

## A LIST OF TWELVE STARS WHOSE RADIAL VELOCITIES VARY

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The variable radial velocities of the stars on the following list have been detected while following the regular program of the D. O. Mills Expedition from the Lick Observatory, University of California, to the Southern Hemisphere. These are in addition to the five cases of variability already announced in *Lick Observatory Bulletin* No. 60.

The custom adopted at Mount Hamilton of giving values of velocities depending on approximate measurements and reductions to the nearest kilometer is followed in this paper. An exception to the general rule of giving the results of careful measurements to the nearest tenth of a kilometer is made in the case of  $\kappa$  *Velorum* on account of the small number of lines in its spectrum and their slightly hazy character.

Most of these determinations have been made with  $\lambda$  4341 ( $H\gamma$ ) central in the camera, using an iron comparison spectrum. A number of spectrograms have, however, been secured with  $\lambda$  4450 central, using titanium for comparison purposes. These plates appear to have a systematic error of about  $-1.1$  km (observed value—true value). Velocity determinations from such spectrograms are indicated by an asterisk (\*). Values depending on poor plates are indicated by a dagger (†).

$\alpha$  *Phoenicis* ( $\alpha = 0^{\text{h}} 21^{\text{m}} 3$ ;  $\delta = -42^{\circ} 51'$ )

Date	Velocity	Measured by
1903, September 15.....	+80.7 km	R. H. Curtiss
October 1.....	+79.0	Palmer
October 5.....	+79.8	R. H. Curtiss
1904, August 3.....	+75.2	Wright
September 10.....	+74.4*	Palmer

$\gamma$  *Phoenicis* ( $\alpha = 1^{\text{h}} 24^{\text{m}} 0$ ;  $\delta = -43^{\circ} 50'$ )

Date	Velocity	Measured by
1903, December 14.....	+40.6 km	Palmer
December 22.....	+36.4	Palmer
1904, June 22.....	+39.0†	Palmer
October 3.....	+14.8*	Palmer
November 15.....	+33.0*	Palmer

The variable velocity of this star was detected by Dr. Palmer. The period as indicated by his observations appears to be roughly 190 days.

$\theta_1$  *Eridani* ( $\alpha = 2^{\text{h}} 54^{\text{m}} 5$ ;  $\delta = -40^{\circ} 42'$ )

This star is the brighter component of the telescopic double  $\theta$  *Eridani*. The spectrum is a composite one of the type of that of the brighter component of  $\zeta$  *Ursae Majoris*. In fact, the system of  $\theta$  *Eridani* may be said to be analogous to that of *Mizar*. On the first plate secured the  $H\gamma$  line, which is broad, and a number of other lines, including  $\lambda 4481$ , all of a similar character, were observed to be double. The magnesium line  $\lambda 4481$  is the only one which can be measured with any degree of satisfaction, and even in this case settings are subject to great uncertainty. The second spectrogram showed the components of the double lines closer together, while on the third the lines are apparently single. Only one spectrogram has been secured of  $\theta_2$  *Eridani*, the other component of the telescopic double. The lines on this plate are single.

Date	Velocity	Measured by
1904, December 23.....	-65 ± +103 ±	Palmer
1905, January 2.....	-30 ± +103 ±	Wright
January 9.....	+15 ±	Wright

$X$  *Eridani* ( $\alpha = 4^{\text{h}} 14^{\text{m}} 1$ ;  $\delta = -34^{\circ} 2'$ )

This spectrum belongs to the same class as that of  $\theta_1$  *Eridani*; that is, both of the spectra are in evidence, though in this case the lines are quite narrow. The line  $\lambda 4481$  is the only one on which measurements have been made.

Date	Velocity	Measured by
1903, October 3.....	+19 ± 1 km	Wright
1904, November 10.....	-13 ± 51 ±	Wright
December 7.....	+20 ±	Wright
December 14.....	-19 ± 70 ±	Palmer

*δ Columbae* ( $\alpha = 6^{\text{h}} 18^{\text{m}}4$ ;  $\delta = -33^{\circ} 23'$ )

Date	Velocity	Measured by
1903, December 5.....	-16.0 km	Palmer
1904, February 8.....	-12.7	Palmer
September 26.....	-1.9*	Palmer
November 2.....	-3.6*	Palmer
December 18.....	± 0.0	Palmer

The variable velocity of this star was detected by Dr. Palmer.

*A Carinae* ( $\alpha = 6^{\text{h}} 47^{\text{m}}6$ ;  $\delta = -53^{\circ} 31'$ )

Date	Velocity	Measured by
1904, November 17.....	+1.5 km*	Palmer
1905, January 9.....	+28	Wright
February 7.....	+48	Wright and Palmer

*σ Puppis* ( $\alpha = 7^{\text{h}} 26^{\text{m}}1$ ;  $\delta = -43^{\circ} 06'$ )

Date	Velocity	Measured by
1904, January 15.....	+86.8 km	Palmer
January 29.....	+89.0	R. H. Curtiss
October 25.....	+97.0*	Palmer
December 22.....	+103.4	Palmer

The variable velocity of this star was detected by Dr. Palmer.

*α Puppis* ( $\alpha = 7^{\text{h}} 48^{\text{m}}8$ ;  $\delta = -40^{\circ} 19'$ )

Date	Velocity	Measured by
1904, January 3.....	+26.5 km	Palmer
February 26.....	+28 ± †	Palmer
November 8.....	+17.2*	Palmer
December 10.....	+16.1*	Palmer
1905, February 23.....	+16	Wright

*a Volantis* ( $\alpha=9^{\text{h}} 0^{\text{m}} 9$ ;  $\delta=-66^{\circ} 0'$ )

The spectra of the two components are present, and both contain numerous lines. On only one plate is the doubling of the lines complete; but the range in the degree of sharpness of the lines on the other plates affords ample confirmation of the composite nature of the star's spectrum.

Date	Velocity	Measured by
1903, December 14.....	+ 3 km (lines fairly sharp)	Wright
1904, February 11.....	+ 54 $\pm$ - 54 $\pm$	Wright
December 6.....	+ 4 (lines fairly sharp)	Palmer
December 24.....	+ 6 (lines fairly sharp)	Palmer
1905, January 15.....	+ 5 (lines rather hazy)	Wright
February 12.....	+ 8 $\pm$ (lines very hazy)	Palmer

*a Carinae* ( $\alpha=9^{\text{h}} 8^{\text{m}} 4$ ;  $\delta=-58^{\circ} 33'$ )

Date	Velocity	Measured by
1904, February 29.....	+ 5.5 km	Wright
1905, January 30.....	+ 33.2	Palmer
February 9.....	+ 10.0	Wright and Palmer
February 22.....	+ 4.5	Palmer
March 7.....	- 1.2	Palmer

There is some evidence of a secondary spectrum. The  $H\gamma$  line on the plate of January 30 has the appearance of a fairly narrow line displaced toward the red from the center of a rather broad absorption. It was, in fact, this peculiar appearance of the line that led me to suspect that the velocity of the star might prove variable.

 $\kappa$  *Velorum* ( $\alpha=9^{\text{h}} 19^{\text{m}} 0$ ;  $\delta=-54^{\circ} 35'$ )

Date	Velocity	Measured by
1904, March 6.....	+ 67 $\pm$ km	Wright
1905, January 14.....	+ 13	Wright and Palmer
February 20.....	+ 63 $\pm$	Wright
March 7.....	+ 53	Palmer

This star has fairly narrow hydrogen and helium lines.  $\lambda 4481$  is also present and well defined. On account of the character of the star's spectrum, the values of the velocities are uncertain to the amount of a kilometer or two.

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*p Velorum* ( $\alpha = 10^{\text{h}} 33^{\text{m}} 2; \delta = -47^{\circ} 43'$ )

This star has a composite spectrum similar to those described above, but is somewhat unique among stars of its class, from the fact that the lines, though numerous, are so sharp that settings can be made with great accuracy on the lines of both spectra.

Date	Velocity	Measured by
1903, December 14.....	+ 34 km	Wright
1904, February 6.....	?      + 37	Wright
December 31.....	+ 22	Wright
1905, January 26.....	- 10      + 40	Wright and Palmer

In the cases where mention is made of the fact, the detection of variable velocity has been made by Dr. Palmer, in others by the writer. In the latter cases, the plate has frequently been turned over to Dr. Palmer for more deliberate measurement than the writer could afford the time to make.

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