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# Radial Velocities for 889 Late-type Stars[1]

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## ABSTRACT

We report radial velocities for 844 FGKM–type main sequence and subgiant stars and 45 K giants, most of which had either low-precision velocity measurements or none at all. These velocities differ from the standard stars of Udry et al. (1999a) by 0.035 km s$^{-1}$ (RMS) for the 26 FGK standard stars in common. The zero–point of our velocities differs from that of Udry et al.: $< V_{\rm present} - V_{\rm Udry} >$ $= +0.053$ km s$^{-1}$. Thus these new velocities agree with the best known standard stars both in precision and zero–point, to well within 0.1 km s$^{-1}$.

Nonetheless, both these velocities and the standards suffer from three sources of systematic error, namely, convective blueshift, gravitational redshift, and spectral type mismatch of the reference spectrum. These systematic errors are here forced to be zero for G2V stars by using the Sun as reference, with Vesta and day sky as proxies. But for spectral types departing from solar, the systematic errors reach 0.3 km s$^{-1}$ in the F and K stars and 0.4 km s$^{-1}$ in M dwarfs.

Multiple spectra were obtained for all 889 stars during four years, and 782 of them exhibit velocity scatter less than 0.1 km s$^{-1}$. These stars may serve as radial velocity standards if they remain constant in velocity. We found 11 new spectroscopic binaries and report orbital parameters for them.

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## 1. Introduction

The radial velocity of a star is ideally the component of the velocity vector of its center of mass that lies along the line–of–sight. Radial velocities are valuable for a variety of astrophysical investigations, including studies of the structure of the Milky Way Galaxy, the orbits of long–period binary stars, and the distances to star clusters (see for example, Binney and Merrifield (1998)). "Barycentric" radial velocities (sometimes referred to as "absolute" radial velocities), such as reported here, are measured relative to the barycenter, or center of mass, of the Solar System. Such velocities are often (incorrectly) termed "heliocentric", though the Sun moves with a speed of $\sim$13 m s$^{-1}$ relative to the barycenter.

Radial velocities of stars in the Galaxy are often measured with an accuracy of only $\sim$0.5 km s$^{-1}$. With advances in the accuracy of proper motion measurements to $\sim$1 mas/yr (e.g., Perryman et al. 1996) for many stars, a corresponding increase in the accuracy of radial velocities is required. Meanwhile, the best *relative* radial velocities have precisions of 3 m s$^{-1}$ (Butler et al. 2000) and new instruments (e.g. HARPS) are designed to achieve a precision of 1 m s$^{-1}$ (Bouchy et al. 2001; Pepe et al. 2000). These relative velocities have proved useful in the detection of extrasolar planets (e.g., Marcy, Cochran, & Mayor (2000)) but they are not necessarily tied to a velocity zero–point. Nonetheless, the precision–velocity instruments have overcome many observational and technical hurdles related to spectroscopic Doppler–shift measurements, either by using a gas absorption cell or a fiber–fed comparison lamp spectrum (Valenti et al. 1995; Butler et al. 1996; Baranne 2000).

The precision–velocity technology has been applied to the establishment of barycentric radial velocities, most notably by the Geneva team (Udry et al. 1999a,b). They have measured velocities for 38 stable dwarf stars with precision better than 0.05 km s$^{-1}$.

Here we provide barycentric radial velocities with typical accuracies of 0.3 km s$^{-1}$ (and precise to 0.03 km s$^{-1}$ for a given spectral type) for 889 stars. Our intent is to provide a velocity measurement at the current epoch for a variety of purposes. Velocity variations with a time scale of hundreds of years may be detected by comparison of present and future velocities. We also hope to establish radial velocity standard stars, by indentifying a subset that exhibit no significant velocity variation above 10 m s$^{-1}$.

## 2. Barycentric Radial Velocities

The Doppler searches for planets have been successful because of the relative ease with which the change in radial velocity may be measured with high internal precision. Such relative velocities circumvent the technical challenges associated with the determination of an accurate velocity zero–point and they avoid the physical interpretation of a barycentric Doppler shift which becomes bewildering at levels below 1 km s$^{-1}$.

Barycentric Doppler shifts carry an unclear interpretation for several reasons. Stellar lines suffer a gravitational redshift (Misner, Thorne, & Wheeler 1973) upon leaving the stellar photosphere, yielding effective redshifts of $V_{\rm grav} = GM/Rc$ (Dravins et al. 1999). This redshift varies from 680 m s$^{-1}$ for F5V to 500 m s$^{-1}$ for M5V stars, the range of spectral types considered here. Uncertainties in stellar masses and radii prevent an accurate removal of this effect. Furthermore, stellar lines suffer a transverse Doppler effect (essentially time dilation), the removal of which requires knowledge of the full velocity vector of the star's space motion. This effect is $\simeq$50 m s$^{-1}$ for the fastest moving stars (Lindegren et al. 1999).

More importantly, stellar Doppler shifts are affected by sub–photospheric convection (granulation), macro-turbulence, stellar rotation, pressure shifts, oscillations and activity cycles. The most important of these effects is granulation. The textbook explanation is that a larger contribution to the stellar flux emerges from hot, rising gas than from falling gas in the convective cells. These motions yield an overall blueshift of spectral lines (Dravins 1999). However, the exact convective blueshift depends on the full 3–D hydrodynamics and radiative transfer in each spectral line as a function of depth in the photosphere (Dravins 1999). The blueshift clearly depends on spectral type and is expected to be $\sim$–1000 m s$^{-1}$ for F5V, –400 m s$^{-1}$ for G2V, and –200 m s$^{-1}$ for K0V (Dravins et al. 1999). Effects due to pressure shifts are less than 100 m s$^{-1}$ for ordinary stars (Dravins et al. 1999; Allende Prieto et al. 1997). Stellar rotation also imposes minor radial velocity effects (Gray 1999).

Moreover, the measurement of spectroscopic barycentric radial velocities usually requires a reference stellar spectrum. Due to constraints of telescope time and available standard stars, only a small number of reference spectra can be used. Typically, the Doppler measurements require use of reference spectra having different spectral types than the program star, which leads to spectral mismatch errors. Since the strengths of spectral lines vary with temperature and metalicity, the spectra of the reference and program stars will be significantly different. In effect, the relative displacement in wavelength between two non–identical spectra is not uniquely defined and therefore is dependent on the algorithm used. Such spurious Doppler effects are minimized, but not eliminated, by using high–resolution spectra with many lines resolved, as adopted in this present survey.

The effects of convection, stellar gravitational redshift, transverse Doppler shift, and the other effects mentioned above cannot be determined for a star with an accuracy that is comparable to the internal measurement errors of ~10 m s$^{-1}$ . Removal of such effects by a model of each star might introduce more model–dependent errors. Nonetheless, with considerable modeling, the measurement of a Doppler shift may be used to determine the "true" velocity component of the center of mass of the star. Alternatively (and more traditionally) Doppler measurements may be left merely as an observable, namely the spectroscopic shift in wavelength, often quoted as $z = \Delta\lambda/\lambda_0$ (Lindegren et al. 1999).

Here, we adopt the philosophy that spectroscopic barycentric radial velocities should first be corrected for local effects, such as that caused by the observer's motion relative to the Solar System barycenter (~30 km s$^{-1}$) and by the solar gravitational blueshift (~3 m s$^{-1}$). In addition, we will correct all of our velocities of FGK stars for gravitational redshift and convective blueshift to first order by using the known radial velocity of the Sun to set the zero–point for the stellar velocity measurements.

Our quoted Doppler shifts represent velocities as if measured at the Solar System barycenter but with the Sun and its potential well removed. Clearly the velocity measurements presented here are amenable to future corrections for the spectral–type dependence relative to G2V for gravitational redshift and convective blueshift, in order to yield the most accurate velocities possible for them (e.g., Gullberg (1999); Saar & Fischer (2000)).

## 3. Spectroscopic Observations

The spectra were obtained with the HIRES echelle spectrometer (Vogt et al. 1994) on the 10-m Keck 1 telescope and with the "Hamilton" echelle spectrometer fed by either the 3-m Shane or the 0.6-m Coude Auxilliary (CAT) Telescopes (Vogt 1987). During an observation the starlight is sent through a glass cell that is filled with iodine vapor (Marcy & Butler 1992) before entering the spectrometer, which superimposes iodine lines on the stellar lines. These iodine absorption lines are used to calibrate the wavelength scale of the spectrum from 5000 Å– 6000 Å.

Our Doppler planet search project contains 889 stars at the Keck and Lick Observatories (Butler et al. 2000). Until now only relative radial velocities have been computed from these spectra and they have a precision of ~3 m s$^{-1}$ (Butler et al. 1996; Vogt et al. 2000) which has allowed the discovery of Jovian and sub-Jovian sized extrasolar planets (Marcy, Cochran, & Mayor 2000).

To achieve barycentric velocities, we adopt two standard spectra. We use the National

Solar Observatory (NSO) FTS solar spectrum (Kurucz et al. 1984) and an M dwarf composite spectrum (see §4) as reference spectra. The 889 stars each typically have ∼12 spectra obtained during four years from 1997 to 2001. The distribution of spectral types in our sample is: 14% F, 46% G, 27% K, and 13% M stars. Except for 45 K giants all stars are main–sequence dwarfs or subgiants. All stars are void of a visible companion within 2 arcsec, though some were subsequently revealed to be spectroscopic binaries (see §9).

## 4. Doppler Method

The barycentric radial velocities reported here are found in a manner similar to that used to find the relative radial velocities for the planet search. An observed spectrum is fit with a synthetic spectrum that is composed of the individual stellar and iodine spectra. In detail, the synthetic spectrum is the product of the deconvolved stellar "template" spectrum (with the spectrometer instrumental profile removed) with a high resolution spectrum of molecular iodine. The product of these two is convolved with the instrumental profile of the spectrometer (at the time of the observation), to produce the final synthetic spectrum, as described in Butler et al. (2000).

The observed spectrum to be synthesized is broken into "chunks" of length 40 pixels corresponding to roughly ∼2 Å. In total 14 free parameters are fit in the Doppler analysis; 11 devoted to the instrumental profile, along with the wavelength zero–point of each chunk, the wavelength dispersion across each chunk, and the Doppler shift of the stellar spectrum relative to the stellar template of that star, $z$ $(= \Delta\lambda/\lambda)$. All of the parameters, except for $z$, are extracted primarily from the iodine portion of the observed spectrum. After the best parameters are found for all the chunks of a spectrum they are saved for further analysis, notably the weighted average of $z$. We apply a correction to all velocities for our topocentric motion relative to the barycenter (McCarthy 1995). For a more in depth discussion of this standard Doppler analysis to obtain relative velocities, see Marcy & Butler (1992); Butler et al. (1996); Valenti et al. (1995).

To obtain barycentric radial velocities, the approach was similar to the standard analysis described above and indeed we used some parameters derived from that analysis. Here, we used the National Solar Observatory (NSO) solar spectrum (Kurucz et al. 1984) as the deconvolved template, for all F, G and K stars. For M dwarfs, we constructed an in–house M star composite spectrum as the template (see below). Since all parameters except for $z$ are extracted from the iodine portion of the spectrum previously, the use of a different stellar template spectrum does not affect these parameters significantly. Therefore in our new fit, we simply adopt the values of the 13 non–$z$ parameters that were previously obtained in the

Doppler analysis for relative velocities (i.e., for the planet search) and we fit here only for the barycentric radial velocity, $z$.

Ordinarily, when the deconvolved stellar spectrum of the individual star is used as the template, the $\chi^2_\nu$ statistic is near unity (usually less than 1.7), because the stellar contribution to the model is a previously obtained deconvolved spectrum of the same star. But in our fit for barycentric velocities, the value of reduced $\chi^2_\nu$ is much larger (poorer) because of the mismatch between the template spectrum (NSO or M dwarf composite) and that of the program star. The program star differs from the Solar or M–dwarf template in spectral type, metalicity, and $v \sin i$. Thus, the spectral fits are not as good, yielding $\chi^2_\nu$ of 3–7.

The internal error per observation, as defined by the weighted standard deviation of the mean of the velocities from all (∼400) chunks, is higher for our barycentric radial velocities than for the relative radial velocities used in the planet search. We find that while the relative velocities carry errors of ∼3 m s$^{-1}$ (for the planet search) the average internal error per observation for the barycentric velocities reported here is ∼20 m s$^{-1}$. A more conservative estimate of our velocity precision is given in §6 as 0.03 km s$^{-1}$ from comparison with the standard stars.

Due to the fact that only one stellar template is used for a large range of stellar types, we expect that our errors (internal error per observation) will depend on $B-V$. The greater the difference between template and program star, the greater the expected error due to spectral mismatch. We plot this internal error in our barycentric velocities versus $B-V$ in Figure 1. Since the NSO solar spectrum, $B-V=$ 0.64 (Carroll and Ostlie 1996), is used for F, G and K stars we expect the errors to be minimized for solar type stars. This is confirmed in Figure 1 . The M dwarf composite template spectrum was created from five different M dwarfs having average spectral type of M3 (see below). The internal velocity errors for stars analyzed with this stellar template are minimized at $B-V\approx$ 1.5, as can also be seen in Figure 1.

Each program star has an average of 12 observations. As many observations as possible are analyzed per star, up to 30, in order to minimize the uncertainty in the mean of the barycentric radial velocities. If the radial velocity of the star were stable we should obtain an uncertainty in the mean of $\sim 20/\sqrt{12} \approx 6$ m s$^{-1}$. A majority of stars indeed exhibit velocity scatter of ∼10 m s$^{-1}$ (RMS) while others have an RMS scatter larger than 100 m s$^{-1}$. Scatter in the latter stars is almost always caused by companions or large chromospheric activity. Overall, 782 of the 889 stars have an RMS velocity scatter less than 0.1 km s$^{-1}$, and 107 stars have an RMS velocity scatter larger than 0.1 km s$^{-1}$. The barycentric radial velocities for these stars are reported in Tables 1 and 2 respectively.

As mentioned above, the NSO solar spectrum could not be used as the template for the M dwarf program stars because the spectra are too different. Therefore, a separate reference spectrum was required for the M stars. For this purpose a composite spectrum of five M stars was produced in the following manner.

Five M stars were selected having barycentric radial velocities reported by Marcy et al. (1987) with low uncertainties: GJ 251 (M4), GJ 411 (M2), GJ 526 (M4), GJ 752A (M3.5), and GJ 908 (M2). One spectrum of high S/N ratio was used from each of these M dwarfs. The spectra were shifted back, to remove the Doppler shifts caused by the barycentric motion of the observatory and by the barycentric radial velocity of the star itself relative to the barycenter, taken from Marcy et al. (1987). To check for any residual Doppler shifts, these corrected spectra were then cross-correlated with respect to one of them, GJ 251. Assuming the resulting displacements were due to random errors, the mean of the residual velocities was taken to be the barycentric velocity zero-point. Using this reference point the spectra were again corrected for their doppler shifts. Finally, the spectra were put on the same wavelength scale and coadded to create a M star composite spectrum.

## 5. Velocity Zero-Point

Using observations of the day sky and the minor planet Vesta we found the zero-point of our velocities for FGK stars. These references were used because they have essentially solar spectra, and the radial velocities of Vesta and the sun relative to a topocentric observer are easily determined. We used the online "JPL Ephemeris Generator" to find these instantaneous velocities [6]. Four observations of the day sky and two observations of Vesta were analysed with the before mentioned Doppler method using the NSO solar spectrum. These references showed that our raw velocities, from Keck and Lick, were consistently large by $522\pm5$ m s$^{-1}$ .

There are various possible sources for the 522 m s$^{-1}$ offset in our raw velocities. The absolute wavelength scales of both the NSO solar spectrum and our FTS iodine spectrum are not well known. According to Kurucz et al. (1984), the solar lines are broadened by 200 m s$^{-1}$ due to the change in the radial velocity during the observation, and the wavelengths may have errors as large as 100 m s$^{-1}$ . The wavelength scale of the iodine FTS spectrum comes from the calibration made at the McMath telescope at Kitt Peak. We have no independent way to verify the integrity of the zero–point in wavelength of this FTS iodine spectrum. The third concern stems from the instrumental profile of the HIRES and the

[6]http://ssd.jpl.nasa.gov/cgi-bin/eph

Hamilton spectrometers. It is known that the PSF is asymmetric to some degree (Valenti et al. 1995) and may give rise to systematic velocity shifts. However, it is unlikely that the same asymmetry in the same direction would be found at two different spectrometers. Therefore, we consider this possibility less plausible.

All Doppler measurements which used the NSO solar spectrum as the reference template were corrected for this offset of 522 m s$^{-1}$. Since currently no M dwarfs exist having a definitive barycentric radial velocity, the velocity zero-point for the M stars in our sample was set using the previously published velocities for the five standards from Marcy et al. (1987) which have errors of $\sim$0.4 km s$^{-1}$.

## 6. Comparison of Present Velocities with Standard Stars

To get an external measure of the accuracy of our barycentric radial velocities we have compared our velocities to published velocities of supposed radial velocity standard stars. We carry out this comparison separately for the FGK stars and for the M stars.

### 6.1. F, G and K Stars

We compared our velocities to those of the 26 standard stars that were measured by Udry et al. (1999a). The results of this comparison are shown in Figures 2 and 3 and yield $< V_{Udry} - V_{Present} > = -53$ m s$^{-1}$, with an rms scatter of 35 m s$^{-1}$. The corresponding uncertainty in the mean is $35/\sqrt{26} = 7$ m s$^{-1}$ . Thus the formal difference in zero points is

$$< V_{\rm Present} - V_{\rm Udry} >= +53 \pm 7 {\rm m\ s^{-1}} \qquad (1)$$

Thus, there appears to be a statistically significant difference in the zero–point of the velocities reported here compared to those of Udry et al. (1999a) of 53 m s$^{-1}$. We do not know the origin of this difference, nor do we know which scale is more "accurate". Few studies will be affected by such small differences. But future highly precise proper motion measurements and precise orbit calculations may require such accurate velocities, including proper treatment of gravitational redshift and convective blueshift.

However, the difference between the present velocities and those of Udry et al. (1999a) do exhibit a significant $B-V$ dependence as seen in Figure 4. The slope of the linear trend is $-182 \pm 24$ m s$^{-1}$ per mag with an RMS scatter around the fit of 23 m s$^{-1}$. This dependence is similar to the $B-V$ dependence seen between the CfA and CORAVEL data (Stefanik et al. 1999; Udry et al. 1999a). This color dependence is likely caused by some spectral type mismatch in one or all of the radial–velocity scales. For solar type stars (near G2V) where our zero-point is well set, we are in good agreement with the CORAVEL velocities, with an offset of only 25 m s$^{-1}$ as seen in Figure 4.

According to Udry et al. (1999a) the ELODIE measurements ensure temporal stability of better than 15 m s$^{-1}$ during time scales of years for their standard stars . However, their quoted velocities have been rounded off at the 50 m s$^{-1}$ level. From our measurements of these stars in common, the temporal variability is less than 10 m s$^{-1}$ during $\sim$5 yr. Therefore it is not certain whether the rms scatter of 35 m s$^{-1}$ between the two sets of velocities is due to our errors or the rounding of the ELODIE data plus their errors. We conclude that the barycentric velocities reside on the same scale with an offset of $\sim$50 m s$^{-1}$, and a scatter of $\sim$35 m s$^{-1}$.

Comparing our velocities for 29 common stars with those reported by Stefanik et al. (1999), with a correction of +136 m s$^{-1}$ added to their native velocities in Table 1 and 2 (Stefanik private communication), we obtain $< V_{\rm CfA} - V_{\rm Present} > = 15$ m s$^{-1}$ which is only marginally different from zero, with an RMS scatter of 123 m s$^{-1}$ as seen in Figure 5. The differences exhibit a significant $B-V$ dependence as seen in Figure 6. The slope of the linear trend is $+448 \pm 111$ m s$^{-1}$ per mag with an RMS scatter around the fit of 109 m s$^{-1}$. This color dependence is likely caused by some spectral type mismatch in one or all of the radial–velocity scales. For solar type stars, we are in good agreement with the CfA velocities, with no offset as seen in Figure 6. This is likely due to the CfA velocity zero–point being set by observations of minor planets as was also done for the present velocities.

Interestingly, the sign of the slope in Figure 6 is opposite of that in Figure 4 between the CORAVEL and present velocities. Since synthetic spectra were used to derive both the CfA and ELODIE velocities, which were used as the reference system in Udry et al. (1999a), (Stefanik et al. 1999; Baranne et al. 1996; Gullberg 1999) this seems to give credence to the notion that using synthetic spectra does not entirely solve the problem of spectral dependent systematic errors.

### 6.2. M stars

The radial–velocity standard stars listed by Udry et al. (1999a) do not include any M dwarfs, and we do not have any M dwarfs in common with Stefanik et al. (1999) or the older CORAVEL standard stars (Udry et al. 1999b). Therefore, we compared our present velocities for M dwarfs to those given in Marcy et al. (1987). The results of this comparison, for 21 stars in common, are shown in Figures 7 and 8 and yield $< V_{MLW} - V_{Present} > = -21$ m s$^{-1}$ with an rms scatter of 164 m s$^{-1}$. The offset is obviously very low since the M star reference spectrum was created using the velocities quoted by Marcy et al. (1987). Since the average internal error for the velocities in Marcy et al. (1987) is $\sim$200 m s$^{-1}$, most of the scatter in the differences is due to them. No $B-V$ dependence is seen in the residuals. It is therefore difficult to ascertain the uncertainty in our present velocities for M dwarfs and similarly difficult to ascertain a zero–point error (whatever that would mean). But a conservative estimate of the errors would be the $\sim$0.4 km s$^{-1}$ uncertainty of the Marcy et al. (1987) velocities which were used in setting the velocity zero–point.

Since the observed offset (21 m s$^{-1}$) for the M dwarfs is within a factor of two of the internal scatter of $\sim$10 m s$^{-1}$, we have not applied any correction to the radial velocities for these stars. There is some concern that our two sets of stars, the F, G, and K stars and the M stars, might not be on the same velocity zero-point. A comparison between them is difficult due to the significant spectral type mismatch errors.

## 7. Uncertainty Estimates

Due to the several systematic errors affecting radial velocities on the order of 0.1 km s$^{-1}$ it is difficult to asertain the true uncertainties of the velocities reported here. Normally two different methods are used to estimate uncertainties: 1) Standard deviation of the mean (i.e. the internal RMS scatter of points), and 2) comparison with published values. We have done both here. On average the standard deviation of the mean, due to the internal scatter of points, for the velocities in Table 1 is $\sim$10 m s$^{-1}$. We also compared our velocities with the best known published standard star velocities of Udry et al. (1999a). This comparison, as shown in the previous section, gave an RMS scatter of the differences of 35 m s$^{-1}$. Therefore, using the traditional methods of estimating uncertainties our velocites are accurate to $\sim$35 m s$^{-1}$.

In this case the traditional methods fail due to the astrophysical sources of errors that affect all spectroscopic measurements of radial velocity. The values of these errors are not known adequately, otherwise we would have corrected for them. It is likely that these systematic errors were also not taken into account by Udry et al. (1999a) or Stefanik et al. (1999). This means that a comparison between their data and ours will not yield the true uncertainty of our velocities or theirs.

What the comparison does show is the precision of velocities within a given spectral type. The velocities of all stars of a given spectral type will have a nearly constant offset from their true kinematic velocities, because the systematic errors are dependent on spectral type. Relative to that constant offset the velocities in that spectral type are very precise. The comparison with Udry et al. (1999a) shows our precision to be no worse than 0.035 km $s^{-1}$ (see Fig. 3).

This high precision within a spectral type can be effectively used to look for moving groups. Moving groups have velocity dispersions of typicaly $\sim$0.5 km $s^{-1}$ such as the Pleiades group (Jones 1970). The present velocities are precise enough within a spectral type to judge whether a star belongs to the moving group or not.

Even though the exact values of the systematic errors are not known we can estimate our true uncertainties. There are three major systematic errors in our velocities, namely, convective blueshift, gravitational redshift and spectral type mismatch. These errors change systematically with spectral type. Since our velocity zero–point was set here using the day sky and the minor planet Vesta, which have well known radial velocities due to Solar System dynamics, the systematic errors were forced to zero for solar–type stars. The errors will rise as the spectral type departs from solar–type. Because the zero–point calibration was used for all FGK–type stars there will be differential errors due to convective blueshift and gravitational redshift that increase with departure from solar–type. Similarly, the spectral type mismatch errors only occur for non solar–type stars, since the NSO solar spectrum was used for the reference, and is therefore unaffected by the velocity zero–point calibration.

The approximate values of the systematic errors are as follows. According to Dravins (1999) the convective blueshift is approximately –1000 m $s^{-1}$ for F5V ($B-V$= 0.4), –400 m $s^{-1}$ for G2V (solar-type, $B-V$= 0.64), and –200 m $s^{-1}$ for K0V ($B-V$= 0.9). The effective velocity error caused by gravitational redshift can be computed from, $V_{\rm grav} = GM/Rc$ (Dravins et al. 1999). We find, with masses and radii given by Allen (2000), that the redshift is +680 m $s^{-1}$ for F5V, +636 m $s^{-1}$ for G2V, and +590 m $s^{-1}$ for K0V. The sum of the two effects shows that the overall systematic error is approximately –320 m $s^{-1}$ for F5V, +236 m $s^{-1}$ for G2V, and +390 m $s^{-1}$ for K0V. Due to our zero–point calibration these errors are here forced to zero for solar–type stars. **Therefore, we expect that our velocities are low by $\sim$556 m $s^{-1}$ for F5V stars, true for solar–type stars, and high by $\sim$154 m $s^{-1}$ for K0V stars.**

With these estimates of the systematic errors in hand we can compute a correction for the velocities as a function of $B-V$. We fit a line to the first two points (F5V and G2V) and to the second two points (G2V and K0V) to obtain two linear interpolations. The first equation, Eqn (2), is for main–sequence stars earlier than solar–type ($B-V$< 0.64), and the second equation, Eqn (3), is for main–sequence stars later than solar–type ($B-V$> 0.64), not including M type stars. Equation (3) may be used for stars with $1.3 > B-V > 0.9$, but represents an extrapolation of the points given above and should be used with caution. Since most of our main–sequence stars have $B-V < 1.1$ this shouldn't cause too many problems. These equations do not account for spectral type mismatch errors because we do not know enough about these effects yet for our velocities.

$$\mathrm{RV}_{\mathrm{kin}} = \mathrm{RV}_{\mathrm{spec}} - 2.317 \times (B-V) + 1.483 \text{ km s}^{-1} \qquad B-V < 0.64 \tag{2}$$

$$\mathrm{RV}_{\mathrm{kin}} = \mathrm{RV}_{\mathrm{spec}} - 0.642 \times (B-V) + 0.411 \text{ km s}^{-1} \qquad 0.64 < B-V < 1.3 \tag{3}$$

These corrections are valid only for main–sequence stars for which the NSO solar spectrum was used as the reference. The velocities for the M type stars, with $B-V > 1.3$ and for which the M composite spectrum was used as the reference, have a zero–point uncertainty of $\sim$0.4 km s$^{-1}$ and therefore a correction for gravitational redshift or convective blueshift is not warranted at this time. However, we expect the velocities of the M stars to be very precise due to their low RMS velocity scatter and their small spectral type range which minimizes the systematic errors. We expect them to also be precise to 0.03 km s$^{-1}$ , just as the FGK main–sequence stars. If the "true" radial velocity of only one of them were known then they all could be corrected for their zero–point error and be very accurate.

We expect that the corrections given in equations (2) and (3) account for convective blueshift and gravitational redshift to within $\sim$0.1 km s$^{-1}$. The errors due to spectral type mismatch are likely to be $\sim$0.1 km s$^{-1}$ (Griffin et al. 2000). From the errors expressed in equations (2) and (3), an additional $\sim$0.1 km s$^{-1}$ for the spectral type mismatch error, along with the distribution of spectral types of our survey stars, the typical uncertainty of the uncorrected radial velocities in Tables 1 and 2 is $\sim$0.3 km s$^{-1}$. For the few subgiants, the errors are somewhat larger, but not easily estimated without models of subphotospheric convection in such stars.

We cannot at this time give a correction for the velocities of our 45 giants. Giants have a gravitational redshift on the order of 0.1 km s$^{-1}$ which is much smaller than that for dwarfs due to the large radius of giants, $\sim$15 $R_{\odot}$ (Allen 2000). The convective blueshift is not known for giants and hinders us from giving a rough velocity correction. Hopefully, more in-depth future studies of the sources of error discussed here, such as recent work by Pourbaix et al. (2002), will allow for more accurate corrections of radial velocities and eventually yield "true" radial velocities. Until that time these corrections may be used for the present velocities.

## 8. Final Radial Velocities and Description of Tables

The barycentric radial velocities for all 889 stars are reported in Tables 1 and 2. The 782 stars that exhibit an RMS velocity scatter less than 100 m s$^{-1}$ are reported in Table 1. Primary and alternate star names are given in the first two columns, and the stellar spectrum used as the template (either NSO or M dwarf composite) is listed in column three. The mean time of the observations is given in column four under <JD> to establish the characteristic epoch for the velocity measurement. The span of observations in days is given in column five, and the mean barycentric radial velocity of all observations for a star is in column six. Stars with only one observation were put in Table 1 even though their RMS scatter is not defined. They can be distinguished by $\Delta$T = 0.

The 107 stars with an RMS velocity scatter greater than 100 m s$^{-1}$ are reported in Table 2. Primary and alternate star names are given in the first two columns. The stellar template spectrum (either NSO or M dwarf) is given in column three. The Julian Date (JD) of one specific observation is given in column four. The barycentric radial velocity of that one observation is given in column five. The mean date of all observations and span of observations are given in columns six and seven. The RMS scatter of the velocities of all observations is given in column eight, and the number of observations in column nine. The last column is for comments where stars with companion orbits or linear trends are noted. "L" indicates that velocities vary linearly with time (see Table 4), "CO" indicates that a companion and its orbit were found, "C" indicates that a published companion exists but an orbit is not given here, and "A" indicates that the star is chromospherically active based on the emission reversal seen at the CaII H&K lines in our spectra.

The orbital parameters for 15 stars with companions are reported in Table 3. The orbital period $P$, velocity semi–amplitude $K$, eccentricity $e$, longitude of periastron $\omega$, and time of periastron $T_0$ are given as well as the primary mass $M_1$, minimum secondary mass $M_{2,\rm min}$, minimum semi–major axis $a_{\rm min}$, and the mass function, $f(M)$. References are also given to other sources which have information on these stars, their companions and orbital parameters. The data for stars with linear trends are given in Table 4. The slope of the radial velocity curve and the number of observations is given for 30 stars.

## 9. Orbits of Binaries

We found 107 stars in this program that exhibit an RMS velocity scatter greater than 100 m s$^{-1}$. We attempted to fit these with a Keplerian orbit. We found 29 stars that yield good Keplerian orbital fits to their relative radial velocities. Many of these binaries have been previously published from our velocities and therefore will not be duplicated here. Several papers contain these previously reported single–line spectroscopic binaries, namely Marcy et al. (1999), Butler et al. (2000), Vogt et al. (2002), Fischer et al. (2002), Cumming et al. (1999), Marcy et al. (2001b).

For 15 stars, our velocities provide unpublished orbital solutions or reveal unknown companions. These orbits are listed in Table 3 which gives the usual orbital parameters for single–line spectroscopic binaries. Plots of the velocities and the associated Keplerian fits are shown in Figures 9–23. The mass for the primary star for each system was estimated from the catalog by Prieto & Lambert (1999) or by using $B-V$ and Allen (2000). From the orbital parameters and primary masses, we determined the minimum companion masses ($M_{\rm min}$), mass functions, $f(M)$, and minimum semimajor axes, $a_{\rm min}$, which are also listed in Table 3. The values of $M_{\rm min}$ range from 42 $\rm M_{Jup}$ to 545 $\rm M_{Jup}$, and therefore the companions are all candidate brown dwarfs or H–burning stellar companions. The uncertainties in the orbital parameters were found by a Monte Carlo technique in which Gaussian velocity noise was added to the best–fit theoretical velocity curve at the times of observation. We ran 50 trials for each case, with orbital parameters being rederived for each trial. The standard deviations of the resulting orbital parameters were taken as the uncertainties. For some stars the Monte Carlo method underestimated the uncertainties in the orbital parameters. For these stars a more conservative estimate of the uncertainties was made by fitting many different Keplerian orbits to the observed relative radial velocities, without any modeled Gaussian noise, and then looking at the scatter of the parameters produced by the best orbital fits.

The stars HD4747, HD65430 and GJ84 have large orbital uncertainties due to incomplete phase coverage. There were insufficient velocity measurements to constrain the orbit of HD18445 even though it is known to have a companion (Halbwachs et. al 2000). Thus it isn't listed in Table 3. The eccentricity for HD140913 was fixed to $e = 0.54$ (Latham et al. 1989) in performing the Keplerian fit, since not enough points were available to constrain the eccentricity. Only the other four parameters were fit for this star. The Keplerian fit for HD208776 is particularly poor as insufficient velocities are available to constrain the orbital period to better than a factor of two. Eleven of the spectroscopic binary stars appear to be newly discovered here: HD4747, HD7483, HD30339, HD34101, HD39587, HD65430, HD174457, HD208776, GJ84, GJ595, HIP52940. Velocities are available upon request of G.M. The companions all have $M_{\rm min}$ in the sub–stellar range or low mass stellar range, and thus offer interesting targets for studies with adaptive optics or interferometry.

## 10. Conclusion

We have provided barycentric radial velocities with an internal precision of 0.03 km s$^{-1}$ for 889 stars. The error estimates stem both from the internal errors found from the spectral chunks within each spectrum and from the comparison with accurate velocities on the CORAVEL scale (Udry et al. 1999a). The radial velocities of the F, G and K dwarfs reside on a velocity zero–point defined by the observations of the Sun, using the day sky and Vesta as proxies. Our velocity scale differs by only 0.053 km s$^{-1}$ from that of Udry et al. (1999a) and 0.015 km s$^{-1}$ from that of Stefanik et al. (1999), thus adding confidence to the zero points of all three sets of velocities. The radial velocities of the M dwarfs reside on the velocity system defined by Marcy et al. (1987) and have not been further corrected, nor is such a correction known to be necessary. These M dwarf velocities are probably accurate to within 200 m s$^{-1}$.

The Doppler shifts reported here have such high accuracy that gravitational redshift and convective blueshift impose comparable (or greater) wavelength shifts. These effects were somewhat removed from our velocity measurements by using the Sun for the velocity zero–point. We expect therefore that for G2V stars the present velocities represent their "true" kinematic velocities within 0.03 km s$^{-1}$. However, for stars departing from solar–type the sum of the two astrophysical effects will produce systematic errors dependent on spectral type. From F to K type dwarfs this variation will be as large as $\sim$0.3 km s$^{-1}$ and will cause our velocities to be low for F type stars and high for K type stars. Using estimates for these effects we give rough velocity corrections in equations (2) and (3). We presume that these corrections bring the velocities within $\sim$0.15 km s$^{-1}$ of their "true" kinematic values.

These precise radial velocities can be used to complement future highly precise proper motion measurement, such as those projected to be obtained by the GAIA mission of the ESA. The radial velocities and proper motions will give the three components of space motion of stars. These precise space motions may be useful for discerning the membership of moving groups, since young moving groups have velocity dispersions of $\sim$0.5 km s$^{-1}$ (Jones 1970).

The 782 stars listed in Table 1 exhibited a velocity scatter of less than 100 m s$^{-1}$ during 4 years. These stars apparently exhibit relatively stable velocities on time scales of a decade and represent candidates for radial velocity standard stars. However, their integrity as velocity standard stars requires future observations to verify their stability. We expect that some of these 782 "stable" stars may reveal slow drifts in radial velocity on time scales longer than 10 yr.

The accuracy of the present velocities offers an opportunity to detect such slow drifts by future measurements made with comparable accuracy. Such velocity variations may prove useful in identifying unseen companions at large orbital distances, i.e., over 10 AU. We found that 107 stars exhibited velocity variations of over 100 m $s^{-1}$ (RMS). For these stars, we have provided the RMS velocity, and also either an orbital solution or a description of the linear trends. We intend these measurements to provide dynamical constraints on the nature of the companions.

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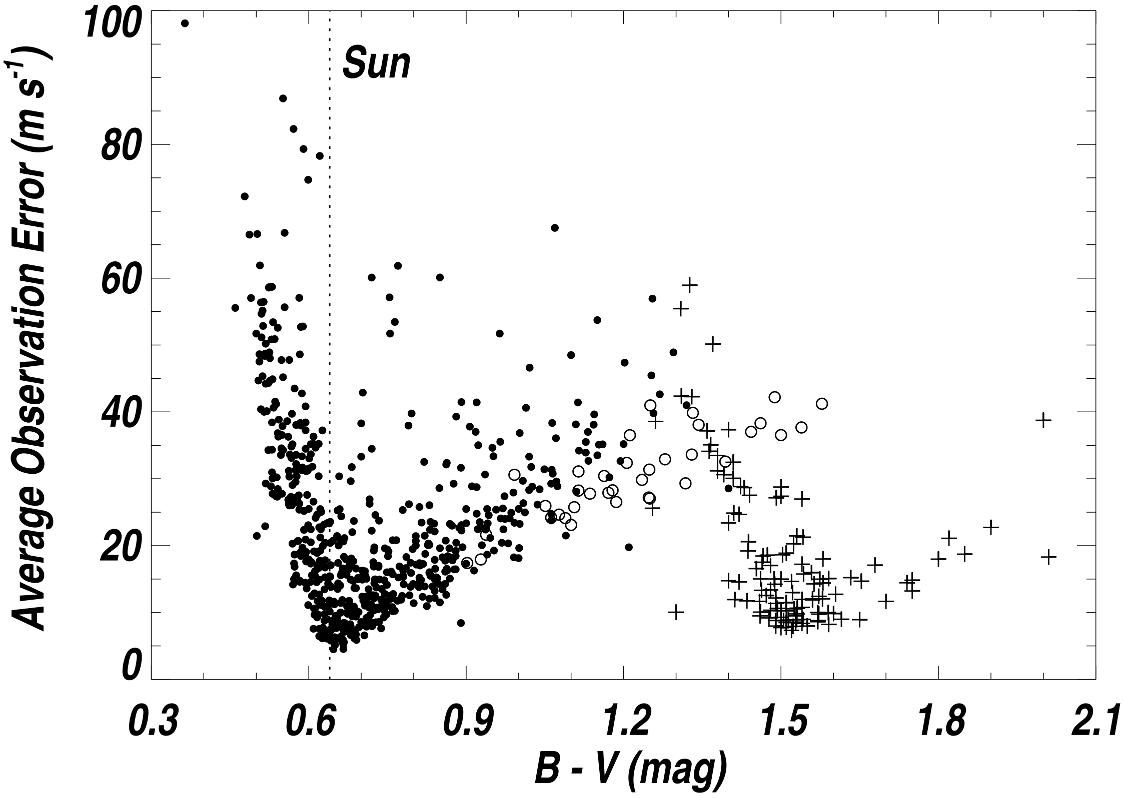


Fig. 1.— The internal velocity error per observation (averaged per star) vs. $B-V$. The dots represent the stars for which the NSO solar spectrum was used as the reference (filled dots represent dwarfs and open dots represent giants) and the plusses represent the stars for which the M star composite spectrum was used as the reference. The $B-V$ for the Sun ($B-V = 0.64$) is shown for clarity. The spectral type dependence of errors is apparent.

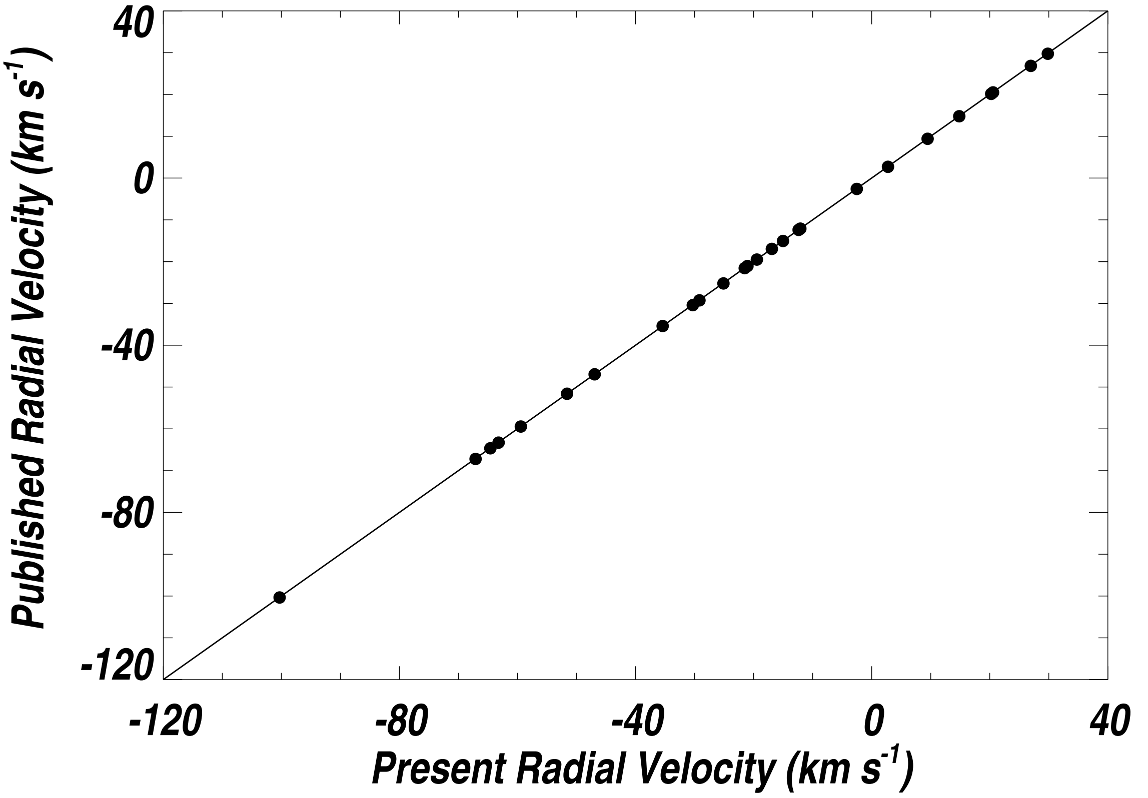


Fig. 2.— Velocities of standard stars vs. velocities measured here, for F, G, and K stars. The standard stars are on the CORAVEL scale (Udry et al. 1999a). The present velocities agree well with the standards, with no visible nonlinear departure of velocity scale.

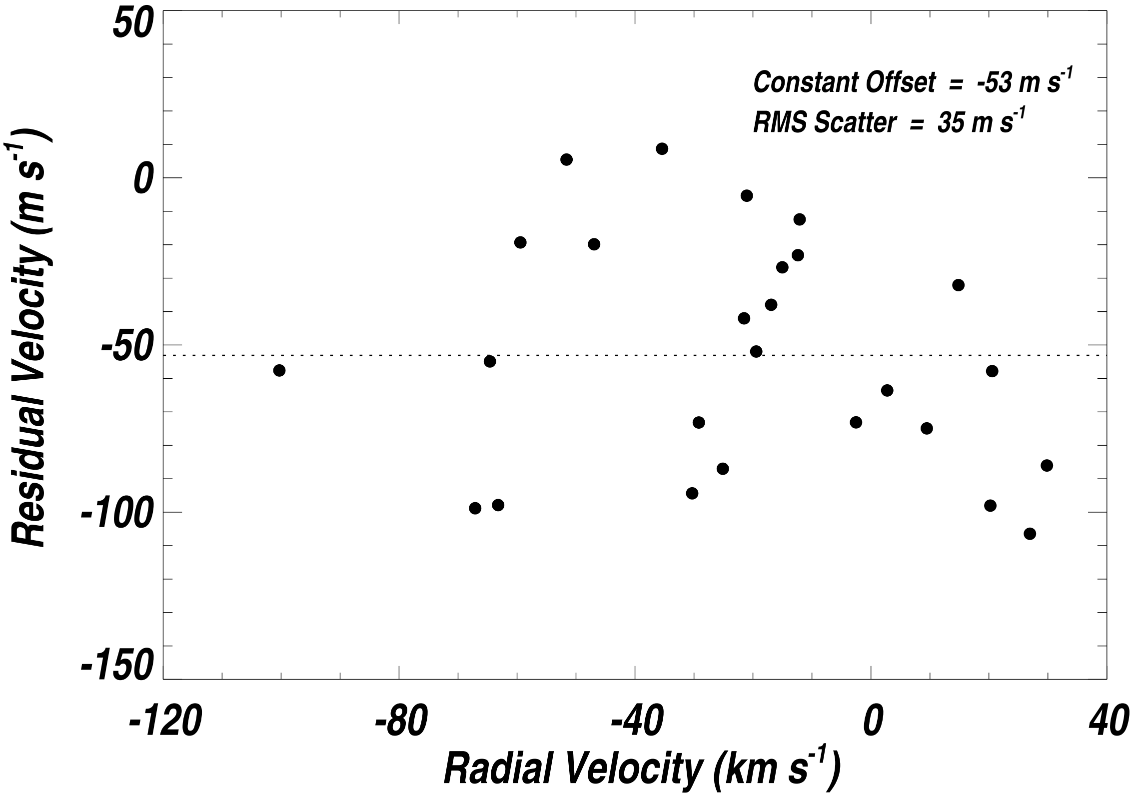


Fig. 3.— Standard–star velocities (Udry et al. 1999a) minus present velocities for all 26 FGK stars in common (as in Figure 2). The differences reveal that the present velocities are higher than those of Udry et al. by 53 m $s^{-1}$, and exhibit an rms scatter of 35 m $s^{-1}$. Thus the present velocities and those of Udry et al. (1999a) each have internal accuracy better than 35 m $s^{-1}$, and differ in zero–point by $\sim$53 m $s^{-1}$.

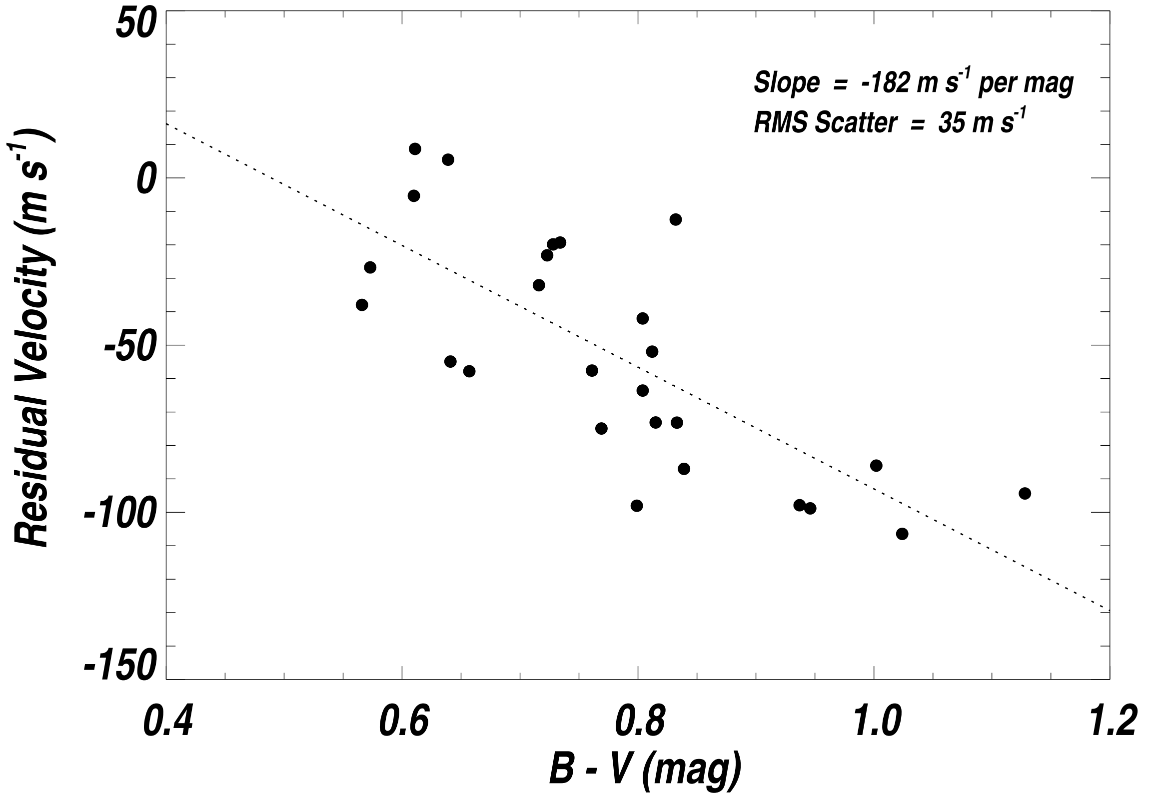


Fig. 4.— Standard–star velocities (Udry et al. 1999a) minus the present velocities as a function of $B-V$. A dependence is apparent, suggesting systematic errors in at least one set of velocities. The slope is $-182 \pm 24$ m s$^{-1}$ per mag. The RMS scatter is 35 m s$^{-1}$ before fitting and 23 m s$^{-1}$ after fitting a line to the data.

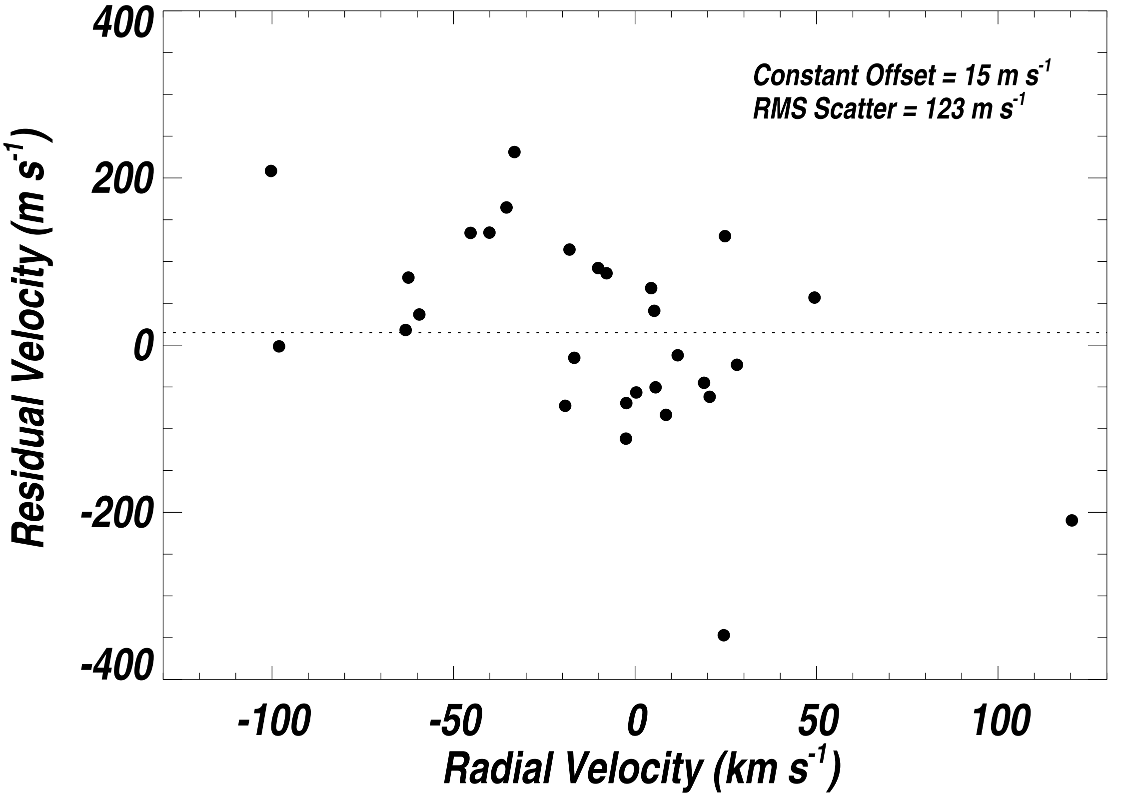


Fig. 5.— Standard–star velocities (Stefanik et al. 1999) minus present velocities for all 29 FGK stars in common. The differences reveal that the present velocities are lower than those of Stefanik et al. by 15 m $s^{-1}$, and exhibit an rms scatter of 123 m $s^{-1}$. Thus the present velocities and those of Stefanik et al. (1999) differ in zero–point by $\sim$15 m $s^{-1}$.

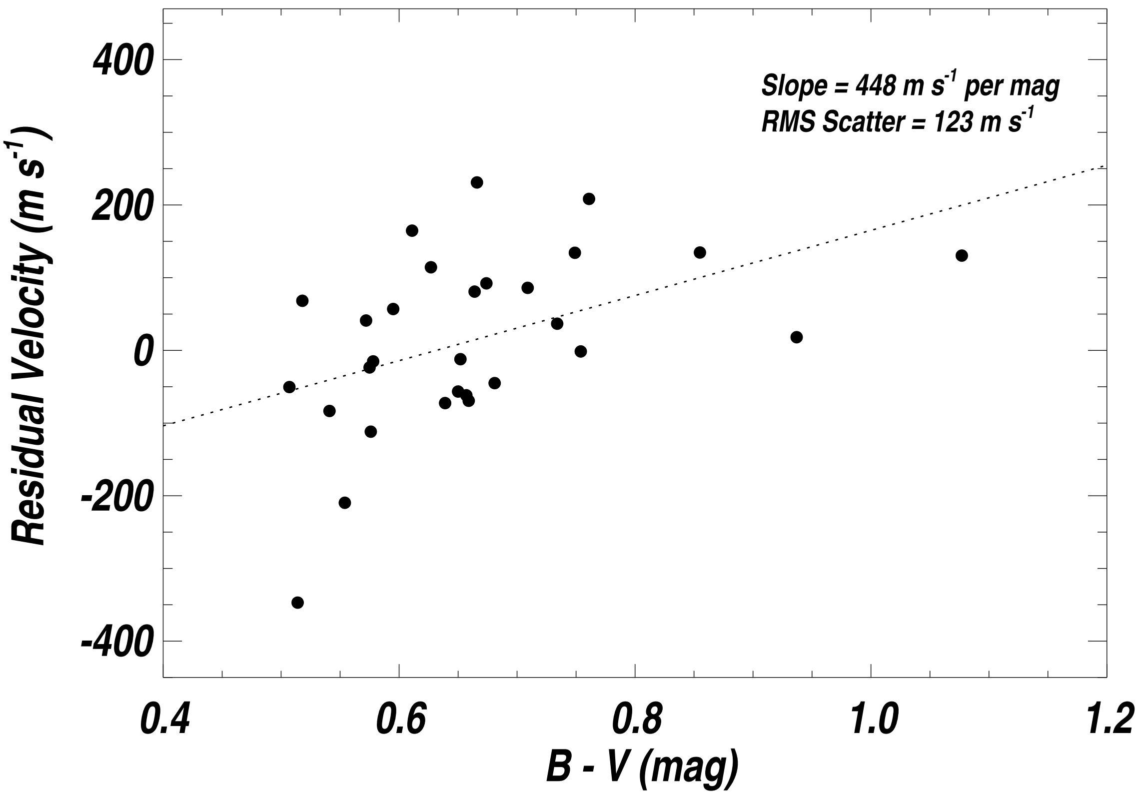


Fig. 6.— Standard–star velocities (Stefanik et al. 1999) minus the present velocities as a function of $B-V$. A dependence is apparent, suggesting systematic errors in at least one set of velocities. The slope is $+448 \pm 111$ m s$^{-1}$ per mag. The RMS scatter is 123 m s$^{-1}$ before fitting and 109 m s$^{-1}$ after fitting a line to the data.

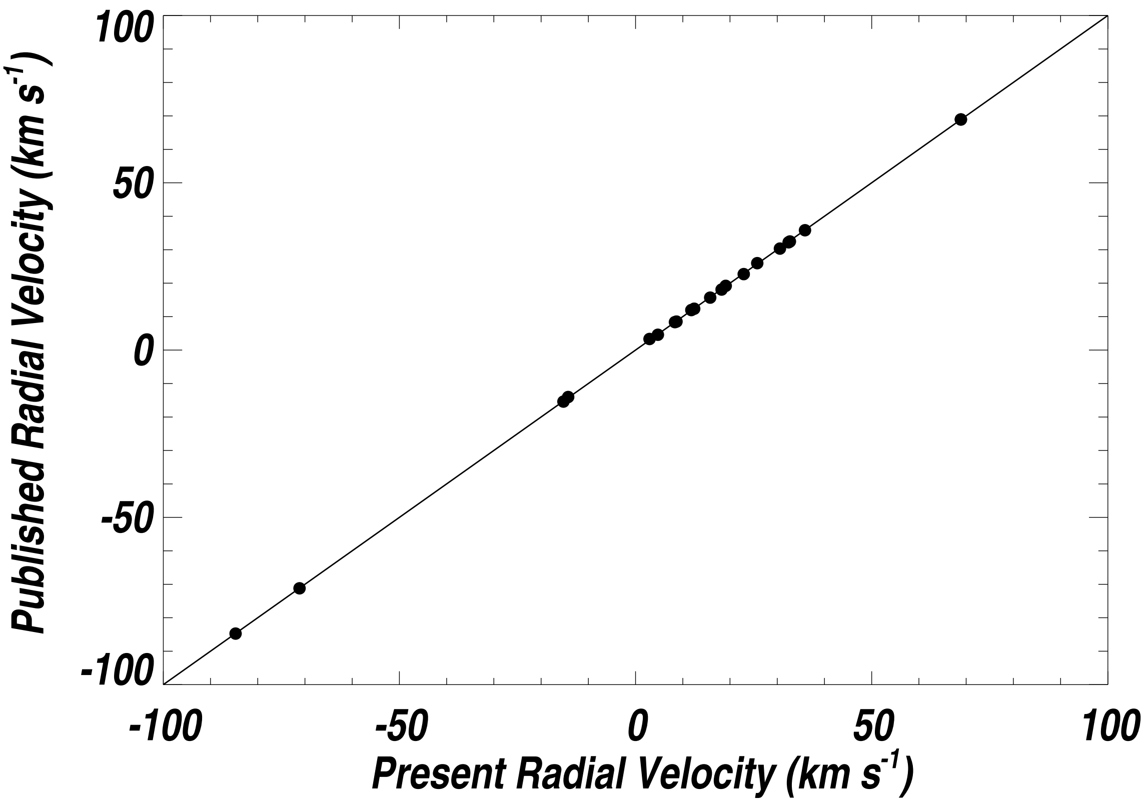


Fig. 7.— Velocities of standard stars (Marcy et al. 1987) vs. present velocities for M dwarfs. The velocities agree well with no apparent nonlinear dependence.

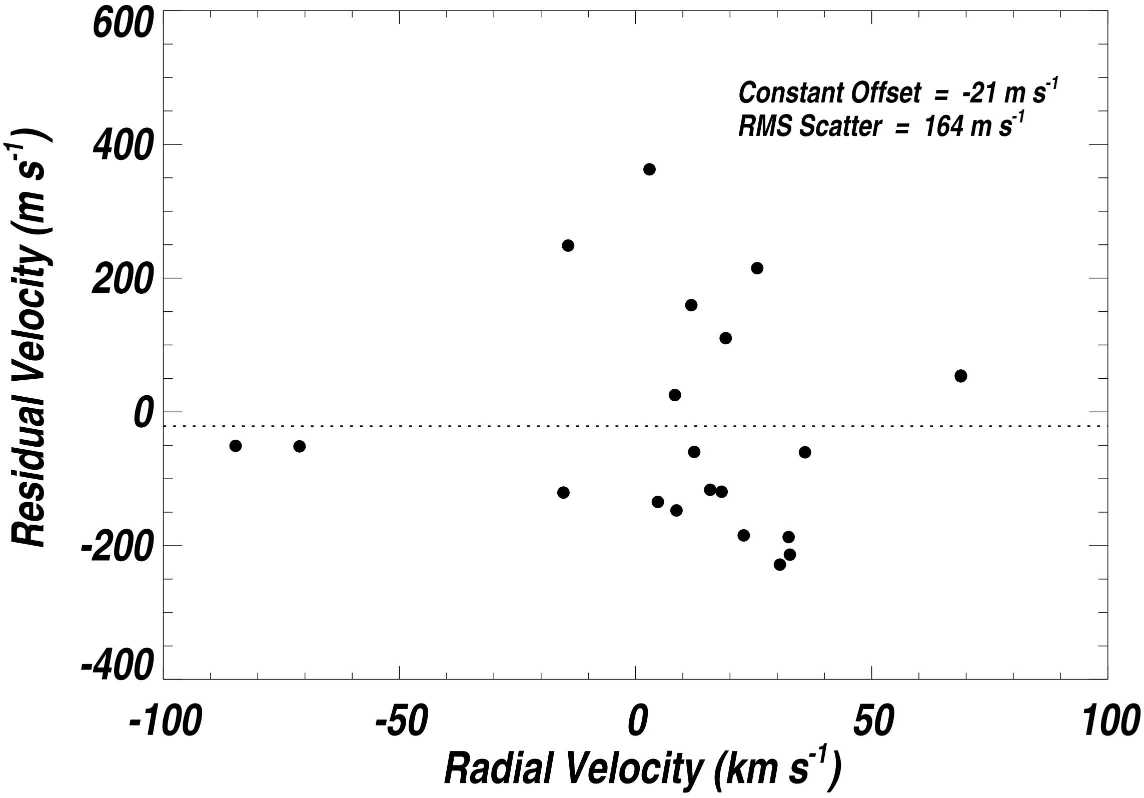


Fig. 8.— Difference between standard stars velocities (Marcy et al. 1987) and present velocities for all 21 M stars in common (as in Figure 7). There is an rms scatter of 164 m s$^{-1}$, and a constant offset of -21 m s$^{-1}$ which is not statistically significant. Thus our velocities for the stars having $B-V>$ 1.3 reside on the velocity scale set by Marcy et al. (1987). No $B-V$ dependence is seen in the residuals.

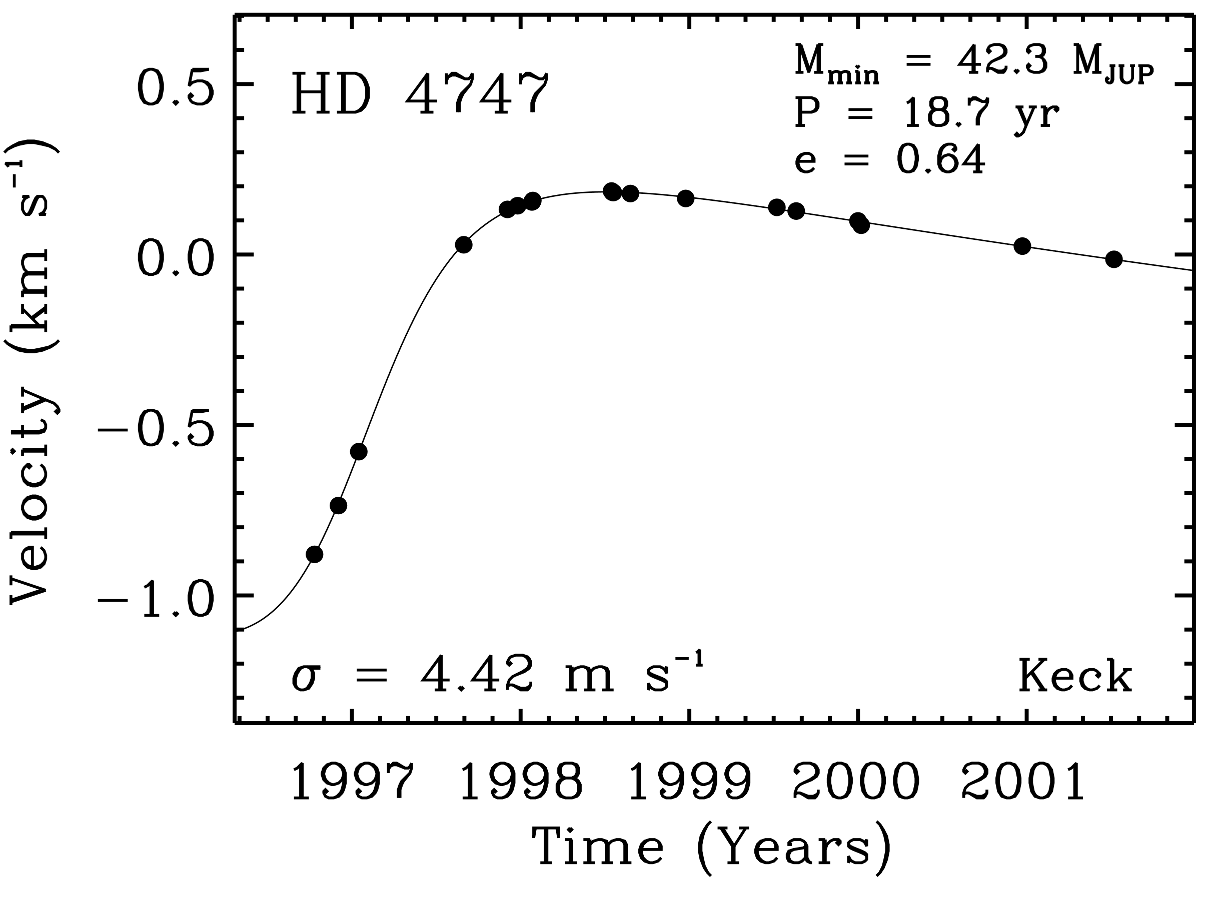


Fig. 9.— Doppler velocities for HD 4747 (G8/K0 V). The solid line is a Keplerian orbital fit with a period of 18.7 yr, a semiamplitude of 0.65 km $s^{-1}$, and an eccentricity of 0.64, yielding a minimum ($M_{\rm min}$) of 42.3 $M_{\rm JUP}$ for the companion. The RMS of the Keplerian fit is 4.42 m $s^{-1}$.

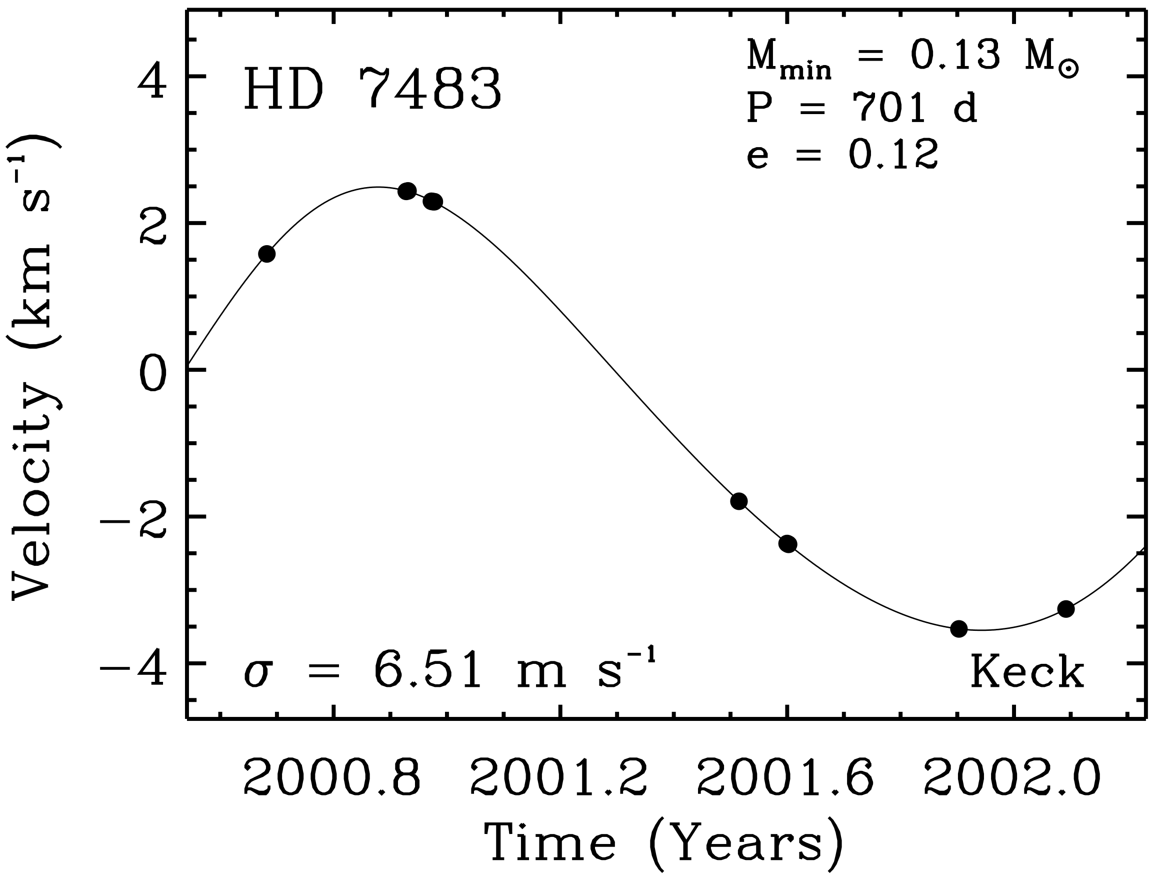


Fig. 10.— Doppler velocities for HD 7483 (G5 V). The solid line is a Keplerian orbital fit with a period of 701 d, a semiamplitude of 3.02 km s$^{-1}$, and an eccentricity of 0.12, yielding a minimum ($M_{\rm min}$) of 0.13 M$_{\odot}$ for the companion. The RMS of the Keplerian fit is 6.51 m s$^{-1}$.

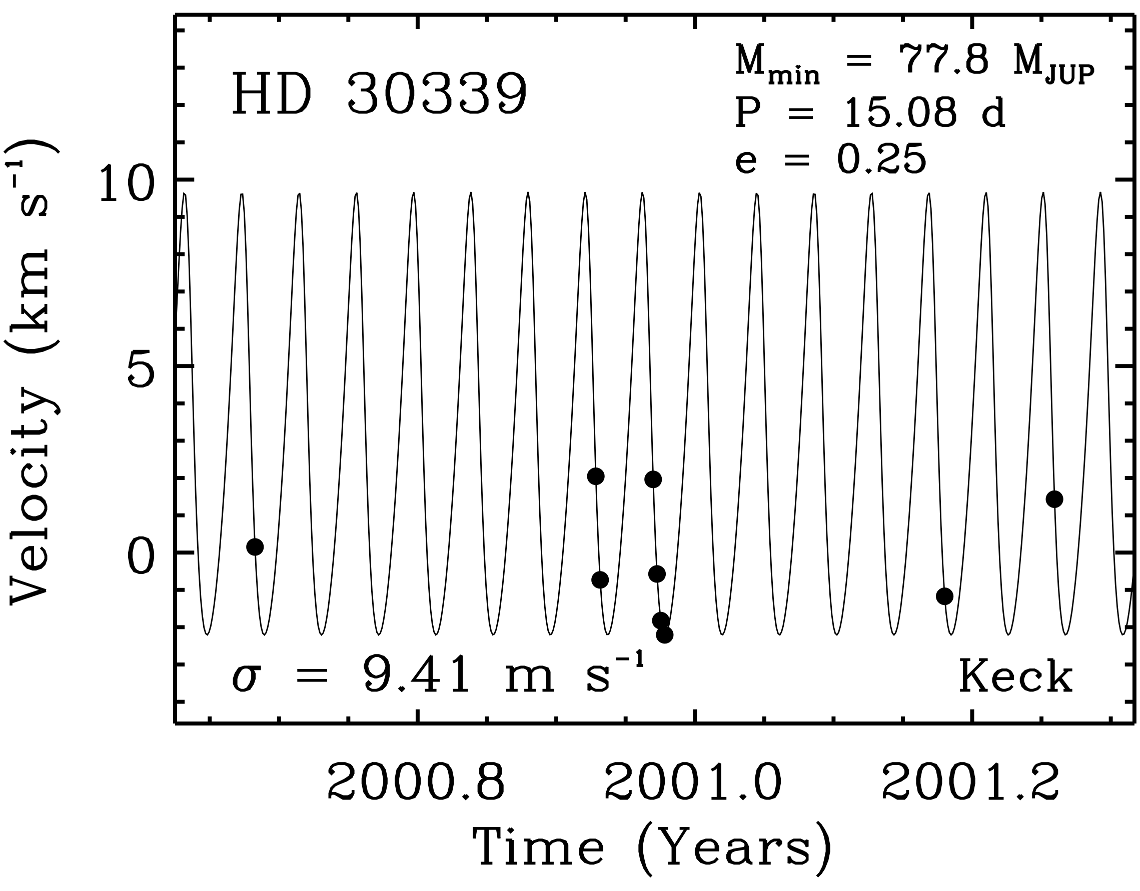


Fig. 11.— Doppler velocities for HD 30339 (F8 V). The solid line is a Keplerian orbital fit with a period of 15.08 d, a semiamplitude of 5.94 km s$^{-1}$, and an eccentricity of 0.25, yielding a minimum ($M_{\rm min}$) of 77.8 $\rm M_{JUP}$ for the companion. The RMS of the Keplerian fit is 9.41 m s$^{-1}$.

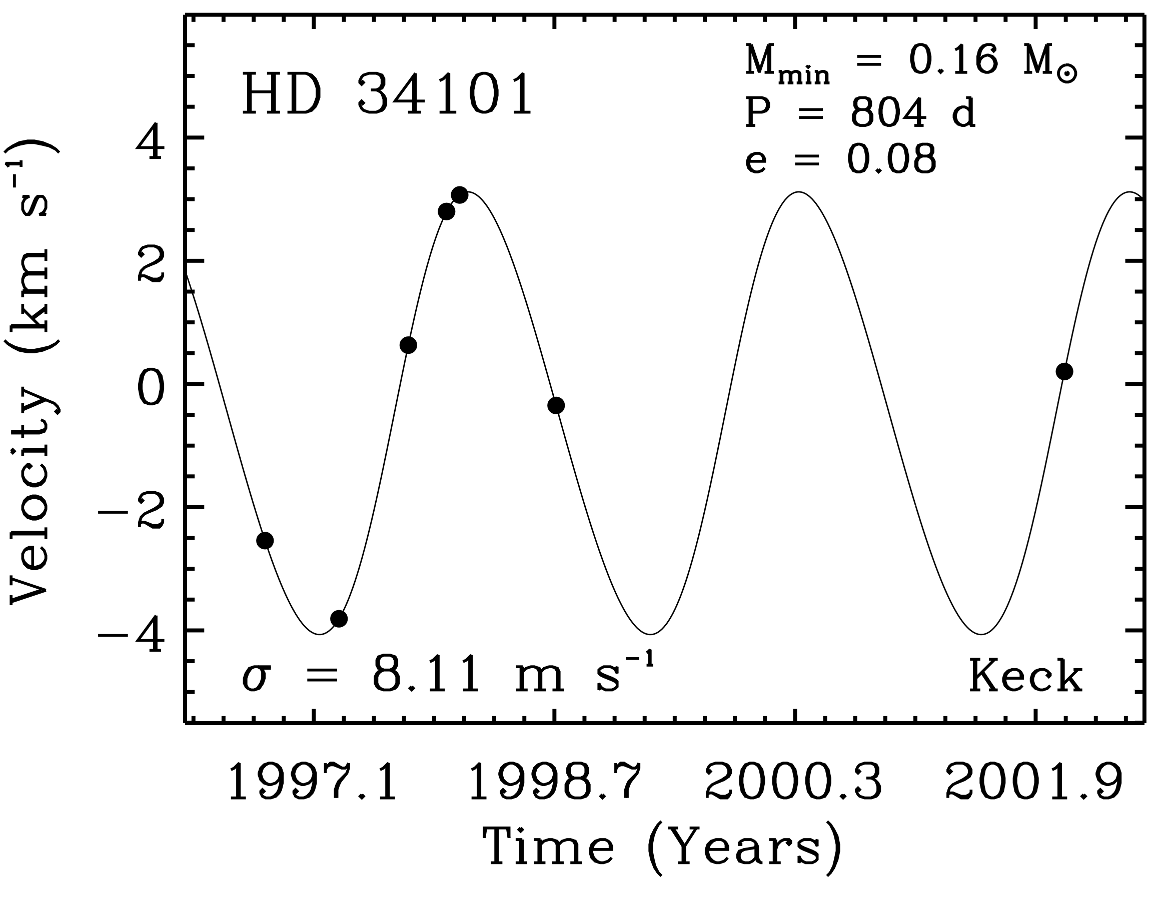


Fig. 12.— Doppler velocities for HD 34101 (G8 V). The solid line is a Keplerian orbital fit with a period of 804 d, a semiamplitude of 3.76 km s$^{-1}$, and an eccentricity of 0.08, yielding a minimum ($M_{\rm min}$) of 0.16 M$_\odot$ for the companion. The RMS of the Keplerian fit is 8.11 m s$^{-1}$.

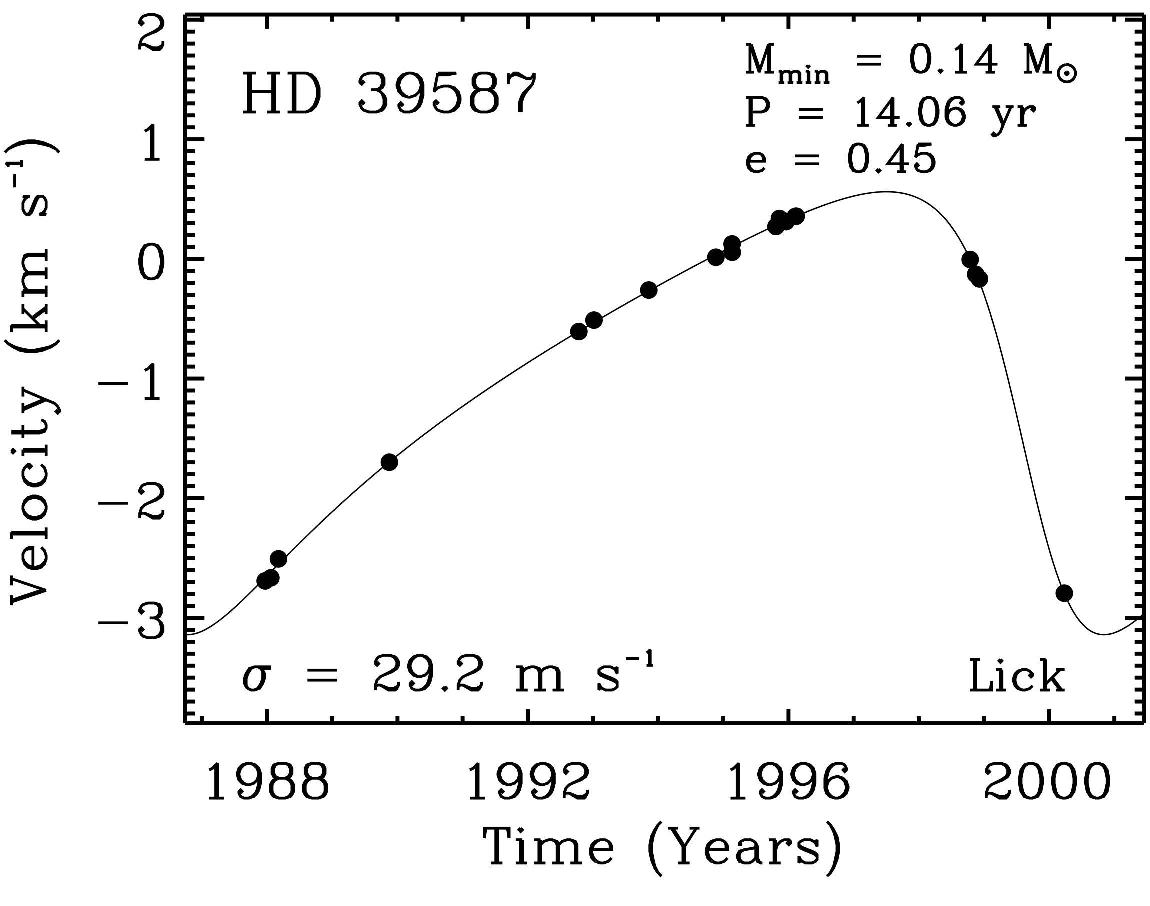


Fig. 13.— Doppler velocities for HD 39587 (G0 V). The solid line is a Keplerian orbital fit with a period of 14.06 yr, a semiamplitude of 1.85 km $s^{-1}$, and an eccentricity of 0.45, yielding a minimum ($M_{\rm min}$) of 0.14 $M_\odot$ for the companion. The RMS of the Keplerian fit is 29.2 m $s^{-1}$.

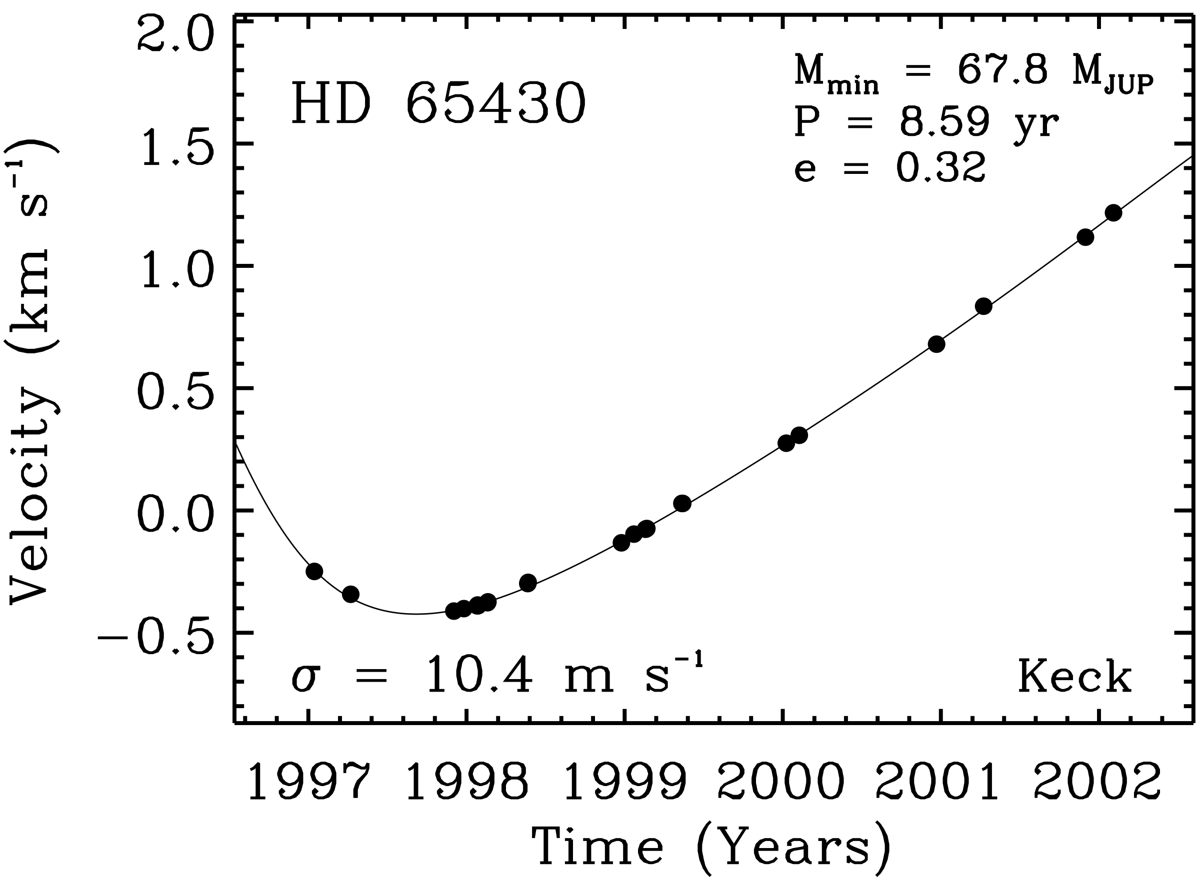


Fig. 14.— Doppler velocities for HD 65430 (K0 V). The solid line is a Keplerian orbital fit with a period of 8.59 yr, a semiamplitude of 1.11 km s$^{-1}$, and an eccentricity of 0.32, yielding a minimum ($M_{\rm min}$) of 67.8 M$_{\rm JUP}$ for the companion. The RMS of the Keplerian fit is 10.4 m s$^{-1}$.

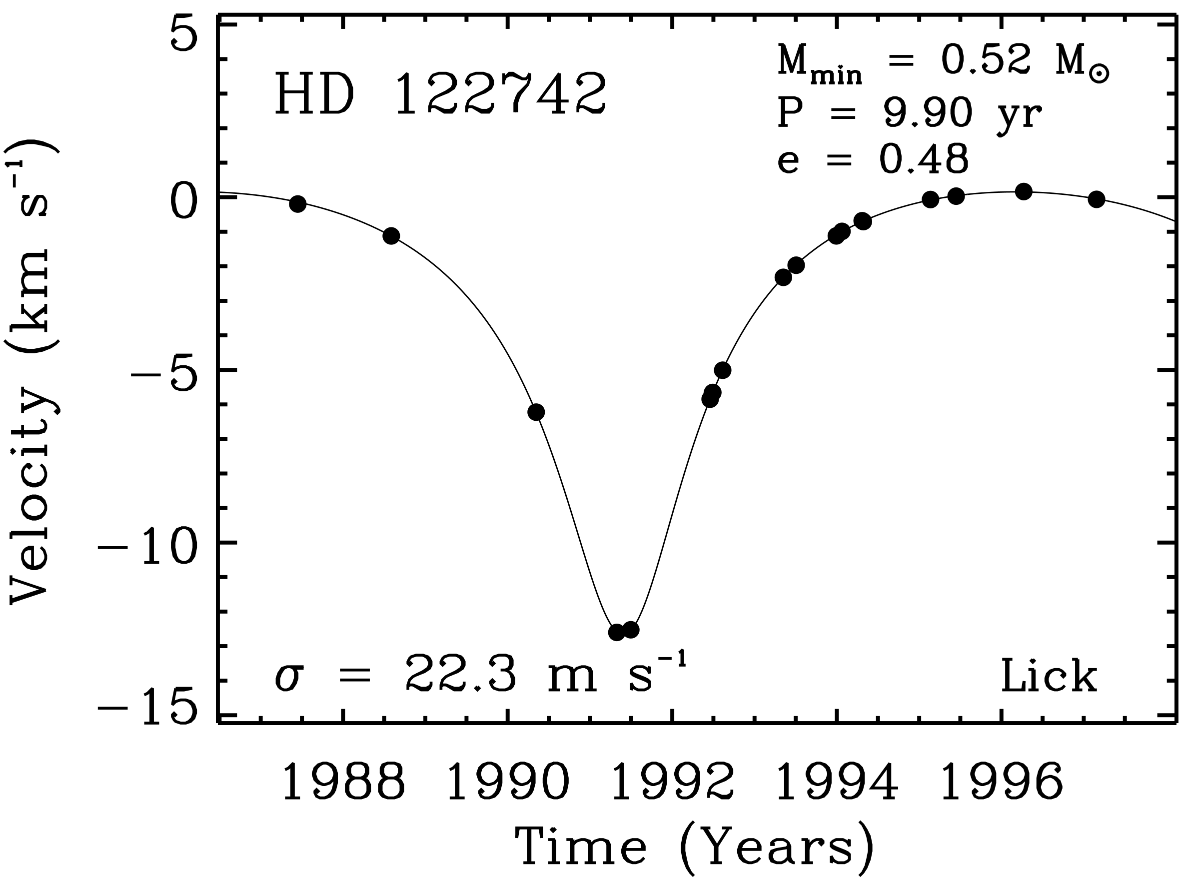


Fig. 15.— Doppler velocities for HD 122742 (G8 V). The solid line is a Keplerian orbital fit with a period of 9.90 yr, a semiamplitude of 6.41 km s$^{-1}$, and an eccentricity of 0.48, yielding a minimum ($M_{\rm min}$) of 0.52 M$_\odot$ for the companion. The RMS of the Keplerian fit is 22.3 m s$^{-1}$.

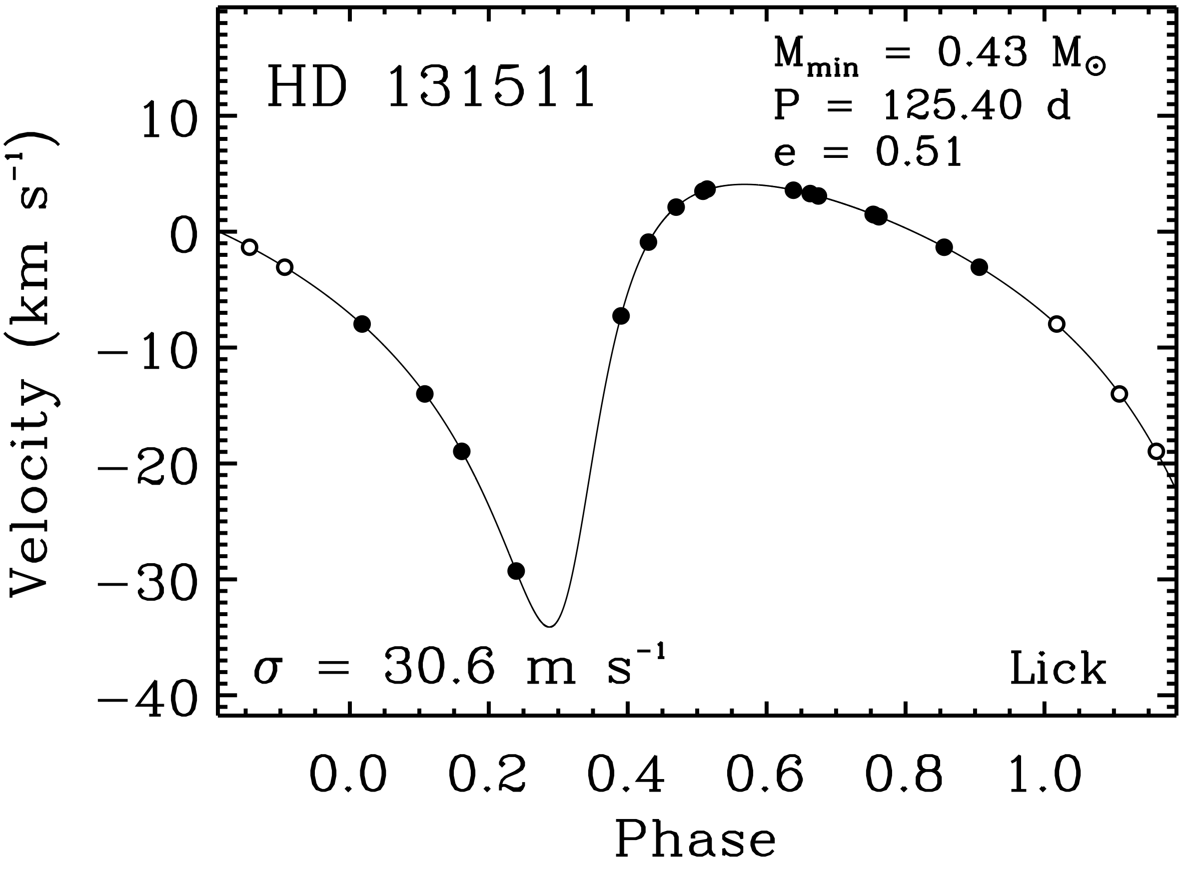


Fig. 16.— Doppler velocities for HD 131511 (K2 V). The solid line is a Keplerian orbital fit with a period of 125.40 d, a semiamplitude of 19.10 km s$^{-1}$, and an eccentricity of 0.51, yielding a minimum ($M_{\rm min}$) of 0.43 M$_\odot$ for the companion. The RMS of the Keplerian fit is 30.6 m s$^{-1}$.

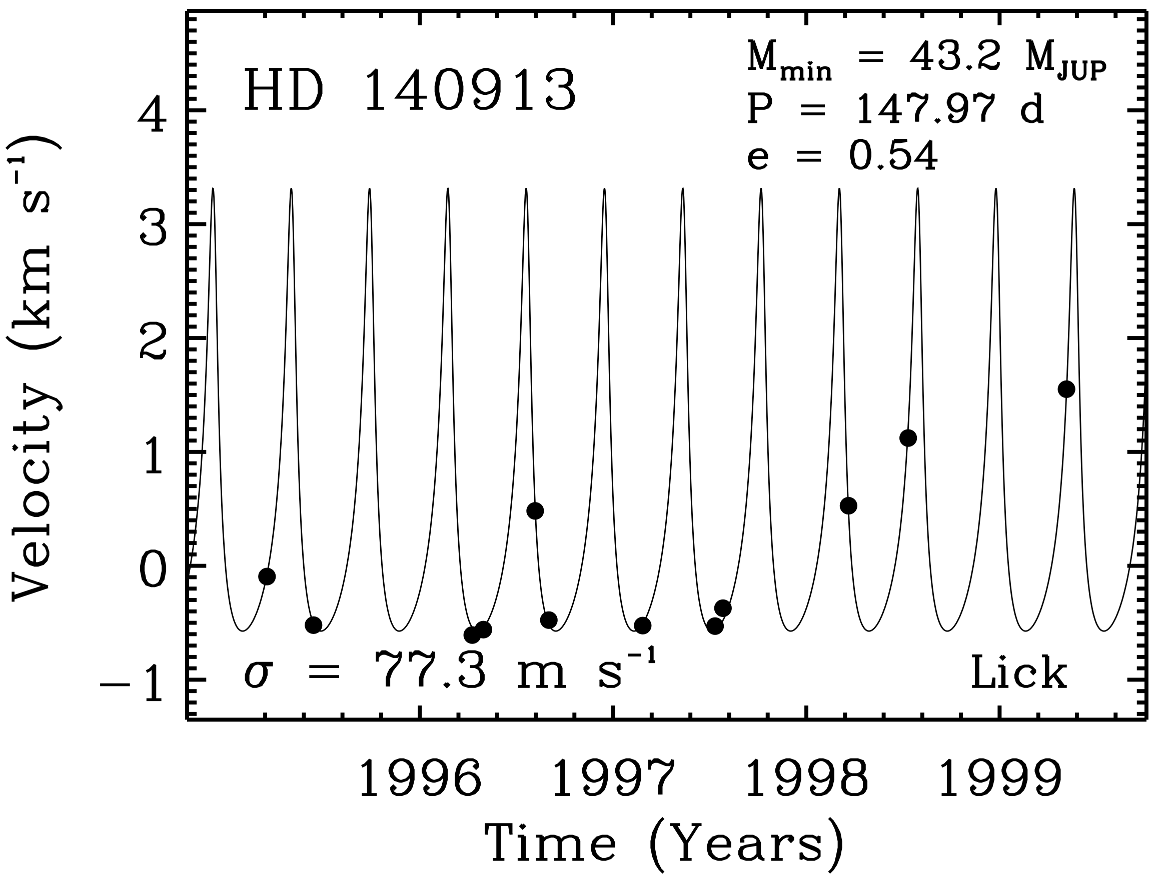


Fig. 17.— Doppler velocities for HD 140913 (G0 V). The solid line is a Keplerian orbital fit with a period of 147.97 d, a semiamplitude of 1.94 km s$^{-1}$, yielding a minimum ($M_{\rm min}$) of 43.2 $M_{\rm JUP}$ for the companion. The eccentricity was fixed to $e = 0.54$ given by Latham et al. (1989) since not enough points were available to constrain the eccentricity. The RMS of the Keplerian fit is 77.3 m s$^{-1}$.

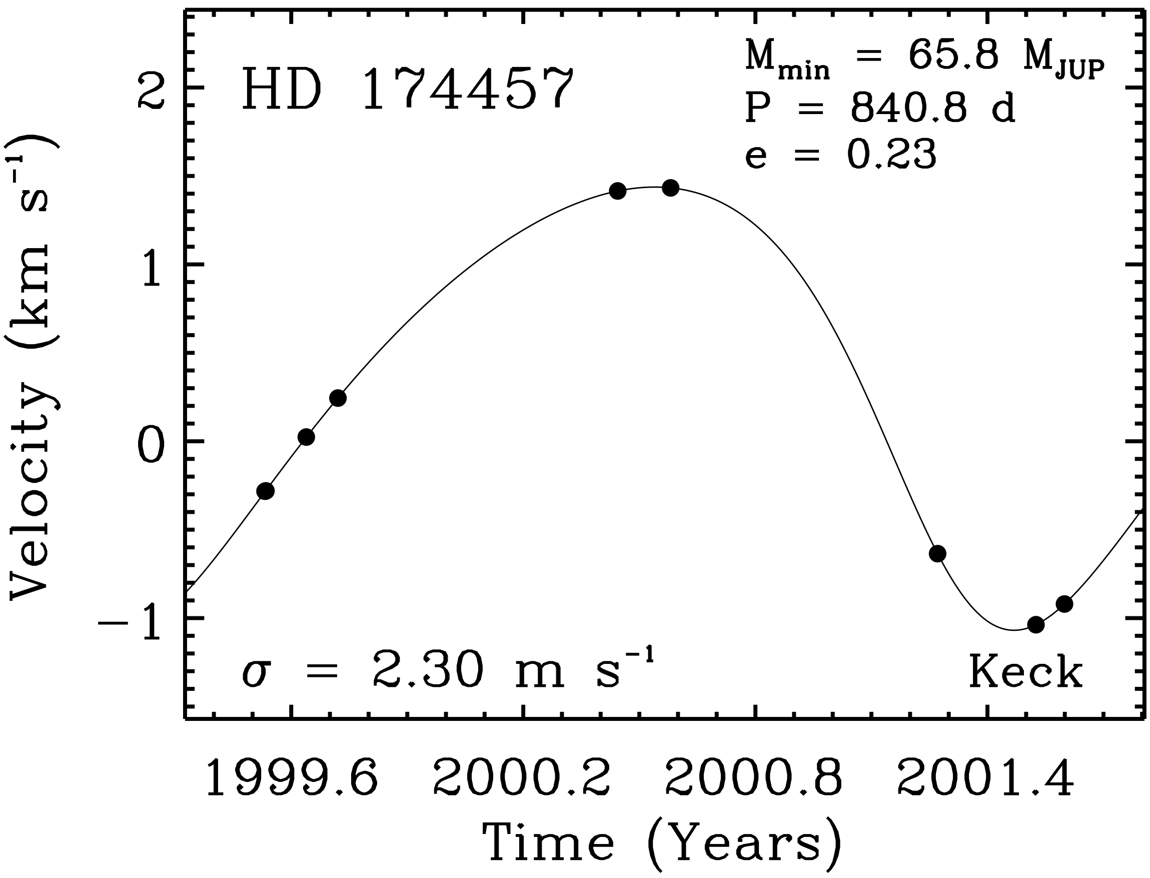


Fig. 18.— Doppler velocities for HD 174457 (F8 V). The solid line is a Keplerian orbital fit with a period of 840.8 d, a semiamplitude of 1.25 km s$^{-1}$, and an eccentricity of 0.23, yielding a minimum ($M_{\rm min}$) of 65.8 $\rm M_{JUP}$ for the companion. The RMS of the Keplerian fit is 2.30 m s$^{-1}$.

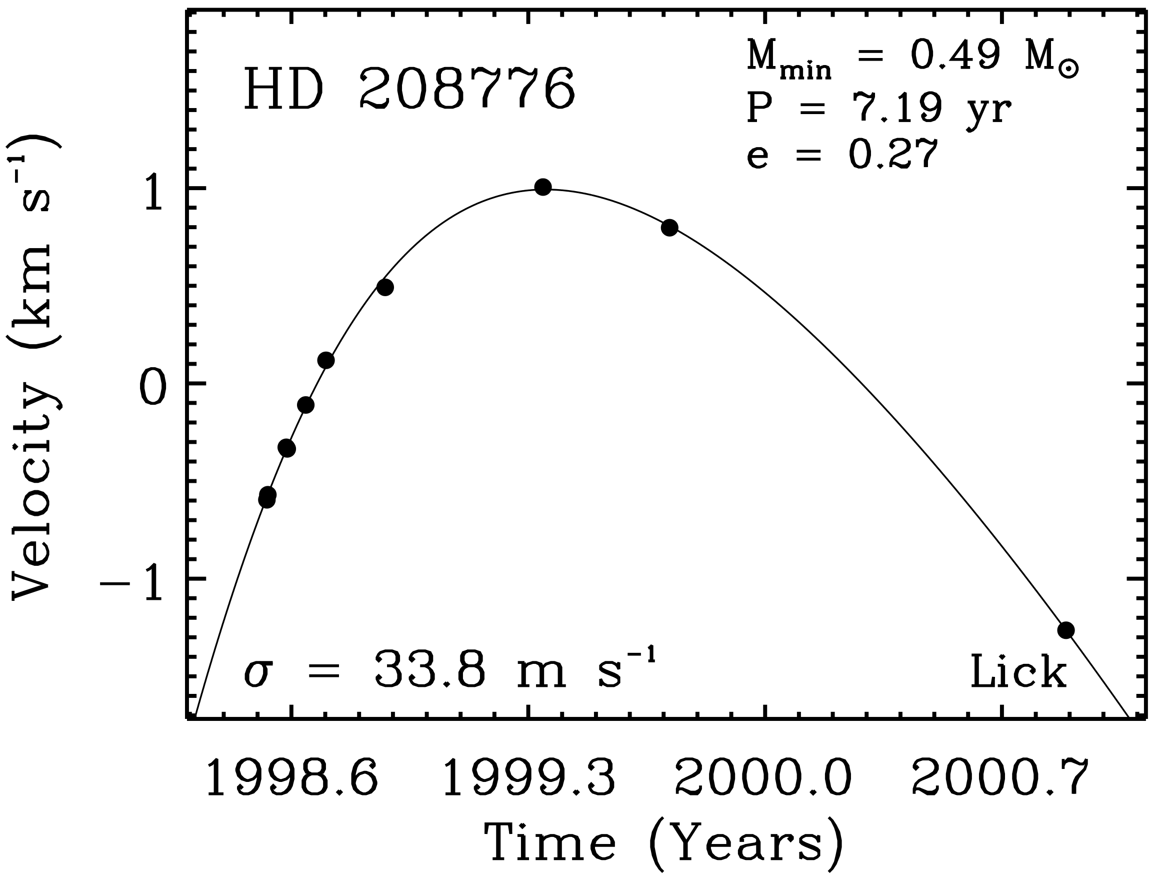


Fig. 19.— Doppler velocities for HD 208776 (G0 V). The solid line is a Keplerian orbital fit with a period of 7.19 yr, a semiamplitude of 5.46 km s$^{-1}$, and an eccentricity of 0.27, yielding a minimum ($M_{\rm min}$) of 0.49 M$_\odot$ for the companion. The RMS of the Keplerian fit is 33.8 m s$^{-1}$.

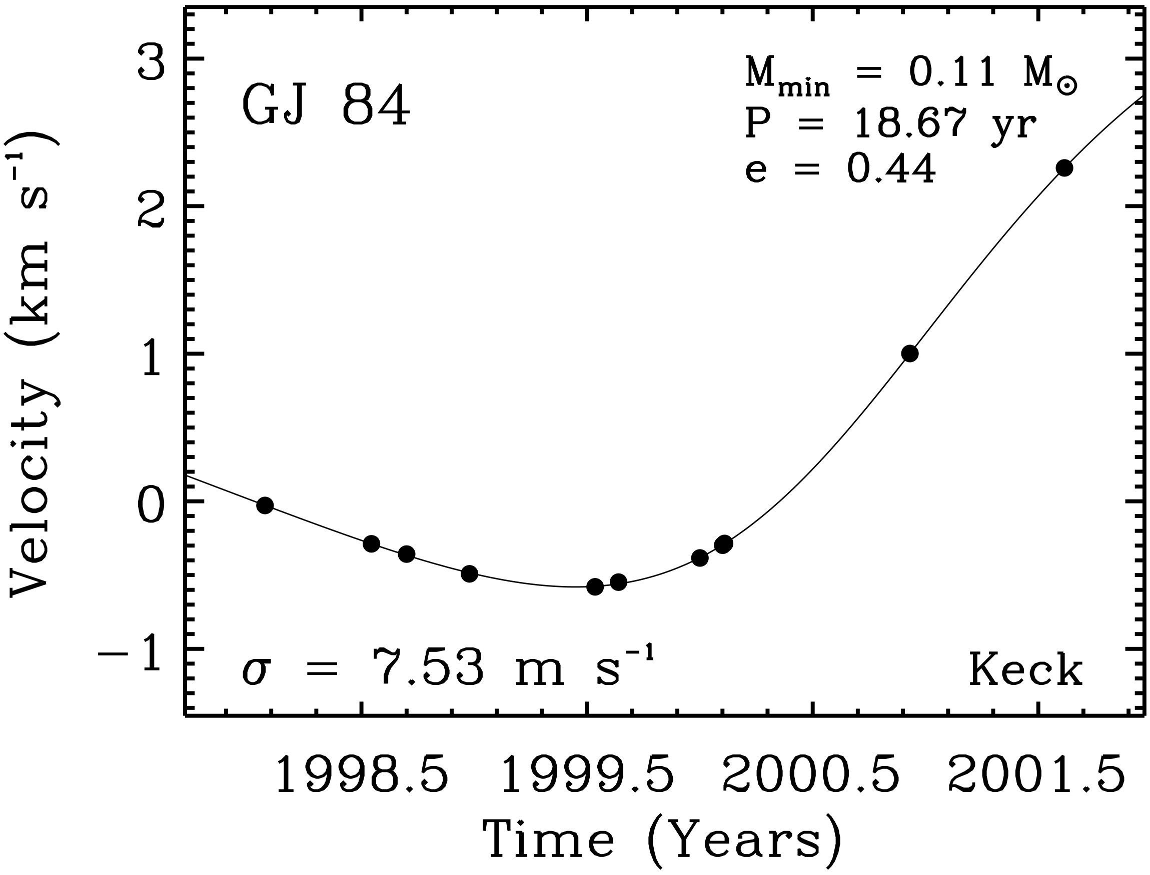


Fig. 20.— Doppler velocities for GJ 84 (M3 V). The solid line is a Keplerian orbital fit with a period of 18.67 yr, a semiamplitude of 2.18 km s$^{-1}$, and an eccentricity of 0.44, yielding a minimum ($M_{\rm min}$) of 0.11 M$_\odot$ for the companion. The RMS of the Keplerian fit is 7.53 m s$^{-1}$.

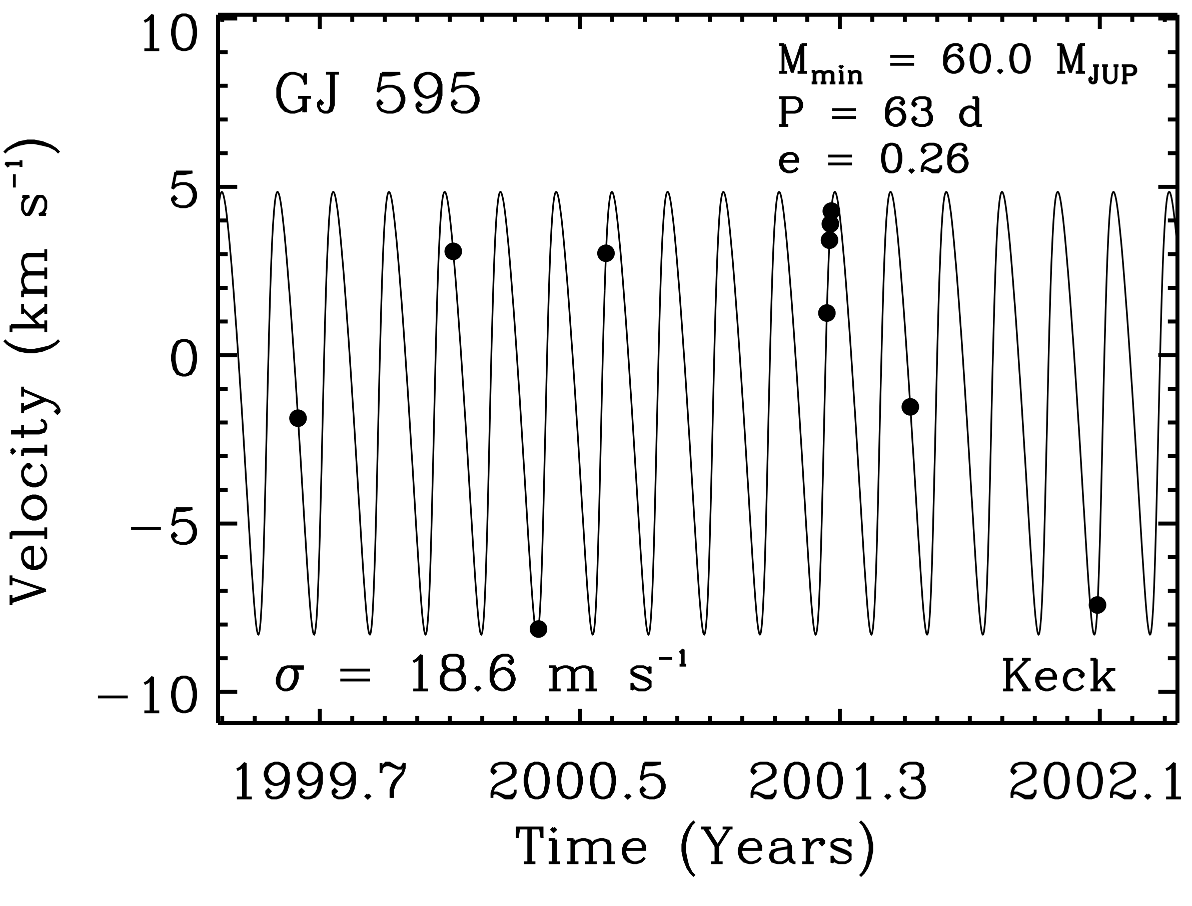


Fig. 21.— Doppler velocities for GJ 595 (M3 V). The solid line is a Keplerian orbital fit with a period of 63 d, a semiamplitude of 6.57 km $s^{-1}$, and an eccentricity of 0.26, yielding a minimum ($M_{\rm min}$) of 60.0 $M_{\rm JUP}$ for the companion. The RMS of the Keplerian fit is 18.6 m $s^{-1}$.

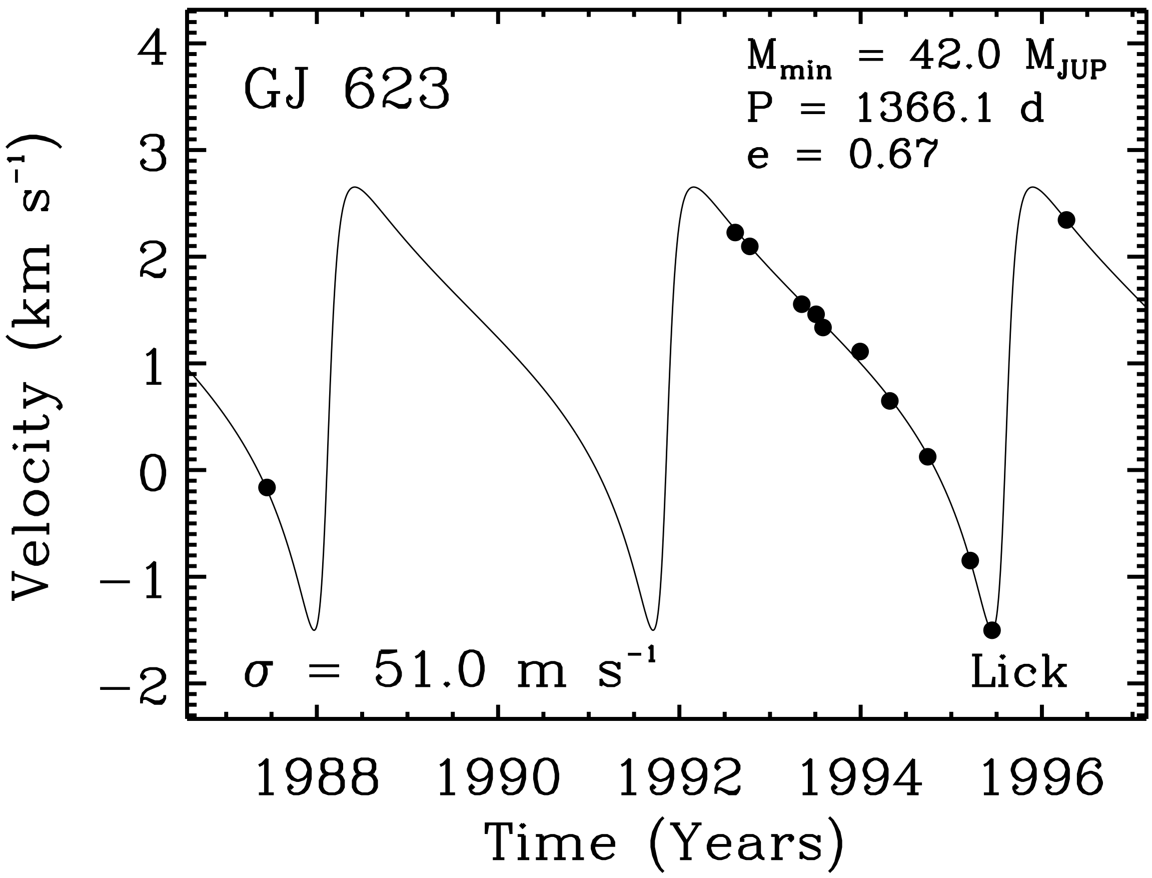


Fig. 22.— Doppler velocities for GJ 623 (M3 V). The solid line is a Keplerian orbital fit with a period of 1366.1 d, a semiamplitude of 2.08 km $s^{-1}$, and an eccentricity of 0.67, yielding a minimum ($M_{\rm min}$) of 42.0 $M_{\rm JUP}$ for the companion. The RMS of the Keplerian fit is 51.0 m $s^{-1}$.

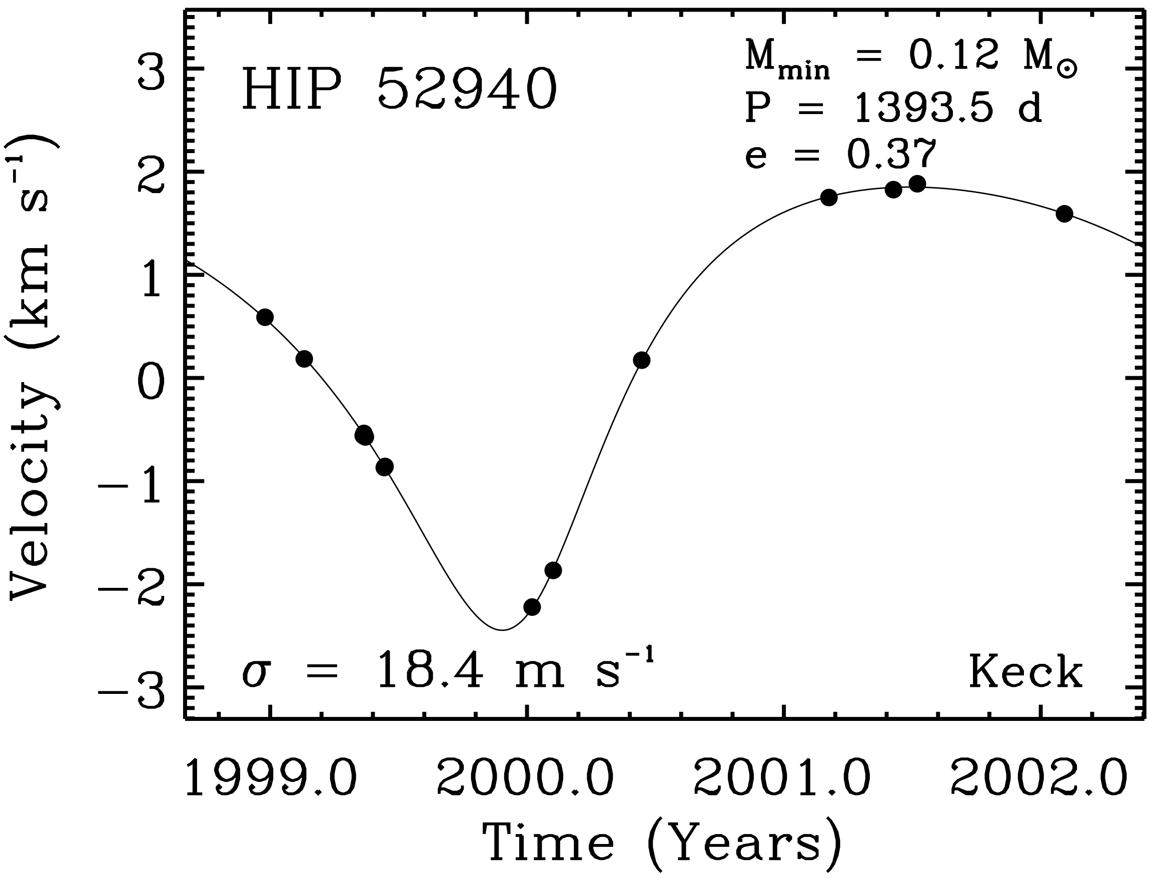


Fig. 23.— Doppler velocities for HIP 52940 (F8 V). The solid line is a Keplerian orbital fit with a period of 1393.5 d, a semiamplitude of 2.15 km s$^{-1}$, and an eccentricity of 0.37, yielding a minimum ($M_{\rm min}$) of 0.12 M$_\odot$ for the companion. The RMS of the Keplerian fit is 18.4 m s$^{-1}$.

Table 1. Radial Velocities of Stable Stars [a]

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 166 | HIP 544 | NSO | 8,783 | 2,662 | −6,537 |
| HD 283 | HIP 616 | NSO | 11,002 | 1,185 | −43,102 |
| HD 377 | HIP 682 | NSO | 11,417 | 208 | 1,184 |
| HD 400 | HIP 699 | NSO | 11,137 | 507 | −15,141 |
| HD 531 | BD +07 9 | NSO | 11,419 | 208 | 13,460 |
| HD 1326A | GJ 15A | M | 9,928 | 4,656 | 11,814 |
| HD 1326B | GJ 15B | M | 11,294 | 509 | 10,976 |
| HD 1388 | HIP 1444 | NSO | 11,016 | 1,338 | 28,498 |
| HD 1461 | HIP 1499 | NSO | 11,083 | 1,184 | −10,166 |
| HD 1832 | HIP 1813 | NSO | 11,250 | 950 | −30,550 |
| HD 1835 | HIP 1803 | NSO | 9,123 | 3,026 | −2,405 |
| HD 2025 | HIP 1936 | NSO | 11,218 | 1,389 | 3,241 |
| HD 2774 | HIP 2497 | NSO | 11,478 | 117 | −51,566 |
| HD 3074 | HIP 2663 | NSO | 10,955 | 1,390 | 29,539 |
| HD 3079 | HIP 2712 | NSO | 11,193 | 390 | −12,347 |
| HD 3651 | HIP 3093 | NSO | 9,708 | 4,708 | −32,961 |
| HD 3674 | HIP 3119 | NSO | 11,161 | 514 | 166 |
| HD 3765 | HIP 3206 | NSO | 11,151 | 1,294 | −63,202 |
| HD 3861 | HIP 3236 | NSO | 11,055 | 105 | −14,796 |
| HD 4203 | HIP 3502 | NSO | 12,020 | 431 | −14,140 |
| HD 4208 | HIP 3479 | NSO | 11,345 | 1,427 | 56,726 |
| HD 4256 | HIP 3535 | NSO | 11,069 | 1,177 | 9,460 |
| HD 4307 | HIP 3559 | NSO | 11,303 | 1,390 | −10,349 |
| HD 4614 | HIP 3821 | NSO | 9,380 | 4,080 | 8,314 |
| HD 4614B | GJ 34B | M | 10,036 | 1,860 | 11,293 |
| HD 4628 | HIP 3765 | NSO | 9,262 | 3,747 | −10,230 |
| HD 4915 | HIP 3979 | NSO | 11,348 | 291 | −3,742 |
| HD 5065 | HIP 4127 | NSO | 11,336 | 510 | −73,844 |
| HD 5133 | HIP 4148 | NSO | 11,470 | 96 | −13,067 |
| HD 5372 | HIP 4393 | NSO | 11,325 | 950 | 596 |
| HD 6101 | HIP 4849 | NSO | 11,041 | 58 | 22,170 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 6611 | HIP 5276 | NSO | 11,027 | 0 | −6,068 |
| HD 6734 | HIP 5315 | NSO | 11,130 | 1,426 | −94,511 |
| HD 7047 | HIP 5534 | NSO | 11,128 | 418 | 9,264 |
| HD 7228 | HIP 5682 | NSO | 11,450 | 509 | −20,538 |
| HD 7590 | HIP 5944 | NSO | 11,425 | 27 | −13,073 |
| HD 7727 | HIP 5985 | NSO | 11,262 | 514 | 5,898 |
| HD 8262 | HIP 6405 | NSO | 11,290 | 507 | 5,636 |
| HD 8389 | HIP 6456 | NSO | 10,869 | 1,177 | 34,647 |
| HD 8574 | HIP 6643 | NSO | 11,328 | 1,161 | 18,886 |
| HD 8648 | HIP 6653 | NSO | 11,441 | 987 | 923 |
| HD 8763 | HIP 6732 | NSO | 11,487 | 117 | −42,532 |
| HD 8941 | HIP 6869 | NSO | 11,171 | 419 | 9,132 |
| HD 9224 | HIP 7090 | NSO | 11,174 | 507 | 14,937 |
| HD 9280 | HIP 7080 | NSO | 11,172 | 3 | 41,861 |
| HD 9331 | HIP 7221 | NSO | 11,933 | 246 | −20,086 |
| HD 9407 | HIP 7339 | NSO | 11,248 | 538 | −33,291 |
| HD 9562 | HIP 7276 | NSO | 11,071 | 1,390 | −14,989 |
| HD 9826 | HIP 7513 | NSO | 8,547 | 2,576 | −28,674 |
| HD 9986 | HIP 7585 | NSO | 11,276 | 987 | −21,047 |
| HD 10002 | HIP 7539 | NSO | 10,973 | 1,119 | 11,562 |
| HD 10086 | HIP 7734 | NSO | 11,297 | 514 | 2,143 |
| HD 10126 | HIP 7733 | NSO | 11,301 | 293 | 56,156 |
| HD 10145 | HIP 7902 | NSO | 11,098 | 1,121 | 17,838 |
| HD 10436 | HIP 8070 | NSO | 11,469 | 184 | −50,957 |
| HD 10476 | HIP 7981 | NSO | 10,921 | 1,387 | −33,647 |
| HD 10697 | HIP 8159 | NSO | 11,044 | 1,044 | −46,022 |
| HD 10700 | HIP 8102 | NSO | 9,838 | 5,053 | −16,619 |
| HD 10780 | HIP 8362 | NSO | 11,404 | 384 | 2,764 |
| HD 11020 | HIP 8346 | NSO | 10,999 | 1,081 | 22,786 |
| HD 11226 | HIP 8548 | NSO | 11,310 | 513 | 10,314 |
| HD 11505 | HIP 8798 | NSO | 11,279 | 420 | −16,470 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 11964 | HIP 9094 | NSO | 11,109 | 1,391 | −9,366 |
| HD 12051 | HIP 9269 | NSO | 11,097 | 1,125 | −35,102 |
| HD 12235 | HIP 9353 | NSO | 9,727 | 3,965 | −18,434 |
| HD 12414 | HIP 9473 | NSO | 10,997 | 301 | 15,898 |
| HD 12661 | HIP 9683 | NSO | 11,463 | 944 | −47,310 |
| HD 12846 | HIP 9829 | NSO | 11,435 | 595 | −4,662 |
| HD 13043 | HIP 9911 | NSO | 11,030 | 1,043 | −39,333 |
| HD 13507 | HIP 10321 | NSO | 11,141 | 397 | 6,172 |
| HD 13531 | HIP 10339 | NSO | 10,979 | 245 | 7,203 |
| HD 13579 | HIP 10531 | NSO | 11,339 | 293 | −12,723 |
| HD 13612B | HIP 10303 | NSO | 11,076 | 1,184 | −5,337 |
| HD 13825 | HIP 10505 | NSO | 11,270 | 432 | −2,237 |
| HD 13931 | HIP 10626 | NSO | 11,265 | 748 | 30,538 |
| HD 14412 | HIP 10798 | NSO | 11,006 | 1,391 | 7,383 |
| HD 15176 | HIP 11432 | NSO | 11,494 | 145 | −41,783 |
| HD 15335 | HIP 11548 | NSO | 11,031 | 1,219 | 41,202 |
| HD 16141 | HIP 12048 | NSO | 11,067 | 1,008 | −50,971 |
| HD 16160 | HIP 12114 | NSO | 9,351 | 3,608 | 25,766 |
| HD 16397 | HIP 12306 | NSO | 11,060 | 1,082 | −99,660 |
| HD 16623 | HIP 12364 | NSO | 11,088 | 829 | 17,502 |
| HD 16895 | HIP 12777 | NSO | 8,930 | 2,937 | 24,453 |
| HD 17190 | HIP 12926 | NSO | 11,146 | 1,186 | 14,138 |
| HD 17230 | HIP 12929 | NSO | 11,443 | 386 | 11,061 |
| HD 17332 | HIP 13027 | NSO | 11,481 | 140 | 4,427 |
| HD 17660 | HIP 13258 | NSO | 11,396 | 324 | −28,904 |
| HD 17925 | HIP 13402 | NSO | 9,385 | 4,084 | 18,068 |
| HD 18143 | HIP 13642 | NSO | 11,079 | 1,186 | 31,950 |
| HD 18144 | HIP 13601 | NSO | 11,418 | 386 | −1,329 |
| HD 18449 | HIP 13905 | NSO | 11,487 | 118 | −37,021 |
| HD 18632 | HIP 13976 | NSO | 11,263 | 540 | 28,826 |
| HD 18803 | HIP 14150 | NSO | 11,210 | 1,426 | 9,878 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 18907 | HIP 14086 | NSO | 11,172 | 2 | 42,718 |
| HD 19034 | HIP 14241 | NSO | 11,082 | 1,186 | −20,344 |
| HD 19308 | HIP 14532 | NSO | 11,234 | 714 | 32,723 |
| HD 19373 | HIP 14632 | NSO | 7,328 | 532 | 49,449 |
| HD 19467 | HIP 14501 | NSO | 10,996 | 1,217 | 6,936 |
| HD 19994 | HIP 14954 | NSO | 9,069 | 4,758 | 19,331 |
| HD 20165 | HIP 15099 | NSO | 11,070 | 1,186 | −16,676 |
| HD 20619 | HIP 15442 | NSO | 10,941 | 1,178 | 22,689 |
| HD 20630 | HIP 15457 | NSO | 7,834 | 1,847 | 19,021 |
| HD 21019 | HIP 15776 | NSO | 10,991 | 1,178 | 41,630 |
| HD 21197 | HIP 15919 | NSO | 11,145 | 1,186 | −13,107 |
| HD 21313 | HIP 16107 | NSO | 11,901 | 182 | −20,017 |
| HD 21847 | HIP 16517 | NSO | 11,263 | 714 | 30,033 |
| HD 22049 | HIP 16537 | NSO | 7,147 | 177 | 16,332 |
| HD 22072 | HIP 16641 | NSO | 11,070 | 1,463 | 11,050 |
| HD 22484 | HIP 16852 | NSO | 8,391 | 2,301 | 28,080 |
| HD 22879 | HIP 17147 | NSO | 11,076 | 1,427 | 120,356 |
| HD 23249 | HIP 17378 | NSO | 11,162 | 1,330 | −6,295 |
| HD 23356 | HIP 17420 | NSO | 11,220 | 501 | 25,287 |
| HD 23439 | HIP 17666 | NSO | 11,102 | 1,119 | 50,704 |
| HD 24040 | HIP 17960 | NSO | 11,278 | 954 | −9,423 |
| HD 24213 | HIP 18106 | NSO | 11,181 | 712 | −39,608 |
| HD 24238 | HIP 18324 | NSO | 11,038 | 1,088 | 38,809 |
| HD 24341 | HIP 18309 | NSO | 11,038 | 1,088 | 142,798 |
| HD 24365 | HIP 18208 | NSO | 11,092 | 1,088 | 19,278 |
| HD 24451 | HIP 18774 | NSO | 11,404 | 354 | 17,670 |
| HD 24496 | HIP 18267 | NSO | 11,236 | 954 | 18,936 |
| HD 24727 | HIP 18388 | NSO | 11,304 | 954 | −18,140 |
| HD 24892 | HIP 18432 | NSO | 10,952 | 1,217 | 45,410 |
| HD 24916 | HIP 18512 | NSO | 11,245 | 1,427 | 3,540 |
| HD 25069 | HIP 18606 | NSO | 11,133 | 1,427 | 38,484 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 25665 | HIP 19422 | NSO | 11,436 | 29 | −13,546 |
| HD 25680 | HIP 19076 | NSO | 9,509 | 4,084 | 24,034 |
| HD 25723 | HIP 19011 | NSO | 11,490 | 144 | 26,748 |
| HD 25918 | HIP 19301 | NSO | 11,538 | 5 | −36,198 |
| HD 26151 | HIP 19232 | NSO | 11,416 | 412 | −6,804 |
| HD 26161 | HIP 19428 | NSO | 11,236 | 714 | 12,924 |
| HD 26162 | HIP 19388 | NSO | 11,497 | 116 | 24,776 |
| HD 26767 | HIP 19786 | NSO | 11,728 | 564 | 38,288 |
| HD 26794 | HIP 19788 | NSO | 10,980 | 1,131 | 56,573 |
| HD 26965 | HIP 19849 | NSO | 7,657 | 1,845 | −42,331 |
| HD 28005 | HIP 20800 | NSO | 11,231 | 714 | 34,768 |
| HD 28187 | HIP 20638 | NSO | 10,990 | 1,215 | 18,321 |
| HD 28343 | HIP 20917 | M | 11,476 | 356 | −35,073 |
| HD 28344 | HIP 20899 | NSO | 11,524 | 171 | 39,145 |
| HD 28676 | HIP 21158 | NSO | 11,305 | 361 | 6,671 |
| HD 28946 | HIP 21272 | NSO | 11,395 | 386 | −46,353 |
| HD 29150 | HIP 21436 | NSO | 11,396 | 386 | −6,615 |
| HD 29528 | HIP 21703 | NSO | 11,901 | 182 | −18,922 |
| HD 29883 | HIP 21988 | NSO | 11,359 | 385 | 17,843 |
| HD 30562 | HIP 22336 | NSO | 11,370 | 293 | 77,189 |
| HD 30708 | HIP 22576 | NSO | 11,209 | 714 | −55,738 |
| HD 31253 | HIP 22826 | NSO | 11,345 | 954 | 12,184 |
| HD 31560 | HIP 22907 | NSO | 11,162 | 1,217 | 6,203 |
| HD 31966 | HIP 23286 | NSO | 11,239 | 743 | −18,058 |
| HD 32147 | HIP 23311 | NSO | 9,858 | 4,085 | 21,552 |
| HD 32923 | HIP 23835 | NSO | 11,305 | 388 | 20,558 |
| HD 32963 | HIP 23884 | NSO | 11,235 | 715 | −62,435 |
| HD 33021 | HIP 23852 | NSO | 11,070 | 1,216 | −22,300 |
| HD 33632 | HIP 24332 | NSO | 11,182 | 708 | −1,707 |
| HD 33636 | HIP 24205 | NSO | 11,411 | 954 | 5,714 |
| HD 33793 | HIP 24186 | M | 11,376 | 410 | 245,194 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 34411 | HIP 24813 | NSO | 7,970 | 1,859 | 66,511 |
| HD 34445 | HIP 24681 | NSO | 11,256 | 743 | −78,949 |
| HD 34575 | HIP 25094 | NSO | 11,731 | 357 | −23,520 |
| HD 34721 | HIP 24786 | NSO | 11,041 | 1,217 | 40,448 |
| HD 34745 | HIP 24864 | NSO | 11,255 | 743 | 35,376 |
| HD 35627 | HIP 25388 | NSO | 11,208 | 713 | 27,267 |
| HD 35681 | HIP 25580 | NSO | 11,195 | 702 | 12,136 |
| HD 35974 | HIP 25490 | NSO | 11,017 | 1,162 | 76,683 |
| HD 36003 | HIP 25623 | NSO | 11,214 | 1,215 | −55,527 |
| HD 36395 | HIP 25878 | M | 10,194 | 4,537 | 8,665 |
| HD 37124 | HIP 26381 | NSO | 11,203 | 1,164 | −23,076 |
| HD 37213 | HIP 26273 | NSO | 11,088 | 1,163 | 12,464 |
| HD 37394 | HIP 26779 | NSO | 9,701 | 2,486 | 1,207 |
| HD 37588 | HIP 26689 | NSO | 10,857 | 0 | −58,276 |
| HD 37962 | HIP 26737 | NSO | 10,899 | 862 | 3,133 |
| HD 38230 | HIP 27207 | NSO | 11,058 | 1,133 | −29,177 |
| HD 38529 | HIP 27253 | NSO | 11,273 | 1,374 | 30,210 |
| HD 38858 | HIP 27435 | NSO | 11,017 | 1,133 | 31,543 |
| HD 39715 | HIP 27918 | NSO | 11,461 | 386 | −33,797 |
| HD 39881 | HIP 28066 | NSO | 11,025 | 1,220 | 333 |
| HD 40397 | HIP 28267 | NSO | 11,113 | 713 | 143,621 |
| HD 40650 | HIP 28634 | NSO | 11,030 | 343 | −76,840 |
| HD 40979 | HIP 28767 | NSO | 10,955 | 344 | 32,542 |
| HD 42250 | HIP 29761 | NSO | 10,908 | 1,119 | 19,715 |
| HD 42581 | HIP 29295 | M | 10,801 | 1,579 | 4,724 |
| HD 42618 | HIP 29432 | NSO | 11,054 | 1,220 | −53,501 |
| HD 43523 | HIP 30023 | NSO | 11,261 | 709 | −16,172 |
| HD 43745 | HIP 29843 | NSO | 10,964 | 1,187 | −2,716 |
| HD 43947 | HIP 30067 | NSO | 11,181 | 714 | 40,545 |
| HD 44420 | HIP 30243 | NSO | 11,745 | 464 | −531 |
| HD 44985 | HIP 30552 | NSO | 11,227 | 714 | 32,253 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 45067 | HIP 30545 | NSO | 11,118 | 1,166 | 47,280 |
| HD 45184 | HIP 30503 | NSO | 10,940 | 1,220 | −3,856 |
| HD 45350 | HIP 30860 | NSO | 11,819 | 431 | −20,727 |
| HD 45391 | HIP 30862 | NSO | 11,459 | 472 | −5,388 |
| HD 45588 | HIP 30711 | NSO | 10,911 | 1,187 | 35,856 |
| HD 46375 | HIP 31246 | NSO | 11,491 | 514 | −1,032 |
| HD 47127 | HIP 31660 | NSO | 11,279 | 750 | 49,694 |
| HD 47157 | HIP 31655 | NSO | 11,549 | 46 | 25,330 |
| HD 47752 | HIP 32010 | NSO | 11,585 | 90 | −44,253 |
| HD 48682 | HIP 32480 | NSO | 8,280 | 2,301 | −23,933 |
| HD 48938 | HIP 32322 | NSO | 10,927 | 1,134 | −10,563 |
| HD 49674 | HIP 32916 | NSO | 11,963 | 182 | 12,045 |
| HD 49736 | HIP 32874 | NSO | 11,048 | 708 | 6,687 |
| HD 50281 | HIP 32984 | NSO | 10,546 | 2,276 | −7,082 |
| HD 50499 | HIP 32970 | NSO | 10,971 | 1,167 | 36,793 |
| HD 50554 | HIP 33212 | NSO | 11,219 | 709 | −3,888 |
| HD 50692 | HIP 33277 | NSO | 10,965 | 1,119 | −15,023 |
| HD 50806 | HIP 33094 | NSO | 10,870 | 1,187 | 72,388 |
| HD 51219 | HIP 33382 | NSO | 11,074 | 737 | −8,071 |
| HD 51866 | HIP 33852 | NSO | 11,060 | 1,120 | −21,624 |
| HD 52265 | HIP 33719 | NSO | 11,370 | 745 | 53,810 |
| HD 52456 | HIP 33848 | NSO | 11,325 | 514 | −11,909 |
| HD 52711 | HIP 34017 | NSO | 9,614 | 4,502 | 24,604 |
| HD 53665 | HIP 34239 | NSO | 11,232 | 747 | −14,703 |
| HD 55575 | HIP 35136 | NSO | 11,386 | 476 | 84,809 |
| HD 56124 | HIP 35265 | NSO | 11,324 | 685 | 22,526 |
| HD 56274 | HIP 35139 | NSO | 10,929 | 1,125 | 66,663 |
| HD 56303 | HIP 35209 | NSO | 11,164 | 705 | 8,150 |
| HD 58781 | HIP 36249 | NSO | 11,285 | 744 | 5,013 |
| HD 59747 | HIP 36704 | NSO | 11,441 | 472 | −15,744 |
| HD 60491 | HIP 36827 | NSO | 11,385 | 410 | −9,667 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 61606 | HIP 37349 | NSO | 11,255 | 1,163 | −18,210 |
| HD 63077 | HIP 37853 | NSO | 10,415 | 97 | 106,159 |
| HD 63433 | HIP 38228 | NSO | 11,232 | 703 | −15,888 |
| HD 63754 | HIP 38216 | NSO | 10,867 | 1,132 | 44,973 |
| HD 64090 | HIP 38541 | NSO | 10,968 | 416 | −234,268 |
| HD 65277 | HIP 38931 | NSO | 11,005 | 1,120 | −4,417 |
| HD 65583 | HIP 39157 | NSO | 10,958 | 1,133 | 14,832 |
| HD 66171 | HIP 39822 | NSO | 10,944 | 1,119 | 36,412 |
| HD 66428 | HIP 39417 | NSO | 11,926 | 92 | 44,140 |
| HD 67228 | HIP 39780 | NSO | 11,431 | 456 | −36,012 |
| HD 67458 | HIP 39710 | NSO | 11,047 | 1,120 | −15,686 |
| HD 67767 | HIP 40023 | NSO | 11,038 | 1,261 | −44,318 |
| HD 68017 | HIP 40118 | NSO | 11,068 | 1,218 | 29,575 |
| HD 68168 | HIP 40133 | NSO | 11,144 | 746 | 9,162 |
| HD 68978 | HIP 40283 | NSO | 10,937 | 1,119 | 51,696 |
| HD 69809 | HIP 40761 | NSO | 11,743 | 422 | 17,534 |
| HD 69897 | HIP 40843 | NSO | 8,392 | 2,250 | 32,733 |
| HD 70843 | HIP 41226 | NSO | 11,267 | 795 | −13,087 |
| HD 71148 | HIP 41484 | NSO | 11,177 | 798 | −32,342 |
| HD 71334 | HIP 41317 | NSO | 11,120 | 1,124 | 17,286 |
| HD 71479 | HIP 41479 | NSO | 11,255 | 742 | 60,217 |
| HD 71881 | HIP 41844 | NSO | 11,046 | 745 | 13,629 |
| HD 72659 | HIP 42030 | NSO | 11,255 | 742 | −18,253 |
| HD 72673 | HIP 41926 | NSO | 10,792 | 808 | 14,785 |
| HD 72760 | HIP 42074 | NSO | 11,386 | 798 | 34,928 |
| HD 73344 | HIP 42403 | NSO | 11,161 | 468 | 6,097 |
| HD 73350 | HIP 42333 | NSO | 11,052 | 412 | 35,370 |
| HD 73667 | HIP 42499 | NSO | 10,981 | 1,091 | −12,088 |
| HD 74014 | HIP 42634 | NSO | 11,462 | 475 | −17,089 |
| HD 75332 | HIP 43410 | NSO | 11,173 | 469 | 4,256 |
| HD 75732 | HIP 43587 | NSO | 9,301 | 2,513 | 27,351 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 76151 | HIP 43726 | NSO | 9,469 | 2,926 | 32,002 |
| HD 76752 | HIP 44089 | NSO | 11,358 | 798 | −12,577 |
| HD 76909 | HIP 44137 | NSO | 11,725 | 429 | 3,045 |
| HD 77407 | HIP 44458 | NSO | 10,843 | 23 | 4,827 |
| HD 78366 | HIP 44897 | NSO | 9,485 | 3,286 | 26,120 |
| HD 79210 | HIP 45343 | M | 11,045 | 974 | 11,142 |
| HD 79211 | HIP 120005 | M | 11,077 | 974 | 12,495 |
| HD 80367 | HIP 45737 | NSO | 11,416 | 412 | 51,009 |
| HD 82106 | HIP 46580 | NSO | 10,970 | 323 | 29,836 |
| HD 83443 | HIP 47202 | NSO | 11,982 | 167 | 28,994 |
| HD 84035 | HIP 47690 | NSO | 10,989 | 1,121 | −12,225 |
| HD 84737 | HIP 48113 | NSO | 8,233 | 1,919 | 4,900 |
| HD 85725 | HIP 48468 | NSO | 10,726 | 752 | 61,610 |
| HD 86728 | HIP 49081 | NSO | 8,649 | 2,716 | 55,956 |
| HD 87359 | HIP 49350 | NSO | 11,113 | 737 | −260 |
| HD 87424 | HIP 49366 | NSO | 11,316 | 380 | −12,133 |
| HD 87836 | HIP 49680 | NSO | 11,568 | 96 | −42,188 |
| HD 87883 | HIP 49699 | NSO | 11,311 | 379 | 9,254 |
| HD 88072 | HIP 49756 | NSO | 11,062 | 737 | −17,886 |
| HD 88218 | HIP 49769 | NSO | 11,010 | 1,261 | 36,652 |
| HD 88230 | HIP 49908 | M | 8,883 | 2,897 | −25,729 |
| HD 88371 | HIP 49942 | NSO | 11,006 | 1,089 | 82,497 |
| HD 88725 | HIP 50139 | NSO | 10,999 | 1,217 | −22,045 |
| HD 88986 | HIP 50316 | NSO | 10,818 | 809 | 29,019 |
| HD 89269 | HIP 50505 | NSO | 10,979 | 1,164 | −7,551 |
| HD 89307 | HIP 50473 | NSO | 11,074 | 358 | 23,011 |
| HD 89391 | HIP 50478 | NSO | 11,167 | 1,119 | 29,607 |
| HD 90125 | HIP 50939 | NSO | 11,054 | 1,286 | −13,937 |
| HD 90156 | HIP 50921 | NSO | 10,899 | 1,162 | 26,934 |
| HD 90711 | HIP 51257 | NSO | 11,012 | 1,089 | 29,940 |
| HD 90722 | HIP 51258 | NSO | 11,703 | 423 | 39,984 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 90839 | HIP 51459 | NSO | 8,584 | 3,023 | 8,529 |
| HD 90875 | HIP 51468 | NSO | 11,381 | 383 | 4,948 |
| HD 91204 | HIP 51579 | NSO | 11,853 | 432 | −8,875 |
| HD 91638 | HIP 51784 | NSO | 11,056 | 381 | −4,751 |
| HD 92788 | HIP 52409 | NSO | 11,535 | 924 | −4,529 |
| HD 92945 | HIP 52462 | NSO | 11,323 | 1,218 | 22,856 |
| HD 93745 | HIP 52888 | NSO | 11,019 | 1,218 | 37,947 |
| HD 94765 | HIP 53486 | NSO | 11,599 | 93 | 5,525 |
| HD 95128 | HIP 53721 | NSO | 9,800 | 4,241 | 11,235 |
| HD 95650 | HIP 53985 | M | 11,816 | 423 | −13,899 |
| HD 95735 | HIP 54035 | M | 10,213 | 4,748 | −84,689 |
| HD 96418 | HIP 54347 | NSO | 11,101 | 411 | −8,013 |
| HD 96574 | HIP 54383 | NSO | 11,271 | 57 | 36,055 |
| HD 96700 | HIP 54400 | NSO | 10,995 | 1,261 | 12,769 |
| HD 97004 | HIP 54614 | NSO | 11,361 | 293 | 5,352 |
| HD 97037 | HIP 54582 | NSO | 11,294 | 709 | −15,914 |
| HD 97101 | GJ 414A | NSO | 10,384 | 2,902 | −16,376 |
| HD 97101B | GJ 414B | M | 10,307 | 1,930 | −15,333 |
| HD 97334 | HIP 54745 | NSO | 9,429 | 3,273 | −3,662 |
| HD 97343 | HIP 54704 | NSO | 11,051 | 1,261 | 39,794 |
| HD 97658 | HIP 54906 | NSO | 10,965 | 1,088 | −1,654 |
| HD 98281 | HIP 55210 | NSO | 11,044 | 1,121 | 13,330 |
| HD 98618 | HIP 55459 | NSO | 11,242 | 865 | 7,058 |
| HD 98697 | HIP 55455 | NSO | 11,441 | 453 | −14,312 |
| HD 99109 | HIP 55664 | NSO | 11,478 | 534 | 32,997 |
| HD 99491 | HIP 55846 | NSO | 11,047 | 1,286 | 4,190 |
| HD 99492 | HIP 55848 | NSO | 11,110 | 1,243 | 3,726 |
| HD 100180 | HIP 56242 | NSO | 11,017 | 1,284 | −4,854 |
| HD 100623 | HIP 56452 | NSO | 11,003 | 1,162 | −21,959 |
| HD 101177 | HIP 56809 | NSO | 11,461 | 386 | −16,912 |
| HD 101259 | HIP 56830 | NSO | 11,077 | 1,121 | 96,905 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 101501 | HIP 56997 | NSO | 7,992 | 2,213 | −5,565 |
| HD 102158 | HIP 57349 | NSO | 11,009 | 1,121 | 28,122 |
| HD 102634 | HIP 57629 | NSO | 11,099 | 381 | 1,254 |
| HD 102870 | HIP 57757 | NSO | 7,466 | 1,058 | 4,448 |
| HD 103095 | HIP 57939 | NSO | 11,289 | 153 | −98,073 |
| HD 103432 | HIP 58067 | NSO | 11,033 | 1,241 | 6,079 |
| HD 103932 | HIP 58345 | NSO | 11,114 | 1,218 | 48,499 |
| HD 104067 | HIP 58451 | NSO | 11,247 | 1,218 | 15,021 |
| HD 104526 | HIP 58698 | NSO | 10,539 | 143 | 4,635 |
| HD 104556 | HIP 58708 | NSO | 11,057 | 1,240 | −10,678 |
| HD 104800 | HIP 58843 | NSO | 11,820 | 547 | 9,989 |
| HD 105113 | HIP 59021 | NSO | 11,070 | 1,218 | 31,871 |
| HD 105405 | HIP 59175 | NSO | 11,412 | 325 | 2,196 |
| HD 105590 | HIP 59272 | NSO | 10,733 | 494 | 1,976 |
| HD 105618 | HIP 59278 | NSO | 11,957 | 219 | 7,466 |
| HD 105631 | HIP 59280 | NSO | 11,033 | 1,240 | −2,428 |
| HD 106116 | HIP 59532 | NSO | 11,063 | 1,241 | 14,543 |
| HD 106156 | HIP 59572 | NSO | 11,063 | 1,240 | −7,415 |
| HD 107148 | HIP 60081 | NSO | 11,890 | 548 | 25,216 |
| HD 107705 | HIP 60353 | NSO | 11,278 | 797 | 4,759 |
| HD 108510 | HIP 60816 | NSO | 11,207 | 0 | 6,888 |
| HD 108874 | HIP 61028 | NSO | 11,521 | 339 | −30,137 |
| HD 109358 | HIP 61317 | NSO | 11,735 | 480 | 6,259 |
| HD 110315 | HIP 61901 | NSO | 11,108 | 1,242 | 24,604 |
| HD 110537 | HIP 62039 | NSO | 11,386 | 748 | 35,461 |
| HD 111031 | HIP 62345 | NSO | 11,051 | 1,243 | −20,458 |
| HD 111066 | HIP 62349 | NSO | 11,351 | 330 | 6,407 |
| HD 111398 | HIP 62536 | NSO | 11,411 | 331 | 3,154 |
| HD 111484 | HIP 62596 | NSO | 11,408 | 721 | −20,643 |
| HD 111484B | SAO 119612 | NSO | 11,387 | 721 | −19,377 |
| HD 111515 | HIP 62607 | NSO | 11,059 | 1,243 | 2,548 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 111631 | HIP 62687 | M | 11,901 | 517 | 5,041 |
| HD 112257 | HIP 63048 | NSO | 11,044 | 473 | −39,428 |
| HD 114174 | HIP 64150 | NSO | 11,083 | 1,119 | 24,002 |
| HD 114710 | HIP 64394 | NSO | 7,397 | 1,058 | 5,295 |
| HD 114729 | HIP 64459 | NSO | 11,380 | 1,244 | 64,925 |
| HD 114783 | HIP 64457 | NSO | 11,551 | 772 | −12,012 |
| HD 114946 | HIP 64577 | NSO | 11,118 | 1,242 | −48,181 |
| HD 115383 | HIP 64792 | NSO | 8,623 | 2,511 | −27,138 |
| HD 115589 | HIP 64905 | NSO | 11,434 | 505 | −21,614 |
| HD 115617 | HIP 64924 | NSO | 9,770 | 0 | −7,850 |
| HD 116442 | HIP 65352 | NSO | 11,301 | 1,242 | 28,421 |
| HD 116443 | HIP 65355 | NSO | 11,155 | 1,242 | 27,416 |
| HD 117207 | HIP 65808 | NSO | 11,199 | 1,240 | −17,476 |
| HD 117936 | HIP 66147 | NSO | 11,404 | 720 | −6,086 |
| HD 118914 | HIP 66621 | NSO | 11,950 | 307 | 16,460 |
| HD 119850 | HIP 67155 | M | 10,336 | 2,856 | 15,809 |
| HD 120066 | HIP 67246 | NSO | 11,205 | 1,241 | −30,561 |
| HD 120467 | HIP 67487 | NSO | 11,252 | 1,157 | −37,806 |
| HD 120476 | HIP 67422 | NSO | 11,492 | 392 | −20,380 |
| HD 121560 | HIP 68030 | NSO | 11,016 | 23 | −10,532 |
| HD 122064 | HIP 68184 | NSO | 11,958 | 548 | −26,471 |
| HD 122120 | HIP 68337 | NSO | 11,130 | 1,157 | −57,444 |
| HD 122303 | HIP 68469 | M | 11,497 | 172 | −25,813 |
| HD 122652 | HIP 68593 | NSO | 11,177 | 675 | 1,409 |
| HD 124106 | HIP 69357 | NSO | 11,117 | 1,396 | 3,288 |
| HD 124292 | HIP 69414 | NSO | 11,104 | 474 | 37,773 |
| HD 124642 | HIP 69526 | NSO | 11,585 | 89 | −16,242 |
| HD 124694 | HIP 69518 | NSO | 11,016 | 22 | −14,644 |
| HD 125184 | HIP 69881 | NSO | 11,184 | 1,403 | −12,377 |
| HD 125455 | HIP 70016 | NSO | 11,154 | 1,404 | −9,806 |
| HD 126053 | HIP 70319 | NSO | 10,208 | 4,746 | −19,241 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 126614 | HIP 70623 | NSO | 11,485 | 480 | −33,086 |
| HD 126961 | HIP 70782 | NSO | 11,050 | 202 | −5,839 |
| HD 127334 | HIP 70873 | NSO | 11,129 | 533 | −405 |
| HD 128167 | HIP 71284 | NSO | 8,333 | 2,080 | 141 |
| HD 128311 | HIP 71395 | NSO | 11,392 | 696 | −9,569 |
| HD 128428 | HIP 71462 | NSO | 11,063 | 795 | −42,074 |
| HD 129010 | HIP 71774 | NSO | 11,149 | 1,158 | −8,137 |
| HD 129191 | HIP 71803 | NSO | 11,827 | 479 | 12,685 |
| HD 130087 | HIP 72190 | NSO | 11,835 | 483 | −15,673 |
| HD 130307 | HIP 72312 | NSO | 11,218 | 1,429 | 12,864 |
| HD 130322 | HIP 72339 | NSO | 12,038 | 407 | −12,441 |
| HD 130871 | HIP 72577 | NSO | 11,147 | 1,429 | −32,159 |
| HD 130948 | HIP 72567 | NSO | 9,090 | 3,698 | −2,502 |
| HD 130992 | HIP 72688 | NSO | 11,256 | 1,134 | −57,160 |
| HD 131117 | HIP 72772 | NSO | 11,105 | 1,242 | −28,834 |
| HD 131156A | GJ 566A | NSO | 7,325 | 1,157 | 1,303 |
| HD 131156B | GJ 566B | NSO | 9,090 | 3,609 | 3,274 |
| HD 131509 | HIP 72830 | NSO | 11,090 | 1,133 | −44,625 |
| HD 131977 | HIP 73184 | NSO | 10,272 | 1,407 | 26,961 |
| HD 132142 | HIP 73005 | NSO | 11,094 | 1,158 | −14,771 |
| HD 132375 | HIP 73309 | NSO | 11,139 | 624 | −24,370 |
| HD 133161 | HIP 73593 | NSO | 11,181 | 796 | −32,628 |
| HD 134044 | HIP 73941 | NSO | 11,222 | 624 | −5,874 |
| HD 134439 | HIP 74235 | NSO | 11,090 | 820 | 310,084 |
| HD 134440 | HIP 74234 | NSO | 11,365 | 692 | 310,614 |
| HD 134987 | HIP 74500 | NSO | 10,962 | 952 | 5,038 |
| HD 135101 | HIP 74432 | NSO | 11,259 | 1,480 | −38,921 |
| HD 135599 | HIP 74702 | NSO | 11,108 | 468 | −3,149 |
| HD 136442 | HIP 75101 | NSO | 11,483 | 720 | −46,935 |
| HD 136654 | HIP 75104 | NSO | 11,020 | 21 | −27,029 |
| HD 136713 | HIP 75253 | NSO | 11,090 | 1,428 | −6,037 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 136834 | HIP 75266 | NSO | 10,982 | 1,403 | −26,374 |
| HD 136923 | HIP 75277 | NSO | 11,196 | 798 | −7,042 |
| HD 136925 | HIP 75281 | NSO | 11,253 | 842 | −48,942 |
| HD 137778 | HIP 75722 | NSO | 11,234 | 1,479 | 7,752 |
| HD 138549 | HIP 76200 | NSO | 11,100 | 1,158 | 12,024 |
| HD 138573 | HIP 76114 | NSO | 11,221 | 625 | −35,691 |
| HD 138776 | HIP 76228 | NSO | 11,509 | 368 | 10,674 |
| HD 139323 | HIP 76375 | NSO | 11,092 | 1,134 | −67,101 |
| HD 139457 | HIP 76543 | NSO | 11,427 | 338 | 37,708 |
| HD 139477 | HIP 76315 | NSO | 11,387 | 453 | −8,893 |
| HD 141004 | HIP 77257 | NSO | 8,789 | 3,560 | −66,416 |
| HD 141103 | HIP 77335 | NSO | 11,106 | 358 | −48,258 |
| HD 142373 | HIP 77760 | NSO | 8,418 | 3,561 | −56,107 |
| HD 142860 | HIP 78072 | NSO | 7,746 | 1,327 | 6,544 |
| HD 143291 | HIP 78241 | NSO | 11,065 | 1,428 | −72,474 |
| HD 143761 | HIP 78459 | NSO | 10,900 | 1,149 | 17,949 |
| HD 144179 | HIP 78842 | NSO | 10,875 | 436 | −24,253 |
| HD 144579 | HIP 78775 | NSO | 11,094 | 1,158 | −59,431 |
| HD 144585 | HIP 78955 | NSO | 11,112 | 1,158 | −14,067 |
| HD 144988 | HIP 79214 | NSO | 11,116 | 1,208 | −53,211 |
| HD 145229 | HIP 79165 | NSO | 11,100 | 359 | −36,204 |
| HD 145435 | HIP 79152 | NSO | 11,086 | 359 | −42,685 |
| HD 145675 | HIP 79248 | NSO | 11,307 | 1,150 | −13,693 |
| HD 145809 | HIP 79524 | NSO | 11,088 | 1,428 | 21,146 |
| HD 145897 | HIP 79540 | NSO | 11,457 | 301 | −23,611 |
| HD 145934 | SAO 102017 | NSO | 11,342 | 1,101 | −27,954 |
| HD 145958 | HIP 79492 | NSO | 11,183 | 1,518 | 18,422 |
| HD 146233 | HIP 79672 | NSO | 11,245 | 1,088 | 11,748 |
| HD 146362 | GJ 615.2B | NSO | 11,121 | 1,134 | −14,855 |
| HD 146775 | HIP 79946 | NSO | 11,116 | 1,245 | −30,218 |
| HD 147044 | HIP 79862 | NSO | 11,339 | 746 | −14,560 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 147231 | HIP 79619 | NSO | 11,182 | 1,157 | −16,461 |
| HD 147379 | HIP 79755 | M | 12,021 | 482 | −18,789 |
| HD 147379B | GJ 617B | M | 12,040 | 482 | −18,530 |
| HD 147776 | HIP 80366 | NSO | 11,541 | 265 | 7,341 |
| HD 148467 | HIP 80644 | NSO | 11,686 | 124 | −36,207 |
| HD 148513 | HIP 80693 | NSO | 11,443 | 299 | 7,723 |
| HD 149200 | HIP 81062 | NSO | 11,017 | 22 | −7,176 |
| HD 149652 | HIP 81279 | NSO | 11,080 | 359 | −31,167 |
| HD 149661 | HIP 81300 | NSO | 10,107 | 3,304 | −12,857 |
| HD 149806 | HIP 81375 | NSO | 11,358 | 747 | 10,391 |
| HD 150433 | HIP 81681 | NSO | 11,122 | 1,065 | −40,215 |
| HD 150698 | HIP 81910 | NSO | 11,073 | 1,131 | 48,229 |
| HD 150933 | HIP 81880 | NSO | 11,287 | 747 | −27,880 |
| HD 151101 | HIP 81660 | NSO | 11,551 | 455 | −1,329 |
| HD 151288 | HIP 82003 | M | 10,162 | 4,746 | −31,357 |
| HD 151541 | HIP 81813 | NSO | 11,067 | 1,158 | 9,475 |
| HD 151877 | HIP 82267 | NSO | 11,082 | 1,160 | 2,033 |
| HD 151995 | HIP 82389 | NSO | 11,145 | 1,429 | −5,557 |
| HD 152391 | HIP 82588 | NSO | 10,746 | 2,588 | 45,066 |
| HD 152446 | HIP 82568 | NSO | 11,142 | 387 | −42,504 |
| HD 152792 | HIP 82636 | NSO | 11,093 | 1,159 | 4,759 |
| HD 153458 | HIP 83181 | NSO | 11,258 | 842 | 641 |
| HD 153627 | HIP 83204 | NSO | 11,306 | 770 | −1,462 |
| HD 153834 | HIP 83254 | NSO | 11,446 | 275 | 10,821 |
| HD 154088 | HIP 83541 | NSO | 11,071 | 1,131 | 14,180 |
| HD 154345 | HIP 83389 | NSO | 11,103 | 1,159 | −46,930 |
| HD 154363 | HIP 83591 | NSO | 11,178 | 1,403 | 34,146 |
| HD 154417 | HIP 83601 | NSO | 11,331 | 63 | −16,739 |
| HD 155060 | HIP 83827 | NSO | 11,175 | 747 | −10,542 |
| HD 155423 | HIP 84082 | NSO | 11,367 | 747 | −33,561 |
| HD 156026 | HIP 84478 | NSO | 11,367 | 772 | 153 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 156365 | HIP 84636 | NSO | 11,089 | 1,163 | −13,136 |
| HD 156681 | HIP 84671 | NSO | 11,427 | 301 | 38,842 |
| HD 156826 | HIP 84801 | NSO | 11,267 | 1,431 | −32,634 |
| HD 157214 | HIP 84862 | NSO | 8,668 | 3,650 | −78,546 |
| HD 157338 | HIP 85158 | NSO | 11,072 | 1,155 | −24,315 |
| HD 157347 | HIP 85042 | NSO | 11,256 | 748 | −35,901 |
| HD 157466 | HIP 85007 | NSO | 11,399 | 800 | 34,125 |
| HD 157617 | HIP 85139 | NSO | 11,455 | 268 | 13,119 |
| HD 157881 | HIP 85295 | M | 11,130 | 1,427 | −23,199 |
| HD 159063 | HIP 85799 | NSO | 11,179 | 699 | −6,385 |
| HD 159222 | HIP 85810 | NSO | 11,144 | 1,249 | −51,605 |
| HD 159501 | HIP 85888 | NSO | 11,470 | 248 | −30,123 |
| HD 159909 | HIP 86193 | NSO | 11,212 | 748 | −76,809 |
| HD 160693 | HIP 86431 | NSO | 11,076 | 1,157 | 34,084 |
| HD 161555 | HIP 86985 | NSO | 11,123 | 358 | 72,021 |
| HD 161848 | HIP 87089 | NSO | 11,064 | 1,428 | −94,929 |
| HD 162826 | HIP 87382 | NSO | 11,216 | 625 | 1,848 |
| HD 163102 | HIP 87678 | NSO | 11,093 | 358 | −26,920 |
| HD 163153 | HIP 87710 | NSO | 11,234 | 750 | −73,024 |
| HD 163489 | GJ 4035 | NSO | 11,135 | 1,163 | −49,364 |
| HD 164507 | HIP 88217 | NSO | 11,265 | 824 | 5,370 |
| HD 164595 | HIP 88194 | NSO | 11,249 | 748 | 2,020 |
| HD 164922 | HIP 88348 | NSO | 11,196 | 1,520 | 20,248 |
| HD 165222 | HIP 88574 | M | 10,299 | 4,747 | 32,671 |
| HD 165438 | HIP 88684 | NSO | 11,457 | 274 | −26,747 |
| HD 165567 | HIP 88533 | NSO | 11,202 | 382 | 3,853 |
| HD 165634 | HIP 88839 | NSO | 11,394 | 83 | −4,867 |
| HD 165683 | HIP 88636 | NSO | 11,426 | 32 | −546 |
| HD 166620 | HIP 88972 | NSO | 9,370 | 3,649 | −19,418 |
| HD 167389 | HIP 89282 | NSO | 11,254 | 749 | −5,545 |
| HD 168009 | HIP 89474 | NSO | 11,329 | 747 | −64,595 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 168723 | HIP 89962 | NSO | 8,930 | 2,734 | 9,371 |
| HD 168746 | HIP 90004 | NSO | 12,060 | 406 | −25,603 |
| HD 169191 | HIP 90067 | NSO | 11,414 | 127 | −19,268 |
| HD 169830 | HIP 90485 | NSO | 12,036 | 406 | −17,304 |
| HD 170174 | SAO 123515 | NSO | 11,177 | 1,208 | −28,841 |
| HD 170469 | HIP 90593 | NSO | 11,954 | 457 | −59,423 |
| HD 170493 | HIP 90656 | NSO | 11,147 | 1,480 | −54,752 |
| HD 170657 | HIP 90790 | NSO | 10,812 | 2,173 | −43,131 |
| HD 170778 | HIP 90586 | NSO | 11,307 | 744 | −22,670 |
| HD 171067 | HIP 90864 | NSO | 11,058 | 1,479 | −46,252 |
| HD 171665 | HIP 91287 | NSO | 11,040 | 1,421 | −23,259 |
| HD 171918 | HIP 91332 | NSO | 11,902 | 394 | −67,256 |
| HD 172051 | HIP 91438 | NSO | 11,149 | 1,421 | 37,103 |
| HD 172310 | HIP 91381 | NSO | 11,189 | 1,038 | 30,997 |
| HD 172513 | HIP 91700 | NSO | 11,397 | 1,248 | −11,545 |
| HD 172649 | HIP 91507 | NSO | 11,016 | 23 | −11,419 |
| HD 173701 | HIP 91949 | NSO | 11,071 | 1,158 | −45,602 |
| HD 173739 | HIP 91768 | M | 11,078 | 1,104 | −834 |
| HD 173740 | HIP 91772 | M | 11,078 | 1,104 | 1,187 |
| HD 173818 | HIP 92200 | NSO | 11,499 | 443 | 15,544 |
| HD 174912 | HIP 92532 | NSO | 11,301 | 418 | −13,083 |
| HD 174947 | HIP 92747 | NSO | 11,424 | 106 | −7,100 |
| HD 175541 | HIP 92895 | NSO | 11,075 | 1,422 | 19,698 |
| HD 175726 | HIP 92984 | NSO | 11,025 | 44 | 10,277 |
| HD 176377 | HIP 93185 | NSO | 11,232 | 825 | −40,611 |
| HD 176982 | HIP 93518 | NSO | 11,037 | 1,419 | −6,793 |
| HD 177153 | HIP 93427 | NSO | 11,290 | 746 | −14,953 |
| HD 177830 | HIP 93746 | NSO | 11,183 | 1,213 | −72,173 |
| HD 179949 | HIP 94645 | NSO | 11,940 | 370 | −24,662 |
| HD 179957 | GJ 9648B | NSO | 11,072 | 1,158 | −41,822 |
| HD 179958 | GJ 9648A | NSO | 11,029 | 1,158 | −41,158 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 180617 | HIP 94761 | M | 9,359 | 3,609 | 35,880 |
| HD 180684 | HIP 94751 | NSO | 11,542 | 420 | −2,615 |
| HD 181234 | HIP 95015 | NSO | 11,510 | 451 | −46,783 |
| HD 181655 | HIP 94981 | NSO | 11,249 | 897 | 2,036 |
| HD 182488 | HIP 95319 | NSO | 11,022 | 41 | −21,508 |
| HD 182572 | HIP 95447 | NSO | 11,151 | 1,340 | −100,292 |
| HD 183341 | HIP 95772 | NSO | 11,206 | 748 | −40,888 |
| HD 183650 | HIP 95821 | NSO | 11,075 | 1,158 | −9,744 |
| HD 183658 | HIP 95962 | NSO | 11,228 | 748 | 58,176 |
| HD 183870 | HIP 96085 | NSO | 11,295 | 1,517 | −48,864 |
| HD 184385 | HIP 96183 | NSO | 11,106 | 441 | 11,406 |
| HD 185144 | HIP 96100 | NSO | 9,977 | 3,998 | 26,691 |
| HD 185295 | SAO 124877 | NSO | 11,135 | 1,339 | −18,575 |
| HD 185351 | HIP 96459 | NSO | 11,426 | 148 | −5,886 |
| HD 185720 | HIP 96813 | NSO | 11,027 | 41 | 15,992 |
| HD 186408 | HIP 96895 | NSO | 9,256 | 3,651 | −27,377 |
| HD 186427 | HIP 96901 | NSO | 8,634 | 2,644 | −27,871 |
| HD 187123 | HIP 97336 | NSO | 11,032 | 269 | −16,954 |
| HD 187237 | HIP 97420 | NSO | 11,223 | 749 | −32,962 |
| HD 187897 | HIP 97779 | NSO | 11,243 | 701 | −37,568 |
| HD 187923 | HIP 97767 | NSO | 10,926 | 1,426 | −20,611 |
| HD 188015 | HIP 97769 | NSO | 11,987 | 379 | 68 |
| HD 188510 | HIP 98020 | NSO | 11,563 | 452 | −192,444 |
| HD 188512 | HIP 98036 | NSO | 8,769 | 3,648 | −40,109 |
| HD 189067 | HIP 98206 | NSO | 11,119 | 413 | −10,922 |
| HD 189625 | HIP 98589 | NSO | 11,268 | 988 | −28,218 |
| HD 190007 | HIP 98698 | NSO | 11,225 | 810 | −30,303 |
| HD 190067 | HIP 98677 | NSO | 11,009 | 1,517 | 20,385 |
| HD 190360 | HIP 98767 | NSO | 11,189 | 1,340 | −45,308 |
| HD 190404 | HIP 98792 | NSO | 10,990 | 1,479 | −2,527 |
| HD 191022 | HIP 98978 | NSO | 11,093 | 441 | −12,842 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 191785 | HIP 99452 | NSO | 10, 947 | 1, 427 | −49, 286 |
| HD 192020 | GJ 4138 | NSO | 11, 118 | 1, 207 | −11, 366 |
| HD 192263 | HIP 99711 | NSO | 11, 346 | 810 | −10, 738 |
| HD 192343 | HIP 99727 | NSO | 11, 781 | 1, 767 | −526 |
| HD 192344 | HIP 99729 | NSO | 12, 075 | 407 | −451 |
| HD 193017 | HIP 100072 | NSO | 11, 084 | 443 | 15, 584 |
| HD 193202 | HIP 99427 | NSO | 11, 355 | 26 | −1, 623 |
| HD 193795 | HIP 100363 | NSO | 11, 976 | 369 | 6, 921 |
| HD 193901 | HIP 100568 | NSO | 11, 593 | 296 | −171, 455 |
| HD 194035 | HIP 100500 | NSO | 11, 252 | 444 | 16, 665 |
| HD 194766 | HIP 100895 | NSO | 11, 101 | 412 | −15, 131 |
| HD 195104 | HIP 101059 | NSO | 11, 022 | 22 | −14, 936 |
| HD 195564 | HIP 101345 | NSO | 11, 141 | 1, 428 | 9, 535 |
| HD 196201 | HIP 101597 | NSO | 11, 431 | 426 | −19, 821 |
| HD 196761 | HIP 101997 | NSO | 11, 023 | 1, 478 | −41, 987 |
| HD 196850 | HIP 101875 | NSO | 11, 196 | 1, 207 | −21, 045 |
| HD 196885 | HIP 101966 | NSO | 11, 152 | 441 | −30, 189 |
| HD 197076 | HIP 102040 | NSO | 11, 035 | 1, 389 | −35, 409 |
| HD 197139 | HIP 101986 | NSO | 11, 437 | 125 | −24, 024 |
| HD 198089 | HIP 102610 | NSO | 11, 158 | 441 | −33, 434 |
| HD 198802 | HIP 103077 | NSO | 11, 104 | 1, 101 | −3, 171 |
| HD 199305 | HIP 103096 | M | 11, 164 | 1, 077 | −17, 161 |
| HD 199476 | HIP 102970 | NSO | 11, 040 | 765 | −30, 230 |
| HD 199598 | HIP 103455 | NSO | 11, 354 | 747 | −25, 301 |
| HD 199960 | HIP 103682 | NSO | 11, 054 | 1, 338 | −17, 605 |
| HD 200538 | HIP 104071 | NSO | 10, 991 | 1, 389 | 15, 377 |
| HD 200746 | HIP 104075 | NSO | 11, 408 | 67 | 13, 807 |
| HD 201091 | HIP 104214 | NSO | 7, 369 | 1, 066 | −65, 726 |
| HD 201092 | HIP 104217 | M | 8, 258 | 2, 297 | −64, 023 |
| HD 202108 | HIP 104733 | NSO | 11, 258 | 747 | 2, 502 |
| HD 202573 | HIP 105000 | NSO | 10, 823 | 799 | −26, 179 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 202575 | HIP 105038 | NSO | 11,175 | 1,337 | −18,065 |
| HD 202751 | HIP 105152 | NSO | 11,054 | 1,338 | −27,427 |
| HD 203644 | HIP 105497 | NSO | 11,436 | 75 | −4,356 |
| HD 204587 | HIP 106147 | M | 11,004 | 1,338 | −84,186 |
| HD 206332 | HIP 107040 | NSO | 11,254 | 746 | −44,542 |
| HD 206387 | HIP 107107 | NSO | 11,807 | 821 | −7,761 |
| HD 206860 | HIP 107350 | NSO | 8,929 | 2,894 | −16,833 |
| HD 207804 | HIP 107840 | NSO | 10,636 | 63 | −14,848 |
| HD 207874 | HIP 107941 | NSO | 11,243 | 720 | −26,702 |
| HD 208313 | HIP 108156 | NSO | 11,509 | 335 | −13,251 |
| HD 208801 | HIP 108506 | NSO | 10,595 | 2,552 | −50,179 |
| HD 209128 | HIP 108691 | NSO | 11,432 | 144 | 8,115 |
| HD 209290 | HIP 108782 | M | 11,425 | 30 | 18,363 |
| HD 209458 | HIP 108859 | NSO | 11,586 | 414 | −14,759 |
| HD 209747 | HIP 109068 | NSO | 11,404 | 127 | −18,889 |
| HD 209761 | HIP 109023 | NSO | 11,443 | 105 | −28,712 |
| HD 209875 | HIP 109144 | NSO | 11,208 | 750 | −40,896 |
| HD 210277 | HIP 109378 | NSO | 10,756 | 766 | −20,873 |
| HD 210302 | HIP 109422 | NSO | 11,472 | 363 | −16,259 |
| HD 210392 | HIP 109428 | NSO | 11,972 | 369 | −1,496 |
| HD 210460 | HIP 109439 | NSO | 10,843 | 1,093 | 20,429 |
| HD 210667 | HIP 109527 | NSO | 11,175 | 435 | −19,443 |
| HD 210752 | HIP 109646 | NSO | 11,157 | 390 | 57,225 |
| HD 210762 | HIP 109602 | NSO | 11,438 | 93 | −8,799 |
| HD 211038 | HIP 109822 | NSO | 10,807 | 796 | 10,407 |
| HD 212801 | HIP 110853 | NSO | 11,021 | 1,389 | −8,475 |
| HD 213119 | HIP 110986 | NSO | 11,407 | 81 | −30,288 |
| HD 213519 | HIP 111148 | NSO | 11,247 | 949 | −31,630 |
| HD 213575 | HIP 111274 | NSO | 11,282 | 449 | −21,544 |
| HD 213628 | HIP 111349 | NSO | 10,939 | 1,003 | −50,445 |
| HD 214557 | HIP 111748 | NSO | 11,177 | 443 | −38,534 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 214749 | HIP 111960 | NSO | 10,984 | 1,165 | 1 |
| HD 214868 | HIP 111944 | NSO | 11,404 | 128 | −10,881 |
| HD 214995 | HIP 112067 | NSO | 11,439 | 93 | −28,855 |
| HD 215152 | HIP 112190 | NSO | 11,345 | 783 | −13,795 |
| HD 215648 | HIP 112447 | NSO | 8,320 | 1,809 | −5,856 |
| HD 216259 | HIP 112870 | NSO | 10,981 | 1,517 | 1,291 |
| HD 216625 | HIP 113086 | NSO | 11,020 | 23 | 10,993 |
| HD 216646 | HIP 113084 | NSO | 11,435 | 93 | −7,670 |
| HD 216899 | HIP 113296 | M | 11,166 | 1,127 | −27,317 |
| HD 217004 | HIP 113386 | NSO | 11,015 | 1,072 | 371 |
| HD 217014 | HIP 113357 | NSO | 10,005 | 9 | −33,225 |
| HD 217107 | HIP 113421 | NSO | 11,199 | 700 | −13,399 |
| HD 217165 | HIP 113438 | NSO | 11,496 | 452 | 15,391 |
| HD 217357 | HIP 113576 | M | 11,087 | 1,074 | 16,420 |
| HD 217459 | HIP 113622 | NSO | 11,446 | 137 | 18,630 |
| HD 217563 | HIP 113686 | NSO | 11,448 | 96 | 4,661 |
| HD 217618 | HIP 113695 | NSO | 11,515 | 334 | −12,730 |
| HD 217813 | HIP 113829 | NSO | 11,423 | 31 | 2,030 |
| HD 217877 | HIP 113896 | NSO | 11,182 | 442 | −12,676 |
| HD 217987 | HIP 114046 | M | 11,139 | 385 | 8,809 |
| HD 218029 | HIP 113864 | NSO | 11,427 | 106 | −8,708 |
| HD 218133 | HIP 114028 | NSO | 11,147 | 443 | −48,799 |
| HD 218209 | HIP 113989 | NSO | 11,114 | 1,040 | −15,895 |
| HD 218566 | HIP 114322 | NSO | 11,028 | 1,186 | −37,804 |
| HD 218730 | HIP 114424 | NSO | 11,160 | 442 | 2,009 |
| HD 218739 | HIP 114385 | NSO | 11,006 | 0 | −5,681 |
| HD 218792 | HIP 114449 | NSO | 11,423 | 105 | 2,548 |
| HD 218868 | HIP 114456 | NSO | 11,193 | 442 | −30,622 |
| HD 219134 | HIP 114622 | NSO | 10,206 | 672 | −18,558 |
| HD 219172 | HIP 114670 | NSO | 11,137 | 419 | −2,828 |
| HD 219538 | HIP 114886 | NSO | 11,096 | 1,090 | 9,990 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | $\Delta$T (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HD 219834B | HIP 115125 | NSO | 11,301 | 1,427 | 10,782 |
| HD 219953 | HIP 115194 | NSO | 10,989 | 1,517 | −48,118 |
| HD 220339 | HIP 115445 | NSO | 11,132 | 1,389 | 34,001 |
| HD 220957 | HIP 115839 | NSO | 10,427 | 97 | −81,264 |
| HD 221146 | HIP 115951 | NSO | 11,100 | 439 | −15,137 |
| HD 221354 | HIP 116085 | NSO | 11,410 | 336 | −25,113 |
| HD 221356 | HIP 116106 | NSO | 10,925 | 1,479 | −12,713 |
| HD 221830 | HIP 116421 | NSO | 11,211 | 444 | −112,299 |
| HD 222033 | HIP 116542 | NSO | 11,195 | 443 | −13,088 |
| HD 222143 | HIP 116613 | NSO | 11,152 | 793 | −169 |
| HD 222368 | HIP 116771 | NSO | 7,945 | 1,787 | 5,656 |
| HD 222582 | HIP 116906 | NSO | 11,315 | 950 | 12,067 |
| HD 223238 | HIP 117367 | NSO | 11,216 | 950 | −15,420 |
| HD 223498 | HIP 117526 | NSO | 11,031 | 1,185 | −23,985 |
| HD 223559 | HIP 117567 | NSO | 11,465 | 117 | −62,839 |
| HD 223691 | HIP 117668 | NSO | 10,999 | 704 | 1,656 |
| HD 223807 | HIP 117756 | NSO | 11,483 | 116 | −15,825 |
| HD 224156 | HIP 117953 | NSO | 11,482 | 117 | 14,883 |
| HD 224383 | HIP 118115 | NSO | 11,146 | 633 | −31,205 |
| HD 225216 | HIP 379 | NSO | 11,476 | 117 | −28,860 |
| HD 225261 | HIP 400 | NSO | 11,105 | 1,389 | 7,511 |
| HD 230409 | HIP 93341 | NSO | 11,578 | 346 | −2,238 |
| HD 230999 | HIP 94615 | NSO | 11,930 | 335 | −81,527 |
| HD 232979 | HIP 21553 | M | 11,693 | 356 | 34,401 |
| HD 233641 | HIP 46639 | NSO | 11,935 | 92 | 36,182 |
| HD 239960 | HIP 110893 | M | 11,146 | 833 | −33,937 |
| HD 245409 | HIP 26335 | M | 11,002 | 1,161 | 22,046 |
| HD 260655 | HIP 31635 | M | 11,181 | 713 | −58,178 |
| HD 265866 | HIP 33226 | M | 10,225 | 2,907 | 22,914 |
| HD 281540 | HIP 19143 | NSO | 11,515 | 170 | 110,217 |
| HD 285968 | HIP 21932 | M | 11,238 | 742 | 26,219 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| HD 349726 | HIP 93873 | M | 11,304 | 723 | 32,407 |
| GJ 2 | HIP 428 | M | 12,055 | 405 | −240 |
| GJ 4A | HIP 473 | M | 11,979 | 405 | 1,669 |
| GJ 4B | BD +45 4408B | M | 12,067 | 432 | −1,655 |
| GJ 14 | HIP 1368 | M | 9,537 | 3,745 | 2,957 |
| GJ 26 | G 132-11 | M | 12,030 | 608 | −347 |
| GJ 47 | G 243-50 | M | 11,852 | 551 | 7,574 |
| GJ 48 | HIP 4856 | M | 11,159 | 866 | 1,500 |
| GJ 49 | HIP 4872 | M | 11,083 | 877 | −5,966 |
| GJ 54.1 | HIP 5643 | M | 11,263 | 532 | 28,089 |
| GJ 70 | HIP 8051 | M | 11,867 | 552 | −25,883 |
| GJ 83.1 | G 73-12 | M | 11,566 | 383 | −28,567 |
| GJ 96 | HIP 11048 | M | 11,890 | 607 | −37,941 |
| GJ 107B | BD +48 746B | M | 9,713 | 3,608 | 25,765 |
| GJ 109 | HIP 12781 | M | 11,522 | 173 | 30,568 |
| GJ 156 | HIP 18280 | M | 10,978 | 1,089 | 62,597 |
| GJ 173 | HIP 21556 | M | 11,788 | 319 | −6,768 |
| GJ 226 | HIP 29277 | M | 11,126 | 741 | −1,622 |
| GJ 273 | HIP 36208 | M | 10,129 | 3,167 | 18,216 |
| GJ 273.1 | HIP 36357 | NSO | 11,155 | 0 | −3,951 |
| GJ 357 | HIP 47103 | M | 11,204 | 743 | −34,581 |
| GJ 361 | HIP 47513 | M | 11,753 | 391 | 11,511 |
| GJ 362 | HIP 47650 | M | 11,777 | 393 | 6,606 |
| GJ 373 | HIP 48714 | M | 11,703 | 422 | 15,493 |
| GJ 382 | HIP 49986 | M | 11,053 | 974 | 7,932 |
| GJ 388 | SAO 81292 | M | 9,343 | 3,135 | 12,420 |
| GJ 390 | HIP 51007 | M | 11,818 | 428 | 21,590 |
| GJ 393 | HIP 51317 | M | 11,020 | 936 | 8,335 |
| GJ 397 | HIP 51525 | M | 11,323 | 351 | 21,052 |
| GJ 402 | HIP 53020 | M | 11,776 | 513 | −1,042 |
| GJ 406 | G 45-20 | M | 11,316 | 380 | 19,482 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| GJ 408 | HIP 53767 | M | 11,133 | 975 | 3,151 |
| GJ 412A | HIP 54211 | M | 10,386 | 2,903 | 68,886 |
| GJ 413.1 | HIP 54532 | M | 11,759 | 456 | −3,830 |
| GJ 424 | HIP 55360 | M | 11,796 | 513 | 60,401 |
| GJ 433 | HIP 56528 | M | 11,419 | 383 | 17,973 |
| GJ 436 | HIP 57087 | M | 11,778 | 513 | 9,607 |
| GJ 445 | HIP 57544 | M | 11,227 | 863 | −111,654 |
| GJ 447 | HIP 57548 | M | 11,362 | 722 | −31,087 |
| GJ 450 | HIP 57802 | M | 11,247 | 863 | 273 |
| GJ 465 | HIP 60559 | M | 11,764 | 455 | 51,174 |
| GJ 486 | HIP 62452 | M | 11,146 | 867 | 19,090 |
| GJ 514 | HIP 65859 | M | 11,085 | 1,158 | 14,556 |
| GJ 519 | HIP 66459 | M | 11,827 | 482 | −14,557 |
| GJ 528B | BD +27 2296B | NSO | 11,519 | 369 | −22,896 |
| GJ 553.1 | HIP 70975 | M | 11,882 | 520 | −1,756 |
| GJ 555 | HIP 71253 | M | 11,496 | 171 | −1,453 |
| GJ 569 | HIP 72944 | M | 9,424 | 1,336 | −7,209 |
| GJ 581 | HIP 74995 | M | 11,498 | 176 | −9,398 |
| GJ 615.1B | BD +13 3091B | NSO | 11,244 | 1,520 | 18,427 |
| GJ 625 | HIP 80459 | M | 11,224 | 842 | −13,034 |
| GJ 628 | HIP 80824 | M | 11,759 | 688 | −21,222 |
| GJ 649 | HIP 83043 | M | 12,002 | 780 | 4,316 |
| GJ 667C | ··· | M | 11,982 | 458 | 6,353 |
| GJ 671 | HIP 84790 | M | 12,056 | 457 | −19,528 |
| GJ 678.1A | HIP 85665 | M | 11,218 | 749 | −12,457 |
| GJ 686 | HIP 86287 | M | 11,149 | 1,099 | −9,515 |
| GJ 687 | HIP 86162 | M | 11,173 | 1,101 | −28,779 |
| GJ 694 | HIP 86776 | M | 11,250 | 748 | −14,269 |
| GJ 699 | HIP 87937 | M | 10,418 | 4,022 | −110,506 |
| GJ 729 | HIP 92403 | M | 11,397 | 721 | −10,499 |
| GJ 745B | HIP 93899 | M | 11,304 | 723 | 32,171 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m $s^{-1}$) |
|---|---|---|---|---|---|
| GJ 793 | HIP 101180 | M | 11,209 | 401 | 10,599 |
| GJ 806 | HIP 102401 | M | 9,736 | 4,037 | −24,702 |
| GJ 821 | HIP 104432 | M | 12,001 | 430 | −58,267 |
| GJ 849 | HIP 109388 | M | 10,972 | 834 | −15,256 |
| GJ 905 | G 171-10 | M | 11,248 | 542 | −77,949 |
| GJ 908 | HIP 117473 | M | 10,076 | 4,505 | −71,147 |
| GJ 1005 | HIP 1242 | M | 11,044 | 60 | −26,425 |
| GJ 1148 | HIP 57050 | M | 11,834 | 484 | −9,095 |
| GJ 2066 | HIP 40501 | M | 11,042 | 744 | 62,205 |
| GJ 2130A | HIP 86961 | M | 12,007 | 460 | −28,990 |
| GJ 3126 | G 244-47 | M | 11,872 | 551 | −84,115 |
| GJ 3709B | ··· | M | 11,786 | 426 | −9,226 |
| GJ 3804 | HIP 67164 | M | 11,910 | 517 | 4,969 |
| GJ 3897B | HIP 74434 | NSO | 11,213 | 1,306 | −38,829 |
| GJ 3992 | HIP 84099 | M | 11,928 | 419 | −44,443 |
| GJ 4048A | G 204-58 | M | 11,994 | 458 | 477 |
| GJ 4062 | G 205-28 | M | 11,940 | 423 | −19,003 |
| GJ 4063 | ··· | M | 11,519 | 296 | 12,495 |
| GJ 4070 | HIP 91699 | M | 12,021 | 456 | −31,764 |
| GJ 4098 | G 207-19 | M | 12,025 | 423 | −1,730 |
| GJ 4333 | HIP 115332 | M | 12,042 | 229 | −6,507 |
| GJ 9492 | HIP 71898 | M | 11,184 | 864 | 18,704 |
| HIP 795 | BD +07 9s | NSO | 11,419 | 208 | 14,685 |
| HIP 5004 | G 269-87 | NSO | 11,865 | 547 | 45,733 |
| HIP 10449 | SAO 129772 | NSO | 11,481 | 140 | 28,116 |
| HIP 15904 | BD +11 468 | NSO | 11,668 | 249 | 86,739 |
| HIP 52942 | SAO 99310 | NSO | 11,425 | 536 | 24,574 |
| HIP 59406 | ··· | M | 11,745 | 392 | −9,100 |
| HIP 80295 | BD -11 4126 | NSO | 11,455 | 395 | −17,315 |
| HIP 89215 | BD +05 3640 | NSO | 11,795 | 689 | −1,050 |
| HIP 103039 | ··· | M | 11,239 | 747 | 16,300 |

Table 1—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | <JD> (−2,440,000) | ΔT (days) | <RV> (m s$^{-1}$) |
|---|---|---|---|---|---|
| HIP 103269 | BD +41 3931 | NSO | 11,531 | 336 | −130,673 |
| HIP 106924 | BD +59 2407 | NSO | 11,640 | 296 | −244,634 |
| BD +18 4505C | ··· | NSO | 11,999 | 722 | −89,693 |
| BD -10 3166 | ··· | NSO | 11,499 | 533 | 26,679 |
| G 161-29 | ··· | NSO | 11,448 | 413 | 22,370 |
| G 195-59 | ··· | M | 11,782 | 401 | −3,451 |
| G 60-06 | ··· | NSO | 11,418 | 533 | −18,105 |

[a] Stars with $\sigma_{\rm rms} < 100$ m s$^{-1}$.

Table 2. Radial Velocities:Stars with RMS $>$ 0.1 km s$^{-1}$ [a]

| Primary Name | Alternate Name | Ref (NSO/M) | JD (−2,440,000) | RV (m s$^{-1}$) | <JD> (−2,440,000) | $\Delta T$ (days) | $\sigma_{\rm rms}$ (m s$^{-1}$) | $N$ | Com |
|---|---|---|---|---|---|---|---|---|---|
| HD 1854 | SAO 192490 | NSO | 10984.112 | 24,327 | 10,714 | 119 | 3,651 | 4 | |
| HD 3346 | HIP 2900 | NSO | 10012.747 | −33,377 | 9,317 | 2,220 | 172 | 29 | |
| HD 3770 | HIP 3169 | NSO | 11774.903 | −8,124 | 11,555 | 1,132 | 178 | 13 | L |
| HD 3795 | HIP 3185 | NSO | 11756.021 | −46,595 | 11,131 | 1,535 | 156 | 24 | L |
| HD 4271 | HIP 3540 | NSO | 11047.927 | 32,566 | 11,037 | 21 | 7,799 | 2 | |
| HD 4747 | HIP 3850 | NSO | 11756.051 | 10,399 | 11,092 | 1,731 | 315 | 21 | CO |
| HD 7483 | HIP 5881 | NSO | 12129.043 | −17,717 | 12,015 | 515 | 2,602 | 11 | CO |
| HD 8331 | HIP 6442 | NSO | 11154.627 | −12,270 | 11,091 | 128 | 2,349 | 2 | |
| HD 9770 | HIP 7372 | NSO | 11070.080 | 33,562 | 11,057 | 27 | 122 | 2 | |
| HD 11909 | HIP 9110 | NSO | 11438.923 | −6,173 | 11,430 | 13 | 137 | 4 | L |
| HD 14802 | HIP 11072 | NSO | 11170.808 | 18,824 | 10,863 | 709 | 418 | 7 | L |
| HD 17037 | HIP 12764 | NSO | 11581.755 | 16,915 | 11,452 | 1,295 | 560 | 14 | L |
| HD 18445 | HIP 13769 | NSO | 11580.723 | 49,877 | 11,491 | 1,147 | 222 | 10 | C |
| HD 21017 | HIP 15861 | NSO | 11779.008 | 8,561 | 11,455 | 74 | 371 | 5 | L |
| HD 25329 | HIP 18915 | M | 11412.131 | −25,177 | 11,179 | 361 | 338 | 3 | |
| HD 25535 | HIP 18824 | NSO | 10786.825 | 10,205 | 10,576 | 421 | 203 | 2 | |
| HD 28388 | HIP 20802 | NSO | 11170.888 | 17,748 | 10,942 | 457 | 498 | 6 | L |
| HD 29461 | HIP 21654 | NSO | 11581.849 | 40,518 | 11,763 | 563 | 116 | 8 | L |
| HD 29587 | HIP 21832 | NSO | 11073.077 | 111,729 | 10,856 | 610 | 786 | 4 | |
| HD 30339 | HIP 22429 | NSO | 12003.721 | 12,208 | 11,911 | 211 | 1,538 | 10 | CO |
| HD 30649 | HIP 22596 | NSO | 11582.778 | 28,904 | 11,391 | 1,545 | 108 | 14 | L |
| HD 31412 | HIP 22919 | NSO | 11581.861 | 47,494 | 11,317 | 1,062 | 144 | 12 | L |
| HD 32387 | HIP 23550 | NSO | 11072.132 | 54,468 | 10,759 | 706 | 1,819 | 3 | |
| HD 32450 | HIP 23452 | M | 11073.049 | −11,004 | 10,956 | 233 | 380 | 2 | |

Table 2—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | JD (−2,440,000) | RV (m s$^{-1}$) | <JD> (−2,440,000) | $\Delta T$ (days) | $\sigma_{\rm rms}$ (m s$^{-1}$) | $N$ | Com |
|---|---|---|---|---|---|---|---|---|---|
| HD 34101 | HIP 24419 | NSO | 11073.046 | 33,664 | 10,950 | 1,942 | 2,543 | 7 | CO |
| HD 35956 | HIP 25662 | NSO | 11551.891 | 9,942 | 11,346 | 1,822 | 2,457 | 14 | C |
| HD 39587 | HIP 27913 | NSO | 10068.858 | −12,171 | 8,846 | 4,580 | 1,294 | 38 | CO |
| HD 43587 | HIP 29860 | NSO | 11582.848 | 5,776 | 11,160 | 1,638 | 3,361 | 14 | C |
| HD 50639 | HIP 33109 | NSO | 11552.956 | −2,947 | 11,412 | 1,169 | 207 | 8 | L |
| HD 54563 | HIP 34608 | NSO | 10784.061 | −15,291 | 10,553 | 365 | 8,953 | 4 | |
| HD 64468 | HIP 38657 | NSO | 11581.909 | −10,624 | 11,267 | 1,541 | 3,991 | 13 | C |
| HD 65430 | HIP 39064 | NSO | 11581.938 | −28,709 | 11,214 | 1,846 | 470 | 26 | CO |
| HD 68988 | HIP 40687 | NSO | 12064.768 | −69,520 | 11,919 | 513 | 120 | 13 | C |
| HD 72780 | HIP 42112 | NSO | 11626.698 | 28,059 | 11,693 | 412 | 169 | 10 | L |
| HD 73512 | HIP 42418 | NSO | 11171.030 | 10,737 | 11,199 | 56 | 29,558 | 2 | |
| HD 73668 | HIP 42488 | NSO | 11229.858 | −21,456 | 11,270 | 775 | 112 | 24 | L |
| HD 81133 | HIP 45995 | NSO | 10546.835 | 11,635 | 10,624 | 400 | 2,456 | 3 | |
| HD 86680 | HIP 49060 | NSO | 11974.896 | 7,317 | 11,935 | 91 | 4,728 | 8 | L |
| HD 89744 | HIP 50786 | NSO | 11698.722 | −5,401 | 11,675 | 737 | 166 | 45 | C |
| HD 94340 | HIP 53217 | NSO | 10545.893 | −15,203 | 10,518 | 84 | 5,126 | 3 | |
| HD 100167 | HIP 56257 | NSO | 11242.931 | −27,596 | 11,037 | 411 | 4,649 | 2 | |
| HD 101206 | HIP 56829 | M | 11551.097 | 40,597 | 11,107 | 945 | 22,398 | 5 | C |
| HD 101563 | HIP 57001 | NSO | 10955.788 | −9,602 | 10,745 | 494 | 656 | 5 | L |
| HD 102540 | HIP 57574 | NSO | 10955.792 | −4,260 | 10,745 | 494 | 4,055 | 5 | L |
| HD 103829 | HIP 58318 | NSO | 12101.779 | −552 | 11,987 | 202 | 128 | 8 | L |
| HD 106252 | HIP 59610 | NSO | 11628.817 | 15,368 | 11,767 | 1,209 | 114 | 15 | C |
| HD 111312 | HIP 62505 | NSO | 11582.041 | 623 | 11,186 | 1,119 | 1,094 | 5 | |
| HD 114762 | HIP 64426 | NSO | 9858.733 | 49,576 | 9,723 | 4,069 | 434 | 66 | C |

Table 2—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | JD (−2,440,000) | RV (m s$^{-1}$) | <JD> (−2,440,000) | $\Delta T$ (days) | $\sigma_{\rm rms}$ (m s$^{-1}$) | $N$ | Com |
|---|---|---|---|---|---|---|---|---|---|
| HD 117126 | HIP 65708 | NSO | 11026.672 | $-7,637$ | $10,975$ | 195 | $1,685$ | 5 | |
| HD 117176 | HIP 65721 | NSO | 9124.792 | $5,036$ | $9,853$ | $4,928$ | 182 | 106 | C |
| HD 117635 | HIP 65982 | NSO | 10954.918 | $-51,998$ | $10,752$ | 492 | 336 | 3 | |
| HD 120136 | HIP 67275 | NSO | 8779.738 | $-16,542$ | $9,558$ | $5,097$ | 340 | 93 | C |
| HD 120690 | HIP 67620 | NSO | 10606.790 | $7,159$ | $10,535$ | 144 | 984 | 2 | |
| HD 122676 | HIP 68634 | NSO | 11004.712 | $-8,017$ | $10,955$ | 196 | $1,419$ | 3 | |
| HD 122742 | HIP 68682 | NSO | 10504.970 | $-8,081$ | $8,986$ | $3,545$ | $3,712$ | 24 | CO |
| HD 129814 | HIP 72043 | NSO | 11680.036 | $6,727$ | $11,474$ | $1,266$ | 101 | 13 | L |
| HD 131511 | HIP 72848 | NSO | 9914.784 | $-31,806$ | $8,966$ | $2,866$ | $8,832$ | 20 | CO |
| HD 131976 | HIP 73182 | M | 10181.904 | $35,628$ | $9,298$ | $2,958$ | $10,056$ | 9 | C |
| HD 136118 | HIP 74948 | NSO | 11627.902 | $-3,062$ | $11,660$ | $1,326$ | 136 | 40 | C |
| HD 136580 | HIP 75039 | NSO | 11627.962 | $-25,626$ | $11,463$ | $1,291$ | 204 | 19 | L |
| HD 140913 | HIP 77152 | NSO | 11304.900 | $-18,679$ | $10,474$ | $1,511$ | 742 | 12 | CO |
| HD 142229 | HIP 77810 | NSO | 11704.927 | $-21,443$ | $11,660$ | 758 | 486 | 9 | L |
| HD 142267 | HIP 77801 | NSO | 10603.902 | $35,666$ | $10,440$ | 328 | $3,931$ | 2 | |
| HD 145206 | HIP 79195 | NSO | 11407.673 | $-36,942$ | $11,379$ | 53 | $2,180$ | 3 | |
| HD 152311 | HIP 82621 | NSO | 10713.733 | $-21,385$ | $10,622$ | 166 | 354 | 3 | |
| HD 157681 | HIP 84950 | NSO | 11811.653 | $-7,723$ | $11,449$ | 299 | 133 | 6 | |
| HD 158222 | HIP 85244 | NSO | 10982.968 | $-14,301$ | $11,103$ | 413 | $2,698$ | 3 | |
| HD 160346 | HIP 86400 | NSO | 10656.768 | $15,947$ | $9,951$ | $1,456$ | $3,724$ | 7 | |
| HD 161198 | HIP 86722 | NSO | 10666.816 | $23,951$ | $10,516$ | 391 | 351 | 3 | |
| HD 161797 | HIP 86974 | NSO | 11372.852 | $-17,004$ | $9,872$ | $4,324$ | 210 | 53 | L |
| HD 166435 | HIP 88945 | NSO | 11026.782 | $-14,403$ | $11,017$ | 23 | 105 | 4 | |
| HD 167665 | HIP 89620 | NSO | 11702.962 | $7,693$ | $11,320$ | $1,879$ | 322 | 16 | L |

Table 2—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | JD (−2,440,000) | RV (m s$^{-1}$) | <JD> (−2,440,000) | $\Delta T$ (days) | $\sigma_{\rm rms}$ (m s$^{-1}$) | $N$ | Com |
|---|---|---|---|---|---|---|---|---|---|
| HD 168443 | HIP 89844 | NSO | 11071.770 | −48,636 | 10,976 | 825 | 182 | 37 | C |
| HD 169822 | HIP 90355 | NSO | 11793.810 | −18,274 | 11,824 | 817 | 312 | 22 | C |
| HD 171115 | HIP 91004 | NSO | 11780.777 | −2,291 | 11,425 | 106 | 175 | 5 | |
| HD 173667 | HIP 92043 | NSO | 8437.936 | 23,043 | 9,353 | 5,165 | 124 | 91 | |
| HD 174457 | HIP 92418 | NSO | 11755.929 | −25,820 | 11,700 | 755 | 908 | 9 | CO |
| HD 175518 | HIP 92918 | NSO | 11014.815 | −66,763 | 11,019 | 22 | 1,946 | 6 | |
| HD 183255 | HIP 95575 | M | 10666.899 | −68,922 | 10,606 | 119 | 10,961 | 3 | |
| HD 184860 | HIP 96471 | NSO | 11793.808 | 63,944 | 11,373 | 1,845 | 514 | 21 | C |
| HD 186704 | HIP 97255 | NSO | 11411.863 | −15,117 | 11,383 | 70 | 3,021 | 4 | L |
| HD 188376 | HIP 98066 | NSO | 10713.746 | −39,136 | 10,492 | 430 | 11,891 | 4 | |
| HD 190406 | HIP 98819 | NSO | 11411.872 | 4,757 | 9,477 | 4,364 | 121 | 52 | L |
| HD 190771 | HIP 98921 | NSO | 11826.657 | −25,063 | 11,478 | 1,072 | 136 | 13 | L |
| HD 195019 | HIP 100970 | NSO | 11792.783 | −91,582 | 11,214 | 788 | 188 | 50 | C |
| HD 197214 | HIP 102264 | NSO | 10713.839 | −21,884 | 10,565 | 437 | 4,096 | 4 | |
| HD 199918 | HIP 103735 | NSO | 10957.090 | 52,560 | 10,661 | 591 | 3,443 | 5 | |
| HD 200565 | HIP 103983 | NSO | 11792.788 | −2,425 | 11,702 | 793 | 137 | 24 | L |
| HD 208527 | HIP 108296 | NSO | 10304.870 | 4,154 | 10,102 | 2,550 | 133 | 30 | |
| HD 208776 | HIP 108473 | NSO | 11440.695 | 31,491 | 11,150 | 435 | 601 | 10 | CO |
| HD 209779 | HIP 109110 | NSO | 11751.921 | −17,310 | 11,543 | 335 | 1,722 | 6 | L |
| HD 215578 | SAO 108160 | NSO | 11439.882 | −16,217 | 11,208 | 1,823 | 1,323 | 21 | L |
| HD 217303 | HIP 113562 | NSO | 11782.895 | −36,049 | 11,439 | 96 | 205 | 7 | |
| HD 219420 | HIP 114834 | NSO | 11049.844 | −22,295 | 11,027 | 44 | 2,813 | 5 | L |
| HD 220077 | HIP 115279 | NSO | 11707.121 | 1,521 | 11,727 | 821 | 132 | 20 | |
| HD 223084 | HIP 117258 | NSO | 11706.125 | 2,164 | 11,310 | 701 | 180 | 33 | L |

Table 2—Continued

| Primary Name | Alternate Name | Ref (NSO/M) | JD (−2,440,000) | RV (m s$^{-1}$) | <JD> (−2,440,000) | $\Delta T$ (days) | $\sigma_{\rm rms}$ (m s$^{-1}$) | $N$ | Com |
|---|---|---|---|---|---|---|---|---|---|
| GJ 84 | HIP 9724 | M | 11583.710 | 23,335 | 11,419 | 1,294 | 867 | 11 | CO |
| GJ 285 | HIP 37766 | M | 11629.714 | 26,531 | 10,322 | 2,280 | 299 | 7 | |
| GJ 494 | HIP 63510 | M | 12127.800 | −11,228 | 12,004 | 546 | 110 | 15 | A |
| GJ 595 | HIP 76901 | M | 11584.166 | 84,921 | 11,886 | 898 | 4,624 | 10 | CO |
| GJ 623 | HIP 80346 | M | 10181.925 | −26,284 | 9,208 | 3,222 | 1,238 | 12 | CO |
| GJ 873 | HIP 112460 | M | 11447.748 | 413 | 9,714 | 4,401 | 124 | 17 | |
| GJ 876 | HIP 113020 | M | 11072.938 | −1,591 | 10,514 | 4,016 | 181 | 53 | C |
| HIP 35519 | SAO 115271 | NSO | 11552.969 | 11,636 | 11,625 | 803 | 1,529 | 5 | |
| HIP 52940 | BD +13 2311B | NSO | 11706.829 | 25,212 | 11,574 | 1,137 | 1,310 | 15 | CO |
| HIP 57450 | BD +51 1696 | NSO | 11679.832 | 64,092 | 11,520 | 810 | 1,211 | 10 | |
| CD -32 8503B | ··· | NSO | 11679.866 | 20,940 | 11,264 | 724 | 319 | 5 | |

[a] Stars with $\sigma_{\rm rms} \geq 100$ m s$^{-1}$.

Table 3. Orbital Parameters

| Star | $P$ (days) | $K$ (km s$^{-1}$) | $e$ | $\omega$ (deg) | $T_0$ (-2450000) | $M_1$ ($M_\odot$) | $M_{2,\rm min}$ ($M_{\rm Jup}$) | $a_{\rm min}$ (AU) | $f(M)$ ($M_\odot$) | Other References |
|---|---|---|---|---|---|---|---|---|---|---|
| HD 4747 | 6832 (653) | 0.65 (0.1) | 0.64 (0.06) | 257 (5) | 453 (473) | 0.83 | 42.3 | 6.7 | 0.000087 | |
| HD 7483 | 701.42 (0.01) | 3.02 (0.01) | 0.12 (0.003) | 313 (0.5) | 1791.1 (0.7) | 0.92 | 136 | 1.6 | 0.0020 | |
| HD 30339 | 15.0778 (0.0003) | 5.94 (0.01) | 0.25 (0.001) | 43 (1) | 1881.199 (0.0003) | 1.10 | 77.8 | 0.13 | 0.00030 | |
| HD 34101 | 803.51 (0.03) | 3.59 (0.01) | 0.08 (0.001) | 275 (1) | 690 (2) | 0.87 | 167 | 1.7 | 0.0038 | |
| HD 39587 | 5136 (12) | 1.85 (0.02) | 0.45 (0.01) | 111 (1) | 1463 (17) | 0.89 | 143 | 5.9 | 0.0024 | |
| HD 65430 | 3138 (342) | 1.11 (0.2) | 0.32 (0.02) | 77 (1) | 3267 (302) | 0.78 | 67.8 | 4.0 | 0.00038 | |
| HD 122742 | 3617 (7) | 6.41 (0.01) | 0.48 (0.001) | 183 (0.1) | 2030 (3) | 0.96 | 545 | 5.3 | 0.0670 | 1,2,3,4,5 |
| HD 131511 | 125.396 (0.001) | 19.10 (0.01) | 0.51 (0.001) | 219 (0.1) | 203.407 (0.004) | 0.78 | 455 | 0.52 | 0.0580 | 6,7 |
| HD 140913 | 147.968 (0.001) | 1.94 (0.01) | 0.54 (fixed) | 18 (1) | 1321.42 (0.02) | 0.98 | 43.2 | 0.55 | 0.000067 | 8,9,10,11 |
| HD 174457 | 840.80 (0.05) | 1.25 (0.01) | 0.23 (0.01) | 139 (1) | 2020 (4) | 1.19 | 65.8 | 1.9 | 0.00016 | |
| HD 208776 | 2624 (371) | 5.46 (1.3) | 0.27 (0.04) | 245 (12) | 690 (100) | 1.24 | 511 | 4.2 | 0.0400 | |
| GJ 84 | 6818 (2491) | 2.18 (0.2) | 0.44 (0.08) | 238 (10) | 1777 (41) | 0.39 | 115 | 5.6 | 0.0054 | |
| GJ 595 | 62.6277 (0.0001) | 6.57 (0.01) | 0.26 (0.001) | 253 (0.1) | 1999.50 (0.02) | 0.28 | 60.0 | 0.22 | 0.0017 | |
| GJ 623 | 1366.1 (0.4) | 2.08 (0.04) | 0.67 (0.01) | 251 (1) | 1298 (10) | 0.31 | 42.0 | 1.7 | 0.00053 | 12,13,14,15,16,17 |
| HIP 52940 | 1393.5 (0.2) | 2.15 (0.01) | 0.37 (0.003) | 199 (1) | 1541 (2) | 1.12 | 126 | 2.6 | 0.0011 | |

References. — (1) Duquennoy & Mayor 1991; (2) Martin et al. 1998; (3) Blazit et al. 1987; (4) Kamper 1987; (5) Wagman 1949; (6) Beavers & Salzer 1983; (7) Kamper & Lyons 1981; (8) Halbwachs et al. 2000; (9) Mazeh et al. 1996; (10) Oetiker et al. 2001; (11) Mayor et al. 1997; (12) McCarthy 1986; (13) Barbieri et al. 1996; (14) Henry & McCarthy 1993; (15) Marcy & Moore 1989; (16) McCarthy & Henry 1987; (17) Lippincott & Borgman 1978

Table 4. Stars With Linear Trends

| Primary Name | Alternate Name | Slope (m s$^{-1}$ per day) | N Obs |
|---|---|---|---|
| HD 3770 | HIP 3169 | 0.41 (0.02) | 13 |
| HD 3795 | HIP 3185 | 0.363 (0.003) | 24 |
| HD 11909 | HIP 9110 | 23.7 (0.8) | 4 |
| HD 14802 | HIP 11072 | -1.73 (0.02) | 7 |
| HD 17037 | HIP 12764 | -1.5 (0.1) | 14 |
| HD 21017 | HIP 15861 | -11.3 (0.3) | 5 |
| HD 28388 | HIP 20802 | -2.7 (0.3) | 6 |
| HD 29461 | HIP 21654 | 0.58 (0.02) | 9 |
| HD 30649[a] | HIP 22596 | 0.27 (0.02) | 15 |
| HD 31412 | HIP 22919 | 0.414 (0.009) | 12 |
| HD 50639 | HIP 33109 | -0.51 (0.01) | 8 |
| HD 72780 | HIP 42112 | -0.91 (0.03) | 10 |
| HD 73668 | HIP 42488 | -0.69 (0.02) | 24 |
| HD 86680[b] | HIP 49060 | 112 (7) | 8 |
| HD 101563 | HIP 57001 | -3.22 (0.07) | 5 |
| HD 102540 | HIP 57574 | -19.9 (0.5) | 5 |
| HD 103829 | HIP 58318 | -2.28 (0.07) | 8 |
| HD 129814 | HIP 72043 | -0.224 (0.004) | 13 |
| HD 136580 | HIP 75039 | -0.47 (0.02) | 18 |
| HD 142229 | HIP 77810 | -1.47 (0.06) | 9 |
| HD 161797 | HIP 86974 | -0.147 (0.006) | 42 |
| HD 167665 | HIP 89620 | -0.59 (0.02) | 16 |
| HD 186704[b] | HIP 97255 | -88 (8) | 4 |
| HD 190406 | HIP 98819 | -0.066 (0.001) | 58 |
| HD 190771 | HIP 98921 | 0.30 (0.02) | 13 |
| HD 200565 | HIP 103983 | -0.54 (0.01) | 24 |
| HD 209779 | HIP 109110 | -10.7 (0.1) | 6 |
| HD 215578 | SAO 108160 | -2.51 (0.03) | 21 |
| HD 219420 | HIP 114834 | -135.5 (0.5) | 5 |
| HD 223084 | HIP 117258 | -0.85 (0.04) | 33 |

[a]Exhibits some additional positive curvature

[b]Exhibits some additional negative curvature