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### A revised ephemeris for the RRab variable BB Bootis.

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#### ABSTRACT.

The variable star BB Boo was discovered in 1964 by Hoffmeister. Meinunger and Wenzel (1968) made photographic observations and proposed a first ephemeris :

$$\text{Max : Hel. J.D. } 2437823.460 + 0.47275 \text{ E } (1)$$

The photographic maxima added to 9 maxima observed visually by 3 Belgian members of GEOS at the Pic-du-Midi, allow the following ephemeris to be precised.

$$\text{Max : Hel. J.D. } 2440872.715 + 0.4727524 \text{ E } (2)$$
$$\pm \quad 7 \quad \pm \quad 9$$

(95% confidence interval for the error bands.)

#### RESUME.

La variable BB Boo fut découverte en 1964 par Hoffmeister. Meinunger et Wenzel (1968) ont effectué des observations photographiques et proposèrent une première éphéméride :

$$\text{Max : Hel. J.J. } 2437823.460 + 0.47275 \text{ E } (1)$$

Ces observations photographiques ajoutées à 9 maximums observés visuellement au Pic-du-Midi par 3 membres belges du GEOS, permettent de préciser l'éphéméride :

$$\text{Max : Hel. J.J. } 2440872.715 + 0.4727524 \text{ E } (2)$$
$$\pm \quad 7 \quad \pm \quad 9$$

#### RESUMEN.

La estrella variable BB Boo fué descubierta en 1964 por Hoffmeister. Meinunger y Wenzel (1968) realizaron observaciones fotográficas y propusieron la primera efeméride :

$$\text{Max : Hel. J.D. } 2437823.460 + 0.47275 \text{ E } (1)$$

El máximo fotográfico, añadido a los 9 máximos visuales observados por 3 miembros belgas del GEOS en el Pic-du-Midi, permite que la anterior efeméride sea precisada :

$$\text{Max : Hel. J.D. } 2440872.715 + 0.4727524 \text{ E } (2)$$
$$\pm \quad 7 \quad \pm \quad 9$$

#### SOMMARIO.

La variabile BB Boo venne scoperta nel 1964 da Hoffmeister. Meinunger e Wenzel (1968) ne effettuarono osservazioni fotografiche e proposero una prima effemeride :

$$\text{Max : Hel. GG. } 2437823.460 + 0.47275 \text{ E } (1)$$

Tali massimi fotografici, aggiunti a 9 massimi osservati visualmente da 3 osservatori belgi, membri del GEOS, dall'Osservatorio del Pic-du-Midi, han portato alla seguente effemeride più precisa :

$$\text{Max : Hel. GG. } 2440872.715 + 0.4727524 \text{ E } (2)$$
$$\pm \quad 7 \quad \pm \quad 9$$

1) Introduction.

S 8504 B00 ( $\alpha$  2000 : 11h53m36s,  $\delta$  2000: +21 53'3") was discovered in 1964 by C. Hoffmeister. It is a RRAb type with variations between 14.4 and 16 p.

Meinunger and Wenzel observed 18 photographic maxima between 1962 and 1966 and proposed a first ephemeris, which is still used as a reference in the 4<sup>th</sup> edition of the General Catalogue of Variable Stars (1985).

$$\text{Max : Hel. J.D. } 2437823.460 \pm 0.47275 \quad E \quad (1)$$

No other observation is available, to our knowledge.

Kukarkin et al. (1969) gave S 8504 B00 the definitive designation of BB Boo. It is interesting to note the steep ascending branch ( $M-m = 0.08$ ). In the paper of Meinunger and Wenzel, the J.D. of the latest maximum is erroneous, and one must read 9246.432 not 9264.432 .

2) Observations.

BB B00 was observed visually by 3 Belgian GEOS members (R. Boninsegna, P. Louis and P. Wils). The 60-cm telescope of Pic-du-Midi (France) was used during a mission of observations of faint and neglected short period stars. During the nights of 1984 March 5, 6, 7 one estimate was made every 15 minutes. The estimation method used was different according to the observers (Argelander and/or fractional method).

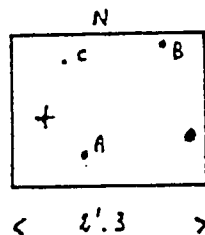


FIGURE 1 : BB Boo and the comparison stars selected from Hoffmeister's chart (1964) by the members of the mission.

3) Results.

The observed maxima were determined by the tracing paper method. Table 2 gives the list of the 9 times of maximum, with the number of estimates used for the determination (N), the observer's name and the O-C according to ephemerides (1) and (2).

| Date     | Observer   | N  | Max Hel. JD. | O-C(1) | O-C(2) |
|----------|------------|----|--------------|--------|--------|
| 05-03-84 | BONINSEGNA | 23 | 2445765.701  | +0.041 | -0.002 |
|          | WILS       | 23 | .702         | +0.042 | -0.001 |
|          | LOUIS      | 19 | .710         | +0.050 | +0.007 |
| 06-03-84 | BONINSEGNA | 22 | 2445766.642  | +0.036 | -0.006 |
|          | WILS       | 21 | .645         | +0.039 | -0.003 |
|          | LOUIS      | 18 | .650         | +0.044 | +0.002 |
| 07-03-84 | BONINSEGNA | 21 | 2445767.590  | +0.039 | -0.004 |
|          | LOUIS      | 19 | .590         | +0.039 | -0.004 |
|          | WILS       | 20 | .602         | +0.051 | +0.008 |

The amplitude variation is different for each observers but a mean light curve is shown in fig. 2. In the absence of definite information about the magnitude of comparison stars, we estimated the visual amplitude to be superior to one mag. The visual light curve confirms the M-m value of 0.08p'. O-C's (1) are in good agreement with each other and using all the maxima it was possible to obtain a better ephemeris.

From the maxima of Meinunger and Wenzel (1968), the error bands of the period is : 0.000006 d. We can link the visual observations to the photographic ones without ambiguity in spite of a gap of 16800 cycles.

Supposing a constant period from 1964 to 1984, and using a least-squares procedure we obtain the following revised ephemeris :

$$\text{Max : Hel. J.D. } 2440872.715 + 0.4727524 E \quad (2)$$

$$\pm 7 \qquad \qquad \pm 9$$

(95% confidence interval for the error bands.)

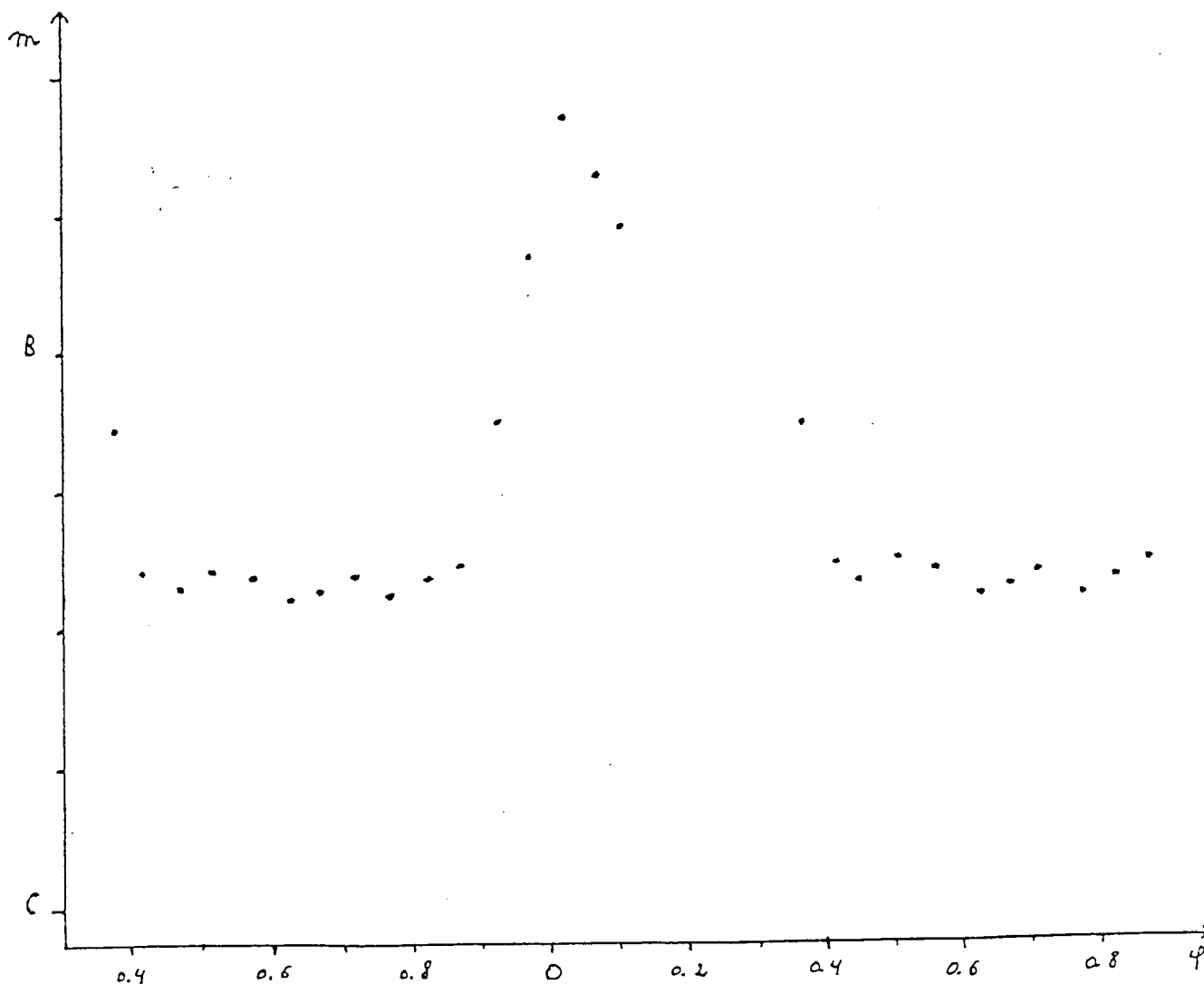


Figure 2 : mean light curve from 186 estimates of the 3 Belgian GEOS observers using ephemeris 2.

## 5) References.

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1. HOFFMEISTER C., 1964, AN 288, 49.
  2. KHOLOPOV P.N., SAMUS N.N., FROLOV M.S., GORANSKY V.P., GORYNYA N.A., KIREEVA N.N., KUKARKINA N.P., KURACHKIN N.E., MEDVEDEVA G.I., PEROVA N.B., SHUGAROV S.Yu., 1985, Fourth edition of the General Catalogue of Variable Stars. (Nauka, Moscow).
  3. KUKARKIN B.V., KHOLOPOV P.N., EFREMOV Yu.N., KUKARKINA N.P., KUROCHKIN N.E., MEDVEDEVA G.I., PEROVA N.B., FEDOROVICH V.P., FROLOV M.S., 1969, Third edition of the General Catalogue of Variable Stars. (Moscow)
  4. MEINUNGER L., WENZEL W., 1968, VSS 7, 389.

P. LOUIS