RADIAL VELOCITIES OF THREE METALLIC-LINE STARS*

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ABSTRACT

Orbital elements are derived for the double-lined spectroscopic binary HD 12881 and the single-lined binary 51 Sagittarii; 11 Virginis is found to be constant in velocity.

In connection with a recent investigation (Abt 1961) of the frequency of spectroscopic binaries among the metallic-line (Am) stars, observations were made of three additional ones which did not fit the criteria used for the selection of a random sample. The spectra are from the Mount Wilson Observatory's 60-inch X-spectrograph (21 A/mm) and the McDonald Observatory's 82-inch coudé spectrograph (18 A/mm); the reductions are similar to those already reported.

HD 12881.—In the course of a spectroscopic study with the Perkins Observatory's 69-inch reflector of the components of visual double stars, Dr. Arne Slettebak noticed this star to be a double-lined metallic-line star. His classification from the K line is

TABLE 1

MOUNT WILSON RADIAL VELOCITIES OF HD 12881

PLATE NO.	DATE (U.T.) 1959	CORRECTED RADIAL VELOCITY (km/sec)		CYCLE AND PHASE
		Primary	Secondary	
Xd-4785.....	Oct. 13.393	+ 12.9	− 96.2	0.392
4804.....	14 396	− 93.1	+ 15.9	0 665
4908.....	Nov. 7.407	+ 25 0	−115.4	7 201
4929.....	8.391	− 12.2	− 78.0	7.469
4951.....	9.400	−107.5	+ 31.8	7.744
5018.....	Dec. 11 222	+ 3.5	− 83.8	16.407
5041.....	12 137	− 85.1	+ 19 1	16.656
5068.....	13 148	− 87.6	+ 26 1	16.931

A2–3, from the Balmer lines is A7, and from the metallic lines is F0. The Mount Wilson slit spectra listed in Table 1 show two spectra that are nearly indistinguishable from each other in spectral characteristics and line strengths. Perhaps the primary star, i.e., the more massive one, has slightly stronger hydrogen and calcium lines, giving it less of a degree of metallicism. However, the effect is so small that it could not be reliably used to distinguish components. The velocities are based on the lines λλ 4045, 4063, 4071, 4077, 4101, 4383, 4404, 4415, and 4481. The observations are few in number but are spaced in such a manner that they seem to admit no other identification of the compo-

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nents or orbital elements very different than those in Table 2. Those elements are based on an application of the method of Lehmann-Filhés, several least-squares solutions for the primary, and least-squares solutions for the amplitude only of the secondary. Although the oribtal elements are not well determined (see Fig. 1), it was decided to make these preliminary results available, as no further observations are planned in the near future. The system is probably not an eclipsing one, as the inclination is only about 47°.

11 Virginis = HR 4629 = HD 105702.—This star was first recognized as an Am star by Bidelman (1951), who classified it as F0 from the K line and F5 III from the metallic lines. The six Victoria radial velocities (Plaskett, Harper, Young, and Plaskett 1921) and four Mount Wilson ones (Adams, Joy, Sanford, and Strömberg 1929) indicate no variability; their mean velocity (Wilson 1953) is -9.2 ± 0.6 km/sec.

The McDonald radial velocities (based on lines λλ 4383, 4404, 4427, 4476, 4501, 4508, 4515, 4520, and 4522) listed in Table 3 give no evidence of variability because the scatter (1.11 km/sec) is only a little larger than that (0.74 km/sec) expected from the internal error, and the mean of -7.0 ± 0.4 km/sec is not significantly different from the

TABLE 2

ORBITAL ELEMENTS FOR HD 12881

$P=3.674$ days	$\omega=258\overset{\circ}{.}0$
$T_0=$JD 2436853.452	$a_1 \sin i=3.63\times10^6$ km
$\gamma=-40.5$ km/sec	$a_2 \sin i=4.30\times10^6$ km
$K_1=72.0$ km/sec	$\mathfrak{M}_1 \sin^3 i=0.800\,\mathfrak{M}_\odot$
$K_2=85.2$ km/sec	$\mathfrak{M}_2 \sin^3 i=0.676\,\mathfrak{M}_\odot$
$e=0.05$	

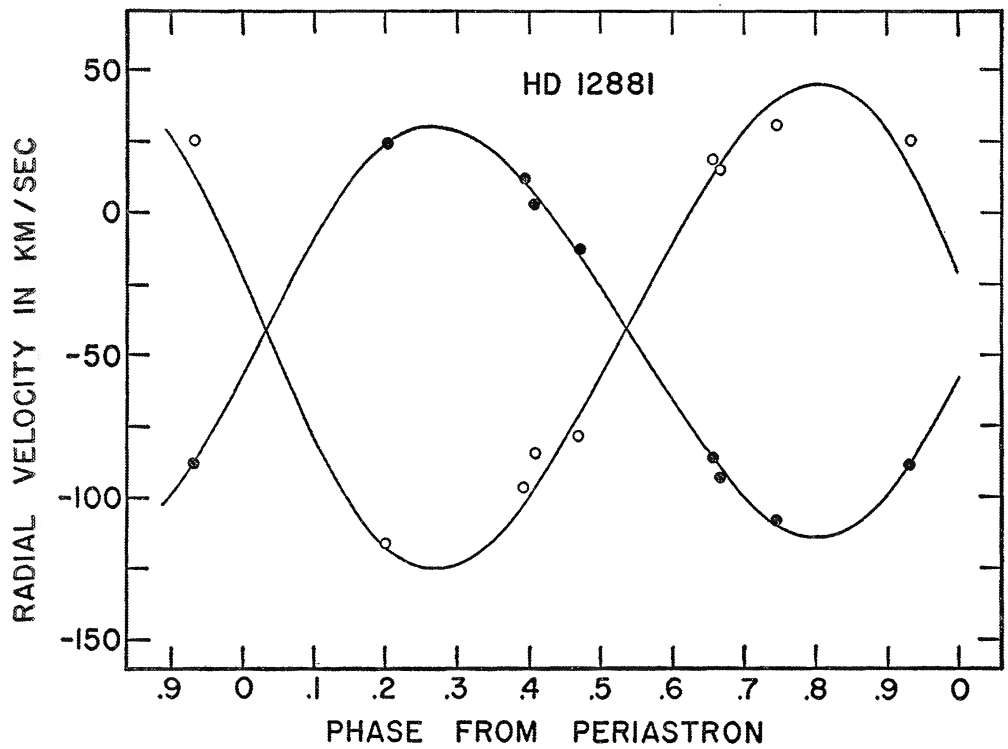

FIG. 1.—Radial velocities for the primary (*dots*) and secondary (*circles*) components of HD 12881 and the computed curves.

TABLE 3

McDONALD RADIAL VELOCITIES OF 11 VIRGINIS

Plate No.	Date (U.T.) 1959	Radial Velocity (km/sec)	Plate No.	Date (U.T.) 1959	Radial Velocity (km/sec)
Cg-3459.....	June 25.225	− 5.4	Cg-3544....	July 16.122	− 5 5
3480.....	26.151	− 6.5	3581 ...	18.151	− 8 5
3493.....	27.140	− 7.6	3624....	21.118	− 6 6
3530.....	July 15.122	−10.3	3688...	25.115	− 5 3

TABLE 4

McDONALD RADIAL VELOCITIES OF 51 SAGITTARII

Plate No.	Date (U.T.) 1959	Radial Velocity (km/sec)	Cycle and Phase
Cg-3466.. ...	June 25.325	−32.2	2296.017
3474	25.415	−27.1	2296 029
3505.... .	27.269	−11 8	2296.257
3515.....	27 422	−10 6	2296.276
3573.....	July 17.254	−48.1	2298.719
3608.... .	19.254	−38.4	2298 966
3634.....	21.367	− 9.1	2299.226
3576	Aug. 14.229	−11.4	2302.166
3812.....	20.256	−48 8	2302.909
3819... ...	21 191	−29 8	2303.024

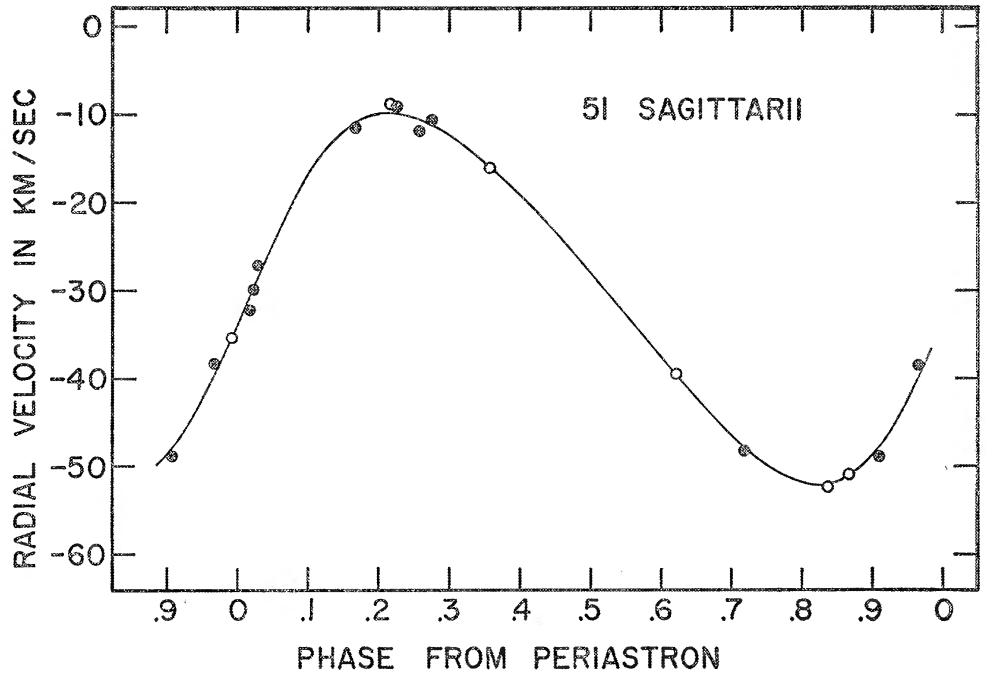

FIG. 2.—The computed radial velocity-curve of 51 Sagittarii with the 1908–1954 Lick and Palomar velocities (*circles*) and 1959 McDonald ones (*dots*).

previous mean. We conclude that the velocity of 11 Virginis is constant at about −8.2 km/sec.

51 h¹ Sagittarii = HR 7341 = HD 184552.—Curtis (Campbell 1911) found this star's velocity to be variable, and Greenstein (1956) called attention to this sharp-lined Am binary; his classifications, based on the K line and the metallic lines, are A3 and F5 III, respectively. Babcock (1958) found this star to have a magnetic field on one plate.

The McDonald radial velocities (based on lines λλ 4383, 4404, 4468, 4476, 4481, 4501, 4508, 4515, 4520, and 4522) listed in Table 4 indicate a period of 8.1 days. By using the four 1908–1920 Lick velocities (Campbell and Moore 1928) and the two 1954 Palomar ones by Greenstein, we can considerably improve this determination. An application of the method of Lehmann-Filhés and two least-square solutions yield the elements given in Table 5. Figure 2 shows the measures and computed velocity-curve. The mean

TABLE 5

ORBITAL ELEMENTS FOR 51 SAGITTARII

$P = 8\ 115813$ days	$e = 0.169$
$T_0 = \text{JD}\ 2418110\ 776$	$\omega = 262°.2$
$\gamma = -30\ 47$ km/sec	$a_1 \sin i = 2\ 33 \times 10^6$ km
$K = 21.18$ km/sec	$f(\mathfrak{M}) = 0\ 00766\ \mathfrak{M}_\odot$

deviation, computed as a probable error, of 0.54 km/sec is close to the mean expected probable error per plate of 0.43 km/sec. Either the mass of the secondary star is low, or the inclination of the orbit is far from 90°.

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