PHOTOMETRIC OBSERVATIONS OF ASTEROIDS 31 EUPHROSYNE, 118 PEITHO,
13 EGERIA, 196 PHILOMENA AND 471 PAPAGENA

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RESUMEN. Mediante fotometría fotoeléctrica BV fueron estudiados los asteroide
31 EUPHROSYNE, 118 PEITHO en su oposición de 1988, y 13 EGERIA,
196 PHILOMENA y 471 PAPAGENA en su oposición de 1989, con el fin de deter-
ninar su período de rotación, la orientación del polo y la forma de los asteroide.
Se presentan las curvas de luz de 118 PEITHO y 13 EGERIA.

ABSTRACT. The asteroids 31 EUPHROSYNE and 118 PEITHO at their opposition
of 1988, and 13 EGERIA, 196 PHILOMENA and 471 PAPAGENA at their opposi-
tion of 1989, have been studied by means of photoelectric photometry BV
with the purpose of determining their rotation periods, pole orientation
and shapes. The lightcurves of 118 PEITHO and 13 EGERIA are shown.

Key words: ASTEROIDS — PHOTOMETRY

INTRODUCTION:

The study of asteroid lightcurves allows us to determine their rotation periods, pole
orientation and shapes. For pole and shape determination at least 3 lightcurves in different
oppositions are necessary, so for our photoelectric observations program we have selected some
asteroids having less than 3 observed oppositions.

OBSERVATIONS:

The observing conditions are shown in table 1 and the comparison stars are shown in
table 2. The ephemeris have been calculated from the orbital elements of the "Ephemeris of
Minor Planets (1988) and (1989)".

Asteroids 31 EUPHROSYNE and 118 PEITHO have been observed with the 60 cm cassegrain
"Lowell Telescope" of the CTIO and 13 EGERIA, 196 PHILOMENA and 471 PAPAGENA with the 76cm
cassegrain telescope of the El Leoncito station of the Felix Aguilar Observatory, San Juan,
Argentina. In both cases digital photoelectric photometers with an RCA 31034 photomultiplier
and a pulse counter system were used. In all the measurements the diaphragm was 30" and the
integration time was 10 sec. We have applied differential photometry in V and B filters of the
Johnson standard system.

The magnitudes were corrected for distance

\[ dV = dV_{obs} - 5 \log (r/D) \]

where \( dV_{obs} \) = Vast-Vcomp corrected for differential extinction and phase angle. Light-time
corrections were applied.

RESULTS

31 EUPHROSYNE: listed as a C type asteroid with a diameter of 248 km and a period of 5.531 hs.
(Lagerkvist et al. 1988)

We have obtained a complete lightcurve on October 7, 1988 and a piece of lightcurve on
October 6. The data obtained agree with the period listed. The observed lightcurve amplitude is
0.09 ± 0.02 mag.
### TABLE 1: OBSERVING CONDITIONS

<table>
<thead>
<tr>
<th>ASTEROID</th>
<th>YEAR</th>
<th>MONTH</th>
<th>D</th>
<th>H</th>
<th>q</th>
<th>r(AU)</th>
<th>D(AU)</th>
<th>PHASE RA (1950.0)</th>
<th>DECL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 EUPHROSyne</td>
<td>1988</td>
<td>oct.</td>
<td>6.2</td>
<td>2.7</td>
<td>9</td>
<td>3.217</td>
<td>2.4059</td>
<td>12.86 23 18.766</td>
<td>-31 54,454</td>
</tr>
<tr>
<td>110 PEITHO</td>
<td>1988</td>
<td>oct.</td>
<td>9.2</td>
<td>7.2</td>
<td>13</td>
<td>2.2865</td>
<td>1.3316</td>
<td>5.41 23 57.514</td>
<td>-10 16,584</td>
</tr>
<tr>
<td>13 EGERIA</td>
<td>1989</td>
<td>may</td>
<td>3.3</td>
<td>2</td>
<td>11</td>
<td>2.6217</td>
<td>1.63</td>
<td>5.15 27 27.807</td>
<td>-22 24,114</td>
</tr>
<tr>
<td>196 PHILOMENA</td>
<td>1989</td>
<td>may</td>
<td>7.0</td>
<td>2</td>
<td>9</td>
<td>3.1664</td>
<td>2.2937</td>
<td>12.55 12 29.277</td>
<td>5 41,405</td>
</tr>
<tr>
<td>471 PAPAGENA</td>
<td>1989</td>
<td>mayo</td>
<td>6.4</td>
<td>1.5</td>
<td>9</td>
<td>3.4963</td>
<td>2.528</td>
<td>5.47 16 9.28</td>
<td>-11 22,821</td>
</tr>
<tr>
<td>18 PEITHO</td>
<td>1989</td>
<td>mayo</td>
<td>7.2</td>
<td>7.6</td>
<td>13</td>
<td>3.4955</td>
<td>2.5238</td>
<td>5.24 16 7.586</td>
<td>-11 21,350</td>
</tr>
</tbody>
</table>

D: mean time of the observation period (days and fractions from Obs. UT)
H: number of observing hours
q: number of observations per hour

### TABLE 2: COMPARISON STARS

<table>
<thead>
<tr>
<th>ASTEROID</th>
<th>STAR (SAD)</th>
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</thead>
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<tr>
<td>31 EUPHROSyne</td>
<td>214477</td>
</tr>
<tr>
<td>110 PEITHO</td>
<td>147808</td>
</tr>
<tr>
<td>13 EGERIA</td>
<td>183515</td>
</tr>
<tr>
<td>196 PHILOMENA</td>
<td>119424</td>
</tr>
<tr>
<td>471 PAPAGENA</td>
<td>159749</td>
</tr>
</tbody>
</table>

18 PEITHO: listed as a S type asteroid with a diameter of 45 km and a period of 7.78 hs.
We have obtained a complete lightcurve on October 9, 1988 and a piece of lightcurve on October 11. The data obtained agree with the period listed. The lightcurve shows two similar maxima and two similar minima, with a lightcurve amplitude of $0.08 \pm 0.01$ mag. (fig.1)

3 EGERIA: listed as a C type asteroid with a diameter of 245 km and a period of 7.045 hs.
We have obtained two pieces of lightcurves on May 3 and 6, 1989 (fig.2). The lightcurve amplitude is $0.12 \pm 0.02$ mag.

96 PHILOMENA: listed as a S type asteroid with a diameter of 162 km and a period of 8.333 hs.
We have obtained three pieces of lightcurve on May 7, 8 and 9, 1989. The data obtained agree with the period listed but the observations of October 8 have poor quality. The lightcurve of 96 PHILOMENA shows two maxima and minima with an amplitude of $0.40 \pm 0.02$ mag.

71 PAPAGENA: listed as a S type asteroid with a diameter of 145 km and a period of 7.105 hs.
We have obtained a complete lightcurve on May 7, 1989 and a piece of lightcurve on May 9. The data agree with the listed period. The lightcurve amplitude is $0.14 \pm 0.02$ mag.
The authors wish to thank the staff of the OAFÁ and CTIO observatories for their assistance, and to Ricardo Gil Hutton for the information provided and kindness. This project has a partial support from the CONICYT and PEDECIBA.

REFERENCES
