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CONFIRMATION OF THE REGULAR INTRINSIC VARIABILITY OF AU MONOCEROTIS

A few years ago the eclipsing binary AU Mon was revealed to be an unusual object in view of its discovered photometric peculiarities (Lorenzi, 1980 a, b). The analysis carried out on the available data allowed to separate the geometrical effects due to the eclipses from the intrinsic variation. Here new normalized photoelectric observations of the system are presented. Their combination with previous data confirm the existence of the periodic intrinsic variation ($P=411^d$) previously found. This confirmation is particularly meaningful in the context of recent IUE spectral analyses of AU Mon (Sahade and Ferrer, 1982, Peters and Polidan, 1984).

Such spectral analyses may offer an explanation to the aforementioned intrinsic variation.

During the period January-March 1983 and March 1984 new photoelectric observations in V light of AU Mon were obtained and combined in 82 normal points.

The resulting normalized observations are listed in Table I a, b. They refer to the same comparison star and to the same technique which follow from the previous work (Lorenzi, 1980a,b).

In Figure 1 these data show a rather smooth eclipsing light curve. In fact just at the end of January 83 and in March 84 the brightness minimum of the intrinsic variation occurred, being the cycle about 411 days long.

Referring to the previous solution (Lorenzi, 1980b), the new normal points have also been transformed by the formula

$$\overline{\Delta m}_V(\varphi_2) = \overline{\Delta V}_{obs}(\varphi_1,\varphi_2) + \alpha(\varphi_1) \qquad (1).$$

φ_1 and φ_2 are the phases of the eclipsing and intrinsic variation, respectively, according to the ephemerides

2442801.3752 + 11.1130371 E, for the former, and
2443105 + 411 E, for the latter.

The function $\alpha = \alpha(\varphi_1)$ represents the available mean light curve of the eclipsing variation, with its sign changed. Instead the expression (1) is

Table Ia

N_R	N_p	$\Delta\varphi_1$	J.D.	φ_1	φ_2	$\overline{\Delta V}$	$s_{\overline{\Delta V}}$	$a(\varphi_1)$	$\overline{\Delta V}+a$
60	13	.003	2445343.4114	.7436	.446	-.657	.002	+.108	-.55
61	11	.003	45346.3339	.0066	.453	+.100	.007	-.657	-.56
61	11	.002	.4262	.0149	.454	+.011	.003	-.518	-.51
62	9	.001	45351.4059	.4630	.466	-.622	.001	+.015	-.61
62	8	.001	.4202	.4643	.466	-.619	.003	+.015	-.60
63	19	.003	45353.3960	.6421	.471	-.646	.006		
64	15	.001	45354.4233	.7345	.473	-.650	.002	+.108	-.54
65	13	.002	45355.3607	.8189	.475	-.652	.001	+.084	-.57
66	15	.001	45356.3618	.9089	.478	-.589	.001	+.040	-.55
67	12	.002	45357.2635	.9901	.480	+.081	.005	-.605	-.52
67	12	.001	.2823	.9918	.480	+.114	.005	-.635	-.52
67	11	.002	.3028	.9936	.480	+.128	.003	-.660	-.53
67	12	.001	.3205	.9952	.480	+.144	.003	-.670	-.53
67	11	.001	.3349	.9965	.480	+.143	.003	-.678	-.54
67	11	.001	.3471	.9976	.480	+.150	.003	-.685	-.54
67	11	.001	.3600	.9988	.480	+.151	.003	-.690	-.54
67	12	.002	.3739	.0000	.480	+.148	.002	-.692	-.54
67	11	.001	.3927	.0017	.480	+.155	.003	-.688	-.53
67	11	.001	.4045	.0028	.480	+.143	.003	-.683	-.54
67	11	.001	.4161	.0038	.480	+.132	.003	-.675	-.54
67	12	.001	.4287	.0049	.480	+.128	.003	-.670	-.54
67	11	.001	.4403	.0060	.480	+.118	.002	-.660	-.54
67	12	.001	.4565	.0074	.480	+.110	.002	-.644	-.53
67	11	.001	.4712	.0088	.480	+.098	.002	-.625	-.53
67	12	.001	.4851	.0100	.480	+.080	.002	-.605	-.53
67	11	.002	.5014	.0115	.481	+.067	.004	-.580	-.51
67	12	.002	.5234	.0135	.481	+.033	.003	-.545	-.51
67	11	.001	.5410	.0151	.481	+.012	.003	-.512	-.50
68	17	.002	45366.3099	.8041	.502	-.649	.002	+.090	-.56
69	15	.001	45367.3507	.8978	.505	-.618	.003	+.044	-.57
70	9	.001	45368.2710	.9806	.507	-.053	.004	-.445	-.50
70	9	.001	.2924	.9825	.507	-.025	.003	-.470	-.50
70	9	.001	.3144	.9845	.507	+.026	.005	-.505	-.48
70	9	.001	.3352	.9864	.507	+.059	.003	-.543	-.48
70	9	.001	.3589	.9885	.507	+.082	.003	-.580	-.50
70	9	.001	.3790	.9903	.507	+.107	.001	-.605	-.50
70	9	.001	.4041	.9926	.507	+.124	.003	-.648	-.52
70	9	.001	.4284	.9947	.507	+.137	.001	-.670	-.53
70	8	.001	.4385	.9957	.507	+.156	.002	-.675	-.52
70	9	.001	.4647	.9980	.507	+.184	.003	-.685	-.50
70	7	.001	.4766	.9991	.507	+.180	.002	-.690	-.51

Table Ib

N_R	N_p	$\Delta\varphi_1$	J.D.	φ_1	φ_2	$\overline{\Delta V}$	$s_{\overline{\Delta V}}$	$a(\varphi_1)$	$\overline{\Delta V}+a$
70	9	.001	45368.4870	.0000	.507	+.183	.003	-.692	-.51
70	7	.001	.4991	.0011	.507	+.176	.003	-.690	-.51
70	7	.001	.5064	.0018	.507	+.188	.002	-.688	-.50
70	7	.001	.5137	.0024	.507	+.186	.003	-.682	-.50
71	15	.001	45369.3508	.0777	.509	-.585	.002	+.030	-.56
72	15	.001	45370.3481	.1675	.512	-.616	.003	+.082	-.53
73	9	.001	45377.3721	.7995	.529	-.640	.003	+.090	-.55
74	11	.001	45384.3068	.4236	.546	-.640	.002	+.015	-.62
75	10	.001	45385.2738	.5106	.548	-.587	.002	+.015	-.57
75	9	.001	.2816	.5113	.548	-.587	.001	+.015	-.57
75	10	.001	.2911	.5121	.548	-.587	.001	+.015	-.57
75	9	.001	.3613	.5184	.548	-.585	.002	+.015	-.57
75	10	.001	.3755	.5197	.548	-.590	.003	+.015	-.58
75	9	.001	.4429	.5258	.549	-.583	.002	+.015	-.57
75	10	.001	.4562	.5270	.549	-.588	.002	+.015	-.57
75	10	.001	.4697	.5282	.549	-.586	.002	+.015	-.57
76	11	.001	45396.2881	.5017	.575	-.587	.002	+.015	-.57
76	12	.001	.3032	.5030	.575	-.585	.002	+.015	-.57

Table Ib (cont.)

N_R	N_p	$\Delta\varphi_1$	J.D.	φ_1	φ_2	$\overline{\Delta V}$	$s_{\overline{\Delta V}}$	$\alpha(\varphi_1)$	$\overline{\Delta V}+\alpha$
77	9	.001	45397.3484	.5971	.577	-.609	.007		
77	7	.000	.3876	.6006	.578	-.626	.000		
78	10	.001	45401.2917	.9519	.587	-.578	.002	-.007	-.59
78	10	.001	.3032	.9530	.587	-.578	.002	-.010	-.59
78	9	.001	.3213	.9546	.587	-.582	.001	-.022	-.60
78	9	.001	.3507	.9572	.587	-.542	.003	-.038	-.58
78	10	.001	.3648	.9585	.587	-.536	.001	-.046	-.58
78	10	.001	.3783	.9597	.587	-.524	.003	-.066	-.59
78	10	.001	.3897	.9608	.587	-.510	.004	-.080	-.59
78	10	.001	.4011	.9618	.587	-.488	.003	-.100	-.59
78	10	.001	.4118	.9627	.587	-.468	.002	-.117	-.59
78	10	.001	.4245	.9639	.587	-.448	.004	-.135	-.58
79	11	.001	45403.3170	.1342	.592	-.608	.003	+.065	-.54
80	9	.001	45766.3845	.8046	.475	-.643	.005	+.090	-.55
80	8	.001	.3982	.8058	.475	-.648	.003	+.090	-.56
81	13	.002	45778.2968	.8765	.504	-.629	.004	+.060	-.57
81	12	.002	.3189	.8785	.504	-.647	.013	+.060	-.59
82	11	.002	45789.3358	.8698	.531	-.639	.003	+.064	-.57
82	10	.001	.3531	.8714	.531	-.640	.003	+.064	-.58
83	9	.001	45790.3141	.9579	.534	-.522	.002	-.045	-.57
83	10	.002	.3302	.9593	.534	-.509	.006	-.055	-.56
83	9	.001	.3473	.9609	.534	-.473	.002	-.034	-.56
83	10	.001	.3609	.9621	.534	-.458	.004	-.100	-.56

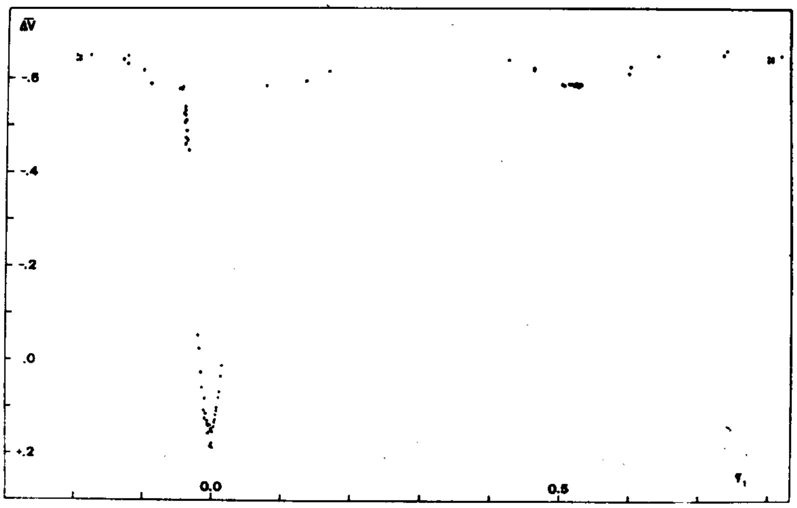

Figure 1 : Plot versus φ_1 of new V normalized observations of AU Mon, carried out during January-February 1983 and March 1984, just in the period of the intrinsic variation cycle, around φ_2=0.5

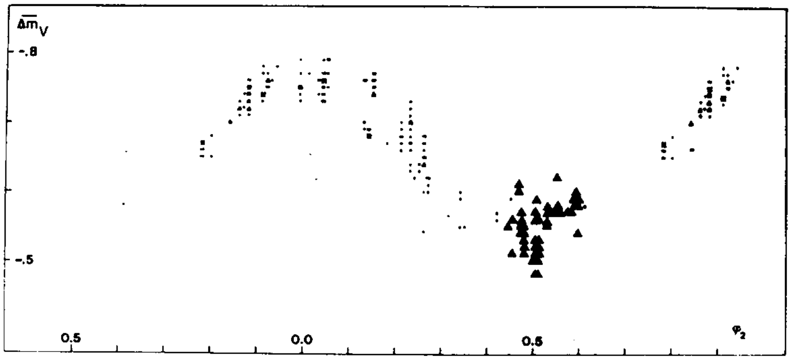

Figure 2 : The light curve of the intrinsic variation by the old observations (• 1976-1979) and by the new ones (▲ 1983-1984). The inserted normal points follow from the formula $\overline{\Delta m}_V(\varphi_2)=\overline{\Delta V}_{obs}+\alpha(\varphi_1)$

representing the calculated mean light curve of the intrinsic variation.

The new Δm's, which follow from (1), appear to fit very well the above mentioned intrinsic light curve (see Figure 2), and this confirms strongly the regular behaviour of the intrinsic variability of the system. To emphasize this fact, we wish to remember that the light curve of Figure 2 results from the overlap of 7 cycles, more precisely a time interval 3000 days long.

The physical scenario of such a binary system was recently enriched by extended spectral investigations (Sahade and Ferrer, 1982 - Peters and Polidan, 1984). From the photometric point of view, the author attempted an average photometric solution (Lorenzi, 1982a) and, in order to obtain more faithful and complete results, he suggested to work on a three-dimensional photometric representation of the involved light changes (Lorenzi, 1982b). In particular Peters and Polidan interpret their IUE observations in terms of a "high temperature accretion region" (HTAR) around the primary of AU Mon (B5 + F-G), as due to the existence of nonthermal sources of energy.

Such HTAR shows to fade over a time scale of a few orbital cycles, while it seems to be present only when AU Mon is faint, that is during the intrinsic brightness decrease of the system. Possibly a change in the radius and / or stellar effective temperature induced by mass accretion is responsible.

Alternatively, according to Peters and Polidan, an increase in the mass transfer rate could obscure more of the star and reduce the observed flux.

Now the photoelectric observations presented in this paper, confirming the existence of the periodic intrinsic variation in AU Mon ($P=411^d$), strengthen the suggestion that a positive correlation may be found between HTAR and the long brightness cycle.

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