ABSTRACT. BP PEGASI : 74 TIMES OF MAXIMA, IMPROVEMENT OF THE EPHEMERIS AND EVIDENCE OF VISUALLY OBSERVED BLAZHKO EFFECT.

The 0.4 mag amplitude RR Lyrae star BP Pegasi has been observed in 1976 and 1977, mainly at the GEOS summer camp of St Rome (France) by 7 visual observers. More than 2400 estimates have been completed leading to the determination of 74 times of maximum.

A significantly negative mean O-C has been found with respect to BROGLIA’s ephemeris (P. BROGLIA, 1959). Nevertheless, we still have to assume the constancy of the period since 1953, as our new period and BROGLIA’s are consistent within their error bars.

The new derived ephemeris is, for the fundamental period:

\[
\text{(2) Max = Hel. J. D. 24 43 014, 5786 + 0.109 543 375 E} \pm 12 \pm 25
\]

(error bars at 95% level of confidence)

A good mean curve has been obtained using the 0.084 510 day period of the 0.1 mag secondary oscillation.

This oscillation has not escaped detection by all of the more productive visual observers, which is an excellent result and a good confirmation of BROGLIA’s determination of the beat period.

RIASSUNTO. BP PEGASI : 74 ISTITANTI DI MASSIMO, MIGLIORAMENTO DELL’EFE ChemERIS E DETEZIONE VISUALE DELL’EFFETTO BLAZHKO.

BP Peg, variabile tipo RR Lyrae, è stata osservata nel 1976 e 1977, principalmente al campo d’estate del GEOS a St Rome (Francia). Sono state effettuate più di 2400 stime, con la conseguente determinazione di 74 istanti di massimo.

L’O-C medio è risultato significativamente negativo in relazione all’effemeride di riferimento (P. BROGLIA, 1959). Non è tuttavia necessario abbandonare l’ipotesi della costanza del periodo (dal 1953), dato che il nostro valore e quello di BROGLIA sono consistenti nelle rispettive bande d’errore.

Il miglioramento dell’effemeride conduce, per il periodo fondamentale a:

\[
\text{(2) Max = G.Gelicic. 24 43 014, 5786 + 0.109 543 375 E} \pm 12 \pm 25
\]

(barre d’errore al livello di confidenza del 95%)

Inoltre è stata ottenuta una buona curva visuale media sul periodo 0.084 510 d dell’oscillazione secondaria, che ha l’ampiezza di 0,1 mag.

Quest’oscillazione è stata evidenziata da tutti gli osservatori che hanno seguito a lungo la stella, ciò che costituisce un eccellente risultato per le osservazioni visuale così come una conferma della determinazione di BROGLIA riguardo al periodo dei battimenti.

RESUME. BP PEGASI : 74 INSTANTS DE MAXIMUMS, AMELIORATION DE L’EPHEMERIDE, ET DETECTION VISUELLE DE L’EFFET BLAZHKO.

BP Pegasi, variable de type RR Lyrae et d’amplitude 0,4 magnitude, a été observée en 1976 et 1977, principalement au camp d’été du GEOS à St Rome (France) par 7 observateurs visuels.

Plus de 2400 estimations ont été effectuées, permettant la détermination de 74 instants de maximums.

L’O-C moyen est négatif, de façon significative, relativement à l’éphéméride de référence (P. BROGLIA, 1959). Cependant, il n’est pas nécessaire d’abandonner l’hypothèse de la constance du période (depuis 1953), car notre nouvelle valeur de période et celle de BROGLIA demeurent compatibles à l’intérieur de leurs bandes d’erreur.

L’éphéméride améliorée devient donc, pour la période fondamentale:

\[
\text{(2) Max = J.Jéhél. 24 43 014, 5786 + 0.109 543 375 E} \pm 12 \pm 25
\]

(bandes d’erreur au niveau de confiance 95%)

Par ailleurs, une bonne courbe moyenne visuelle a été obtenue sur la période 0.084 510 d de l’oscillation secondaire, qui a un demi-mesure de magnitude d’amplitude.

Cette oscillation a été détectée par tous les observateurs visuels les plus productifs, ce qui est un excellent résultat, ainsi qu’une bonne confirmation de la détermination de la période de battement par BROGLIA.

RESUMEN. BP PEGASI : 74 INSTANTES DE MAXIMOS, MEJORA DE LA EFEMERIDE Y DETECCION VISUAL DEL EFECTO BLAZHKO.

BP Pegasi, variable de tipo RR Lyrae y de amplitud 0,4 magnitudes, fue observada en 1976 y 1977, principalmente en el campo de verano del GEOS en St Rome (Francia) por 7 observadores visuales.

Fueron efectuadas más de 2400 estimaciones, las cuales permitieron la determinación de 74 instantes de máximos.

El O-C es negativo, de forma significativa, con respecto a la efemérides de referencia (P. BROGLIA, 1959). Sin embargo, no es necesario abandonar la hipótesis de la constancia del periodo (data de 1953) pues nuestro nuevo valor del periodo y el de BROGLIA continuan siendo compatibles dentro de sus bandas de error.

La efeméride mejorada queda pues así para el periodo fundamental:

\[
\text{(2) Max = Hel. J. D. 24 43 014, 5786 + 0.109 543 375 E} \pm 12 \pm 25
\]

(barras de error con un nivel de confianza del 95%)

Por otra parte, ha sido obtenida una buena curva media visual sobre el periodo 0.084 510 de la oscilación secundaria, que tiene una decima de magnitud de amplitud. Esta oscilación ha sido detectada por todos los observadores visuales más productivos, lo que es un excelente resultado, al mismo tiempo que una buena confirmación del periodo de batimiento por BROGLIA.
1. INTRODUCTION

BP Pegasi, with coordinates 1950.0: \( \alpha = 21 \text{ h } 31 \text{ m } 00 \text{ s} \), \( \delta = + 22^\circ 31'.3 \), is an RRs-type variable, spectrum A5 - F0, mean range 11.81 to 12.23 V, M-m = 0.30.

The fundamental period \( P_0 \) of the light variation is given by the following ephemeris:

\[
\text{(1) Max } = \text{Hel. J.D. } 2434600.5520 \pm 0.10954347 \pm 7 \quad \pm 5 \text{ (mean error)}
\]

Ephemeris (1) was derived by P. BROGLIA from extensive photoelectric photometry carried out at the MILANO-MERATE Observatory in 1953 and 1958-59 (A. MASANI and P. BROGLIA, 1954; P. BROGLIA, 1959).

BROGLIA was able to prove the presence of a Blazhko effect with a slightly variable beat period \( P_b \): \( P_b = 0.3720 \text{ d} \) in 1953 and \( P_b = 0.3698 \text{ d} \) in 1958-59. The beat phenomenon causes the O-C's to vary within \( \pm 0.003 \text{ d} \) and the magnitude of the maxima within \( \pm 0.045 \text{ mag} \) in V and \( \pm 0.07 \text{ mag} \) in B, as referred to the fundamental oscillation (1).

Besides, BROGLIA pointed out a probable shortening of the period \( P_0 \) before 1953, mainly on the grounds of a discrepancy with the epoch of KUKARKIN's ephemeris (B.V. KUKARKIN, 1938) in relation to (1).

2. OBSERVATIONS

BP Pegasi was visually observed at the GEOS 1976 summer camp of ST ROME (Lozère, France), simultaneously with two other RRs stars. The instrument assigned to BP Peg was a 256-mm telescope (at 57x magnification).

Figure 1 gives the identification chart. Approximate v magnitudes for the three most important comparison stars are: \( A = 11.1 \), \( B = 11.8 \), \( D = 12.7 \).

2211 visual estimates were made by 8 observers from 1976 August 18 to 1976 September 01 (see Table 1).

214 further estimates (69 made in 1976 October and 145 in 1977 September) were made by the author in Paris, after the ST ROME camp, using the same telescope:

![Fig. 1. Field of BP Pegasi.](image)

<table>
<thead>
<tr>
<th>Observers</th>
<th>Identification</th>
<th>Origin</th>
<th>Number of estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alain</td>
<td>FIGER</td>
<td>F - Paris</td>
<td>569</td>
</tr>
<tr>
<td>Jean-François</td>
<td>LE BORGNE</td>
<td>F - Brest (*)</td>
<td>412</td>
</tr>
<tr>
<td>Pascal</td>
<td>GUIRAUDOU</td>
<td>F - Montgeron</td>
<td>368</td>
</tr>
<tr>
<td>Claudio</td>
<td>ROMOLI</td>
<td>I - Altopascio</td>
<td>326</td>
</tr>
<tr>
<td>Philippe</td>
<td>RALINCOURT</td>
<td>F - Nantes</td>
<td>306</td>
</tr>
<tr>
<td>Alain</td>
<td>ROYER</td>
<td>F - Epinac</td>
<td>155</td>
</tr>
<tr>
<td>Alain</td>
<td>MAROT</td>
<td>F - Quimper</td>
<td>41</td>
</tr>
<tr>
<td>Nicola</td>
<td>ZACCARIA</td>
<td>I - Pisa</td>
<td>34</td>
</tr>
</tbody>
</table>

(*) Now at the Pic-du-Midi and Toulouse Observatory

Table 1. ST ROME Camp: List of the observers of BP Pegasi. The 2211 observations were made from 1976 AUG 18 to 1976 SEP 01.
3. DISCUSSION

3.1 List of the observed maxima

The times of the 63 maxima observed at ST ROME 76 are listed in Table 2. They were derived from the individual light curves by several GEOS members, using manual smoothing. The 11 additional maxima observed at PARIS are listed in Table 3.

3.2 Determination of a mean O-C

The O-C's in Tables 2 and 3 are referred to ephemeris (1). A systematic negative trend appears in both cases. There is no significant difference between the results obtained in 1976 and those obtained in 1977. Consequently, the arithmetic mean for all the O-C's is: $O-C = -0.0073 \pm 0.012 \text{d}$. The error on the mean O-C is expressed at a 95% level of confidence.

The standard deviation of the 74 individual O-C's is: $s(O-C) = 0.0053 \text{d}$, that is: $7.6 \text{mn}$ (and 4.8% of the period length).

Weighting the data (see for example E. PORETTI, 1981 ; Ph. RALINCOURT, 1982) does not bring here any decisive improvement as they are rather homogeneous and the weighted mean O-C is very similar to the unweighted one.

3.3 Ascertainning of the period

Between our mean maximum, at Hel.J.D. 24 43 014. 5786 $\pm$ 0.0012, and the epoch of BROGLIA's ephemeris, we find an interval of $8414.0266 \pm 0.0018 \text{d}$ for 76810 elapsed cycles.

The mean period over 23 years: $P_0 = 0.109543375 \pm 0.00025 \text{d}$ (at 95%)

can compare with BROGLIA's period: $0.10954347 \pm 0.00010 \text{d}$ (at 95%)

Both periods are equal within a 95% confidence interval.

As a consequence, our significative O-C does not necessarily imply a new shortening of BP Peg's period. On the contrary, we still have to assume the constancy of the period since 1953.

On the other hand, the slight improvement of BROGLIA's period does not alter his statement concerning a probable shortening before 1953.

3.4 Investigation on the Blazhko effect

It is not unreasonnable to look for a visually observed Blazhko effect as the secondary oscillation exhibits a 0.09 V-magnitude amplitude (according to BROGLIA, 1959).

However, as our basic data, the visual estimates, are rather inaccurate, they might fail to evidence the periodic variation of O-C's and height of maxima. In that way indeed, only a part of the visual estimates, i.e. those around the times of maximum are taken in account.

It is of importance to use all the information, and plotting a mean curve on the secondary period is the way to it; with visual estimates with a standard deviation of 0.01 mag, calculating means on batches of 10 to 20 measures will give an adequate signal-to-noise ratio.

Figure 2 shows the mean curves obtained by the 5 most productive observers (FGR, FLB, GUI, RML, RAL). For each observer we have plotted two mean curves using two periods: $P_0$ the fundamental, and $P_1 = 0.084510 \text{d}$ the secondary one. $P_1$ is derived from the formula: $1/P_1 = 1/P_0 + 1/P_0$ where $P_0 = 0.10954347 \text{d}$ and $P_0 = 0.3698 \text{d}$.

A remarkable result is found, as a significative oscillation for $P_1$ is present on the mean curves of all 5 observers.

To test the reality of the phenomenon, 3 curves have been computed in another way: when subtracting the fundamental oscillation from the data, the result does not change much (as a rule, the shape of the curve is kept and the amplitude decreases a little).

Table 4 summarizes the main characteristics of the mean curves.
<table>
<thead>
<tr>
<th>Date</th>
<th>Geoc. U.T.</th>
<th>Hel. J.D.</th>
<th>O-C</th>
<th>Observer</th>
<th>Date</th>
<th>Geoc. U.T.</th>
<th>Hel. J.D.</th>
<th>O-C</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUG 76</td>
<td>22:10.</td>
<td>9.4283</td>
<td>-0.0091</td>
<td>ROY</td>
<td>21</td>
<td>23:50.2</td>
<td>12.4978</td>
<td>-0.0068</td>
<td>GUI</td>
</tr>
<tr>
<td>18</td>
<td>00:44.</td>
<td>9.5353</td>
<td>-0.0116</td>
<td>FGR</td>
<td>21</td>
<td>03:51.6</td>
<td>12.4989</td>
<td>-0.0057</td>
<td>FGR</td>
</tr>
<tr>
<td>19</td>
<td>03:15.4</td>
<td>9.6404</td>
<td>-0.0161</td>
<td>ROY</td>
<td>21</td>
<td>23:54.3</td>
<td>12.5007</td>
<td>-0.0039</td>
<td>RAL</td>
</tr>
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<td>03:23.4</td>
<td>9.6460</td>
<td>-0.0105</td>
<td>FGR</td>
<td>22</td>
<td>00:00.</td>
<td>12.5047</td>
<td>+0.0001</td>
<td>FLB</td>
</tr>
<tr>
<td>19</td>
<td>03:29.8</td>
<td>9.6504</td>
<td>-0.0061</td>
<td>ROY</td>
<td>22</td>
<td>02:18.</td>
<td>12.6005</td>
<td>-0.0137</td>
<td>RAL</td>
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<td>21:47.4</td>
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<td>-0.0107</td>
<td>FGR</td>
<td>22</td>
<td>02:21.9</td>
<td>12.6032</td>
<td>-0.0110</td>
<td>FGR</td>
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<tr>
<td>19</td>
<td>21:48.2</td>
<td>10.4132</td>
<td>-0.0101</td>
<td>GUI</td>
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<td>02:25.3</td>
<td>12.6056</td>
<td>-0.0086</td>
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<td>10.4181</td>
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<td>FGR</td>
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<td>01:41.</td>
<td>14.5748</td>
<td>-0.0111</td>
<td>FGR</td>
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<tr>
<td>19</td>
<td>21:58.5</td>
<td>10.4203</td>
<td>-0.0030</td>
<td>RAL</td>
<td>24</td>
<td>01:42.</td>
<td>14.5755</td>
<td>-0.0104</td>
<td>RML</td>
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<tr>
<td>19</td>
<td>22:00.0</td>
<td>10.4214</td>
<td>-0.0019</td>
<td>FLB</td>
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<td>02:02.</td>
<td>14.5894</td>
<td>+0.0035</td>
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<td>22:00.5</td>
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<td>02:08.8</td>
<td>14.5941</td>
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<td>10.5275</td>
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<td>16.5530</td>
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<td>11.3971</td>
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<td>GUI</td>
<td>26</td>
<td>21:46.</td>
<td>17.4116</td>
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<tr>
<td>20</td>
<td>21:32.</td>
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<td>22:04.</td>
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<td>20</td>
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<td>22:13.5</td>
<td>17.4307</td>
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<td>-0.0026</td>
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<td>27</td>
<td>00:43.</td>
<td>17.5346</td>
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<td>11.5037</td>
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<td>27</td>
<td>00:43.2</td>
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<td>00:29.3</td>
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<td>-0.0097</td>
<td>RAL</td>
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<td>00:32.7</td>
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<td>03:01.3</td>
<td>18.6306</td>
<td>-0.0084</td>
<td>RAL</td>
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</tbody>
</table>

Table 2. BP PEG observed at S'ROME 76 by 6 observers. 63 times of maxima. The O-C's refer to ephemeris (1).
Fig. 2  Mean curves by 5 observers for both periods of BP Pegasi.
Left: fundamental period $P_0$; ephemeris (1): 34 600.5520 + 0.10954347 E. Dots are means on 0.02 period.
Right: secondary period $P_1$; ephemeris (1'): 34 600.5520 + 0.084509705 E. Dots are means on 0.05 period.
Table 3. BP Peg observed at PARIS by FGR. 11 times of maxima. The O-C's refer to ephemeris (1).

<table>
<thead>
<tr>
<th>Date</th>
<th>Geoc. U.T.</th>
<th>Hel. J.D.</th>
<th>O-C (day)</th>
</tr>
</thead>
<tbody>
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<td>23:22.</td>
<td>68.4767</td>
<td>-0.0046</td>
</tr>
<tr>
<td>1976 OCT 17</td>
<td>20:26.5</td>
<td>69.3547</td>
<td>-0.0030</td>
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<tr>
<td>1977 SEP 02</td>
<td>01:21.</td>
<td>388.5610</td>
<td>-0.0063</td>
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<tr>
<td>1977 SEP 05</td>
<td>21:27.</td>
<td>392.2984</td>
<td>-0.0030</td>
</tr>
<tr>
<td>1977 SEP 06</td>
<td>00:06.</td>
<td>392.5088</td>
<td>-0.0021</td>
</tr>
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<td>1977 SEP 06</td>
<td>21:04.5</td>
<td>393.3827</td>
<td>-0.0046</td>
</tr>
<tr>
<td>1977 SEP 11</td>
<td>00:56.</td>
<td>397.5435</td>
<td>-0.0064</td>
</tr>
<tr>
<td>1977 SEP 11</td>
<td>21:53.</td>
<td>398.4164</td>
<td>-0.0099</td>
</tr>
<tr>
<td>1977 SEP 13</td>
<td>21:21.8</td>
<td>400.3946</td>
<td>-0.0034</td>
</tr>
<tr>
<td>1977 SEP 14</td>
<td>20:39.</td>
<td>401.3649</td>
<td>-0.0190</td>
</tr>
<tr>
<td>1977 SEP 14</td>
<td>23:16.</td>
<td>401.4739</td>
<td>-0.0196</td>
</tr>
</tbody>
</table>

Table 4. BP Peg: Phases of maximum and minimum and Amplitudes from light-curves of Figure 2.

<table>
<thead>
<tr>
<th>Observer</th>
<th>FUNDAMENTAL (P₀)</th>
<th>SECONDARY (P₁)</th>
<th>Amplitude ratio (P₁/P₀) %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>φ_MAX</td>
<td>φ_MIN</td>
<td>AMPL.</td>
</tr>
<tr>
<td>FGR</td>
<td>0.935</td>
<td>0.545</td>
<td>0.26 m</td>
</tr>
<tr>
<td>RAL</td>
<td>0.94</td>
<td>0.61</td>
<td>0.30</td>
</tr>
<tr>
<td>RML</td>
<td>0.965</td>
<td>0.495</td>
<td>0.36</td>
</tr>
<tr>
<td>FLB</td>
<td>0.95</td>
<td>0.54</td>
<td>0.25</td>
</tr>
<tr>
<td>GUI</td>
<td>0.93</td>
<td>0.51</td>
<td>0.49</td>
</tr>
<tr>
<td>Mean</td>
<td>0.944</td>
<td>0.54</td>
<td>0.33 m</td>
</tr>
</tbody>
</table>

Notable discrepancies in phase are apparent at the maximum of the secondary oscillation, whereas a better fit exists at the minimum, thus excluding the hypothesis of a random distribution.

The amplitude ratio of the secondary to the fundamental oscillation is a little higher than expected: 33% for us, versus 21% in V and 24% in B according to BROGLIA.

Clearly, the amplitude of the primary oscillation (0.33 mag) has been under-estimated by the visual observers, as is often the case in visual mean curves (see, for example, A. FIGER, 1982).

The amplitude ratio drops to 27% when considering the GEOS observers' mean curve plotted after the secondary period in Figure 3.

Figure 4, showing BROGLIA's V mean curve after the secondary period, is a proof of the quality of visual observations. The shape can compare, whereas the shift in phase has no significance for the very long time elapsed between the visual and BROGLIA's observations.
Fig. 3. Mean curve by visual observers FGR, RAL, RML, FLB, GUI, for secondary period $P_1$ (ephemeris $1'$). Dots are means on 0.05 period.

Fig. 4. BROGLIA's V mean curve for secondary period $P_1$ (ephemeris $1'$). Dots are means on 0.05 period from 860 V measurements in 1958-59.
Tables 5 and 6 give the numerical values used for the plotting of Figs. 3 and 4.

<table>
<thead>
<tr>
<th>Phase $\phi$</th>
<th>Number $n$</th>
<th>mean Mag. $\bar{m}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>73</td>
<td>12.105</td>
</tr>
<tr>
<td>0.075</td>
<td>81</td>
<td>12.076</td>
</tr>
<tr>
<td>0.125</td>
<td>72</td>
<td>12.082</td>
</tr>
<tr>
<td>0.175</td>
<td>99</td>
<td>12.047</td>
</tr>
<tr>
<td>0.225</td>
<td>82</td>
<td>12.022</td>
</tr>
<tr>
<td>0.275</td>
<td>90</td>
<td>12.020</td>
</tr>
<tr>
<td>0.325</td>
<td>86</td>
<td>12.010</td>
</tr>
<tr>
<td>0.375</td>
<td>85</td>
<td>12.041</td>
</tr>
<tr>
<td>0.425</td>
<td>84</td>
<td>12.021</td>
</tr>
<tr>
<td>0.475</td>
<td>75</td>
<td>12.034</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase $\phi$</th>
<th>Number $n$</th>
<th>mean Mag. $\bar{m}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.525</td>
<td>78</td>
<td>12.006</td>
</tr>
<tr>
<td>0.575</td>
<td>71</td>
<td>12.026</td>
</tr>
<tr>
<td>0.625</td>
<td>73</td>
<td>12.025</td>
</tr>
<tr>
<td>0.675</td>
<td>64</td>
<td>12.029</td>
</tr>
<tr>
<td>0.725</td>
<td>70</td>
<td>12.013</td>
</tr>
<tr>
<td>0.775</td>
<td>83</td>
<td>12.035</td>
</tr>
<tr>
<td>0.825</td>
<td>82</td>
<td>12.042</td>
</tr>
<tr>
<td>0.875</td>
<td>88</td>
<td>12.053</td>
</tr>
<tr>
<td>0.925</td>
<td>84</td>
<td>12.056</td>
</tr>
<tr>
<td>0.975</td>
<td>86</td>
<td>12.093</td>
</tr>
</tbody>
</table>

Table 5. Mean points for Figure 3 (from the visual estimates): Phase $\phi$ refers to ephemeris 1', $n$ is the estimates number and $\bar{m}$ is the mean magnitude for phase $\phi$.

<table>
<thead>
<tr>
<th>Phase $\phi$</th>
<th>Number $n$</th>
<th>mean Mag. $\Delta V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025</td>
<td>44</td>
<td>-0.543</td>
</tr>
<tr>
<td>0.075</td>
<td>39</td>
<td>-0.556</td>
</tr>
<tr>
<td>0.125</td>
<td>34</td>
<td>-0.534</td>
</tr>
<tr>
<td>0.175</td>
<td>42</td>
<td>-0.565</td>
</tr>
<tr>
<td>0.225</td>
<td>34</td>
<td>-0.568</td>
</tr>
<tr>
<td>0.275</td>
<td>39</td>
<td>-0.589</td>
</tr>
<tr>
<td>0.325</td>
<td>43</td>
<td>-0.585</td>
</tr>
<tr>
<td>0.375</td>
<td>39</td>
<td>-0.577</td>
</tr>
<tr>
<td>0.425</td>
<td>43</td>
<td>-0.547</td>
</tr>
<tr>
<td>0.475</td>
<td>48</td>
<td>-0.513</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase $\phi$</th>
<th>Number $n$</th>
<th>mean Mag. $\Delta V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.525</td>
<td>41</td>
<td>-0.532</td>
</tr>
<tr>
<td>0.575</td>
<td>46</td>
<td>-0.496</td>
</tr>
<tr>
<td>0.625</td>
<td>39</td>
<td>-0.538</td>
</tr>
<tr>
<td>0.675</td>
<td>40</td>
<td>-0.515</td>
</tr>
<tr>
<td>0.725</td>
<td>49</td>
<td>-0.524</td>
</tr>
<tr>
<td>0.775</td>
<td>42</td>
<td>-0.499</td>
</tr>
<tr>
<td>0.825</td>
<td>51</td>
<td>-0.497</td>
</tr>
<tr>
<td>0.875</td>
<td>48</td>
<td>-0.507</td>
</tr>
<tr>
<td>0.925</td>
<td>49</td>
<td>-0.501</td>
</tr>
<tr>
<td>0.975</td>
<td>50</td>
<td>-0.535</td>
</tr>
</tbody>
</table>

Table 6. Mean points for Figure 4 (from BROGLIA’s V measures): Phase $\phi$ refers to ephemeris 1', $n$ is the measures number and $\Delta V$ is the mean magnitude for phase $\phi$. 
5. CONCLUSION

This study emphasizes the interest of visual estimates performed according to the GEOS philosophy, that is to say managing to obtain large concentrations of measures on a few selected stars.

The visual observations of BP Pegasi in 1976-77 show a negative O-C with reference to BROGLIA's ephemeris (1), and allow one to propose a slightly more accurate new ephemeris for the fundamental period.

It has also been possible to evidence visually the Blazhko effect in BP Pegasi, obtaining a good mean curve on the secondary period of 0.084 510 day, though this oscillation has an amplitude as low as 0.1 magnitude.

This result is especially significant of the possibilities of visual observations, as a suggestion effect can be ruled out here since the secondary oscillation is not a phenomenon observed directly and the observers at St ROME did not know at all of the Blazhko effect of BP Pegasi.

Moreover it brings a good confirmation of BROGLIA's determination of the beat period.

A. FIGER

REFERENCES

BROGLIA P., 1959, Milano-Merate Contr., n.s.; N° 142; "La Seconda Periodicità della Variabile BP Pegasi".

FIGER A., 1983, GEOS Circ. EB 08; "44 Times of Minimum and First Ephemeris for the EW Star FZ Orionis".

KUKARKIN B.V., 1938, Nishni-Novgorod V.5.5.


MASANI A., BROGLIA P., 1954, Milano-Merate Contr., n.s., N° 47; "Risultati delle Osservazioni Fotometriche e Problemi Relativi alla Variabile BP Pegasi".

PORETTI E., 1981, GEOS Circ. EB 06; "List of Minima and Accurate Determination of Mean Minimum for VW Cep".

RALINCOURT P., 1982, GEOS Circ. RR 04; "New Maxima of CY Aquarii Observed in August 1980 and Accurate Determination of a Mean Maximum".