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# FOUR NEW PLANETS ORBITING METAL-ENRICHED STARS[1]

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## ABSTRACT

We report the detection of four new extrasolar planets from the Anglo-Australian Planet Search orbiting the metal-enriched stars HD 73526, HD 76700, HD 30177, and HD 2039. The planetary companion of HD 76700 has a circular orbit with a period of 3.98 days. With $M \sin i = (0.197 \pm 0.017) M_{\rm J}$, or $0.69 M_{\rm SAT}$, it is one of the lowest minimum mass extrasolar planets yet detected. The remaining planets all have elliptical orbits with periods ranging from 190.5 days to 4.4 yr. All four planets have been found orbiting hosts from a subsample of 20 metal-enriched and faint ($V < 9$) stars, which was added to the Anglo-Australian Planet Search's magnitude-limited $V < 7.5$ main sample in 1999 October. These stars were selected for metal enrichment on the basis of their Strömgren photometry, and their enrichment has been subsequently confirmed by detailed spectroscopic analysis.

*Subject headings:* planetary systems — stars: individual (HD 2039, HD 30177, HD 73526, HD 76700)

## 1. INTRODUCTION

The Anglo-Australian Planet Search (AAPS) is a long-term planet detection program that aims to perform extrasolar planet detection and measurement at the highest possible precision. Together with a program using similar techniques on the Lick 3 m and Keck I 10 m telescopes (Fischer et al. 2001; Vogt et al. 2000), AAPS provides all-sky planet search coverage for inactive F, G, K, and M dwarfs down to a magnitude limit of $V = 7.5$. Initial results from this program (Tinney et al. 2001, 2002a; Butler et al. 2001, 2002b; Jones et al. 2002a, 2002b) demonstrate that it achieves long-term, systematic velocity precisions of 3 m $s^{-1}$ or better, for suitably stable stars, down to our main sample magnitude limit of $V = 7.5$.

AAPS is being carried out on the 3.9 m Anglo-Australian Telescope (AAT), using the University College London Echelle Spectrograph (UCLES) and an $I_2$ absorption cell. UCLES is operated in its 31 line $mm^{-1}$ mode. Prior to 2001 September, it was used with an MIT/LL 2048×4096 15 $\mu$m pixel CCD, and since then has been used with an EEV 2048×4096 13.5 $\mu$m pixel CCD. Our target sample includes 178 F, G, and K stars with $\delta < -20°$ and $V < 7.5$. Where age/activity information is available from $R'_{HK}$ indices—see, for example, Henry et al. (1996) and Tinney et al. (2002b)—we require target stars to have $\log R'_{HK} > -4.5$ (corresponding to ages greater than 3 Gyr). The observing and data-processing procedures follow that described in Butler et al. (1996, 2001).

In addition to our primary sample of $V < 7.5$ dwarfs, a small subsample of 20 fainter dwarfs (down to $V < 9$) was added in 1999 October, following suggestions that metal-enriched stars seemed to be preferentially revealing planets (see, e.g., Laughlin 2000 and references therein). These stars all had *uvby* photometry suggesting metal enrichment above solar abundances ([Fe/H] $\gtrsim 0.1$). All stars in this fainter subsample were observed with a maximum exposure time of 300 s, regardless of observing conditions. As a result, the velocity precisions achieved for these targets are not as high as those demonstrated for the AAPS main sample (Jones et al. 2002a; Butler et al. 2001).

## 2. CHARACTERISTICS OF THE HOST STARS

The characteristics for each of the four host stars are summarized in Table 1; please refer to the table notes for references.

HD 30177 (HIP 21850, SAO 233633) is a chromospherically inactive G8 V star, which was found to be photometrically stable by the *Hipparcos* satellite. Suitably calibrated Strömgren *uvby* photometry from the General Catalog of Photometric Data[10] (Hauck & Mermilliod 1997) permits the estimation of HD 30177's metallicity. We have used both the commonly used *uvby* calibration of Schuster & Nissen (1989) and also a more recent recalibration by Haywood (2002). The former provides systematically lower metallicities for these stars by ~0.07 dex. A detailed metallicity analysis has been performed for all the G dwarfs in the AAPS (Bond et al. 2003, in preparation), and the result from that study is also indicated in the table. The $b-y$ colors of these stars also permit the estimation of effective temperatures using the calibration of Hauck & Mermilliod (1997) and Olsen (1984). From HD 30177's $\log R'_{HK} = -5.08$ we estimate intrinsic stellar velocity jitter to be in the range 2–4 m $s^{-1}$ (Saar et al. 1998).

[1] Based on observations obtained at the Anglo-Australian Telescope, Siding Spring, Australia.

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[10] Data obtained directly from http://obswww.unige.ch/gcpd/gcpd.html.

TABLE 1

Stellar Parameters

| Parameter | HD 30177 | HD 73526 | HD 76700 | HD 2039 | Reference |
|---|---|---|---|---|---|
| log $R'_{HK}$ | −5.08 | ... | <−4.9 | −4.91 | 1 |
| *Hipparcos* $N_{\rm obs}$ | 105 | 137 | 109 | 147 | 2 |
| *Hipparcos* $\sigma$ | 0.017 | 0.02 | 0.012 | 0.022 | 2 |
| *Hipparcos* $\pi$ (mas) | 18.3 ± 0.8 | 10.6 ± 1.0 | 16.8 ± 0.7 | 11.1 ± 1.1 | 2 |
| $M_V$ | 4.72 ± 0.09 | 4.1 ± 0.2 | 4.3 ± 0.1 | 4.25 ± 0.24 | 2 |
| $M_{\rm Bol}$ | 4.36 ± 0.10 | 3.7 ± 0.2 | 3.9 ± 0.2 | 4.22 ± 0.25 | 3 |
| Spectral type | G8 V | G6 V | G6–G8 V | G2/G3 IV/V | 4 |
| [Fe/H] (*uvby*) | +0.20 ± 0.16 | +0.10 ± 0.16 | +0.14 ± 0.16 | +0.10 ± 0.16 | 5 |
| [Fe/H] (*uvby*) | +0.32 ± 0.16 | +0.16 ± 0.16 | +0.19 ± 0.16 | +0.17 ± 0.16 | 6 |
| [Fe/H] (spec) | +0.19 ± 0.09 | +0.11 ± 0.10 | +0.10 ± 0.11 | +0.10 ± 0.11 | 7 |
| $T_{\rm eff}$ $b-y$ (K) | 5320 ± 20 | 5450 ± 20 | 5423 ± 20 | 5675 ± 20 | 8 |
| Mass ($M_\odot$) | 0.95 ± 0.05 | 1.05 ± 0.05 | 1.00 ± 0.05 | 0.98 ± 0.05 | 9 |
| Age (Gyr) | 11.4–17.0 | 7.4–11.0 | 9.2–12.8 | 2–10 | 9 |

References.—(1) Tinney et al. 2002b. See text for HD 76700; (2) ESA 1997; (3) Allen & Cox 2000; (4) Houck & Cowley 1975; Houck 1978. See text for HD 76700; (5) Data from Hauck & Mermilliod 1997 and calibration from Schuster & Nissen 1989; (6) Eqs. (2)–(4) of Haywood 2002; (7) Bond et al. 2002; (8) Hauck & Mermilliod 1997; Olsen 1984; (9) See § 2 and Fig. 1.

Figure 1 shows evolutionary tracks at [Fe/H] = +0.2 and +0.1 for stars of near-solar mass from the compilation of Girardi et al. (2000). The [Fe/H] = +0.1 tracks were obtained by interpolation between the [Fe/H] = +0.2 and [Fe/H] = 0.0 tracks in Girardi et al. (2000). On the basis of these models and the metallicity measurements for HD 30177, its mass is estimated to be $0.95 \pm 0.05$ $M_\odot$, and it would appear (in common with HD 73526 and HD 76700) to be beginning its evolution off the main sequence. Estimated age ranges are also indicated in Table 1.

HD 73526 (HIP 42282, SAO 220191) is a G6 V dwarf. No $R'_{HK}$ estimate is currently available. *Hipparcos* finds it to be photometrically stable. Metallicity, $T_{\rm eff}$, and mass and age estimates (based on the tracks in Fig. 1) are shown in Table 1 as for HD 30177.

HD 76700 (HIP 43686, SAO 250370, LTT 3291) is cataloged as a G6 V dwarf by SIMBAD, as G5 by the Henry Draper catalog (Cannon & Pickering 1918–24), and as G8 V by *Hipparcos* (ESA 1997). The *Hipparcos* $B-V$ color (+0.745) would indicate a G8 spectral type is more likely than G5 or G6, although the GCPD $b-y$ color (Hauck & Mermilliod 1997) would indicate that a G6 type is more appropriate. *Hipparcos* found it to be photometrically stable. Metallicity, $T_{\rm eff}$, and mass and age estimates (based on the tracks in Fig. 1) are shown in Table 1 as before. There is no published log $R'_{HK}$ measurement for HD 76700. Because the velocity amplitude observed in this star is small ($26 \pm 2$ m s$^{-1}$), a Ca H and K spectrum was acquired to determine the level at which our results could be affected by velocity jitter. Figure 2 shows this spectrum for HD 76700 compared

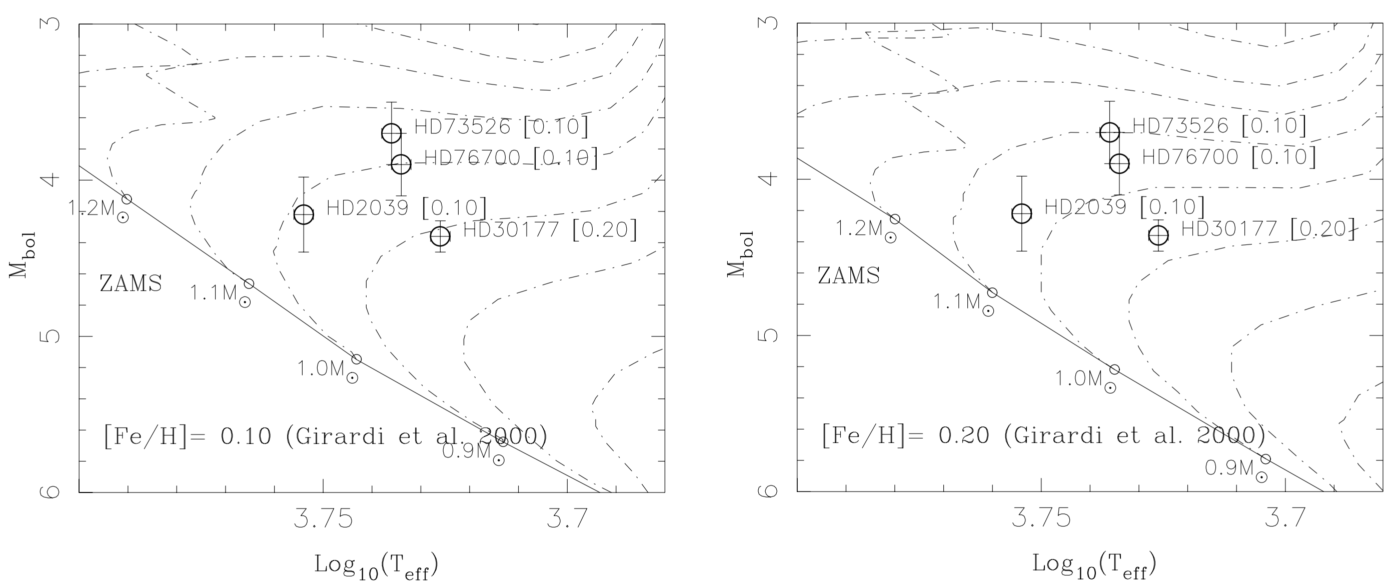


Fig. 1.—Evolutionary tracks from the compilation of Girardi et al. (2000). The zero-age main sequence (ZAMS) is shown as a solid line, with evolutionary models at the indicated masses shown as dot-dashed lines. The open circles and uncertainties indicate the stars under discussion in this paper, with their estimated uncertainties indicated in brackets. The [Fe/H] = +0.2 tracks are directly from Girardi et al. (2000), while the [Fe/H] = +0.1 tracks were obtained by interpolation between the cataloged [Fe/H] = +0.2 and 0.0 models.

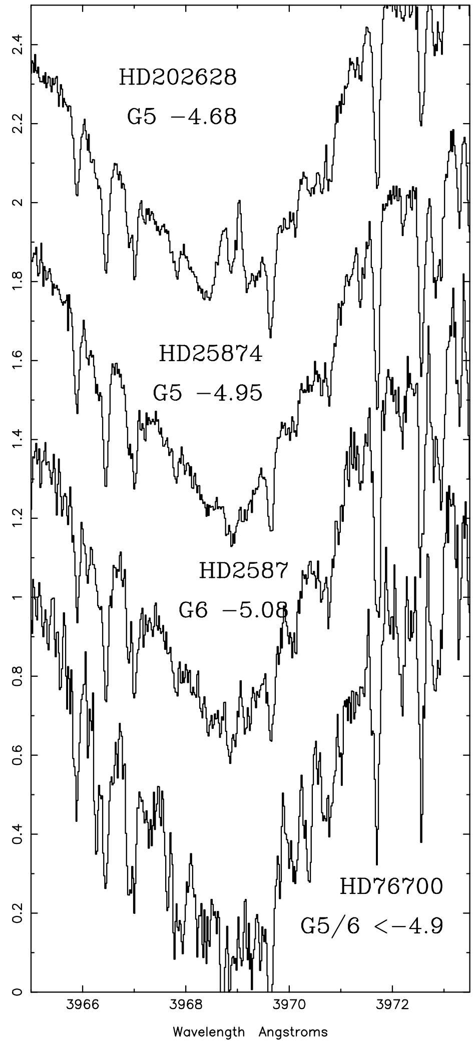


FIG. 2.—UCLES spectrum in the region of the Ca H line for HD 76700 and several comparison objects with log $R'_{HK}$ measurements from Tinney et al. (2002b). For each object the spectral type and measured log $R'_{HK}$ value are shown. On the basis of on these spectra we assign an upper limit to the log $R'_{HK}$ value for HD 76700 of −4.9.

to those for several objects of similar spectral type, along with their spectral types and log $R'_{HK}$ values (Tinney et al. 2002b). HD 76700 shows no evidence for a line reversal. Based on this comparison we assign an upper limit to log $R'_{HK}$ for HD 76700 of −4.9, from which we estimate its intrinsic stellar velocity jitter to be in the range 3–6 m s$^{-1}$ or less (Saar et al. 1998).

HD 2039 (HIP 1931, SAO 23205) is a chromospherically inactive G2/G3 IV/V star, which was found to be photometrically stable by *Hipparcos*. There are multiple measures of this star's Strömgren *uvby* photometry, the mean of which indicates the metallicity, $T_{\rm eff}$, and mass estimates (based on the tracks in Fig. 1) shown in Table 1.

## 3. RADIAL VELOCITY OBSERVATIONS AND ORBITAL SOLUTIONS

Fifteen observations of HD 30177 are listed in Table 2. The column labeled "Uncertainty" is the velocity uncertainty produced by our least-squares fitting procedure. This fit simultaneously determines the Doppler shift and the spectrograph point-spread function (PSF) for each observation made through the iodine cell, given an iodine absorption spectrum and an "iodine-free" template spectrum of the object (Butler et al. 1996). The uncertainty is derived for each measurement by taking the mean of 400 useful spectral regions (each 2 Å long) from each exposure. This uncertainty includes the effects of photon counting uncertainties, residual errors in the spectrograph PSF model, and variation in the underlying spectrum between the template and "iodine" epochs. All velocities are measured relative to the zero point defined by the template observation. Only observations in which the uncertainty is less than twice the median uncertainty are listed. These data are shown in Figure 3. The figure shows the best-fit Keplerian model for the data, with the resultant orbital parameters listed in Table 3. Because of HD 30177's faintness compared

TABLE 2

VELOCITIES FOR HD 30177

| JD[a] (−2,451,000) | RV[a] (m s$^{-1}$) | Uncertainty (m s$^{-1}$) |
|---|---|---|
| 118.0974 | 77.9 | 10.9 |
| 119.1924 | 37.2 | 17.1 |
| 121.1514 | 49.7 | 14.8 |
| 157.1022 | 95.4 | 8.6 |
| 211.9834 | 92.4 | 11.3 |
| 212.9660 | 92.5 | 10.4 |
| 213.9995 | 92.3 | 9.1 |
| 214.9506 | 104.0 | 9.3 |
| 525.9973 | 26.9 | 6.9 |
| 630.9156 | −0.5 | 9.9 |
| 768.3296 | −61.5 | 10.2 |
| 921.1075 | −117.8 | 10.2 |
| 1127.3205 | −168.5 | 12.4 |
| 1188.2532 | −172.9 | 7.8 |
| 1358.9181 | −173.4 | 7.8 |

[a] Julian Dates (JD) are barycentric. Radial velocities (RV) are barycentric but have an arbitrary zero point determined by the radial velocity of the template, as described in § 3.

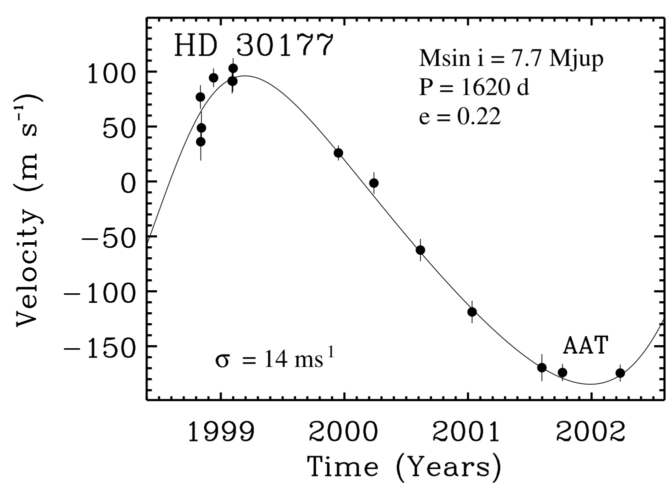


FIG. 3.—AAT Doppler velocities for HD 30177 from 1998 November to 2002 May. The solid line is a best-fit Keplerian with the parameters shown in Table 3. The rms of the velocities about the fit is 14 m s$^{-1}$. Assuming 0.95 $M_\odot$ for the primary, the minimum ($M \sin i$) mass of the companion is $(7.7 \pm 1.5) M_{\rm J}$, and the semimajor axis is 2.6 ± 0.9 AU.

TABLE 3
ORBITAL PARAMETERS

| Parameter | HD 30177 | HD 73526 | HD 76700 | HD 2039 |
|---|---|---|---|---|
| Orbital period $P$ (days) | $1620 \pm 800$ | $190.5 \pm 3.0$ | $3.971 \pm 0.001$ | $1183 \pm 150$ |
| Velocity amplitude $K$ (m $s^{-1}$) | $140 \pm 10$ | $108 \pm 8$ | $25 \pm 2$ | $130 \pm 20$ |
| Eccentricity $e$ | $0.22 \pm 0.17$ | $0.34 \pm 0.08$ | $0.00 \pm 0.04$ | $0.67 \pm 0.1$ |
| $\omega$ (deg) | $288 \pm 40$ | $207 \pm 30$ | ... | $333 \pm 15$ |
| $a_1 \sin i$ (km) | $(3.0 \pm 1.5) \times 10^6$ | $(0.265 \pm 0.01) \times 10^6$ | $1381 \pm 1.2$ | $(1.56 \pm 0.30) \times 10^6$ |
| Periastron time (JD−2,450,000) | $1027 \pm 200$ | $951 \pm 12$ | $1212.9 \pm 0.1$ | $1183 \pm 150$ |
| $M \sin i$ ($M_J$) | $7.7 \pm 1.5$ | $3.0 \pm 0.3$ | $0.197 \pm 0.017$ | $4.9 \pm 1.0$ |
| $a$ (AU) | $2.6 \pm 0.9$ | $0.66 \pm 0.05$ | $0.049 \pm 0.004$ | $2.2 \pm 0.2$ |
| rms about fit (m $s^{-1}$) | 14 | 18 | 6.2 | 15 |

to the AAPS main sample, the residuals about the fit (14 m $s^{-1}$) are significantly higher than the baseline 3 m $s^{-1}$ precision level demonstrated for the main sample (Butler et al. 2001; Jones et al. 2002a).

Eighteen observations of HD 73526 are listed in Table 4, and they are shown in Figure 4 along with a Keplerian fit to the data with the orbital parameters listed in Table 3. Note again the larger residuals (17 m $s^{-1}$) compared to the AAPS main sample. Twenty-four observations of HD 76700 are listed in Table 5, and they are shown in Figure 5 along with a Keplerian fit to the data with the orbital parameters listed in Table 3. The 36 observations of HD 2039 are listed in Table 6, and they are shown in Figure 6 along with a Keplerian fit to the data with the orbital parameters listed in Table 3.

## 4. DISCUSSION

The resultant minimum companion mass for HD 76700 is $M \sin i = (0.197 \pm 0.017) M_J$, with an orbital semimajor axis $a = 0.049 \pm 0.004$ AU and eccentricity $e = 0.00 \pm 0.04$. This zero eccentricity is consistent with the expectation that a planet with a period of just $3.971 \pm 0.001$ days will almost certainly lie in an orbit that has been tidally circularized (Marcy & Butler 1998). The resulting orbital parameters for HD 76700 place it amongst the planetary companions with the lowest known minimum masses. HD 76700 joins HD 49674, HD 16141, HD 168746, and HD 46375 (Butler et al. 2003; Marcy, Butler, & Vogt 2000; Pepe et al. 2002) in the group of extrasolar planetary companions with measured minimum masses less than a Saturn mass ($0.299 M_J$).

The remaining three extrasolar planets all have elliptical orbits, although the ellipticity of the orbit for the companion to HD 30177 ($e = 0.22 \pm 0.17$) is not different from zero with great significance. As further data are acquired over the coming years this parameter will become far better constrained, and it is possible that this extrasolar planet could turn out to be in a substantially circular orbit. If so, this system would join with the other known nearly circular systems with gas giant planets lying in orbits between where the Earth and Jupiter lie in our own solar system ($\epsilon$ Ret, HD 4208, the outer components of 47 UMa, HD 28185 [Jones et al. 2002a]). These extrasolar planets would seem to indicate that gas giants exist in nearly circular orbits with semimajor axes all the way out to, and beyond, that of Jupiter, as confirmed recently by the detection of the outer planet in the 55 Cnc system (Marcy et al. 2002).

Of the 20 stars included in our metal-enriched ([Fe/H] $\gtrsim 0.1$) subsample along with our main sample in

TABLE 4
VELOCITIES FOR HD 73526

| JD[a] (−2,451,000) | RV[a] (m $s^{-1}$) | Uncertainty (m $s^{-1}$) |
|---|---|---|
| 212.1302 | 23.5 | 12.9 |
| 213.1314 | 66.8 | 13.7 |
| 214.2389 | 61.6 | 14.9 |
| 236.1465 | 48.4 | 10.9 |
| 630.0280 | 35.5 | 11.0 |
| 717.9000 | −120.7 | 12.8 |
| 920.1419 | −32.0 | 13.4 |
| 984.0378 | 78.0 | 9.3 |
| 1009.0976 | 71.8 | 9.7 |
| 1060.8844 | −58.9 | 7.4 |
| 1091.8465 | −149.8 | 13.6 |
| 1386.9003 | 51.8 | 6.8 |
| 1387.8921 | 64.0 | 6.2 |
| 1420.9248 | −14.4 | 7.8 |
| 1421.9199 | −9.6 | 6.5 |
| 1422.8602 | −9.8 | 7.3 |
| 1424.9237 | −19.1 | 10.4 |
| 1454.8529 | −109.0 | 6.3 |

[a] As for Table 2.

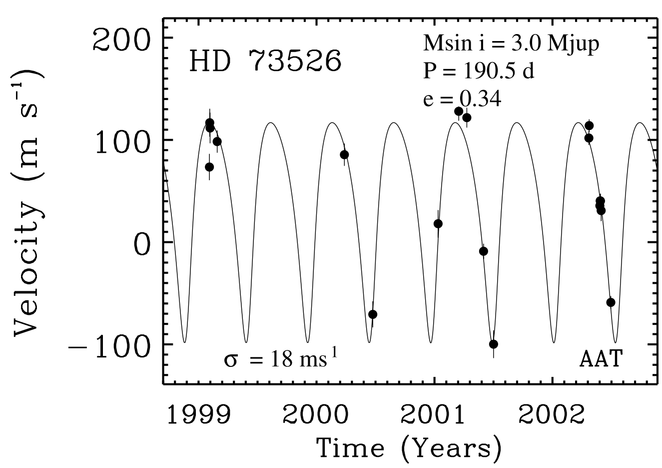


FIG. 4.—AAT Doppler velocities for HD 73526 from 1999 January to 2002 June. The solid line is a best-fit Keplerian with the parameters shown in Table 3. The rms of the velocities about the fit is 18 m $s^{-1}$. Assuming 1.05 $M_\odot$ for the primary, the minimum ($M \sin i$) mass of the companion is $(3.0 \pm 0.3) M_J$, and the semimajor axis is $0.66 \pm 0.05$ AU.

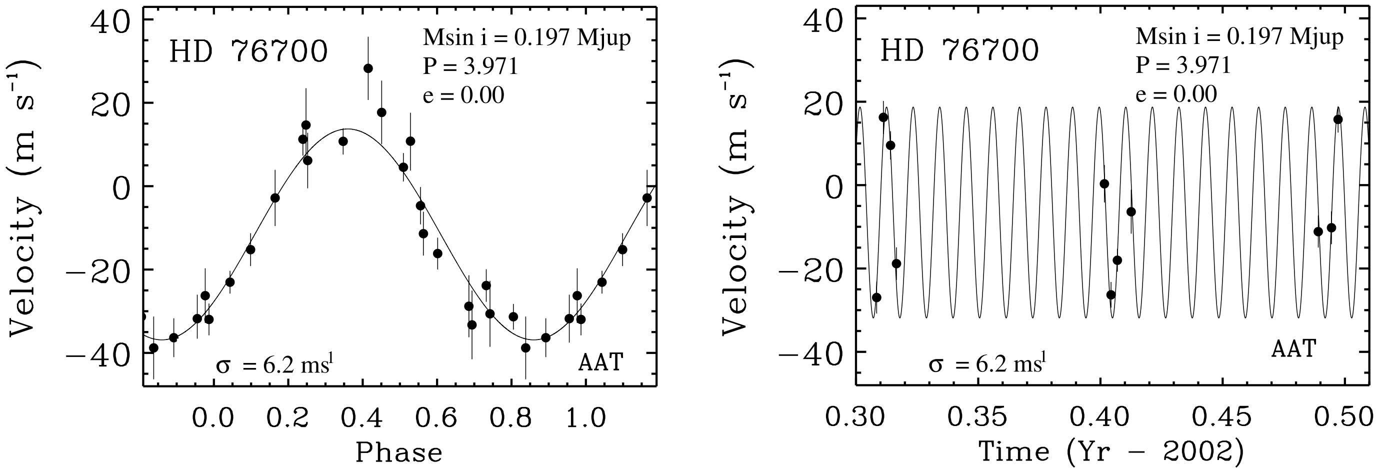


FIG. 5.—AAT Doppler velocities for HD 76700 from 1999 February to 2002 June, phased at the best-fit Keplerian period of 3.971 days (*left panel*) and plotted unphased from the last three observing runs in 2002 (*right panel*). The plotted Keplerian has the parameters shown in Table 3. The rms of the velocities about the fit is 6.2 m $s^{-1}$. Assuming 1.0 $M_\odot$ for the primary, the minimum ($M \sin i$) mass of the companion is $(0.197 \pm 0.017) M_J$, and the semimajor axis is $0.049 \pm 0.004$ AU.

late 1999, five have revealed the presence of planetary companions (the four planets discussed here—HD 30177, 73526, 76700, and 2039—along with the previously known companion to HD 83443 [Butler et al. 2002b; Mayor et al. 2002]). This gives us a lower limit (there may be longer period or lower-mass planets present that we cannot yet detect) to the discovery rate of 25% ± 11% for this "metallicity-biased" subsample. This compares with the overall discovery rates estimated for the Keck, Lick, and AAPS of ~8% (i.e., 8% of stars surveyed have planets in orbits within 3.5 AU of their host stars [Butler

TABLE 5
VELOCITIES FOR HD 76700

| JD[a] (−2,451,000) | RV[a] (m $s^{-1}$) | Uncertainty (m $s^{-1}$) |
|---|---|---|
| 212.1565 | 9.2 | 6.7 |
| 213.1501 | 40.3 | 7.6 |
| 214.2583 | −21.3 | 8.2 |
| 274.0177 | −18.6 | 7.9 |
| 530.1791 | 26.7 | 8.8 |
| 683.8938 | −19.8 | 5.7 |
| 920.1606 | 29.7 | 7.6 |
| 984.0068 | 22.8 | 7.1 |
| 1009.0638 | −26.8 | 7.5 |
| 1060.9036 | −24.3 | 4.7 |
| 1091.8517 | −16.8 | 7.4 |
| 1129.8425 | 18.2 | 6.7 |
| 1359.0760 | −14.3 | 6.6 |
| 1386.9145 | −20.0 | 3.8 |
| 1387.9170 | 23.2 | 3.9 |
| 1388.9898 | 16.5 | 3.4 |
| 1389.8741 | −11.8 | 3.9 |
| 1420.9418 | 7.3 | 4.5 |
| 1421.9331 | −19.3 | 3.1 |
| 1422.8793 | −11.0 | 2.7 |
| 1424.9439 | 0.6 | 5.3 |
| 1452.8943 | −4.2 | 3.8 |
| 1454.8682 | −3.2 | 3.9 |
| 1455.8565 | 22.8 | 3.1 |

[a] As for Table 2.

TABLE 6
VELOCITIES FOR HD 2039

| JD[a] (−2,451,000) | RV[a] (m $s^{-1}$) | Uncertainty (m $s^{-1}$) |
|---|---|---|
| 118.0578 | 25.4 | 8.4 |
| 118.9610 | −23.3 | 16.7 |
| 119.9445 | 1.9 | 11.7 |
| 121.0385 | −29.6 | 16.2 |
| 211.9514 | −12.3 | 18.8 |
| 212.9234 | 8.6 | 13.4 |
| 213.9749 | 0.0 | 17.0 |
| 214.9171 | −11.6 | 13.7 |
| 386.3227 | −52.2 | 17.1 |
| 387.2981 | −29.0 | 15.3 |
| 411.2293 | −13.3 | 15.5 |
| 414.2585 | −14.1 | 10.6 |
| 473.0883 | −40.9 | 10.6 |
| 525.9286 | −76.1 | 13.7 |
| 527.9226 | −28.3 | 10.9 |
| 745.2702 | −49.2 | 17.6 |
| 828.0703 | −42.6 | 12.7 |
| 828.9943 | −47.6 | 10.5 |
| 829.9757 | −43.1 | 11.4 |
| 856.0702 | −31.0 | 15.0 |
| 919.9434 | −26.4 | 14.4 |
| 920.9672 | −20.5 | 14.5 |
| 1093.2947 | 138.8 | 14.2 |
| 1127.2341 | 100.3 | 15.0 |
| 1151.2230 | 66.4 | 8.3 |
| 1152.0860 | 69.3 | 9.6 |
| 1154.2124 | 74.9 | 11.6 |
| 1187.0957 | 56.6 | 9.8 |
| 1188.0300 | 51.3 | 8.4 |
| 1189.1502 | 59.7 | 11.8 |
| 1190.0931 | 51.1 | 8.5 |
| 1422.3281 | −7.4 | 11.2 |
| 1425.3322 | −1.3 | 7.6 |
| 1455.2852 | −27.3 | 6.1 |
| 1477.2543 | −39.3 | 14.1 |
| 1511.1045 | −26.7 | 15.2 |

[a] As for Table 2.

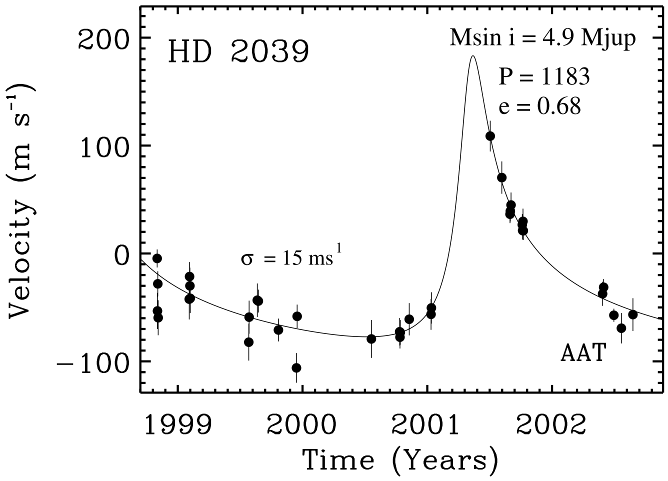


FIG. 6.—AAT Doppler velocities for HD 2039 from 1998 November to 2002 July, with the best-fit Keplerian with parameters shown in Table 3. The rms of the velocities about the fit is 15 m $s^{-1}$. Assuming 0.98 $M_\odot$ for the primary, the minimum ($M \sin i$) mass of the companion is $(4.9 \pm 1.0)M_J$, and the semimajor axis is $2.2 \pm 0.2$ AU.

et al. 2002a])—a difference which, while not of great statistical significance, is not unexpected, given that extrasolar planets seem to be being found preferentially around metal-enriched stars (e.g., Reid 2002 and Laughlin 2000 and references therein). It is also interesting to note (even if perhaps not statistically significant) that all four of the stars in this paper would seem to be beginning their evolution off the main sequence (see Fig. 1).

These results would suggest that the biasing of planet surveys toward metal-enriched host stars *may* offer a benefit in the planet detection rate. However, such an increased discovery rate must be balanced against the fact that it will produce an inherently biased sample of extrasolar planets. With the total number of known extrasolar planets still numbering less than a hundred, and the parameters of this ensemble of planets still poorly placed in a scheme of extrasolar planetary formation and evolution, now is not the time for planet searches to begin biasing their large surveys in the chase for better "hit rates" at the expense of scientific utility.

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