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# FIRST BV LIGHT CURVE FOR THE ECLIPSING BINARY PP LACERTAE

PP Lac was discovered by Miller on photographic plates taken in 1948 - 1955 at Castel Gandolfo. Miller and Wachmann (1971) found an amplitude of 0.9 mag. (11.1 - 12.0 p) and a period of about $0^d.5$. The type of variation proposed was EW or RR.

Figer and Rolland (1976 and 1977), from visual estimates made by GEOS members, classified it as an EW-type variable, with a period of $0^d.4011$. They could not discriminate the primary minimum from the secondary one, so a doubt still remained on the type of variation of the star.

The GCVS (Kholopov et al., 1985) classifies the star as EW/KW, and gives the following elements:

11.1 - 12.0 p; min II 12.0;

Min I = JD Hel 2445595.438 + $0^d.401163 \cdot E$

Recently, Maraziti (1989) reexamined all visual observations made by GEOS members from 1976 to 1988. Collecting 128 minima from 17 observers, plus 18 other minima published by Locher (1977, 1978, 1979), he found the following ephemeris:

Min I (or II) = JD Hel 2442903.235 + $0^d.40116150 \cdot E$ (1)

$\pm 2$ $\pm 48$

(95% level of confidence for error bars).

He was not able to distinguish between primary and secondary minimum.

In order to check this result by means of photoelectric measures, PP Lac was selected as one of the targets of GEOS missions at Jungfraujoch Observatory. Four missions were performed in 1985, 1986, 1988 and 1989, though most of observations were made during the last one. The GEOS members who took part in the different missions were M. Dumont, J. Remis, J.C. Misson, S. Ferrand, P. Louis, Ph. Rousselot, E. Joffrin, R. Boninsegna, R. Lecocguen.

The observations were made using a photometer attached to the 76 cm telescope. B and V filters of the Geneva system were used, and the B-V values were turned into Johnson and Morgan system. 132 measures in each colour were obtained in 4 nights.

Table I

PP Lac - photoelectric observations

| JD (hel) 2440000+ | V | B-V | phase (1) | JD (hel) 2440000+ | V | B-V | phase (1) |
|---|---|---|---|---|---|---|---|
| | m | m | | | m | m | |
| 6266.4390 | 11.576 | 0.769 | 0.666 | 7775.4154 | 11.591 | 0.745 | 0.184 |
| 6266.4626 | 11.496 | 0.775 | 0.725 | 7775.4390 | 11.523 | 0.734 | 0.243 |
| 6266.4939 | 11.536 | 0.758 | 0.803 | 7775.4411 | 11.529 | 0.728 | 0.248 |
| 6266.5195 | 11.660 | 0.781 | 0.867 | 7775.4425 | 11.522 | 0.743 | 0.252 |
| 6266.5550 | 12.045 | 0.780 | 0.955 | 7775.4453 | 11.541 | 0.733 | 0.259 |
| 6266.5793 | 12.186 | 0.839 | 0.016 | 7775.4467 | 11.550 | 0.724 | 0.262 |
| 7378.5694 | 12.017 | 0.754 | 0.942 | 7775.4480 | 11.547 | 0.730 | 0.266 |
| 7378.5721 | 12.077 | 0.762 | 0.949 | 7775.4494 | 11.547 | 0.728 | 0.269 |
| 7378.5735 | 12.061 | 0.795 | 0.952 | 7775.4529 | 11.542 | 0.743 | 0.278 |
| 7378.5742 | 12.108 | 0.775 | 0.954 | 7775.4543 | 11.534 | 0.752 | 0.281 |
| 7378.5756 | 12.097 | 0.795 | 0.957 | 7775.4557 | 11.556 | 0.726 | 0.285 |
| 7378.5763 | 12.146 | 0.773 | 0.959 | 7775.4571 | 11.570 | 0.707 | 0.288 |
| 7378.5791 | 12.168 | 0.789 | 0.966 | 7775.4585 | 11.554 | 0.736 | 0.292 |
| 7378.5812 | 12.161 | 0.851 | 0.971 | 7775.4779 | 11.616 | 0.747 | 0.340 |
| 7378.5937 | 12.193 | 0.848 | 0.003 | 7775.4793 | 11.621 | 0.750 | 0.344 |
| 7378.5951 | 12.199 | 0.812 | 0.006 | 7775.4807 | 11.622 | 0.757 | 0.347 |
| 7383.4603 | 11.617 | 0.741 | 0.134 | 7775.4821 | 11.632 | 0.744 | 0.351 |
| 7383.4652 | 11.628 | 0.743 | 0.146 | 7775.4855 | 11.655 | 0.767 | 0.359 |
| 7383.4673 | 11.622 | 0.752 | 0.151 | 7775.4869 | 11.653 | 0.758 | 0.363 |
| 7383.4694 | 11.612 | 0.748 | 0.156 | 7775.4883 | 11.658 | 0.769 | 0.366 |
| 7383.4714 | 11.594 | 0.750 | 0.161 | 7775.4897 | 11.666 | 0.764 | 0.370 |
| 7383.4888 | 11.508 | 0.735 | 0.205 | 7775.4911 | 11.677 | 0.760 | 0.373 |
| 7383.4909 | 11.504 | 0.733 | 0.210 | 7775.4925 | 11.695 | 0.748 | 0.377 |
| 7383.4930 | 11.508 | 0.732 | 0.215 | 7775.4953 | 11.712 | 0.745 | 0.384 |
| 7383.4971 | 11.500 | 0.728 | 0.226 | 7775.4967 | 11.709 | 0.759 | 0.387 |
| 7383.4999 | 11.504 | 0.719 | 0.232 | 7775.4980 | 11.728 | 0.752 | 0.390 |
| 7383.5020 | 11.508 | 0.727 | 0.238 | 7775.4994 | 11.749 | 0.744 | 0.394 |
| 7383.5069 | 11.518 | 0.725 | 0.250 | 7775.5008 | 11.746 | 0.766 | 0.397 |
| 7383.5096 | 11.514 | 0.740 | 0.257 | 7775.5043 | 11.776 | 0.769 | 0.406 |
| 7383.5124 | 11.521 | 0.736 | 0.264 | 7775.5057 | 11.772 | 0.774 | 0.410 |
| 7383.5152 | 11.520 | 0.739 | 0.271 | 7775.5071 | 11.789 | 0.779 | 0.413 |
| 7383.5201 | 11.520 | 0.734 | 0.283 | 7775.5085 | 11.808 | 0.769 | 0.416 |
| 7383.5221 | 11.535 | 0.736 | 0.288 | 7775.5098 | 11.819 | 0.773 | 0.420 |
| 7775.3779 | 11.775 | 0.758 | 0.091 | 7775.5112 | 11.849 | 0.765 | 0.423 |
| 7775.3828 | 11.735 | 0.752 | 0.103 | 7775.5126 | 11.907 | 0.750 | 0.427 |
| 7775.3855 | 11.724 | 0.751 | 0.110 | 7775.5175 | 11.936 | 0.755 | 0.439 |
| 7775.3897 | 11.696 | 0.744 | 0.120 | 7775.5189 | 11.949 | 0.765 | 0.442 |
| 7775.3911 | 11.698 | 0.743 | 0.124 | 7775.5203 | 11.966 | 0.755 | 0.446 |
| 7775.3925 | 11.682 | 0.743 | 0.127 | 7775.5217 | 11.984 | 0.763 | 0.449 |
| 7775.3939 | 11.680 | 0.735 | 0.131 | 7775.5230 | 12.005 | 0.760 | 0.453 |
| 7775.3980 | 11.626 | 0.759 | 0.141 | 7775.5244 | 12.016 | 0.775 | 0.456 |
| 7775.3994 | 11.629 | 0.751 | 0.145 | 7775.5272 | 12.123 | 0.740 | 0.463 |
| 7775.4008 | 11.626 | 0.752 | 0.148 | 7775.5286 | 12.107 | 0.781 | 0.467 |
| 7775.4022 | 11.623 | 0.741 | 0.152 | 7775.5300 | 12.116 | 0.779 | 0.470 |
| 7775.4036 | 11.614 | 0.756 | 0.155 | 7775.5314 | 12.112 | 0.792 | 0.474 |
| 7775.4050 | 11.623 | 0.745 | 0.158 | 7775.5328 | 12.111 | 0.791 | 0.477 |
| 7775.4092 | 11.603 | 0.746 | 0.169 | 7775.5369 | 12.169 | 0.788 | 0.487 |
| 7775.4105 | 11.597 | 0.741 | 0.172 | 7775.5390 | 12.167 | 0.787 | 0.493 |
| 7775.4119 | 11.597 | 0.745 | 0.176 | 7775.5439 | 12.125 | 0.784 | 0.505 |
| 7775.4133 | 11.596 | 0.749 | 0.179 | 7775.5460 | 12.104 | 0.799 | 0.510 |

Table I (cont.)

| JD (hel) 2440000+ | V | B-V | phase (1) | JD (hel) 2440000+ | V | B-V | phase (1) |
|---|---|---|---|---|---|---|---|
| 7775.5480 | 12$^m$.081 | 0$^m$.789 | 0.515 | 7775.5897 | 11$^m$.675 | 0$^m$.748 | 0.619 |
| 7775.5494 | 12.071 | 0.787 | 0.518 | 7775.5918 | 11.648 | 0.760 | 0.624 |
| 7775.5598 | 11.920 | 0.805 | 0.544 | 7775.5932 | 11.643 | 0.756 | 0.628 |
| 7775.5619 | 11.897 | 0.799 | 0.550 | 7775.5973 | 11.625 | 0.761 | 0.638 |
| 7775.5633 | 11.884 | 0.792 | 0.553 | 7775.5987 | 11.626 | 0.745 | 0.641 |
| 7775.5647 | 11.872 | 0.785 | 0.557 | 7775.6001 | 11.609 | 0.755 | 0.645 |
| 7775.5696 | 11.828 | 0.778 | 0.569 | 7775.6154 | 11.538 | 0.766 | 0.683 |
| 7775.5710 | 11.796 | 0.776 | 0.572 | 7775.6168 | 11.531 | 0.759 | 0.686 |
| 7775.5723 | 11.781 | 0.786 | 0.576 | 7775.6189 | 11.548 | 0.744 | 0.692 |
| 7775.5744 | 11.769 | 0.762 | 0.581 | 7775.6210 | 11.530 | 0.752 | 0.697 |
| 7775.5779 | 11.747 | 0.769 | 0.589 | 7775.6251 | 11.521 | 0.753 | 0.707 |
| 7775.5793 | 11.721 | 0.774 | 0.593 | 7775.6272 | 11.526 | 0.744 | 0.712 |
| 7775.5814 | 11.716 | 0.765 | 0.598 | 7775.6286 | 11.527 | 0.741 | 0.716 |
| 7775.5828 | 11.688 | 0.776 | 0.602 | 7775.6307 | 11.524 | 0.748 | 0.721 |
| 7775.5842 | 11.673 | 0.770 | 0.605 | 7775.6328 | 11.527 | 0.747 | 0.726 |
| 7775.5876 | 11.686 | 0.745 | 0.614 | 7775.6342 | 11.528 | 0.743 | 0.730 |

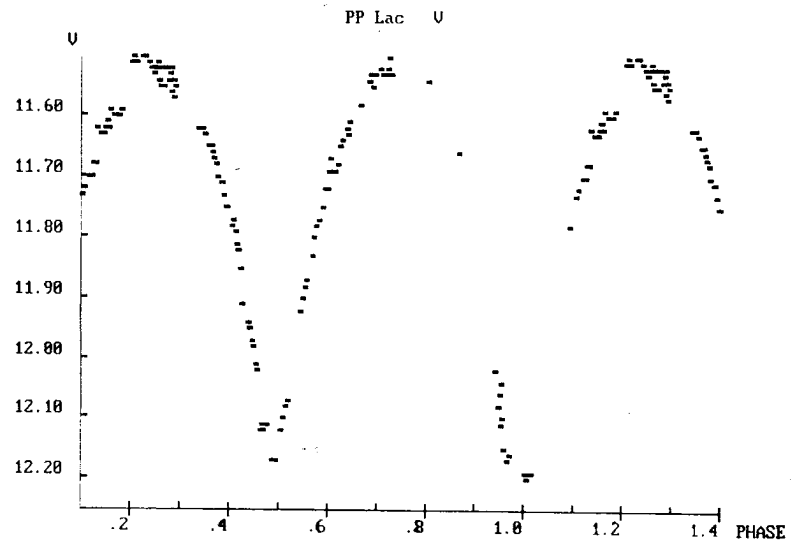


Figure 1a.

All observations are listed in Table I. Figure 1 shows the V and B-V light curves obtained according to ephemeris (1). One can note a good agreement with this ephemeris.

The shape of light curves is typical of an EW-type variable, with nearly equal minima and quasi-constant B-V index. One can note a slight increase

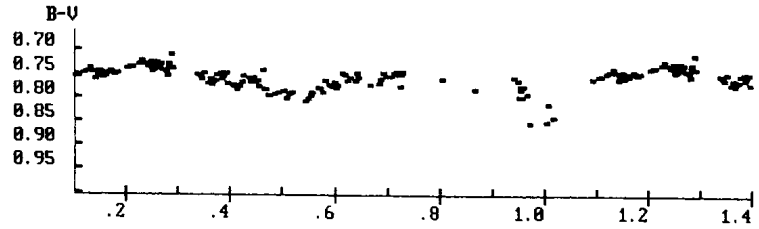


Figure 1b.

of B-V index during both minima. This might be due to the disappearance, during minima, of the contact zone between the two stars, which has a higher temperature than the rest of their surfaces.

It is apparent a slight difference in the V magnitude between the two minima: min I is 12.20 while min II is 12.17. This difference, however, is too small to be considered significant. More precise observations are needed to establish the magnitudes of minima.

The mean B-V, not corrected for reddening, is 0.76.

On the night of September 5, 1989, it was possible to observe a complete secondary minimum, at JD Hel 2447775.5380 $\pm$ 0.0010; the time of minimum was calculated using the technique described by Gaspani (1988).

The O-C calculated from (1) is $-0^d.0042$, which is a further confirmation of the above GEOS ephemeris (1).

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References:

Figer, A., Rolland, R.: 1976, GEOS NC 142.
Figer, A., Rolland, R.: 1977, I.B.V.S. No. 1231.
Gaspani, A.: 1988, Fiche techn. GEOS FT 30: Ricerca di estremi di curve di luce di stelle variabili mediante tecniche di ottimizzazione via approssimazione stocastica.
Kholopov, P.N. et al.: 1985, General Catalogue of Variable Stars.
Locher, K.: 1977, BBSAG Bulletin, Nos 32, 33, 35.
Locher, K.: 1978, BBSAG Bulletin, Nos 38, 40.
Locher, K.: 1979, BBSAG Bulletin, Nos 42, 44, 45.
Maraziti, A.: 1989, GEOS Circular on Eclipsing Binaries (to be printed).
Miller, W.J., Wachmann, A.A.: 1971, Ricerche Astronomiche, 8, No. 12.