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AT PEGASI: PHOTOELECTRIC OBSERVATIONS AND LIGHT ELEMENTS

The only existing photoelectric light curve of the eclipsing binary AT Peg(HD 210892 = BD+07°4824) was given by Cristaldi and Walter(1963). It is reanalyzed by Giuricin et al.(1981). Several authors observed the system visually and photographically. The published times of minima are listed in Table I. The spectroscopic orbital elements are studied by Hill and Barnes(1972). Margrave(1981) investigated the period changes of the system by combining his photoelectric times of minima with the other photoelectric ones since 1969. He concluded that the period is decreasing. Moreover, this decreasing has been accelerated since 1975 which fits quadratic light elements.

The system was observed photoelectrically at Ege University Observatory on 13 nights during the observational seasons of 1983, 1984, 1985 and 1986. The observations were made in blue and yellow colours using the 48 cm Cassegrain telescope and photoelectric photometer equipped with an unrefrigerated photomultiplier tube EMI 9781A and Johnson's standard B,V filters. A total of 529 and 396 points were obtained in B and V colours, respectively. BD+07°4818 was used as the comparison, and BD+08°4800 as the check star. The comparison star showed no significant variations against the check star. The extinction coefficients were determined for each night from observations of the comparison star. The differential observations(variable minus comparison) were corected for the atmospheric extinction. Four primary and two secondary times of minima were obtained and included in Table I.

Table I. Times of minima of AT Pegasi.

JD Hel.	Min	Method	W	E	(O-C)	Ref.
2433504.526	I	vis	1	-6050	-0.060	1
504.523	I	vis	1	-6050	-0.063	1
558.387	I	vis	1	-6003	-0.066	1
888.463	I	vis	1	-5715	-0.061	1
34272.406	I	vis	1	-5380	-0.056	2
303.350	I	vis	1	-5353	-0.056	2
35019.666	I	pg	2	-4728	-0.041	3
034.572	I	pg	2	-4715	-0.034	3
097.598	I	pg	2	-4660	-0.043	3
332.541	I	vis	1	-4455	-0.047	4
332.549	I	vis	1	-4455	-0.039	4
370.363	I	vis	1	-4422	-0.045	4
370.365	I	vis	1	-4422	-0.043	4
388.710	I	pg	2	-4406	-0.036	3
726.810	I	pg	2	-4111	-0.030	3
36085.527	I	vis	1	-3798	-0.037	4
085.528	I	vis	1	-3798	-0.036	4
100.434	I	vis	1	-3785	-0.029	4
108.447	I	vis	1	-3778	-0.038	4
108.455	I	vis	1	-3778	-0.030	4
108.460	I	vis	1	-3778	-0.025	4
37175.478	I	vis	1	-2847	-0.010	5
175.471	I	vis	1	-2847	-0.017	6
497.5211	I	pe	3	-2566	-0.0155	7
544.507	I	vis	1	-2525	-0.019	5
544.515	I	vis	1	-2525	-0.011	5
872.315	I	vis	1	-2239	0.010	8
872.317	I	vis	1	-2239	0.012	8
872.321	I	vis	1	-2239	0.016	8
872.318	I	vis	1	-2239	0.013	8
873.480	I	vis	1	-2238	0.029	9
904.402	I	vis	1	-2211	0.006	8
37911.287	I	vis	1	-2205	0.015	8
38226.464	I	vis	1	-1930	0.019	10
234.468	I	vis	1	-1923	0.001	10
288.348	I	vis	1	-1876	0.015	8
288.347	I	vis	1	-1876	0.014	8
319.289	I	pg	2	-1849	0.012	10
642.458	I	pg	2	-1567	-0.015	11
940.447	I	vis	1	-1307	-0.007	12
940.454	I	vis	1	-1307	0.000	12

Table I(continued)

JD Hel.	Min	Method	W	E	(O-C)	Ref.
2439057.353	I	vis	1	-1205	-0.001	12
356.480	I	vis	1	-944	-0.002	6
356.485	I	vis	1	-944	0.003	6
356.486	I	vis	1	-944	0.004	6
387.406	I	vis	1	-917	-0.020	13
685.443	I	vis	1	-657	0.036	14
40407.438	I	pe(V)	3	-27	-0.001	15
438.383	I	pe(V)	3	0	0.000	15
477.326	I	vis	1	34	-0.024	16
493.394	I	pe(V)	3	48	-0.001	17
877.3368	I	pe(V)	3	383	0.0044	18
877.3372	I	pe(V)	3	383	0.0048	18
41576.446	I	vis	1	993	0.004	16
599.378	I	vis	1	1013	0.014	16
661.2728	I	pe(B,V)	3	1067	0.0203	19
42661.8136	I	pe(V)	3	1940	0.0315	20
712.2435	I	pe(V)	3	1984	0.0338	21
43728.8093	I	pe(V)	3	2871	0.0249	20
44089.8270	I	pe(V)	3	3186	0.0267	20
128.7925	I	pe(V)	3	3220	0.0255	20
136.8149	I	pe(V)	3	3227	0.0253	20
442.8188	I	pe(V)	3	3494	0.0253	22
520.7515	I	pe(V)	3	3562	0.0244	22
826.7553	I	pe(V)	3	3829	0.0243	23
45219.8562	I	pe(V)	3	4172	0.0191	24
615.2538	I	pe(B)	3	4517	0.0184	25
957.360	II	pe(B)	-	4815.5	0.019	25
46000.3358	I	pe(B,V)	3	4853	0.0169	26
298.3155	I	pe(B,V)	3	5113	0.0152	26
315.5062	I	pe(B,V)	3	5128	0.0147	26
334.419	II	pe(B,V)	-	5144.5	0.017	26

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The (O-C) residuals in the Table I were computed with the following light elements given in the Second Supplement to the Third Edition of GCVS(1974):

$$\text{Hel MinI JD} = 2440438.383 + 1^{d}.146082.E. \qquad (1)$$

The (O-C) values are plotted in Figure 1.

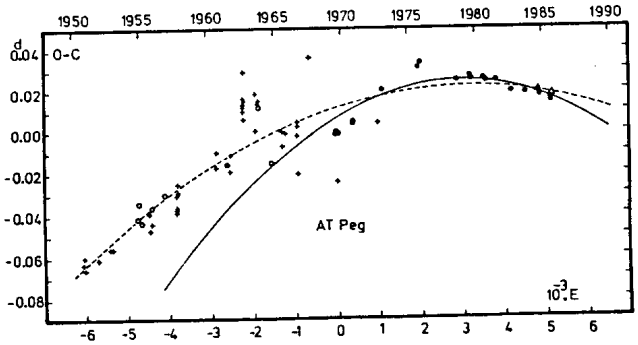

Figure 1. O-C diagram of AT Pegasi. The plusses, circles, dots and triangles denote visual, photographic, photoelectric primary and photoelectric secondary minima, respectively. The dashed and solid lines represent the computed parabola using the equation (2) and (3), respectively.

Using all times of primary minima listed in Table I, quadratic light elements have been calculated by the weighted least squares method as follows:

$$\text{Hel MinI JD} = \underset{\pm 14}{2440438.3946} + \underset{\pm 3}{1^{d}.1460884}.E - \underset{\pm 10}{1^{d}.00\text{x}10^{-9}}.E^{2}. \qquad (2)$$

This means that the period of AT Peg is decreasing with the rate of (5.5 ± 0.5) second per century. On the other hand, using only all of the photoelectric times of minima, following quadratic light elements have been obtained with the same method:

$$\text{Hel MinI JD} = \underset{\pm 14}{2440438.3898} + \underset{\pm 10}{1^{d}.1460938}.E - \underset{\pm 21}{1^{d}.92\text{x}10^{-9}}.E^{2}. \qquad (3)$$

The decrease in the period is (10.6 ± 1.1) second per century for this set. The light elements given by the equation (3) are in good agreement with the photoelectric times of minima but, the photographic and visual observations show large deviations. However, the light elements given by the equation (2) seem to fit all observations. At present, it is difficult to decide which elements are appropriate because of the lower accuracy of the photographic and visual observations. For this reason, the photoelectric minimum times are needed.

The light and colour curves of AT Peg are shown in Figure 2 where the phases have been calculated with the following linear light elements:

$$\text{Hel MinI JD} = \underset{\pm 4}{2445615.2541} + \underset{\pm 3}{1^{d}.1460766}.E. \qquad (4)$$

These light elements have been obtained with the photoelectric primary minima between the years of 1975 and 1985 using the least squares method. The light curves of AT Peg show a deep primary and a shallow secondary minimum. Their amplitudes are about $0^{m}.845$ and $0^{m}.785$ at the primary, $0^{m}.080$ and $0^{m}.100$ at the secondary minimum in B and V light, respectively. The system is redder at the primary and slightly bluer at the secondary mini-

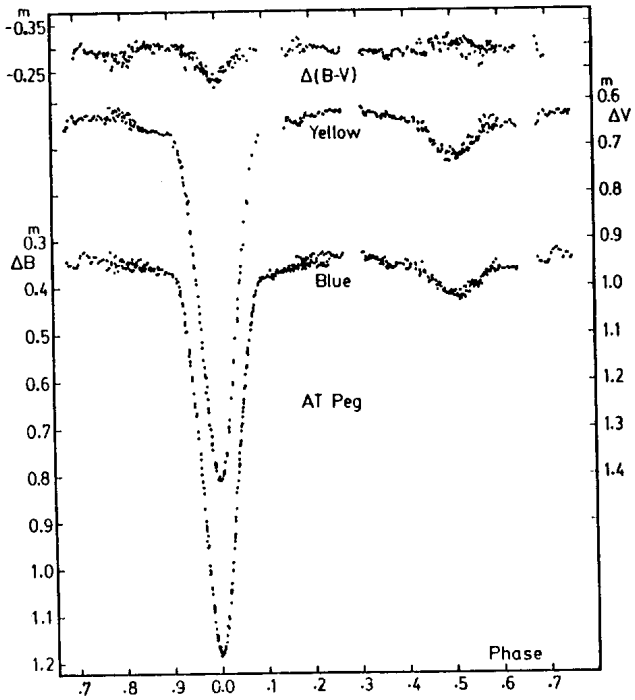

Figure 2. The light and colour curves of AT Peg.

mum which implies that the spectral type of the secondary is later than the primary. The photometric analysis of the light curves is in progress and will be published elsewhere. This work has been partly supported by the Research Foundation of Ege University with the project number 1985/036.

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