10 10 10 10 10 1												
$15\ 23\ 12.31\ \ +30\ 17\ 16.1\ \ 075312\ \ 137107\ \ \ 4.99\ \ 0.577\ \ \ 53.70\ \ \ 1.24\ \ \ 55.98\ \ \ \ 0.78\ \ \ \ \ G2\ V\ \ \ 1$		•										
15 28 09.61 -09 20 53.1 075718 137763 6.89 0.788 50.34 1.11 48.58 1.33 G9 V 3												
15 29 11.18 +80 26 55.0 075809 139777 6.57 0.665 45.32 0.57 45.77 0.37 G1.5 V(n) 3												
15 36 02.22 +39 48 08.9 076382 139341 6.78 0.906 45.85 0.79 44.83 0.60 K1 V 3											` /	

Table 1—Continued

-				Нірр	oarcos	Hippe	arcos	van Leeu	iwen (2007b)		
R.A.	Decl.	HIP	$^{\mathrm{HD}}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B-V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
15 44 01.82	+02 30 54.6	077052	140538	5.86	0.684	68.16	0.87	68.22	0.66	G5 V	1
$15\ 46\ 26.61$	$+07\ 21\ 11.1$	077257	141004	4.42	0.604	85.08	0.80	82.48	0.32	G0 IV-V	3
$15\ 47\ 29.10$	$-37\ 54\ 58.7$	077358	140901	6.01	0.715	65.60	0.77	65.13	0.40	G7 IV-V	2
$15\ 48\ 09.46$	$+01\ 34\ 18.3$	077408	141272	7.44	0.801	46.84	1.05	46.97	0.80	G9 V	3
$15\ 52\ 40.54$	$+42\ 27\ 05.5$	077760	142373	4.60	0.563	63.08	0.54	62.92	0.21	G0 V	3
$15\ 53\ 12.10$	$+13\ 11\ 47.8$	077801	142267	6.07	0.598	57.27	0.88	57.64	0.54	G0 IV	1
$16\ 01\ 02.66$	$+33\ 18\ 12.6$	078459	143761	5.39	0.612	57.38	0.71	58.02	0.28	G0 V	3
$16\ 01\ 53.35$	$+58 \ 33 \ 54.9$	078527	144284	4.01	0.528	47.79	0.54	47.54	0.12	F8 IV-V	1
$16\ 04\ 03.71$	$+25\ 15\ 17.4$	078709	144287	7.10	0.771	46.56	0.89	45.01	0.79	G8+V	3
$16\ 04\ 56.79$	$+39\ 09\ 23.4$	078775	144579	6.66	0.734	69.61	0.57	68.87	0.33	K0 V	3
$16\ 06\ 29.60$	$+38\ 37\ 56.1$	078913	144872	8.58	0.963	42.57	0.86	42.55	0.77	K3 V	3
$16\ 09\ 42.79$	$-56\ 26\ 42.5$	079190	144628	7.11	0.856	69.66	0.90	68.17	0.64	K1 V	2
$16\ 10\ 24.31$	$+43\ 49\ 03.5$	079248	145675	6.61	0.877	55.11	0.59	56.91	0.34	K0 IV-V	3
$16\ 13\ 18.45$	$+13\ 31\ 36.9$	079492	145958	6.68	0.764	41.05	1.58	42.40	1.12	G9 V	3
$16\ 13\ 48.56$	$-57\ 34\ 13.8$	079537	145417	7.53	0.815	72.75	0.82	72.01	0.68	K3 V	2
16 14 11.93	$-31\ 39\ 49.1$	079578	145825	6.55	0.646	45.73	0.95	46.40	0.62	G2 V	2
16 14 40.85	$+33\ 51\ 31.0$	079607	146361	5.23	0.599	46.11	0.98	47.44	1.22	G1 IV-V	3
$16\ 15\ 37.27$	$-08\ 22\ 10.0$	079672	146233	5.49	0.652	71.30	0.89	71.94	0.37	G2 V	3
16 24 01.29	$-39\ 11\ 34.7$	080337	147513	5.37	0.625	77.69	0.86	78.26	0.37	G1 V	2
16 24 19.81	$-13\ 38\ 30.0$	080366	147776	8.40	0.950	46.44	1.20	46.46	1.06	K3- V	2
16 28 28.14	$-70\ 05\ 03.8$	080686	147584	4.90	0.555	82.61	0.57	82.53	0.52	F9 V	2
16 28 52.67	$+18\ 24\ 50.6$	080725	148653	6.98	0.848	51.20	1.49	50.87	0.80	K2 V	3
16 31 30.03	$-39\ 00\ 44.2$	080925	148704	7.24	0.858	40.60	1.75	40.77	2.01	K1 V	2
16 36 21.45	$-02\ 19\ 28.5$	081300	149661	5.77	0.827	102.27	0.85	102.55	0.40	K0 V	3
16 37 08.43	+00 15 15.6	081375	149806	7.09	0.828	49.63	0.92	49.18	0.62	K0 V	3
16 39 04.14	$-58\ 15\ 29.5$	081520	149612	7.01	0.616	46.13	0.91	44.54	0.54	G5 V	2
16 42 38.58	+68 06 07.8	081813	151541	7.56	0.769	41.15	0.57	39.97	0.45	K1 V	1
16 52 58.80	$-00\ 01\ 35.1$	082588	152391	6.65	0.749	59.04	0.87	57.97	0.66	G8+ V	3
16 57 53.18	$+47\ 22\ 00.1$	083020	153557	7.76	0.980	55.71	1.21	54.63	0.61	K3 V	3
17 02 36.40	+47 04 54.8	083389	154345	6.76	0.728	55.37	0.55	53.80	0.32	G8 V	1
17 04 27.84	$-28\ 34\ 57.6$	083541	154088	6.59	0.814	55.31	0.89	56.06	0.50	K0 IV-V	2
17 05 16.82	+00 42 09.2	083601	154417	6.00	0.578	49.06	0.89	48.39	0.40	F9 V	3
17 10 10.35	-60 43 43.6	083990	154577	7.38	0.889	73.07	0.91	73.41	0.70	K2.5 V	2
17 12 37.62	$+18\ 21\ 04.3$	084195	155712	7.95	0.941	48.69	1.03	47.70	0.93	K2.5 V	3
17 15 20.98	$-26\ 36\ 10.2$	084405	155885	4.33	0.855	167.08	1.07	168.54	0.54	K1.5 V	2
17 19 03.83	$-46\ 38\ 10.4$	084720	156274	5.47	0.764	113.81	1.36	113.61	0.69	M0 V	1
17 20 39.57	+32 28 03.9	084862	157214	5.38	0.619	69.48	0.56	69.80	0.25	G0 V	1
17 22 51.29	$-02\ 23\ 17.4$	085042	157347	6.28	0.680	51.39	0.85	51.22	0.40	G3 V	3
17 25 00.10	$+67\ 18\ 24.1$	085235	158633	6.44	0.759	78.14	0.53	78.11	0.30	K0 V	1
17 30 16.43	$+47\ 24\ 07.9$	085653	159062	7.22	0.737	44.77	0.59	44.91	0.50	G9 V	3
17 30 10.43	$-01 \ 03 \ 46.5$	085667	158614	5.31	0.737	60.80	1.42	61.19	0.68	G8 IV-V	1
17 32 00.99	$+34\ 16\ 16.1$	085810	159222	6.52	0.639	42.20	0.56	41.81	0.35	G1 V	3
11 02 00.00	104 10 10.1	000010	100222	0.02	0.000	44.40	0.00	41.01	0.00	OI V	0

Table 1—Continued

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (12) (17) (18) (19) (10) (11) (12) (12) (17) (17) (18) (19) (10) (11) (12) (12) (17) (17) (18) (19) (10) (11) (12) (12) (17) (17) (18) (19) (10) (11) (12) (12) (17) (17) (17) (17) (17) (17) (17) (17
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
$\begin{array}{cccccccccccccccccccccccccccccccccccc$
18 38 53.40 -21 03 06.7 091438 172051 5.85 0.673 77.02 0.85 76.43 0.47 G6 V 2 18 40 54.88 +31 31 59.1 091605 8.54 0.865 41.88 1.59 42.48 1.11 K2.5 V 3 18 55 18.80 -37 29 54.1 092858 175073 7.98 0.857 41.84 1.19 41.31 0.98 K1 V 2 18 55 53.22 +23 33 23.9 092919 175742 8.16 0.910 46.64 1.03 46.74 0.85 K0 V 1 18 57 01.61 +32 54 04.6 093017 176051 5.20 0.594 66.76 0.54 67.24 0.37 G0 V 1 18 58 51.00 +30 10 50.3 093185 176377 6.80 0.606 42.68 0.64 41.94 0.47 G1 V 3
$\begin{array}{cccccccccccccccccccccccccccccccccccc$
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18 55 53.22 +23 33 23.9 092919 175742 8.16 0.910 46.64 1.03 46.74 0.85 K0 V 1 18 57 01.61 +32 54 04.6 093017 176051 5.20 0.594 66.76 0.54 67.24 0.37 G0 V 1 18 58 51.00 +30 10 50.3 093185 176377 6.80 0.606 42.68 0.64 41.94 0.47 G1 V 3
18 55 53.22 +23 33 23.9 092919 175742 8.16 0.910 46.64 1.03 46.74 0.85 K0 V 1 18 57 01.61 +32 54 04.6 093017 176051 5.20 0.594 66.76 0.54 67.24 0.37 G0 V 1 18 58 51.00 +30 10 50.3 093185 176377 6.80 0.606 42.68 0.64 41.94 0.47 G1 V 3
$18\ 58\ 51.00\ \ +30\ 10\ 50.3\ \ 093185\ \ 176377 \qquad 6.80 0.606 \qquad 42.68 0.64 \ 41.94 \qquad 0.47 \qquad \qquad G1\ V \qquad 3$
·
19 06 52.46 -37 48 38.4 093858 177565 6.15 0.705 58.24 0.91 58.98 0.47 G6 V 2
19 07 57.32 +16 51 12.2 093966 178428 6.08 0.705 47.72 0.77 46.66 0.48 G5 IV-V 3
19 12 05.03 +49 51 20.7 094336 179957 5.85 0.666 40.16 0.83 40.90 0.58 G3 V 3
19 12 11.36 +57 40 19.1 094346 180161 7.04 0.804 50.00 0.54 49.96 0.32 G8 V 1
19 21 29.76 -34 59 00.6
$19\ 23\ 34.01 +33\ 13\ 19.1 095319 182488 \qquad 6.37 0.804 \qquad 64.54 0.60 \qquad 63.45 \qquad 0.35 \qquad G9+V 3$
19 24 58.20 +11 56 39.9 095447 182572 5.17 0.761 66.01 0.77 65.89 0.26 G8 IVvar 1
19 31 07.97 +58 35 09.6 095995 184467 6.60 0.859 59.84 0.64 58.96 0.65 K2 V 3
19 32 06.70 -11 16 29.8 096085 183870 7.53 0.922 55.50 0.90 56.73 0.72 K2.5 V 2
19 32 21.59 +69 39 40.2 096100 185144 4.67 0.786 173.41 0.46 173.77 0.18 G9 V 3
19 33 25.55 +21 50 25.2 096183 184385 6.89 0.745 49.61 0.94 48.64 0.63 G8 V 3
19 35 55.61 +56 59 02.0 096395 185414 6.73 0.636 41.24 0.49 41.48 0.30 G0 1
19 41 48.95 +50 31 30.2 096895 186408 5.99 0.643 46.25 0.50 47.44 0.27 G1.5 V 3
19 45 33.53 +33 36 07.2 097222 186858 7.68 1.000 49.09 1.43 47.34 0.82 K3+ V 3
19 51 01.64 +10 24 56.6 097675 187691 5.12 0.563 51.57 0.77 52.11 0.29 F8 V 1
19 59 47.34 -09 57 29.7
20 00 43.71 +22 42 39.1 098505 189733 7.67 0.932 51.94 0.87 51.41 0.69 K2 V 3
20 02 34.16 +15 35 31.5 098677 190067 7.15 0.714 51.71 0.83 52.71 0.65 K0 V 3

Table 1—Continued

				Hipp	parcos	Hippe	arcos	van Leeu	wen (2007b)		
R.A.	Decl.	HIP	$^{\mathrm{HD}}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B - V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
20 03 37.41	$+29\ 53\ 48.5$	098767	190360	5.73	0.749	62.92	0.62	63.06	0.34	G7 IV-V	3
20 03 52.13	$+23\ 20\ 26.5$	098792	190404	7.28	0.815	64.17	0.85	63.43	0.57	K1 V	3
20 04 06.22	$+17\ 04\ 12.6$	098819	190406	5.80	0.600	56.60	0.76	56.28	0.35	G0 V	3
20 04 10.05	$+25\ 47\ 24.8$	098828	190470	7.82	0.924	46.28	0.91	45.56	0.77	K2.5 V	3
20 05 09.78	$+38\ 28\ 42.4$	098921	190771	6.18	0.654	52.99	0.55	53.22	0.36	G2 V	3
$20\ 05\ 32.76$	$-67\ 19\ 15.2$	098959	189567	6.07	0.648	56.45	0.74	56.41	0.44	G2 V	2
20 07 35.09	$-55\ 00\ 57.6$	099137	190422	6.26	0.530	43.08	0.79	42.68	0.45	F9 V	2
20 08 43.61	$-66\ 10\ 55.4$	099240	190248	3.55	0.751	163.73	0.65	163.71	0.17	G8 IV	2
20 09 34.30	$+16\ 48\ 20.8$	099316	191499	7.56	0.810	41.07	1.18	42.26	0.99	G9 V	3
$20\ 11\ 06.07$	$+16\ 11\ 16.8$	099452	191785	7.34	0.830	48.83	0.91	49.04	0.65	K0 V	3
$20\ 11\ 11.94$	$-36\ 06\ 04.4$	099461	191408	5.32	0.868	165.24	0.90	166.25	0.27	K2.5 V	2
$20\ 13\ 59.85$	$-00\ 52\ 00.8$	099711	192263	7.79	0.938	50.27	1.13	51.77	0.78	K2.5 V	3
$20\ 15\ 17.39$	$-27\ 01\ 58.7$	099825	192310	5.73	0.878	113.33	0.89	112.22	0.30	K2+V	2
$20\ 17\ 31.33$	$+66\ 51\ 13.3$	100017	193664	5.91	0.602	56.92	0.52	56.92	0.24	G0 V	3
$20\ 27\ 44.24$	$-30\ 52\ 04.2$	100925	194640	6.61	0.724	51.50	0.82	51.22	0.54	G8 V	2
$20\ 32\ 23.70$	$-09\ 51\ 12.2$	101345	195564	5.66	0.689	41.26	0.87	40.98	0.33	G2 V	3
20 32 51.64	$+41\ 53\ 54.5$	101382	195987	7.08	0.796	44.99	0.64	45.35	0.43	G9 V	3
20 40 02.64	$-60\ 32\ 56.0$	101983	196378	5.11	0.544	41.33	0.73	40.55	0.27	G0 V	2
20 40 11.76	$-23\ 46\ 25.9$	101997	196761	6.36	0.719	68.28	0.82	69.53	0.40	G8 V	2
20 40 45.14	$+19\ 56\ 07.9$	102040	197076	6.43	0.611	47.65	0.76	47.74	0.48	G1 V	3
20 43 16.00	$-29\ 25\ 26.1$	102264	197214	6.95	0.671	44.57	0.87	44.83	0.91	G6 V	2
20 49 16.23	$+32\ 17\ 05.2$	102766	198425	8.25	0.939	42.23	0.98	41.58	0.83	K2.5 V	3
20 56 47.33	$-26\ 17\ 47.0$	103389	199260	5.70	0.507	47.61	0.95	45.52	0.38	F6 V	2
20 57 40.07	$-44\ 07\ 45.7$	103458	199288	6.52	0.587	46.26	0.81	45.17	0.46	G2 V	2
21 02 40.76	$+45\ 53\ 05.2$	103859	200560	7.69	0.970	51.65	0.72	51.36	0.63	K2.5 V	3
21 07 10.38	$-13\ 55\ 22.6$	104239	200968	7.12	0.901	56.67	1.18	56.90	0.60	G9.5 V	2
21 09 20.74	$-82\ 01\ 38.1$	104436	199509	6.98	0.619	41.28	0.58	41.95	0.37	G1 V	$\overline{2}$
21 09 22.45	$-73\ 10\ 22.7$	104440	200525	5.67	0.590	53.38	2.18	50.59	1.52	F9.5 V	2
21 14 28.82	+10 00 25.1	104858	202275	4.47	0.529	54.11	0.85	54.09	0.66	F7 V	3
21 18 02.97	$+00\ 09\ 41.7$	105152	202751	8.15	0.990	52.03	1.23	50.46	1.03	K3 V	3
21 18 27.27	$-43\ 20\ 04.7$	105184	202628	6.75	0.637	42.04	0.90	40.95	0.46	G1.5 V	2
21 19 45.62	$-26\ 21\ 10.4$	105312	202940	6.56	0.737	53.40	1.09	55.65	0.62	G7 V	2
21 24 40.64	$-68\ 13\ 40.2$	105312 105712	203244	6.98	0.723	48.86	0.81	48.97	0.68	G8 V	2
21 26 58.45	$-56\ 07\ 30.9$	105712	203244	8.65	0.723	43.12	1.17	43.47	1.01	K2.5 V	2
21 27 01.33	-44 48 30.9	105905	203985	7.49	0.924 0.876	43.12 42.52	1.17	42.54	1.32	K2.5 V K2 III-IV	2
21 36 41.24	$-44\ 48\ 30.9$ $-50\ 50\ 43.4$	106696	205390	7.49 7.14	0.879	67.85	0.92	68.40	0.58	K2 111-1 V K1.5 V	2
21 40 29.77	$-50\ 50\ 45.4$ $-74\ 04\ 27.4$	107022	205536	7.14 7.07	0.755	45.17	0.92 0.67	45.41	0.58 0.52	G9 V	2
		107022	205556				0.69	45.41 44.97		G9 V F6 V	3
21 44 08.58	+28 44 33.5	107310 107350		$4.49 \\ 5.96$	$0.512 \\ 0.587$	44.64			0.43	G0 IV-V	ა 3
21 44 31.33	+14 46 19.0		206860			54.37	0.85	55.91	0.45		$\frac{3}{2}$
21 48 00.05	-40 15 21.9	107625	207144	8.62	0.960	42.12	1.06	42.20	0.93	K3 V	
21 48 15.75	-47 18 13.0	107649	207129	5.57	0.601	63.95	0.78	62.52	0.35	G0 V	2
$21\ 53\ 05.35$	$+20\ 55\ 49.9$	108028	208038	8.18	0.937	41.71	0.98	43.40	0.75	K2.5 V	3

Table 1—Continued

				Hipp	arcos	Hippe	arcos	van Leeu	wen (2007b)		
R.A.	Decl.	HIP	$^{ m HD}$			π	σ_{π}	π	σ_{π}	Spec	
(J2000.0)	(J2000.0)	Name	Name	V	B-V	(mas)	(mas)	(mas)	(mas)	Type	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$21\ 54\ 45.04$	$+32\ 19\ 42.9$	108156	208313	7.73	0.911	49.21	0.93	50.11	0.80	K2 V	3
$22\ 09\ 29.87$	$-07 \ 32 \ 55.1$	109378	210277	6.54	0.773	46.97	0.79	46.38	0.48	G8 V	3
$22\ 11\ 11.91$	$+36\ 15\ 22.8$	109527	210667	7.23	0.812	44.57	0.79	43.67	0.53	G9 V	3
$22\ 14\ 38.65$	$-41\ 22\ 54.0$	109821	210918	6.23	0.648	45.19	0.71	45.35	0.37	G2 V	2
$22\ 15\ 54.14$	$+54\ 40\ 22.4$	109926	211472	7.50	0.810	46.62	0.67	46.43	0.50	K0 V	3
$22\ 18\ 15.62$	$-53\ 37\ 37.5$	110109	211415	5.36	0.614	73.47	0.70	72.54	0.36	G0 V	2
$22\ 24\ 56.39$	$-57\ 47\ 50.7$	110649	212330	5.31	0.665	48.81	0.61	48.63	0.34	G2 IV-V	2
$22\ 25\ 51.16$	$-75\ 00\ 56.5$	110712	212168	6.12	0.599	43.39	0.96	43.39	0.50	G0 V	2
$22\ 39\ 50.77$	$+04\ 06\ 58.0$	111888	214683	8.48	0.938	44.10	1.12	41.49	0.76	K3 V	3
$22\ 42\ 36.88$	$-47\ 12\ 38.9$	112117	214953	5.99	0.584	42.47	0.72	42.31	0.40	F9.5 V	2
$22\ 43\ 21.30$	$-06\ 24\ 03.0$	112190	215152	8.11	0.966	46.46	1.31	46.47	0.90	K3 V	3
$22\ 46\ 41.58$	$+12\ 10\ 22.4$	112447	215648	4.20	0.502	61.54	0.77	61.36	0.19	F7 V	1
$22\ 47\ 31.87$	$+83\ 41\ 49.3$	112527	216520	7.53	0.867	50.15	0.64	50.83	0.44	K0 V	3
$22\ 51\ 26.36$	$+13\ 58\ 11.9$	112870	216259	8.29	0.849	47.56	1.18	46.99	1.01	K2.5 V	3
$22\ 57\ 27.98$	$+20\ 46\ 07.8$	113357	217014	5.45	0.666	65.10	0.76	64.07	0.38	G3 V	3
$22\ 58\ 15.54$	$-02\ 23\ 43.4$	113421	217107	6.17	0.744	50.71	0.75	50.36	0.38	G8 IV-V	3
23 03 04.98	$+20\ 55\ 06.9$	113829	217813	6.65	0.620	41.19	0.87	40.46	0.57	G1 V	3
$23\ 10\ 50.08$	$+45\ 30\ 44.2$	114456	218868	6.98	0.750	42.65	0.74	41.15	0.54	G8 V	3
$23\ 13\ 16.98$	$+57\ 10\ 06.1$	114622	219134	5.57	1.000	153.24	0.65	152.76	0.29	K3 V	3
23 16 18.16	$+30\ 40\ 12.8$	114886	219538	8.07	0.871	41.33	0.97	41.63	0.72	K2 V	3
23 16 42.30	$+53\ 12\ 48.5$	114924	219623	5.58	0.556	49.31	0.58	48.77	0.26	F7 V	1
$23\ 16\ 57.69$	$-62\ 00\ 04.3$	114948	219482	5.64	0.521	48.60	0.60	48.69	0.33	F6 V	2
23 19 26.63	$+79\ 00\ 12.7$	115147	220140	7.53	0.893	50.65	0.64	52.07	0.47	K2 V	3
$23\ 21\ 36.51$	$+44\ 05\ 52.4$	115331	220182	7.36	0.801	45.63	0.83	46.46	0.53	G9 V	3
23 23 04.89	$-10\ 45\ 51.3$	115445	220339	7.80	0.881	51.37	1.25	52.29	0.86	K2.5 V	3
$23\ 31\ 22.21$	+59 09 55.9	116085	221354	6.76	0.839	59.31	0.67	59.06	0.45	K0 V	3
$23\ 35\ 25.61$	$+31\ 09\ 40.7$	116416	221851	7.90	0.845	42.63	0.93	42.00	0.72	K1 V	3
23 37 58.49	$+46\ 11\ 58.0$	116613	222143	6.58	0.665	43.26	0.80	42.86	0.42	G3 V	3
23 39 37.39	$-72\ 43\ 19.8$	116745	222237	7.09	0.989	87.72	0.64	87.56	0.51	K3+ V	2
23 39 51.31	$-32\ 44\ 36.3$	116763	222335	7.18	0.802	53.52	0.86	53.85	0.63	G9.5 V	2
23 39 57.04	$+05\ 37\ 34.6$	116771	222368	4.13	0.507	72.51	0.88	72.92	0.15	F7 V	1
23 52 25.32	$+75\ 32\ 40.5$	117712	223778	6.36	0.977	92.68	0.55	91.82	0.30	K3 V	3
23 56 10.67	$-39\ 03\ 08.4$	118008	224228	8.24	0.973	45.28	1.11	45.52	0.93	K2.5 V	2
23 58 06.82	+50 26 51.6	118162	224465	6.72	0.694	41.35	0.76	40.77	0.49	G4 V	3
	, 00 20 01.0		321100	···-	0.001	11.00	00	10	0.10	<u> </u>	

Note. — Column 12 reference codes: (1) The *Hipparcos* catalog; (2) Gray et al. (2006); (3) Gray et al. (2003).

 $^{^{\}mathrm{a}}$ The parallax is from Söderhjelm (1999).

Table 2. Stars Excluded Due to Large Offset from the Main Sequence

				Hip_{I}	parcos	Hippa	rcos				
R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HIP Name (3)	HD Name (4)	V (5)	B - V (6)	π (mas) (7)	σ_{π} (mas) (8)	M_V (9)	$^{\mathrm{MS}}_{V}{}^{\mathrm{a}}_{(10)}$	Spec Type (11)	Ref (12)
00 49 09.90	+05 23 19.0	003829		12.37	0.554	226.95	5.35	14.15	4.21	DG	1
$01\ 55\ 57.47$	$-51\ 36\ 32.0$	009007	011937	3.69	0.844	57.19	0.62	2.48	5.72	G9 IV	2
03 43 14.90	$-09\ 45\ 48.2$	017378	023249	3.52	0.915	110.58	0.88	3.74	6.08	K1 III-IV	2
05 16 41.36	$+45\ 59\ 52.8$	024608	034029	0.08	0.795	77.29	0.89	-0.48	5.48	Late G + Late F III	3
$07\ 34\ 27.43$	$+62\ 56\ 29.4$	036834		10.40	0.942	87.01	2.17	10.10	6.22	M0	4
$07\ 42\ 57.10$	$-45\ 10\ 23.2$	037606	062644	5.04	0.765	41.43	0.81	3.13	5.33	G8 IV-V	2
$07\ 45\ 18.95$	$+28\ 01\ 34.3$	037826	062509	1.16	0.991	96.74	0.87	1.09	6.47	K0 III	5
16 41 17.16	$+31\ 36\ 09.8$	081693	150680	2.81	0.650	92.63	0.60	2.64	4.73	F9 IV	1
18 21 18.60	$-02\ 53\ 55.8$	089962	168723	3.23	0.941	52.81	0.75	1.84	6.22	K0 III-IV	5
19 55 18.79	$+06\ 24\ 24.4$	098036	188512	3.71	0.855	72.95	0.83	3.03	5.78	G9.5 IV	2
19 55 50.36	$-26\ 17\ 58.2$	098066	188376	4.70	0.748	42.03	0.94	2.82	5.24	G5 IV	2
20 06 21.77	$+35\ 58\ 20.9$	099031	191026	5.38	0.850	41.34	0.54	3.46	5.75	K0 IV	5
$20\ 45\ 17.38$	$+61\ 50\ 19.6$	102422	198149	3.41	0.912	69.73	0.49	2.63	6.07	K0 IV	5
$21\ 58\ 24.52$	$+75\ 35\ 20.6$	108467		10.56	0.742	47.95	1.08	8.96	5.21	M0	1
23 19 06.67	$-13\ 27\ 30.8$	115126	219834	5.20	0.787	$40.28^{\rm b}$	$1.51^{\rm b}$	3.23	5.44	G8.5 IV	2

Note. — Column 12 reference codes: (1) The Hipparcos catalog; (2) Gray et al. (2006); (3) Griffin & Griffin (1986); (4) Endl et al. (2006); (5) Gray et al. (2003).

^aThis column lists the absolute magnitude of the Cox (2000) main sequence corresponding to the B-V color of the star.

^bThe parallax is from Söderhjelm (1999).

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Table 3. Stars Excluded Due to Large Parallax Errors $(\sigma_{\pi}/\pi \geq 0.05)$

			Hipparcos Hipparcos van Leeuwen (2007b)		wen (2007b)	Alternate								
R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HIP Name (3)	HD Name (4)	V (5)	B - V (6)	π (mas) (7)	σ_{π} (mas) (8)	π (mas) (9)	σ_{π} (mas) (10)	Spec Type (11)	Ref (12)	π (mas) (13)	σ_{π} (mas) (14)	Method (15)
00 22 23.61	-27 01 57.3	001768	001815	8.30	0.888	44.57	7.12	34.63	4.58	K2 V	1	40		01
$01\ 49\ 23.36$	$-10\ 42\ 12.8$	008486	011131	6.72	0.654	43.47	4.48	44.32	3.02	G1 V	2	43		01
$02\ 15\ 42.55$	$+67\ 40\ 20.2$	010531	013579	7.13	0.920	42.46	2.51	53.82	1.74	K2 V	3	71		01
$02\ 57\ 14.71$	$-24\ 58\ 10.2$	013772	018455	7.33	0.863	44.49	2.55	44.51	2.09	K2 V	1	38.87	1.50	02
$03\ 47\ 02.12$	$+41\ 25\ 38.2$	017666	023439	7.67	0.796	40.83	2.24	45.65	2.63	K3 V	2	43		01
$04\ 29\ 44.87$	$-29\ 01\ 37.4$	020968		11.42	0.646	120.70	56.47	25.66	10.02	F9.5 V	1	6		01
$04\ 30\ 12.58$	$+05\ 17\ 55.8$	021000		9.83	0.600	84.76	4.74	93.67	7.62	F8+	3	9		01
$05\ 44\ 56.79$	$+09\ 14\ 31.5$	027111	247168	11.35	0.699	44.67	14.98	61.21	15.04	F8:	3	6		01
$07 \ 03 \ 58.92$	$-43\ 36\ 40.8$	034069	053706	6.83	0.779	66.29	6.81	47.99	9.89	K0.5 V	1	61.54	1.05	03
$08 \ 35 \ 51.27$	$+06\ 37\ 22.0$	042173	072946	7.25	0.710	42.71	4.61	38.11	0.85	G8 V	2	37.68	1.41	04
$10\ 04\ 50.59$	$-31\ 05\ 28.0$	049376		11.99	0.938	41.59	3.13	43.49	3.44	M2+V	1	8		01
$12\ 29\ 55.04$	$+36\ 26\ 42.1$	060970		11.91	0.800	43.42	3.62	37.95	4.14			6		01
$12\ 31\ 18.92$	$+55\ 07\ 07.7$	061100	109011	8.08	0.941	42.13	3.11	39.84	1.07	K2 V	3	48		01
$12\ 59\ 18.98$	$+06\ 30\ 33.7$	063383		10.69	0.515	45.19	44.19	3.18	18.34	G	3	5		01
13 33 18.71	-77 34 24.6	066125		9.31	0.914	52.09	39.91	55.78	10.02	K2.5 V	1	28.45	1.13	05
$15 \ 31 \ 54.05$	+09 39 26.9	076051		9.80	0.787	44.59	20.41	12.33	11.19	G2 V	2	16		01
15 38 39.95	$-08\ 47\ 41.0$	076602	139460	6.56	0.520	44.21	4.72	40.99	3.72	F7 V	2	30		01
15 38 40.08	$-08\ 47\ 29.4$	076603	139461	6.45	0.505	40.19	3.62	37.56	4.29	F6.5 V	2	31		01
16 19 31.52	$-30\ 54\ 06.7$	079979	146835	7.29	0.585	56.82	23.38	-4.71	13.69	F9- V	1	20.72	1.02	06
$22\ 06\ 11.82$	$+10\ 05\ 28.7$	109119		10.20	0.668	93.81	66.11	0.40	12.19	F2 IV	2	9		01
$22\ 12\ 59.72$	$-47\ 23\ 11.1$	109670		11.48	0.660	44.20	16.43	3.51	3.07	G5 V	1	5		01
$22\ 26\ 34.28$	$-16\ 44\ 31.7$	110778	212697	5.55	0.618	49.80	2.54	49.50	1.23	G5 V	1	67		01
$23\ 01\ 51.54$	$-03\ 50\ 55.4$	113718	217580	7.48	0.943	59.04	3.40	58.70	0.92	K2.5 V	2	67		01
$23\ 44\ 07.36$	$-27\ 11\ 45.8$	117081	222834	9.01	0.535	58.45	47.16	63.56	21.02	G1 V	1	10		01

Note. — Column 12 reference codes: (1) Gray et al. (2006); (2) Gray et al. (2003); (3) The Hipparcos catalog. Column 15 notes: (01) Distance estimated by fitting the Hipparcos V magnitude and B-V color to the Cox (2000) main sequence. (02) Hipparcos parallax of the companion HIP 13769. (03) Hipparcos parallax of the companion HIP 34065, which is included in the sample. (04) Hipparcos parallax of the companion HIP 42172. (05) Hipparcos parallax of the companion HIP 79980.

Table 4. CPM Companions Identified

WDS	Disc	Pair	Primary	С	PM Ca	ndidate C	ompanion	Reason
ID	Desig	ID	Name	ρ (")	θ (°)	Epoch	Name	Code
		DI.	· 11 A · .	1 CDM				
		— Physi	ically Associate	ed CPM	Comp	anions —		
			HD 004391 ^a	49	240	1993.70	•••	1
01158 - 6853	$\rm HJ~3423$	A-CD	$\rm HD\ 007693$	318	315	1989.73	HD7788	2
01368 + 4124	LWR 1	AD	$\rm HD~009826$	55	150	1989.77	v And B	3
01398 - 5612	DUN 5	AB	HD 010360	13	185	1997.61	HD 10361	4
02361 + 0653	PLQ 32	AB	HD 016160	162	110	1990.73	NLTT 8455	1
02482 + 2704	LDS1138	AB	$\rm HD\ 017382$	21	27	1989.98	NLTT 8996	1
02556 + 2652	LDS 883	AC	HD 018143	45	267	1989.98	NLTT 9303	2
03042 + 6142	LDS9142	AC	HD 018757	262	68	1993.94	NLTT 9726	1
03182 - 6230	ALB 1	AB	HD 020807	308	220	1996.87	HD 20766	2
04076 + 3804	ALC 1	AE	HD 025998	746	100	1989.76	HD 25893	2
04153 - 0739	STF 518	AC	$\rm HD~026965$	81	99	1985.96	LHS 25	2
04153 - 0739	STF 518	AB	HD 026965	85	104	1985.96	HD 26976	4
04155 + 0611	H 4 98	AB	HD 026923	64	315	1986.77	HD 26913	2
05023 - 5605	LDS 135	AB	HD 032778	81	145	1989.98	NLTT 14447	1
05244 + 1723	WNO 52	AC	HD 035296	707	252	1989.91	HD 35171	2
05369 - 4758	HDS 751	AB	HD 037572	18	285	1997.02	HIP 26369	2
05413 + 5329	ENG 22	AB	HD 037394	99	70	1991.11	HD 233153	2
			$\rm HD~043162^{a}$	164	171	1996.04		1
06173 + 0506	LEP 24	AE	HD 043587	102	306	1990.82	NLTT 16333	1
06461 + 3233	LDS6201	AB	HD 263175	30	101	1989.84	LHS 1867	1
07040 - 4337	DUN 38	AB	HD 053705	24	128	1994.93	HD 53706	2
07040 - 4337	DUN 38	AC	HD 053705	184	336	1994.93	HD 53680	2
07400 - 0336	BGH 3	AB	HD 061606	57	112	1985.96	NLTT 18260	1
07291 + 3147	ALC 3	AE	HIP 036357	756	355	1988.93	HD 58946	2
			HD 063077	914	6	1991.88	NLTT 18414	1
07578-6018	LDS 198	AB	HD 065907	61	74	1991.21	LHS 1960	1
08122 + 1739	STF1196	AC	HD 068257	6	90	1997.18	HD 68256	4
08421-4256	LDS 230	AB	HD 074385	46	184	1994.18	NLTT 20102	1
08526 + 2820	LDS6219	AB	HD 075732	84	128	1998.29	LHS 2063	1
09305-3206	LDS5704	AB	HD 082342	11	204	1992.19		1
09327 + 2659	LDS3903	AB	HD 082443	65	68	1998.31	NLTT 22015	1
			HD 086728	133	278	1989.93	GJ 376 B	5

Table 4—Continued

WDS	WDS Disc Pa		Primary		ompanion	Reason		
ID	Desig	ID	Name	ρ (")	θ (°)	Epoch	Name	Code
10306+5559	LDS2863	AB	HD 090839	124	303	1998.30	HD 237903	2
11047 - 0413	STF1506	A-BC	${ m HD} \ 096064$	13	218	1985.06	NLTT 26194	1
11268 + 0301	STF1540	AB	HD 099491	29	149	1996.27	HD 99492	2
11317 + 1422	STF1547	AB	HD 100180	17	332	1993.08	NLTT 27656	1
11387 + 4507	STF1561	AB	HD 101177	8	270	1997.28	LHS 2436	4
13237 + 0243	STF1740	AB	HD 116442	26	76	1997.18	HD 116443	2
14196 - 0509	KUI 67	AB	HD 125455	12	104	1994.19	LHS 2895	6
14396 - 6050	RHD 1	AB	$HD\ 128620$	7	213	1997.19	HD 128621	4
14396 - 6050	LDS 494	AC	$HD\ 128620$	7867	225	1997.19	HIP 70890	2
15282 - 0921	$\mathrm{SHJ}\ 202$	AB	HD 137763	52	133	1991.21	HD 137778	2
15292 + 8027	STF1972	AC	HD 139777	33	70	1994.44	HD 139813	2
15360 + 3948	STT 298	AB-C	HD 139341	123	328	1993.29	HD 139323	2
15475 - 3755	SEE 249	AB	HD 140901	14	138	1997.29	NLTT 41169	6
16048 + 3910	WNO 47	AB	HD 144579	70	280	1991.27	LHS 3150	1
16133 + 1332	STF2021	AB	HD 145958	3	340	1989.27	$NLTT\ 42272$	4
16147 + 3352	STF2032	AB	HD 146361	6	248	1991.28	HD 146362	4
16147 + 3352	STF2032	AE	HD 146361	634	241	1991.28	HIP 79551	2
			HD 147513	345	248	1993.25	HIP 80300	2
16579 + 4722	STFA 32	AC	HD 153557	113	260	1991.30	HD 153525	2
17153 - 2636	SHJ 243	AB	$HD\ 155885$	4	160	1997.33		4
17153 - 2636	SHJ 243	AC	$HD\ 155885$	732	74	1997.33	$\rm HD\ 156026$	2
17191 - 4638	BSO 13	AB	HD 156274	13	245	1992.43	NLTT 44525	4
			$\rm HD\ 157347^{a}$	49	147	1992.35		1
17350 + 6153	LDS2736	AB-C	$\rm HD\ 160269$	738	161	1992.36	HIP 86087	2
17419 + 7209	STF2241	AB	${ m HD}\ 162004$	31	10	1993.63	$\rm HD\ 162003$	2
18409 + 3132	$\rm HJ\ 1337$	AB	HIP 091605	9	150	1989.34	LHS 3402	7
19121 + 4951	STF2486	AB	HD 179957	7	195	1992.65	LHS 3441	4
19418 + 5032	STFA 46	AB	HD 186408	40	132	1991.52	HD 186427	2
19456 + 3337	LEP 93	AF	$HD\ 186858$	793	55	1992.67	HD 187013	2
19456 + 3337	STF2576	BF	HD 186858	810	58	1992.67	HD 225732	1
19510 + 1025	J 124	AC	HD 187691	23	221	1991.53		1
20036 + 2954	LDS6339	AB	$\rm HD\ 190360$	178	232	1992.49	LHS 3509	2
20111 + 1611	GIC 163	AE	HD 191785	102	95	1992.74	LHS 3530	1
20408 + 1956	LDS1045	AC	$\rm HD\ 197076$	125	184	1992.67	NLTT 49681	1
20493 + 3217	LDS2931	AB	$\rm HD\ 198425$	33	247	1992.56	$\rm NLTT~49961$	1

Table 4—Continued

WDS	Disc	Pair	Primary	C	Reason			
ID	Desig	ID	Name	ρ (")	θ (°)	Epoch	Name	Code
21270-4449	LDS6352	AB	HD 203985	88	259	1993.61	LTT 8515	1
22159 + 5440	GIC 177	AT	HD 211472	76	105	1991.60	GJ 4269	1
22259 - 7501	DUN 238	AB	HD 212168	20	93	1996.78	HIP 110719	1
			$\rm HD\ 218868^{a}$	50	90	1989.68		1
		-	— Refuted CP	M Can	didates	_		
			HD 000166	311	147	1989.83	SAO 73748	8
			HD 001581	87	343	1993.64	• • •	9
01333 - 2411	LDS2209	AB	HD 009540	336	220	1996.72	NLTT 5160	10
			HD 012846	304	336	1990.87		10
			HD 025665	287	134	1993.72	NLTT 12588	8
04053 + 2201	STT 559	AB	HD 025680	174	0	1989.97	HIP 19075	8
04155 + 0611	STU 18	AE	$\rm HD\ 026923$	223	63	1986.77	$BD+05\ 617$	10
			${ m HD} \ 068257$	372	107	1997.18		8
			${ m HD} \ 073667$	335	207	1997.10	NLTT 19982	10
			HD 075767	385	41	1997.10	NLTT 20430	10
			$\rm HD\ 082885$	328	333	1998.29	NLTT 22106	8
			HD 084117	722	331	1995.09	NLTT 22384	8
			${\rm HD}\ 096064$	296	142	1985.06		10
			HD 097658	346	139	1992.32		10
			HD 114783	240	46	1996.23		10
			HD 141004	235	200	1993.25		10
			$\rm HD\ 206860$	591	16	1990.80		10

Note. — Reason Code values: (1) Photometric distance to the CPM candidate matches the *Hipparcos* distance to the primary (see Table 5). (2) Published parallax and proper motion for the CPM candidate matches the corresponding primary's values from *Hipparcos*. (3) Spectroscopic distance to the CPM candidate matches the *Hipparcos* distance to the primary. (4) Known companion with a published orbit (each of these were seen as comoving diffraction spikes). (5) Published evidence, see § 4.3. (6) Companionship implied by proximity to the primary and a matching, large proper motion. (7) Measurements of the pair in the WDS confirm orbital motion. (8) While the proper motion is similar enough to enable selection as a possible CPM companion, the numerical value for the candidate in catalogs (Høg et al. 1998; Salim & Gould 2003; Zacharias et al. 2004b; Lépine

& Shara 2005 Hipparcos) are significantly different from the primary's Hipparcos values, ruling out a physical association. (9) The candidate companion is a non-stellar artifact such as a plate defect. (10) Photometric distance to the CPM candidate is significantly different than the primary's Hipparcos distance (see Table 5).

^aNew companion discovered by this effort.

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Primary CompSpec ===== CCD Magnitudes ====== $_{\mathrm{Nbr}}$ Infrared Magnitudes D Error ρ (") (mas yr^{-1}) Name Type $_{\mathrm{ref}}$ Vref RrefrefObsH(pc) ref (pc) (1) (2) (3) (4) (5)(6) (7) (8)(9) (10)(11)(12)(13)(14)(15)(16)(17)(18)(19)— Physically Associated CPM Companions — HD 004391 49 14.36 13.1411.463 9.88 9.349.03 19.3 3.1 2 HD 016160 162 M3.5V1813 14473 11.68 - 1 10.471 8.87 1 1 7.33 6.796.57 6.9 1.1 HD 017382 21 275 -1233 16.5 4 13.89 5 10.73 10.179.87 22.19.0 HD 018757 262 717 -6973 12.656 10.07 7 8.88 8.33 8.10 22.65.2 HD 032778 81 656 -708 10.499.641 8.85 1 7.86 7.327.06 23.9 3.9 . . . $\mathrm{HD}\ 043162$ 164 -32106 12.9611.7810.218.728.16 7.8713.22.0 1 1 1 1 9.09 HD 043587 102 -212166 7 13.2912.1110.581 8.568.27 16.52.5 8.93 HD 061606 57 67 -28610 8.09 10 7.3410 6.38 5.70 5.57 12.52.1 HD 063077 914 $_{\mathrm{DC}}$ 11 -24616547 16.6015.9715.3914.7814.5514.4015.31.1 HD 065907 61 521 103 12 9.33 12 7 6.91 6.28 6.06 17.57.474.8 HD 074385 46 -294-8413 12.6814 9.00 8.42 8.17 22.0 3.4 HD 075732 -23884 -4828 13.261 11.91 1 10.241 2 8.56 7.93 7.67 8.7 1.4 HD 082342 11M3.5V15 -75386 13 13.1412.0310.581 9.278.77 8.50 23.74.2HD 082443 -2429.4712.6 65 M5.5V15 -1343 16.8 4 14.395 12.07 7 10.36 9.865.1HD 096064 -189-11316 10.0 7.276.626.42 17.0^{a} 2.6 13 HD 100180 17-328-1893 9.2417 7.757 7.046.526.3723.54.3 HD 144579 70 -54755 3 14.2318 12.7518 11.479.90 9.459.16 25.4^{b} 7.3 18 HD 157347 M3.0V12.1811.06 3 8.26 7.4413.42.1 49 9.647.68HD 186858 810 F5.5IV-V19 19 -4473 9.2520 8.38 21 6.64 6.126.00 15.42.9 HD 187691 11.5523 12.67- 1 1 10.041 1 8.89 8.30 8.01 20.0 4.8 20.9 HD 191785 102 M3.5V- 1 -432392 3 13.93 1 12.73 1 11.14- 1 1 9.63 9.11 8.88 3.4 HD 197076 125 M2.5V10 108 312 3 11.88 10.80 9.471 8.16 7.657.4215.8 2.5 HD 198425 33 -158-2783 18.6 15.477 13.687 11.7811.1810.8625.77.3 ${
m HD}\ 203985$ 88 M3.5V13.4912.291 10.711 9.228.628.3515.92.4 1 - 1 1 HD 211472 76 205 66 3 13.93 22 9.72 9.198.93 22.3 3.5 HD 212168 G0V8.80 20 19 60 35 23 8.09 1 7.431 1 6.56 5.945.81 16.9° 2.8 HD 218868 50 -50-3227 15.3222 12.577 10.84 10.239.90 25.96.0 12.15HD 263175 30 M0.5V10 -45499 3 10 11.18 1010.11 10 8.99 8.43 8.18 30.6 4.8 - Refuted CPM Candidates

11.94

10.62 21

9.50

14.27

12.74

15.36

14.95

9.31

16.92

14.07

- 1

-1

- 1

1

1

7

11.12

9.84

9.06 1

12.96

11.51

14.60

13.61

15.11

13.63

8.90 1

7

1

1

1

7

10.10

10.18

11.70

10.22

13.63

12.32

8.32

13.40

12.77

8.43

1

1

1

1

1

1

2

2

9.35

9.66

7.88

10.92

9.30

12.85

11.56

12.59

12.06

7.79

9.47

9.80

8.04

11.18

9.57

13.06

11.74

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 $82.4 \quad 13.4$

13.2

8.9

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18.3

83.9

9.3

81.7

55.6

38.1^b 6.8

355.8

109.4

54.0

76.9 13.2

300.0

HD 009540

HD 012846

HD 026923

HD 073667

HD 075767

HD 096064

HD 097658

HD 114783

HD 141004

HD 206860

336

304

223

335

385

296

346

240

235

591

288

-32

-15

58

58

111

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-153 13

-102

-131

-178

-89 24

185 3

7

3

12.75

11.48 21

9.99

15.35

13.77

16.20 1

15.94 1

9.78 1

18.35 1

15.04 21

Spectral Type, Proper Motion, and Photometry of CPM Candidates

Note. — Reference codes for columns 4, 7, 9, 11, and 13: (1) CTIO observations obtained for this work; (2) Henry et al. (2002); (3) The LSPM North catalog (Lépine & Shara 2005); (4) Visual Double Stars in Hipparcos (Dommanget & Nys 2000); (5) The Guide Star Catalog, Version 2.2.01 (I/271); (6) Catalog of stars with high proper motions (I/306A); (7) The USNO B 1.0 Catalog (Monet et al. 2003); (8) Revised Luyten Half-Second Catalog (Bakos et al. 2002); (9) The Revised NLTT Catalog (Salim & Gould 2003); (10) Reid et al. (2004); (11) Kunkel et al. (1984); (12) All-sky Compiled Catalog (Kharchenko 2001); (13) NLTT Catalog (Luyten 1979); (14) The Catalog of Nearby Stars (Gliese & Jahreiß 1991); (15) Hawley et al. (1996); (16) Yale Trigonometric Parallaxes, Fourth Edition (van Altena et al. 1995); (17) An Astrometric Catalog (Rapaport et al. 2001); (18) Weis (1996); (19) Gray et al. (2003, 2006); (20) The Tycho-2 Catalog (Høg et al. 2000); (21) The NOMAD Catalog (Zacharias et al. 2004a); (22) The Guide Star Catalog, Version 2.3.2 (Lasker et al. 2008); (23) Yale Zones Catalog Integrated (I/141); (24) The DENIS Consortium (The 2005).

^aWhile this distance is too low compared to the primary's *Hipparcos* distance of 24.6 pc, the companion is a roughly equal-brightness binary. Adjusting the *Hipparcos* and 2MASS magnitudes accordingly changes the distance estimate to 24.0 ± 3.7 , a much better match with the distance to the primary.

^bSee § 4.3 for a discussion of these photometric distance estimates and the status of these companions.

^cEven though the companion is HIP 110719, its *Hipparcos* astrometry has large errors, necessitating the photometric distance check.

Table 6. Optical WDS Entries

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
00022+2705	BU 733	AC	HD 224930	64	325	161.7	2000
00022 + 2705	BU 733	AD	HD 224930	15	296	109.9	1921
00022 + 2705	HSW 1	AE	HD 224930	2	309	100.9	1998
00066 + 2901	ENG 1	A-CD	HD 000166	9	196	142.4	1991
00066 + 2901	STT 549	AB	HD 000166	15	259	186.7	2002
00066 + 2901	BU 1338	CD	HD 000166	8	210	3.2	1999
00200 + 3814	S 384	AB	HD 001562	43	22	100.7	2003
00200 + 3814	S 384	AC	HD 001562	4	260	22.6	1998
00229 - 1213	BUP 6		HD 001835	5	294	213.9	1998
00352 - 0336	BU 490	AB-C	HD 003196	15	324	24.4	1998
00394 + 2115	STT 550	AB	HD 003651	9	80	167.6	1997
00484 + 0517	BUP 10	AC	HD 004628	4	241	158.5	2000
00490 + 1656	BUP 12	AB	HD 004676	4	330	82.9	1998
00490 + 1656	BUP 12	AC	HD 004676	4	162	64.2	1998
00491 + 5749	STF 60	AC	HD 004614	4	258	216.0	1991
00491 + 5749	STF 60	AD	HD 004614	5	1	177.0	1991
00491 + 5749	STF 60	AE	HD 004614	12	127	91.8	2002
00491 + 5749	STF 60	AF	HD 004614	2	275	369.3	1991
00491 + 5749	STF 60	\overline{AG}	HD 004614	15	256	409.8	2002
00491 + 5749	STF 60	AH	$\rm HD\ 004614$	2	355	689.2	1991
00491 + 5749	STF 60	BC	HD 004614	3	237	152.0	1921
00491 + 5749	STF 60	BE	HD 004614	3	121	220.8	1991
00491 + 5749	STF 60	BH	${ m HD}\ 004614$	3	356	679.9	1991
00491 + 5749	STF 60	FG	${ m HD}\ 004614$	5	188	142.3	2000
00498 + 7027	ENG 2		HD 004635	9	277	90.9	1999
00531 + 6107	$BU\ 497$	AB	$\mathrm{HD}\ 005015$	22	172	145.0	2003
00531 + 6107	$BU\ 497$	AD	$\mathrm{HD}\ 005015$	3	145	105.6	1991
00531 + 6107	$BU\ 497$	AE	$\mathrm{HD}\ 005015$	2	42	127.4	1959
00531 + 6107	BU 497	BC	${ m HD}\ 005015$	7	162	0.9	1946
01083 + 5455	STT 551	AB	${ m HD}\ 006582$	14	270	428.9	1998
01083 + 5455	BUP 14	AC	${ m HD}\ 006582$	2	258	175.6	1991
01083 + 5455	BUP 14	AE	HD 006582	1	145	87.7	1907
01083 + 5455	STT 551	AF	${ m HD}\ 006582$	2	328	53.2	1854
01083 + 5455	BUP 14	CD	${ m HD}\ 006582$	2	115	4.3	1998
01291 + 2143	HO 9	AB	$\mathrm{HD}\ 008997$	24	47	55.7	2003

Table 6—Continued

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
01291+2143	НО 9	AD	HD 008997	11	217	81.8	1999
01291 + 2143	HO 9	$_{\mathrm{BC}}$	HD 008997	23	91	2.7	2001
01350 - 2955	BU 1000	AB-D	HD 009770	12	19	132.2	1998
01368 + 4124	BUP 23	AB	HD 009826	1	128	114.0	1909
01368 + 4124	STT 554	AC	HD 009826	9	291	271.6	2006
01425 + 2016	HJ 2071	AB	HD 010476	6	10	53.2	1998
01425 + 2016	HJ 2071	AC	HD 010476	13	4	154.0	1998
01441 - 1556	BUP 25		HD 010700	5	157	137.0	2000
01477 + 6351	ENG 7		HD 010780	10	176	45.9	2003
01591 + 3313	ENG 9	AB	HD 012051	11	137	92.8	2002
01591 + 3313	BUP 28	AC	HD 012051	3	26	91.2	1934
02171 + 3413	DOR 66	AB	HD 013974	2	337	65.4	1907
02442 + 4914	STF 296	AC	HD 016895	18	229	77.2	1924
02442 + 4914	STF 296	BC	HD 016895	13	215	73.5	1924
03042 + 6142	KUI 11	AB	HD 018757	1	132	12.7	1931
03091 + 4937	BUP 38		HD 019373	1	132	146.2	1911
03194 + 0322	STT 557	AB	$\rm HD\ 020630$	16	166	266.6	2002
03194 + 0322	BUP 42	BC	$\rm HD\ 020630$	6	272	214.2	2000
03329 - 0927	MBA 1	AB	${\rm HD}\ 022049$	1	326	17.1	2001
03329 - 0927	MBA 1	AC	${ m HD}\ 022049$	1	15	17.6	2001
03329 - 0927	MBA 1	AD	${ m HD}\ 022049$	1	355	44.3	2001
03329 - 0927	MBA 1	AE	${ m HD}\ 022049$	1	69	28.7	2001
03329 - 0927	MBA 1	AF	$\rm HD\ 022049$	1	70	41.3	2001
03329 - 0927	MBA 1	\overline{AG}	$\rm HD\ 022049$	1	119	41.1	2001
03329 - 0927	MBA 1	AH	$\rm HD\ 022049$	1	321	21.0	2001
03329 - 0927	MBA 1	AI	${ m HD}\ 022049$	1	294	34.0	2001
03329 - 0927	MBA 1	AJ	${ m HD}\ 022049$	1	145	27.9	2001
03329 - 0927	MBA 1	AK	${ m HD}\ 022049$	1	208	38.5	2001
03562 + 5939	ENG 16	AB	${\rm HD}\ 024409$	10	7	134.7	1999
03562 + 5939	ENG 16	AC	HD 024409	7	50	193.4	1999
03562 + 5939	BUP 48	AF	HD 024409	2	75	37.6	1925
04033 + 3516	OSO 16		HD 025329	3	240	16.0	1994
04053 + 2201	STT 559	AC	$\rm HD\ 025680$	5	17	149.2	1997
04053 + 2201	STT 559	BC	$\rm HD\ 025680$	8	124	58.2	1997
04076 + 3804	STT 531	AC	$\rm HD\ 025998$	15	218	225.2	2002

Table 6—Continued

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
04076+3804	BU 545	CD	HD 025998	15	305	1.3	1991
04153 - 0739	STF 518	AD	HD 026965	18	97	77.9	1992
04153 - 0739	STF 518	AE	HD 026965	10	8	211.0	1907
04153 - 0739	STF 518	BD	HD 026965	1	196	147.0	1922
04153 - 0739	STF 518	BE	HD 026965	1	356	279.5	1922
04155 + 0611	H498	AC	HD 026923	8	48	230.1	2003
04155 + 0611	H498	$^{\mathrm{CD}}$	HD 026923	7	316	54.3	1987
05188 - 1808	SEE 50	AB	HD 034721	4	234	45.5	1951
05188 - 1808	SEE 50	$_{\mathrm{BC}}$	HD 034721	2	101	15.8	1951
05191 + 4006	STFB 3	AB	HD 034411	1	274	29.1	1900
05191 + 4006	STFB 3	AC	HD 034411	6	268	41.7	1934
05191 + 4006	STFB 3	AD	HD 034411	29	349	203.4	2003
05191 + 4006	DOB 4	AE	HD 034411	5	34	174.8	2003
05191 + 4006	KUI 20	$^{\mathrm{CB}}$	HD 034411	2	351	27.2	1934
05191 + 4006	DOB 4	DE	HD 034411	10	112	147.7	2003
05226 + 7914	STF 634	AB	HD 033564	86	135	25.8	2001
05226 + 7914	STF 634	AC	HD 033564	3	333	173.1	1999
05244 + 1723	S 478	AB	HD 035296	35	271	102.7	2002
05413 + 5329	BUP 82	AC	HD 037394	3	307	87.1	1925
05413 + 5329	BUP 82	AD	HD 037394	2	262	688.0	1909
05413 + 5329	BUP 82	BE	HD 037394	2	159	129.7	1910
05460 + 3717	BLL 16		HD 038230	3	104	104.0	1954
05584 - 0439	A 322	AC	HD 040397	13	304	195.5	2002
06173 + 0506	ENG 26	AB	HD 043587	8	241	179.7	2002
06173 + 0506	BUP 87	AC	HD 043587	1	265	58.5	1911
06173 + 0506	BUP 87	AD	HD 043587	1	231	69.3	1911
06467 + 4335	SHJ 75	AB	HD 048682	47	40	30.1	2007
06467 + 4335	WAL 47	AC	HD 048682	1	330	80.0	1944
07040 - 4337	WRH 38	AD	HD 053705	2	268	33.3	1999
07096 + 2544	HO 519	AB	HD 054371	6	103	22.2	1927
07096 + 2544	STTA 83	AC	HD 054371	32	80	120.5	2002
07291 + 3147	A 2124	AC	HIP 036357	14	285	221.7	1998
07291 + 3147	A 2124	CD	HIP 036357	3	$\frac{270}{270}$	102.3	1998
07549 + 1914	ENG 33	AB	HD 064468	12	285	96.8	2007
07549 + 1914	ENG 33	AC	HD 064468	10	65	125.4	2007
		-		-		- "	

Table 6—Continued

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
07549+1914	BUP 109	AD	HD 064468	3	28	43.1	1925
08116+3227	STT 564	AB	HD 068017	6	327	55.0	1915
08116+3227	STT 564	AC	HD 068017	10	66	289.3	2007
08122+1739	STF1196	AB-D	HD 068257	12	107	275.2	2007
08122+1739	ENH 1	AB-E	HD 068257	3	26	557.7	1991
08122+1739	ENH 1	AB-F	HD 068257	2	47	629.2	1894
08122+1739	ENH 1	AB-G	HD 068257	3	332	664.4	1991
08122 + 1739	STF1196	$^{\mathrm{CD}}$	HD 068257	5	107	274.8	1991
08122+1739	ENH 1	EF	HD 068257	6	106	218.7	1997
08379-0648	HJ 99	AB	HD 073350	15	181	60.2	2002
08379-0648	HJ 99	BC	HD 073350	3	215	9.8	1999
08391-2240	BU 208	AC	HD 073752	6	186	113.7	1999
08398 + 1131	ENG 36	AB	HD 073667	9	337	142.3	2002
08398 + 1131	BUP 119	BC	HD 073667	10	13	30.6	2002
09123 + 1500	BUP 125	AB	HD 079096	3	117	88.5	1997
09123 + 1500	STT 569	AC	HD 079096	11	217	204.4	2007
09179 + 2834	ABT 6	AB-C	HD 079969	1	56	152.4	1921
09179 + 2834	ABT 6	AB-D	HD 079969	3	133	166.4	1999
10189 + 4403	ENG 43		HD 089269	14	97	145.2	2002
10306 + 5559	ARN 4	AC	HD 090839	3	294	233.1	2002
10314 - 5343	HJ 4329		HD 091324	28	103	73.9	2000
10365 - 1214	KUI 51		HD 091889	6	0	37.5	2007
11125 + 3549	STTA108	AB	HD 097334	23	67	156.5	2004
11125 + 3549	STTA108	AC	HD 097334	4	144	86.5	1998
11125 + 3549	STTA108	BD	HD 097334	2	88	34.9	1910
11182 + 3132	POP1219	AC	$\rm HD\ 098230$	3	324	56.4	2007
11268 + 0301	STF1540	AC	HD 099491	3	187	90.5	1937
11387 + 4507	STF1561	AC	HD 101177	22	90	164.9	2006
11387 + 4507	STF1561	AD	HD 101177	2	76	704.2	1991
11387 + 4507	STF1561	AE	HD 101177	6	331	64.5	2001
11387 + 4507	STF1561	$_{\mathrm{BC}}$	HD 101177	17	89	173.3	2002
11387 + 4507	STF1561	BE	HD 101177	5	340	64.0	2000
11387 + 4507	STF1561	CD	HD 101177	3	72	552.9	1991
11411 + 3412	STT 574		HD 101501	11	88	158.4	1998
11507 + 0146	STT 576	AB	$HD\ 102870$	11	285	305.3	1984

Table 6—Continued

Nbr			
	θ	ho	
Obs	(deg)	(")	Epoch
4	80	421.7	2002
6	200	264.7	2007
11	238	85.8	1924
1	89	34.3	1958
7	339	120.6	1999
1	88	50.8	1990
13	37	376.2	2007
14	127	268.6	2002
1	263	325.5	1923
27	87	113.3	2007
9	117	82.6	1999
8	342	68.6	2000
7	286	159.6	2007
6	99	269.2	2007
5	38	333.7	2007
6	347	60.3	1953
10	99	274.5	2007
3	68	51.0	2000
5	40	127.2	1924
4	268	674.7	1911
8	0	69.2	1984
6	41	217.5	2000
4	99	152.8	1999
3	102	153.8	1983
4	232	189.3	1934
4	335	456.4	1999
4	337	335.8	1999
9	208	195.5	2002
17	285	172.8	2002
14	235	171.0	2002
6	125	8.4	1956
9	86	102.4	1998
23	49	135.3	2002
12	118	206.7	1998
11	93	24.2	2007
	6 11 1 7 1 13 14 1 27 9 8 7 6 5 6 10 3 5 4 8 6 4 4 9 17 14 6 9 23 12	6 200 11 238 1 89 7 339 1 88 13 37 14 127 1 263 27 87 9 117 8 342 7 286 6 99 5 38 6 347 10 99 3 68 5 40 4 268 8 0 6 41 4 99 3 102 4 232 4 335 4 337 9 208 17 285 14 235 6 125 9 86 23 49 12 118	6 200 264.7 11 238 85.8 1 89 34.3 7 339 120.6 1 88 50.8 13 37 376.2 14 127 268.6 1 263 325.5 27 87 113.3 9 117 82.6 8 342 68.6 7 286 159.6 6 99 269.2 5 38 333.7 6 347 60.3 10 99 274.5 3 68 51.0 5 40 127.2 4 268 674.7 8 0 69.2 6 41 217.5 4 99 152.8 3 102 153.8 4 232 189.3 4 232 189.3

Table 6—Continued

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
16147+3352	STF2032	AD	HD 146361	107	82	90.5	2006
16147 + 3352	STF2032	BD	HD 146361	66	81	95.0	1998
16156 - 0822	BUP 165		HD 146233	2	280	25.8	1958
16243 - 1338	BUP 169	AB	HD 147776	3	281	103.0	1909
16289 + 1825	STF2052	AC	HD 148653	2	29	143.3	1925
16364-0219	BUP 171		HD 149661	1	245	100.3	1910
17153 - 2636	SHJ 243	AD	HD 155885	11	338	276.6	1998
17153 - 2636	SHJ 243	AE	HD 155885	3	312	38.4	1998
17153 - 2636	SHJ 243	BD	HD 155885	6	339	284.9	1987
17191 - 4638	BSO 13	AC	HD 156274	2	279	41.8	1900
17191 - 4638	BSO 13	AD	HD 156274	1	30	47.0	1900
17207 + 3228	DOR 1	AB	HD 157214	12	340	308.1	2002
17207 + 3228	ARN 14	AD	HD 157214	1	59	395.0	2002
17207 + 3228	ARN 14	AE	HD 157214	3	51	302.2	2002
17207 + 3228	ARN 14	AF	HD 157214	3	104	383.2	2002
17207 + 3228	DOR 1	BC	HD 157214	2	216	8.8	1911
17350 + 6153	SDR 1	AB-D	HD 160269	2	245	23.9	1999
17419 + 7209	STF2241	AC	HD 162004	12	108	79.2	1999
17419 + 7209	STF2241	AD	${ m HD}\ 162004$	1	84	100.5	1905
17419 + 7209	STF2241	CD	${ m HD}\ 162004$	1	19	67.6	1908
17465 + 2743	ABT 14	AD	HD 161797	1	0	256.1	1921
17465 + 2743	ABT 14	$\operatorname{BC-D}$	HD 161797	1	7	272.6	1921
18025 + 2619	HO 564	AB	HD 164922	6	326	96.1	1999
18025 + 2619	HO 564	AC	HD 164922	2	57	80.3	1924
18055 + 0230	STF2272	AC	HD 165341	53	282	34.9	1947
18055 + 0230	STF2272	AD	HD 165341	18	324	88.1	2007
18055 + 0230	STF2272	AR	HD 165341	24	29	155.0	2000
18055 + 0230	STF2272	AS	HD 165341	35	11	193.2	2000
18055 + 0230	STF2272	AT	HD 165341	23	48	125.9	2007
18055 + 0230	STF2272	AU	HD 165341	15	334	184.5	1945
18055 + 0230	STF2272	AV	HD 165341	37	246	138.6	1946
18055 + 0230	STF2272	AY	HD 165341	2	354	231.9	2000
18055+0230	STF2272	BC	HD 165341	4	252	32.4	1932
18055+0230	STF2272	BD	HD 165341	1	247	69.3	1900
18055 + 0230	STF2272	$_{\mathrm{BR}}$	HD 165341	$\overline{22}$	50	121.1	2000

Table 6—Continued

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
18055+0230	STF2272	BZ	HD 165341	2	163	68.3	2000
18055+0230	STF2272	VT	HD 165341	21	72	247.3	1946
18055+0230	STF2272	VW	HD 165341	4	270	180.9	1910
18055+0230	STF2272	VX	HD 165341	2	254	17.4	2002
18070+3034	AC 15	AC	HD 165908	6	59	96.2	1998
18070 + 3034	AC 15	AD	HD 165908	4	103	140.0	1998
18070 + 3034	AC 15	AE	HD 165908	4	78	168.8	1998
18070 + 3034	AC 15	AF	HD 165908	2	165	162.5	1998
18070 + 3034	AC 15	\overline{AG}	HD 165908	5	360	177.0	1998
18570 + 3254	BU 648	AB-C	HD 176051	7	289	64.7	1960
18570 + 3254	BU 648	AB-D	HD 176051	4	198	85.0	1998
18570 + 3254	BU 648	AE	HD 176051	3	320	105.3	1934
18570 + 3254	BU 648	AF	HD 176051	3	87	100.3	1934
19080 + 1651	ENG 66	AB	HD 178428	10	288	132.3	2007
19121 + 4951	STF2486	AC	HD 179957	4	101	26.8	2005
19121 + 4951	STF2486	AD	HD 179957	6	102	192.9	2000
19250 + 1157	STT 588	AB	HD 182572	29	286	101.7	2006
19250 + 1157	STT 588	AC	HD 182572	7	282	140.6	2000
19250 + 1157	COM 7	AD	HD 182572	3	140	78.8	1914
19250 + 1157	STT 588	BC	HD 182572	24	266	44.2	2006
19324 + 6940	STT 590		HD 185144	6	339	492.8	1999
19464 + 3344	STF2580	AC	HD 186858	32	125	110.5	2005
19464 + 3344	KPR 4	AD	HD 186858	4	63	105.6	2005
19464 + 3344	KPR 4	AE	HD 186858	1	61	40.9	1960
19464 + 3344	STF2580	$_{\mathrm{BC}}$	HD 186858	21	139	101.3	1999
19464 + 3344	STF2576	FH	HD 186858	3	348	51.8	1998
19464 + 3344	STF2576	FI	HD 186858	7	333	35.1	1998
19464 + 3344	TKA 1	FJ	HD 186858	2	249	25.9	2006
19464 + 3344	STF2576	$_{ m GI}$	HD 186858	2	257	15.9	1919
19510 + 1025	J 124	AB	HD 187691	4	203	14.4	1958
19510 + 1025	POP1228	AD	HD 187691	3	121	53.5	2002
19510 + 1025	POP1228	AE	HD 187691	3	147	84.6	2002
20041+1704	STT 592	AB	HD 190406	20	289	166.9	2002
20041+1704	STT 592	AC	HD 190406	22	333	213.9	2001
20041 + 1704	BUP 202	AD	HD 190406	6	360	83.7	2002

Table 6—Continued

WDS ID	Disc Desig	Pair ID	Primary Name	Nbr Obs	θ (deg)	ρ (")	Epoch
20041+1704	BUP 202	AE	HD 190406	3	51	169.0	2000
20041 + 1704	BUP 202	AF	HD 190406	2	312	142.3	2000
20041 + 1704	ENG 69	BC	HD 190406	19	204	151.5	2000
20041 + 1704	STTA202	BG	HD 190406	15	232	182.7	2002
20041 + 1704	BUP 202	СН	HD 190406	3	185	95.4	2000
20052 + 3829	BU 1481	AB	HD 190771	1	230	12.4	1906
20052 + 3829	WAL 126	AC	HD 190771	3	180	40.0	1944
20096 + 1648	STF2634	AC	HD 191499	2	312	74.8	1924
20111 + 1611	ENG 71	AB	HD 191785	9	148	205.4	2002
20111 + 1611	HZG 15	AD	HD 191785	7	267	40.8	1998
20111 + 1611	BUP 205	BC	HD 191785	4	273	61.7	2002
20140 - 0052	BU 1485	A-BC	HD 192263	19	102	73.1	2003
20140 - 0052	ABT 15	AD	HD 192263	1	244	71.3	1921
20140 - 0052	J 551	BC	HD 192263	4	265	0.2	1949
20140 - 0052	BU 1485	BC-D	HD 192263	8	65	23.5	1998
20324 - 0951	BU 668	AC	HD 195564	6	200	103.2	1921
20408 + 1956	BUP 215	AB	HD 197076	2	25	93.7	1924
21028 + 4551	BU 1138	AB^{a}	$\rm HD\ 200560$	54	170	0.1	1985
21028 + 4551	BU 1138	CA	${ m HD}\ 200560$	19	150	153.1	2002
21028 + 4551	BU 1138	CE	${ m HD}\ 200560$	6	250	5.6	1962
21072 - 1355	BU 157	AC	$\rm HD\ 200968$	15	287	26.2	1999
21072 - 1355	KPR 5	AD	HD 200968	1	78	276.2	1950
21145 + 1000	STF2777	AB-C	$\rm HD\ 202275$	80	6	72.5	2005
21180 + 0010	ENG 82	AB	${ m HD}\ 202751$	10	44	157.0	2003
21180 + 0010	TOB 317	AD	${ m HD}\ 202751$	2	56	129.1	2000
21180 + 0010	BUP 228	$_{\mathrm{BC}}$	${ m HD}\ 202751$	3	117	12.3	2000
21180 + 0010	LYS 44	BD	${ m HD}\ 202751$	2	182	41.8	2000
21198 - 2621	BU 271	AC	HD 202940	3	72	81.7	1909
21198 - 2621	BU 271	AD	HD 202940	1	62	247.2	1917
21198 - 2621	BU 271	AE	HD 202940	2	32	180.6	1999
21441 + 2845	STF2822	AC	HD 206826	14	290	72.6	1999
21441 + 2845	STF2822	AD	HD 206826	46	45	197.5	2001
21441 + 2845	STF2822	BD	HD 206826	23	46	198.7	1991
21441 + 2845	ES 521	DE	HD 206826	3	284	16.9	1999
21483-4718	BSO 15		HD 207129	29	351	75.2	1999
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Table 6—Continued

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WDS	Disc	Pair	Primary	Nbr	θ	ρ	
ID	Desig	ID	Name	Obs	(deg)	(")	Epoch
22159+5440	BU 377	AB	HD 211472	17	62	38.0	2006
22159 + 5440	BU 377	AC	HD 211472	6	52	35.2	2006
22159 + 5440	BU 377	AD	HD 211472	5	158	22.2	2006
22159 + 5440	BU 377	AQ	HD 211472	3	259	56.6	1999
22159 + 5440	BU 377	AR	HD 211472	2	256	62.7	1999
22159 + 5440	BU 377	AS	HD 211472	3	336	55.4	2006
22159 + 5440	BU 377	BC	HD 211472	11	303	6.7	2007
22159 + 5440	BU 377	QR	HD 211472	2	233	6.6	1999
22249 - 5748	I 383		$\rm HD\ 212330$	2	237	81.2	1914
22467 + 1210	HJ 301	AC	$\rm HD\ 215648$	5	15	145.0	1924
22514 + 1358	STT 597	AB	$\rm HD\ 216259$	12	329	201.2	1998
22514 + 1358	BUP 233	BC	${ m HD}\ 216259$	3	194	114.1	1998
23108 + 4531	$\rm HJ\ 1853$		$\rm HD\ 218868$	2	281	31.4	1905
23133 + 5710	STT 599		HD 219134	12	244	271.6	2002
23167 + 5313	BUP 235		$\rm HD\ 219623$	2	320	129.3	1930
23399 + 0538	BUP 240	AB	$\rm HD\ 222368$	4	305	119.2	2002
23399 + 0538	BUP 240	AC	$\rm HD\ 222368$	3	21	307.3	2002
23524+7533	BU 996	AC	HD 223778	11	141	145.7	2000

^aWhile the AB pair has an orbital solution in ORB6 and is likely physically bound, it is listed here to identify that component B is only optically associated with the sample star, which is component C. As noted in the next line, the blinking of archival images also helps identify AC as an optical pair. Thus, the physical pair AB is not associated with sample star C.

 ${\it Table 7.} \quad {\it Hipparcos} \ {\it Component Solutions}$

HD Name	$\begin{array}{c} {\rm HIP} \\ {\rm Name} \end{array}$	Companion ID	Solution Quality	Companion Status	Reason
(1)	(2)	(3)	(4)	(5)	(6)
000123	000518	В	A	YES	1
003196	002762	В	A	YES	1
003443	002941	В	A	YES	1
004614	003821	В	A	YES	1
007693	005842	D	A	YES	1
009770	007372	В	\mathbf{C}	YES	1
010360	007751	A	D	YES	1
016765	012530	В	В	YES	2
018143	013642	В	\mathbf{A}	YES	1
020010	014879	В	\mathbf{A}	YES	1
024409	018413	D	A	YES	1
025893	019255	В	A	YES	1
035112	025119	В	A	YES	1
037572	026373	В	В	YES	3
039855	027922	В	A	YES	4
048189	031711	В	A	YES	2
053705	034065	В	\mathbf{A}	YES	3
057095	035296	В	A	YES	1
064096	038382	В	A	YES	1
064606	038625	В	\mathbf{C}	NO	5
068255	040167	В	В	YES	1
068255	040167	\mathbf{C}	В	YES	1
073752	042430	В	A	YES	1
096064	054155	В	\mathbf{C}	YES	4
096064	054155	\mathbf{C}	\mathbf{C}	YES	1
099491	055846	В	D	YES	3
100180	056242	В	A	YES	4
101177	056809	В	\mathbf{A}	YES	1
111312	062505	В	\mathbf{C}	MAY	5
115404	064797	В	A	YES	1
116442	065352	В	\mathbf{A}	YES	3
128620	071683	В	D	YES	1
130042	072493	В	A	YES	2
131156	072659	В	A	YES	1

Table 7—Continued

HD Name (1)	HIP Name (2)	Companion ID (3)	Solution Quality (4)	Companion Status (5)	Reason (6)
133640	073695	В	В	YES	
137107	075333	В	A	YES	1
139341	076382	В	A	YES	1
145958	079492	В	A	YES	1
146361	079607	В	В	YES	1
148653	080725	В	A	YES	1
148704	080925	$^{-}$ C	A	NO	5
153557	083020	В	В	YES	6
155885	084405	A	A	YES	1
156274	084720	В	A	YES	1
158614	085667	В	A	YES	1
160269	086036	В	A	YES	1
162004	086620	В	D	YES	3
165341	088601	В	D	YES	1
165908	088745	В	A	YES	1
	091605	В	В	YES	2
176051	093017	В	A	YES	1
177474	093825	В	A	YES	1
179957	094336	В	A	YES	1
184467	095995	\mathbf{S}	В	YES	1
186858	097222	В	A	YES	1
189340	098416	В	A	YES	1
191499	099316	В	A	YES	5
200968	104239	В	A	YES	2
202275	104858	В	A	YES	1
202940	105312	В	A	YES	1
206826	107310	В	A	YES	1
212168	110712	В	A	YES	4

Note. — Column 5 values: 'YES' identifies physically associated companions, 'NO' marks unrelated field stars, and 'MAY' denotes unconfirmed candidates retained for further investigations. Column 6 notes: (1) Visual binary and/or spectroscopic binary with an or-

bital solution. (2) Measurements of the pair in the WDS confirm orbital motion. (3) Companion has matching independent parallax and proper motion measurements with the primary. (4) Companion has matching proper motion and photometric distance with the primary (see Table 4). (5) See individual system notes in § 4.3. (6) Companionship confirmed based on matching large proper motion and proximity to the primary.

Table 8. Accelerating Proper Motion Solutions

$_{ m HD}$	HIP		===== Hippe	arcos =====	===== Tyc	ho-2 =====	μ difference			Companion	
Name (1)	Name (2)	H59 (3)	$\mu_{\alpha} \; (\text{mas yr}^{-1})$ (4)	$\mu_{\delta} \text{ (mas yr}^{-1})$ (5)	$\mu_{\alpha} \text{ (mas yr}^{-1})$ (6)	$\mu_{\delta} \text{ (mas yr}^{-1})$ (7)	(σ) (8)	MK05 ^a (9)	F07 ^b (10)	Status (11)	Reason (12)
000123	000518	C	247.36 ± 0.81	17.77 ± 0.70	270.6 ± 1.6	30.1 ± 1.7	16.2			YES	1
003196	002762	$^{\rm C}$	407.68 ± 1.31	-36.47 ± 0.61	415.9 ± 0.5	-23.2 ± 0.5	22.6			YES	1
003443	002941	$^{\mathrm{C}}$	1422.09 ± 2.84	-17.15 ± 1.23	1391.0 ± 2.3	-13.0 ± 2.3	11.1			YES	1
004747	003850		516.74 ± 1.04	119.52 ± 0.72	518.8 ± 1.4	124.7 ± 1.4	4.0			YES	1
007788^{c}	005896	$^{\mathrm{C}}$	411.11 ± 0.50	127.43 ± 0.48	404.9 ± 3.3	108.3 ± 3.0	6.6			YES	1
010307	007918	G	791.35 ± 0.65	-180.16 ± 0.47	806.6 ± 1.0	-152.2 ± 1.0	31.8	Y	Y	YES	1
010360	007751	$^{\rm C}$	286.10 ± 1.01	16.66 ± 1.41	302.6 ± 1.4	-14.1 ± 1.3	24.8			YES	1
013445	010138		2092.84 ± 0.50	654.32 ± 0.55	2150.3 ± 2.5	673.2 ± 2.4	24.3	Y	Y	YES	2
014802	011072	\mathbf{G}	197.34 ± 0.77	-4.39 ± 0.51						YES	1
017382	013081	G	264.17 ± 1.24	-127.75 ± 0.81	274.5 ± 1.1	-122.6 ± 1.1	9.6	Y	Y	YES	1
018143	013642	$^{\rm C}$	262.72 ± 1.86	-191.44 ± 1.15	274.0 ± 1.7	-185.4 ± 1.6	7.1			YES	1
024409	018413	$^{\mathrm{C}}$	-284.06 ± 0.90	159.32 ± 0.96	-265.1 ± 0.9	169.7 ± 1.0	23.5			YES	1
025998	019335	\mathbf{G}	163.93 ± 0.65	-203.52 ± 0.55	166.8 ± 1.2	-203.1 ± 1.3	2.4		Y	MAY	3
026491	019233		185.91 ± 0.46	336.76 ± 0.51	196.7 ± 1.1	333.7 ± 1.2	10.1	Y	Y	YES	4
035112	025119	$^{\mathrm{C}}$	54.20 ± 1.44	-139.41 ± 0.94	69.7 ± 1.3	-152.1 ± 1.3	14.5			YES	1
036705	025647	G	32.14 ± 0.53	150.97 ± 0.73	48.9 ± 1.3	137.6 ± 1.2	17.0	Y	Y	YES	2
039587	027913		-163.17 ± 1.06	-98.92 ± 0.60	-174.6 ± 0.7	-89.9 ± 0.7	16.8	Y	Y	YES	1
040397	028267		71.23 ± 0.93	-203.34 ± 0.66	73.6 ± 1.0	-206.5 ± 1.1	3.7			YES	2
043587	029860		-189.37 ± 0.71	171.18 ± 0.50	-195.4 ± 1.0	164.6 ± 1.0	8.9	Y	Y	YES	1
045088	030630		-119.32 ± 1.06	-164.06 ± 0.76	-115.3 ± 0.8	-167.8 ± 0.8	6.0		Y	YES	1
048189	031711	C	-50.08 ± 0.73	72.69 ± 0.66	-26.0 ± 3.8	72.4 ± 3.4	6.3			YES	$\overline{2}$
052698	033817	G	206.58 ± 0.48	40.89 ± 0.72	203.3 ± 1.4	37.5 ± 1.3	3.5		Y	YES	5
$053680^{\rm d}$	034052	G	-75.43 ± 0.75	401.32 ± 2.10	-93.0 ± 1.2	395.3 ± 1.1	14.9	Y	Y	YES	5
	036357	G	160.40 ± 1.56	174.68 ± 1.02	159.7 ± 1.0	175.8 ± 1.1	1.1		Y	MAY	3
)58946 ^e	036366		159.33 ± 1.26	193.82 ± 0.56	157.2 ± 0.6	186.9 ± 0.6	11.7	Y	Y	YES	6
063077	037853	G	-220.83 ± 0.46	1722.89 ± 0.55	-274.1 ± 1.1	1687.0 ± 1.1	58.4	Y	Y	YES	7
064096	038382	C	-68.46 ± 1.11	-344.83 ± 1.03	-60.0 ± 0.7	-338.9 ± 0.7	9.6			YES	1
064606	038625	C	-251.57 ± 2.07	-62.07 ± 1.48	-259.1 ± 1.5	-47.7 ± 1.4	10.4			YES	1
065430	039064		180.46 ± 0.91	-544.36 ± 0.50	180.1 ± 1.1	-550.8 ± 1.0	6.4	Y	Y	YES	1
067199	039342		-157.34 ± 0.47	-130.52 ± 0.66	-155.9 ± 1.4	-126.7 ± 1.3	3.1			MAY	8
068017	040118		-460.69 ± 1.17	-644.64 ± 0.61	-464.7 ± 0.8	-646.5 ± 0.8	4.1			MAY	8
068255	040167	C	28.29 ± 2.00	-150.94 ± 1.15	79.8 ± 1.7	-129.4 ± 1.7	28.7			YES	2

Table 8—Continued

HD HIP $=$ ===== Hipparcos ===== $=$ ==== Tycho-2 ===== μ difference Converge μ_{α} (mas yr ⁻¹) μ_{δ} (nas yr ⁻¹) μ_{δ} (mas yr ⁻¹) μ_{δ} (mas yr ⁻¹) μ_{δ} (ma	ompanion Status Reas (11) (12) YES 2	Status
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	YES 2	(11)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(++)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	VIDO 4	YES
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	YES 1	YES
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	MAY 8	MAY
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	YES 2	YES
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	YES 1	YES
$120780 067742 G -583.27 \pm 0.91 -60.27 \pm 0.59 -596.4 \pm 1.1 -45.9 \pm 1.0 18.7 Y Y$	YES 1	YES
	YES 1	YES
122742 068682 O 85.26 \pm 0.64 \pm 304.04 \pm 0.47 91.1 \pm 1.2 \pm 307.5 \pm 1.2 5.7	YES 5	YES
144114 000004 O 00.40 ± 0.04 = 004.04 ± 0.41	YES 1	YES
$125276 069965 \dots -356.39 \pm 0.81 \qquad 366.76 \pm 0.78 -351.9 \pm 1.1 \qquad 365.3 \pm 1.1 \qquad 4.3 \qquad \dots \qquad \dots$	MAY 4	MAY
$128642 070857 O -73.73 \pm 0.65 -132.93 \pm 0.59 -72.0 \pm 0.8 -129.6 \pm 0.9 \qquad 4.3 \qquad \dots \qquad \dots$	YES 1	YES
130042 072493 C -107.28 ± 0.70 -320.91 ± 0.95 -109.4 ± 1.7 -330.8 ± 1.7 5.9	YES 6	YES
131582 072875 G -824.15 ± 1.27 2.29 ± 1.07 -824.4 ± 0.8 11.0 ± 0.8 8.1 Y Y	YES 5	YES
131923 073241 G -15.47 ± 0.89 -337.07 ± 0.88 -15.5 ± 1.0 -327.8 ± 1.2 7.7 Y Y	YES 1	YES
133640 073695 C -436.24 ± 1.20 18.94 ± 1.17 -443.7 ± 1.2 9.9 ± 1.2 9.8 Y	YES 1	YES
137763 075718 G 72.69 ± 1.09 -363.37 ± 0.79 76.4 ± 1.0 -359.0 ± 1.0 5.5 Y	YES 1	YES
139341 076382 C -482.47 ± 2.25 27.52 ± 1.47 -455.2 ± 0.8 51.0 ± 0.9 20.1	YES 1	YES
$140538 077052 \dots -44.96 \pm 0.95 -144.73 \pm 0.78 -48.0 \pm 0.8 -147.2 \pm 0.8 \qquad 4.4 \qquad \dots \qquad \dots$	YES 6	YES
144287 078709 G -488.79 ± 0.58 696.64 ± 0.73 -532.9 ± 1.0 683.0 ± 1.1 45.8 Y Y	YES 1	YES
$145825 079578 \dots -81.41 \pm 0.89 -252.61 \pm 1.04 -78.4 \pm 1.2 -256.9 \pm 1.2 \qquad 4.4 \qquad \dots \qquad \dots$	YES 1	YES
146361 079607 C -266.47 ± 0.86 -86.88 ± 1.12 -289.0 ± 3.0 -85.1 ± 2.8 7.5	YES 1	YES
$147584 080686 \dots \qquad 199.89 \pm 0.31 \qquad 110.77 \pm 0.51 \qquad 197.8 \pm 0.7 \qquad 111.5 \pm 0.7 \qquad 3.2 \qquad \dots \qquad \dots$	YES 1	YES
148653 080725 C -345.93 ± 1.56 385.98 ± 1.36 -339.9 ± 1.2 383.3 ± 1.3 4.3	YES 1	YES
148704 080925 C -428.05 ± 1.47 -333.41 ± 1.43 -427.6 ± 1.1 -326.2 ± 1.2 5.1	YES 1	YES
153557 083020 C -146.90 ± 1.15 272.21 ± 1.35 -153.9 ± 1.3 267.8 ± 1.4 6.2	YES 2	
156274 084720 C 1035.25 ± 1.38 109.22 ± 0.65 1053.5 ± 2.1 144.0 ± 2.0 19.4	YES 1	YES
158614 085667 C -126.64 ± 1.72 -172.00 ± 0.91 -126.7 ± 1.1 -179.6 ± 1.1 6.9		YES
160269 086036 C 277.38 ± 0.54 -525.62 ± 0.60 265.4 ± 3.3 -520.9 ± 3.2 3.9	YES 1	

Table 8—Continued

HD	HIP		===== Hipp	arcos =====	===== Tyc	ho-2 =====	μ difference			Companion	
Name	Name	H59	$\mu_{\alpha} \; (\text{mas yr}^{-1})$	$\mu_{\delta} \; (\text{mas yr}^{-1})$	$\mu_{\alpha} \; (\text{mas yr}^{-1})$	$\mu_{\delta} \; (\text{mas yr}^{-1})$	(σ)	$\mathrm{MK05^{a}}$	$\mathrm{F07^{b}}$	Status	Reason
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
161198	086722	G	-123.15 ± 1.00	-619.84 ± 0.88	-123.1 ± 1.1	-628.0 ± 1.0	8.2	Y	Y	YES	1
161797	086974		-291.42 ± 0.49	-750.00 ± 0.53	-310.3 ± 0.4	-750.3 ± 0.4	38.5	Y	Y	YES	1
165341	088601	$^{\rm C}$	124.56 ± 1.15	-962.66 ± 0.91	276.3 ± 2.3	-1091.8 ± 2.3	86.6			YES	1
165401	088622		-30.66 ± 0.88	-322.06 ± 0.75	-26.0 ± 1.1	-316.7 ± 1.1	6.5	Y	Y	YES	8
165499	089042	\mathbf{G}	-77.60 ± 0.59	234.68 ± 0.44	-81.5 ± 0.9	221.2 ± 0.9	15.6	Y	Y	YES	5
167425	089805		38.89 ± 0.57	-276.16 ± 0.51	37.9 ± 1.4	-280.4 ± 1.4	3.1			YES	9
177474	093825	$^{\rm C}$	96.93 ± 2.44	-279.67 ± 1.34	87.7 ± 1.2	-283.9 ± 1.2	4.9			YES	1
179957	094336	$^{\rm C}$	-205.02 ± 0.97	624.33 ± 0.89	-209.5 ± 1.3	622.2 ± 1.4	3.8			YES	1
181321	095149	\mathbf{G}	78.88 ± 4.08	-108.93 ± 2.50	87.6 ± 1.2	-86.4 ± 1.3	9.3	Y	Y	YES	5
186858	097222	$^{\rm C}$	13.30 ± 1.07	-440.57 ± 1.35	18.9 ± 2.6	-445.8 ± 2.4	3.1			YES	1
189340	098416	$^{\rm C}$	-246.73 ± 2.31	-392.36 ± 1.63	-282.0 ± 1.0	-399.7 ± 1.0	15.9			YES	1
190771	098921		263.35 ± 0.46	111.57 ± 0.46	259.2 ± 1.1	115.7 ± 1.1	5.3	Y	Y	YES	8
191408	099461		456.89 ± 0.89	-1574.91 ± 0.61	458.4 ± 1.1	-1569.3 ± 1.1	5.3	Y	Y	YES	6
191499	099316	$^{\rm C}$	3.79 ± 1.00	175.79 ± 1.02	3.9 ± 1.4	167.9 ± 1.4	5.6			YES	2
193664	100017		468.52 ± 0.55	296.81 ± 0.41	472.5 ± 1.1	296.1 ± 1.2	3.7			MAY	8
195564	101345		307.59 ± 0.88	106.07 ± 0.66	307.2 ± 0.7	103.7 ± 0.7	3.4			YES	2
195987	101382	O	-156.89 ± 0.53	452.80 ± 0.47	-154.3 ± 0.9	454.5 ± 0.9	3.4			YES	1
200560	103859		402.30 ± 0.66	141.72 ± 0.57	396.1 ± 0.8	141.0 ± 0.8	7.8	Y	Y	YES	2
200968	104239	$^{\rm C}$	382.32 ± 1.31	-46.55 ± 0.60	382.3 ± 0.9	-39.9 ± 0.8	8.3			YES	6
202940	105312	$^{\rm C}$	-582.35 ± 1.11	-357.67 ± 0.62	-568.3 ± 1.5	-353.7 ± 1.5	9.7			YES	1
203985	105911	\mathbf{G}	264.07 ± 1.28	184.71 ± 0.97	253.2 ± 1.1	179.6 ± 1.2	9.5	Y	Y	YES	5
206826	107310	$^{\rm C}$	260.33 ± 0.61	-242.73 ± 0.57	277.4 ± 2.7	-251.1 ± 2.6	7.1			YES	1
211415	110109		439.86 ± 0.53	-632.60 ± 0.43	436.8 ± 0.9	-632.8 ± 0.9	3.4			YES	6
212330	110649		180.71 ± 0.41	-331.27 ± 0.38	150.6 ± 1.1	-344.9 ± 1.1	30.0	Y	Y	YES	8
214953	112117		6.15 ± 0.63	-331.43 ± 0.51	3.1 ± 1.1	-326.9 ± 1.0	5.3	Y	Y	YES	9
223778	117712		341.82 ± 0.53	41.88 ± 0.47	325.8 ± 1.0	45.6 ± 1.1	16.4	Y	Y	YES	1
224930	000171	X	778.59 ± 2.81	-918.72 ± 1.81	829.9 ± 1.2	-989.4 ± 1.1	43.1	Y	Y	YES	1

Note. — Column 11 values: 'YES' identifies physically associated companions and 'MAY' denotes unconfirmed candidates retained for further investigations. Column 12 notes: (1) Visual and/or spectroscopic binary with an orbital solution. (2) Nearby companion is likely responsible for the proper motion acceleration (see § 4.3). (3) Hipparcos G flag and the χ^2 test in Frankowski et al. (2007) suggest an unseen companion, but because the Hipparcos and Tycho-2 proper

motions differ by less than 3σ , this is retained as a candidate for further investigations. (4) See individual system notes in § 4.3. (5) Hipparcos 'G' flag and a greater than 3σ difference in proper motion indicate an unseen companion. (6) Nearby companion with evidence of orbital motion based on WDS measurements is likely responsible for the proper motion acceleration. (7) Radial velocity variations indicate a spectroscopic binary, but not enough observations exist to derive an orbit. (8) Greater than 3σ difference in proper motion is the only evidence of a companion. The companion is considered physical if it also passed the χ^2 test in Frankowski et al. (2007), otherwise is retained as a candidate. (9) Nearby companion with matching photometric distance is likely likely responsible for the proper motion acceleration (see Table 10).

a'Y' in this column indicates that this was identified as a proper-motion binary by Makarov & Kaplan (2005)

b'Y' in this column indicates that this was identified as a proper-motion binary by Frankowski et al. (2007)

^cWide companion, 319" away from HD 7693.

^dWide companion, 185" away from HD 53705.

^eWide companion, 756" away from HIP 36357.

Table 9. Hipparcos Orbital Solutions

HD	HIP	Period (days) (3)	Companion	Reason
Name	Name		Status	Code
(1)	(2)		(4)	(5)
001273	001349	411.4	YES	1
006582	005336	7816.0	YES	1
010476	007981	207.3	NO	2
013974	010644	10.0	YES	1
014214	010723	93.5	YES	1
016739	012623	331.0	YES	1
032850	023786	204.4	YES	
110833	062145	270.2	YES	1
112914	063406	736.8	YES	1
113449	063742	231.2	YES	3
121370	067927	494.2	YES	1
122742	068682	3614.9	YES	
128642	070857	179.7	YES	1
131511	072848	125.4	YES	1
142373	077760	51.3	NO	2
143761	078459	78.0	MAY	3
160346	086400	83.9	YES	1
195987	101382	57.3	YES	1 2
203244	105712	1060.6	NO	

Note. — Column 4 values: 'YES' identifies physically associated companions, 'NO' marks unrelated field stars, and 'MAY' denotes unconfirmed candidates retained for further investigations. Column 5 notes: (1) Visual binary and/or spectroscopic binary with an orbital solution. (2) The pho-

tocentric orbital solution with a fairly high inclination is refuted by constant radial velocities measured over several years (Nidever et al. 2002; Abt & Biggs 1972; Gontcharov 2006; Latham et al. 2010). Hipparcos and Tycho-2 proper motions match to within 3σ , providing further evidence against a companion for the moderately inclined orbits. (3) See individual system notes in § 4.3.

WDS	Pair	HD	Sep	PA	Epoch		ΔT	μ_{α}	μ_{δ}		===	=== '	CCD Ma	gnitude	s ===		Infrare	ed Mag	nitudes	D	Error
ID (1)	ID (2)	Name (3)	(") (4)	(deg) (5)	(year) (6)	N (7)	(years) (8)	(mas (9)	1.	ref (11)	V (12)	ref (13)	$R \\ (14)$	ref (15)	<i>I</i> (16)	ref (17)	$J \\ (18)$	H (19)	K (20)	(pc) (21)	(pc) (22)
00458-4733	AB	004391	16.6	307	1993	3	98				12.7	1					8.44	7.95	7.64	12.0	1.9
03562 + 5939	AE	024409	8.9	228	1999	3	92				12.9	2					9.22	8.66	8.50	26.3	4.1
05287 - 6527	$^{\mathrm{AB}}$	036705	9.2	345	1998	3	69				13.0	2					8.17	7.66	7.34	7.2^{a}	1.1
05545 - 1942	$^{\mathrm{AB}}$	039855	10.6	20	2003	12	127								9.13	3	7.99	7.40	7.22	19.0	2.9
$05584\!-\!0439$	$^{\mathrm{AD}}$	040397	89.3	313	2000	2	40	78	-216	3			15.15	4	13.28	3	11.11	10.64	10.31	19.0	3.6
10172 + 2306	$^{\mathrm{AB}}$	089125	7.7	299	2005	30	154				11.4	2					8.36	7.79	7.59	24.9	3.9
15193 + 0146	$^{\mathrm{AB}}$	136202	11.4	35	2000	45	175	376	-517	5	10.2	2					7.49	6.91	6.75	20.6	3.5
16371 + 0015	$^{\mathrm{AB}}$	149806	6.3	19	2000	3	54				13.0	2					8.09	7.57	7.28	6.7^{a}	1.0
17465 + 2743	A-BC	161797	34.9	248	2007	108	226	-333	-753	5	10.4	2					$6.52^{\rm b}$	5.92^{b}	$5.70^{\rm b}$	6.2	0.9
18197 - 6353	$^{\mathrm{AB}}$	167425	7.8	352	2000	6	103				10.8	2					8.00	7.42	7.19	23.7	3.7
20096 + 1648	$^{\mathrm{AB}}$	191499	4.0	14	2003	51	221				9.4	2					6.21	5.88	5.95	12.9^{a}	3.5
$22426\!-\!4713$	$^{\mathrm{AB}}$	214953	7.5	125	1998	15	104	6	-320	6	10.3	2					7.44	6.86	6.63	17.8	2.8

Table 10. WDS Companions Confirmed by Photometry

Note. — Columns 1, 2, and 4–8 are from the WDS, and the astrometry listed in Columns 4–6 is for the most recent observation in the catalog as of 2008 July. Reference codes for columns 11, 13, 15, 17 are as follows: (1) Differential photometry with CTIO 0.9m V-band image; (2) Visual Double Stars in Hipparcos (Dommanget & Nys 2000); (3) The USNO B 1.0 Catalog (Monet et al. 2003); (4) The NOMAD Catalog (Zacharias et al. 2004a); (5) The LSPM North catalog (Lépine & Shara 2005); (6) The NLTT Catalog (Luyten 1979).

^aSee § 4.3 for a discussion of these photometric distance estimates and the status of these companions.

 $^{^{\}mathrm{b}}$ The companion is a visual binary. The $\mathit{Hipparcos}$ input catalog lists individual V magnitudes of 10.2 and 10.7 for the components. 2MASS lists combined magnitudes for the two stars. The 2MASS magnitudes have been accordingly adjusted for one component.

Table 11. Visual Orbit Solutions

WDS	HD	HIP	Discoverer		ΔT					Comp
Coord	Name	Name	ID	N	(years)	P	G	Ref	SB	Stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
()	()	()	()	()	()	()	()	()	()	()
			Resolve	ed-nair	Visual Orl	hits				
			1000170	oa pair	Visual Oil	5105				
00022 + 2705	224930	000171	BU 733AB	178	127	26.28 y	2	Sod1999	1	YES
00063 + 5826	000123	000518	STF3062	582	183	$106.7 \; { m y}$	2	Sod1999		YES
00352 - 0336	003196	002762	HO 212AB	201	121	6.89 y	1	Msn2005	2	YES
00373 - 2446	003443	002941	BU 395	163	132	25.09 y	1	Pbx2000b	2	YES
00490 + 1656	004676	003810	64 PscAa,Ab			$13.82~\mathrm{d}$	8	Bod1999b	2	YES
00491 + 5749	004614	003821	STF 60AB	1029	228	480 y	3	Str1969a		YES
01083 + 5455	006582	005336	WCK $1Aa,Ab$	14	31	21.75 y	4	Dru1995	1	YES
01158 - 6853	007788	005896	$\rm HJ~3423AB$	70	165	857.0 y	5	Sca 2005b		YES
01158 - 6853	007693	005842	I $27CD$	69	106	85.2 y	3	Sod1999		YES
01350 - 2955	009770	007372	DAW 31AB	88	79	4.56 y	1	Msn1999c		YES
01350 - 2955	009770	007372	BU $1000AB-C$	44	120	111.8 y	4	Nwb1969a		YES
01398 - 5612	010361	007751	DUN 5	159	177	483.66 y	5	vAb1957		YES
01418 + 4237	010307	007918	MCY 2	6	13	$19.5 \; y$	4	Sod1999	1	YES
02104 - 5049	013445	010138	ESG 1	4	5	69.7 y	5	Lgr2006		YES
02171 + 3413	013974	010644	MKT 5Aa,Ab	21	2	$10.02~\mathrm{d}$	1	MkT1995	2	YES
02422 + 4012	016739	012623	MCA 8	41	23	$330.98 \; d$	8	Bgn2006	2	YES
02442 + 4914	016895	012777	STF 296AB	71	224	2720 y	5	Hop1958		YES
02556 + 2652	018143	013642	STF 326AB	76	175		5	Hop1967		YES
03121 - 2859	020010	014879	HJ 3555	94	167	269 y	4	Sod1999		YES
03128 - 0112	019994	014954	HJ 663	15	154	1420 y	5	Hle1994		YES
03236 - 4005	021175	015799	I 468	3	56	111 y	5	Sod1999		YES
04076 + 3804	025893	019255	STT 531AB	171	153	590 y	5	Hei1986b		YES

Table 11—Continued

HADC	IID	IIID	D.		A.T.					
WDS	HD Name	HIP Name	Discoverer ID	N	ΔT	D	G	Ref	$_{ m SB}$	Comp Stat
Coord					(years)	P				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
04153 - 0739	026976	000000	STF 518BC	173	149	252.1 y	4	$\mathrm{Hei}1974\mathrm{c}$		YES
05074 + 1839	032923	023835	A 3010	19	76	1.19 y	3	Egg1956		NO
05226 + 0236	035112	025119	A 2641	21	88	93 y	4	Sod1999		YES
06173 + 0506	043587	029860	CAT 1Aa,Ab	4	3	28.8 y	5	Cat2006	1	YES
06262 + 1845	045088	030630	BU 1191	14	106	600 y	5	Hle1994		YES
07175 - 4659	057095	035296	I 7	60	107	94.0 y	4	Hei1995		YES
07518 - 1354	064096	038382	BU 101	229	132	22.70 y	2	Pbx2000b	2	YES
08122 + 1739	068257	040167	STF1196AB	1133	182	59.58 y	1	WSI2006b		YES
08122 + 1739	068257	040167	STF1196AB-C	515	207	1115 y	4	Hei1996b		YES
08122 + 1739	068256	040167	HUT 1 Ca , Cb	5	19	17.32 y	5	Hei1996b	1	YES
08391 - 2240	073752	042430	$\mathrm{BU}\ 208\mathrm{AB}$	126	124	123.0 y	3	Hei1990c		YES
09123 + 1500	079096	045170	FIN 347Aa,Ab	99	40	2.71 y	1	Msn1996a	2	YES
09179 + 2834	079969	045617	STF3121AB	388	173	34.17 y	1	Sod1999		YES
09357 + 3549	082885	047080	HU 1128	19	101	201 y	5	Hei1988d		YES
10281 + 4847	090508	051248	KUI 50	11	67	765 y	5	Hle1994		YES
11047 - 0413	096064	054155	A $676BC$	53	95	23.23 y	2	Doc2001e		YES
11182 + 3132	098231	055203	STF1523AB	1560	227	59.88 y	1	Msn1995		YES
11268 + 0301	099491	055846	STF1540AB	120	227	32000 y	5	Hop1960a		YES
11387 + 4507	101177	056809	STF1561AB	110	224	2050 y	5	Hle1994		YES
13169 + 1701	115404	064797	BU 800AB	194	123	770.0 y	4	Hle1994		YES
13473 + 1727	120136	067275	STT 270	56	169	2000 y	5	Hle1994		YES
14396 - 6050	128620	071683	RHD 1AB	438	255	79.91 y	2	Pbx2002	2	YES
14514 + 1906	131156	072659	STF1888AB	1358	227	151.6 y	2	Sod1999		YES
15038 + 4739	133640	073695	STF1909	769	226	206 y	2	Sod1999		YES
15232 + 3017	137107	075312	STF1937AB	1002	225	41.56 y	1	WSI2006b	2	YES

Table 11—Continued

WDS	HD	HIP	Discoverer		ΔT					Comp
Coord	Name	Name	ID	N	(years)	P	G	Ref	SB	Stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
15360 + 3948	139341	076382	STT 298AB	515	164	55.6 y	1	Sod1999		YES
16133 + 1332	145958	079492	STF2021AB	395	224	1354 y	4	Hop1964b		YES
16147 + 3352	146361	079607	STF2032AB	1041	226	726 y	4	Rag2009		YES
16289 + 1825	148653	080725	STF2052AB	528	185	224 y	2	Sod1999		YES
17153 - 2636	155885	084405	$\mathrm{SHJ}\ 243\mathrm{AB}$	264	230	470.9 y	4	Irw1996		YES
17191 - 4638	156274	084720	$BSO\ 13AB$	127	127	693.24 y	5	Wie1957		YES
17304 - 0104	158614	085667	STF2173	692	176	46.40 y	1	Hei1994a	2	YES
17350 + 6153	160269	086036	BU 962AB	129	125	76.1 y	3	Sod1999	1	YES
17419 + 7209	162003	086614	STF2241AB	141	207	12500 y	5	Rmn1994		YES
17433 + 2137	161198	086722	DUQ 1	6	5	$2558.4~\mathrm{d}$	5	Duq1996	1	YES
17465 + 2743	161797	086794	AC 7BC	343	153	43.20 y	2	Cou1960b		YES
18055 + 0230	165341	088601	STF2272AB	1678	230	88.38 y	1	Pbx2000b	2	YES
18070 + 3034	165908	088745	AC 15AB	205	146	$56.4 \mathrm{\ y}$	2	Sod1999		YES
18570 + 3254	176051	093017	$\mathrm{BU}\ 648\mathrm{AB}$	332	127	61.18 y	2	Doc2008f	1	YES
19064 - 3704	177474	093825	HJ 5084	260	165	121.76 y	2	Hei1986b		YES
19121 + 4951	179958	094336	STF2486AB	258	188	3100 y	4	Hle1994		YES
19311 + 5835	184467	095995	MCA 56	28	21	1.35 y	1	Pbx2000b	2	YES
19418 + 5032	186408	096895	STFA 46AB	534	206	18212 y	4	Mrc1999		YES
19456 + 3337	186858	097222	STF2576FG	426	179	232 y	2	Sod1999		YES
19598 - 0957	189340	098416	HO 276	36	39	4.90 y	2	Pbx2000b	2	YES
20329 + 4154	195987	101382	BLA 8	1	0	$57.32 \mathrm{\ d}$	8	Trr2002	2	YES
21145 + 1000	202275	104858	STT 535AB	486	155	$2084.03 \; \mathrm{d}$	1	Mut2008	2	YES
21198 - 2621	202940	105312	$\mathrm{BU}\ 271\mathrm{AB}$	49	117	261.62 y	5	Jas1997		YES
21441 + 2845	206826	107310	STF2822AB	693	229	789 y	4	Hei1995		YES
23524 + 7533	223778	117712	BU 996AB	15	103	290.0 y	5	Hle1994		YES

Table 11—Continued

WDS	HD	HIP	Discoverer		ΔT					Comp
Coord	Name	Name	ID	N	(years)	P	G	Ref	SB	Stat
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
			Photocentr	ric-moti	on Visual	Orbits				
00169-5239	001273	001349	GJ 13			411.4 d	9	Jnc2005	1	YES
01425 + 2016	010476	007981	$107 \; \mathrm{Psc}$			$207.27~\mathrm{d}$	9	$\mathrm{HIP}1997\mathrm{d}$		NO
02180 + 0145	014214	010723	GC 2770			$93.29~\mathrm{d}$	9	Fek2007	1	YES
02225 - 2349	014802	011072	κ For			26.5 y	9	Gon 2000		YES
02361 + 0653	016160	012114	PLQ 32Aa, P	6	5	61 y	9	Hei1994b		YES
02481 + 2704	017382	013081	GC 3359			15.5 y	9	Hei1990d	1	YES
05067 + 1427	032850	023786	GJ 3330			$204.38 \; d$	9	$\mathrm{HIP}1997\mathrm{d}$	1	YES
05544 + 2017	039587	027913	χ^1 Ori			$5156.29 \; {\rm d}$	9	HaI2002	1	YES
11182 + 3132	098231	055203	ξ UMa Aa,Ab			1.83 y	9	Hei1996b	1	YES
12442 + 5146	110833	062145	GC 17326			$270.21 \; d$	9	$\mathrm{HIP}1997\mathrm{d}$	1	YES
12595 + 4159	112914	063406	LTT 13738			$710.6~\mathrm{d}$	9	Jnc2005	1	YES
13038 - 0510	113449	063742	GC 17714			$231.23 \; d$	9	$\mathrm{HIP}1997\mathrm{d}$		YES
13546 + 1825	121370	067927	η Boo			$494.2~\mathrm{d}$	9	Jnc2005	1	YES
14035 + 1047	122742	068682	GJ 538			$3614.89 \; d$	9	$\rm HIP1997d$	1	YES
14160-0600	124850	069701	$\iota { m Vir}$			55 y	9	Gon 2003		MAY
14294+8049	128642	070857	GC 19630			$179.73~{ m d}$	9	$\rm HIP1997d$	1	YES
14534+1909	131511	072848	DE Boo			$125.4~\mathrm{d}$	9	Jnc2005	1	YES
15282 - 0921	137763	075718	${\it BAG~25Aa,Ab}$	1	0	$889.6 \mathrm{~d}$	9	Jnc2005	2	YES
15527+4227	142373	077760	χ Her			$51.29 \mathrm{\ d}$	9	$\mathrm{HIP}1997\mathrm{d}$		NO
16010+3318	143761	078459	ρ CrB			0.11 y	9	Gat2001a	1	MAY
16147 + 3352	146361	079607	σ CrB C			52 y	9	Hei1990d		YES
16285-7005	147584	080686	ζ TrA			12.9 d	9	Jnc2005	1	YES

Table 11—Continued

WDS Coord (1)	HD Name (2)	HIP Name (3)	Discoverer ID (4)	N (5)	$ \Delta T $ (years) (6)	P (7)	G (8)	Ref (9)	SB (10)	Comp Stat (11)
17393+0333 17465+2743 21094-7310 21247-6814	160346 161797 200525 203244	086400 086974 104440 105712	GJ 688 TRN 2Aa,Ab I 379A GC 29928	 2 4 	 0 34 	83.70 d 65 y 2145 d 1060.61 d	9 9 9 9	Jnc2005 Hei1994a Gln2006 HIP1997d	1 	YES YES YES NO

Note. — Column 11 values: 'YES' identifies physically associated companions, 'NO' marks unrelated field stars, and 'MAY' denotes unconfirmed candidates retained for further investigations.

Table 12. CNS Candidates Refuted by Constant RV Measures

HD	Comp		RV Constant
Name	Claim	Ref	References
(1)	(2)	(3)	(4)
004813	SB?	1	2,3
005133	$_{ m SB}$	1,4,5	6,7
017925	RV-Var	1	6,8
020630	SB?	1	6,8
020794	$_{ m SB}$	1	5,7,9
022484	SB?	1	6,8
025457	RV-Var	1	5,7,9
034721	$_{ m SB}$	1	6,8
042807	SB?	1	8
046588	SB?	1,10	11,12
073752	$_{ m SB}$	1	5,7,13
090839	SB?	1	6,8
102870	SB?	1	6
109358	$_{ m SB}$	1,14	6,8,15
114613	RV-Var	1	7,16
130948	$_{ m SB}$	1	6,8
141004	SB1	1	1,6,8
155885	RV-Var	1	6,8
158633	$_{ m SB}$	1	8
182572	SB?,RV-Var?	1	1
184385	RV-Var	1	6,8
192310	SB?	1	5,7,9
222368	SB?	1	6

Note. — Reference codes in Columns 3 & 4: (1) Gliese (1969); Gliese & Jahreiß (1979, 1991); (2) DM91; (3) Abt & Willmarth (2006); (4) Joy (1947); (5) Abt & Biggs (1972); (6) Nidever et al. (2002); (7) Gontcharov (2006); (8) Latham et al. (2010); (9) Duflot et al. (1995); (10) Batten et al. (1989); (11) Gomez & Abt (1982); (12) Pourbaix et al. (2004); (13) Heintz (1968); (14) Abt & Levy (1976); (15) Morbey & Griffin (1987); (16) Mur-

doch et al. (1993).

Table 13. Survey Stars and their Stellar, Brown Dwarf, and Planetary Companions

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			Sun		A									
			Mercury			0.24 y		0.39	Y					
			Venus			0.62 y		0.72	Y					
			Earth			1.00 y		1.00	Y					
			Mars			1.88 y		1.52	Y					
			Jupiter			11.86 y		5.20	Y					
			Saturn			29.42 y		9.54	Y					
			Uranus			84.01 y		19.19	Y					
			Neptune			164.8 y		30.06	Y					
$00\ 02\ 10.16$	$+27\ 04\ 56.1$	224930	85 Peg		A									
					AB	26.28 y	0.83	10.1	Y	O	1		M	
$00\ 06\ 15.81$	$+58\ 26\ 12.2$	000123	HIP 518	N	A									
					AB	106.7 y	1.44	30.9	Y	O			M	
					$_{\mathrm{Ba,Bb}}$	$47.69~\mathrm{d}$			Y		1			
$00\ 06\ 36.78$	$+29\ 01\ 17.4$	000166	HIP 544											
$00\ 12\ 50.25$	$-57\ 54\ 45.4$	000870	HIP 1031											
$00\ 16\ 12.68$	$-79\ 51\ 04.3$	001237	HIP 1292	N	A									
			GJ 3021 b			$133.71 \ d$		0.50	Y		1			
			HD 1237B		AB		3.87	67.7	Y			\mathbf{S}		
$00\ 16\ 53.89$	$-52\ 39\ 04.1$	001273	HIP 1349		A									
					Aa,Ab	1.13 y			Y	U	1			
$00\ 18\ 41.87$	$-08\ 03\ 10.8$	001461	HIP 1499											
$00\ 20\ 00.41$	$+38\ 13\ 38.6$	001562	HIP 1598											
$00\ 20\ 04.26$	$-64\ 52\ 29.2$	001581	ζ Tuc											
$00\ 22\ 51.79$	$-12\ 12\ 34.0$	001835	HIP 1803											
$00\ 24\ 25.93$	$-27\ 01\ 36.4$	002025	HIP 1936											
$00\ 25\ 45.07$	$-77\ 15\ 15.3$	002151	β Hyi											
$00\ 35\ 14.88$	$-03\ 35\ 34.2$	003196	13 Cet		A									
					Aa,Ab	$2.08 \mathrm{\ d}$			Y		1			
					AB	6.89 y	0.24	5.10	Y	O	2		M	\mathbf{S}
00 37 20.70	$-24\ 46\ 02.2$	003443	HIP 2941		A									

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			GJ 25 B		AB	25.09 y	0.67	10.3	Y	О	2		M	
00 39 21.81	$+21\ 15\ 01.7$	003651	$54 \mathrm{Psc}$	N	A									
			$\mathrm{HD}\ 3651\ \mathrm{b}$			62.24 d		0.30	Y		1			
			$\mathrm{HD}\ 3651\mathrm{B}$		AB		43.07	476	Y			$_{\mathrm{S}}$		
$00\ 40\ 49.27$	$+40\ 11\ 13.8$	003765	HIP 3206											
$00\ 44\ 39.27$	$-65\ 38\ 58.3$	004308	HIP 3497		A									
			$\mathrm{HD}\ 4308\ \mathrm{b}$			$15.56~\mathrm{d}$		0.12	Y		1			
$00\ 45\ 04.89$	$+01\ 47\ 07.9$	004256	HIP 3535											
$00\ 45\ 45.59$	$-47\ 33\ 07.2$	004391	HIP 3583	N	A									
					AB		16.6	251	Y			P		
					AC		49.0	742	Y			P		
$00\ 48\ 22.98$	$+05\ 16\ 50.2$	004628	HIP 3765	N	A									
					Aa,Ab		2.7	20.1	M			\mathbf{R}		
$00\ 48\ 58.71$	$+16\ 56\ 26.3$	004676	$64 \mathrm{Psc}$	N	A									
					Aa,Ab	$13.82~\mathrm{d}$	0.01	0.23	Y	O	2			\mathbf{S}
$00\ 49\ 06.29$	$+57\ 48\ 54.7$	004614	η Cas		A									
			LHS 122		AB	480 y	11.99	71.4	Y	O				
$00\ 49\ 26.77$	$-23\ 12\ 44.9$	004747	HIP 3850		A									
					Aa,Ab	18.7 y			Y		1		M	
$00\ 49\ 46.48$	$+70\ 26\ 58.1$	004635	HIP 3876											
$00\ 50\ 07.59$	$-10\ 38\ 39.6$	004813	HIP 3909											
$00\ 51\ 10.85$	$-05\ 02\ 21.4$	004915	HIP 3979											
$00\ 53\ 01.13$	$-30\ 21\ 24.9$	005133	HIP 4148											
$00\ 53\ 04.20$	$+61\ 07\ 26.3$	005015	HIP 4151											
$01\ 08\ 16.39$	$+54\ 55\ 13.2$	006582	$\mu \text{ Cas}$		A									
			μ Cas B		Aa,Ab	$21.75~\mathrm{y}$	1.01	7.63	Y	P	1			
$01\ 15\ 00.99$	$-68\ 49\ 08.1$	007693	HIP 5842		$C^{\mathbf{a}}$									
			GJ 55.1 B		CD	$85.2 \mathrm{\ y}$	1.14	24.7	Y	O			M	
			HD 7788		$_{A,CD}$		318	6883	Y			${ m T}$		
			GJ 55.3 B		AB	857 y	5.96	129	Y	P				
$01\ 15\ 11.12$	$-45\ 31\ 54.0$	007570	ν Phe											

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep ("') (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
01 16 29.25	+42 56 21.9	007590	HIP 5944											
$01\ 21\ 59.12$	$+76\ 42\ 37.0$	007924	HIP 6379											
			HD 7924 b			$5.40 \mathrm{d}$		0.06	Y		1			
01 29 04.90	$+21\ 43\ 23.4$	008997	HIP 6917		A									
					Aa,Ab	$10.98 \; d$			Y		2			V
01 33 15.81	$-24\ 10\ 40.7$	009540	HIP 7235											
01 34 33.26	$+68\ 56\ 53.3$	009407	HIP 7339											
01 35 01.01	$-29\ 54\ 37.2$	009770	HIP 7372		A									
					AB	4.56 y	0.18	3.89	Y	O				
					Ba,Bb	11.50 h		0.01	Y				\mathbf{E}	
					$_{\mathrm{AB,C}}$	111.8 y	1.42	30.7	Y	P				
01 36 47.84	$+41\ 24\ 19.7$	009826	v And	N	A									
			v And d			4.62 d		0.06	Y		1			
			v And c			241.31 d		0.83	Y		1			
			v And b			3.55 y		2.55	Y		1			
			v And B		AD		55	742	Y			$_{\mathrm{S}}$		
$01\ 37\ 35.47$	$-06\ 45\ 37.5$	010008	HIP 7576											
01 39 36.02	$+45\ 52\ 40.0$	010086	HIP 7734											
01 39 47.54	$-56\ 11\ 47.0$	010360	HIP 7751		B^{a}									
			HD 10361		AB	483.66 y	7.82	61.2	Y	P			\mathbf{M}	
$01\ 41\ 47.14$	$+42\ 36\ 48.1$	010307	HIP 7918		A									
					Aa,Ab	19.5 y	0.58	7.39	Y	P	1		\mathbf{M}	
$01\ 42\ 29.32$	$-53\ 44\ 27.0$	010647	q^1 Eri		A									
			HD 10647 b			2.75 y		2.03	Y		1			
$01\ 42\ 29.76$	$+20\ 16\ 06.6$	010476	$107 \mathrm{Psc}$											
01 44 04.08	$-15\ 56\ 14.9$	010700	τ Cet											
$01\ 47\ 44.83$	$+63\ 51\ 09.0$	010780	HIP 8362											
01 59 06.63	$+33\ 12\ 34.9$	012051	HIP 9269											
$02\ 06\ 30.24$	$+24\ 20\ 02.4$	012846	HIP 9829											
$02\ 10\ 25.93$	$-50\ 49\ 25.4$	013445	HIP 10138	N	A									
			Gl 86 b			$15.76 \ d$		0.11	Y	P	1			

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			GJ 86 B		AB	69.7 y	1.69	18.2	Y	Р	V		Μ	
$02\ 17\ 03.23$	$+34\ 13\ 27.2$	013974	δ Tri		A									
					Aa,Ab	$10.02 \mathrm{d}$	0.01	0.11	Y	O	2			
$02\ 18\ 01.44$	$+01\ 45\ 28.1$	014214	HIP 10723		A									
					Aa,Ab	93.29 d			Y	U	1			
$02\ 18\ 58.50$	$-25\ 56\ 44.5$	014412	HIP 10798											
$02\ 22\ 32.55$	$-23\ 48\ 58.8$	014802	κ For		A									
					AB	26.5 y	0.5	11.0	Y	U	V	R	M	
$02\ 36\ 04.89$	$+06\ 53\ 12.7$	016160	HIP 12114		A									
					Aa,Ab	61 y	3.2	23.0	Y	U		R		
			NLTT 8455		$_{\mathrm{Aa,B}}$		164	1177	Y			Р		
$02\ 36\ 41.76$	$-03\ 09\ 22.1$	016287	HIP 12158		A									
					Aa,Ab	$14.84 \ d$	0.01	0.24	Y		1			
$02\ 40\ 12.42$	$-09\ 27\ 10.3$	016673	HIP 12444		A									
					Aa,Ab				Y		V			
$02\ 41\ 14.00$	$-00\ 41\ 44.4$	016765	HIP 12530		A									
					AB		3.3	74.5	Y		V	O		
$02\ 42\ 14.92$	$+40\ 11\ 38.2$	016739	12 Per		A									
					Aa,Ab	330.98 d	0.05	1.21	Y	O	2			$_{\mathrm{S}}$
$02\ 42\ 33.47$	$-50\ 48\ 01.1$	017051	ι Hor		A									
			HR 810 b			$302.8 \mathrm{~d}$		0.93	Y		1			
$02\ 44\ 11.99$	$+49\ 13\ 42.4$	016895	θ Per		A									
			NLTT 8787		AB	2720 y	22.29	248	Y	P				
$02\ 48\ 09.14$	$+27\ 04\ 07.1$	017382	HIP 13081		A									
					Aa,Ab	15.27 y			Y	U	1		M	
			NLTT 8996		AB		20.7	509	Y			P		
$02\ 52\ 32.13$	$-12\ 46\ 11.0$	017925	HIP 13402											
$02\ 55\ 39.06$	$+26\ 52\ 23.6$	018143	HIP 13642		A									
			HD 18143 B		AB		5	117	Y	P			M	
			NLTT 9303		AC		44	1033	Y			${ m T}$		
$03\ 00\ 02.81$	$+07\ 44\ 59.1$	018632	HIP 13976											

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
03 02 26.03	+26 36 33.3	018803	51 Ari											
$03\ 04\ 09.64$	$+61\ 42\ 21.0$	018757	HIP 14286		A									
			NLTT 9726		AC		263.2	6377	Y			Р		
$03\ 09\ 04.02$	$+49 \ 36 \ 47.8$	019373	ι Per											
$03\ 12\ 04.53$	$-28\ 59\ 15.4$	020010	12 Eri	N	A									
			GJ 127 B		AB	269 y	4.0	56.9	Y	P				
					$_{\mathrm{Ba,Bb}}$				M		V			
$03\ 12\ 46.44$	$-01\ 11\ 46.0$	019994	94 Cet		A									
			HD 19994 b			1.47 y		1.43	Y		1			
					AB	1420 y	6.77	152	Y	P				
$03\ 14\ 47.23$	$+08\ 58\ 50.9$	020165	HIP 15099											
$03\ 15\ 06.39$	$-45\ 39\ 53.4$	020407	HIP 15131											
$03\ 18\ 12.82$	$-62\ 30\ 22.9$	020807	ζ^2 Ret	N	A									
			$\rm HD\ 20766$		AB		309.2	3720	Y			${ m T}$		
$03\ 19\ 01.89$	$-02\ 50\ 35.5$	020619	HIP 15442											
$03\ 19\ 21.70$	$+03\ 22\ 12.7$	020630	κ Cet											
$03\ 19\ 55.65$	$-43\ 04\ 11.2$	020794	HIP 15510											
$03\ 21\ 54.76$	$+52\ 19\ 53.4$	232781	HIP 15673											
$03\ 23\ 35.26$	$-40\ 04\ 35.0$	021175	HIP 15799	N	A									
					AB	111 y	1.8	31.4	Y	P				
$03\ 32\ 55.84$	$-09\ 27\ 29.7$	022049	ϵ Eri	N	A									
			ϵ Eri b			7.2 y		3.5	Y		1			
03 36 52.38	$+00\ 24\ 06.0$	022484	10 Tau											
$03\ 40\ 22.06$	$-03\ 13\ 01.1$	022879	HIP 17147											
$03\ 43\ 55.34$	$-19\ 06\ 39.2$	023356	HIP 17420											
$03\ 44\ 09.17$	$-38\ 16\ 54.4$	023484	HIP 17439	N	A									
					Aa,Ab				M		V			
$03\ 54\ 28.03$	$+16\ 36\ 57.8$	024496	HIP 18267	N	A									
					AB		2.7	55.2	Y			\mathbf{M}		
$03\ 55\ 03.84$	$+61\ 10\ 00.5$	024238	HIP 18324											
$03\ 56\ 11.52$	$+59\ 38\ 30.8$	024409	HIP 18413		A									

Table 13—Continued

(J2000.0) (1)	(J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
					AD	34.57 y	0.4	8.79	Y		1		Μ	
					AE		8.9	195	Y			Р		
$04\ 02\ 36.74$	$-00\ 16\ 08.1$	025457	HIP 18859											
$04\ 03\ 15.00$	$+35\ 16\ 23.8$	025329	HIP 18915											
$04\ 05\ 20.26$	$+22\ 00\ 32.1$	025680	39 Tau	N	A									
					Aa,Ab		0.4	6.78	Y			M		
$04\ 07\ 21.54$	$-64\ 13\ 20.2$	026491	HIP 19233	N	A									
					Aa,Ab	19.19 y			Y		1		M	
$04\ 08\ 36.62$	$+38\ 02\ 23.0$	025998	HIP 19335		$\mathrm{E^{b}}$									
					Ea, Eb				M				M	
			HD 25893		AE		746	15662	Y			${ m T}$		
					AB	590 y	3.87	81.3	Y	P	V			
$04\ 09\ 35.04$	$+69 \ 32 \ 29.0$	025665	HIP 19422											
$04\ 15\ 16.32$	$-07\ 39\ 10.3$	026965	HIP 19849		A									
			LHS 25		$_{A,BC}$		83	413	Y			${ m T}$		
			HD 26976		$_{\mathrm{BC}}$	252.1 y	6.94	34.6	Y	P				
$04\ 15\ 28.80$	$+06\ 11\ 12.7$	026923	HIP 19859		A									
			HD 26913		AB		64.5	1375	Y			${ m T}$		
$04\ 43\ 35.44$	$+27\ 41\ 14.6$	029883	HIP 21988											
$04\ 45\ 38.58$	$-50\ 04\ 27.2$	030501	HIP 22122											
$04\ 47\ 36.29$	$-16\ 56\ 04.0$	030495	HIP 22263											
$04\ 49\ 52.33$	$-35\ 06\ 27.5$	030876	HIP 22451											
$05\ 02\ 17.06$	$-56\ 04\ 49.9$	032778	HIP 23437		A									
			NLTT 14447		AB		79.1	1778	Y			P		
$05\ 05\ 30.66$	$-57\ 28\ 21.7$	033262	ζ Dor											
$05\ 06\ 42.22$	$+14\ 26\ 46.4$	032850	HIP 23786		A									
					Aa,Ab	$205.68~\mathrm{d}$			Y	U	1			
$05\ 07\ 27.01$	$+18\ 38\ 42.2$	032923	104 Tau	N										
$05\ 18\ 50.47$	$-18\ 07\ 48.2$	034721	HIP 24786											
$05\ 19\ 08.47$	$+40\ 05\ 56.6$	034411	HIP 24813											
$05\ 22\ 33.53$	$+79\ 13\ 52.1$	033564	HIP 25110		A									

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			HD 33564 b			1.06 y		1.12	Y		1			
$05\ 22\ 37.49$	$+02\ 36\ 11.5$	035112	HIP 25119		A									
					AB	93 y	1.1	22.2	Y	P			M	
$05\ 24\ 25.46$	$+17\ 23\ 00.7$	035296	HIP 25278	N	A									
			HD 35171		AC		707.2	10174	Y			${ m T}$		
$05\ 26\ 14.74$	$-32\ 30\ 17.2$	035854	HIP 25421											
$05\ 27\ 39.35$	$-60\ 24\ 57.6$	036435	HIP 25544											
$05\ 28\ 44.83$	$-65\ 26\ 54.9$	036705	AB Dor	N	A									
					Aa,Ab		0.16	2.43	Y			\mathbf{S}	M	
					AB		9.2	139	Y			P		
					$_{\mathrm{Ba,Bb}}$		0.07	1.06	Y			\mathbf{R}		
$05\ 36\ 56.85$	$-47\ 57\ 52.9$	037572	UY Pic		A									
			HIP 26369		AB		18.3	459	Y			${ m T}$		
$05\ 37\ 09.89$	$-80\ 28\ 08.8$	039091	π Men		A									
			HD 39091 b			5.89 y		3.38	Y		1			
$05\ 38\ 11.86$	$+51\ 26\ 44.7$	037008	HIP 26505											
$05\ 41\ 20.34$	$+53\ 28\ 51.8$	037394	HIP 26779		A									
			HD 233153		AB		98.8	1213	Y			${ m T}$		
$05\ 46\ 01.89$	$+37\ 17\ 04.7$	038230	HIP 27207											
$05\ 48\ 34.94$	$-04\ 05\ 40.7$	038858	HIP 27435											
$05\ 54\ 04.24$	$-60\ 01\ 24.5$	040307	HIP 27887		A									
			${ m HD}~40307~{ m b}$			4.31 d		0.05	Y		1			
			$\mathrm{HD}\ 40307\ \mathrm{c}$			$9.62 \mathrm{~d}$		0.08	Y		1			
			$\mathrm{HD}\ 40307\ \mathrm{d}$			$20.46~\mathrm{d}$		0.13	Y		1			
$05\ 54\ 22.98$	$+20\ 16\ 34.2$	039587	χ^1 Ori		A									
					Aa,Ab	14.06 y	0.5	4.33	Y	U	1	\mathbf{R}	M	
$05\ 54\ 30.16$	$-19\ 42\ 15.7$	039855	HIP 27922		A									
			BD-19 1297B		AB		10.6	249	Y			P		
$05\ 58\ 21.54$	$-04\ 39\ 02.4$	040397	HIP 28267	N	A									
					AB		3.9	91.9	Y			M	M	
			NLTT 15867		AD		89.3	2103	Y			P		

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
06 06 40.48	+15 32 31.6	041593	HIP 28954											
$06\ 10\ 14.47$	$-74\ 45\ 11.0$	043834	α Men	N	A									
					Aa,Ab		3.05	31.1	Y		V	M		
$06\ 12\ 00.57$	$+06\ 46\ 59.1$	042618	HIP 29432											
$06\ 13\ 12.50$	$+10\ 37\ 37.7$	042807	HIP 29525											
$06\ 13\ 45.30$	$-23\ 51\ 43.0$	043162	HIP 29568		A									
					AB		164	2742	Y			Р		
$06\ 17\ 16.14$	$+05\ 06\ 00.4$	043587	HIP 29860		A									
					Aa,Ab	28.8 y	0.62	11.9	Y	P	1		M	
			NLTT 16333		AE		103.1	1984	Y			Р		
$06\ 22\ 30.94$	$-60\ 13\ 07.2$	045270	HIP 30314	N	A									
					AB		16.2	385	M			\mathbf{R}		
$06\ 24\ 43.88$	$-28\ 46\ 48.4$	045184	HIP 30503											
$06\ 26\ 10.25$	$+18\ 45\ 24.8$	045088	OU Gem		A									
					Aa,Ab	$6.99 \mathrm{d}$			Y		2			V
					AB	600 y	3.23	47.6	Y	P			M	
$06\ 38\ 00.36$	$-61\ 32\ 00.2$	048189	HIP 31711	N	A									
					AB		0.3	6.39	Y			O	M	
$06\ 46\ 05.05$	$+32\ 33\ 20.4$	263175	HIP 32423		A									
			$^{ m HD}\ 263175{ m B}$		AB		30	787	Y			P		
$06\ 46\ 14.15$	$+79\ 33\ 53.3$	046588	HIP 32439											
$06\ 46\ 44.34$	$+43\ 34\ 38.7$	048682	$\psi^5~{ m Aur}$											
$06\ 55\ 18.67$	$+25\ 22\ 32.5$	050692	HIP 33277											
$06\ 58\ 11.75$	$+22\ 28\ 33.2$	051419	HIP 33537											
$06\ 59\ 59.66$	$-61\ 20\ 10.3$	053143	HIP 33690											
$07\ 01\ 13.74$	$-25\ 56\ 55.4$	052698	HIP 33817		A									
					Aa,Ab				Y		V		M	
$07\ 01\ 38.59$	$+48\ 22\ 43.2$	051866	HIP 33852											
$07\ 03\ 30.46$	$+29\ 20\ 13.5$	052711	HIP 34017											
$07\ 03\ 57.32$	$-43\ 36\ 28.9$	053705	HIP 34065		A									
			HD 53706		AB		20.9	345	Y			${ m T}$		

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			HD 53680		AC		184.9	3053	Y			Т		
					Ca,Cb				Y				M	
$07\ 08\ 04.24$	$+29\ 50\ 04.2$	053927	HIP 34414											
07 09 35.39	$+25\ 43\ 43.1$	054371	HIP 34567		A									
					Aa,Ab	$32.81 \ d$			Y		1			
$07\ 15\ 50.14$	$+47\ 14\ 23.9$	055575	HIP 35136											
$07\ 17\ 29.56$	$-46\ 58\ 45.3$	057095	HIP 35296		A									
					AB	94.0 y	0.75	10.9	Y	P				
$07\ 27\ 25.47$	$-51\ 24\ 09.4$	059468	HIP 36210											
07 29 01.77	$+31\ 59\ 37.8$		HIP 36357	N	$E^{\mathbf{a}}$									
					Ea,Eb				M				M	
			HD 58946		AE		756.1	13351	Y			${ m T}$		
			GJ 274B		AB		3.4	60.0	Y			O	M	
07 30 42.51	$-37\ 20\ 21.7$	059967	HIP 36515											
07 33 00.58	$+37\ 01\ 47.4$	059747	HIP 36704											
$07\ 34\ 26.17$	$-06\ 53\ 48.0$	060491	HIP 36827											
07 39 59.33	$-03\ 35\ 51.0$	061606	HIP 37349		A									
			NLTT 18260		AB		58.3	828	Y			P		
$07\ 45\ 35.02$	$-34\ 10\ 20.5$	063077	HIP 37853		A									
					Aa,Ab				Y		V		M	
			NLTT 18414		AB		914	13901	Y			P		
07 49 55.06	$+27\ 21\ 47.4$	063433	HIP 38228											
$07\ 51\ 46.30$	$-13\ 53\ 52.9$	064096	9 Pup		A									
					AB	22.7 y	0.60	9.90	Y	O	2		M	
07 54 34.18	$-01\ 24\ 44.1$	064606	HIP 38625	N	A									
					Aa,Ab	1.23 y			Y		1		M	
07 54 54.07	$+19\ 14\ 10.8$	064468	HIP 38657		Á									
					Aa,Ab	$161.2~\mathrm{d}$			Y		1			
$07\ 56\ 17.23$	$+80\ 15\ 55.9$	062613	HIP 38784											
$07\ 57\ 46.91$	$-60\ 18\ 11.1$	065907	HIP 38908	N	A									
			LHS 1960		AB		60.3	977	Y			P		

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
					BC		3	48.6	Y			Μ		
07 59 33.93	$+20\ 50\ 38.0$	065430	HIP 39064		A									
					Aa,Ab	8.59 y			Y		1		M	
08 00 32.13	$+29\ 12\ 44.5$	065583	HIP 39157											
08 02 31.19	$-66\ 01\ 15.4$	067199	HIP 39342		A									
					Aa,Ab				M				M	
$08\ 07\ 45.86$	$+21\ 34\ 54.5$	067228	μ Cnc											
08 11 38.64	$+32\ 27\ 25.7$	068017	HIP 40118		A									
					Aa,Ab				M				M	
08 12 12.73	$+17\ 38\ 52.0$	068257	ζ Cnc C	N	Á									
			HD 68255		AB	59.58 y	0.86	21.6	Y	O			M	
			HD 68256		AB,C	1115 y	7.70	193	Y	Р			M	
					Ca,Cb	17.32 y	0.18	4.51	Y	Р	1			
					Cb1,Cb2				Y				$_{ m L}$	
					Cb1,Cb3				\mathbf{M}			R		
08 18 23.95	$-12\ 37\ 55.8$	069830	HIP 40693		Á									
			HD 69830 b			$8.67~\mathrm{d}$		0.08	Y		1			
			HD 69830 c			31.56 d		0.19	Y		1			
			HD 69830 d			197 d		0.63	Y		1			
08 19 19.05	$+01\ 20\ 19.9$		HIP 40774											
08 27 36.79	$+45\ 39\ 10.8$	071148	HIP 41484											
08 32 51.50	$-31\ 30\ 03.1$	072673	HIP 41926											
08 34 31.65	$-00\ 43\ 33.8$	072760	HIP 42074	N	A									
					Aa,Ab		0.96	20.3	Y			R	M	
08 37 50.29	$-06\ 48\ 24.8$	073350	HIP 42333	N										
08 39 07.90	$-22\ 39\ 42.8$	073752	HIP 42430	N	A									
					AB	123.0 y	1.71	33.2	Y	O				
08 39 11.70	+65 01 15.3	072905	π^1 UMa											
08 39 50.79	+11 31 21.6	073667	HIP 42499											
08 42 07.52	$-42\ 55\ 46.0$	074385	HIP 42697		A	•••								
			NLTT 20102		AB		45	1029	Y			Р		

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
08 43 18.03	-38 52 56.6	074576	HIP 42808											
08 52 16.39	$+08 \ 03 \ 46.5$	075767	HIP 43557	N	A									
					Aa,Ab	$10.25~\mathrm{d}$			Y		1			
					AB		3.4	81.7	Y			M		
					$_{\mathrm{Ba,Bb}}$				Y		2			
$08\ 52\ 35.81$	$+28\ 19\ 50.9$	075732	$55 \mathrm{Cnc}$		A									
			$55 \mathrm{Cnc}\;\mathrm{e}$			2.80 d		0.04	Y		1			
			55 Cnc b			$14.65~\mathrm{d}$		0.11	Y		1			
			$55~\mathrm{Cnc}~\mathrm{c}$			$44.38 \ d$		0.24	Y		1			
			$55 \mathrm{Cnc} \mathrm{f}$			$260.7~\mathrm{d}$		0.78	Y		1			
			$55~\mathrm{Cnc}~\mathrm{d}$			14.70 y		5.84	Y		1			
			LHS 2063		AB		84.7	1045	Y			Р		
$08\ 54\ 17.95$	$-05\ 26\ 04.1$	076151	HIP 43726											
$08\ 58\ 43.93$	$-16\ 07\ 57.8$	076932	HIP 44075											
$09\ 08\ 51.07$	$+33\ 52\ 56.0$	078366	HIP 44897											
$09\ 12\ 17.55$	$+14\ 59\ 45.7$	079096	81 Cnc	N	A									
					Aa,Ab	2.71 y	0.12	2.44	Y	O	2			\mathbf{S}
			Gl 337C		AE		43	875	Y			Р		
					Ea, Eb		0.53	10.8	Y			M		
$09\ 14\ 20.54$	$+61\ 25\ 23.9$	079028	HIP 45333		A									
					Aa,Ab	$16.24~\mathrm{d}$			Y		1			
$09\ 17\ 53.46$	$+28\ 33\ 37.9$	079969	HIP 45617		A									
					AB	34.17 y	0.68	11.7	Y	O			M	
$09\ 22\ 25.95$	$+40\ 12\ 03.8$	080715	HIP 45963		A									
					Aa,Ab	3.8 d			Y		2			V
$09\ 30\ 28.09$	$-32\ 06\ 12.2$	082342	HIP 46626		A									
					AB		12	231	Y			P		
$09\ 32\ 25.57$	$-11\ 11\ 04.7$	082558	HIP 46816											
$09\ 32\ 43.76$	$+26\ 59\ 18.7$	082443	HIP 46843		A									
			NLTT 22015		AB		65.2	1160	Y			P		
$09\ 35\ 39.50$	$+35\ 48\ 36.5$	082885	HIP 47080		A									

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
					AB	201 y	3.84	43.7	Y	Р			M	
$09\ 42\ 14.42$	$-23\ 54\ 56.1$	084117	HIP 47592											
$09\ 48\ 35.37$	$+46\ 01\ 15.6$	084737	HIP 48113											
10 01 00.66	$+31\ 55\ 25.2$	086728	HIP 49081	N	A									
			GJ 376 B		AB		133	2001	Y			P		
					$_{\mathrm{Ba,Bb}}$				M				L	
10 04 37.66	$-11\ 43\ 46.9$	087424	HIP 49366											
10 08 43.14	$+34\ 14\ 32.1$	087883	HIP 49699											
			HD 87883 b			7.54 y		3.6	Y		1			
$10\ 13\ 24.73$	$-33\ 01\ 54.2$	088742	HIP 50075											
$10\ 17\ 14.54$	$+23\ 06\ 22.4$	089125	HIP 50384		A									
			GJ 387 B		AB		7.7	175	Y			Р		
10 18 51.95	$+44\ 02\ 54.0$	089269	HIP 50505											
10 23 55.27	$-29\ 38\ 43.9$	090156	HIP 50921											
10 28 03.88	$+48\ 47\ 05.6$	090508	HIP 51248		A									
			LHS 2266		AB	765 y	7.08	162	Y	Р				
10 30 37.58	$+55\ 58\ 49.9$	090839	HIP 51459	N	A									
			HD 237903		AB		122.5	1565	Y			Т		
					Ba,Bb				M		V			
10 31 21.82	$-53\ 42\ 55.7$	091324	HIP 51523											
10 35 11.27	+84 23 57.6	090343	HIP 51819											
10 36 32.38	$-12\ 13\ 48.4$	091889	HIP 51933											
10 42 13.32	$-13\ 47\ 15.8$	092719	HIP 52369											
$10\ 43\ 28.27$	$-29\ 03\ 51.4$	092945	HIP 52462											
10 56 30.80	$+07\ 23\ 18.5$	094765	HIP 53486											
10 59 27.97	$+40\ 25\ 48.9$	095128	$47~\mathrm{UMa}$		A									
			47 UMa b			3.00 y		2.14	Y		1			
			$47~\mathrm{UMa~c}$			6.00 y		3.39	Y		1			
11 04 41.47	$-04\ 13\ 15.9$	096064	HIP 54155		A									
			NLTT 26194		A,BC		11.8	310	Y			P		
			BD-033040C		$^{\mathrm{BC}}$	23.23 y	0.34	8.93	Y	O	V			

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
11 08 14.01	+38 25 35.9	096612	HIP 54426											
11 12 01.19	$-26\ 08\ 12.0$	097343	HIP 54704											
11 12 32.35	$+35\ 48\ 50.7$	097334	HIP 54745	N	A									
			Gl 417B		AE		89.7	1966	Y			R		
					Ea,Eb		0.1	2.19	Y			M		
11 14 33.16	$+25\ 42\ 37.4$	097658	HIP 54906											
11 18 10.95	$+31\ 31\ 45.7$	098230	ξ UMa B	N	${ m B^a}$									
					Ba,Bb	$3.98 \; d$			Y		1			
			HD 98231		ÁΒ	59.88 y	2.54	21.2	Y	O				\mathbf{S}
					Aa,Ab	1.84 y			Y	U	1			
11 18 22.01	$-05\ 04\ 02.3$	098281	HIP 55210											
11 26 45.32	+03 00 47.2	099491	83 Leo		A									
			HD 99492		AB	32000 y	40.76	723	Y	Р		$_{\mathrm{T}}$		
			HD 99492 b			17.04 d		0.12	Y		1			
11 31 44.95	$+14\ 21\ 52.2$	100180	88 Leo	N	A									
					Aa,Ab		0.1	2.33	M			R		
			NLTT 27656		AB		15.3	356	Y			P		
11 34 29.49	$-32\ 49\ 52.8$	100623	HIP 56452	N	A									
			LHS 309		AB		17	162	Y			M		
11 38 44.90	+45 06 30.3	101177	HIP 56809		A									
			LHS 2436		AB	2050 y	10.33	240	Y	P			M	
					Ba,Bb	23.54 d			Y		2			
11 38 59.72	+42 19 43.7	101206	HIP 56829		A	20.04 d								• • • •
					Aa,Ab	12.92 d	• • • •	• • •	Y		1	• • •		• • •
 11 41 03.02	+34 12 05.9	101501	61 UMa				• • •	• • •				• • •		
11 46 31.07	$-40 \ 30 \ 01.3$	102365	HIP 57443	N	 A	• • •	• • •	• • •	• • •	• • •	• • •	• • •		• • • •
			LHS 313		AB	• • •	22.9	211	 Y	• • •	• • •			• • •
 11 47 15.81	-30 17 11.4	102438	HIP 57507	• • • •		• • •			_	• • • •	• • •	М		• • • •
				• • • •	 A o A b	• • •	• • •	• • •	 M	• • •	 V	• • •		• • • •
11 50 41 79		102070	 2 V:	• • •	Aa,Ab	• • •	• • •	• • •	М	• • •	V	• • •		• • •
11 50 41.72	+01 45 53.0	102870	β Vir		• • • •	• • •	• • •	• • • •	• • •	• • •	• • •	• • •	• • •	• • •
$11\ 52\ 58.77$	$+37\ 43\ 07.2$	103095	HIP 57939	N					• • •	• • •		• • •	• • •	

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
11 59 10.01	-20 21 13.6	104067	HIP 58451											
12 00 44.45	$-10\ 26\ 45.6$	104304	HIP 58576											
12 09 37.26	$+40\ 15\ 07.4$	105631	HIP 59280											
12 30 50.14	+53 04 35.8	108954	HIP 61053											
12 33 31.38	$-68\ 45\ 20.9$	109200	HIP 61291											
12 33 44.54	+41 21 26.9	109358	HIP 61317	N										
12 41 44.52	+55 43 28.8	110463	HIP 61946		A									
					Aa,Ab				M		V			
12 44 14.55	+51 45 33.5	110833	HIP 62145		A									
					Aa,Ab	271.17 d			Y	U	1		М	
12 44 59.41	+39 16 44.1	110897	HIP 62207											
12 45 14.41	$-57\ 21\ 28.8$	110810	HIP 62229											
12 48 32.31	$-15\ 43\ 10.1$	111312	HIP 62505	N	A									•••
					Aa,Ab	2.68 y	0.1	2.38	Y		2		M	
• • •	• • •	• • • •	• • •	• • • •	Aa,Ab Aa,B		$\frac{0.1}{2.7}$	64.3	M			R	M	• • • •
12 48 47.05	+24 50 24.8	 111395	 HIP 62523	• • • •		• • •				• • • •				• • • •
12 48 47.03	$+24\ 50\ 24.8$ $-09\ 50\ 02.7$	111393	HIP 63366		 A	• • •	• • •	• • •	• • •	• • •		• • •		• • • •
				N		102.17.1	• • • •	• • •	 Y	• • •		• • •	• • •	• • • •
	• • •	• • •	• • •	• • •	$_{ m Aa,Ab}$	103.17 d		16.7	Y		1	 М	• • •	• • •
10 50 90 50		110014		• • • •		•••	0.8	16.7			• • • •		• • •	• • •
12 59 32.78	$+41\ 59\ 12.4$	112914	HIP 63406	• • • •	A		• • • •	• • •	3.7			• • • •	• • • •	• • • •
					Aa,Ab	1.95 y	• • • •	• • • •	Y	U	1	• • •		• • • •
13 03 49.66	-05 09 42.5	113449	HIP 63742	N	A		• • • •	• • •						• • •
				• • •	Aa,Ab	231.23 d	• • •	• • •	Y	U	V	R	M	• • •
13 11 52.39	$+27\ 52\ 41.5$	114710	β Com	• • •	• • •		• • •	• • •				• • •	• • •	• • •
13 12 03.18	$-37\ 48\ 10.9$	114613	HIP 64408	• • • •	• • •		• • •		• • •			• • •		• • •
$13\ 12\ 43.79$	$-02\ 15\ 54.1$	114783	HIP 64457		A									
			HD 114783 b			1.35 y		1.17	Y		1			
$13\ 13\ 52.23$	$-45\ 11\ 08.9$	114853	HIP 64550											
$13\ 15\ 26.45$	$-87\ 33\ 38.5$	113283	HIP 64690		A									
					Aa,Ab				\mathbf{M}				M	
$13\ 16\ 46.52$	$+09\ 25\ 27.0$	115383	59 Vir											

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
13 16 51.05	+17 01 01.9	115404	HIP 64797		A									
			LHS 2714		AB	770 y	8.06	89.2	Y	P			\mathbf{M}	
13 18 24.31	$-18\ 18\ 40.3$	115617	61 Vir											
13 23 39.15	$+02\ 43\ 24.0$	116442	HIP 65352		A									
			HD 116443		AB		26.2	404	Y			${ m T}$		
13 25 45.53	$+56\ 58\ 13.8$	116956	HIP 65515											
13 25 59.86	$+63\ 15\ 40.6$	117043	HIP 65530											
13 28 25.81	+13 46 43.6	117176	70 Vir		A									
			70 Vir b			116.69 d		0.48	Y		1			
13 41 04.17	$-34\ 27\ 51.0$	118972	HIP 66765											
13 41 13.40	$+56\ 43\ 37.8$	119332	HIP 66781											
13 47 15.74	+17 27 24.9	120136	τ Boo	N	A									
			au Boo b			3.31 d		0.05	Y		1			
			HD 120136B		AB	2000 y	14.39	224	Y	Р			M	
13 51 20.33	$-24\ 23\ 25.3$	120690	HIP 67620		A									
					Aa,Ab	10.3 y			Y		1		M	
13 51 40.40	-57 26 08.4	120559	HIP 67655											
13 52 35.87	$-50\ 55\ 18.3$	120780	HIP 67742	N	A									
					Aa,Ab				Y				M	
					AB		5.8	99.1	Y			M		
13 54 41.08	+18 23 51.8	121370	η Boo		A									
			η Boo		Aa,Ab	1.34 y			Y	U	1			
13 55 49.99	+14 03 23.4	121560	HIP 68030			1.04 y								
14 03 32.35	$+10\ 47\ 12.4$	121300 122742	HIP 68682	• • • •	A			•••			• • •			• • •
				• • • •	Aa,Ab		• • •	• • •	 Y	 U	 1	•••	 M	• • •
 14 11 46.17	$-12\ 36\ 42.4$	 124106	HIP 69357	• • • •		9.9 y	• • •	• • •				• • • •		• • •
14 11 46.17	$-12\ 50\ 42.4$ $-03\ 19\ 12.3$	124100 124292	HIP 69414	• • • •	• • •	• • •			• • • •				• • •	• • •
14 12 45.24 14 15 38.68	-03 19 12.3 -45 00 02.7	124292	HIP 69414 HIP 69671	 N	• • •	• • •						• • • •	• • • •	• • •
14 16 00.87	$-45\ 00\ 02.7$ $-06\ 00\ 02.0$	124550	$\iota \text{ Vir}$		۸	• • •								• • • •
				• • •	A	 55	• • •		 M	 TT		• • •	• • •	• • •
14 10 00 00	 0F 40 FF F	105076			Aa,Ab	55 y	• • •	• • • •	М	U	• • •	• • •		• • •
14 19 00.90	$-25\ 48\ 55.5$	125276	HIP 69965	N	Α				• • •	• • •	• • •	• • •	• • •	• • •

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
					Aa,Ab		8.0	144	Μ			R	Μ	
$14\ 19\ 34.86$	$-05\ 09\ 04.3$	125455	HIP 70016	N	A									
			LHS 2895		AB		8.1	169	Y			M		
$14\ 23\ 15.28$	$+01\ 14\ 29.6$	126053	HIP 70319											
$14\ 29\ 22.30$	$+80\ 48\ 35.5$	128642	HIP 70857		A									
					Aa,Ab	$178.78 \; \mathrm{d}$			Y	U	1		\mathbf{M}	
$14\ 29\ 36.81$	$+41\ 47\ 45.3$	127334	HIP 70873											
$14\ 33\ 28.87$	$+52\ 54\ 31.6$	128165	HIP 71181											
$14\ 36\ 00.56$	$+09\ 44\ 47.5$	128311	HIP 71395		A									
			HD 128311 b			1.25 y		1.10	Y		1			
			$\rm HD\ 128311\ c$			2.50 y		1.74	Y		1			
$14\ 39\ 36.50$	$-60\ 50\ 02.3$	128620	α Cen	N	A									
			HD 128621		AB	79.91 y	17.57	23.3	Y	O	2			
			Proxima Cen		AC		7867	10422	Y			${ m T}$		
14 40 31.11	$-16\ 12\ 33.4$	128987	HIP 71743											
$14\ 41\ 52.46$	$-75\ 08\ 22.1$	128400	HIP 71855											
$14\ 45\ 24.18$	$+13\ 50\ 46.7$	130004	HIP 72146											
$14\ 47\ 16.10$	$+02\ 42\ 11.6$	130307	HIP 72312											
$14\ 49\ 23.72$	$-67\ 14\ 09.5$	130042	HIP 72493		A									
					AB		1.5	37.4	Y			O	M	
$14\ 50\ 15.81$	$+23\ 54\ 42.6$	130948	HIP 72567	N	A									
			HD 130948 B		AB		2.6	47.2	Y			M		
			HD 130948 C		$_{\mathrm{BC}}$		0.1	1.82	Y			M		
$14\ 51\ 23.38$	$+19\ 06\ 01.7$	131156	ξ Boo		A									
			HD 131156B		AB	151.6 y	4.94	33.2	Y	O				
$14\ 53\ 23.77$	$+19\ 09\ 10.1$	131511	HIP 72848		A									
					Aa,Ab	$125.4 \ d$			Y	U	1			\mathbf{S}
$14\ 53\ 41.57$	$+23\ 20\ 42.6$	131582	HIP 72875		Á									
					Aa,Ab				Y				M	
14 55 11.04	$+53\ 40\ 49.2$	132142	HIP 73005											
$14\ 56\ 23.04$	$+49\ 37\ 42.4$	132254	HIP 73100											

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
14 58 08.80	-48 51 46.8	131923	HIP 73241		A									
					Aa,Ab	14.87 y			Y		1		M	
15 03 47.30	$+47\ 39\ 14.6$	133640	44 Boo		Á									
			NLTT 39210		AB	206 y	3.8	47.5	Y	O	V		M	
					Ba,Bb	6.43 h			Y		2		\mathbf{E}	
15 10 44.74	$-61\ 25\ 20.3$	134060	HIP 74273											
15 13 50.89	$-01\ 21\ 05.0$	135204	HIP 74537	N	A									
					AB		0.1	1.77	Y			O		
15 15 59.17	$+00\ 47\ 46.9$	135599	HIP 74702											
15 19 18.80	$+01\ 45\ 55.5$	136202	HIP 74975		A									
			LHS 3060		AB		11.4	289	Y			P		
15 21 48.15	$-48\ 19\ 03.5$	136352	HIP 75181											
15 22 36.69	$-10\ 39\ 40.0$	136713	HIP 75253											
15 22 46.83	$+18\ 55\ 08.3$	136923	HIP 75277											
15 23 12.31	$+30\ 17\ 16.1$	137107	$\eta \text{ CrB}$	N	A									
			HD 137108		AB	41.56 y	0.87	15.5	Y	O	2			
			GJ 584 C		$_{\mathrm{AB,E}}$		193.5	3456	Y			$_{\mathrm{S}}$		
15 28 09.61	$-09\ 20\ 53.1$	137763	HIP 75718	N	A									
					Aa,Ab	2.44 y	0.1	2.06	Y	U	2	R	M	$_{\mathrm{S}}$
			HD 137778		AΒ		52.3	1076	Y			${ m T}$		
			GJ 586 C		AC		1212	24948	Y			${ m T}$		
15 29 11.18	+80 26 55.0	139777	HIP 75809		A									
			HD 139813		AB		31.3	683	Y			${ m T}$		
$15\ 36\ 02.22$	$+39\ 48\ 08.9$	139341	HIP 76382		A									
					AB	55.6 y	0.79	17.6	Y	O			M	
			HD 139323		$_{AB,C}$		121.5	2710	Y			${ m T}$		
$15\ 44\ 01.82$	$+02\ 30\ 54.6$	140538	ψ Ser		A									
					AB		4.4	64.5	Y			O	\mathbf{M}	
$15\ 46\ 26.61$	$+07\ 21\ 11.1$	141004	HIP 77257											
$15\ 47\ 29.10$	$-37\ 54\ 58.7$	140901	HIP 77358	N	A									
			NLTT 41169		AB		15	230	Y			M		

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
15 48 09.46	+01 34 18.3	141272	HIP 77408	N	A									
					AB		17.9	381	Y			\mathbf{S}		
$15\ 52\ 40.54$	$+42\ 27\ 05.5$	142373	χ Her											
$15\ 53\ 12.10$	$+13\ 11\ 47.8$	142267	39 Ser		A									
					Aa,Ab	$138.56 \ d$			Y		1			
$16\ 01\ 02.66$	$+33\ 18\ 12.6$	143761	$\rho \text{ CrB}$	N	A									
			$\rho \text{ CrB b}$			39.84 d		0.23	M		1			
					Aa,Ab	$40.18 \ d$			M	U				
$16\ 01\ 53.35$	$+58\ 33\ 54.9$	144284	θ Dra	N	A									
					Aa,Ab	3.07 d			Y		2			V
$16\ 04\ 03.71$	$+25\ 15\ 17.4$	144287	HIP 78709		A									
					Aa,Ab	12.19 y	0.2	4.44	Y		1		M	
$16\ 04\ 56.79$	$+39\ 09\ 23.4$	144579	HIP 78775	N	A									
			LHS 3150		AB		70.3	1020	Y			P		
$16\ 06\ 29.60$	$+38\ 37\ 56.1$	144872	HIP 78913											
$16\ 09\ 42.79$	$-56\ 26\ 42.5$	144628	HIP 79190											
$16\ 10\ 24.31$	$+43\ 49\ 03.5$	145675	14 Her		A									
			14 Her b			4.81 y		2.85	Y		1			
$16\ 13\ 18.45$	$+13\ 31\ 36.9$	145958	HIP 79492	N	A									
			NLTT 42272		AB	1354 y	5.09	120	Y	Р				
					AD		1623	38278	M			\mathbf{S}		
$16\ 13\ 48.56$	$-57\ 34\ 13.8$	145417	HIP 79537											
16 14 11.93	$-31\ 39\ 49.1$	145825	HIP 79578		A									
					Aa,Ab	7.14 y			Y		1		M	
$16\ 14\ 40.85$	$+33\ 51\ 31.0$	146361	σ^2 CrB	N	A									
					Aa,Ab	$1.14 \mathrm{d}$			Y	O	2			V
			${ m HD} \ 146362$		AB	726 y	5.26	110	Y	P			M	
			HIP 79551		AE		633.7	13357	Y			$_{\mathrm{T}}$		
			σ CrB D		$_{\mathrm{Ea,Eb}}$	52 y			Y	U				
$16\ 15\ 37.27$	$-08\ 22\ 10.0$	146233	18 Sco											
$16\ 24\ 01.29$	$-39\ 11\ 34.7$	147513	HIP 80337		A									

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			HD 147513 b			1.45 y		1.31	Y		1			
					AB		345	4408	Y			\mathbf{T}		
$16\ 24\ 19.81$	$-13\ 38\ 30.0$	147776	HIP 80366	N	A									
					AC		6.4	137	M			R		
					AD		9.7	208	Y			M		
$16\ 28\ 28.14$	$-70\ 05\ 03.8$	147584	$\zeta \text{ TrA}$		A									
					Aa,Ab	$12.98~\mathrm{d}$			Y	U	1		M	
$16\ 28\ 52.67$	$+18\ 24\ 50.6$	148653	HIP 80725		A									
			LHS 3204		AB	224 y	2.21	43.4	Y	O			M	
16 31 30.03	$-39\ 00\ 44.2$	148704	HIP 80925	N	A									
					Aa,Ab	$31.86~\mathrm{d}$			Y		2		M	
$16\ 36\ 21.45$	$-02\ 19\ 28.5$	149661	HIP 81300											
$16\ 37\ 08.43$	$+00\ 15\ 15.6$	149806	HIP 81375	N	A									
					AB		6.3	128	Y			P		
$16\ 39\ 04.14$	$-58\ 15\ 29.5$	149612	HIP 81520											
$16\ 42\ 38.58$	$+68\ 06\ 07.8$	151541	HIP 81813											
$16\ 52\ 58.80$	$-00\ 01\ 35.1$	152391	HIP 82588											
$16\ 57\ 53.18$	$+47\ 22\ 00.1$	153557	HIP 83020	N	A									
					AB		4.9	89.7	Y			M	M	
			HD 153525		AC		112.1	2051	Y			${ m T}$		
$17\ 02\ 36.40$	$+47\ 04\ 54.8$	154345	HIP 83389		A									
			HD 154345 b			9.10 y		4.18	Y		1			
$17\ 04\ 27.84$	$-28\ 34\ 57.6$	154088	HIP 83541											
$17\ 05\ 16.82$	$+00\ 42\ 09.2$	154417	HIP 83601											
$17\ 10\ 10.35$	$-60\ 43\ 43.6$	154577	HIP 83990											
$17\ 12\ 37.62$	$+18\ 21\ 04.3$	155712	HIP 84195											
$17\ 15\ 20.98$	$-26\ 36\ 10.2$	155885	36 Oph		A									
					AB	470.9 y	13.0	77.1	Y	P				
			${ m HD}\ 156026$		AC		731.6	4340	Y			${ m T}$		
$17\ 19\ 03.83$	$-46\ 38\ 10.4$	156274	$41~\mathrm{Ara}$		A									
					Aa,Ab	$88.03~\mathrm{d}$			Y		1		M	

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			NLTT 44525		AB	693.24 y	10.42	91.7	Y	Р				
$17\ 20\ 39.57$	$+32\ 28\ 03.9$	157214	72 Her											
$17\ 22\ 51.29$	$-02\ 23\ 17.4$	157347	HIP 85042		A									
	• • •		HR 6465		AB		49	956	Y			P		
$17\ 25\ 00.10$	$+67\ 18\ 24.1$	158633	HIP 85235											
$17\ 30\ 16.43$	$+47\ 24\ 07.9$	159062	HIP 85653											
$17\ 30\ 23.80$	$-01\ 03\ 46.5$	158614	HIP 85667		A									
					AB	46.40 y	0.98	16.0	Y	O	2		M	
$17\ 32\ 00.99$	$+34\ 16\ 16.1$	159222	HIP 85810											
$17\ 34\ 59.59$	$+61\ 52\ 28.4$	160269	26 Dra		A									
					AB	76.1 y	1.53	21.7	Y	O	1		M	
			HIP 86087		$_{\rm AB,C}$		737.6	10466	Y			${ m T}$		
17 39 16.92	$+03 \ 33 \ 18.9$	160346	HIP 86400		A									
					Aa,Ab	83.73 d			Y	U	1			
17 41 58.10	$+72\ 09\ 24.9$	162004	31 Dra B		B^{a}									
			HD 162003		AB	12500 y	55.2	1273	Y	P		${ m T}$		
17 43 15.64	$+21\ 36\ 33.1$	161198	HIP 86722		A									
					Aa,Ab	7.0 y	0.17	3.85	Y	Р	1		M	
17 44 08.70	$-51\ 50\ 02.6$	160691	μ Ara		Á									
			HD 160691 d			9.55 d		0.09	Y		1			
			HD 160691 e			$310.55 \; d$		0.94	Y		1			
			HD 160691 b			1.72 y		1.51	Y		1			
			HD 160691 c			6.82 y		3.78	Y		1			
$17\ 46\ 27.53$	$+27\ 43\ 14.4$	161797	μ Her A		A									
					Aa,Ab	65.0 y	1.43	11.9	Y	U	V	R	M	
			NLTT 45430		Aa,BC		34	282	Y			Р		
					$\stackrel{'}{\mathrm{BC}}$	43.2 y	1.36	11.3	Y	O				
$17\ 53\ 29.94$	$+21\ 19\ 31.1$		HIP 87579											
18 02 30.86	+26 18 46.8	164922	HIP 88348		A									
			HD 164922 b			3.16 y		2.11	Y		1			
18 05 27.29	$+02\ 30\ 00.4$	165341	70 Oph	N	A									

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			NLTT 45900		AB	88.38 y	4.55	23.1	Y	О	2		Μ	
18 05 37.46	$+04 \ 39 \ 25.8$	165401	HIP 88622		A									
					Aa,Ab				Y		V		M	
18 06 23.72	$-36\ 01\ 11.2$	165185	HIP 88694											
18 07 01.54	$+30\ 33\ 43.7$	165908	HIP 88745	N	A									
					Aa,Ab		0.2	3.13	M		V	R		
					AB	56.4 y	1.0	15.6	Y	O				
18 09 37.42	$+38\ 27\ 28.0$	166620	HIP 88972											
18 10 26.16	$-62\ 00\ 07.9$	165499	ι Pav		A									
					Aa,Ab				Y				M	
18 15 32.46	+45 12 33.5	168009	HIP 89474											
18 19 40.13	$-63\ 53\ 11.6$	167425	HIP 89805		A									
					AB		7.8	179	Y			Р	M	
18 31 18.96	$-18\ 54\ 31.7$	170657	HIP 90790											
18 38 53.40	$-21\ 03\ 06.7$	172051	HIP 91438											
18 40 54.88	+31 31 59.1		HIP 91605		A									
			LHS 3402		AB		9.3	218	Y			0		
18 55 18.80	-37 29 54.1	175073	HIP 92858											
18 55 53.22	+23 33 23.9	175742	HIP 92919		A			• • • •						
					Aa,Ab	2.88 d			Y		1			
 18 57 01.61	$+32\ 54\ 04.6$	 176051	 HIP 93017		A A									
	•			• • • •	AB	61.18 y	1.24	18.4	 Y	 O	 1	• • •		• • •
19 59 51 00		 1 <i>76</i> 977	HIP 93185	• • • •								• • •		• • •
18 58 51.00 19 06 25.11	$+30\ 10\ 50.3$ $-37\ 03\ 48.4$	$\frac{176377}{177474}$		• • • •	۸	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •	• • •
			γ CrA A	• • •	A	101.70	1.00	20.0	 Y		• • •	• • •		• • •
10.06.50.46		177505		• • •	AB	121.76 y	1.90	32.9		О	• • •	• • •	M	• • • •
19 06 52.46	-37 48 38.4	177565	HIP 93858			• • •	• • •	• • • •	• • •	• • • •	• • •	• • •	• • • •	
19 07 57.32	$+16\ 51\ 12.2$	178428	HIP 93966	N	A									• • • •
				• • •	Aa,Ab	21.96 d			Y		1			
19 12 05.03	$+49\ 51\ 20.7$	179957	HIP 94336	• • • •	A						• • •	• • •		• • •
			HD 179958	• • •	AB	3100 y	12.75	311	Y	Р			M	
19 12 11.36	$+57\ 40\ 19.1$	180161	HIP 94346											

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
19 21 29.76	-34 59 00.6	181321	HIP 95149		A									
					Aa,Ab				Y				M	
19 23 34.01	$+33\ 13\ 19.1$	182488	HIP 95319											
19 24 58.20	$+11\ 56\ 39.9$	182572	31 Aql											
19 31 07.97	$+58\ 35\ 09.6$	184467	HIP 95995		A									
					AB	1.35 y	0.09	1.53	Y	O	2			
19 32 06.70	$-11\ 16\ 29.8$	183870	HIP 96085											
19 32 21.59	$+69\ 39\ 40.2$	185144	σ Dra											
19 33 25.55	$+21\ 50\ 25.2$	184385	HIP 96183											
19 35 55.61	+56 59 02.0	185414	HIP 96395		A									
					Aa,Ab	13.08 y			Y		1			
19 41 48.95	$+50\ 31\ 30.2$	186408	16 Cyg A	N	Á									
					Aa,Ab		3.4	71.7	Y		V	R		
			HD 186427		Aa,B	18212 y	40.79	859	Y	Р		Т		
			16 Cyg B b			2.19 y		1.68	Y		1			
19 45 33.53	+33 36 07.2	186858	HIP 97222		F^{a}									
					FG	232 y	2.07	43.7	Y	0			M	
			HD 187013		AF		780	16476	Y			Т		
					Aa,Ab				M		V			
			HD 225732		AB		26	549	Y			P		
19 51 01.64	+10 24 56.6	187691	HIP 97675		A									
					AC		22.5	431	Y			Р		• • • •
19 59 47.34	-09 57 29.7	189340	HIP 98416		A				_					
					AB	4.90 y	0.15	3.33	 Y	 O	2		 М	
20 00 43.71	$+22\ 42\ 39.1$	189733	 HIP 98505	• • • •	A					_				• • •
			HD 189733 b			2.22 d	• • •	0.03	 Y	• • •	 1	• • •	 E	
20 02 34.16	+15 35 31.5	 190067	HIP 98677	 N	 A					• • •		• • •		• • •
					A AB	• • •	2.9	55.0	 Y	• • •		 М	• • •	
20 03 37.41		190360	 HIP 98767	• • • •		• • •				• • •	• • •		• • • •	
	$+29\ 53\ 48.5$				Α	 17 11 J	• • •	0.12	 Y	• • •	1	• • •	• • •	• • •
• • •	• • •	• • •	HD 190360 c		• • •	17.11 d		0.13			1	• • •	• • • •	• • •
	• • •		HD 190360 b		• • •	8.01 y	• • •	4.02	Y		1		• • •	

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			LHS 3509		AB		178.2	2825	Y			Т		
20 03 52.13	$+23\ 20\ 26.5$	190404	HIP 98792											
20 04 06.22	$+17\ 04\ 12.6$	190406	HIP 98819	N	A									
			HD 354613		Aa,Ab		0.79	14.0	Y			M		
20 04 10.05	$+25\ 47\ 24.8$	190470	HIP 98828											
20 05 09.78	$+38\ 28\ 42.4$	190771	HIP 98921		A									
					Aa,Ab				Y		V		M	
20 05 32.76	$-67\ 19\ 15.2$	189567	HIP 98959											
20 07 35.09	$-55\ 00\ 57.6$	190422	HIP 99137											
20 08 43.61	$-66\ 10\ 55.4$	190248	δ Pav											
20 09 34.30	$+16\ 48\ 20.8$	191499	HIP 99316	N	A									
			ADS 13434B		AB		4.45	105	Y			Р	M	
20 11 06.07	+16 11 16.8	191785	HIP 99452		A									
					AE		103.8	2116	Y			Р		
20 11 11.94	-36 06 04.4	191408	HIP 99461		A									
			LHS 487		AB	•••	7.1	42.7	Y			O	M	
20 13 59.85	$-00\ 52\ 00.8$	192263	HIP 99711		A									
			HD 192263 b			24.36 d		0.15	Y		1			
20 15 17.39	$-27\ 01\ 58.7$	192310	HIP 99825			21.00 d								
20 17 31.33	+66 51 13.3	193664	HIP 100017		A									
					Aa,Ab				М				M	
20 27 44.24	$-30\ 52\ 04.2$	194640	HIP 100925											
20 32 23.70	$-09\ 51\ 12.2$	195564	HIP 101345	N	A									
			LTT 8128		AB		4.4	107	Y			M	M	
20 32 51.64	+41 53 54.5	195987	HIP 101382		A									
					Aa,Ab	57.32 d	0.02	0.44	 Y	 O	2	• • •	M	• • •
20 40 02.64	$-60 \ 32 \ 56.0$	196378	ϕ^2 Pav	• • •								• • •		• • •
20 40 02.64	$-00 \ 52 \ 50.0$ $-23 \ 46 \ 25.9$	196761	φ Pav HIP 101997	• • • •	• • •	• • •					• • • •		• • •	
20 40 11.76	$-25\ 40\ 25.9$ $+19\ 56\ 07.9$	190701	HIP 101997 HIP 102040	• • •	Λ	• • •	• • • •						• • •	• • • •
	•		NLTT 49681	• • • •	A	• • •	195.1	2620	 Y		• • •	 Р	• • •	
	 20 25 26 1	 197214	HIP 102264	• • •	AC	• • •	125.1	2620		• • •	• • •		• • •	• • •
20 43 16.00	$-29\ 25\ 26.1$	197214	птР 102204		• • •	• • •	• • • •			• • •		• • •	• • •	• • •

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
					Aa,Ab				Y		V			
20 49 16.23	$+32\ 17\ 05.2$	198425	HIP 102766		A									
					Aa,Ab				M		V			
			NLTT 49961		AB		33.0	793	Y			P		
20 56 47.33	$-26\ 17\ 47.0$	199260	HIP 103389											
20 57 40.07	$-44\ 07\ 45.7$	199288	HIP 103458											
21 02 40.76	$+45\ 53\ 05.2$	200560	HIP 103859	N	$^{\mathrm{C}}$									
			GJ 816.1B		$\mathrm{CD^c}$		3.3	64.3	Y			M	M	
21 07 10.38	$-13\ 55\ 22.6$	200968	HIP 104239		A									
			GJ 819B		AB		4.31	75.7	Y			O	M	
21 09 20.74	$-82\ 01\ 38.1$	199509	HIP 104436											
21 09 22.45	$-73\ 10\ 22.7$	200525	HIP 104440	N	A									
					AB	5.87 y	0.2	3.95	Y	U		R		
			NLTT 50542		$_{AB,C}$		7.2	142	Y			M		
21 14 28.82	$+10\ 00\ 25.1$	202275	δ Equ	N	A									
					AB	5.71 y	0.23	4.25	Y	Ο	2			\mathbf{S}
21 18 02.97	$+00\ 09\ 41.7$	202751	HIP 105152											
21 18 27.27	$-43\ 20\ 04.7$	202628	HIP 105184											
21 19 45.62	$-26\ 21\ 10.4$	202940	HIP 105312		A									
					Aa,Ab	21.35 d			Y		1			
			LHS 3656		AB	261.62 y	3.01	54.1	Y	P			M	
21 24 40.64	$-68\ 13\ 40.2$	203244	HIP 105712											
21 26 58.45	$-56\ 07\ 30.9$	203850	HIP 105905											
21 27 01.33	$-44\ 48\ 30.9$	203985	HIP 105911		A									
					Aa,Ab				Y				M	
			LTT 8515		AB		88.0	2068	Y			P		
21 36 41.24	$-50\ 50\ 43.4$	205390	HIP 106696											
21 40 29.77	$-74\ 04\ 27.4$	205536	HIP 107022											
21 44 08.58	$+28\ 44\ 33.5$	206826	μ Cyg A		A									
			HD 206827		AB	789 y	5.32	118	Y	P			M	
21 44 31.33	$+14\ 46\ 19.0$	206860	HIP 107350	N	A									

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
			HN Peg B		AB		43.2	772	Y			Μ		
$21\ 48\ 00.05$	$-40\ 15\ 21.9$	207144	HIP 107625											
$21\ 48\ 15.75$	$-47\ 18\ 13.0$	207129	HIP 107649											
$21\ 53\ 05.35$	$+20\ 55\ 49.9$	208038	HIP 108028											
$21\ 54\ 45.04$	$+32\ 19\ 42.9$	208313	HIP 108156											
$22\ 09\ 29.87$	$-07\ 32\ 55.1$	210277	HIP 109378		A									
			$\mathrm{HD}\ 210277\ \mathrm{b}$			$1.21 \mathrm{\ y}$		1.14	Y		1			
$22\ 11\ 11.91$	$+36\ 15\ 22.8$	210667	HIP 109527											
$22\ 14\ 38.65$	$-41\ 22\ 54.0$	210918	HIP 109821											
$22\ 15\ 54.14$	$+54\ 40\ 22.4$	211472	HIP 109926		A									
			GJ 4269		AT		77.2	1662	Y			P		
$22\ 18\ 15.62$	$-53\ 37\ 37.5$	211415	HIP 110109		A									
					AB		3.4	46.9	Y			O	M	
$22\ 24\ 56.39$	$-57\ 47\ 50.7$	212330	HIP 110649		A									
					Aa,Ab				Y				M	
$22\ 25\ 51.16$	$-75\ 00\ 56.5$	212168	HIP 110712		A									
			HIP 110719		AB		20.8	479	Y			P		
$22\ 39\ 50.77$	$+04\ 06\ 58.0$	214683	HIP 111888											
$22\ 42\ 36.88$	$-47\ 12\ 38.9$	214953	HIP 112117		A									
			NLTT 54607		AB		7.8	184	Y			P	M	
$22\ 43\ 21.30$	$-06\ 24\ 03.0$	215152	HIP 112190											
$22\ 46\ 41.58$	$+12\ 10\ 22.4$	215648	ξ Peg	N	A									
					AB		11.1	180	Y			O		
$22\ 47\ 31.87$	$+83\ 41\ 49.3$	216520	HIP 112527											
$22\ 51\ 26.36$	$+13\ 58\ 11.9$	216259	HIP 112870											
$22\ 57\ 27.98$	$+20\ 46\ 07.8$	217014	51 Peg		A									
			51 Peg b			$4.23 \mathrm{\ d}$		0.05	Y		1			
$22\ 58\ 15.54$	$-02\ 23\ 43.4$	217107	HIP 113421	N	A									
			$\mathrm{HD}\ 217107\ \mathrm{b}$			7.13 d		0.07	Y		1			
			$\mathrm{HD}\ 217107\ \mathrm{c}$			$11.14~\mathrm{y}$		5.15	M		1			
					AB		0.3	5.96	\mathbf{M}			\mathbf{R}		

Table 13—Continued

R.A. (J2000.0) (1)	Decl. (J2000.0) (2)	HD Name (3)	Other Name (4)	N (5)	Comp ID (6)	Period (7)	Ang Sep (") (8)	Lin Sep (AU) (9)	Sts (10)	VB (11)	SB (12)	CP (13)	OT (14)	CH (15)
23 03 04.98	+20 55 06.9	217813	HIP 113829											
23 10 50.08	$+45\ 30\ 44.2$	218868	HIP 114456		A									
					AB		50	1215	Y			Р		
23 13 16.98	$+57\ 10\ 06.1$	219134	HIP 114622											
23 16 18.16	+30 40 12.8	219538	HIP 114886											
23 16 42.30	+53 12 48.5	219623	HIP 114924											
23 16 57.69	$-62\ 00\ 04.3$	219482	HIP 114948											
23 19 26.63	$+79\ 00\ 12.7$	220140	HIP 115147	N	A									
			NLTT 56532		AB		10.8	207	Y			M		
					AC		962.6	18486	Y			${ m T}$		
23 21 36.51	$+44\ 05\ 52.4$	220182	HIP 115331											
23 23 04.89	$-10\ 45\ 51.3$	220339	HIP 115445											
23 31 22.21	+59 09 55.9	221354	HIP 116085											
23 35 25.61	+31 09 40.7	221851	HIP 116416											
23 37 58.49	+46 11 58.0	222143	HIP 116613											
23 39 37.39	$-72\ 43\ 19.8$	222237	HIP 116745											
23 39 51.31	$-32\ 44\ 36.3$	222335	HIP 116763											
23 39 57.04	$+05\ 37\ 34.6$	222368	$\iota \operatorname{Psc}$											
23 52 25.32	$+75\ 32\ 40.5$	223778	HIP 117712		A									
					Aa,Ab	7.75 d			Y		2			V
					AB	290 y	4.14	45.1	Y	P			M	
23 56 10.67	-39 03 08.4	224228	HIP 118008			200 y								
23 58 06.82	+50 26 51.6	224465	HIP 118162		A									
29 90 00.02					Aa,Ab	52.41 d			Y		1			

^aThe sample star is not the system's primary, which is identified as component A below.

^bThe brightest component of the system is HD 25998, but is designated as component E in the WDS. Component A is the wide CPM companion, HD 25893, which is about 2 magnitudes fainter and itself a visual binary. We have retained the component designations of the WDS, so the fainter visual pair is AB and the wide CPM companion is E. WDS components C and D are optical, and E itself might have a close companion, as evidenced by its accelerating proper motion (see Table 8).

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cWDS lists these entries for HD 200595, a bright binary 153" away from the sample star HD 200560, but one that is not physically associated with it. HD 200560 is itself is a close CPM pair and listed in the WDS as CD. We have retained the WDS designations, which makes C and D

the only physically associated components of this system.

Table 14. Summary of Confirmed Companions

Type	Total	Unique	VB	SB	СР	ОТ
VB SB CP OT	95 88 125 88	21 23 96 9	 45 10 46	45 7 39	10 7 21	46 39 21

Table 15. Summary of Systematic Companion Searches

Search	Nbr (%)	Compa	anions
Method	Searched	Total	New
(1)	(2)	(3)	(4)
Latham et al. (2010) radial velocities	$344^{\rm a}~(76\%)$	59	4
CCPS radial velocities	$241^{\rm b}~(53\%)$	20	1
Speckle interferometry	453~(100%)	45	0
CHARA SFP	296 (65%)	8	0
CPM: blinking archival plates	409 (90%)	70	4
The <i>Hipparcos</i> survey	453 (100%)	83	
AO surveys ^c	82 (18%)	6	2

 $^{^{\}rm a}{\rm This}$ number includes only primaries. Latham et al. (2010) also reports the velocities of 38 companions.

 $^{^{\}rm b}{\rm This}$ number includes only primaries. We analyzed CCPS velocities for 14 companions as well.

^cTurner et al. (2001); Luhman & Jayawardhana (2002); Chauvin et al. (2006); Metchev & Hillenbrand (2009)

Table 16. Multiplicity Statistics

G 1	7. T	===	Perce	_	
Sample	N	Single	Binary	Triple	Quad+
Cu	rrent l	Results			
Observed	454	56 ± 2	33 ± 2	8 ± 1	3 ± 1
Including candidates	454	54 ± 2	34 ± 2	9 ± 2	3 ± 1
Compl analysis adjusted	454	54 ± 2			
Distance	limite	d Subsar	nples		
Distance $\leq 15 \text{ pc} \dots$	103	52 ± 5	37 ± 5	8 ± 3	2 ± 1
Distance $\leq 20 \text{ pc} \dots$	239	57 ± 5	33 ± 5	9 ± 3	2 ± 1
Distance $\leq 23 \text{ pc} \dots$	359	57 ± 3	32 ± 3	8 ± 2	3 ± 1
Distance $\leq 25 \text{ pc} \dots$	454	56 ± 2	33 ± 2	8 ± 1	3 ± 1
D	M91 R	esults			
Observed	164	57 ± 4	38 ± 4	4 ± 1	1 ± 1
Incl $P(\chi^2) < 0.01$	164	50 ± 4	30 ± 4 41 ± 4	7 ± 2	2 ± 1
Incompl $(q > 0.1)$	164	43			2 ± 1
Incompl $(M_2 < 10 \text{ M}_{\text{J}}) \dots$	164	33			
- '					
Current Wor	k & D	M91 Coı	mparison		
DM91, common stars	106	56 ± 5	39 ± 5	4 ± 2	2 ± 1
This work, common stars	106	49 ± 5	40 ± 5	9 ± 3	2 ± 1
This work, random subset	106	55 ± 5	34 ± 4	8 ± 3	3 ± 2
This work, $dec > -15^{\circ}$	307	54 ± 3	35 ± 3	8 ± 2	3 ± 1
This work, $F7 \leq SpT \leq G9$	281	56 ± 3	34 ± 3	7 ± 2	3 ± 2

Table 17. Physical Parameters of the Sample Stars

HD Name (1)	HIP Name (2)	C (3)	Spec Type (4)	Ref (5)	Mass (M _☉) (6)	Ref (7)	[Fe/H] (8)	Ref (9)	$\log(R'_{HK})$ (10)	Ref (11)
Sun			G2V		1.00		0.00			
000123	000518	A	G4V	1			-0.01	2	-4.644	1
000166	000544	• • • •	G8V	1		• • • •	0.12	3	-4.458	1
000870	001031	• • •	K0V	4		• • •	-0.20	2	-4.824	4
001237	001292	A	G8.5V	4	• • •	• • • •	-0.09	2	-4.496	4
001273	001349	Aa	G5V	4		• • • •	-0.65	2 3	-4.802	4
001461 001562	001499 001598		G3V G1V	1 1	• • •	• • •	$0.16 \\ -0.34$	3 2	-5.030 -4.979	5 1
001502	001598		F9.5V	4			-0.34 -0.18	3	-4.879 -4.855	4
001835	001803		G5V	4			0.22	3	-4.440	5
002025	001936		K3V	4			-0.27	3	-4.933	4
002151	002021		G0V	4			-0.09	3	-5.006	4
003196	002762	Aa	F8.5V	1			-0.07	2	-4.461	1
003443	002941	A	G7V	4	0.94	6	-0.14	2	-4.940	5
003651	003093	A	K0V	1			0.16	3	-5.020	5
003765	003206		K2.5V	1			0.12	3	-5.101	1
004256	003535		K3IV-V	1			0.22	3	-5.042	1
004308	003497	A	G6V	4			-0.18	3	-4.853	4
004391	003583	A	G5V	4		• • •	-0.25	2	-4.669	4
004614	003821	A	G0V	7		• • •	-0.17	3	-4.930	5
004628	003765	Aa	K2V	1	• • •		-0.19	3	-5.071	1
004635	003876		K2.5V+	1	1.00				-4.670	5
004676	003810	Aa	F8V	$\frac{1}{4}$	1.22	8	-0.06	2	-4.917	1
004747 004813	003850 003909	Aa	G9V F7V	4 1	• • •	• • • •	$-0.25 \\ -0.15$	$\frac{3}{2}$	-4.720 -4.780	5 1
004815 004915	003979		G6V	1		• • •	-0.13 -0.18	3	-4.780 -4.860	5
004915	003373		F8V	7			-0.16		-4.800 -5.02	9
005133	004148		K2.5V	4			-0.13	3	-4.751	4
006582	005336	Aa	K1V	1			-0.83	2	-5.031	1
007570	005862		F9V	4			0.14	3	-4.861	4
007590	005944		G0-V	1			-0.07	3	-4.530	5
007693	005842	$^{\rm C}$	K2+V	4	0.92	10	0.05	3	-4.580	4
007924	006379		K0	7			-0.12	3	-4.830	5
008997	006917	Aa	K2.5V	1			-0.59	2	-4.557	1
009407	007339		G6.5V	1					-5.010	5
009540	007235		G8.5V	4			-0.04	3	-4.600	5
009770	007372	A	K2V	4	0.74	10	-0.65	2	-4.354	4
009826	007513	A	F8V	7	1.2	11	0.12	3	-5.040	5
010008	007576	• • •	G9V	1	• • •	• • •	-0.03	1	-4.530	1
010086	007734	۸ -	G5V	1	• • •	• • • •	0.09	3	-4.600	5
010307	007918	Aa	G1V	1		• • •	-0.05	2	-5.017	1
010360	007751	В	K2V	4			-0.20	3	-4.899	4

Table 17—Continued

HD	HIP		Spec		Mass					
Name	Name	$^{\rm C}$	Type	Ref	(M_{\odot})	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
010476	007981		K0V	1			-0.07	3	-4.950	5
010647	007978	A	F9V	4			-0.08	3	-4.675	4
010700	008102		G8.5V	4			-0.36	3	-4.980	5
010780	008362		G9V	1			-0.06	3	-4.690	5
012051	009269		G9V	1			0.15	3	-5.050	5
012846	009829		G2V-	1			-0.20	3	-4.980	5
013445	010138	A	K1V	4			-0.20	3	-4.768	4
013974	010644	Aa	G0V	7			-0.39	2	-4.710	5
014214	010723	Aa	G0IV-	1			0.06	2	-5.114	1
014412	010798		G8V	4			-0.45	3	-4.850	5
014802	011072	A	G0V	4			-0.08	2	-5.050	5
016160	012114	Aa	K3V	1			0.08	2	-5.094	1
016287	012158	Aa	K2.5V	1			0.08	3	-4.504	1
016673	012444	Aa	F8V	1			-0.11	2	-4.586	1
016739	012623	Aa	F9IV-V	1	1.38	12	0.14	2	-5.012	1
016765	012530	A	F7V	1			-0.24	2	-4.400	1
016895	012777	A	F7V	7			0.02	3	-4.970	5
017051	012653	A	F9V	4			0.09	3	-4.625	4
017382	013081	Aa	K0V	1					-4.450	5
017925	013402		K1.5V	4			0.11	3	-4.357	4
018143	013642	A	K2IV	1			0.21	3	-5.119	1
018632	013976		K2.5V	1			0.18	3	-4.418	1
018757	014286	A	G1.5V	1			-0.44	2	-4.987	1
018803	014150		G6V	1			0.09	3	-4.880	5
019373	014632		F9.5V	1			0.13	3	-5.020	5
019994	014954	A	F8.5V	1			0.17	3	-4.880	5
020010	014879	A	F6V	4			-0.16	2	-4.901	4
020165	015099		K1V	1			-0.04	3	-4.860	5
020407	015131		G5V	4			-0.46	2	-4.734	4
020619	015442		G2V	1			-0.18	3	-4.830	5
020630	015457		G5Vvar	7			0.10	3	-4.47	9
020794	015510		G8V	4			-0.23	3	-4.998	4
020807	015371	A	G0V	4			-0.23	3	-4.827	4
021175	015799	A	K1V	4			0.12	2	-4.773	4
022049	016537	A	K2V	4			-0.15	4	-4.510	5
022484	016852		F9V	7			-0.03	3	-5.120	5
022879	017147		F9V	7			-0.76	3	-4.920	5
023356	017420		K2.5V	4			-0.07	3	-4.807	4
023484	017439	Aa	K2V	4			0.04	3	-4.534	4
024238	018324		K2V	1			-0.32	3	-4.980	5
024409	018413	A	G3V	1			-0.25	2	-4.927	1
024496	018267	A	G7V	1			-0.01	3	-4.870	5
025329	018915		K3Vp	1			-1.69	2	-4.940	5

Table 17—Continued

HD Name (1)	HIP Name (2)	C (3)	Spec Type (4)	Ref (5)	Mass (M _☉) (6)	Ref (7)	[Fe/H] (8)	Ref (9)	$\log(R'_{HK}) \tag{10}$	Ref (11)
025457	018859		F7V	1			-0.10	2	-4.390	5
025665	019422		K2.5V	1			-0.06	3	-4.847	1
025680	019076	Aa	G1V	1			0.04	3	-4.608	1
025998	019335	Ea	F8V	1			0.02	2	-4.468	1
026491	019233	Aa	G1V	4			-0.06	3	-4.889	4
026923	019859	A	G0V	4			-0.13	2	-4.521	4
026965	019849	A	K0.5V	4			-0.08	3	-4.900	5
029883	021988		K5III	7			-0.16	3	-4.87	9
030495	022263		G1.5V	4			-0.01	3	-4.600	5
030501	022122		K2V	4			-0.09	4	-4.762	4
030876	022451		K2V	7			-0.11	3	-4.55	9
032778	023437	\mathbf{A}	G7V	4			-0.48	3	-4.870	4
032850	023786	Aa	G9V	1			-0.19	2	-4.600	5
032923	023835		G1V	1	• • •		-0.13	3	-5.030	5
033262	023693		F9V	4			-0.20	2	-4.373	4
033564	025110	A	F7V	1			-0.06	2	-4.949	1
034411	024813		G1V	1			0.09	3	-5.050	5
034721	024786		F9-V	4			-0.08	3	-5.030	5
035112	025119	Α	K2.5V	1	• • •		-0.27	2	-4.879	1
035296	025278	A	F8V	1	• • •		-0.15	2	-4.353	1
035854	025421		K3-V	4	• • •		-0.04	3	-4.922	4
036435	025544		G9V	4	• • •		-0.18	2	-4.499	4
036705	025647	Aa	K2V	4	0.87	13	-0.59	2	-3.880	4
037008	026505		K1V	1	• • •		-0.31	3	-4.960	5
037394	026779	A	K0V	1			0.16	3	-4.553	1
037572	026373	A	K1.5V	4			-0.49	2	-4.234	4
038230	027207	• • • •	K0V	1	• • • •		-0.02	3	-4.990	5
038858	027435	• • •	G2V	1	• • • •		-0.21	3	-4.950	5
039091	026394	A	G0V	4	• • •	• • •	0.04	3	-4.941	4
039587	027913	Aa	G0V	4	1.10	14	-0.16	2	-4.426	4
039855	027922	A	G8V	4	• • • •		-0.49	2	-4.932	4
040307	027887	A	K2.5V	4	• • •	• • •	-0.25	3	-5.037	4
040397	028267	A	G7V	1	• • • •		-0.05	3	-4.980	5
041593	028954		G9V	1	• • • •		• • •	• • •	-4.390	5
042618	029432		G3V	1	• • • •		-0.09	3	-4.940	5
042807	029525		G5V	1	• • •	• • •	-0.21	2	-4.465	1
043162	029568	A	G6.5V	4	• • •		-0.10	2	-4.400	5
043587	029860	Aa	G0V	4	• • •	• • •	-0.08	3	-5.000	5
043834	029271	Aa	G7V	4			0.05	3	-4.940	4
045088	030630	Aa	K3V	1	0.83	15	-0.85	2	-4.266	1
045184	030503		G1.5V	4	• • •	• • • •	0.03	3	-4.950	5
045270	030314	Α	G0Vp	4	• • •	• • • •	-0.18	2	-4.378	4
046588	032439		F8V	1			-0.25	2	-4.885	1

Table 17—Continued

HD	HIP		Spec		Mass					
Name	Name	$^{\rm C}$	Type	Ref	$({\rm M}_{\odot})$	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
048189	031711	A	G1V	4			-0.23	2	-4.268	4
048682	032480		F9V	1			0.09	3	-4.850	5
050692	033277		G0V	1			-0.13	3	-4.940	5
051419	033537		G5V	1			-0.33	3	-4.870	5
051866	033852		K3V	1					-4.889	1
052698	033817	Aa	K1V	4					-4.590	5
052711	034017		G0V	1			-0.10	3	-4.960	5
053143	033690		K0IV-V	4			-0.01	2	-4.547	4
053705	034065	A	G0V	4			-0.15	3	-4.981	4
053927	034414		K2.5V	1			-0.27	2	-4.984	1
054371	034567	Aa	G6V	1			-0.10	2	-4.462	1
055575	035136		F9V	1			-0.35	2	-4.950	5
057095	035296	\mathbf{A}	K2.5V	4					-4.538	4
059468	036210		G6.5V	4			0.01	3	-4.946	4
059747	036704		K1V	1			-0.03	3	-4.370	5
059967	036515		G2V	4			-0.24	2	-4.372	4
060491	036827		K2.5V	1			-0.26	3	-4.430	5
061606	037349	\mathbf{A}	K3-V	1			-0.05	3	-4.390	5
062613	038784		G8V	7			-0.23	2	-4.840	5
063077	037853	Aa	F9V	4			-0.75	2	-4.970	5
063433	038228		G5V	1			0.02	3	-4.390	5
064096	038382	A	G0V	4	0.93	6	-0.18	2	-4.883	4
064468	038657	Aa	K2.5V	1			0.09	3	-5.146	1
064606	038625	Aa	K0V	1			-0.80	2	-4.940	5
065430	039064	Aa	K0V	1			-0.04	3	-5.010	5
065583	039157		K0V	1			-0.48	3	-4.950	5
065907	038908	A	F9.5V	4			-0.15	3	-4.846	4
067199	039342	Aa	K2V	4			0.01	2	-4.843	4
067228	039780		G2IV	1			0.17	3	-5.120	5
068017	040118	Aa	G3V	1			-0.30	3	-4.920	5
068257	040167	A	F8V	1			0.08	2		
069830	040693	A	G8+V	4			-0.08	3	-4.950	5
071148	041484		G1V	1			-0.01	3	-4.950	5
072673	041926		G9V	4			-0.33	3	-4.950	5
072760	042074	Aa	K0-V	1			0.03	3	-4.380	5
072905	042438		G1.5Vb	7			-0.25	2	-4.400	5
073350	042333		G5V	1			0.04	3	-4.490	5
073667	042499		K2V	1			-0.36	3	-4.970	5
073752	042430	A	G5IV	4	1.25	10	0.31	2	-5.031	4
074385	042697	A	K2+V	4			-0.03	2	-4.902	4
074576	042808		K2.5V	4			-0.24	2	-4.402	4
075732	043587	A	K0IV-V	1			0.25	3	-5.040	5
075767	043557	Aa	G1.5V	1			-0.18	2	-4.638	1

Table 17—Continued

HD	HIP		Spec		Mass		_			
Name	Name	$^{\rm C}$	Type	Ref	(M_{\odot})	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	, ,	, ,	, ,	, ,		, ,	, ,	, ,		, ,
076151	043726		G3V	4			0.07	3	-4.853	4
076932	044075		G2V	4			-0.70	2	-4.781	4
078366	044897		G0IV-V	1			0.03	3	-4.555	1
079028	045333	Aa	G0IV-V	1			-0.10	2	-5.073	1
079096	045170	Aa	G9V	1	0.89	6	-0.30	2	-4.846	1
079969	045617	A	K3V	1	0.74	10	-0.22	2	-4.736	1
080715	045963	Aa	K2.5V	1			-0.58	1	-4.099	1
082342	046626	A	K3.5V	4					-5.131	4
082443	046843	A	K1V	4					-4.234	4
082558	046816		K0	7			-0.21	3	-4.254 -4.09	9
082885	047080	A	G8+V	1			-0.21		-4.68	9
084117	047592		F8V	4		• • • •	-0.08	3	-4.862	4
084737	047332		G0IV-V	1	• • • •	• • •	-0.03 0.14	3	-4.802 -5.230	5
086728	049081	Α	G01V-V G4V	1		• • • •	0.14 0.11	3	-5.250 -5.060	5
087424			K2V	4	• • • •	• • • •		3		
	049366	• • • •				• • • •	-0.14		-4.440	5
087883	049699	• • • •	K2.5V	1	• • •	• • • •	0.04	3	-4.999	1
088742	050075		G0V	4	• • • •	• • •	-0.04	3	-4.806	4
089125	050384	A	F6V	1	• • •	• • •	-0.44	2	-4.832	1
089269	050505	• • •	G4V	1	• • •	• • •	-0.18	3	-4.940	5
090156	050921	• • •	G5V	4	• • •	• • •	-0.21	3	-4.950	5
090343	051819		K0	7	• • •	• • •			-4.58	9
090508	051248	A	GoV	1			-0.40	2	-5.005	1
090839	051459	A	F8V	1	• • •	• • •	-0.05	3	-4.860	5
091324	051523		F9V	4	• • •		-0.28	2	-4.766	4
091889	051933		F8V	4			-0.27	2	-4.849	4
092719	052369		G1.5V	4			-0.21	2	-4.826	4
092945	052462		K1.5V	4			-0.12	3	-4.320	5
094765	053486		K2.5V	1		• • •	-0.03	3	-4.546	1
095128	053721	Α	G0V	7	• • •		0.02	3	-5.020	5
096064	054155	A	G8+V	1			-0.13	2	-4.373	1
096612	054426		K3-V	1					-4.836	1
097334	054745	A	G1V	1			0.08	3	-4.368	1
097343	054704		G8.5V	4			-0.05	3	-5.000	5
097658	054906		K1V	1			-0.27	3	-4.920	5
098230	055203	$_{\mathrm{Ba}}$	G2V	16			-0.30	2		
098281	055210		G8V	7			-0.17	3	-4.940	5
099491	055846	A	K0IV	7			0.24	3	-4.840	5
100180	056242	Aa	F9.5V	1			-0.02	3	-4.940	5
100623	056452	A	K0-V	4			-0.32	3	-4.890	5
101177	056809	A	F9.5V	1			-0.17	3	-4.930	5
101206	056829	Aa	K5V	7					-4.52	9
101501	056997		G8V	1			-0.03	3	-4.550	5
102365	057443	A	G2V	4			-0.26	3	-4.957	4

Table 17—Continued

HD	HIP		Spec		Mass					
Name	Name	$^{\rm C}$	Type	Ref	(M_{\odot})	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
102438	057507		G6V	4			-0.23	3	-4.924	4
102870	057757		F8V	7			0.16	3	-4.940	5
103095	057939		K1V	1			-1.16	3	-4.850	5
104067	058451		K3-V	4			0.04	3	-4.751	4
104304	058576		G8IV	4			0.16	3	-4.920	5
105631	059280		G9V	1			0.14	3	-4.650	5
108954	061053		F9V	1			-0.13	2	-4.921	1
109200	061291		K1V	4			-0.23	3	-5.124	4
109358	061317		G0V	1			-0.10	3	-4.920	5
110463	061946	Aa	K3V	7					-4.47	9
110810	062229		K2+V	4			-0.03	3	-4.441	4
110833	062145	Aa	K3V	7			0.08	2	-4.70	9
110897	062207		F9V	1			-0.59	2	-4.869	1
111312	062505	Aa	K2.5V	4					-4.571	4
111395	062523		G7V	1			0.06	3	-4.580	5
112758	063366	Aa	G9V	4			-0.38	2	-5.067	4
112914	063406	Aa	K3-V	1			-0.26	3	-5.043	1
113283	064690	Aa	G5V	4			-0.15	2	-4.720	4
113449	063742	Aa	K1V	1					-4.340	1
114613	064408		G4IV	4			0.16	3	-5.118	4
114710	064394		G0V	7			0.04	3	-4.760	5
114783	064457	\mathbf{A}	K1V	1			0.10	3	-5.056	1
114853	064550		G1.5V	4			-0.24	3	-4.936	4
115383	064792		G0Vs	7			0.21	3	-4.400	5
115404	064797	A	K2.5V	1			-0.49	1	-4.640	1
115617	064924		G7V	4			0.09	3	-5.040	5
116442	065352	A	G9V	1			-0.30	3	-4.940	5
116956	065515		G9V	1			-0.13	2	-4.447	1
117043	065530		G6V	7			0.06	2	-4.96	9
117176	065721	A	G5V	7			-0.01	3	-4.990	5
118972	066765		K0V	4			-0.09	3	-4.439	4
119332	066781		K0IV-V	7					-4.70	9
120136	067275	A	F7V	7			0.25	3	-4.700	5
120559	067655		G7V	4			-0.95	2	-5.029	4
120690	067620	Aa	G5+V	4			0.05	3	-4.750	5
120780	067742	Aa	K2V	4			-0.26	3	-4.888	4
121370	067927	Aa	G0IV	7			0.27	2		
121560	068030		F6V	7			-0.41	3	-4.920	5
122742	068682	Aa	G6V	1			-0.08	2	-4.955	1
124106	069357		K1V	4			-0.13	3	-4.630	5
124292	069414		G8+V	1			-0.10	3	-4.970	5
124580	069671		G0V	4			-0.28	2	-4.597	4
124850	069701	Aa	F7V	7			-0.04	2		

Table 17—Continued

HD	HIP		Spec		Mass					
Name	Name	$^{\rm C}$	Type	Ref	$({\rm M}_{\odot})$	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
125276	069965	Aa	F9V	4			-0.62	2	-4.641	4
125455	070016	A	K1V	7			-0.15	3	-4.930	5
126053	070319		G1.5V	1			-0.29	3	-4.940	5
127334	070873		G5V	1			0.22	3	-5.060	5
128165	071181		K3V	7			-0.09	3	-4.67	9
128311	071395	A	K3-V	1			0.01	3	-4.489	1
128400	071855		G5V	4			-0.14	2	-4.518	4
128620	071683	A	G2V	4	1.11	17	0.19	3	-5.059	4
128642	070857	Aa	G5	7			-0.39	2	-4.910	5
128987	071743		G8V	4			0.02	2	-4.439	4
130004	072146		K2.5V	1					-4.919	1
130042	072493	A	K1V	4			-0.21	2	-4.949	4
130307	072312		K2.5V	1			-0.20	3	-4.560	5
130948	072567	A	G2V	7			-0.19	2	-4.500	5
131156	072659	A	G7V	1	0.94	10	-0.07	3	-4.472	1
131511	072848	Aa	K0V	1			0.11	3	-4.510	1
131582	072875	Aa	K3V	7			-0.54	2		
131923	073241	Aa	G4V	4			0.09	3	-5.059	4
132142	073005		K1V	7			-0.30	3	-5.000	5
132254	073100		F8-V	1			0.02	2	-5.030	1
133640	073695	A	G2V	7			-0.42	2	-4.61	9
134060	074273		G0V	4			0.08	3	-5.042	4
135204	074537	A	G9V	1			-0.06	2	-5.107	1
135599	074702		K0V	1			-0.09	3	-4.520	5
136202	074975	A	F8III-IV	7			-0.04	2		
136352	075181		G2-V	4			-0.23	3	-5.013	4
136713	075253		K3IV-V	1			0.15	3	-4.878	1
136923	075277		G9V	1			-0.07	3	-4.770	5
137107	075312	A	G2V	7	1.19	6	-0.10	2	-4.76	9
137763	075718	Aa	G9V	1			0.02	2	-4.970	5
139341	076382	A	K1V	1	0.85	10			-5.102	1
139777	075809	A	G1.5V(n)	1			-0.31	2	-4.405	1
140538	077052	A	$\overline{\mathrm{G5V}}$	7			0.06	3	-4.830	5
140901	077358	A	G7IV-V	4			0.08	3	-4.802	4
141004	077257		G0IV-V	1			0.09	3	-4.970	5
141272	077408	A	G9V	1			-0.05	2	-4.390	5
142267	077801	Aa	G0IV	7			-0.38	3	-4.850	5
142373	077760		G0V	1			-0.39	3	-5.110	5
143761	078459	Aa	G0V	1	1.04	18	-0.14	3	-5.080	5
144284	078527	Aa	F8IV-V	7	1.2	19	0.04	2		
144287	078709	Aa	G8+V	1			-0.13	2	-5.020	5
144579	078775	A	K0V	1			-0.49	3	-4.970	5
144628	079190		K1V	4			-0.30	3	-5.128	4

Table 17—Continued

HD	HIP		Spec		Mass	_	_			
Name	Name	$^{\rm C}$	Type	Ref	(M_{\odot})	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
144872	078913		K3V	1			-0.30	2	-4.804	1
145417	079537		K3V	4			-1.37	2	-5.205	4
145675	079248	A	K0IV-V	1			0.41	3	-5.060	5
145825	079578	Aa	G2V	4			0.03	3	-4.793	4
145958	079492	A	G8V	1			-0.07	3	-4.940	5
146233	079672		G2V	1			0.03	3	-4.950	5
146361	079607	Aa	G1IV-V	1	1.14	20	-0.26	2	-3.827	1
147513	080337	A	G1V	4			0.07	3	-4.656	4
147584	080686	Aa	F9V	4			-0.19	2	-4.585	4
147776	080366	A	K3-V	4			-0.26	3	-4.810	4
148653	080725	A	K2V	1	0.79	10			-4.655	1
148704	080925	Aa	K1V	4			-0.60	2	-5.101	4
149612	081520		G5V	4			-0.40	3	-4.954	4
149661	081300		K0V	4			0.05	3	-4.570	5
149806	081375	A	K0V	1			0.17	3	-4.830	5
151541	081813		K1V	7			-0.18	3	-4.990	5
152391	082588		G8.5V	4			-0.05	3	-4.440	5
153557	083020	A	K3V	1			-0.33	2	-4.508	1
154088	083541		K0IV-V	4			0.28	3	-5.020	5
154345	083389	A	G8V	7			-0.10	3	-4.910	5
154417	083601		F9V	1			0.03	3	-4.590	5
154577	083990		K2.5V	4			-0.56	3	-5.080	4
155712	084195		K2.5V	1					-4.988	1
155885	084405	A	K1.5V	4					-4.711	4
156274	084720	Aa	M0V	7			-0.27	3		
157214	084862		G0V	7			-0.15	3	-5.040	5
157347	085042	A	G3V	1			0.03	3	-5.040	5
158614	085667	A	G8IV-V	7	0.98	6	-0.01	2	-5.12	9
158633	085235		K0V	7			-0.33	3	-4.930	5
159062	085653		G9V	1			-0.51	2	-5.030	5
159222	085810		G1V	1			0.09	3	-4.900	5
160269	086036	A	G0V	7	1.08	10	-0.22	2	-4.61	9
160346	086400	Aa	K2.5V	1			-0.09	2	-4.956	1
160691	086796	A	G3IV-V	4			0.26	3	-5.101	4
161198	086722	Aa	G9V	1			-0.39	2	-4.970	5
161797	086974	Aa	G5IV	7			0.24	3	-5.110	5
162004	086620	В	G0V	7			-0.18	2	-4.86	9
164922	088348	A	G9V	1			0.17	3	-5.050	5
165185	088694		G0V	4			-0.25	2	-4.545	4
165341	088601	A	K0-V	1	0.90	6	-0.29	2	-4.698	1
165401	088622	Aa	G0V	1			-0.50	2	-4.668	1
165499	089042	Aa	G0V	4			-0.17	2	-4.935	4
165908	088745	Aa	F7V	7			-0.55	2	-5.020	5

Table 17—Continued

HD Name (1)	HIP Name (2)	C (3)	Spec Type (4)	Ref (5)	Mass (M _☉) (6)	Ref (7)	[Fe/H] (8)	Ref (9)	$\log(R'_{HK})$ (10)	Ref (11)
166620	088972		K2V	1			-0.05	3	-4.970	5
167425	089805	A	F9.5V	4			0.02	2	-4.606	4
168009	089474		G1V	1			-0.02	3	-5.080	5
170657	090790		K2V	4			-0.15	3	-4.650	5
172051	091438		G6V	4			-0.24	3	-4.900	5
175073	092858		K1V	4			-0.14	2	-4.889	4
175742	092919	Aa	K0V	7						
176051	093017	A	G0V	7	1.07	10	-0.19	2		
176377	093185		G1V	1			-0.23	3	-4.870	5
177474	093825	Α	F8V	4			-0.22	2	-4.890	4
177565	093858		G6V	4			0.07	3	-4.973	4
178428	093966	Aa	G4V	4			0.05	2	-5.110	4
179957	094336	A	G3V	1			• • •		-5.050	5
180161	094346		G8V	7					-4.520	5
181321	095149	Aa	G1V	4			-0.26	2	-4.372	4
182488	095319		G9+V	1			0.12	3	-4.940	5
182572	095447		G8IVvar	7			0.36	3	-5.100	5
183870	096085		K2.5V	4			-0.05	3	-4.512	4
184385	096183		G8V	1			0.11	3	-4.560	5
184467	095995	A	K2V	1	0.8	6	-0.22	2	-5.047	1
185144	096100		G9V	1			-0.16	3	-4.850	5
185414	096395	Aa	G0	7			-0.16	2	-4.88	9
186408	096895	Aa	G1.5V	1	• • •		0.08	3	-5.100	5
186858	097222	F	K3+V	1	0.69	10		• • •	-4.726	1
187691	097675	A	F8V	7	• • •		0.12	3	-5.050	5
189340	098416	A	F9V	1	1.12	10	-0.05	2	-4.951	1
189567	098959	• • •	G2V	4			-0.18	3	-4.857	4
189733	098505	A	K2V	1	• • •		-0.12	2	-4.553	1
190067	098677	A	K0V	1	• • •		-0.30	3	-4.880	5
190248	099240		G8IV	4	• • •		0.26	3	-5.092	4
190360	098767	A	G7IV-V	4	• • •		0.19	3	-5.090	5
190404	098792		K1V	1	• • •		-0.44	3	-4.980	5
190406	098819	Aa	GoV	4	• • •		0.02	3	-4.770	5
190422	099137		F9V	4	• • •		-0.21	2	-4.458	4
190470	098828		K2.5V	1	• • •		-0.16	1	-4.828	1
190771	098921	Aa	G2V	1	• • •		0.14	3	-4.430	5
191408	099461	A	K2.5V	4	• • •		-0.33	3	-5.079	4
191499	099316	A	G9V	1	• • •	• • • •			-5.076	1
191785	099452	A	K0V	1	• • •	• • • •	-0.09	3	-5.030	5
192263	099711	A	K2.5V	1	• • •	• • •	-0.07	3	-4.676	1
192310	099825		K2+V	4	• • •	• • •	0.14	2	-5.048	4
193664	100017	Aa	GoV	1	• • •	• • • •	-0.11	3	-4.927	1
194640	100925		G8V	4			-0.06	3	-4.924	4

Table 17—Continued

HD Name (1)	HIP Name (2)	C (3)	Spec Type (4)	Ref (5)	Mass (M _☉) (6)	Ref (7)	[Fe/H] (8)	Ref (9)	$\log(R'_{HK}) \tag{10}$	Ref (11)
195564	101345	A	G2V	1			0.01	3	-5.130	5
195987	101382	Aa	G9V	1	0.84	21	-0.38	2	-4.970	5
196378	101983		G0V	4			-0.32	3	-4.837	4
196761	101997		G8V	4			-0.25	3	-4.920	5
197076	102040	A	G1V	1			-0.09	3	-4.920	5
197214	102264		G6V	4			-0.50	2	-4.920	5
198425	102766	Aa	K2.5V	1					-4.726	1
199260	103389		F6V	4			-0.17	2	-4.402	4
199288	103458		G2V	4			-0.47	3	-4.847	4
199509	104436		G1V	4			-0.27	3	-4.925	4
200525	104440	A	F9.5V	4			-0.13	2	-4.667	4
200560	103859	$^{\rm C}$	K2.5V	1			0.01	2	-4.512	1
200968	104239	A	G9.5V	4			0.02	3	-4.650	4
202275	104858	A	F7V	1	1.19	6	-0.07	2	-4.905	1
202628	105184		G1.5V	4			-0.01	3	-4.782	4
202751	105152		K3V	1			-0.09	3	-5.111	1
202940	105312	Aa	G7V	4			-0.34	2	-4.988	4
203244	105712		G8V	4			-0.32	2	-4.555	4
203850	105905		K2.5V	4			-0.67	2	-5.033	4
203985	105911	Aa	K2III-IV	4						
205390	106696		K1.5V	4			-0.18	3	-4.702	4
205536	107022		G9V	4			-0.03	3	-5.084	4
206826	107310	A	F6V	1			-0.20	2	-4.783	1
206860	107350	A	G0V	4			-0.01	3	-4.400	4
207129	107649		G0V	4			-0.04	3	-5.020	4
207144	107625		K3V	4					-4.990	4
208038	108028	• • • •	K2.5V	1					-4.569	1
208313	108156	• • • •	K2V	1			-0.08	3	-4.987	1
210277	109378	Α	G8V	1			0.20	3	-5.060	5
210667	109527		G9V	1			0.16	3	-4.500	5
210918	109821	• • •	G2V	4			-0.07	3	-5.121	4
211415	110109	A	G0V	4			-0.36	2	-4.918	4
211472	109926	A	K0V	1			0.03	2	-4.538	1
212168	110712	A	G0V	4			-0.04	3	-4.981	4
212330	110649	Aa	G2IV-V	4			0.01	3	-5.157	4
214683	111888	• • • •	K3V	1	• • •				-4.554	1
214953	112117	A	F9.5V	4	• • •		0.03	3	-4.988	4
215152	112190	• • •	K3V	1		• • • •	-0.17	1	-4.925	1
215648	112447	Α	F7V	7		• • • •	-0.16	3	-5.070	5
216259	112870	• • •	K2.5V	1	• • •		-0.47	3	-4.950	5
216520	112527		K0V	1	• • •				-4.980	5
217014	113357	A	G2V+	4	• • • •		0.15	3	-5.080	5
217107	113421	A	G8IV-V	1			0.27	3	-5.080	5

Table 17—Continued

$^{\mathrm{HD}}$	HIP		Spec		Mass					
Name	Name	$^{\rm C}$	Type	Ref	(M_{\odot})	Ref	[Fe/H]	Ref	$\log(R'_{HK})$	Ref
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
										, ,
217813	113829		G1V	1			0.02	3	-4.470	5
218868	114456	A	G8V	1			0.19	3	-4.750	5
219134	114622		K3V	1			0.09	3	-5.089	1
219482	114948		F6V	4			-0.20	2	-4.434	4
219538	114886		K2V	1			-0.05	3	-4.840	5
219623	114924		F7V	7			-0.09	2	-4.84	9
220140	115147	A	K2V	1			-0.64	2	-4.074	1
220182	115331		G9V	1			0.01	2	-4.370	5
220339	115445		K2.5V	1			-0.24	3	-4.896	1
221354	116085		K0V	1			-0.01	3	-5.149	1
221851	116416		K1V	1			-0.13	2	-4.735	1
222143	116613		G3V	1			0.12	3	-4.555	1
222237	116745		K3+V	4			-0.20	3	-4.959	4
222335	116763		G9.5V	4			-0.16	3	-4.909	4
222368	116771		F7V	7			-0.08	3	-4.76	9
223778	117712	Aa	K3V	1	0.79	15	-0.71	2	-4.518	1
224228	118008		K2.5V	4					-4.468	4
224465	118162	Aa	G4V	1			-0.01	2	-4.969	1
224930	000171	A	G5V	1	0.91	10	-0.78	2	-4.880	1
232781	015673		K3.5V	1					-4.691	1
263175	032423	A	K3V	1			-0.59	1	-4.903	1
	036357	Ea	K2.5V	1			-0.61	1	-4.526	1
	040774		G5	7					-4.38	9
	087579		K2.5V	1					-4.529	1
	091605	A	K2.5V	1			-0.68	1	-4.909	1

Note. — Reference codes for columns 5, 7, 9, and 11: (1) Gray et al. (2003); (2) Nordström et al. (2004); (3) Valenti & Fischer (2005); (4) Gray et al. (2006); (5) Wright et al. (2004); (6) Pourbaix (2000); (7) The *Hipparcos* catalog; (8) Boden et al. (1999); (9) Mason et al. (2010); (10) Söderhjelm (1999); (11) Lowrance et al. (2002); (12) Bagnuolo et al. (2006); (13) Close et al. (2005); (14) Catala et al. (2006); (15) Raghavan et al. (2010b); (16) Ball et al. (2005); (17) Pourbaix et al. (2002); (18) Gatewood et al. (2001); (19) Mazeh et al. (2002); (20) Raghavan et al. (2009); (21) Torres et al. (2002).

Table 18. Spectral Types and Masses of the Companions

Comp	Alt	Spec		Mass	
Name	Name	Type	Ref	(M_{\odot})	Ref
(1)	(2)	(3)	(4)	(5)	(6)
,	,	. ,	. ,	()	()
HD 000123 Ba				0.95	1
HD 000123 Bb				0.22	1
HD 001237 B	HD 1237B	$M4\pm1V$	2	0.13	3
HD 003196 Ab				0.40^{a}	4
HD 003196 B		G2V	5	1.00	4
HD 003443 B	$_{ m GJ}$ 25 $_{ m B}$			0.70	6
HD 003651 B	HD 3651B	$T7.5 \pm 0.5$	7	0.05	7
HD 004391 B		M4V	8		
HD 004391 C		M5V	8		
HD 004614 B	LHS 122	K7V	8		
HD 004676 Ab				1.17	9
HD 006582 Ab	μ Cas B	M3V	5		
HD 007693 A	HD 7788	F5V	10	1.32	11
HD 007693 B	GJ 55.3 B	K1V	10		
HD 007693 D	GJ 55.1 B			0.86	12
HD 008997 Ab		G7V	13		
$\mathrm{HD}\ 009770\ \mathrm{Ba}$				0.73	14
HD 009770 Bb				0.67	14
HD 009770 C		M3V	5		
${\rm HD} \ 009826 \ {\rm D}$	v And B	M4.5V	15	0.2	15
$\mathrm{HD}\ 010307\ \mathrm{Ab}$				0.2	12
HD 010360 A	HD 10361	K2V	10		
HD 013445 B	GJ 86 B	WD	16	0.5	17
$\mathrm{HD}\ 013974\ \mathrm{Ab}$		K3V	13		
$\mathrm{HD}\ 014802\ \mathrm{B}$		M2V	5		
HD 016160 B	NLTT 8455	M3.5V	18		
$\mathrm{HD}\ 016739\ \mathrm{Ab}$				1.24	19
${ m HD} \ 016765 \ { m B}$		K2V	5		
$\mathrm{HD}\ 016895\ \mathrm{B}$	NLTT 8787	M2V	8		
$\mathrm{HD}\ 017382\ \mathrm{B}$	NLTT 8996	M7V	8		
${ m HD} \ 018143 \ { m B}$	$\mathrm{HD}\ 18143\ \mathrm{B}$	K9V	5		
${ m HD} \ 018143 { m \ C}$	NLTT 9303	M7V	8		
${ m HD} \ 018757 { m \ C}$	NLTT 9726	M2V	8		
HD 019994 B		M2V	5		
HD 020010 Ba	GJ 127 B	K2V	5		
$\mathrm{HD}\ 020807\ \mathrm{B}$	HD 020766	G2V	10	1.12	20
${ m HD} \ 021175 \ { m B}$		M3V	5		
HD 024409 \to		M2V	8		
HD 024496 B		M2V	5		
${ m HD} \ 025998 \ { m A}$	HD 25893	G9V	21		
HD 025998 B		K2V	5		
HD 026923 B	HD 26913	G6V	21	0.87	11
$^{ m HD}$ 026965 $^{ m B}$	LHS 25	M4.5	22		

Table 18—Continued

Comp	Alt	Spec		Mass	
Name	Name	Type	Ref	(M_{\odot})	Ref
(1)	(2)	(3)	(4)	(5)	(6)
` '	. ,	. ,	. ,	. ,	` '
HD 026965 C	HD 26976	DA3	23		
HD 032778 B	NLTT 14447	M0V	8		
HD 032923 B		G1V	5		
HD 035112 B		M1V	5		
HD 035296 C	HD 35171	K7V	8		
HD 036705 Ab		M8V	24	0.09	25
HD 036705 Ba		M5V	26	0.16	26
HD 036705 Bb		$M4V \pm 1$	26	0.14	26
HD 037394 B	HD 233153	M1V	8		
HD 037572 B	HIP 26369	K5V	10		
HD 039587 Ab				0.15	27
HD 039855 B	BD-19 1297B	K9V	8		
HD 040397 B		M4V	5		
HD 040397 D	NLTT 15867	M5V	8		
HD 043162 B		M4V	8		
HD 043587 Ab				0.54	28
HD 043587 E	NLTT 16333	M4V	8		
HD 043834 Ab		$M5V \pm 1.5$	29	0.14	29
HD 045088 Ab				0.71	30
HD 045088 B		M4V	5		
HD 045270 B		M0V	5		
HD 048189 B		K7V	5		
HD 053705 B	HD 053706	K0.5V	10	0.78	20
HD 053705 Ca	HD 053680	K6V	10		
HD 057095 B		K6V	5		
HD 061606 B	NLTT 18260	K9V	8		
${ m HD} \ 063077 \ { m B}$	NLTT 18414	DC	31	0.56	32
HD 064096 B				0.9	6
HD 065907 B	LHS 1960	M0V	8		
HD 065907 $^{\circ}$ C		M5V	5		
$\mathrm{HD}\ 068257\ \mathrm{B}$	$^{ m HD}~068255$	F8V	21	1.52	11
HD 068257 Ca	${ m HD} \ 068256$	G0 IV-V	21		
HD 068257 Cb1		M2V			
HD 068257 Cb2		M2V			
${ m HD} \ 068257 \ { m Cb3}$		M2V-M4V			
$\mathrm{HD}\ 072760\ \mathrm{Ab}$				0.13	33
$\mathrm{HD}\ 073752\ \mathrm{B}$		K2V	5	1.07	12
$\mathrm{HD}\ 074385\ \mathrm{B}$	NLTT 20102	M2V	8		
$\mathrm{HD}\ 075732\ \mathrm{B}$	LHS 2063	M6V	8		
HD 075767 Ba		M3V	34		
$\mathrm{HD}\ 075767\ \mathrm{Bb}$		M4V	34		
$\mathrm{HD}\ 079096\ \mathrm{Ab}$				0.85	6
HD 079096 Ea	$\mathrm{Gl}\ 337\mathrm{C}$	L8	35		

Table 18—Continued

Comp Name (1)	Alt Name (2)	Spec Type (3)	Ref (4)	Mass (M _☉) (5)	Ref (6)
HD 079096 Eb		L8	36		
HD 079969 B		K4V	5	0.74	12
$\mathrm{HD}\ 080715\ \mathrm{Ab}$		K3V	13		
$\mathrm{HD}\ 082342\ \mathrm{B}$		M3.5V	37		
${\rm HD} \ 082443 \ {\rm B}$	NLTT 22015	M5.5V	37		
${ m HD} \ 082885 \ { m B}$		M8V	5		
$\mathrm{HD}\ 086728\ \mathrm{Ba}$	GJ 376 B	M6.5V	38		
$\mathrm{HD}\ 086728\ \mathrm{Bb}$		M6.5V	38		
${ m HD} \ 089125 \ { m B}$	GJ 387 B	M1V	8		
$\rm HD~090508~B$	LHS 2266	M2V	5		
HD 090839 Ba	HD 237903	K5	8		
HD 096064 B	NLTT 26194	K7	5		
$^{ m HD}$ 096064 $^{ m C}$	BD-033040C	K7	5		
HD 097334 Ea	Gl 417B	L4.5V	39	0.1	40
$^{ m HD}$ 097334 $^{ m Eb}$		L4.5V	40	0.1	40
$\mathrm{HD}\ 098230\ \mathrm{Ab}$		M3V	41		
$\mathrm{HD}\ 098230\ \mathrm{Aa}$	HD 98231	F9V	42		
HD 099491 B	HD 099492	K2V	43	1.24	20
HD 100180 B	NLTT 27656	K5V	8		
HD 100623 B	LHS 309	DC	18		
HD 101177 Ba	LHS 2436	K3V	8		
HD 101177 Bb		M2V	13		
$^{ m HD}\ 102365\ { m B}$	LHS 313	M4V	37	• • •	
HD 111312 Ab	• • •	M2V	5	0.58	13
HD 111312 B	• • •	K8V	13	• • •	
HD 112758 B	• • •	M2V	5	• • •	
HD 115404 B	LHS 2714	M0.5V	37		
HD 116442 B	HD 116443	K2V	21	0.78	20
HD 120136 B	HD 120136B	M2V	5		
HD 120780 B		M4V	5		
HD 125455 B	LHS 2895	M6	8		
HD 128620 B	HD 128621	K2IV	10	0.93	44
HD 128620 C	HIP 070890			0.11	45
HD 130042 B	• • •	K8V	5		
HD 130948 B	HD 130948 B	$L2 \pm 2$	46	0.07	46
HD 130948 C	HD 130948 C	$L2 \pm 2$	46	0.07	46
HD 131156 B	HD 131156B			0.67	12
HD 133640 Ba	NLTT 39210	K2V	47		
HD 133640 Bb	• • •	M2V	13		
HD 135204 B		G9V	5		
HD 136202 B	LHS 3060	K9V	8		
HD 137107 B	HD 137108		• • • •	1.05	6
HD 137107 E	GJ 584 C	L8V	39	0.06	39

Table 18—Continued

Comp	Alt	Spec		Mass	
Name	Name	Type	Ref	(M_{\odot})	Ref
(1)	(2)	(3)	(4)	(5)	(6)
()	,	()	()	()	()
HD 137763 Ab		K9	13	0.57	13
HD 137763 B	HD 137778	K2V	21	0.87	20
HD 137763 C	GJ 586 C	M4.5V	48		
HD 139341 B		K1V	5	0.83	12
HD 139341 C	HD 139323	K2IV-V	21	1.13	20
HD 139777 B	HD 139813	K2V	8	1.15	20
HD 140538 B		M5V	5		
HD 140901 B	NLTT 41169	M2	5		
HD 141272 B		$M3V \pm 0.5$	49	0.26	49
HD 143761 Ab				0.14	50
HD 144284 Ab				0.46	51
HD 144287 Ab		K4V	5		
HD 144579 B	LHS 3150	M4V	8		
HD 145958 B	NLTT 42272	G9V	21		
HD 145958 D		Т6	52		
HD 146361 Ab				1.09	53
HD 146361 B	HD 146362			1.03	53
HD 146361 Ea	HIP 079551	M2.5V	48		
HD 146361 Eb	sig CrB D	1V12.5 V		0.1	54
HD 147513 B		DA2	23		
HD 148653 B	LHS 3204			0.77	12
HD 148704 Ab		K1V	 13		
HD 149806 B		M6V	8		
HD 153557 B	• • •	M2V	5		
HD 153557 B	 HD 153525	1V1 Z V		0.73	 11
HD 155885 B		K1.5V	5		
HD 155885 C	 HD 156026	K1.5V K5V	10	• • •	
HD 156274 B	NLTT 44525	K7V	37	• • •	• • • •
HD 150274 B HD 157347 B	HR 6465	M3V	55	• • •	
HD 157547 B HD 158614 B				0.90	6
HD 160269 B	• • •	• • •	• • •	0.90 0.65	12
HD 160269 C	 HIP 86087	 M0.5V	22		
HD 161797 Ab		M8V	5	• • •	
HD 161797 Ab HD 161797 B	 NLTT 45430		5 5	• • • •	• • • •
HD 161797 B HD 161797 C		M3V M2V	5 5	• • •	
HD 161797 C HD 162004 A	 UD 162002	M3V		1 20	11
HD 162004 A HD 165341 B	HD 162003 NLTT 45900	F5V	8	1.38	11 6
HD 165341 B HD 165908 B		 VeV		0.78	_
HD 165908 B HD 167425 B	• • •	K6V Mov	5 8		• • • •
	• • •	M0V	-	0.71	19
HD 176051 B	• • •	K3V	5	0.71	12
HD 177474 B		F8V	5		• • • •
HD 179957 B	HD 179958	G4V	5		
HD 184467 B				0.8	6

Table 18—Continued

Comp	Alt	Spec		Mass	
Name	Name	Type	Ref	(M_{\odot})	Ref
(1)	(2)	(3)	(4)	(5)	(6)
. ,	, ,	. ,	. ,	. ,	. ,
HD 186408 Ab		M0V	5		
HD 186408 B	HD 186427	G3V	10	1.10	20
HD 186858 Aa	HD 187013	F5.5IV-V	21	1.24	11
HD 186858 B		K4V	5		
${ m HD} \ 186858 \ { m G}$	HD 225732	K3V	5	0.68	12
HD 187691 C		M3V	8		
HD 189340 B				0.94	12
HD 190067 B		K7V	5		
HD 190360 B	LHS 3509	M4.5V	22		
HD 190406 Ab	HD 354613	$\mathrm{L}4.5\pm1.5$	56	0.06	56
HD 191408 B	LHS 487	M5V	5		
HD 191499 B	ADS 13434B	K5V	5		
${ m HD} \ 191785 \ { m E}$		M3.5V	55		
HD 195564 B	LTT 8128	M2V	5		
HD 195987 Ab				0.67	57
HD 197076 C	NLTT 49681	M2.5V	22		
HD 198425 B	NLTT 49961	M6V	8		
HD 200525 B		G0V	5		
HD 200525 $^{\circ}$ C	NLTT 50542	M3V	5		
HD 200560 D	GJ 816.1B	M3V	5		
HD 200968 B	GJ 819B	K7V	37		
${ m HD}\ 202275\ { m B}$				1.12	6
HD 202940 B	LHS 3656	K9V	5		
HD 203985 B	LTT 8515	M3.5V	55		
HD 206826 B	HD 206827	G5V	5		
HD 206860 B	HN Peg B	$T2.5 \pm 0.5$	7	0.02	7
HD 211415 B		K9V	5		
${ m HD} \ 211472 \ { m T}$	GJ 4269	M4V	8		
HD 212168 B	HIP 110719	G0V	10	1.13	20
HD 214953 B	NLTT 54607	M0.5V	37		
HD 215648 B		M4V	5		
HD 218868 B		M5V	8		
HD 220140 B	NLTT 56532	M3V	8		
HD 220140 C		M7V	8	0.1	58
HD 223778 Ab				0.75	30
HD 223778 B		M6V	5		
HD 224930 B		$K5\pm1~V$	42	0.58	12
HD 263175 B	HD 263175B	M0.5V	22		
HIP 036357 A	HD 58946	F1V	21	1.40	11
HIP 036357 B	GJ 274 B	M7V	5		
HIP 091605 B	LHS 3402	M2V	8		
		•			

Note. — Reference codes for columns 4 and 6 are as follows: (1) Griffin (1999); (2) Chauvin et al. (2007); (3) Chauvin et al. (2006); (4)

DM91; (5) Estimated using primary's spectral type and ΔV from the WDS or other catalogs; (6) Pourbaix (2000); (7) Luhman et al. (2007); (8) Estimated from optical and infrared magnitudes from catalogs; (9) Boden et al. (1999); (10) Gray et al. (2006); (11) Nordström et al. (2004); (12) Söderhjelm (1999); (13) Estimated using primary's mass or spectral type and mass-ratio from an SB2 orbital solution; (14) Cutispoto et al. (1997); (15) Lowrance et al. (2002); (16) Mugrauer & Neuhäuser (2005); (17) Lagrange et al. (2006); (18) Henry et al. (2002); (19) Bagnuolo et al. (2006); (20) Valenti & Fischer (2005); (21) Gray et al. (2003); (22) Reid et al. (2004); (23) Holberg et al. (2002); (24) Boccaletti et al. (2008); (25) Close et al. (2007); (26) Janson et al. (2007); (27) König et al. (2002); (28) Catala et al. (2006); (29) Eggenberger et al. (2007); (30) Raghavan et al. (2010b); (31) Kunkel et al. (1984); (32) Holberg et al. (2008); (33) Metchev & Hillenbrand (2009); (34) Fuhrmann et al. (2005); (35) Wilson et al. (2001); (36) Burgasser et al. (2005); (37) Hawley et al. (1996); (38) Gizis et al. (2000); (39) Kirkpatrick et al. (2001); (40) Bouy et al. (2003); (41) Ball et al. (2005); (42) ten Brummelaar et al. (2000); (43) The Hipparcos catalog; (44) Pourbaix et al. (2002); (45) Wertheimer & Laughlin (2006); (46) Potter et al. (2002); (47) Lu et al. (2001); (48) Reid et al. (1995); (49) Eisenbeiss et al. (2007); (50) Gatewood et al. (2001); (51) Mazeh et al. (2002); (52) Looper et al. (2007); (53) Raghavan et al. (2009); (54) Heintz (1990); (55) This work; (56) Liu et al. (2002); (57) Torres et al. (2002); (58) Makarov et al. (2007).

 $^{\rm a} \rm Estimated$ using mass-sum of Aa+Ab from DM91 and mass of Aa from Nordström et al. (2004)