The Astronomical Journal, 127:1712–1719, 2004 March

RADIAL VELOCITY STUDIES OF CLOSE BINARY STARS. IX.[1]

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Received 2003 November 14; accepted 2003 December 11

ABSTRACT

Radial velocity measurements and sine-curve fits to the orbital velocity variations are presented for the eighth set of 10 close binary systems: AB And, V402 Aur, V445 Cep, V2082 Cyg, BX Dra, V918 Her, V502 Oph, V1363 Ori, KP Peg, and V335 Peg. Half of the systems (V445 Cep, V2082 Cyg, V918 Her, V1363 Ori, and V335 Peg) were discovered photometrically by the *Hipparcos* mission, and all systems are double-lined (SB2) contact binaries. The broadening function method permitted improvement of the orbital elements for AB And and V502 Oph. The other systems have been observed for radial velocity variations for the first time; in this group are five bright ($V < 7.5$) binaries: V445 Cep, V2082 Cyg, V918 Her, KP Peg, and V335 Peg. Several of the studied systems are prime candidates for combined light and radial velocity synthesis solutions.

Key words: binaries: close — binaries: eclipsing — stars: variables: other

On-line material: machine-readable table

1. INTRODUCTION

This paper is a continuation in a series of papers of radial velocity studies of close binary stars (Lu & Rucinski 1999; Rucinski & Lu 1999; Rucinski, Lu, & Mochnacki 2000; Lu, Rucinski, & Ogłoza 2001; Rucinski et al. 2001; Rucinski et al. 2002; Rucinski et al. 2003) and presents data for the eighth group of 10 close binary stars observed at the David Dunlap Observatory. Selection of the targets is quasi-random: At a given time, we observe a few dozen close binary systems with periods shorter than 1 day, brighter than 11 mag, and with declinations greater than $-15°$. We publish the results in groups of 10 systems as soon as reasonable orbital elements are obtained from measurements evenly distributed in orbital phases. For technical details and conventions, and for preliminary estimates of errors and uncertainties, see the interim summary paper Rucinski (2002a, hereafter Paper VII). With this paper, we decided to introduce some minor changes into the reduction process: We used the pair of IRAF routines NOAO.IMRED.SPEC.FITCOORDS and NOAO.IMRED.SPEC.TRANSFORM to rectify images of the spectra and improve wavelength calibrations; the procedure of cosmic-ray removal was done using a separate, stand-alone program (Pych 2003).

We estimate spectral types of the program stars using our classification spectra. These are compared with the mean $B-V$ color indexes taken from the Tycho-2 catalog (Høg et al. 2000) and the photometric estimates of the spectral types using the relations published by Bessell (1979).

The observations reported in this paper have been collected mostly during the year 2002; exceptions are: BX Dra and V335 Peg, for which some observations were collected in 2001, and V918 Her, for which some observations were in 2003 May. The ranges of dates for individual systems can be found in Table 1.

All systems discussed in this paper, except AB And and V502 Oph, have been observed for radial velocity variations for the first time. We have derived the radial velocities in the same way as described in previous papers. See Paper VII for a discussion of the broadening-function approach used in the derivation of the radial velocity orbit parameters: the amplitudes K_i, the center-of-mass velocity V_0, and the time-of-primary-eclipse epoch T_0.

This paper is structured in a way similar to that of previous papers in that most of the data for the observed binaries are in two tables consisting of the radial velocity measurements (Table 1) and their sine-curve solutions (Table 2). The data in Table 2 are organized in the same manner as in previous papers. In addition to the parameters of spectroscopic orbits, the table provides information about the relation between the spectroscopically observed epoch of the primary-eclipse T_0 and the recent photometric determinations in the form of the

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TABLE 1

DDO Observations of the Eighth Group of 10 Close Binary Systems

HJD −2,400,000	Phase	V_1	ΔV_1	V_2	ΔV_2
AB And					
52494.8051.........................	0.1749	−235.6	−0.7	94.5	6.0
52494.8176.........................	0.2126	−251.7	2.3	98.8	−0.4
52494.8284.........................	0.2451	−260.6	−0.2	99.8	−2.9
52495.6065.........................	0.5896	97.0[a]	0.2	−111.7[a]	−14.6

Notes.—Table 1 is presented in its entirety in the electronic edition of the Astronomical Journal. A portion is shown here for guidance regarding its form and content. Velocities are expressed in km s^{-1}. The deviations ΔV_i are relative to the simple sine-curve fits to the radial velocity data. Observations leading to entirely unseparable broadening- and correlation-function peaks are marked by ellipses; these observations may eventually be used in more extensive modeling of broadening functions.

[a] The data given 0.5 weight in the orbital solution.

$O - C$ deviations for the number of elapsed periods E. It also contains our new spectral classifications of the program objects. Section 2 of the paper contains brief summaries of previous studies of individual systems and comments on the new data. Figures 1–3 show the radial velocity data and solutions. Figure 4 shows the BFs for all systems; the functions have been selected from among the best-defined ones around the orbital phase of 0.25 using the photometric system of phases counted from the deeper eclipse.

2. RESULTS FOR INDIVIDUAL SYSTEMS

2.1. *AB And*

Photometric variability of AB And was discovered by Guthnick & Prager (1927). Oosterhoff (1930) gave a photometric ephemeris. Twenty years later, Oosterhoff (1950) reported discovery of the period variation. Since that time, AB And became a target of numerous photometric investigations. On the basis of the photoelectric observations, Landolt (1969) determined the spectral type of K2 V. He also noted asymmetries in the light curve. The asymmetries have been explained in Bell, Hilditch, & King (1984) and Djurasevic, Rovithis-Livaniou, & Rovithis (2000) by a model with photospheric spots. Demircan et al. (1994) suggested that observed period variability may be a result of the orbital motion in a wide triple system. The third body should be a white dwarf in such a case. Strömgren photometry presented by Rucinski & Kaluzny (1981) suggested the spectral type of AB And to be G5.

The first spectroscopic observations of this object were published by Struve et al. (1950). AB And was then classified

TABLE 2

Spectroscopic Orbital Elements

Name	Spectral Type	Other Names	V_0	K_1 (K_2)	ϵ_1 (ϵ_2)	T_0 − 2,400,000 ($O - C$)(d) [E]	P (days) [$(M_1 + M_2)\sin^3 i$]	q
AB And...............	EW/W	SAO 73069	−27.53(0.67)	130.32(1.17)	5.13	52,503.0443(4)	0.3318919	0.560(7)
	G8V	HIP 114508		232.88(0.83)	8.20	−0.0105 [−2957]	1.648(20)	
V402 Aur	EW/W	HD 282719	+ 40.82(0.93)	41.94(0.83)	4.33	52,448.9698(16)	0.603491	0.201(6)
	F2V	HIP 23433		208.98(2.17)	13.46	+0.0008 [371]	0.988(27)	
V445 Cep............	EW/A	HD 210431	+ 40.69(0.95)	20.33(0.85)	4.57	52,470.5847(21)	0.448776	0.167(10)
	A2V	HIP 109191		122.08(2.04)	11.55	+0.0072 [8847]	0.134(6)	
V2082 Cyg..........	EW/A:	HD 183752	−34.12(0.58)	33.16(0.51)	2.85	52,466.1122(17)	0.714084	0.238(5)
	F2V	HIP 95833		139.38(0.99)	6.75	−0.0249 [5554]	0.380(7)	
BX Dra................	EW/A	HIP 78891	−26.11(3.43)	80.01(2.46)	8.87	52,248.2984(34)	0.579027	0.289(16)
	F0IV-V			276.39(6.37)	23.90	+0.0006 [6473]	2.72(16)	
V918 Her	EW/W	HD 151701	−25.72(0.74)	53.93(0.49)	3.45	52,555.8419(14)	0.57481	0.271(5)
	A7V	HIP 82253		199.37(1.72)	10.43	+0.0253 [7055]	0.968(21)	
V502 Oph	EW/W	HD 150484	−42.56(0.85)	82.71(1.03)	6.38	52,452.7492(7)	0.45339	0.335(9)
	G0V	HIP 81703		246.70(1.00)	6.89	−0.0500 [8718]	1.679(22)	
V1363 Ori	EW/A	HD 289949	+ 37.89(2.02)	44.88(2.46)	16.32	52,592.4999(20)	0.431921	0.205(15)
	F:[a]	HIP 23809		219.30(4.18)	21.62	+0.0196 [9475]	0.825(45)	
KP Peg	EW/A	HD 204215	+ 5.52(1.03)	72.84(1.05)	6.20	52,504.9303(21)	0.727203	0.322(10)
	A2V	HIP 105882		226.43(4.10)	18.18	+0.0214 [5507]	2.020(86)	
V335 Peg	EW/A:	HD 216417	−15.41(0.43)	44.61(0.27)	2.47	52,330.1642(15)	0.810720	0.262(4)
	F5V	HIP 112960		170.56(1.77)	12.54	−0.1590 [4724]	0.837(21)	

Notes.—The spectral types given in the second column are all new and relate to the combined spectral type of all components in a system. The convention of naming the binary components in this table is that the more massive star is marked by the subscript "1" so that the mass ratio is defined to be always $q \leq 1$. Figs. 1–3 should help identify which component is eclipsed at the primary minimum. The standard errors of the circular solutions in the table are expressed in units of last decimal places quoted; they are given in parantheses after each value. The center-of-mass velocities (V_0), the velocity amplitudes (K_i), and the standard unit-weight errors of the solutions (ϵ) are all expressed in kilometers per second. The spectroscopically determined moments of primary minima are given by T_0; the corresponding $O - C$ deviations (in days) have been calculated from the most recent available ephemerides, as given in the text, using the assumed periods and the number of epochs given by [E]. The values of $(M_1 + M_2)\sin^3 i$ are in solar mass units.

[a] V1363 Ori: early to mid F type.

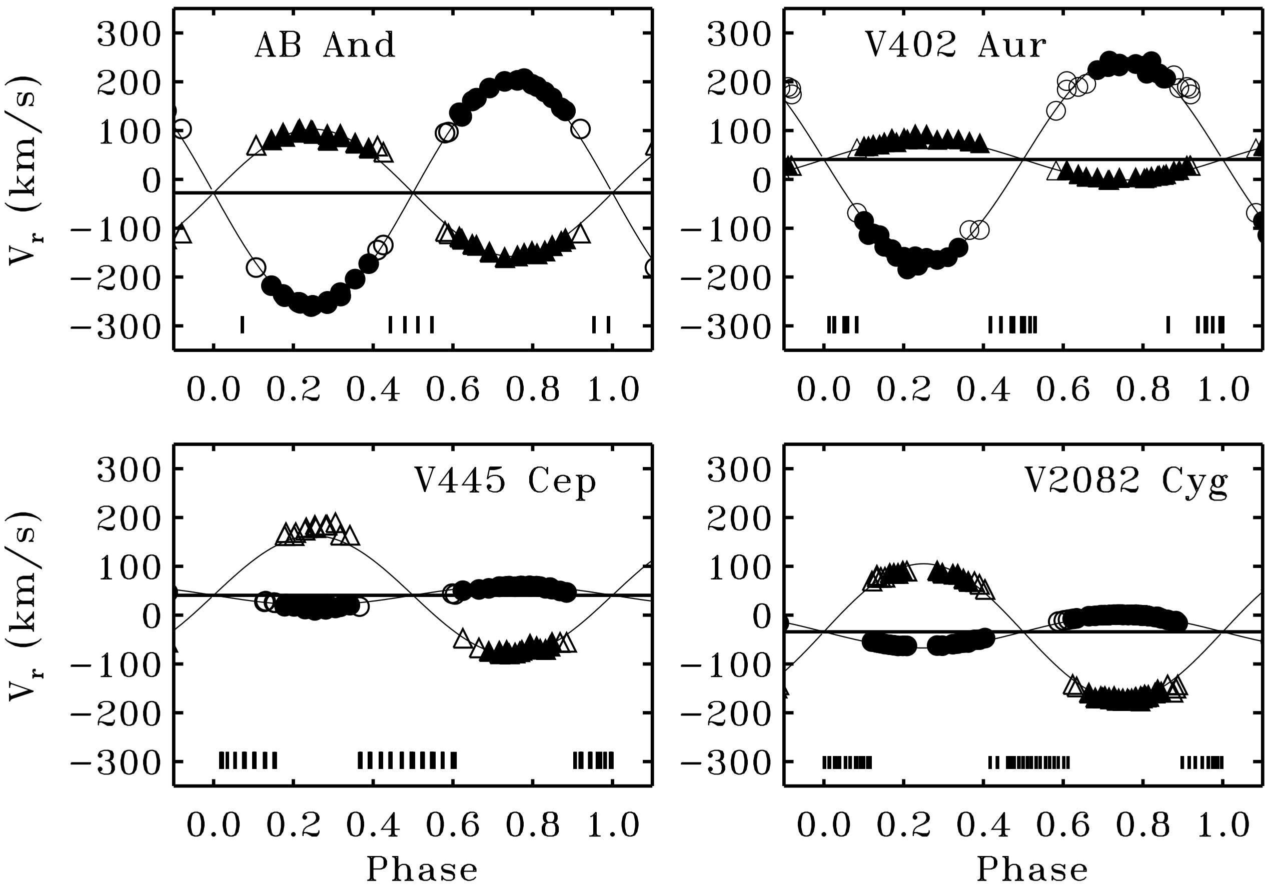

FIG. 1.—Radial velocities of the systems AB And, V402 Aur, V445 Cep, and V2082 Cyg plotted in individual panels vs. the orbital phases. All four systems are contact binaries. V445 Cep and V2082 Cyg are A-type contact systems, while AB And and V402 Aur are W-type contact systems. The lines give the respective circular-orbit (sine-curve) fits to the radial velocities. The circles and triangles in this and the next two figures correspond to components with velocities V_1 and V_2, respectively, as listed in Table 1. The component eclipsed at the minimum corresponding to T_0 (as given in Table 2) is the one that shows negative velocities for the phase interval 0.0–0.5. The open symbols indicate observations contributing half-weight data in the solutions. Short marks in the lower parts of the panels show phases of available observations that were not used in the solutions because of the blending of lines. All panels have the same vertical range −350 to +350 km s^{-1}.

as a W UMa star with spectral type G5. The radial velocities of the components were measured in this investigation in only seven spectra; therefore, this result was rather preliminary. The results were $V_0 = -45$ km s^{-1}, $K_1 = 165$ km s^{-1}, and $K_2 = 265$ km s^{-1}. An extensive discussion on the system with the combined light and radial velocity solution was presented by Hrivnak (1988), who classified the spectral type of AB And to be G5 V. Radial velocity curves obtained by Hrivnak (1988) were modified to include proximity effects. The measured radial velocities gave the following orbital parameters: $V_0 = -24.6 \pm 0.9$ km s^{-1}, $K_1 = 115.7 \pm 0.7$ km s^{-1}, and $K_2 = 235.7 \pm 1.5$ km s^{-1}.

For the preliminary moment of eclipse T_0, as referred to in Table 2, we used the moment of Pribulla et al. (2002). Similar to the previous researchers, we find the system to be a W-type contact binary. Our spectral type, G8 V, is slightly later than most of the previous determinations. AB And has relatively red color index $B-V = 0.925$, which corresponds to the spectral type K2. Spots in the photospheres of the system components may be a possible explanation of the spectral type discrepancy. The broadening functions of both system components are well defined and radial velocities are measured precisely. We note a difference in the center-of-mass velocity of the system between our estimate, $V_0 = -27.5 \pm 0.7$ km s^{-1}, and the result presented by Hrivnak (1988). In addition, the amplitude of radial velocity of the less massive component obtained by Hrivnak (1988) was smaller than our result, $K_1 = 130.3$ km s^{-1}, possibly because Hrivnak (1988) used the cross-correlation method which—in our experience—frequently underestimates the velocity amplitudes.

The *Hipparcos* parallax, 8.34 ± 1.48 mas, gives the distance of 120 ± 20 pc. The observed proper motion is moderately large (Høg et al. 2000), resulting, for the assumed distance, in tangential velocities of $V_{\rm RA} = 109$ km s^{-1} and $V_{\rm decl} = -53$ km s^{-1} and the combined spatial velocity of $V = 74$ km s^{-1}. Because the observed variability of the period and of V_0 can be interpreted as an influence of a companion, the parallax may be incorrect; the large error is consistent with that. The direct, parallax-based estimate of $M_V = 4.1 \pm 0.4$ only marginally agrees with the one from the absolute-magnitude calibration (Rucinski & Duerbeck 1997), $M_V({\rm cal}) = 5.0$; however, $V_{\rm max} = 9.5$ is also poorly defined, partly because of the spots and partly because of the small number of calibrated light curves even for this popular system.

The masses of the components are very well defined, $M_1 \sin^3 i = 1.06\ M_\odot$ and $M_2 \sin^3 i = 0.59\ M_\odot$, and are surprisingly large for components of a G8/K2 contact system. We have seen a very similar situation in AH Vir (Lu & Rucinski 1993), which is also a system consisting of massive but unusually cool components. It is very likely that the strong magnetic activity of AB And and AH Vir may have something to do with this anomaly.

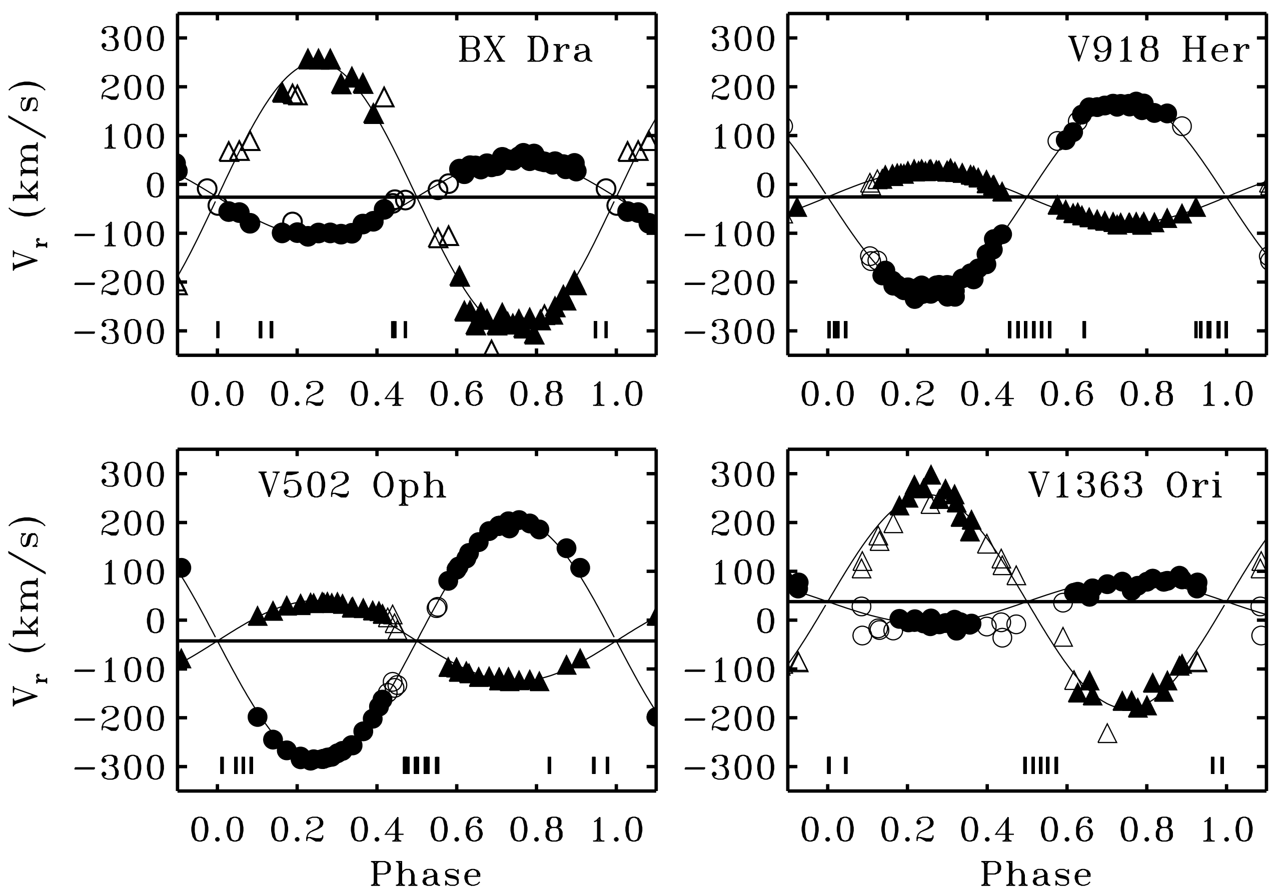

FIG. 2.—Same as Fig. 1, but with the radial velocity orbits for the systems BX Dra, V918 Her, V502 Oph, and V1363 Ori. BX Dra and V1363 Ori are A-type contact systems, while V918 Her and V502 Oph are W-type contact systems.

2.2. *V402 Aur*

V402 Aur was discovered as a variable by Oja (1991) during an *UBV* photometric survey of astrometric standard stars. The light curve and ephemeris were published 3 years later (Oja 1994). The spectral type derived from Henry Draper Extension Charts is F0 (Nesterov et al. 1995). Spectral type in the SIMBAD database is F2. The spectral type corresponding to $B-V = 0.40$ derived from the Tycho-2 catalog (Høg et al. 2000) is F3-4. Our new spectral type is F2V.

The mass ratio is small, $q = 0.20$. Similar depths of the eclipses and the well-defined broadening functions strongly suggest that V402 Aur is a contact binary of the W type (with the assumed moment of the primary eclipse, as referred to in Table 2 of Pribulla et al. 2002). The small sum of the masses for an early-F system, $(M_1 + M_2)\sin^3 i = 0.99 \pm 0.03\ M_\odot$, is consistent with the small photometric amplitude of 0.17 mag, both being due to the low inclination of the orbit.

2.3. *V445 Cep*

Variability of V445 Cep was discovered by *Hipparcos*. The full amplitude of the *Hipparcos* light curve is only 0.03 mag. The star has an abnormally blue color index for its period (Rucinski 2002b), which raised the suspicion that the pulsations are the source of the observed photometric variability. Our radial velocity observations confirm the binary nature of the system, but with the period equal to twice the *Hipparcos* period. We adjusted the preliminary *Hipparcos* T_0 by one quarter forward of the light maximum to $T_0 = 2,448,500.1146$.

The mass ratio of V445 Cep, $q = 0.17 \pm 0.01$, is small. We also find a very small value of $(M_1 + M_2)\sin^3 i = 0.134 \pm 0.006\ M_\odot$. This result, together with small photometric amplitude, suggests a small inclination angle of the orbit. The system seems to be a contact binary, but small amplitudes of radial velocities and photometric variability make it difficult to derive the orbital parameters.

The results of low-resolution spectroscopic observations were presented by Grenier et al. (1999). The star was classified as A2 V. The radial velocity of the whole system $V_r = 38.6 \pm 9.6$ km s^{-1} is in a good agreement with our $V_0 = 40.69 \pm 0.95$ km s^{-1}.

The color index $B-V = 0.123$ was found in the Tycho-2 catalog (Høg et al. 2000). This corresponds to a spectral type A4. Our spectral type is A2 V. The system is bright, $V_{max} = 6.82$, which, together with the *Hipparcos* parallax, gives $M_V = 1.58 \pm 0.13$. Thus, this is one of the best-determined luminosities for an A spectral-type contact binary.

2.4. *V2082 Cyg*

This star was listed as a variable candidate by Hoffleit (1979). Its variability was confirmed by *Hipparcos*. The light curve from *Hipparcos* has a small amplitude of only 0.05 mag and similar depths of the eclipses. We used the *Hipparcos* data for the preliminary T_0.

The spectral type of V2082 Cyg in the SIMBAD database is F0, while our spectral type is F2V. $B-V = 0.313$ from the Tycho-2 catalog (Høg et al. 2000) corresponds to the spectral type F1. V2082 Cyg is most probably an A-type contact binary,

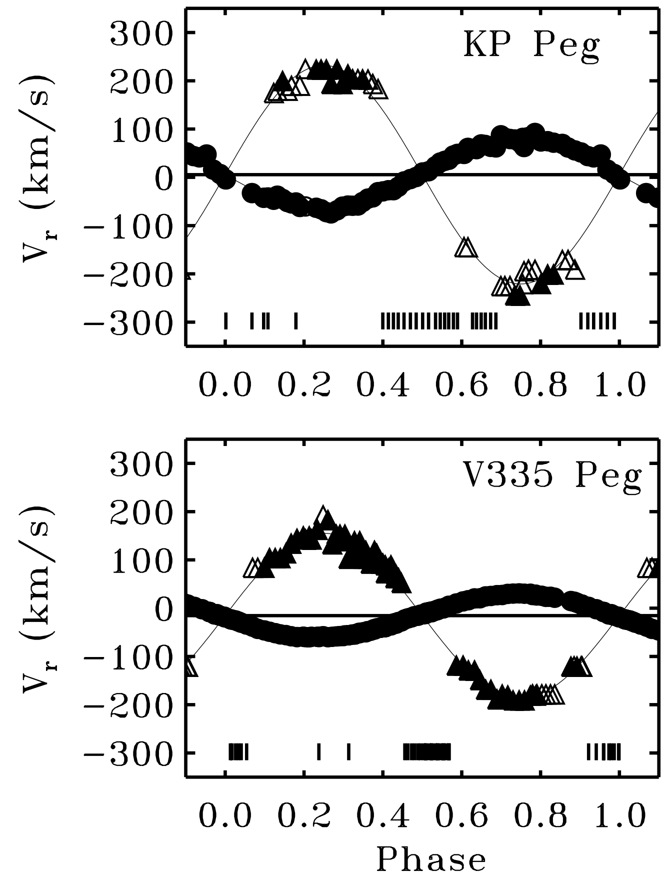

FIG. 3.—Same as Fig. 1, but with the radial velocity orbits for the systems KP Peg and V335 Peg. Both systems are A-type contact binaries.

although the secondary component is faint (the relative luminosity from the broadening function, $L_2 = 0.10 \pm 0.02$), so that we cannot exclude a semidetached configuration. The system must be viewed at a very low inclination angle, which would explain the small photometric and radial velocity amplitudes, leading to poorly resolved broadening functions, with the partly merged signatures of both components (see Fig. 4).

The absolute magnitude based on the *Hipparcos* parallax and the adopted $V_{\max} = 6.64$ is $M_V = 1.85 \pm 0.12$. It agrees well with the RD97 calibration, $M_V(\mathrm{cal}) = 1.71$. The proper motion, especially in declination, is large (Høg et al. 2000), resulting, for the assumed distance, in the combined spatial velocity of $V = 54$ km s^{-1}.

The radial velocity of the system was previously measured at low resolution by Shajn (1951) on three occasions. The author noticed that the radial velocity of this star is variable.

2.5. *BX Dra*

BV 228 (BX Dra) was discovered to be a variable star by Strohmeier (1958). Strohmeier et al. (1965) classified the star as an RR Lyrae type variable. Some doubt as to this classification and hints about the binary nature of the star based both on spectroscopy and photometry were presented by Smith (1990). The author, in a photometric survey of variable stars, found a new period and changed the classification to an elliptical variable. Independently, Agerer & Dahm (1995) presented a light curve and classified BX Dra as an β Lyrae type variable. Nevertheless, Solano et al. (1997) still regarded it as a RR Lyrae variable, although they have found some other stars to be incorrectly classified as RR Lyrae variables in the General Catalogue of Variable Stars (Kholopov et al. 1985-1988). SIMBAD still lists this star as a variable star of RR Lyrae type. The spectral type of BX Dra in the SIMBAD database is A3.

We found that the variable is definitely a contact binary of the A type. The color index $B-V = 0.352$ from the Tycho-2 catalog (Høg et al. 2000) corresponds to the spectral type of F2. Our spectral type is F0IV-V. The star is one of the faintest in our sample ($V_{\max} = 10.5$) and the broadening functions are noisy and show undesirable baseline slopes (see Fig. 4). However, because the radial velocity amplitudes are relatively large, this object may deserve further photometric and spectroscopic investigations.

The radial velocity has been measured by Layden (1994) at low resolution, $V_r = 75 \pm 30$ km s^{-1}. The radial velocity was also measured again by Solano et al. (1997), and the result $V_r = -24 \pm 3$ km s^{-1}, is in agreement with our result $V_r = -26.11 \pm 3.43$ km s^{-1} within the respective errors. The moment of the primary eclipse referred to in Table 2 was taken from the *Hipparcos* catalog.

2.6. *V918 Her*

Variability of this star was discovered by *Hipparcos*. The spectral type of this star in the SIMBAD database is A2. Grenier et al. (1999) classified its spectrum as A5 V. Our spectral classification of V918 Her is A7 V. The $B-V$ index from the Tycho-2 catalog (Høg et al. 2000) is 0.249 and corresponds to a spectral type A8/9 V, which may indicate some reddening.

The radial velocity of the system measured by Grenier et al. (1999), $V_r = -33.9 \pm 7.2$ km s^{-1}, is different from our result of $V_r = -25.72 \pm 0.74$ km s^{-1}.

We find the object to be an A-type contact binary. Otherwise the system is rather inconspicuous, but is bright, $V_{\max} = 7.30$, and thus was included in the magnitude-limited sample of Rucinski (2002b). We have adopted T_0 from the *Hipparcos* catalog.

2.7. *V502 Oph*

V502 Oph was discovered to be an eclipsing binary by Hoffmeister (1935). The first ephemeris based on visual observations was published by Lause (1937). Over the years, the star has been the subject of numerous investigations. The light curve of the system is not stable and the orbital period was found to undergo a change in the years 1955–1966 (Binnendijk 1969). The period is successively decreasing, but the rate of the change observed in the years 1989–2003 has not been constant (J. M. Kreiner 2003, private communication). For Table 2, we adopted T_0 from the *Hipparcos* catalog. We found however, that the orbital period from the *Hipparcos* catalog definitely does not fit our spectral data. We established that the period which fits our data best is 0.453390 days and this period was used for calculating the orbital elements in Table 2.

Observations of V502 Oph with the VLA revealed that it is a binary radio source (Hughes & McLean 1984). Since W UMa type systems usually show low radio activity (Rucinski 1995), this may suggest the existence of an optically undetected companion to the eclipsing binary system (Hughes & McLean 1984). The presence of a late-type tertiary component was in fact noticed in the spectrum of V502 Oph by Hendry & Mochnacki (1998).

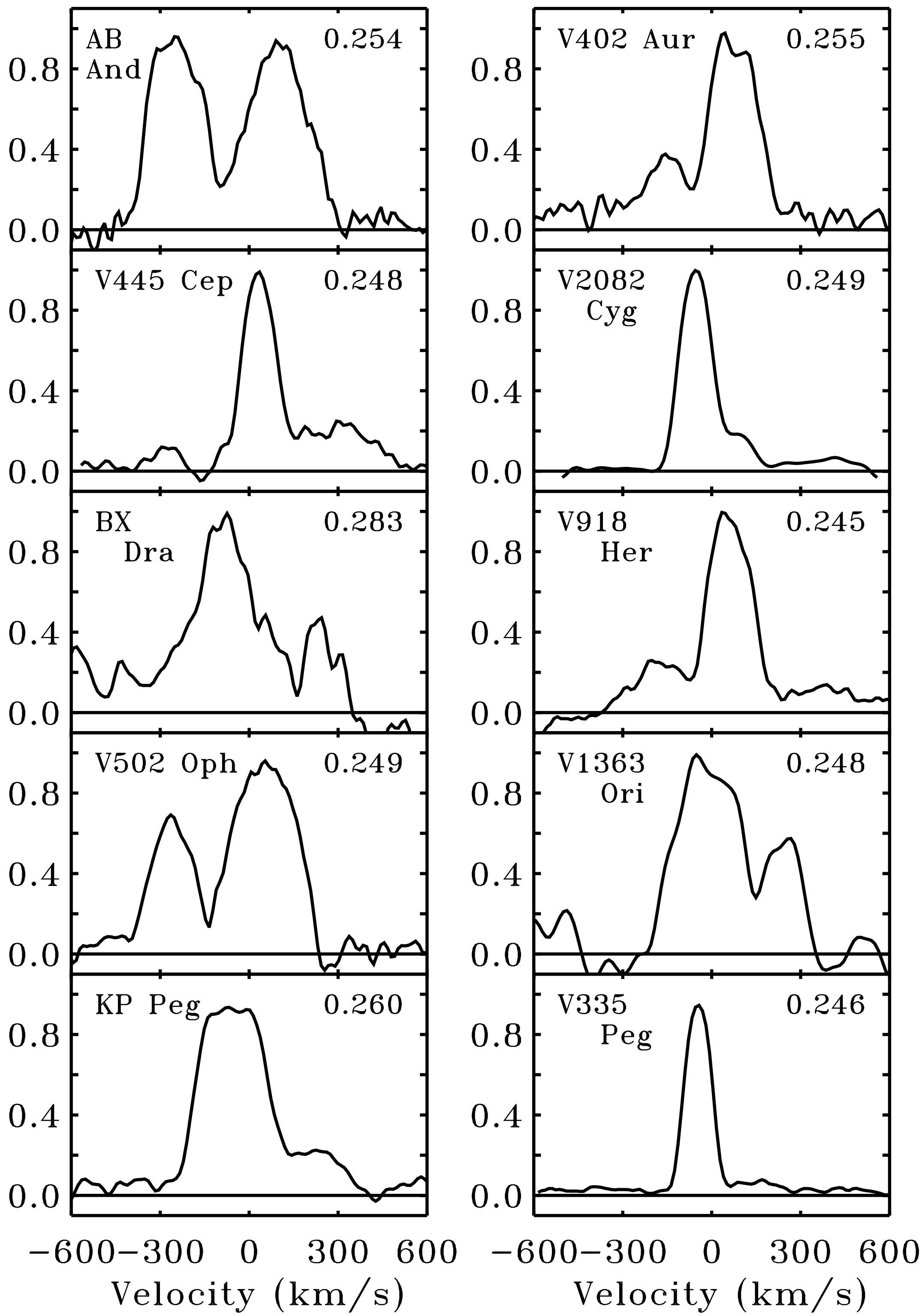

FIG. 4.—Broadening functions (BFs) for all binary systems of this group; all for orbital phases around 0.25, as in similar figures in the previous papers.

The pioneering investigation on the radial velocity orbit of this W UMa type variable was done by Gratton (as described in Struve & Gratton 1948). The derived orbit elements based on these old observations, $V_r = -37$ km s^{-1}, $K_1 = 95$ km s^{-1}, and $K_2 = 235$ km s^{-1}, are surprisingly close to the values presented in Table 2. Radial velocity measurements presented later by Struve & Zebergs (1959) generally supported earlier results; the −13 km s^{-1} shift in the mass-center velocity was considered insignificant in view of the low accuracy of the measurements. The spectra of the components were classified as G1 V for the primary and F9 V for the secondary component, reflecting the fact that this is a W-type contact system with a slightly hotter secondary.

The spectral type in the SIMBAD database is G2 V+. . . . The spectral type of V502 Oph based on the Tycho-2 color index (Høg et al. 2000), $B-V = 0.615$, is G1, which is close to G0 V found by us.

2.8. *V1363 Ori*

The variability of V1363 Ori was discovered by *Hipparcos*. The spectral type derived from Henry Draper Extension Charts is F5 (Nesterov et al. 1995), while in the SIMBAD database it is F8. The $B-V = 0.56$ color index derived from the Tycho-2 catalog (Høg et al. 2000) corresponds to a spectral type of F9. For technical reasons, we were not able to obtain a good classification spectrum of the star; we can only confine it to the early to mid-F spectral type.

The light curve of this variable presented by Gomez-Forrellad et al. (1999) shows the O'Connell effect. This source was used for the initial T_0.

V1363 Ori is an A-type contact binary at the faint end of our magnitude accessibility, so that the broadening functions are rather poor. The *Hipparcos* parallax is poorly determined, 9.47 ± 2.36, so that the binary may have a spectroscopically undetectable companion.

2.9. *KP Peg*

This star was listed as a suspected variable by Hopmann (1948). Walker (1987) confirmed that the component A of this visual binary system (separation 3″.5, magnitude difference 1.6) is a variable of β Lyrae type. He also gave its ephemeris and presented the light curve (Walker 1988). Abt (1985), in one of his spectral classification papers of binaries from the Aitken (1932) catalog, classified it as an A2 V star. We confirm this spectral type. It is also consistent with the $B-V = 0.060$ color index from the Tycho-2 catalog (Høg et al. 2000). Due to the early spectral type and the weak spectral lines in our standard spectral window, the broadening functions are rather poorly defined, with the component signatures partly merged in the broadening functions.

The *Hipparcos* parallax, 4.37 ± 1.67 mas, is poorly determined, probably because of the presence of the third body in the system. With the corrected $V_{max} = 7.07$ (Rucinski 2002b), the absolute magnitude of the binary is one of the brightest in our program, $M_V = +0.3 \pm 0.8$. The adopted T_0 is from the *Hipparcos* catalog.

2.10. *V335 Peg*

Variability of V335 Peg was discovered by *Hipparcos*. The light curve from *Hipparcos* has a small amplitude of 0.05 mag. It is most probably an A-type contact binary, although the broadening function of the secondary component is very weak (the relative luminosity determined from the broadening function is only $L_2 = 0.05 \pm 0.01$) and is difficult to measure, contrary to that for the primary component, whose velocity could be measured very precisely. At this point we cannot exclude a semidetached configuration.

When we phased the observations, we noticed a small—about 3.5 km s^{-1}—systematic shift in radial velocities of the primary component between seasons 2001 and 2002. We have found that a correction to the period derived from *Hipparcos* light curve may eliminate this discrepancy. The orbital solution presented in Table 2 has been obtained with the new period, $P = 0.81072$ days, but with the same T_0. We note that this period implies a large T_0 shift of $O - C = -0.159$ days. The orbital parameters obtained for the *Hipparcos* period, $P = 0.810746$ days, $V_0 = -15.85 \pm 0.47$ km s^{-1}, $K_1 = 45.52 \pm 0.33$ km s^{-1}, $K_2 = 169.58 \pm 1.77$ km s^{-1}, result in a smaller $O - C = -0.036$ days. In the absence of any photometric data during the elapsed 4724 orbital cycles, we have not been able to decide whether the original period was incorrect or was variable, or if there was a radial velocity shift caused by a third body in the system with a possible miscount in the number of orbital cycles.

V335 Peg is one of the brightest short-period binaries in the sky (Rucinski 2002b), $V_{max} = 7.24$, and is relatively nearby, with the parallax 16.26 ± 0.86 mas, resulting in $M_V = 3.30 \pm 0.12$. The color index $B-V = 0.439$ corresponds to the spectral type of F5, which is the same as found in our spectra, F5 V. This does not agree well with the RD97 calibration, $M_V(\mathrm{cal}) = 1.85$. The reason for this discrepancy is not clear. We note that V335 Peg is a source of X-ray radiation and is listed in *ROSAT* Bright Survey (Schwope et al. 2000). The proper motions of V335 Peg are large in both coordinates (Høg et al. 2000), which—when coupled with the moderate distance of 62 pc—results in a combined spatial velocity of $V = 58$ km s^{-1}.

3. SUMMARY

This paper presents spectral classifications, radial velocity data, and circular orbital solutions for the eighth group of 10 close binary systems observed at the David Dunlap Observatory. All systems are double-lined (SB2) contact binaries. Half of the systems (V445 Cep, V2082 Cyg, V918 Her, V1363 Ori, V335 Peg) were discovered photometrically by the *Hipparcos* mission and two are well known, frequently observed contact systems (AB And, V502 Oph), which had been previously observed spectroscopically but for which our broadening function method permitted improvement of the orbital elements. We spectroscopically detected very weak companions of V2082 Cyg, KP Peg, and especially V335 Peg. We note that V445 Cep, V2082 Cyg, V918 Her, KP Peg, and V335 Peg are bright binaries with the observed $V_{max} < 7.5$. They were previously considered in the rigorously selected, magnitude-limited sample of Rucinski (2002b).

This study was done while W. Pych held the NATO Postdoctoral Fellowship administered by the Natural Sciences and Engineering Council of Canada (NSERC); he also acknowledges the support from the Polish Grant KBN 2 P03D 029 23. The NSERC supported research of S. M. R. and of R. M. B. through a research grant to T. Bolton. W. O., G. S., and K. G. acknowledge the travel and subsistence support from the NATO collaborative linkage grant PST.CLG.978810, as well as the Polish KBN grant 2-P03D-006-22. The research has made use of the SIMBAD database, operated at the CDS, Strasbourg, France and accessible through the Canadian Astronomy Data Centre, which is operated by the Herzberg Institute of Astrophysics, National Research Council of Canada.

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