RESEARCH INTO THE ECLIPSING SYSTEM V 366 CYG

J.M. Kreiner
Institute of Physics, Pedagogical University, 30-084 Kraków, Poland

J. Tremko
Astronomical Institute of the Slovak Academy of Sciences,
059 60 Tatranská Lomnica, Czechoslovakia

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ABSTRACT. Photoelectric observations in the B spectral range were made of the eclipsing system V 366 Cyg at the Astronomical Observatory in Skalnaté Pleso. The published minimum epochs and the newly derived minimum epochs were used to study changes of period. A secular variation of the period was found, and its possible cause are discussed. The reason for this change cannot be determined uniquely since the observed minima are distributed non-uniformly in time and because the changes are slow as compared to the length of the observation interval. Semi-regular changes of brightness were detected in the primary minimum.

ИССЛЕДОВАНИЕ ЗАТМЕННОЙ СИСТЕМЫ V 366 Cyg. Были получены фотоэлектрические наблюдения затменной системы V 366 Cyg в Астрономической обсерватории Скалнате Плесо. Опубликованные эпохи минимумов и новые полученные эпохи были использованы для изучения изменений периода. Было найдено вековое изменение периода и приводятся возможные причины его изменений. Причину изменений не возможно определить однозначно, поскольку наблюденные минимумы по шкале времени распределены не равномерно и изменения проходят медленно в сравнении с длиной наблюдательного интервала. Были обнаружены изменения яркости в первичном минимуме.

VÝSKUM ZÁKRYTOVEJ SÚSTAVY V 366 Cyg. Získali sa fotoelektrické pozorovania v B spektrálnom obore zákrytovej sústavy V 366 Cyg na Astronomickom observatóriu na Skalnatom Plese. Publikované epochy minima a nové odvodené epochy minima sa použili na štúdium zmien periódy. Našla sa sekulárna zmena periódy a diskutujú sa možné príčiny jej zmeny. Príčina zmeny sa nedá jednoznačne určiť, nakoľko pozorované minimá sú v časovej škále rozložené nerovnomerne a taktiež zmeny prebiehajú pomaly v porovnaní s dĺžkou pozorovacieho intervalu. Detekovali sa polopravidelné zmeny jasnosti v primárnom minime.

1. INTRODUCTION

The variable star V 366 Cyg (BD $+53^{\circ}2479$) was discovered by Schneller (1929). Beyer (1939) made further observations which he used to classify the star as a system of the beta Lyrae type. He found the period to be 1.096016 days. After that, the star observed only sporadically, particularly in an effort to determine the minimum epochs (Beyer, 1939; Zonn, 1939; Gaposhkin,1953; Soloviev, 1943). With the exception of Gaposhkin, who obtained the photographic light curve, these observer used the visual method. The first photoelectric minimum epoch and, simultaneously, also the whole photoelectric curve of light variations was obtained by van Houten (1959) in integral light. Van Houten confirmed the previous classification, determined by Beyer (1939), and found that the depth of the primary minimum was 0.46 mag and of the secondary minimum 0.19 mag. No change of period was observed. Since then, further minima were determined only in the 1980's, either photographically or photoelectrically (Diethelm, 1982; Faulkner and Kaitchuk, 1983; Frank, 1983; Braune et al., 1984; Hübscher and Mundry, 1984). Besides the minimum epochs determined over the last 30 years, no other research into this eclipsing system has been conducted. Consequently, V 366 Cyg was included in the observational program of the Skalnaté Pleso Astronomical Observatory. The purpose of the observations was to determine new minimum epochs and to analyse the brightness variations over a much longer time interval.

2. OBSERVATIONAL MATERIAL AND ITS PROCESSING

The photoelectric observations were made during two observational seasons in 1985 and 1986 at the Astronomical Institute of the Slovak Academy of Sciences in Skalnaté Pleso with the 0.6/7.5-m mirror telescope. The star was observed on 5 nights. The mirror telescope is equipped with a semi-automatic photoelectric photometer with an electron multiplier of the EMI 6256 type. The photoelectric photometer has a set of 9 filters for UBV photometry, medium-band photometry and narrow-band photometry. A detailed description of its opto-mechanical part as well as the properties of the photometric system can be found in (Horák et al., 1965). The previous electronic system, which operated on the

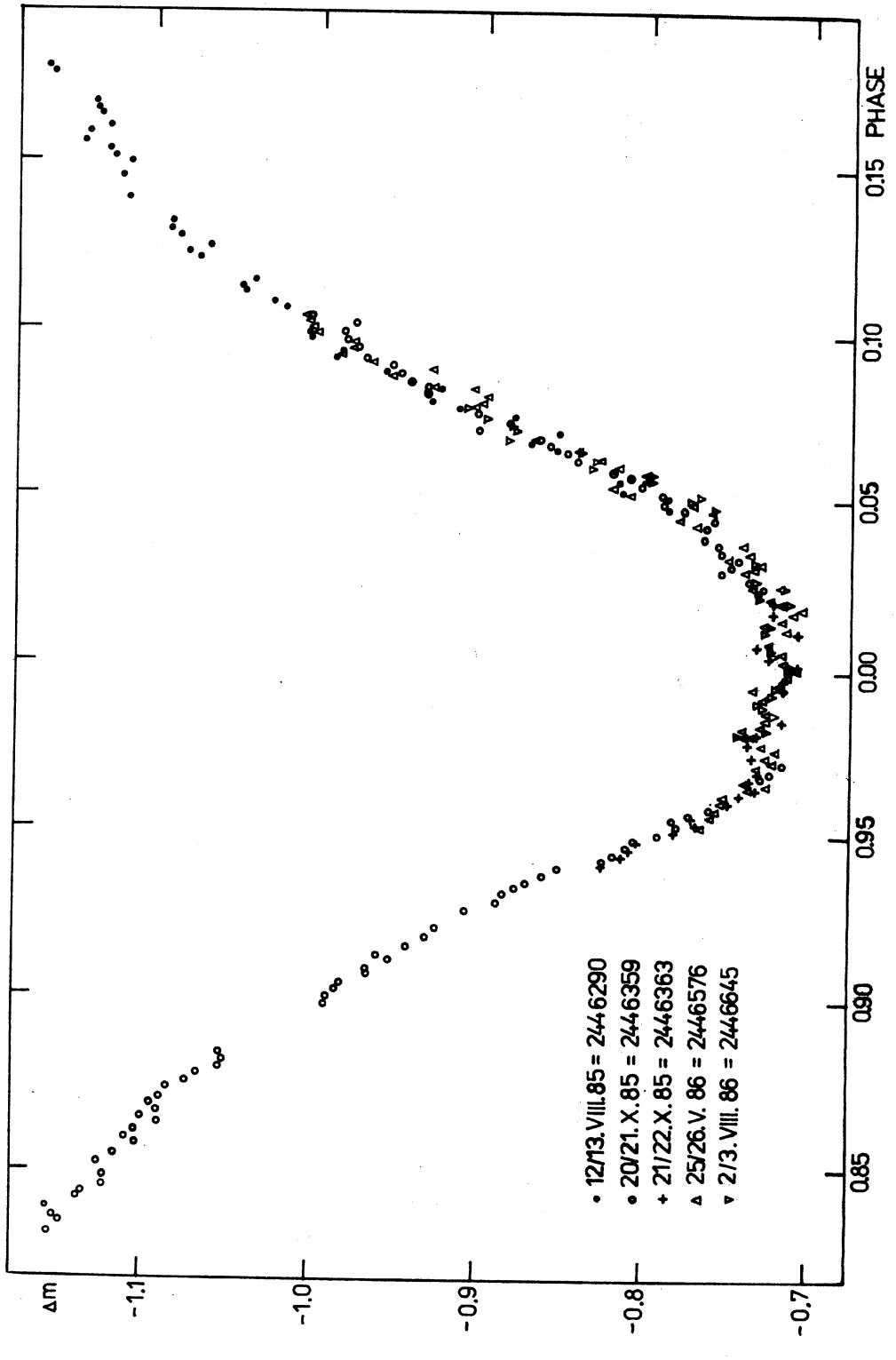

Fig. 1. The composite light curve of V 366 Cyg.

principle of integrating an electric current, was replaced by a device which operates on the pulse-counting principle (Klocok et al., 1986).

The observational process is controlled by computer programs which enable observations to be made according to various observational schemes determined in advance. The observational scheme depends on the number of filters, the number of programmed stars and on the kind or number of observations required. An EMG 666 desk calculator is used to control the observation process. The observation time data, the observed data and the other information, required by the observer, and the further processing of the data are stored on magnetic tape, or produced in print-out form by the printer. The device has an internal time unit of one second. The time resolution of the observations, i.e. the shortest pulse-counting interval, is 3 seconds and it is limited by the capability of the printer. A detailed description of the device can be found in (Klocok et al., 1986).

V 366 Cyg was observed with a standard B filter. The pulse-counting interval was set to 10 seconds which, with a view to the slow variations of the variable's brightness, was quite sufficient. BD + $53^{\circ}2480$ was used as the comparison star and BD $+53^{\circ}2475$ as the check star. The comparison star was observed with sufficient frequency, twice in a 3-minute interval on the average. The check star was observed only sporadically. The variable star was observed in series of 5 observations in order to determine the scatter of the observations. The individual observations are given in Tab. 1. Figure 1 shows the mean values of the star's brightness for all five observation nights.

T A B L E 1

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
2446290.+		.4316	-0.825	.4423	-0.848	.4506	-0.893
.4231	-0.782	.4317	-0.818	.4424	-0.861	.4507	-0.882
.4232	-0.790	.4318	-0.818	.4426	-0.858	.4528	-0.877
.4233	-0.799	.4337	-0.818	.4427	-0.850	.4529	-0.879
.4235	-0.790	.4338	-0.812	.4428	-0.854	.4530	-0.889
.4236	-0.793	.4339	-0.815	.4448	-0.862	.4531	-0.874
.4264	-0.794	.4340	-0.812	.4449	-0.868	.4533	-0.895
.4265	-0.786	.4341	-0.797	.4450	-0.873	.4552	-0.924
.4266	-0.799	.4360	-0.824	.4451	-0.880	.4553	-0.921
.4267	-0.785	.4361	-0.823	.4452	-0.877	.4554	-0.912
.4268	-0.791	.4363	-0.823	.4478	-0.869	.4555	-0.914
.4287	-0.813	.4364	-0.820	.4479	-0.865	.4557	-0.912
.4289	-0.813	.4365	-0.822	.4480	-0.855	.4575	-0.933
.4290	-0.817	.4385	-0.832	.4481	-0.851	.4577	-0.933
.4291	-0.814	.4386	-0.843	.4483	-0.847	.4578	-0.932
.4292	-0.826	.4388	-0.844	.4502	-0.883	.4579	-0.932
.4313	-0.820	.4389	-0.849	.4504	-0.888	.4580	-0.933
.4315	-0.818	.4390	-0.848	.4505	-0.884	.4598	-0.940

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.4599	-0.945	.4905	-1.024	.5157	-1.091	.5428	-1.132
.4600	-0.931	.4907	-1.032	.5158	-1.085	.5453	-1.139
.4601	-0.938	.4908	-1.024	.5160	-1.098	.5454	-1.141
.4603	-0.914	.4909	-1.030	.5161	-1.081	.5455	-1.143
.4622	-0.912	.4910	-1.037	.5162	-1.097	.5456	-1.141
.4624	-0.926	.4929	-1.043	.5180	-1.080	.5457	-1.139
.4625	-0.937	.4931	-1.048	.5181	-1.090	.5476	-1.125
.4626	-0.929	.4932	-1.041	.5183	-1.085	.5477	-1.116
.4627	-0.929	.4933	-1.051	.5184	-1.087	.5478	-1.118
.4646	-0.956	.4934	-1.046	.5185	-1.097	.5480	-1.120
.4647	-0.959	.4953	-1.041	.5202	-1.070	.5481	-1.117
.4648	-0.948	.4954	-1.041	.5203	-1.086	.5503	-1.142
.4649	-0.933	.4955	-1.053	.5204	-1.083	.5505	-1.129
.4650	-0.928	.4956	-1.060	.5205	-1.087	.5506	-1.132
.4669	-0.957	.4957	-1.040	.5207	-1.086	.5507	-1.132
.4671	-0.959	.4974	-1.038	.5235	-1.114	.5508	-1.134
.4672	-0.959	.4975	-1.040	.5236	-1.116	.5529	-1.140
.4673	-0.966	.4977	-1.042	.5237	-1.116	.5530	-1.138
.4674	-0.963	.4978	-1.040	.5239	-1.116	.5531	-1.134
.4716	-0.990	.4979	-1.042	.5240	-1.123	.5550	-1.142
.4717	-0.995	.5036	-1.076	.5306	-1.114	.5551	-1.129
.4719	-0.987	.5037	-1.076	.5307	-1.117	.5552	-1.145
.4720	-0.992	.5038	-1.067	.5308	-1.129	.5553	-1.142
.4721	-0.993	.5039	-1.072	.5309	-1.120	.5554	-1.138
.4741	-0.981	.5062	-1.082	.5310	-1.121	.5649	-1.163
.4743	-0.995	.5063	-1.083	.5351	-1.118	.5650	-1.161
.4744	-0.993	.5065	-1.078	.5352	-1.124	.5651	-1.168
.4745	-0.992	.5066	-1.082	.5354	-1.108	.5652	-1.156
.4746	-0.976	.5067	-1.076	.5355	-1.110	.5653	-1.171
.4789	-1.020	.5084	-1.066	.5356	-1.124	.5674	-1.164
.4790	-1.003	.5085	-1.063	.5374	-1.130	.5675	-1.167
.4791	-1.012	.5086	-1.060	.5375	-1.128	.5676	-1.162
.4792	-1.002	.5087	-1.069	.5377	-1.122	.5677	-1.171
.4794	-0.994	.5088	-1.077	.5378	-1.124	.5678	-1.172
.4812	-1.006	.5110	-1.082	.5379	-1.119		
.4813	-1.006	.5111	-1.088	.5399	-1.130	2446359.+	
.4814	-1.005	.5112	-1.083	.5400	-1.124	.2328	-1.156
.4816	-1.012	.5114	-1.088	.5401	-1.134	.2329	-1.156
.4817	-1.007	.5115	-1.085	.5402	-1.124	.2330	-1.153
.4884	-1.023	.5133	-1.091	.5404	-1.128	.2332	-1.156
.4885	-1.015	.5135	-1.089	.5424	-1.143	.2333	-1.156
.4886	-1.017	.5136	-1.091	.5425	-1.144	.2351	-1.155
.4887	-1.028	.5137	-1.091	.5426	-1.149	.2353	-1.148
.4888	-1.020	.5138	-1.092	.5427	-1.146	.2354	-1.145

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.2355	-1.145	.2615	-1.099	.2826	-1.067	.3176	-0.961
.2356	-1-145	.2616	-1.107	.2827	-1.077	.3177	-0.972
.2375	-1.151	.2617	-1.113	.2828	-1.066	.3178	-0.964
.2376	-1.149	.2636	-1.112	.2829	-1.078	.3180	-0.965
.2377	-1.149	.2637	-1.112	.2849	-1.071	.3181	-0.968
.2378	-1.161	.2638	-1.106	.2850	-1.073	.3199	-0.961
.2379	-1.159	.2639	-1.108	.2851	-1.064	.3200	-0.963
.2398	-1.149	.2641	-1.110	.2853	-1.060	.3201	-0.975
.2399	-1.169	.2660	-1.101	.2854	-1.066	.3203	-0.963
.2400	-1.150	.2661	-1.109	.2872	-1.058	.3204	-0.975
.2401	-1.159	.2662	-1.105	.2873	-1.051	.3223	-0.960
.2403	-1.158	.2664	-1.104	.2875	-1.047	.3224	-0.950
.2432	-1.147	.2665	-1.098	.2876	-1.059	.3226	-0.946
.2434	-1.148	.2684	-1.083	.2877	-1.055	.3228	-0.955
.2435	-1.125	.2685	-1.087	.2895	-1.054	.3247	-0.955
.2436	-1.128	.2686	-1.099	.2897	-1.047	.3248	-0.971
.2437	-1.140	.2687	-1.092	.2898	-1.046	.3249	-0.955
.2457	-1.136	.2688	-1.089	.2899	-1.056	.3250	-0.967
.2458	-1.127	.2707	-1.098	.2900	-1.051	.3251	-0.951
.2459	-1.136	.2708	-1.095	.2918	-1.061	.3271	-0.945
.2460	-1.133	.2709	-1.110	.2919	-1.064	.3272	-0.943
.2462	-1.150	.2711	-1.101	.2921	-1.050	.3273	-0.946
.2481	-1.128	.2712	-1.098	.2922	-1.058	.3274	-0.941
.2482	-1.122	.2731	-1.098	.2923	-1.027	.3275	-0.935
.2483	-1.129	.2732	-1.096	.3084	-0.992	.3307	-0.941
.2485	-1.125	.2734	-1.090	.3085	-0.990	.3308	-0.920
.2486	-1.113	.2735	-1.085	.3086	-0.994	.3309	-0.927
.2506	-1.117	.2736	-1.086	.3087	-0.992	.3310	-0.930
.2507	-1.128	.2755	-1.098	.3088	-0.993	.3311	-0.935
.2508	-1.126	.2756	-1.096	.3107	-0.996	.3331	-0.923
.2509	-1.114	.2757	-1.105	.3108	-0.988	.3332	-0.919
.2510	-1.131	.2759	-1.100	.3109	-0.999	.3334	-0.927
.2560	-1.129	.2760	-1.084	.3110	-0.982	.3335	-0.922
.2562	-1.130	.2778	-1.082	.3112	-0.988	.3336	-0.932
.2563	-1.128	.2779	-1.092	.3130	-0.987	.3394	-0.899
.2564	-1.114	.2780	-1.089	.3131	-0.983	.3395	-0.905
.2565	-1.131	.2781	-1.088	.3132	-0.986	.3396	-0.914
.2588	-1.117	.2782	-1.092	.3133	-0.980	.3398	-0.904
.2589	-1.123	.2801	-1.084	.3134	-0.989	.3399	-0.914
.2590	-1.116	.2802	-1.089	.3152	-0.977	.3418	-0.882
.2591	-1.117	.2804	-1.083	.3153	-0.978	.3420	-0.890
.2592	-1.110	.2805	-1.081	.3155	-0.981	.3421	-0.894
.2612	-1.103	.2806	-1.087	.3156	-0.982	.3422	-0.891
.2613	-1.097	.2825	-1.075	.3157	-0.986	.3423	-0.885

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.3440	-0.883	.3629	-0.801	.3892	-0.727	.4644	-0.778
.3442	-0.885	.3648	-0.790	.3893	-0.734	.4645	-0.779
.3443	-0.886	.3649	-0.790	.4443	-0.738	.4646	-0.767
.3444	-0.882	.3650	-0.803	.4444	-0.738	.4666	-0.771
.3445	-0.884	.3651	-0.791	.4446	-0.725	.4667	-0.761
.3463	-0.872	.3653	-0.787	.4447	-0.741	.4668	-0.776
.3464	-0.881	.3671	-0.779	.4448	-0.734	.4669	-0.772
.3466	-0.877	.3672	-0.777	.4466	-0.727	.4670	-0.757
.3467	-0.879	.3673	-0.778	.4467	-0.732	.4693	-0.766
.3468	-0.879	.3674	-0.789	.4469	-0.732	.4695	-0.760
.3486	-0.870	.3676	-0.791	.4470	-0.723	.4696	-0.756
.3487	-0.878	.3695	-0.782	.4471	-0.744	.4697	-0.760
.3488	-0.878	.3696	-0.789	.4490	-0.734	.4698	-0.763
.3490	-0.870	.3697	-0.779	.4491	-0.739	.4716	-0.779
.3491	-0.859	.3699	-0.787	.4492	-0.747	.4718	-0.770
.3509	-0.851	.3700	-0.777	.4493	-0.741	.4719	-0.785
.3510	-0.856	.3718	-0.780	.4495	-0.741	.4720	-0.785
.3511	-0.876	.3719	-0.778	.4514	-0.770	.4721	-0.781
.3512	-0.862	.3720	-0.765	.4515	-0.765	.4741	-0.796
.3514	-0.859	.3721	-0.771	.4516	-0.754	.4742	-0.796
.3531	-0.851	.3723	-0.774	.4517	-0.741	.4743	-0.802
.3532	-0.842	.3742	-0.757	.4519	-0.755	.4745	-0.774
.3534	-0.854	.3743	-0.760	.4537	-0.751	.4746	-0.792
.3535	-0.857	.3744	-0.766	.4538	-0.749	.4765	-0.780
.3536	-0.857	.3746	-0.763	.4539	-0.758	.4766	-0.796
.3555	-0.812	.3747	-0.758	.4540	-0.751	.4767	-0.800
.3556	-0.821	.3766	-0.745	.4541	-0.747	.4768	-0.797
.3557	-0.830	.3767	-0.758	.4559	-0.738	.4770	-0.796
.3559	-0.827	.3768	-0.765	.4561	-0.744	.4796	-0.817
.3560	-0.837	.3769	-0.741	.4562	-0.742	.4797	-0.801
.3578	-0.817	.3770	-0.751	.4563	-0.746	.4798	-0.797
.3579	-0.821	.3841	-0.730	.4564	-0.755	.4799	-0.808
.3581	-0.825	.3842	-0.730	.4582	-0.764	.4800	-0.800
.3582	-0.817	.3843	-0.732	.4583	-0.750	.4822	-0.805
.3583	-0.817	.3844	-0.735	.4584	-0.754	.4823	-0.803
.3601	-0.811	.3845	-0.734	.4585	-0.763	.4824	-0.818
.3602	-0.810	.3865	-0.729	.4587	-0.754	.4826	-0.812
.3604	-0.812	.3866	-0.721	.4606	-0.761	.4827	-0.818
.3605	-0.811	.3867	-0.735	.4607	-0.743	.4850	-0.823
.3606	-0.818	.3868	-0.716	.4608	-0.762	.4851	-0.822
.3624	-0.816	.3870	-0.728	.4609	-0.768	.4852	-0.826
.3625	-0.814	.3888	-0.709	.4610	-0.761	.4853	-0.808
.3626	-0.810	.3889	-0.702	.4642	-0.769	.4854	-0.827
.3628	-0.792	.3890	-0.721	.4643	-0.744	.4875	-0.826

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.4876	-0.852	.5135	-0.960	.5349	-0.984	.4738	-0.758
.4878	-0.844	.5136	-0.947			.4739	-0.745
.4879	-0.852	.5137	-0.929	2446360.+		.4741	-0.726
.4880	-0.841	.5138	-0.952	.4490	-0.818	.4742	-0.732
.4901	-0.849	.5139	-0.944	.4491	-0.825	.4761	-0.742
.4902	-0.849	.5159	-0.953	.4493	-0.822	.4762	-0.729
.4903	-0.853	.5160	-0.947	.4494	-0.820	.4763	-0.742
.4904	-0.848	.5161	-0.957	.4495	-0.840	.4764	-0.727
.4906	-0.853	.5162	-0.953	.4517	-0.815	.4765	-0.733
.4925	-0.859	.5163	-0.945	.4518	-0.809	.4786	-0.733
.4926	-0.876	.5184	-0.959	.4519	-0.815	.4787	-0.743
.4927	-0.856	.5185	-0.956	.4520	-0.817	.4788	-0.734
.4928	-0.870	.5186	-0.976	.4522	-0.817	.4789	-0.737
.4929	-0.846	.5188	-0.940	.4552	-0.815	.4791	-0.747
.4949	-0.850	.5189	-0.955	.4554	-0.814	.4812	-0.739
.4951	-0.859	.5209	-0.967	.4555	-0.806	.4813	-0.730
.4952	-0.873	.5210	-0.974	.4556	-0.802	.4814	-0.736
.4953	-0.873	.5211	-0.980	.4557	-0.812	.4815	-0.734
.4954	-0.868	.5212	-0.975	.4579	-0.819	.4816	-0.728
.4974	-0.913	.5213	-0.969	.4580	-0.811	.4837	-0.725
.4975	-0.902	.5238	-0.967	.4581	-0.798	.4838	-0.727
.4976	-0.896	.5239	-0.976	.4582	-0.807	.4840	-0.727
.4977	-0.903	.5240	-0.954	.4583	-0.803	.4841	-0.741
.4978	-0.906	.5241	-0.977	.4612	-0.800	.4842	-0.740
.5000	-0.876	.5243	-0.960	.4613	-0.777	.4863	-0.741
.5001	-0.889	.5265	-1.005	.4614	-0.779	.4864	-0.745
.5002	-0.887	.5266	-1.000	.4615	-0.787	.4865	-0.738
.5003	-0.874	.5267	-1.004	.4616	-0.779	.4866	-0.739
.5004	-0.893	.5268	-1.008	.4637	-0.780	.4867	-0.734
.5026	-0.899	.5270	-1.001	.4638	-0.755	.4888	-0.720
.5027	-0.912	.5293	-0.990	.4639	-0.773	.4890	-0.724
.5028	-0.909	.5294	-0.994	.4640	-0.763	.4891	-0.724
.5029	-0.905	.5295	-0.994	.4641	-0.780	.4893	-0.723
.5031	-0.902	.5296	-0.984	.4663	-0.771	.4913	-0.725
.5084	-0.937	.5298	-0.975	.4664	-0.777	.4915	-0.743
.5086	-0.930	.5318	-0.978	.4665	-0.766	.4916	-0.754
.5087	-0.950	.5319	-0.969	.4666	-0.763	.4917	-0.748
.5088	-0.932	.5320	-0.989	.4667	-0.783	.4918	-0.731
.5089	-0.926	.5321	-0.976	.4711	-0.769	.4938	-0.740
.5109	-0.947	.5322	-0.984	.4713	-0.762	.4940	-0.731
.5110	-0.939	.5345	-1.016	.4714	-0.754	.4941	-0.738
.5111	-0.920	.5346	-1.010	.4715	-0.754	.4942	-0.735
.5112	-0.934	.5347	-1.021	.4716	-0.760	.4943	-0.740
.5113	-0.935	.5348	-1.001	.4737	-0.760	.4980	-0.714

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.4981	-0.723	.5385	-0.736	.3927	-0.725	.4102	-0.743
.4982	-0.727	.5386	-0.716	.3940	-0.750	.4103	-0.738
.4983	-0.716	.5387	-0.711	.3941	-0.733	.4104	-0.734
.4984	-0.713	.5388	-0.739	.3043	-0.739	.4119	-0.724
.5004	-0.719	.5390	-0.725	.3945	-0.748	.4120	-0.737
.5005	-0.712			.3958	-0.744	.4122	-0.748
.5007	-0.724	2446576.+		.3959	-0.730	.4123	-0.716
.5008	-0.733	.3779	-0.777	.3960	-0.731	.4124	-0.729
.5009	-0.731	.3780	-0.776	.3961	-0.740	.4137	-0.741
.5093	-0.728	.3781	-0.753	.3962	-0.715	.4138	-0.731
.5094	-0.700	.3782	-0.762	.3976	-0.744	.4139	-0.730
.5096	-0.717	.3813	-0.757	.3977	-0.721	.4141	-0.722
.5097	-0.724	.3814	-0.762	.3978	-0.731	.4142	-0.719
.5098	-0.724	.3815	-0.767	.3979	-0.729	.4154	-0.739
.5122	-0.725	.3816	-0.755	.3994	-0.712	.4155	-0.733
.5123	-0.713	.3829	-0.768	.3995	-0.731	.4157	-0.716
.5124	-0.720	.3830	-0.750	.3996	-0.734	.4218	-0.744
.5125	-0.713	.3831	-0.747	.3997	-0.718	.4219	-0.733
.5126	-0.719	.3832	-0.757	.3998	-0.729	.4220	-0.725
.5172	-0.711	.3833	-0.769	.4011	-0.728	.4222	-0.729
.5173	-0.707	.3847	-0.754	.4012	-0.727	.4223	-0.725
.5174	-0.710	.3848	-0.761	.4014	-0.723	.4240	-0.753
.5176	-0.700	.3849	-0.755	.4015	-0.737	.4241	-0.736
.5177	-0.711	.3850	-0.738	.4016	-0.729	.4242	-0.732
.5201	-0.719	.3851	-0.747	.4030	-0.716	.4243	-0.720
.5202	-0.715	.3867	-0.763	.4032	-0.736	.4244	-0.739
.5203	-0.736	.3868	-0.760	.4033	-0.722	.4261	-0.734
.5204	-0.738	.3869	-0.753	.4034	-0.715	.4263	-0.731
.5205	-0.725	.3870	-0.746	.4035	-0.722	.4264	-0.736
.5229	-0.740	.3871	-0.744	.4048	-0.724	.4265	-0.702
.5230	-0.719	.3887	-0.747	.4049	-0.739	.4266	-0.695
.5231	-0.748	.3888	-0.760	.4051	-0.734	.4281	-0.708
.5232	-0.720	.3889	-0.757	.4052	-0.734	.4282	-0.715
.5233	-0.741	.3890	-0.755	.4065	-0.735	.4284	-0.712
.5275	-0.710	.3891	-0.740	.4066	-0.740	.4285	-0.711
.5276	-0.709	.3905	-0.750	.4067	-0.752	.4286	-0.728
.5277	-0.703	.3906	-0.728	.4069	-0.732	.4301	-0.705
.5278	-0.714	.3907	-0.735	.4070	-0.727	.4303	-0.706
.5279	-0.714	.3908	-0.759	.4082	-0.753	.4304	-0.720
.5349	-0.721	.3909	-0.721	.4083	-0.740	.4305	-0.712
.5350	-0.706	.3923	-0.725	.4084	-0.737	.4306	-0.721
.5351	-0.731	.3924	-0.742	.4086	-0.738	.4320	-0.719
.5352	-0.727	.3925	-0.722	.4087	-0.747	.4321	-0.717
.5353	-0.736	.3926	-0.721	.4101	-0.745	.4322	-0.727

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.4324	-0.715	.4528	-0.719	.4728	-0.747	.4991	-0.796
.4325	-0.721	.4530	-0.720	.4729	-0.744	.4992	-0.809
.4341	-0.690	.4531	-0.720	.4731	-0.749	.4994	-0.802
.4342	-0.728	.4546	-0.721	.4732	-0.744	.4995	-0.830
.4343	-0.732	.4547	-0.716	.4783	-0.778	.5008	-0.846
.4344	-0.706	.4548	-0.723	.4784	-0.763	.5009	-0.846
.4345	-0.721	.4549	-0.733	.4785	-0.773	.5011	-0.841
.4360	-0.722	.4551	-0.744	.4786	-0.774	.5012	-0.858
.4362	-0.723	.4565	-0.733	.4800	-0.785	.5013	-0.822
.4363	-0.728	.4566	-0.720	.4801	-0.786	.5048	-0.860
.4364	-0.714	.4567	-0.745	.4802	-0.783	.5049	-0.889
.4365	-0.714	.4568	-0.741	.4803	-0.779	.5050	-0.883
.4381	-0.747	.4569	-0.750	.4804	-0.780	.5051	-0.869
.4382	-0.745	.4583	-0.722	.4817	-0.776	.5053	-0.837
.4383	-0.726	.4584	-0.717	.4818	-0.767	.5148	-0.908
.4384	-0.704	.4585	-0.733	.4819	-0.755	.5149	-0.905
.4386	-0.724	.4586	-0.719	.4821	-0.745	.5150	-0.904
.4428	-0.717	.4587	-0.708	.4822	-0.766	.5152	-0.916
.4429	-0.721	.4613	-0.734	.4840	-0.772	.5153	-0.898
.4431	-0.712	.4614	-0.753	.4841	-0.777	.5170	-0.898
.4432	-0.712	.4615	-0.744	.4842	-0.767	.5171	-0.905
.4433	-0.716	.4616	-0.741	.4843	-0.785	.5172	-0.909
.4447	-0.741	.4617	-0.739	.4881	-0.797	.5173	-0.901
.4448	-0.725	.4631	-0.727	.4882	-0.811	.5175	-0.892
.4449	-0.723	.4632	-0.739	.4883	-0.802	.5192	-0.919
.4450	-0.723	.4633	-0.748	.4884	-0.834	.5193	-0.905
.4451	-0.745	.4635	-0.726	.4885	-0.829	.5194	-0.888
.4467	-0.734	.4636	-0.743	.4898	-0.831	.5195	-0.883
.4468	-0.719	.4653	-0.749	.4900	-0.822	.5196	-0.894
.4469	-0.710	.4654	-0.726	.4901	-0.818	.5213	-0.919
.4470	-0.720	.4655	-0.746	.4902	-0.823	.5214	-0.911
.4471	-0.713	.4656	-0.745	.4903	-0.813	.5215	-0.892
.4485	-0.709	.4658	-0.709	.4916	-0.796	.5231	-0.952
.4487	-0.705	.4671	-0.751	.4917	-0.803	.5232	-0.908
.4488	-0.720	.4672	-0.750	.4918	-0.803	.5233	-0.915
.4489	-0.708	.4674	-0.743	.4919	-0.804	.5235	-0.937
.4490	-0.714	.4675	-0.754	.4921	-0.801	.5236	-0.941
.4505	-0.717	.4676	-0.757	.4934	-0.777	.5248	-0.945
.4506	-0.698	.4691	-0.735	.4935	-0.793	.5249	-0.953
.4507	-0.704	.4692	-0.731	.4936	-0.788	.5251	-0.962
.4509	-0.707	.4694	-0.734	.4937	-0.774	.5252	-0.945
.4510	-0.713	.4695	-0.755	.4972	-0.831	.5253	-0.950
.4526	-0.723	.4696	-0.738	.4974	-0.811	.5267	-0.966
.4527	-0.716	.4727	-0.738	.4975	-0.817	.5268	-0.957

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.5269	-0.939	.4575	-0.727	.4846	-0.725	.5348	-0.785
.5271	-0.900	.4598	-0.725	.4865	-0.723	.5349	-0.775
.5272	-0.900	.4599	-0.732	.4866	-0.732	.5351	-0.763
.5302	-0.969	.4600	-0.732	.4867	-0.729	.5370	-0.745
.5303	-0.982	.4601	-0.722	.4869	-0.727	.5371	-0.750
.5304	-0.963	.4602	-0.728	.4870	-0.730	.5373	-0.767
.5305	-0.951	.4619	-0.731	.4919	-0.726	.5374	-0.769
.5306	-0.974	.4620	-0.737	.4920	-0.731	.5375	-0.770
.5321	-0.989	.4622	-0.732	.4921	-0.740	.5400	-0.795
.5322	-0.994	.4623	-0.731	.4922	-0.728	.5401	-0.791
.5323	-0.990	.4624	-0.726	.4924	-0.717	.5402	-0.798
.5324	-0.982	.4640	-0.736	.4941	-0.726	.5403	-0.812
.5326	-0.985	.4641	-0.729	.4942	-0.735	.5404	-0.805
.5339	-0.977	.4642	-0.718	.4943	-0.726	.5425	-0.796
.5341	-0.979	.4644	-0.714	.4945	-0.716	.5426	-0.802
.5342	-1.000	.4661	-0.735	.5015	-0.715	.5427	-0.806
.5343	-0.980	.4663	-0.740	.5016	-0.709	.5428	-0.790
.5344	-0.946	.4664	-0.721	.5018	-0.712	.5429	-0.808
.5358	-0.987	.4665	-0.731	.5019	-0.720	.5455	-0.848
.5359	-0.984	.4666	-0.731	.5020	-0.712	.5456	-0.830
.5360	-0.985	.4684	-0.728	.5040	-0.733	.5457	-0.823
.5361	-0.970	.4685	-0.721	.5041	-0.741	.5458	-0.841
.5362	-0.973	.4686	-0.749	.5043	-0.737	.5459	-0.844
.5394	-1.001	.4688	-0.742	.5044	-0.742	.5476	-0.827
.5395	-1.005	.4689	-0.747	.5045	-0.717	.5477	-0.829
.5397	-0.995	.4706	-0.730	.5069	-0.703	.5478	-0.835
.5399	-1.007	.4707	-0.730	.5070	-0.731	.5480	-0.837
.5417	-1.006	.4708	-0.716	.5072	-0.723	.5481	-0.836
.5418	-1.002	.4709	-0.718	.5096	-0.739	.5499	-0.851
.5432	-1.005	.4711	-0.721	.5097	-0.729	.5500	-0.852
.5433	-1.009	.4728	-0.721	.5098	-0.749	.5501	-0.839
.5434	-1.019	.4729	-0.723	.5099	-0.742	.5502	-0.827
.5435	-1.020	.4730	-0.720	.5100	-0.719	.5503	-0.847
.5436	-1.005	.4732	-0.716	.5148	-0.728	.5521	-0.857
.5452	-1.005	.4733	-0.724	.5149	-0.730	.5522	-0.861
.5453	-1.004	.4796	-0.725	.5150	-0.733	.5523	-0.882
.5454	-1.016	.4797	-0.720	.5152	-0.732	.5524	-0.877
.5455	-1.014	.4799	-0.712	.5153	-0.724	.5526	-0.878
.5457	-0.999	.4800	-0.699	.5319	-0.760	.5544	-0.892
		.4801	-0.714	.5320	-0.764	.5545	-0.878
2446645.+		.4822	-0.728	.5321	-0.764	.5546	-0.892
.4572	-0.751	.4823	-0.709	.5322	-0.760	.5547	-0.878
.4573	-0.759	.4844	-0.719	.5346	-0.777	.5566	-0.875
.4574	-0.744	.4845	-0.728	.5347	-0.787	.5567	-0.883

Table 1 - continued

J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB	J.D. hel	ΔB
.5568	-0.885	.5591	-0.897	.5612	-0.904	.5633	-0.910
.5569	-0.883	.5609	-0.889	.5613	-0.903	.5634	-0.909
.5589	-0.897	.5610	-0.894	.5631	-0.922	.5635	-0.900
.5590	-0.879	.5611	-0.903	.5632	-0.915		

Each point represents an average of five observations, provided some of the observations were not omitted because of large deviation. During the summer, the extinction variations over several minutes were also observed. Consequently, the internal accuracy of the mean points differs. Due to the cloud cover on the night of Oct. 20/21, 1985, no observations were made in the neighbourhood of the primary minimum phase. The minimum epochs were derived from the observations made at Skalnaté Pleso using the graphic-paper method. They are given at the end of Tab. 2, and the third column of this table gives their limits of error.

3. SECULAR CHANGES OF THE PERIOD AND VARIATIONS OF THE LIGHT CURVE

In the last study of the star made by van Houten (1959), the author came to the conclusion that the period was constant and, therefore, he computed a linear ephemeris. However, the minimum epochs derived from recent photoelectric observations, including those made at Skalnaté Pleso, deviate considerably from the ephemeris published by van Houten. Moreover, we found that the linear ephemeris could not be applied to the observation interval as a whole. We then attempted to find a better approximation. We found that the ephemeris we computed, given below, which has a quadratic term, is sufficiently satisfactory and fits the observations well within the observation interval as a whole:

$$\text{MIN } I_{\text{hel.}} = \text{J.D. } 2434489.5915 \pm 35 + 1^{d}.09601648 \pm 39 - 2.50 \pm .62 \times 10^{-10} \times E^{2}$$

In computing the ephemeris, we used the minimum epochs summarized in Tab. 2. The minimum epochs whose weight in Tab. 2 is shown as zero were omitted. Zero weight was assigned to two minimum epochs. Schneller's minimum (1929) apparently deviates because it is not an observed minimum epoch, but only an estimated value. Further, it is very probable that there is a printing error in Gaposhkin's paper (1953), because his minimum epoch differs by more than one quarter of a day, which is impossible considering the period of V 366 Cyg. In the ephemeris we derived, the error in determining the secular term is relatively small as compared to its absolute value. The decrease in the period of V 366 Cyg from the beginning of observations and throughout the whole 55 years of observations can be considered as proved. It would be premature to attempt to determine a single cause of this decrease. Although the minimum observations are distributed non-uniformly on the time scale, it does not probable that the-

TABLE 2

MINIMA OF V 366 CYG

No	J.D. hel.	Error	Note	w	E	O - C_1	O - C_2	References
1	2425504.46		p.est.	0	- 8198	-0.014	+0.028	Schneller (1929)
2	5900.097		p	1	- 7837	-0.038	+0.002	Beyer (1939)
3	7283.254		p	1	- 6575	-0.050	-0.018	Beyer (1939)
4	7642.796		p	1	- 6247	-0.001	+0.029	Beyer (1939)
5	7846.635		v	1	- 6061	-0.020	+0.009	Zonn (1939)
6	7962.805		p	1	- 5955	-0.027	+0.001	Beyer (1939)
7	8391.348		p	1	- 5564	-0.026	0.000	Beyer (1939)
8	8745.357		p	1	- 5241	-0.029	-0.005	Beyer (1939)
9	9085.114		p	1	- 4931	-0.036	-0.014	Beyer (1939)
10	9789.590		p	0	- 4288	-0.297?	-0.278?	Gaposchkin (1953)
11	2430548.302		p	1	- 3596	-0.027	-0.011	Soloviev (1943)
12	4489.5933		p	5	0	-0.0004	+0.0019	van Houten (1956)
13	2445211.363:		e sec	2	+ 9782.5	+0.016	+0.014	Diethelm (1982)
14	5229.415		p	1	+ 9799	-0.016	-0.018	Braune, Hübscher, Mundry (1983)
15	5242.5866		e	3	+ 9811	+0.0031	+0.0015	Faulkner, Kaitchuk (1983)
16	5605.3591		e	3	+10142	-0.0049	-0.0058	Hübscher, Mundry (1984)
17	5651.402		p	1	+10184	+0.005	+0.005	Hübscher, Mundry (1984)
18	6290.369	±0.002	e	3	+10767	-0.0036	-0.0030	this paper
19	6359.421	±0.002	e	3	+10830	-0.0004	+0.0003	this paper
20	6576.431	±0.002	e	3	+11028	-0.0011	+0.0002	this paper
21	6645.481	±0.003	e	3	+11091	+0.0000	+0.0015	this paper

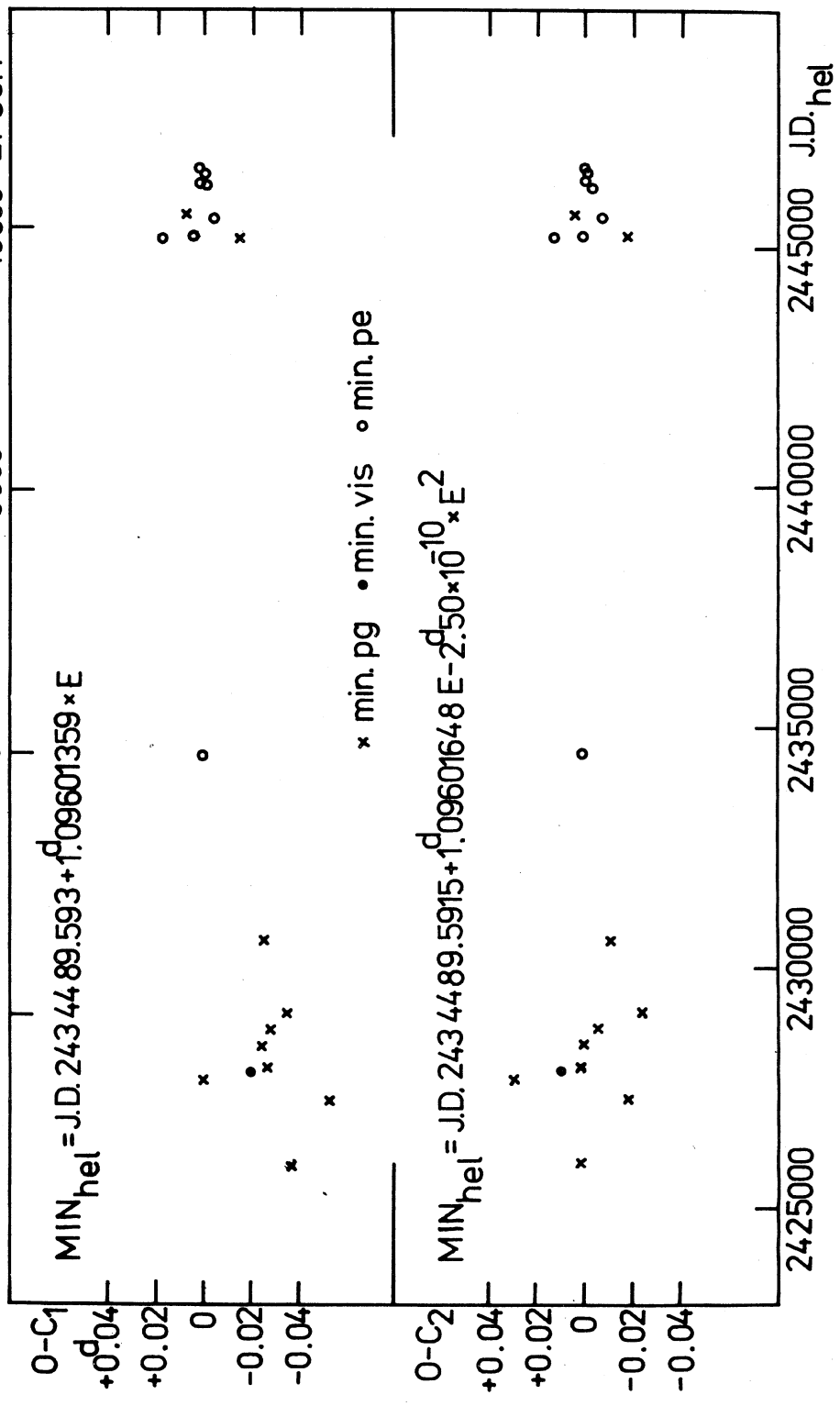

Fig. 2. O - C diagrams for the linear ephemeris and for the ephemeris with secular term of V 366 Cyg.

re are periodic changes on a time scale shorter than the interval of observation, however, smaller irregular changes cannot be excluded. With a view to the nature and slowness of the secular change, its causes may be several, or due to the combination of several causes. One of the possibilities is mass transfer from the component with the larger mass to that with the smaller. However, this interpretation can only be based on the spectrum of the brighter component of the binary. Assuming that the mass-losing component is in the main sequence and that its mass is roughly $1.5M_{\odot}$, and that the mass of the other component is about the same as that of the Sun, the application of the relation

$$\Delta P/P = 3[2(\mu - 1)/\mu(1 - \mu)]\,\Delta m/m,$$

where $m = m_1 + m_2$, $\mu = m_2/m$, then yields a mass transfer value of approximately 2×10^{-7} masses of the Sun per year. This value is too high. According to Branczewicz and Dworak (1980) both stars are distinctly below the Roche limit, expressed as percentage just over 70. However, this figure is the weak link in the interpretation of V 366 Cyg. Nevertheless, we may assume with a fairly high degree of probability that we have so far been observing only a small part of the curve of the apparent change in period, which can be caused by the rotation of the apside line, or by the presence of a third body in the system. Since the nature of the mass-losing component is not known sufficiently, one cannot disregard even the activity-driven structure hypothesis (van Buren and Young, 1985). The cause of the changes must thus be considered as unexplained.

The current linear ephemeris was calculated only from the photoelectric minima given in Tab. 2, which were taken with the weights given in the same table. This ephemeris applies to observations made after J.D. 2434000. One must bear in mind that the observations are distributed non-uniformly in time, that there is only one minimum for the zero epoch and that others are accumulated about epoch E = 10000. The linear ephemeris reads

$$\mathrm{MIN}\ I_{hel.} = \mathrm{J.D.}\ 2434489.5937 \pm 27 + 1^{d}.09601364 \pm 29 \times E$$

The $O - C_1$ values for the linear ephemeris are in the appropriate column of Tab 2 and they are plotted in the upper part of Fig. 2. The $O - C_2$ values in Tab. 2 and in the bottom part of Fig. 2 relate to the ephemeris with the quadratic term.

The complete light curve of V 366 Cyg in integral light without the use of colour filter was obtained by van Houten (1959). Our observations with the B filter only cover the part of the light curve in the neighbourhood of the primary minimum. Since the minima are shallow, one cannot determine whether the eclipse is partial or total. Van Houten's observations made during one night clear document totality in the minimum, and those made on another night constant brightness in the phase outside the minimum. However, van Houten's later observations do not support this and indicate thet the light curve is variable. With a view to the spectral class of the primary component, the pe-

riod and shape of the minima, the classification of this system may be disputable. Taking into account the descending and ascending branches, the expected brightness under partial eclipse in the minimum should be roughly 0.02 mag weaker than observed. It would seem that there is light contamination in the phase about the primary minimum. This effect is very small. On the other hand, in the course of four observation nights over an observation interval of about one year, this effect was observed and it seems that the brightness variations were synchronized in phase 0.97 - 0.01. Further observations may prove this effect to be either temporary or a permanent property of the system.

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