A NEW VARIABLE STAR IN THE CONSTELLATION OF OPHINCH

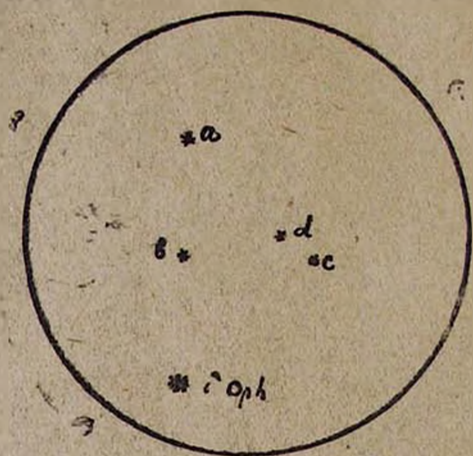
By L. Semeonoff

V452 Oph.

N 1.

Telecopic aspect.

Coordinates:



Shonfeld Durchmusterung photo-reproduction.

	α	δ	m
a	16h 5m 20s	—3°51′ 26.	7,0
b	16h 5m 50s	—3°40′ 0.	7,2
c	16h 6m 28s	—3°48′ 0.	7,5
d	16h 6m 10s	—3°47′ 24s	7,0

The chronometer Al. Guillaume № 1483

Number of observations:

1933 from September 8 till October 31—46 observations

1934 from September 4 till November 9—55 observations

Total 101 observations.

Observvations were carried out chiefly in September-october of each. year. After October the conditions become unfavourable because the given group of stars is near to the horizon.

The instruments used for observations are as follows:

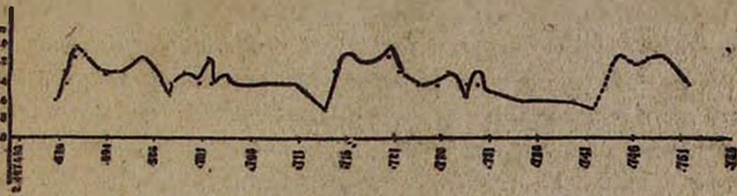
1) 9" refractor of Repsold, and

2) 3" refrator of Zeiss.

After beeing worked out the material of observations is settled as follows:

One degree is equal to $0^m.14$.

In this group the variable star is „b" which we mark by „V 452" Ophiuch.



In the maximum brightness V 452 oph. reaches $7^m.10$ and in the minimum it reaches $7^m 72$ i. e. oscillations of its brightness are within limits, apporoximately, $0^m 56$ (0.5 of star magnitude).

Investigations of brightness changings of V 452 oph. (see curve of brightness) shows that its brightness first rises fast and in two-three days reaches the limited significance; after this the curve of brightness gives a slight descent equal to 0.1—0.2 of the star magnitude. Then brightness reaches again the maximal significance. This descent and ascention goes smoothly during 5—6 days, which is followed by a normal descent of brightness. On the 12th or 13th day after the maximum (on the 14th day after the main minimum) a new assention of brightness begins, which for this time is accopanied by jumps: during three days brightness berins to rise smoothly on $0^m.2-0^m.3$ and then to lower also smoothly: but then a new rising begins whtch is followed by sharp descent during some

[1]) In the given case some role could have also the moen but I avoided to make observations near the full moon.

hours. After this jump a new ascention andethen smooth descent till the main maximum takes place.

Two suppositions can be made about this:

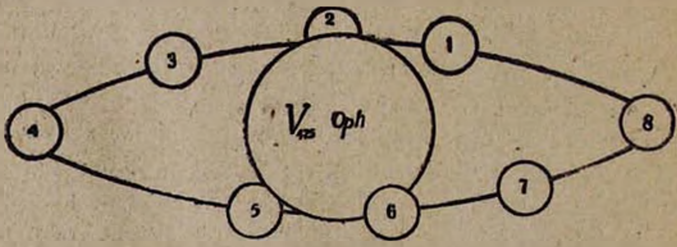
1) on the twelvth day (after maximum) we dealt with the secondary wave; but in the main work of P. ten—Bruggencate („Die veranderliche Sterne") about Cepheid type stars we meet the following conclusion: „It is noticede the appearance of secondary waves on the curves of cepheid- type stars brightness. With the stars having periods more than 9 days secondary wave may be observed only on its descending branch (the same is said in the Bull. astr. Inst. Netherlandy 3,115 1926). With stars with periods from 9 to 12 days it is observed that the secondary wave, if such one exists in general, corresponds very close with maximum brightness while for separate stars with periods more than 12 days, the secondary wave is observed on the ascending branch of the curve". As the period of brightness changing of V^{452} oph. is about" 14^d , the secondary wave must be on the ascendinh branch and not at all on the descending one.

In this case it seems probable that

$$P = 2.427.685 \; {}^d 8 + 14^d$$

with the probable error $b = 0.^d 2$. Besides, for explanation of some peculiarities of the curve it is supposed the presence of a satelite which is neither dark nor quite bright revolving round the main star with period approximately $27.^d 7$.

The eclipse of the satelite causes the first smooth descent of brightness immediately after maximum. The eclipse of



the main star causes charp descent of brightness about which is mentioned above. For explanation the folowing schematic drawing is given below.

J. D.	m	J. D.	m	J. D.	m
2		2		2	
427.324.868	7.m30	427.345.855	7.16	427.355.786	7.30
				.798	7.30
.325.843	7.16			.819	7.30
		.347.814	7.30	.836	7.30
.861	7.30	.82	7.30		
.331.807	7.30				
.847	7.30			.357.768	7.58
.871	7.30	.349.800	7.44	.785	7.58
.901	7.16	.849	7.30	.794	7.58
		.861	7.30	.812	7.58
.833.833	7.44				
.854	7.44			.360.791	7.30
.863	7.44	.350.826	7.16	.819	7.58
		.854	7.16	.826	7.58
		.872	7.16		
.335.801	7.44			.365.766	7.44
.814	7.44	.351.791	7.30		
.846	7.44	.805	7.30		
				.377.753	7.44
.340.816	7.30	.353.793	7.30	.776	7.44
.840	7.30	.802	7.30		
.846	7.30	.809	7.30		
.341.826	7.30				
.840	7.44				
427.685.833	7.58	427.700.847	7m 44	427.725.778	7m 44
.869	7.58			.795	7.44
		.701.805	7m 16	.726.785	7.30
.686.812	7.44	.843	7.44		
.845	7.30	.702.[illegible]05	7.30	.728.7[illegible]1	7.58
.875	7.44	.854	7.30	.778	7.58
				.782	7.44
.687.848	7.02	.703.793	7.30		
.861	7.16	.829	7.44	.729.791	7.30
		.849	7.44	.804	7.44
.688.843	7.16			.734.761	7.58
		.710.791	7.44	.791	7.58
.690.862	7.30	.841	7.44		
.889	7.30	.713.796	7.7[illegible]	.746.771	7.30
.691.858	7.30	.714.785	7.30	.747.772	7.16
.871	7.30	.808	7.[illegible]0	.749.757	7.16
		.715.797	7.16	.751.7[illegible]8	7.44
		.815	7.16		
.694.822	7.16				
.847	7.16	.716.791	7.16		
		.840	7.16		
.697.834	7.44	.720.787	7.16		
.850	7.58	.858	7.02		
		.721.795	7.30		
.698.808	7.30	.809	7.30		
.843	7.30	.722.785	7.44		
		.805	8.44		

Position I. V 452 oph. bright-curve after minimum goes to acention and reaches minimum.

Position 2.—Satelite goes round the main. star (satelite eclipse). But as it is not very bright the slow and slight weakening summary brightness takes place and for this reason the curve gives smooth and slight descent.

Position 3.—Satelite goes outside of the main starthe normal way of the curve is restored.

Position. 4—Though satelite is not eclipsed, but owing to the descent of brightness of V 452 oph. itself the bright-curve goes to descent.

Position 5.—A new period begins and, therefore a new ascending branch of brightness is curved.

Position 6.—Satelite darkens the main star (V 452 oph.) a sharp descent takes place and they comes bright ascention in some hours.

Position 7 and 8.—Descent of the curve goes by itself and so on, At this supposition we can admit that the main star gives flashings not of the same brightness as for cepheid-type stars, which as Eddington's vivid expression is „anormal candle" of the universe seems rather incredible. The most probable is, that the satelite causes tide wave on the main star that complicates the general aspect. Owing to the elliptical form of satelite orbit in the focus of which Is V 452 oph. tide wave will not be of the equal force in position 4 and 8. therefore bright-curve of V 452 oph. will not give the same minima in the same period. In the position 4 minimum of brightness will be higher on $0.^m2-0.^m3$ than in position 8.

It might be considered, of course, that $P=2.427.685^d8$ 27^d7, but this suppositicn comlicates more the question.

The following accounts will be done on suppositions that $P=14^d \pm 0.^d2$.

Logarithmus of the period gives:

$1gP = 1.146.$

Relation between period and vital absolute brightness found out by Miss Leavitt gives (Shapley, Stars clusters p. 129) : $M = -3.0$.

Accordingly, the photographic brightness entirely taken gives (idem, p. 137) Mph = — 2.1.

For „color index" it is got.

$$Mph - Mv = +0.9$$

Spectral class of stars may be defined by „color index" and also by 1gP (idem p. 137).

. For $\sqrt{\ }$ 52 oph we obtain that it belong to the type G_8.

The density of $\sqrt{\ }$452 oph, comnuted by 1gP method (Payne, Stars of high Luminosity) gives:

$$P = 10^{-4.33}$$

Calculation of annual parallax done in the principal formula of astrophysics:

$$M = m + 5 + 5\lg\pi$$

gives: $\pi = 0.''000912$, that gives in its turn the distance $\sqrt{\ }$452 oph equal to D = 1096 par. sec. For further calculations it is necessary at first to decide the effectiveness of temperature V oph.

If calculation is done by Schwarzchied (Tikhov „Astrophotometry") taking the absolute color index equal to +0.900° we shall obtain for T an absurdly great value, namely: 7.900° that is considered great for spectral-type stars G_8.

The same calculations, but taken from international zero-point gives: T = 5040°, that is more probable because the temperature of spectral type stars G oscilliate within limits 4.700° till 6000°.

The formula of Eddington for star radius gives (compared with our sun

$$\lg\frac{R}{R_\odot} = 0.2(m_\odot - m) - 2\lg\frac{T}{T_\odot} - 0.2\,[4.85 - (-3)] - 2\lg\frac{5040}{T_\odot}$$

thence $R = 28.64R_\odot$

The same calculations but chiefly made by formula Harkanyi that proceed from the surface brightness of stars and from „color index" give almost the same results as the abovementioned. I do not stay upon them here.

For the star's volume V_{oph} we obtain $V_{oph} = 23500\, V_\odot$ i. e. the volume $\sqrt{\ }$452 oph is 23500 times more than the volume of the sun. But taking into consideration its unsignificant density for the mass of Voph we shall have only: $M_{oph} = 1.1M_\odot$.

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ԱՄՓՈՓՈՒՄ

V_{452} Oph *ուսումնասիրությունը ցույց է տալիս, վոր նա փոփոխական է և, յերևվի, նրա ամենահավանական պարբերությունն է.*

$$p = 2,427.685^{d},8 + 14^{d}.0$$

հավանական սխալով՝ $\pm 0,^{d}2$

Պայծառության կորի մի շարք առանձնահատկությունները բացատրելու համար պետք է ընդունել արբանյակի արկայությունը (վոչ խավար է և վոչ էլ այնքան պայծառ) և վորը պտտում է գլխավոր աստղի շուրջը մոտ $27,^{d}7$ *որում. Ահա և այդ արբանյակի խավարումը, մեր կարծիքով, առաջացնում է գլխավոր աստղի պայծառության սահուն անկումն անմիջապես գլխավոր* maximum-*ից հետո. Պայծառության հետագա փոփոխությունները բացատրվում են նկար 3-րդով.*

Հետագա հաշվումների ժամանակ մենք ղեկավարվել ենք այն մեթոդներով, վորը տվել է Shapley *իր* „Stars clusters" *աշխատությունում և ստացել հետևյալ տվյալները.*

$M_{v} = -3^{m},0 \qquad M_{ph} = -2,^{m}1$

„Color index"-*ի համար.*

$M_{ph} - M_{v} = -2^{m},1 - (-3^{m},0) = +0^{m},9$

և վորտեղից V452 oph *սպեկտրալ կարգը կլինի* G_{5}.

բացարձակ ջերմաստիճանը կլինի.

$$T \approx 5040^{\circ}$$

խտությունը $S = 10^{-4.33}$, *պարալաքս՝* $\pi = 0.''000912$, *իսկ հեռավորությունը* $D = 1096$ *պարսեկ.*

Ստեֆան-Բոլցմանի բանաձևով (վերամշակված ըստ Էդինգտոնի) ստանում ենք. $R = 28,64\ R_{\odot}$

$$M = 1,1\ M_{\odot}$$

Լ. Սեմյոնով

Աստղադիտարան

Յերևան

15 հունվ. 1935 թ.