

# BULLETIN OF THE ASTRONOMICAL INSTITUTES OF THE NETHERLANDS

1952 DECEMBER 29

VOLUME XI

NUMBER 440

COMMUNICATION FROM THE OBSERVATORY AT LEIDEN

## NOTE ON THE PERIOD OF BF VIRGINIS,

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The value of the period of BF Virginis given by TSESEVICH as well as those given by former authors are erroneous. This is caused by a mistake in the counting of the periods elapsed. STRUVE derived spectroscopic elements of this system, using TSESEVICH's photometric elements, and consequently introducing erroneous phases. In this article a new period is derived and a rediscussion is given of STRUVE's material of radial velocities. The results are

$$\text{Min.} = \text{J.D. } 2434119.492 + 0^d.6405755 E \\ \pm 0.003 \pm 0.0000006 \text{ m.e.}$$

$$V = +9 \text{ km/sec} \pm 4 \text{ km/sec m.e.}$$

$$K_1 = 80 \quad \text{,,} \quad \pm 6 \quad \text{,,} \quad \text{,,}$$

Anticipating an investigation by the author on the periods of some eclipsing variables with short period, the aim of this article is to correct a serious mistake in the value of the period of the eclipsing variable BF Virginis as given by TSESEVICH as well as of those given by former authors<sup>1)</sup>.

In the following Table I all the observed minima are collected. A mean epoch of STRUVE's radial-velocity observations, which are rediscussed below, has been

added to this list, and also two recent photoelectric observations by the author, which will be published later when the investigation mentioned is finished.

The third column gives the values of  $E_1$  as assumed by SOLOVIEV, while the fourth column represents the deviations of the observed minima from the formula:

$$\text{Min.} = \text{J.D. } 2428313.306 + 0^d.639599 E_1, \quad (1)$$

in which the epoch and the period have been adopted from TSESEVICH's note<sup>1)</sup>. It is remarkable that TSESEVICH's period caused a pronounced systematic effect in these deviations, for which no explanation was

<sup>1)</sup> *L. c.*

- <sup>1)</sup> TSESEVICH, *Astr. Circ. U.S.S.R.* No. 35, 7, 1944.  
HOFFMEISTER, *A.N.* 255, No. 6118, 401, 1935.  
LAUSE, *A.N.* 264, No. 6318, 108, 1937.  
SOLOVIEV, *Tadj. Circ.* 25, 1937.

TABLE I  
Observed minima of BF Virginis

| Authority     | Min. J. D. Hel. | $E_1$    | $(O-C)_1$ | $(O-C)_{1a}$ | $E_2$  | $(O-C)_2$ |
|---------------|-----------------|----------|-----------|--------------|--------|-----------|
|               | 24...           |          | d         | d            |        | d         |
| SOLOVIEV ph   | 19926.34        | -13115   | +1.375    | -0.090       | -22157 | +0.080    |
| HOFFMEISTER „ | 25999.56        | -3618    | +0.323    | -0.050       | -12676 | +0.003    |
| „ „           | 26094.36        | -3470    | +0.463    | +0.106       | -12528 | -0.002    |
| „ „           | 26384.51        | -3016    | +0.235    | -0.069       | -12075 | -0.033    |
| SOLOVIEV „    | 26454.32        | -2907    | +0.328    | +0.037       | -11966 | -0.046    |
| HOFFMEISTER „ | 26771.46        | -2411    | +0.227    | -0.007       | -11471 | +0.009    |
| „ „           | 27188.43        | -1759    | +0.179    | +0.019       | -10820 | -0.035    |
| „ „           | 27505.53        | -1263    | +0.038    | -0.065       | -10325 | -0.020    |
| „ „           | 27539.47        | -1210    | +0.079    | -0.017       | -10272 | -0.031    |
| „ „           | 27546.55        | -1199    | +0.123    | +0.028       | -10261 | +0.003    |
| SOLOVIEV vis  | 28311.400       | -3       | +0.013    | +0.055       | -9067  | +0.006    |
| „ „           | 28313.319       | 0        | +0.013    | +0.056       | -9064  | +0.003    |
| „ „           | 28315.237       | +3       | +0.012    | +0.056       | -9061  | -0.001    |
| Lause „       | 28671.400       | (+ 560)  | -0.081    | +0.026       | -8505  | +0.002    |
| „ „           | 28687.399       | (+ 585)  | -0.072    | +0.038       | -8480  | -0.013    |
| „ „           | 28694.449       | (+ 596)  | -0.058    | +0.054       | -8469  | -0.010    |
| TSESEVICH     | 31241.387       | (+ 4579) | -0.634    | -0.073       | -4493  | +0.000    |
| STRUVE sp     | 32689.734       |          |           |              | -2232  | +0.006    |
| KWEE pe       | 34094.510       |          |           |              | -39    | +0.000    |
| „ „           | 34119.4932      |          |           |              | 0      | +0.0007   |

given. This systematic effect can be removed by assuming an ephemeris of:

$$\text{Min.} = \text{J.D. } 2428313.263 + 0^d.639484 E_1 \quad (1a)$$

in which the period is very close to that adopted earlier by SOLOVIEV, but the large dispersion in the residuals still remained, as is shown in column 5 of Table 1, where the deviations from formula 1a are given.

Furthermore, the last two observations by the author, which are of high accuracy, suggested a period which must be larger than that of TSESEVICH. Prof. P. TH. OOSTERHOFF suggested that a period of about  $0^d.640574$  would agree better with the observations; so new values of  $E$  were computed with the aid of this period. These values are given in column 6 of Table 1. The main difference between this column and column 3 is the number of periods elapsed in one year, SOLOVIEV having counted one period too much for every year. That this could happen is caused by the low declination of the star, the observations being made always close to the time of opposition.

Before the final solution of the photometric elements is made STRUVE's material of radial velocities is re-discussed.

In the months May and June 1948 STRUVE<sup>1)</sup> made some measurements of radial velocities of the brighter

component of this system. For computing the phases he used TSESEVICH's formula, thus introducing erroneous phases, which consequently led to the surprising conclusion that the measured component would be eclipsed at secondary minimum, although the depth of this minimum is only  $0^m.1$ , against  $0^m.5$  for that of the primary minimum.

After recomputing the phases with a provisional period of  $0^d.640574$ , and assuming the primary minimum to occur at the moment the radial velocity of the brighter and measured component changes from positive to negative with respect to the velocity of the system, a least-squares solution yields the following results:

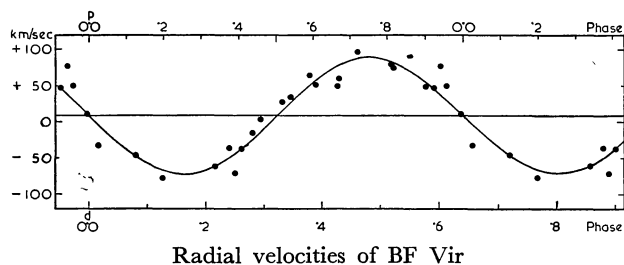
$$\begin{aligned} \text{Middle epoch Min.} &= \text{J.D. } 2432689.734 \pm 0.009 \text{ m.e.} \\ V &= +9 \text{ km/sec} \pm 4 \text{ km/sec m.e.} \\ K_1 &= 80 \quad \quad \pm 6 \quad \quad \quad \end{aligned}$$

In Table 2 the new phases and  $(O-C)$ 's are given, while in Figure 1 the radial-velocity curve is plotted according to these new elements. The figure shows clearly that the observations agree much better with the theoretical sine curve than they do in STRUVE's article. It should be noticed that near phase zero the slope of the observed radial-velocity curve seems to be steeper than that of the theoretical curve, which may be an indication of SCHLESINGER's rotation effect.

TABLE 2  
New phases and  $(O-C)$ 's of STRUVE's radial-velocity observations of BF Virginis.

| Plate No | Phase      | $(O-C)$    | Plate No | Phase      | $(O-C)$    | Plate No | Phase      | $(O-C)$   |
|----------|------------|------------|----------|------------|------------|----------|------------|-----------|
| 10865    | P<br>0.669 | -18 km/sec | 10928    | P<br>0.590 | +14 km/sec | 11086    | P<br>0.607 | -6 km/sec |
| 10866    | 0.721      | +10 "      | 10961    | 0.816      | -7 "       | 11122    | 0.337      | -1 "      |
| 10893    | 0.390      | -28 "      | 10970    | 0.374      | +12 "      | 11129    | 0.902      | -6 "      |
| 10898    | 0.957      | +18 "      | 10977    | 0.941      | +39 "      | 11133    | 0.437      | +8 "      |
| 10905    | 0.407      | -1 "       | 10978    | 0.997      | +0 "       | 11151    | 0.196      | -11 "     |
| 10906    | 0.459      | +16 "      | 10989    | 0.538      | +7 "       | 11198    | 0.810      | -4 "      |
| 10907    | 0.518      | +11 "      | 11049    | 0.125      | +1 "       | 11222    | 0.666      | -28 "     |
| 10917    | 0.025      | -29 "      | 11075    | 0.924      | +1 "       |          |            |           |

FIGURE 1



To complete Table 1 two recent epochs observed photoelectrically by the author have been added. The first, which resulted from only 4 observations during

<sup>1)</sup> *Ap. J.* 108, 497, 1948.

mid-eclipse and 9 observations on the rising branch, was given a weight equal to all the earlier epochs. The second resulted from 100 observations during the whole minimum, and has been given a relative weight 100 times those of the others. A least-squares solution with these weights gave the following formula for prediction of future minima:

$$\text{Min.} = \text{J.D. } 2434119.492 + 0^d.6405755 E_1 \quad (2)$$

$$\pm 0.003 \pm 0.000006 \text{ m.e.}$$

The deviations from this formula are given in column 7 of Table 1. The large positive value in this column for the first epoch may be an indication of variability of the period, but more observations will be required to prove such a variability.