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On the shape of the *uvby* lightcurves of CP stars (*)

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Summary. — We present the lightcurves in the Strömgren system of 56 CP stars. The observational data have been fitted by a sine wave and its first harmonic. The least-square parameters are tabulated and it is shown that such a fit describes very well the CP variations in most cases, the only exceptions being due to observational uncertainties.

Key words : CP stars : lightcurves — CP stars : Strömgren photometry.

1. Introduction.

A recent analysis by North (1984) shows that the lightcurves of CP stars can often be well represented by a sine wave and its first harmonic. Recently we performed new reductions of most of our older *uvby* data and got an homogeneous set of CP star observations. Hence it was possible to carry out the same kind of harmonic analysis for a relatively large sample of lightcurves (56 stars).

2. Observations.

The observations were collected at the European Southern Observatory on La Silla with the Danish 50 cm telescope, the ESO 50 cm telescope and the Bochum 60 cm telescope. Details of the observing runs are given in table I. Usually the variable and two comparison stars were observed in the sequence C_1-V-C_2-V-C_2-V-C_1. Most of the data were reduced with the PHOT2 programme (Manfroid and Heck, 1983). This procedure yielded accurate absolute photometry and allowed to decide on the variations of some comparison stars, which were deleted from the differential measurements. Among the variable comparison stars, HD 28843 and HD 33331 proved to be CP stars and were then included in our study.

The list of objects, with the comparison stars, is given in table II. The first three columns give the HD number, another identification and the spectral type of the programme stars. (The spectral types are from a preliminary version of the *Catalogue général des étoiles Ap et Am connues*, kindly provided by P. Renson.) The runs, with the corresponding number of observations N and HD numbers of the comparison stars C_1 and C_2 are listed in the four next columns. In col. 8, we have indicated the possible values of the period P, taken from the references quoted in col. 9. (For many stars, improved or new periods were derived for this study; see Manfroid and Mathys, 1985.) When a star has been observed during several runs, it may happen that a few equally spaced frequencies ($f + n\,\Delta f$) appear from the periodogram as almost equally probable. When this occurs, the value of the frequency separation Δf is also given in col. 8.

3. Analysis of the lightcurves.

For each star, a least-square fit of the observations was done with a function

$$m = A_0 + A_1 \sin\left(\frac{2\,\pi(t - t_0)}{P} + \phi_1\right) + A_2 \sin\left(\frac{4\,\pi(t - t_0)}{P} + \phi_2\right),$$

where m is the magnitude and t the time. For each star the time of the first observation of the first run has been taken as time origin t_0. When a star was observed during several runs, each run was treated independently with the same period. The differences between the A_0 obtained gave the shifts that had to be imposed for each run in order to eliminate long term spurious variations (all observations were brought into coincidence to the first run for each star). These variations can generally be tracked down to small differences in the instrumental systems. It was not found necessary — nor generally possible — to use the

(*) Based on observations collected at the European Southern Observatory, La Silla, Chile.
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other coefficients to correct further those effects. Those corrections are possible, of course, only when the phase coverage of the variations is adequate in each run. For instance, star HD 83368 could not be studied in this way when the period $P = 2.8519$ d was used.

The least-square fit yields a standard deviation σ. Analysis of σ in a given range of periods was an effective way to improve the value of P or to discriminate between different possible periods. Also, in several instances, the value of the period given in table II was adjusted, within the limits of accuracy given in the quoted reference, to minimize σ. Table III lists for every star the period effectively used, the time of the first observation of the first run (JD 2,440,000.000 + t_0) and, for each colour, the average differential magnitude A_0 (for the first run), the amplitudes A_1 and A_2 of the fundamental cosine variation and of its first harmonic, together with their phases ϕ_1 and ϕ_2 and the deviation σ, in magnitudes. The fact that σ is, for most of the observed stars, larger in u than in the other colours, reflecting a higher dispersion of the measurements, is not unusual in Strömgren photometry. Indeed, the accuracy that can be achieved is less good in u than in the other bands, because the signal is generally lower and the atmospheric corrections have to be larger (especially to account for the increase of the extinction at short wavelengths). Notice that for visual double stars whose both members have been measured together (see remarks to Table II), A_1 and A_2 must still be corrected to account for the contribution of the constant component to the total light (see Renson and Manfroid, 1981). A similar correction should be introduced for spectroscopic binaries as well, but its value cannot be determined since the magnitude of the secondary is, of course, unknown. The curves corresponding to the solutions listed in table III are plotted in figures 1 to 60. The various symbols used refer to the different runs (see Table I). In some instances, several periods which look equally possible are given.

4. Conclusions.

We have presented a quantitative analysis of the shape of the lightcurves of 56 CP stars. This constitutes probably the largest homogeneous sample of such material up to now.

The main conclusion is that a sine wave and its first harmonic appear to be quite adequate to describe all lightcurves within the accuracy of the measurements. For large amplitude variables like HD 125630, this means really quite a nice fit. The material however is strongly biased towards Si and Sr-Cr-Eu stars because these were selected as having maximum chances of being found variable and, hence, of making the observing runs « successful ».

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TABLE I. — *The observing runs.*

Run	Date	Telescope	Symbol
1	February 1977	Danish 0.5 m	Z
2	July 1977	Danish 0.5 m	◈
3	November 1977	Danish 0.5 m	×
4	July 1978	Bochum 0.61 m	⧗
5	December 1978	ESO 0.5 m	✱
6	June 1979	Danish 0.5 m	⊔
7	March 1980	Danish 0.5 m	ʘ
8	December 1980	Danish 0.5 m	⌅
9	September 1981	Danish 0.5 m	+
10	January 1982	Danish 0.5 m	▲

Remarks to table II.

a Spectroscopic binary (long period, > 50 years ?)
b Absolute measurements
c The sample has been augmented by the inclusion of 11 absolute measurements obtained by Pedersen and Thomsen (1977) at ESO in January and February 1976
d A visual companion of magnitude 10.5, with a separation of 1.5″, was measured simultaneously
e A visual companion of magnitude 4.3, with a separation of 0.2″, was measured simultaneously
f Spectroscopic binary ?
g The sample has been augmented by the inclusion of 17 measurements obtained between September and December 1983 within the frame of the ESO Long Term Photometric Programme (with the same comparison stars)
h A visual companion of magnitude 8.2, with a separation of 6″, was measured simultaneously
i The sample has been augmented by the inclusion of 9 measurements obtained in December 1983 within the frame of the ESO Long Term Photometric Programme (with the same comparison stars)
j A visual companion of magnitude 9.4, with a separation of 2.3″, was measured simultaneously
k Spectroscopic binary
l Magnetic observations (Thompson, 1983) support the 2.85 d period rather than the half value derived from photometric measurements only (Renson *et al.*, 1984); as a matter of fact, in the latter paper, the present authors, in consideration of the interpretation of the rapid light variations observed by Kurtz (1982), had already argued in favour of the longer period
m Because of unsufficient phase coverage for the 2.85 d period, it proved better to estimate the shift in A_0 between both runs (see Sect. 3) from a least-square fit of the data performed with the 1.42 d period
n A visual companion of magnitude 8.8, with a separation of 3.2″, was measured simultaneously
o A visual companion of magnitude 8.0, with a separation of 2″, was measured simultaneously
p A visual companion of magnitude 5.5, with a separation of 1″, was measured simultaneously
q In view of the low number of observations in each run, the shift in A_0 between both runs (see Sect. 3) was estimated from the mean value of each series of points; such a questionable treatment also affects the reliability of the period determination
r Periods corresponding to frequencies spaced by $4\,n\,\Delta f$ are the most probable ones

Reference list for table II.

1 Borra *et al.*, 1983.
2 Manfroid and Renson, 1983b.
3 Renson and Manfroid, 1981.
4 Manfroid and Mathys, 1985.
5 Manfroid and Renson, 1981.
6 Manfroid and Mathys, 1984.
7 Kurtz, 1982.
8 Manfroid and Renson, 1983a.
9 Renson and Manfroid, 1980.

TABLE II. — *Studied stars.*

HD	Other id.	Sp. Type	Run	N	C_1	C_2	Possible periods (d)	Ref.	Rem.
5737	HR 280	B6 He w	9	17	6178	4691	19.4/16.7/0.949/0.486	1	a
10840	CpD−61°139	B9 Si	9	15	11995	9798	2.100	2	
12767	HR 612	A0 Si	3	26	12563	13709	1.89	3	
22470	HR 1100	A0 Si	3	42	23055	22203	1.9387 ($\Delta f = 0.00260$)	4	
			5	8	23055	22203			
24155	HR 1194	B9 Si	5	16	23990		2.53465 ($\Delta f = 0.00099$)	3	
			9	8	23990				
27463	HR 1357	A0 EuCr	8	33	28667	29115	5		
28843	HR 1441	B9 He w	3	42			1.37390	6	b,c
29009	HR 1449	B9 Si	3	42			3.79864	6	b,d
			5	8					
			9	7					
29305	HR 1465	A0 Si	3	40	27604		2.9433	4	e
			5	9	27604				
			9	9	27604				
			10	6	27604				
32549	HR 1638	B9 Si	5	14	31373		4.64	3	f
32966	BD−14°1045	B9 Si	8	32	32996	31810	3.095	5	
33331	CoD−44°1873	A0	8	31	35288		1.144	5	
34631	CoD−46°1760	B9 Si	8	31	35288		2.200	5	
36916	BD−4°1173	B9 SiMn	3	36	37077	37410	1.5652	4	
			5	7	37077	37410			
			9	6	37077				
			10	8	37077				
37808	HR 1957	B9 Si	3	33	37507	37635	1.0960 ($\Delta f = 0.00257$)	4	
			5	8	37507	37635			
41089	CoD−42°2282	B9 SrEuCr	8	33	42303	41742	1.37857 ($\Delta f = 0.00094$)	4	g
45530	BD+5°1249	B9 Si	10	18	45431	46300	1.585	2	h
54118	HR 2683	A0 Si	8	33	52622	57969	3.2754 ($\Delta f = 0.00091$)	4	i
56350	CpD−53°1289	A0 EuCrSr	8	32	52622	53762	1.904	5	
58292	CpD−55°1224	A0 Si	10	19	56216	57969	2.95/1.484	2	
58448	CpD−61°814	B8 Si	10	19	56239	53349	0.831	2	
61966	HR 2971	B9 Si	8	26	62400	61435	27.0/1.035/0.962	4	
64972	CoD−27°4729	B8 Si	10	18	64756		0.727	2	
66255	HR 3151	A0 Si	1	41	66210	66192	6.816 ($\Delta f = 0.00149$)	4	
			5	8	66210	66192			
66605	CoD−44°3980	A0 Si	1	33	65211		2.2304 ($\Delta f = 0.00148$)	4	j
			5	8	65211				
66624	HR 3162	B9 Si	8	27	65925	66358	2.0082 ($\Delta f = 0.00256$)	4	k
			10	7	65925	66358			
66698	CoD−29°5439	A0 Eu	10	19	64756	68758	4.12	2	
73340	HR 3413	B9 Si	1	33	73127	71043	2.66745 ($\Delta f = 0.00148$)	4	
			5	8	73127	71043			
83368	HR 3831	A7 SrCrEu	1	32	82578	84552	2.8519	7	l,m,n
			5	8	82578	84552			
83625	CpD−53°2664	A0 SiSr	1	30	82856	84228	1.08184 ($\Delta f = 0.00148$)	4	
			5	8	82856	84228			
90044	HR 4082	B9 SiCrSr	7	28	90882		4.39	4	
90763	HR 4109	A1 Sr	7	24	90430	90882	3.57/1.786/0.637	4	
96616	HR 4327	A3 Sr	1	13	98176	95370	2.4394 ($\Delta f = 0.000883$)	4	o
			7	30	98176	95370			
103192	HR 4552	B9 Si	7	30	101431		2.344	8	p
112381	CpD−53°5397	A0 SiCr	7	29	113902	111588	2.84	8	
114365	HR 4965	A0 Si	7	29	113902	114772	1.272	8	
119419	HR 5158	A0 SiCrEu	7	29	117150	119038	2.605	8	
122532	HR 5269	A0 Si	7	29	123445	124176	1.837	8	k
125630	CpD−66°2519	A2 SiCrSr	7	33	126226	125990	2.205	8	
143658	CpD−53°7015	B9 Si	6	19	143101	145361	5.2	9	
144231	CpD−62°5193	B9 Si	6	22	144481	143238	4.41	9	
148898	HR 6153	A7 Sr	6	29	147084	150453	1.79/4.67/2.33	4	
150549	HR 6204	A0 Si	6	21	150026	145689	3.76	9	
159376	HR 6545	B9 Si	6	18	160915	156897	9.75	9	
164258	HR 6709	A3 SrCrEu	6	15	161868	164259	0.719/0.359	4	f
166469	HR 6802	A0 SiCrSr	2	18	167666	168646	2.8855 ($\Delta f = 0.00269$)	4	
			4	13	167666	168646			
166596	HR 6804	B3 Si	6	17	166114		1.67/0.83	9	
170397	HR 6932	A0 SiCrEu	2	14	170902	171130	2.1912 ($\Delta f = 0.00265$)	4	
			4	11	170902	171130			
			9	9	171130				
177517	HR 7230	B9 HgSi	2	12	177817		0.33772 ($\Delta f = 0.00269$)	4	k,q
			4	4	177817		/0.48773 ($\Delta f = 0.00270$)		
183806	HR 7416	A0 CrEuSr	2	20	181623	183007	2.9213 ($\Delta f = 0.00267$)	4	
			4	13	181623	183007			
189832	CoD−39°13583	A6 SrCrEu	2	17	189388	191889	18.89 ($\Delta f = 0.00066$)	4	r
			4	8	189388	191889			
			9	14	189388	191889			
199728	HR 8033	B9 Si	2	14	200761	201184	2.24085 ($\Delta f = 0.00269$)	4	
			4	16	200761	201184			
208217	CpD−62°6281	A0 SrEuCr	9	15	207964		8.35	2	
212385	CoD−39°14697	A3 Sr	2	14	214085	214150	2.5265 ($\Delta f = 0.00027$)	4	
			4	15	214085	214150			
216494	HR 8704	B9 HgMn	9	17	217376		0.724/1.27/3.40/1.70	4	
221006	HR 8919	A0 Si	2	12	224392	218631	2.3148 ($\Delta f = 0.00264$)	4	
			4	11	224392	218631			
			9	11	219571	224686			

TABLE III. — *Parameters of the least-squares fits of the lightcurves.*

HD	P	t_0		A_0	A_1	A_2	ϕ_1	ϕ_2	σ
5737	19.4	4861.820	*u*	−2.90727	0.00284	0.00492	6.162	3.478	0.00216
			v	−2.30182	0.00153	0.00157	0.133	3.176	0.00138
			b	−2.02330	0.00238	0.00062	0.544	3.038	0.00080
			y	−1.82344	0.00219	0.00071	0.559	4.339	0.00062
10840	2.100	4861.883	*u*	−0.53731	0.06589	0.01829	4.669	0.361	0.00405
			v	−0.18985	0.01092	0.00332	4.940	0.864	0.00213
			b	0.07442	0.01102	0.00846	4.645	0.674	0.00155
			y	0.31809	0.01771	0.01074	4.571	0.336	0.00136
12767	1.89	3455.580	*u*	−2.13572	0.00565	0.00632	3.675	3.177	0.00561
			v	−1.42067	0.01494	0.00269	4.208	3.024	0.00330
			b	−1.25909	0.01319	0.00301	4.299	2.907	0.00235
			y	−1.14326	0.00827	0.00283	4.081	2.868	0.00213
22470	1.9387	3455.605	*u*	−0.81535	0.05343	0.01787	3.428	0.336	0.00501
			v	−0.33619	0.02445	0.00993	3.370	0.230	0.00300
			b	−0.24609	0.02608	0.01045	3.417	0.269	0.00287
			y	−0.18641	0.02461	0.00890	3.373	0.280	0.00303
24155	2.53465	3842.583	*u*	−1.00863	0.05767	0.01257	5.249	4.299	0.00679
			v	−0.50818	0.03995	0.00640	5.173	4.443	0.00449
			b	−0.47810	0.03414	0.00577	5.135	5.095	0.00395
			y	−0.47011	0.02854	0.00277	5.099	4.678	0.00365
27463	2.833	4578.554	*u*	−0.69173	0.00937	0.00296	1.314	4.523	0.00396
			v	−0.61004	0.00746	0.00326	4.154	3.332	0.00267
			b	−0.62246	0.01128	0.00251	1.205	4.983	0.00168
			y	−0.58553	0.00776	0.00104	1.172	4.990	0.00124
28843	1.37382	2778.614	*u*	6.24282	0.07433	0.01004	2.267	1.417	0.00855
			v	5.76337	0.06540	0.00175	2.733	3.573	0.00694
			b	5.72525	0.05940	0.00116	2.686	2.594	0.00712
			y	5.77490	0.04543	0.00232	2.544	1.576	0.00593
29009	3.79864	3455.642	*u*	6.36704	0.01472	0.00547	6.199	3.163	0.00578
			v	5.73034	0.01272	0.00274	0.187	2.774	0.00664
			b	5.67111	0.01186	0.00284	0.151	2.794	0.00656
			y	5.72504	0.00863	0.00310	6.243	3.178	0.00489
29305	2.9433	3455.659	*u*	−3.86648	0.04318	0.01514	4.696	5.942	0.00764
			v	−3.56506	0.01201	0.00415	4.790	6.044	0.00468
			b	−3.16662	0.01672	0.00353	4.739	5.625	0.00701
			y	−2.81504	0.01796	0.00395	4.746	5.976	0.00335
32549	4.59	3842.617	*u*	−0.55633	0.03797	0.00674	4.516	1.884	0.01039
			v	−1.08860	0.01371	0.00309	3.979	6.035	0.00561
			b	−1.12413	0.01939	0.00639	4.111	3.933	0.00545
			y	−1.12377	0.01681	0.00343	4.601	4.739	0.00754
32966	3.095	4578.581	*u*	−0.01792	0.08017	0.01276	4.848	1.563	0.00369
			v	0.61109	0.07282	0.00593	4.606	1.456	0.00224
			b	0.72371	0.06400	0.00595	4.658	1.505	0.00180
			y	0.77390	0.04873	0.00682	4.775	1.590	0.00144
33331	1.144	4578.605	*u*	−1.65498	0.03318	0.00456	3.426	2.341	0.00773
			v	−1.12509	0.01873	0.00287	3.437	2.313	0.00475
			b	−0.95062	0.01789	0.00244	3.451	2.217	0.00417
			y	−0.85740	0.01659	0.00252	3.426	2.213	0.00335
34631	2.200	4578.605	*u*	−1.58471	0.01028	0.02879	1.265	0.633	0.00476
			v	−1.01221	0.01027	0.00950	1.841	0.401	0.00302
			b	−0.86021	0.02327	0.01401	1.898	0.579	0.00205
			y	−0.75764	0.02789	0.01766	1.890	0.589	0.00176
36916	1.5652	3455.744	*u*	−0.48337	0.03726	0.00972	6.124	3.594	0.00568
			v	0.26989	0.02820	0.00683	5.564	4.176	0.00364
			b	0.51142	0.02859	0.00653	5.674	4.115	0.00327
			y	0.68427	0.02181	0.00397	5.832	4.167	0.00260
37808	1.0960	3455.770	*u*	0.25726	0.02121	0.00168	1.613	5.779	0.00244
			v	0.65723	0.01517	0.00099	1.714	0.180	0.00293
			b	0.75448	0.01456	0.00048	1.760	5.182	0.00241
			y	0.83316	0.00904	0.00162	1.683	4.714	0.00271
41089	1.37857	4578.627	*u*	−0.30916	0.02301	0.00306	6.055	0.583	0.00438
			v	0.35936	0.01699	0.00195	5.933	5.911	0.00483
			b	0.64165	0.01765	0.00221	5.943	0.031	0.00269
			y	0.88063	0.01499	0.00165	5.898	0.541	0.00218
45530	1.585	4972.609	*u*	1.10278	0.01746	0.03009	2.988	1.933	0.00764
			v	1.52363	0.00320	0.00382	5.011	1.888	0.00355
			b	1.59161	0.00267	0.01463	3.165	1.838	0.00230
			y	1.77321	0.00680	0.01664	2.747	1.904	0.00303
54118	3.27536	4578.643	*u*	−1.98861	0.01238	0.00422	4.525	6.279	0.00473
			v	−1.72739	0.01728	0.00206	2.948	0.481	0.00381
			b	−1.54614	0.01491	0.00940	3.527	0.173	0.00262
			y	−1.34344	0.00794	0.00655	4.435	0.128	0.00217
56350	1.904	4578.660	*u*	0.07835	0.00700	0.02115	2.462	1.203	0.00517
			v	−0.06803	0.00853	0.01295	4.032	1.065	0.00346
			b	0.05805	0.00861	0.01390	3.471	1.027	0.00240
			y	0.22790	0.00470	0.00752	3.252	1.032	0.00183
58292	2.95	4972.659	*u*	0.97431	0.03899	0.01202	2.795	0.618	0.00393
			v	1.22510	0.00243	0.00204	4.824	1.410	0.00264
			b	1.28438	0.00684	0.00404	2.539	2.145	0.00219
			y	1.34397	0.00805	0.00499	2.463	2.289	0.00298
58448	0.831	4972.683	*u*	0.39631	0.01605	0.01539	4.059	0.101	0.00251
			v	0.61080	0.01028	0.00450	3.911	0.416	0.00196
			b	0.75249	0.00822	0.00497	3.876	0.369	0.00177
			y	0.90646	0.00449	0.00340	4.229	0.030	0.00198
61966	27.0	4578.679	*u*	−1.68137	0.01084	0.00164	2.607	3.013	0.00566
			v	−1.10127	0.00325	0.00112	1.143	4.066	0.00345
			b	−0.87560	0.00279	0.00019	1.403	0.417	0.00251
			y	−0.69601	0.00243	0.00067	1.886	1.353	0.00203
61966	1.035	4578.679	*u*	−1.68099	0.00886	0.00367	3.359	3.663	0.00645
			v	−1.10056	0.00381	0.00018	4.984	3.311	0.00337
			b	−0.87504	0.00305	0.00115	4.732	4.282	0.00245
			y	−0.69567	0.00235	0.00124	4.103	4.200	0.00207
64972	0.725	4972.743	*u*	−0.59052	0.00215	0.00977	2.288	5.478	0.00402
			v	0.35345	0.00117	0.00449	1.062	5.211	0.00317
			b	0.50612	0.00077	0.00174	1.934	4.255	0.00299
			y	0.58955	0.00093	0.00082	1.200	2.918	0.00286
66255	6.816	3170.724	*u*	−1.29004	0.03738	0.00394	4.859	5.798	0.00366
			v	−0.65040	0.01940	0.00414	4.995	1.001	0.00250
			b	−0.57034	0.01972	0.00354	4.952	1.021	0.00201
			y	−0.56101	0.01888	0.00256	4.919	0.994	0.00309
66605	2.2304	3170.739	*u*	0.80035	0.03573	0.00857	0.222	3.674	0.00335
			v	0.60302	0.00718	0.00595	1.788	4.078	0.00336
			b	0.52875	0.01605	0.00522	0.910	3.999	0.00313
			y	0.51059	0.02577	0.00558	0.578	4.093	0.00318
66624	2.00823	4578.736	*u*	−1.17372	0.02306	0.00418	5.758	3.809	0.00329
			v	−0.57031	0.01569	0.00178	5.755	4.352	0.00230
			b	−0.29307	0.01508	0.00124	5.744	5.656	0.00192
			y	−0.04321	0.01033	0.00072	5.778	0.272	0.00162
66698	4.12	4972.778	*u*	0.80341	0.01364	0.02995	0.411	4.708	0.00384
			v	1.07297	0.00191	0.00769	4.548	4.732	0.00300
			b	1.12723	0.00591	0.01065	6.254	4.609	0.00214
			y	1.18889	0.00669	0.00795	6.208	4.758	0.00294
73340	2.66745	3170.760	*u*	−0.74642	0.01701	0.00932	4.425	4.154	0.00365
			v	−0.50784	0.01658	0.00493	4.116	4.466	0.00267
			b	−0.46815	0.01726	0.00472	4.069	4.460	0.00264
			y	−0.44129	0.01005	0.00336	4.210	4.177	0.00227
83368	2.8519	3170.810	*u*	0.13026	0.00363	0.02060	5.070	2.080	0.00289
			v	−0.17098	0.00325	0.02401	0.932	2.176	0.00255
			b	−0.34918	0.00225	0.00161	1.424	0.689	0.00310
			y	−0.44253	0.00128	0.00878	1.721	5.365	0.00292

TABLE III (continued).

HD	P	t_0		A_0	A_1	A_2	ϕ_1	ϕ_2	σ
83625	1.08184	3170.833	u	0.11226	0.02003	0.00343	5.898	5.847	0.00303
			v	0.23342	0.01382	0.00636	5.469	5.292	0.00264
			b	0.25162	0.01763	0.00693	5.453	5.438	0.00275
			y	0.32388	0.01320	0.00470	5.589	5.508	0.00224
90044	4.39	4310.523	u	0.60781	0.02313	0.01090	0.861	0.105	0.00523
			v	0.74473	0.00834	0.00830	5.336	0.259	0.00407
			b	0.72071	0.01311	0.01050	5.124	0.421	0.00396
			y	0.78143	0.00871	0.00530	4.975	0.563	0.00430
90763	3.57	4310.538	u	0.02351	0.00264	0.00664	2.819	0.343	0.00465
			v	0.00802	0.00079	0.00544	2.608	0.352	0.00309
			b	−0.03653	0.00072	0.00348	0.993	0.505	0.00246
			y	−0.04436	0.00044	0.00228	0.187	0.703	0.00204
96616	2.4394	3178.928	u	−0.36110	0.03035	0.01738	0.377	3.795	0.00375
			v	−0.30089	0.00910	0.00468	0.373	3.765	0.00182
			b	−0.29427	0.01586	0.00641	0.347	3.837	0.00180
			y	−0.26316	0.01338	0.00549	0.335	3.927	0.00161
103192	2.344	4310.567	u	−0.65520	0.02667	0.00868	5.995	2.295	0.00484
			v	−0.43715	0.01835	0.00531	5.895	2.479	0.00373
			b	−0.43982	0.01897	0.00533	5.941	2.582	0.00357
			y	−0.41264	0.01421	0.00424	6.012	2.550	0.00327
112381	2.84	4310.597	u	0.55095	0.00247	0.00177	2.662	1.573	0.00380
			v	0.68656	0.00436	0.00057	5.173	0.179	0.00224
			b	0.70355	0.00433	0.00116	5.203	5.576	0.00224
			y	0.81771	0.00143	0.00141	4.693	5.575	0.00248
114365	1.272	4310.614	u	−0.10098	0.00672	0.03475	5.366	1.735	0.00466
			v	0.19308	0.02493	0.00405	2.296	2.250	0.00268
			b	0.20621	0.00567	0.00934	2.207	1.830	0.00175
			y	0.24860	0.00942	0.01138	5.496	1.714	0.00186
119419	2.605	4310.630	u	0.13280	0.02620	0.00596	4.935	0.528	0.00420
			v	0.59780	0.01666	0.00292	4.810	0.952	0.00336
			b	0.76298	0.02003	0.00380	4.854	0.699	0.00269
			y	0.98549	0.01136	0.00242	4.765	1.106	0.00245
122532	1.837	4310.648	u	−0.74032	0.02644	0.00374	4.117	6.193	0.00358
			v	−0.45432	0.02142	0.00286	4.141	5.808	0.00286
			b	−0.43060	0.02266	0.00312	4.138	5.667	0.00323
			y	−0.37291	0.02107	0.00171	4.136	5.846	0.00329
125630	2.205	4310.665	u	−0.14455	0.01739	0.02003	6.161	2.467	0.00497
			v	0.33268	0.05860	0.03197	5.765	4.740	0.00389
			b	0.26603	0.00732	0.02402	2.177	2.192	0.00351
			y	0.32563	0.04412	0.04593	2.534	1.936	0.00363
143658	5.18	4025.574	u	−0.43953	0.01245	0.00718	5.070	3.039	0.00574
			v	0.13264	0.00591	0.00275	6.005	3.325	0.00379
			b	0.37152	0.00587	0.00160	5.941	3.212	0.00149
			y	0.53059	0.00548	0.00069	5.339	3.335	0.00147
144231	4.39	4025.594	u	−0.12995	0.02904	0.00257	4.753	0.204	0.00635
			v	0.29973	0.01529	0.00153	4.784	5.780	0.00360
			b	0.44178	0.01452	0.00105	4.810	5.736	0.00192
			y	0.51899	0.01319	0.00161	4.854	6.091	0.00136
148898	1.79	4025.657	u	−1.51112	0.00866	0.00382	3.166	4.850	0.00465
			v	−1.24870	0.00647	0.00314	3.073	5.224	0.00258
			b	−0.98952	0.00300	0.00112	2.753	4.245	0.00248
			y	−0.60330	0.00168	0.00087	2.958	0.761	0.00275
148898	4.65	4025.657	u	−1.50981	0.00450	0.00499	1.285	3.837	0.00523
			v	−1.24835	0.00163	0.00446	1.569	3.815	0.00341
			b	−0.98883	0.00254	0.00300	1.812	3.775	0.00193
			y	−0.60325	0.00084	0.00235	1.309	3.765	0.00236
150549	3.76	4025.679	u	−1.66527	0.01018	0.02001	4.025	0.032	0.00469
			v	−1.10126	0.00956	0.01595	3.392	6.071	0.00281
			b	−0.94900	0.01146	0.01299	3.725	6.039	0.00158
			y	−0.87405	0.01079	0.00760	3.969	6.012	0.00252
159376	9.75	4025.716	u	0.75899	0.01799	0.00927	3.372	0.287	0.00221
			v	0.81342	0.01233	0.00560	3.336	0.326	0.00183
			b	0.94446	0.01333	0.00450	3.265	0.207	0.00132
			y	1.04968	0.01041	0.00414	3.262	0.193	0.00204
164258	0.719	4025.639	u	2.36047	0.00170	0.00485	0.390	3.693	0.00248
			v	2.10991	0.00156	0.00344	0.208	3.816	0.00160
			b	2.13745	0.00186	0.00175	0.282	4.322	0.00259
			y	2.18635	0.00029	0.00137	1.136	4.219	0.00233
166469	2.8855	3342.487	u	−0.86155	0.01926	0.00217	3.139	4.700	0.00606
			v	−0.08297	0.00593	0.00125	3.546	4.161	0.00375
			b	0.20931	0.00775	0.00101	3.185	4.334	0.00268
			y	0.35283	0.00576	0.00033	3.236	5.114	0.00245
166596	1.678	4025.620	u	−1.89527	0.01272	0.01292	3.686	5.927	0.00644
			v	−0.94192	0.00735	0.01280	3.669	6.013	0.00419
			b	−0.61432	0.00546	0.01400	3.595	6.007	0.00336
			y	−0.38944	0.00618	0.01396	3.443	6.095	0.00426
170397	2.1912	3342.537	u	−0.57592	0.01456	0.00294	4.312	0.418	0.00462
			v	−0.27549	0.00240	0.00308	3.758	0.244	0.00333
			b	−0.09149	0.00190	0.00335	2.997	6.213	0.00180
			y	0.00209	0.00186	0.00204	2.706	0.600	0.00252
177517	0.33772	3342.559	u	0.06949	0.00960	0.00879	0.131	3.351	0.00245
			v	−0.04971	0.00694	0.00619	6.021	3.592	0.00273
			b	−0.05565	0.00523	0.00359	5.875	3.623	0.00250
			y	−0.05606	0.00474	0.00314	5.368	4.064	0.00293
183806	2.92133	3342.578	u	−0.35944	0.00315	0.00544	6.206	6.061	0.00614
			v	−0.00657	0.00583	0.00458	0.454	0.273	0.00403
			b	0.40810	0.00424	0.00392	0.430	0.011	0.00218
			y	0.61727	0.00199	0.00279	0.831	6.029	0.00251
189832	18.886	3342.596	u	0.39712	0.01114	0.00419	5.521	6.228	0.00672
			v	0.23537	0.00964	0.00426	5.784	0.044	0.00572
			b	0.27759	0.00112	0.00141	0.698	5.351	0.00232
			y	0.31486	0.00206	0.00147	2.410	4.893	0.00249
199728	2.24085	3342.619	u	0.72626	0.04062	0.03441	2.432	3.971	0.00920
			v	1.36179	0.02028	0.01784	1.788	3.959	0.00570
			b	1.51072	0.01915	0.01624	1.756	4.006	0.00438
			y	1.57397	0.01351	0.01221	1.820	4.010	0.00439
208217	8.35	4862.547	u	1.20084	0.00825	0.00331	0.164	1.625	0.00617
			v	1.09218	0.03182	0.02707	0.388	0.848	0.00452
			b	1.13352	0.00694	0.00830	6.053	0.923	0.00207
			y	1.29655	0.00543	0.00267	3.846	3.722	0.00153
212385	2.5265	3342.639	u	1.02375	0.00779	0.00652	4.239	1.326	0.00658
			v	0.90332	0.00742	0.00285	3.671	1.608	0.00464
			b	0.81115	0.00261	0.00123	1.576	1.035	0.00235
			y	0.78766	0.00462	0.00220	0.862	5.244	0.00299
216494	0.724	4862.587	u	−1.75800	0.00485	0.00922	2.469	2.713	0.00496
			v	−1.67299	0.00143	0.00476	2.742	2.993	0.00320
			b	−1.32403	0.00035	0.00184	5.564	3.079	0.00137
			y	−0.99799	0.00180	0.00181	3.820	4.006	0.00156
216494	1.27	4862.587	u	−1.75952	0.00283	0.00924	5.617	2.908	0.00588
			v	−1.67358	0.00110	0.00418	5.252	3.157	0.00373
			b	−1.32413	0.00037	0.00108	4.713	3.827	0.00173
			y	−0.99772	0.00109	0.00216	3.537	1.129	0.00176
216494	3.40	4862.587	u	−1.75933	0.00118	0.00803	2.387	2.630	0.00642
			v	−1.67369	0.00098	0.00476	0.295	2.614	0.00355
			b	−1.32427	0.00142	0.00155	0.004	2.858	0.00130
			y	−0.99826	0.00099	0.00206	5.613	3.250	0.00172
221006	2.31483	3342.662	u	−1.83103	0.04711	0.02539	2.101	2.766	0.00980
			v	−0.72970	0.02706	0.01754	2.750	2.763	0.00776
			b	−0.34512	0.02460	0.01419	2.822	2.921	0.00363
			y	−0.19201	0.01716	0.00985	2.596	2.795	0.00357

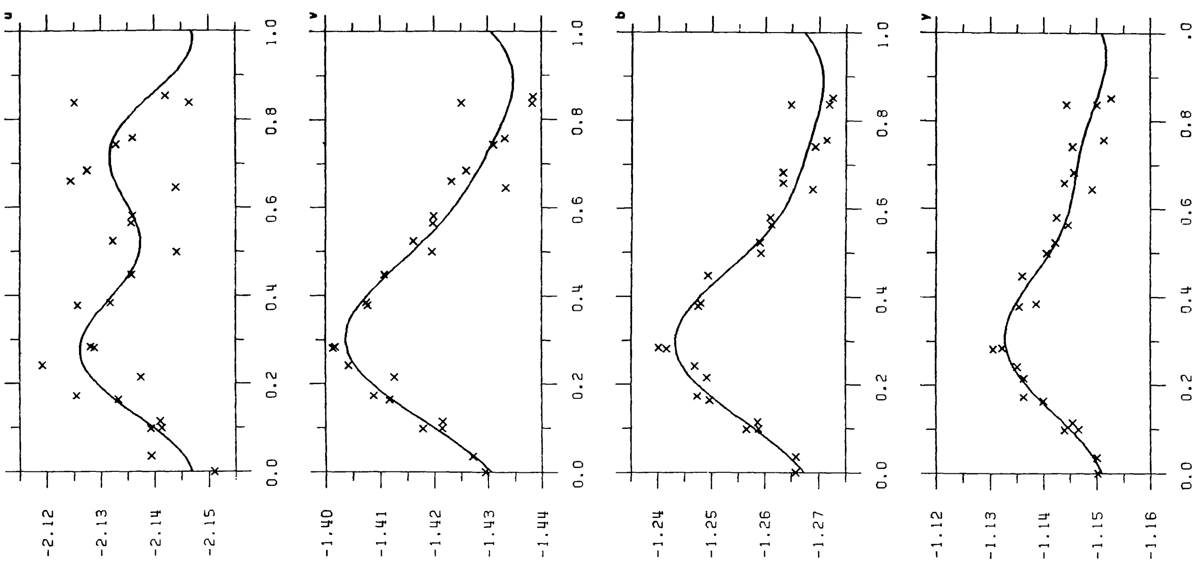

FIGURE 3. — Lightcurves of HD 12767.

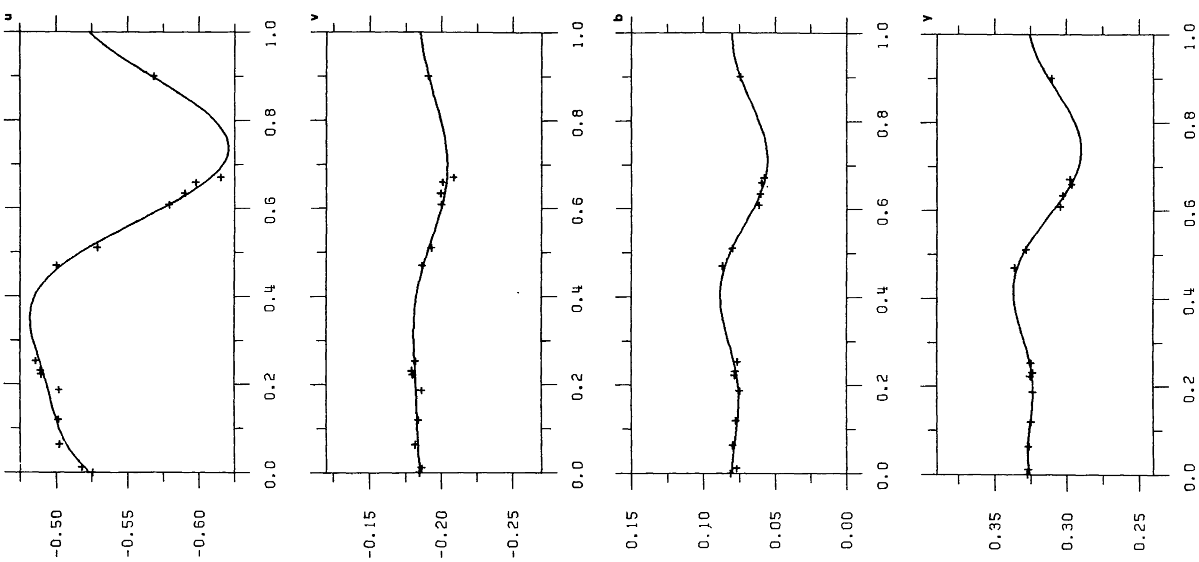

FIGURE 2. — Lightcurves of HD 10840.

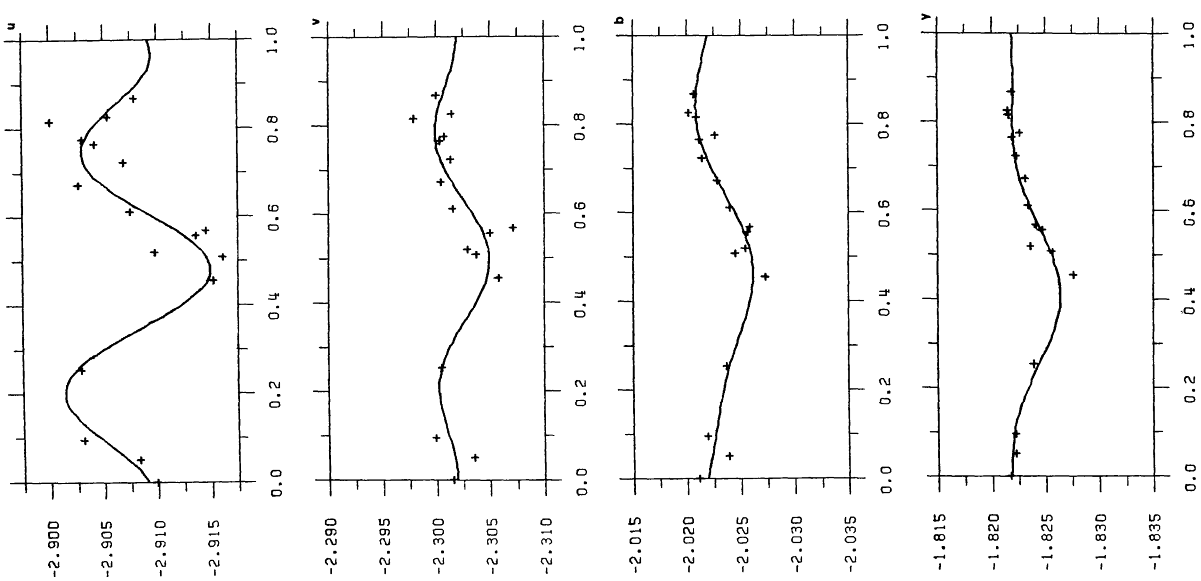

FIGURE 1. — Lightcurves of HD 5737.

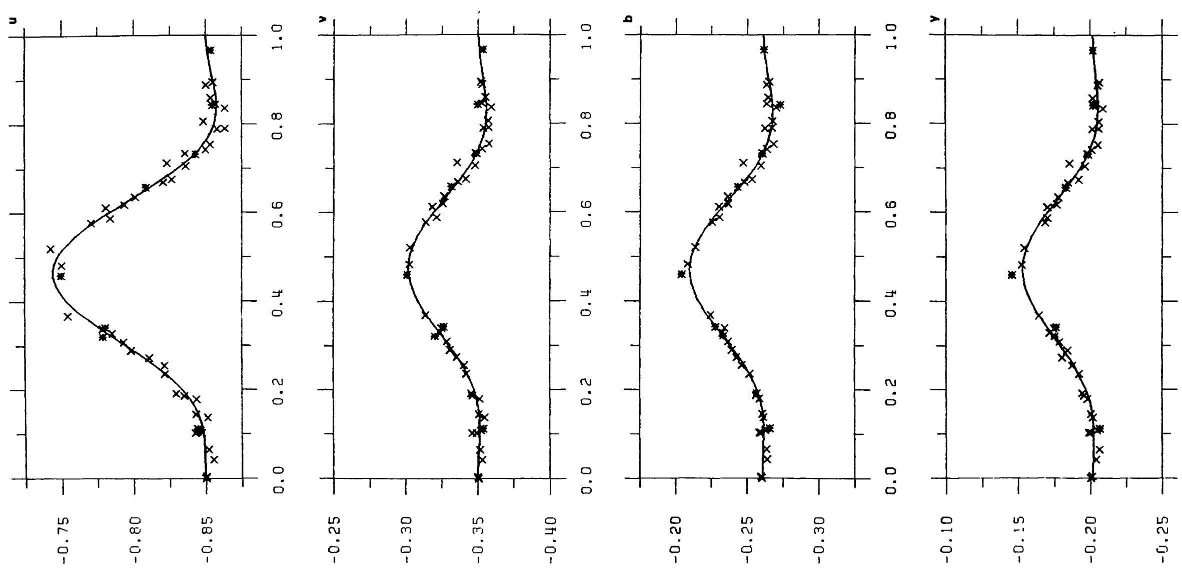

FIGURE 4. — Lightcurves of HD 22470.

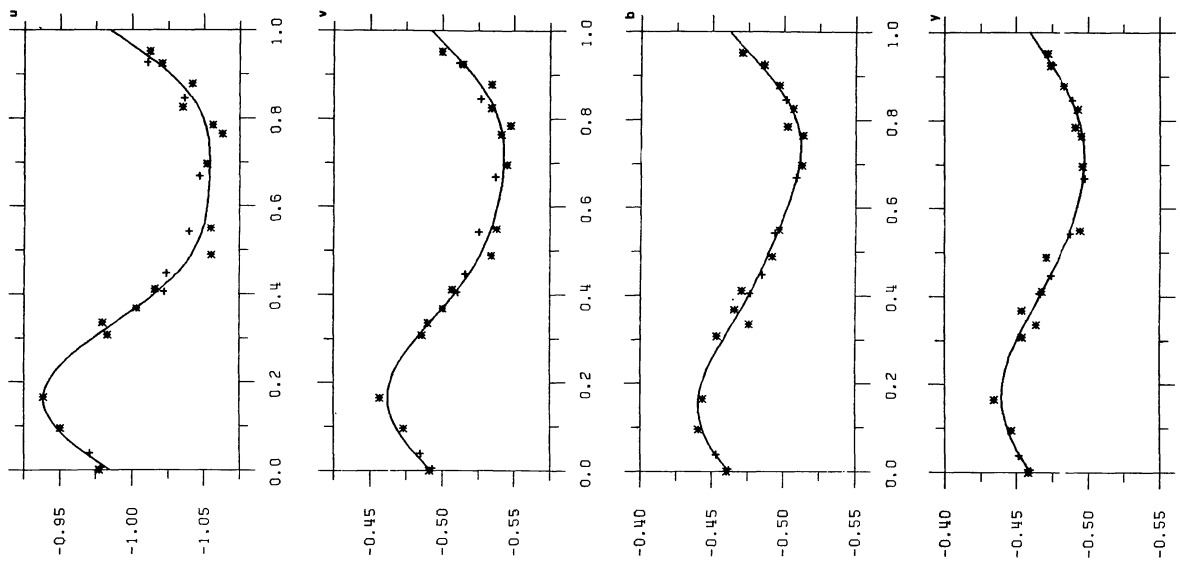

FIGURE 5. — Lightcurves of HD 24155.

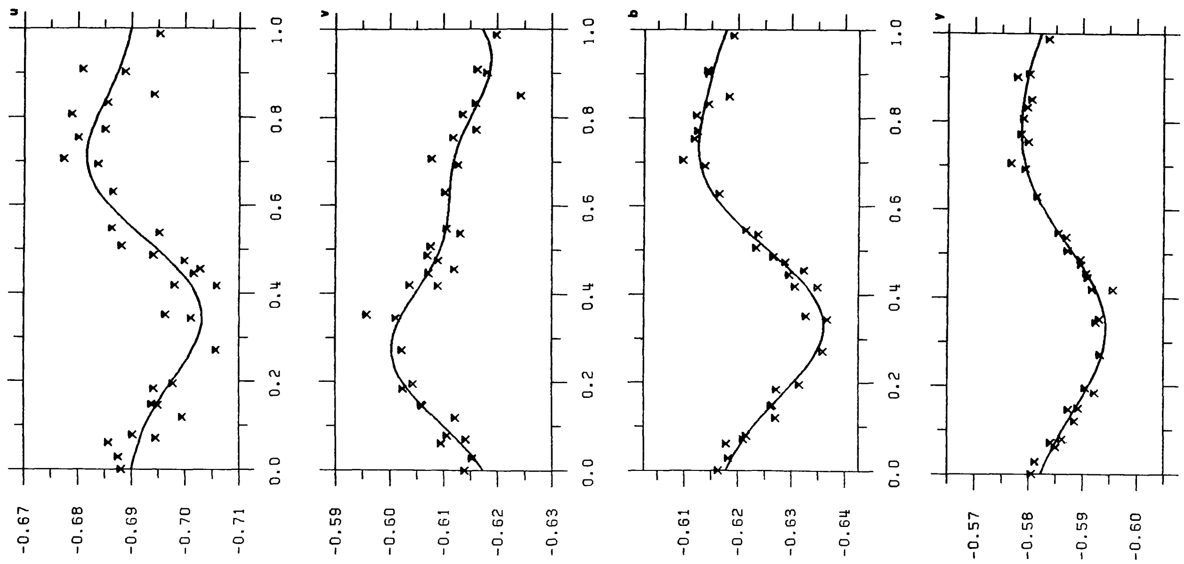

FIGURE 6. — Lightcurves of HD 27463.

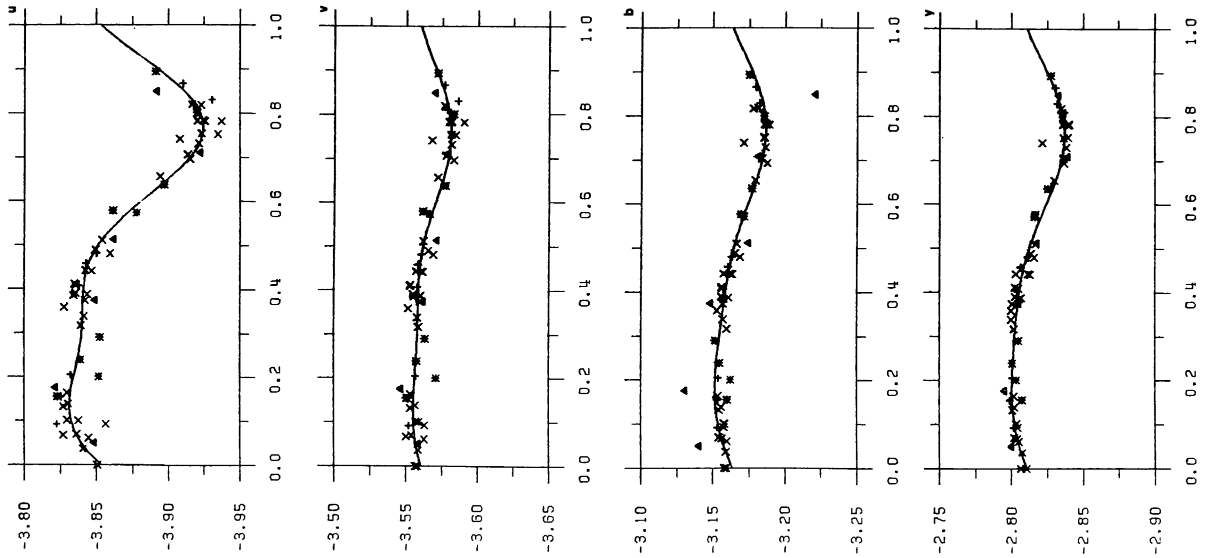

FIGURE 9. — Lightcurves of HD 29305.

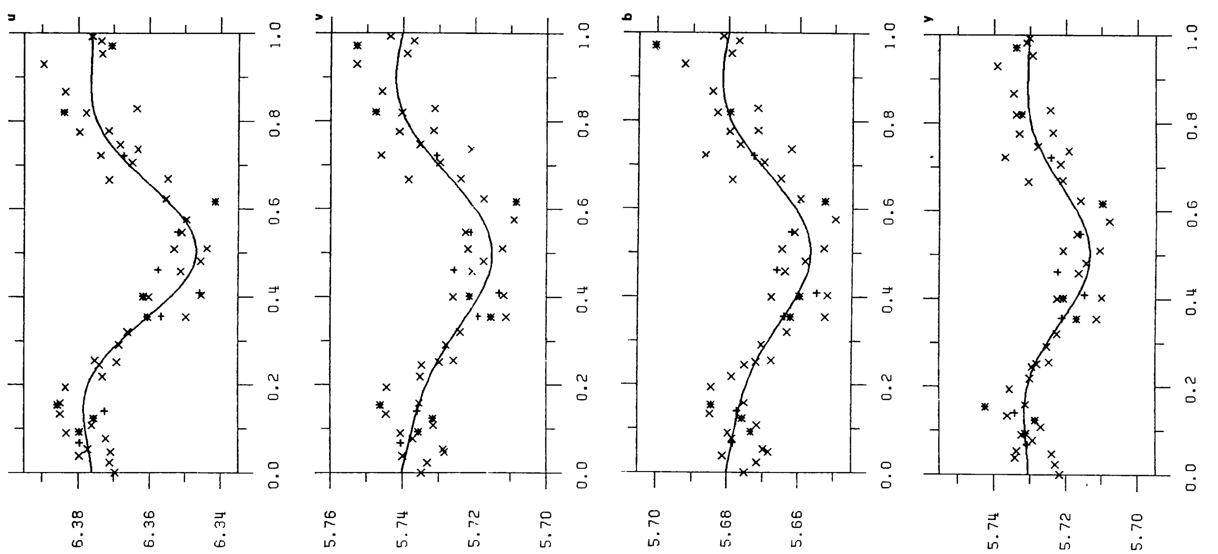

FIGURE 8. — Lightcurves of HD 29009.

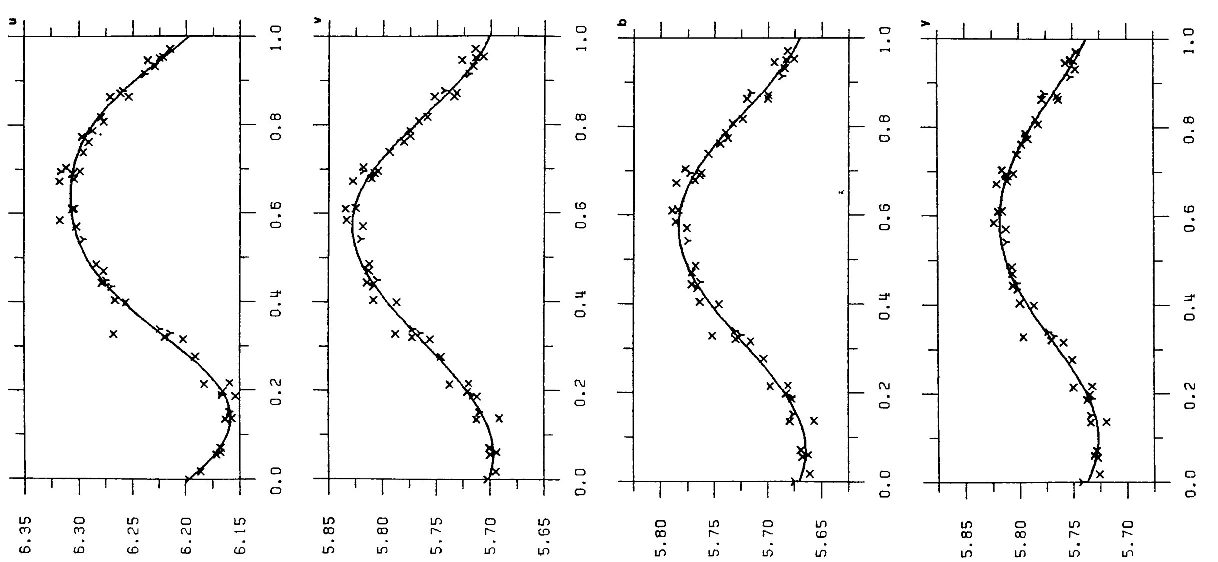

FIGURE 7. — Lightcurves of HD 28843. Points labeled Y are observations of Pedersen and Thomsen (1977).

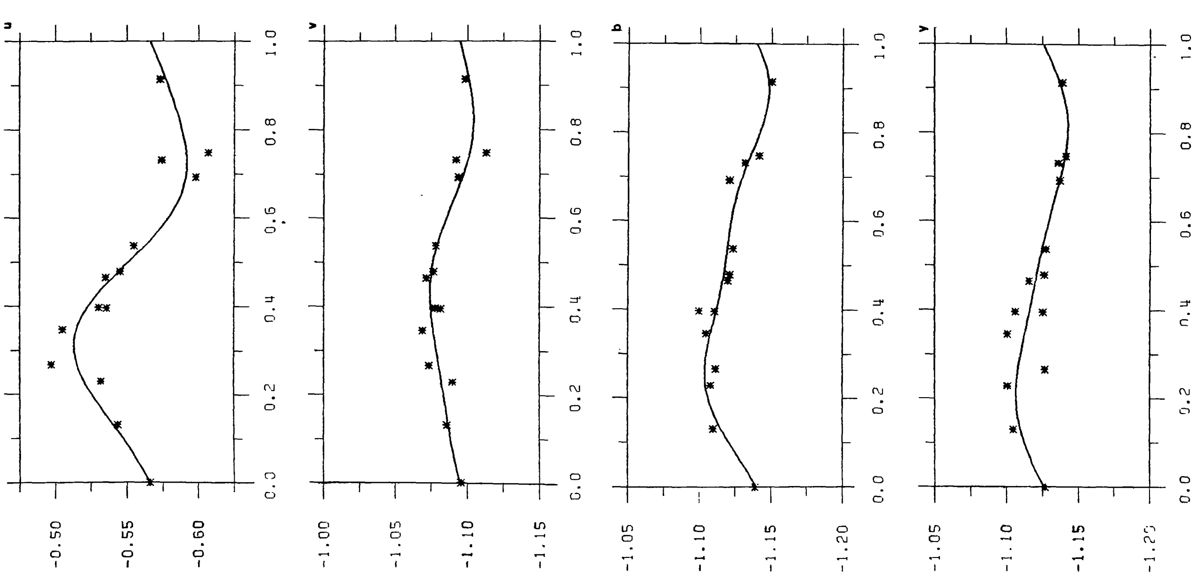

FIGURE 10. — Lightcurves of HD 32549.

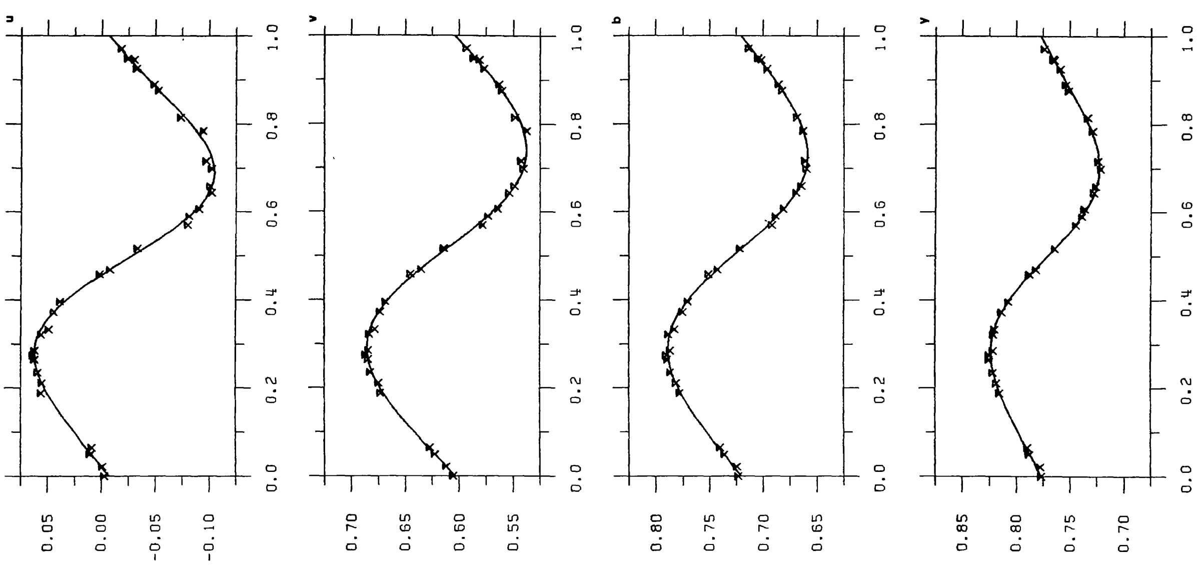

FIGURE 11. — Lightcurves of HD 32966.

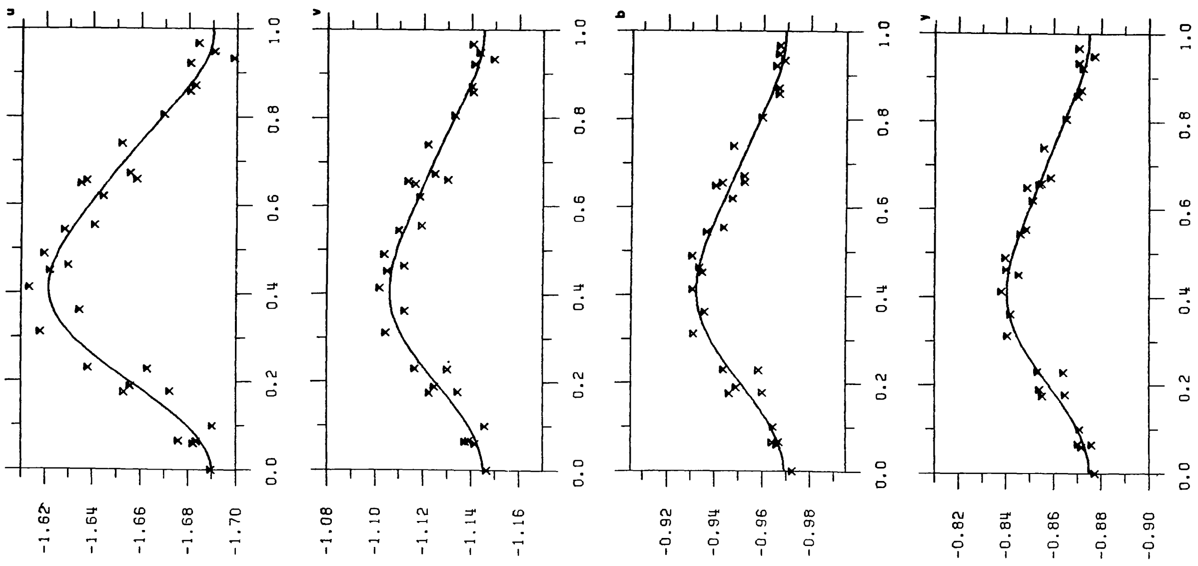

FIGURE 12. — Lightcurves of HD 33331.

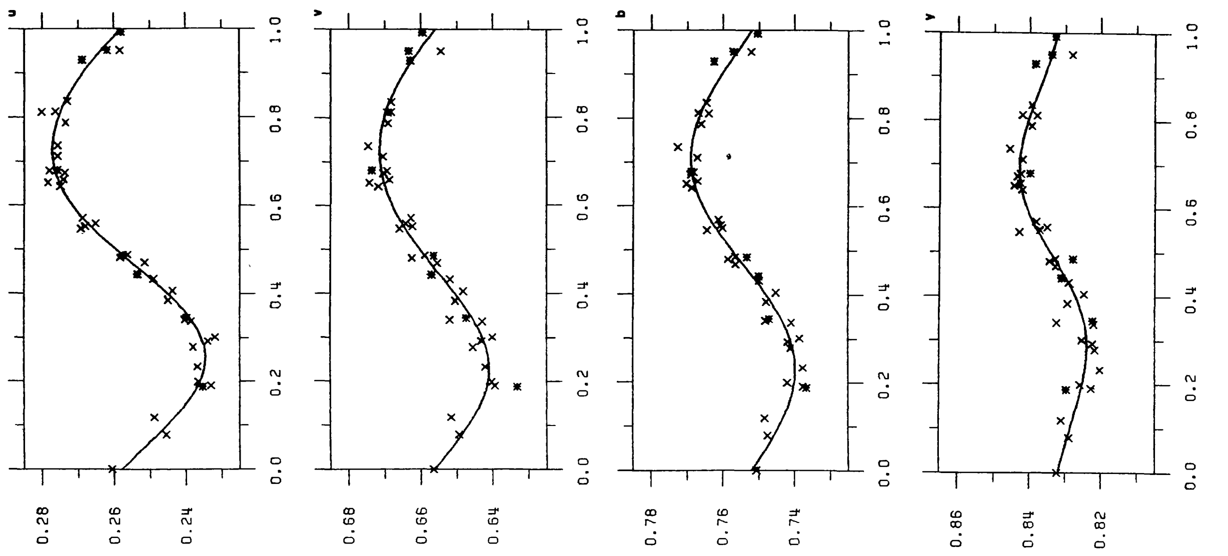

FIGURE 15. — Lightcurves of HD 37808.

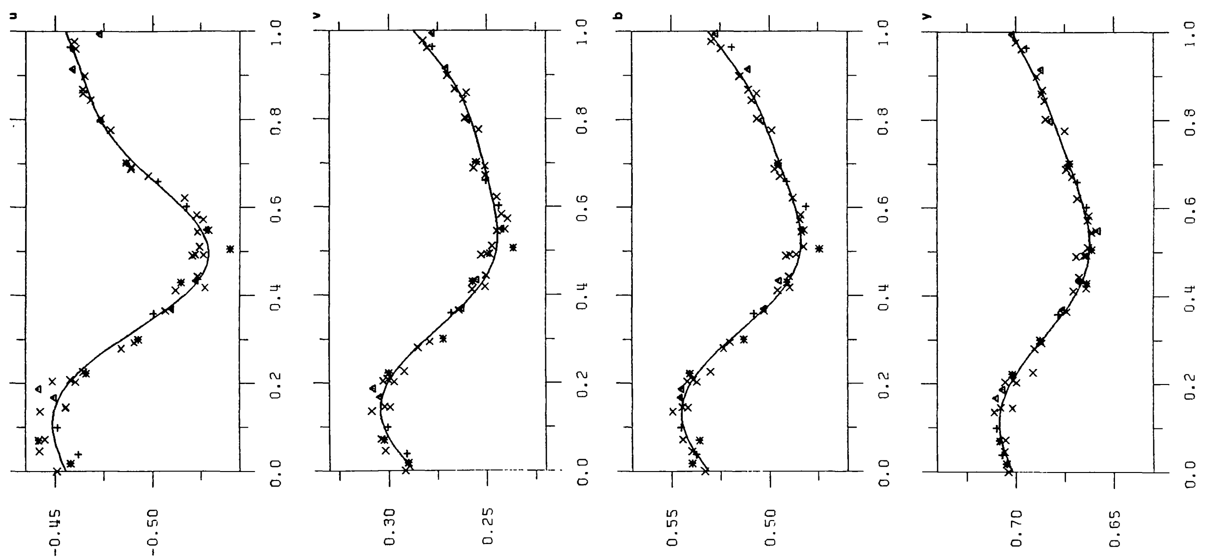

FIGURE 14. — Lightcurves of HD 36916.

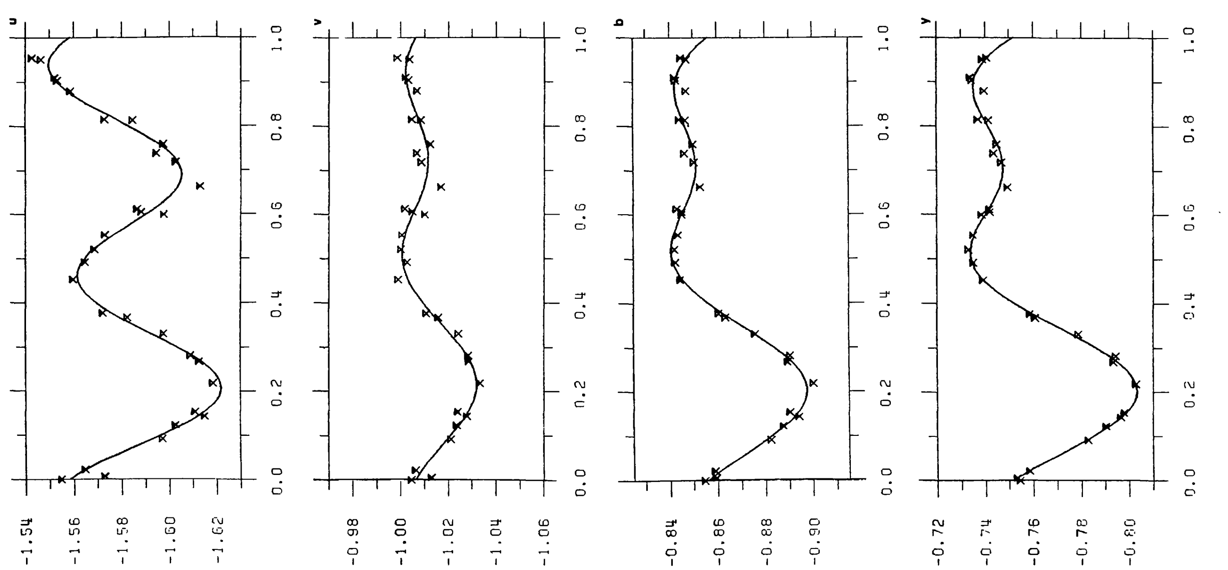

FIGURE 13. — Lightcurves of HD 34631.

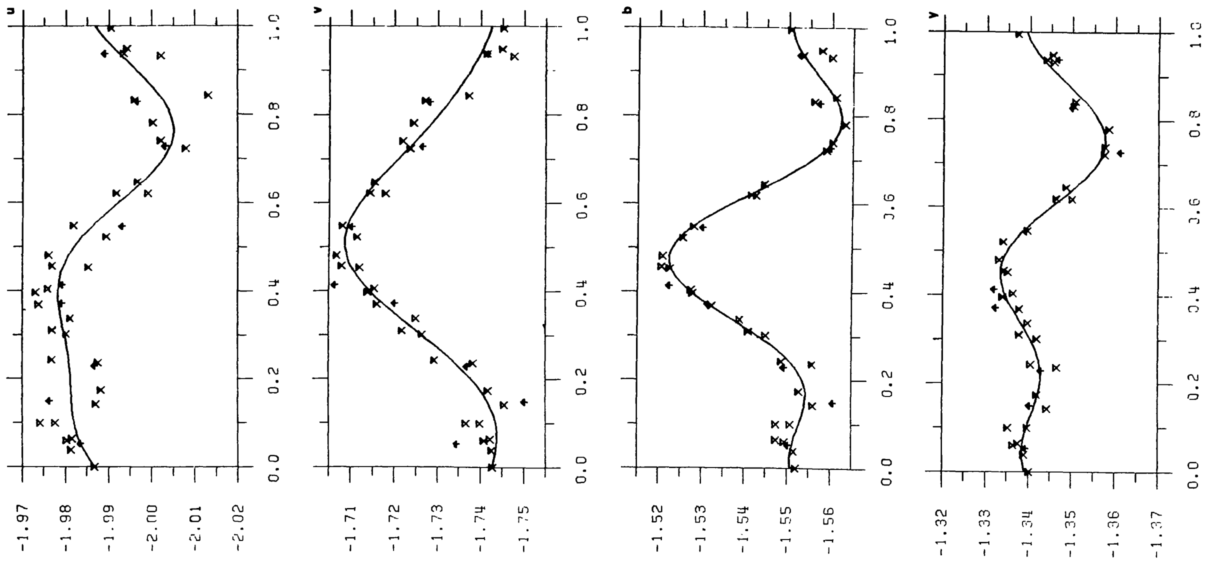

FIGURE 18. — Lightcurves of HD 54118. Arrows label observations of the ESO Long Term Photometric Programme.

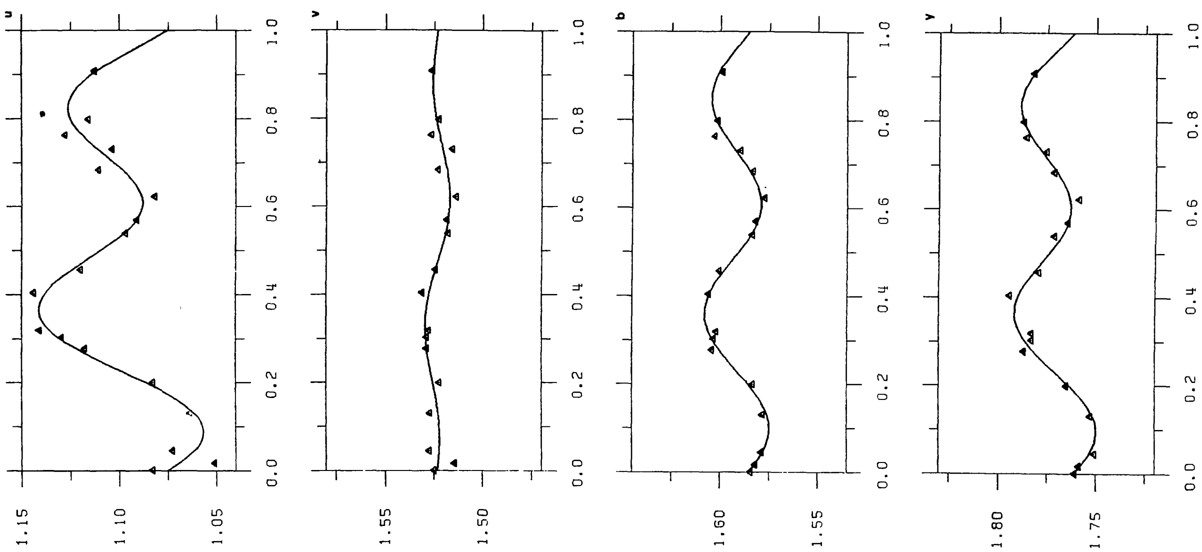

FIGURE 17. — Lightcurves of HD 45530.

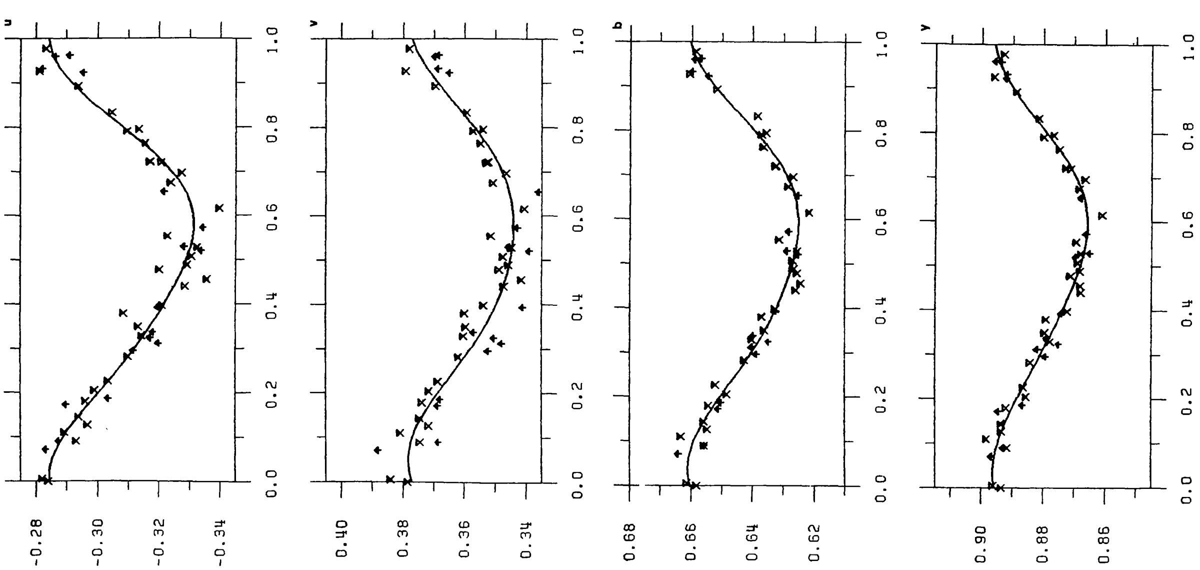

FIGURE 16. — Lightcurves of HD 41089. Arrows label observations of the ESO Long Term Photometric Programme.

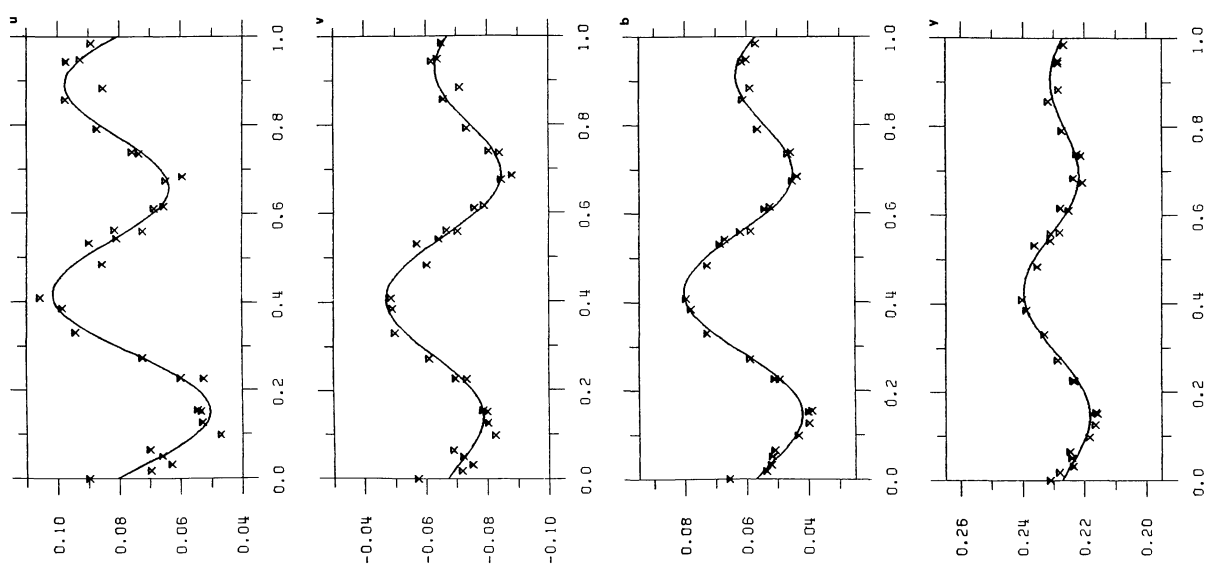

FIGURE 19. — Lightcurves of HD 56350.

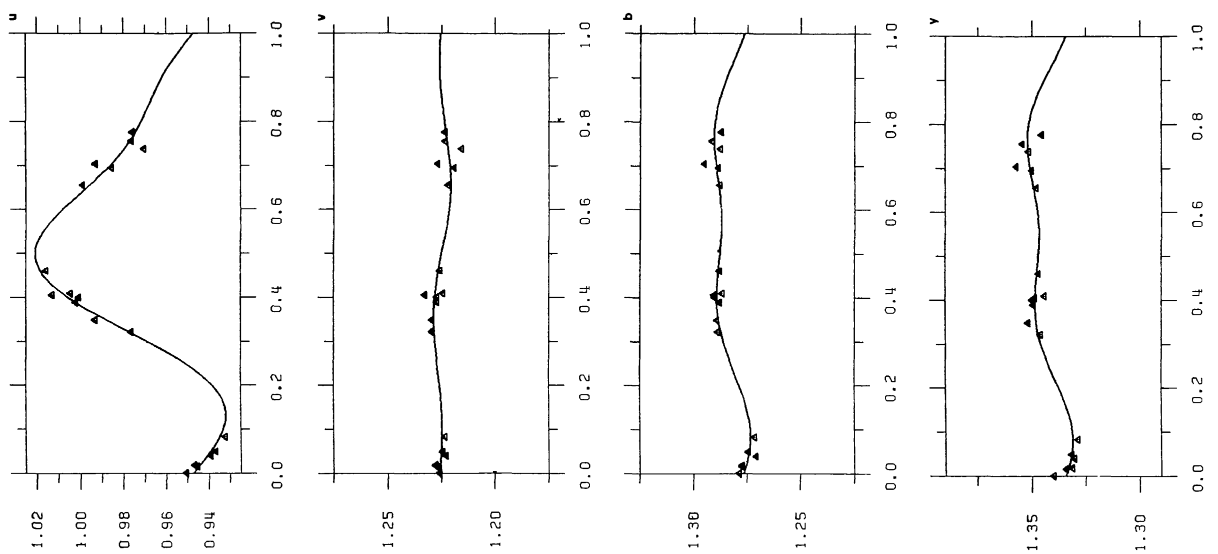

FIGURE 20. — Lightcurves of HD 58292.

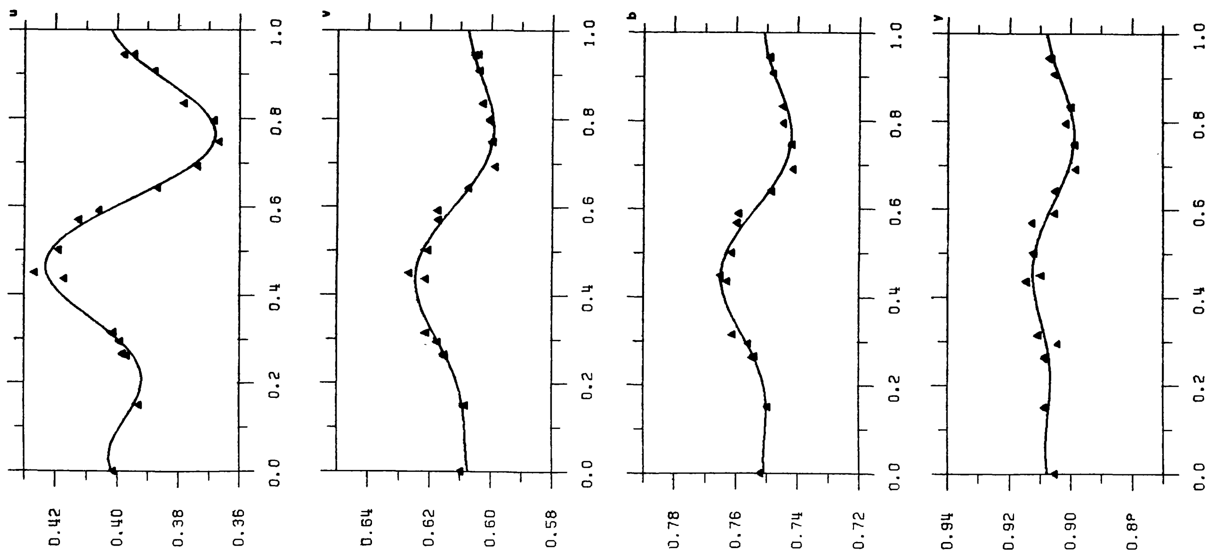

FIGURE 21. — Lightcurves of HD 58448.

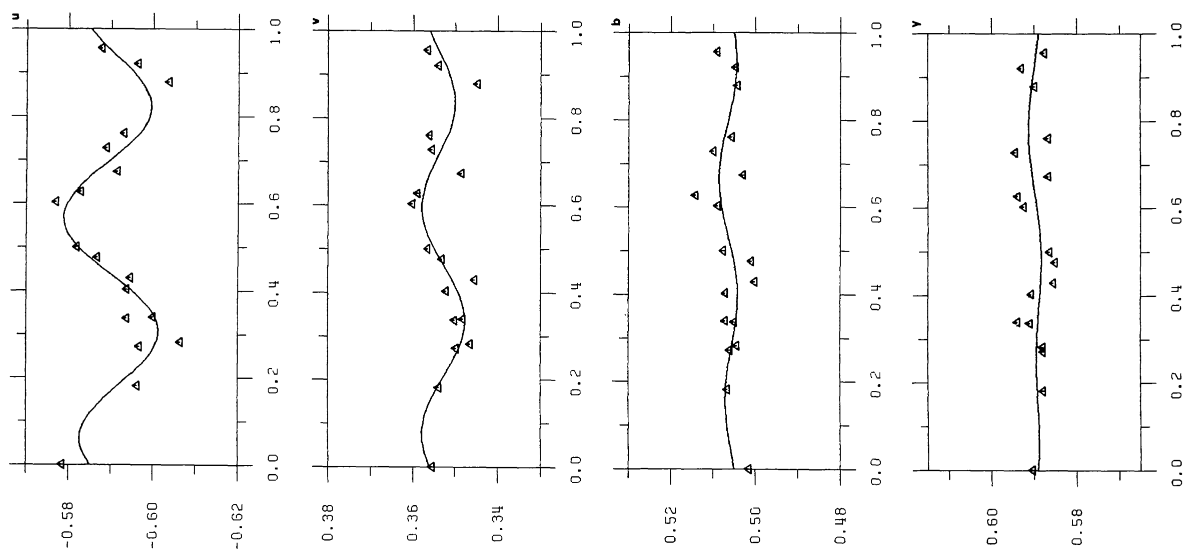

FIGURE 24. — Lightcurves of HD 64972.

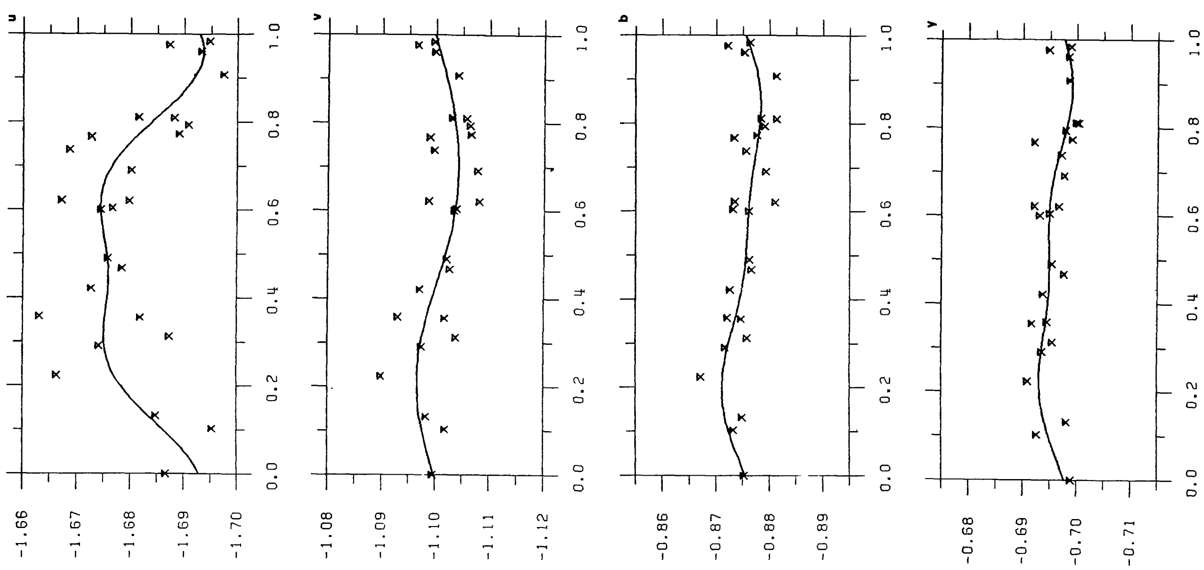

FIGURE 23. — Lightcurves of HD 61966 with the period 1.035 d.

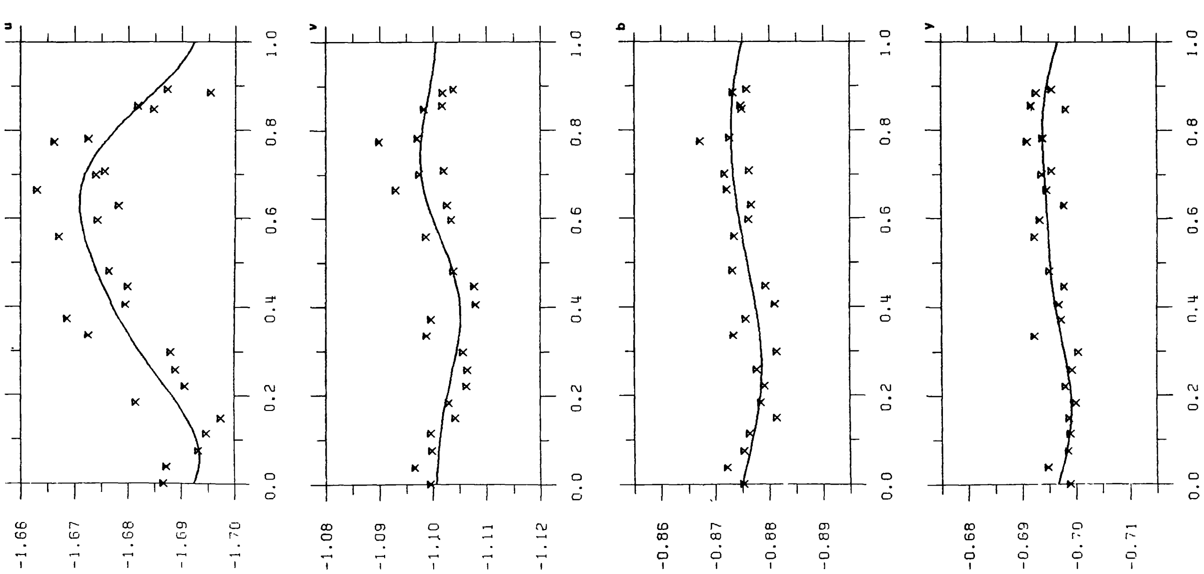

FIGURE 22. — Lightcurves of HD 61966 with the period 27.0 d.

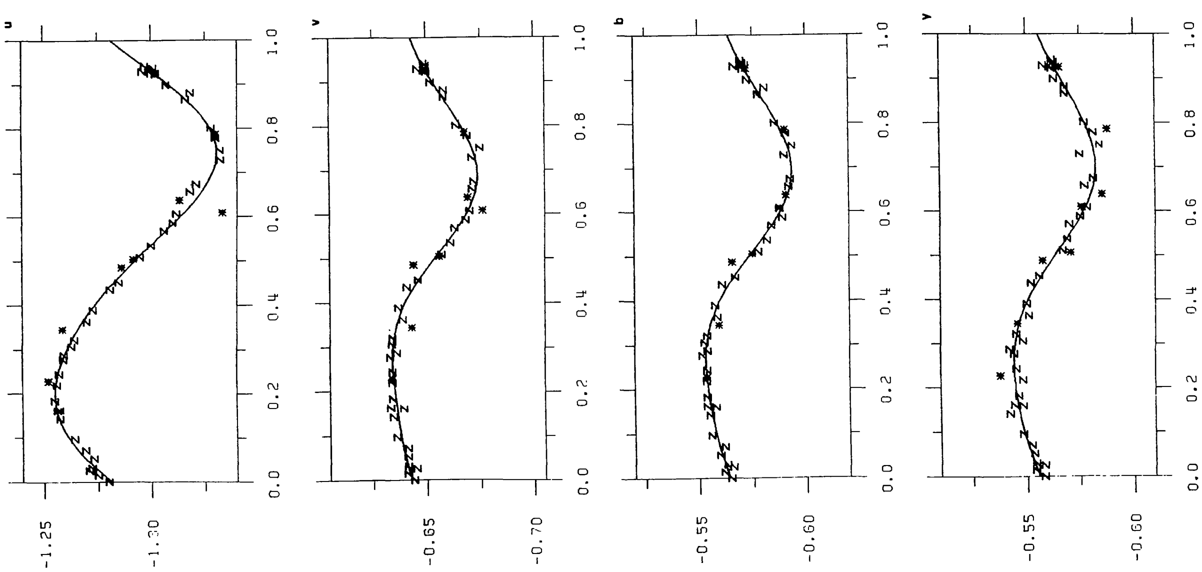

FIGURE 25. — Lightcurves of HD 66255.

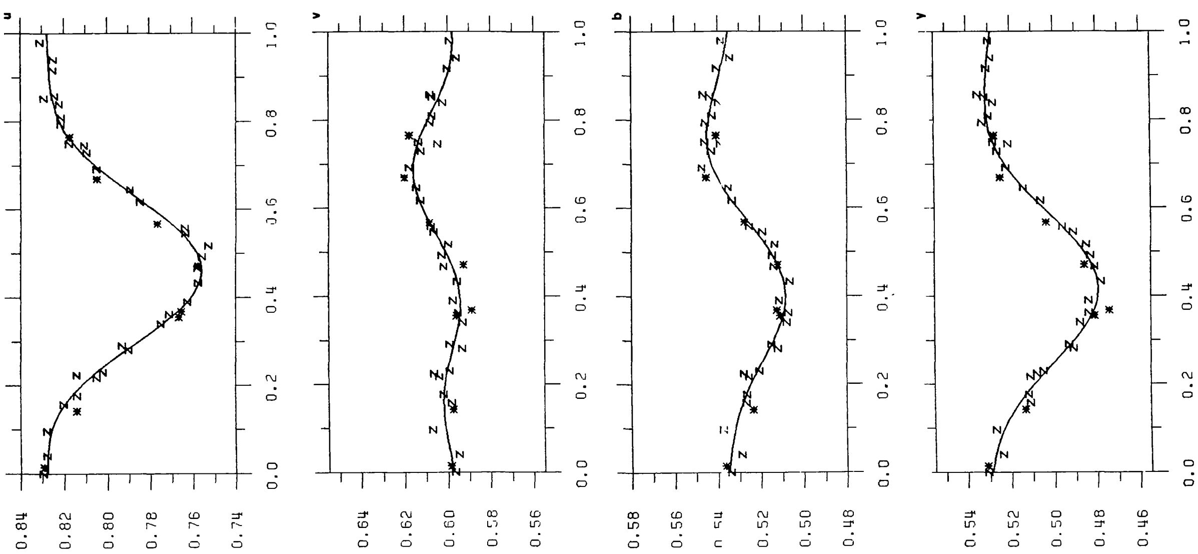

FIGURE 26. — Lightcurves of HD 66605.

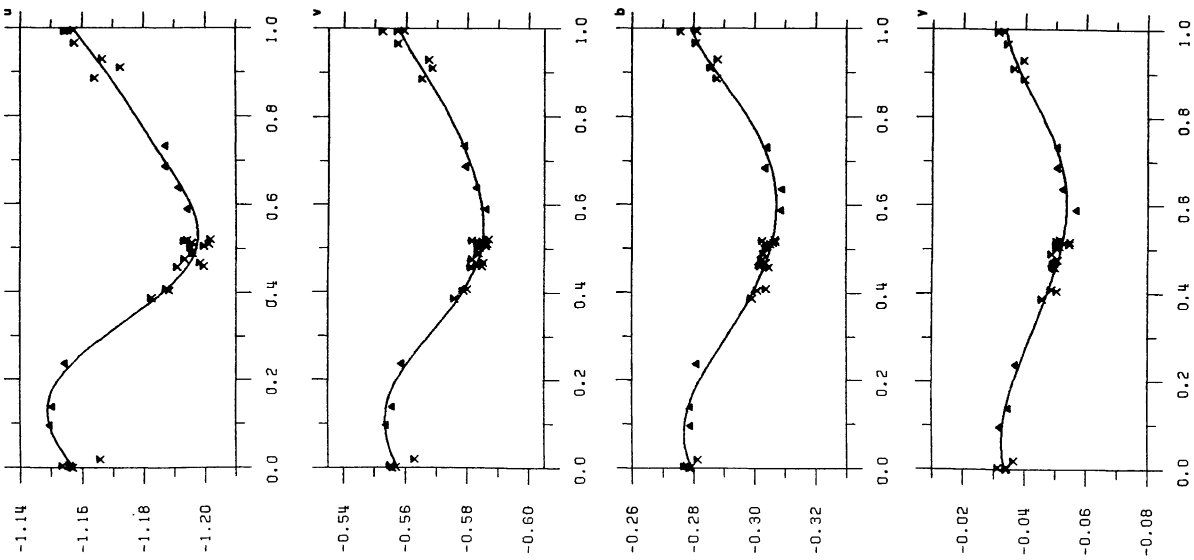

FIGURE 27. — Lightcurves of HD 66624.

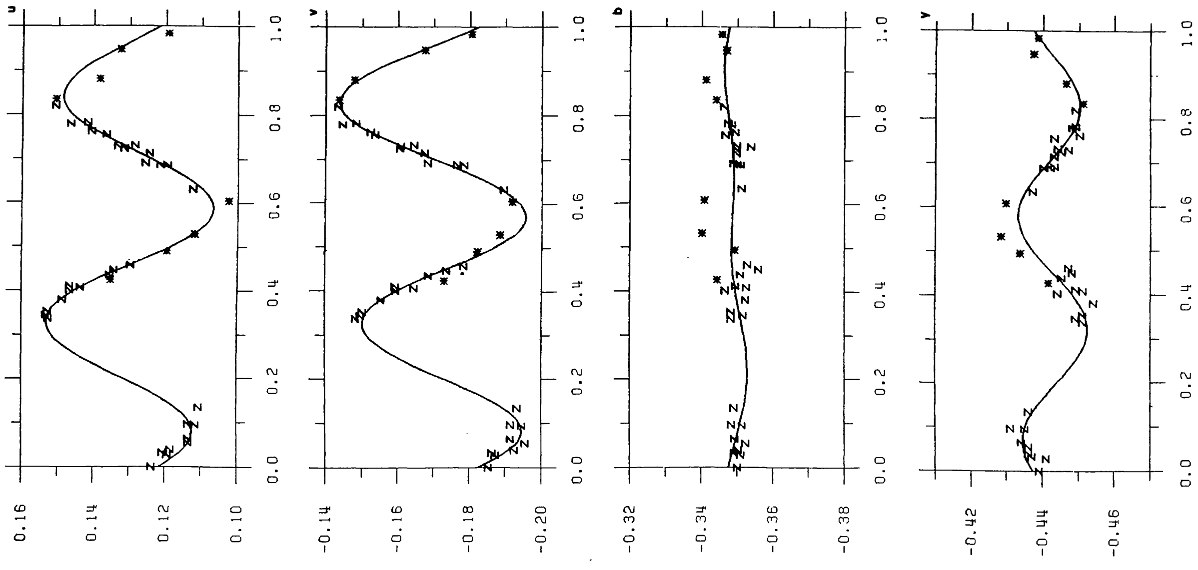

FIGURE 30. — Lightcurves of HD 83368.

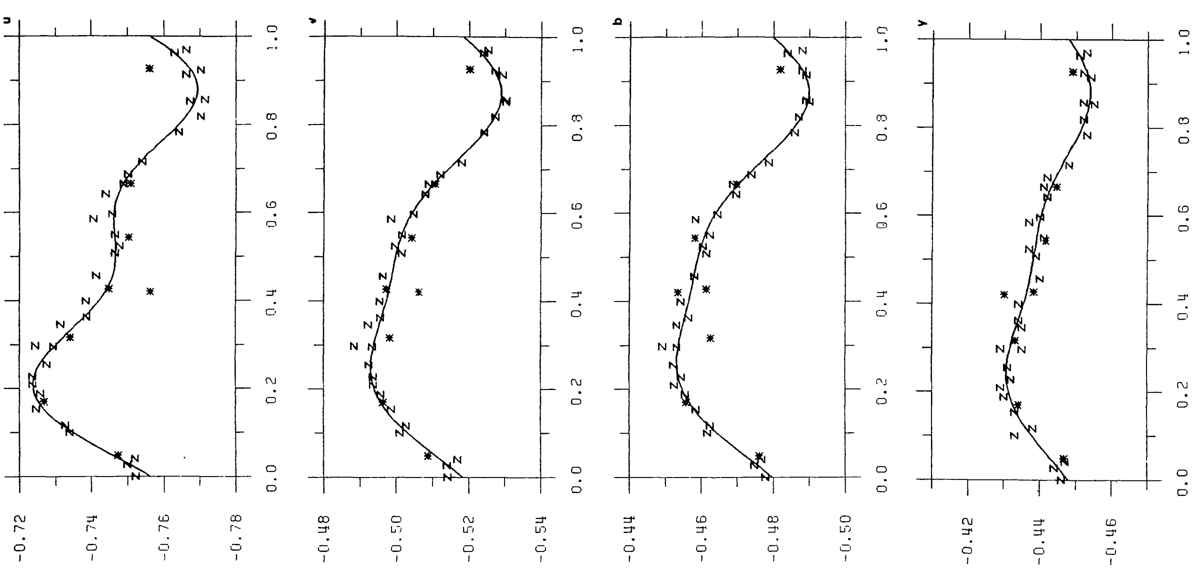

FIGURE 29. — Lightcurves of HD 73340.

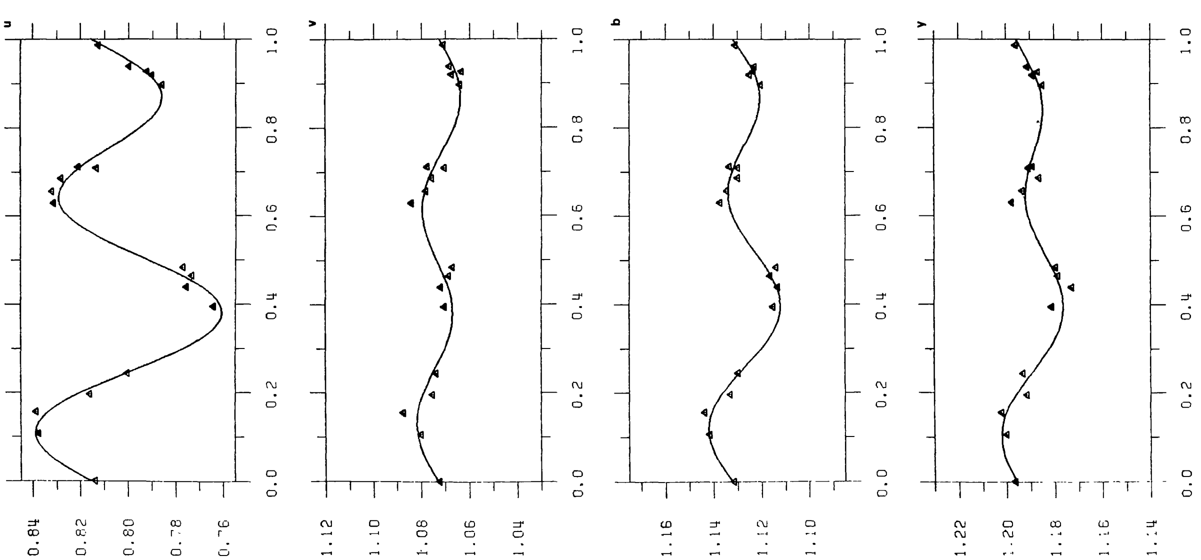

FIGURE 28. — Lightcurves of HD 66698.

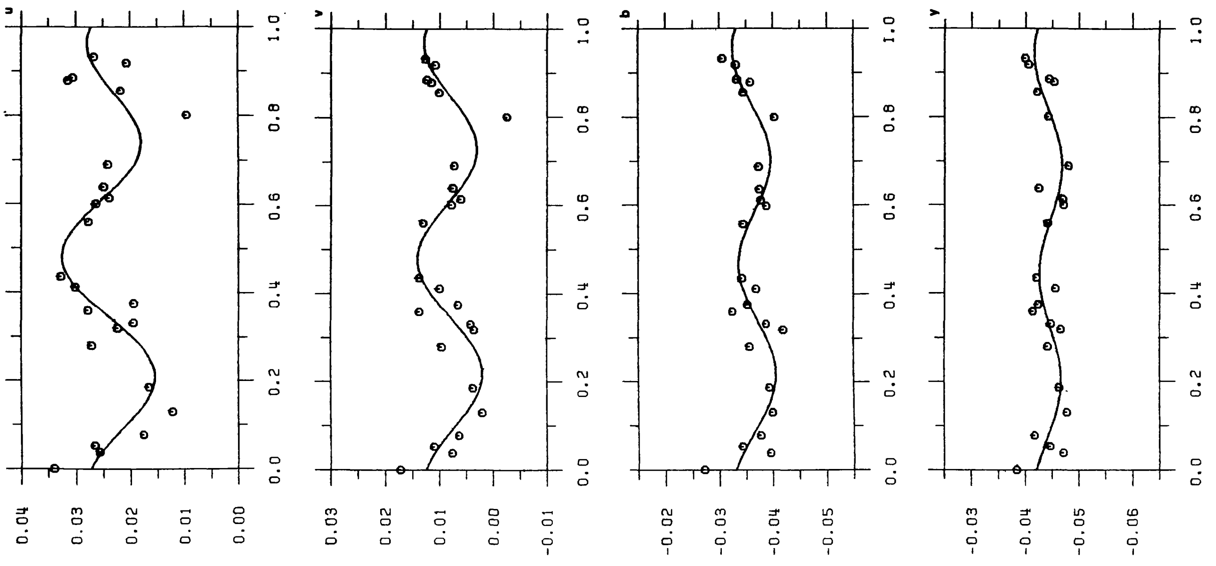

FIGURE 33. — Lightcurves of HD 90763.

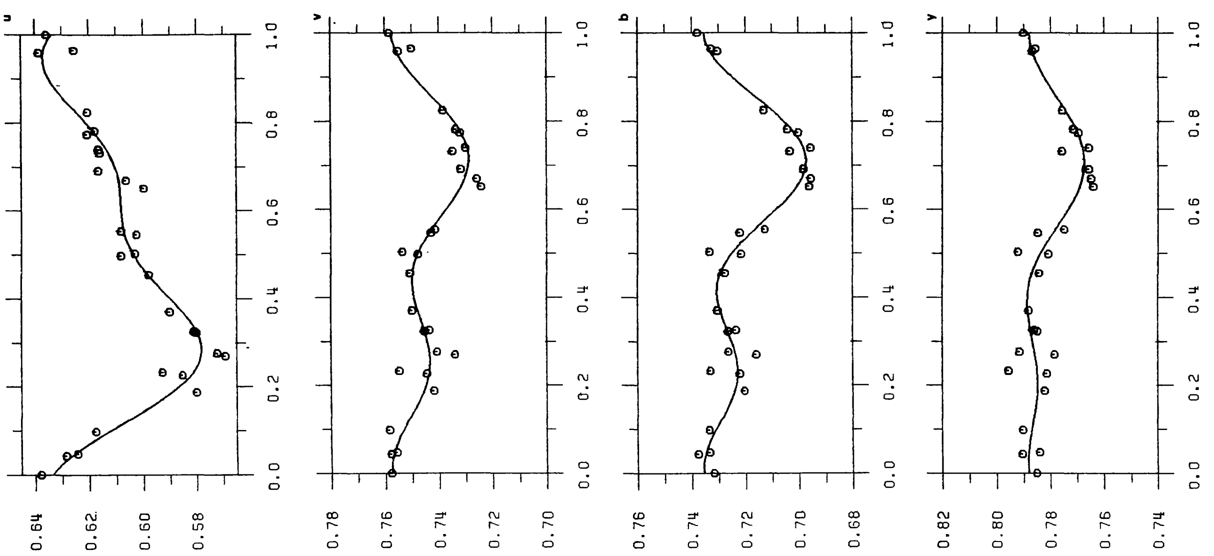

FIGURE 32. — Lightcurves of HD 90044.

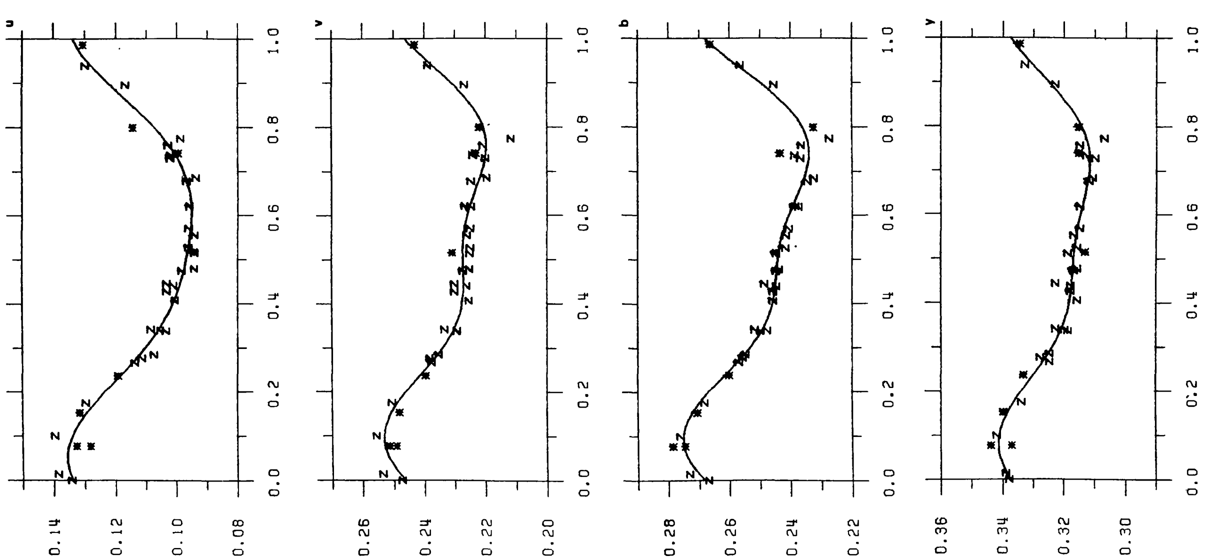

FIGURE 31. — Lightcurves of HD 83625.

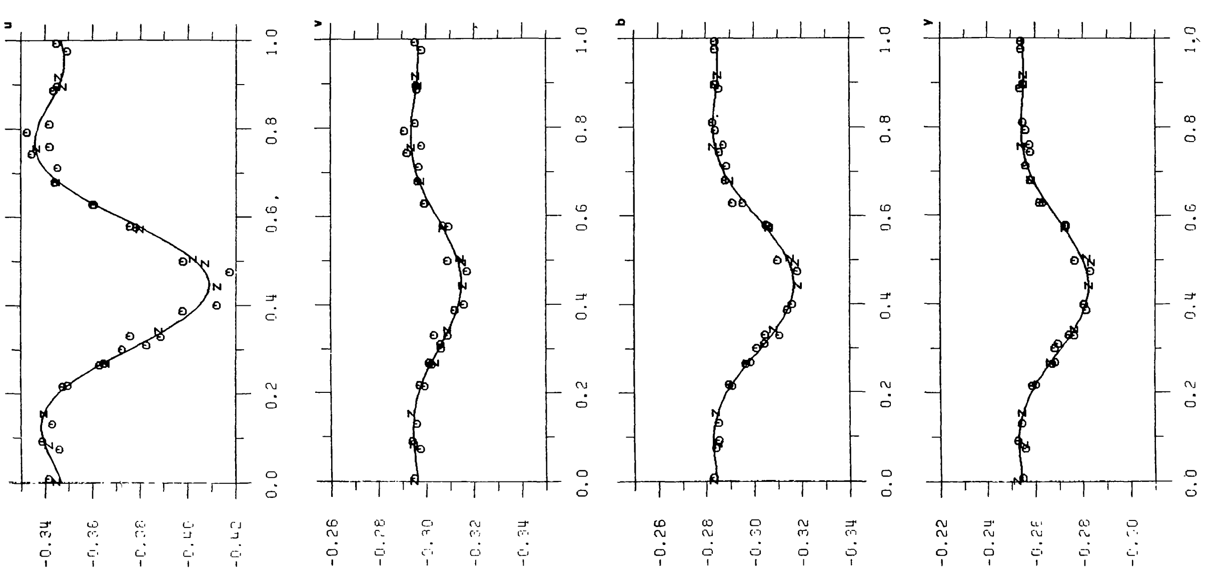

FIGURE 34. — Lightcurves of HD 96616.

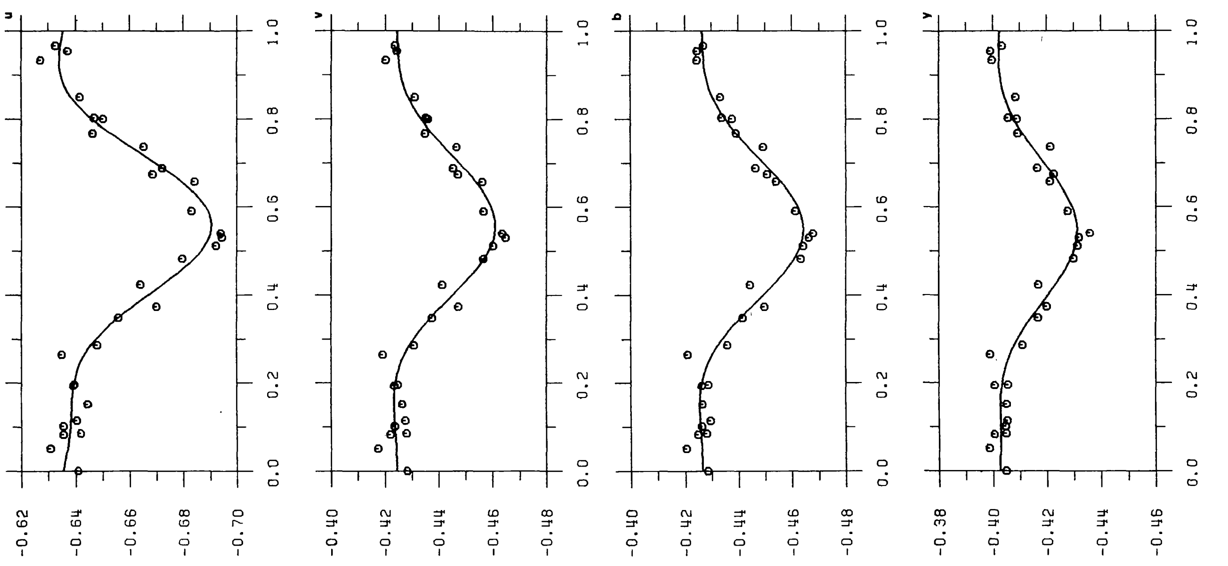

FIGURE 35. — Lightcurves of HD 103192.

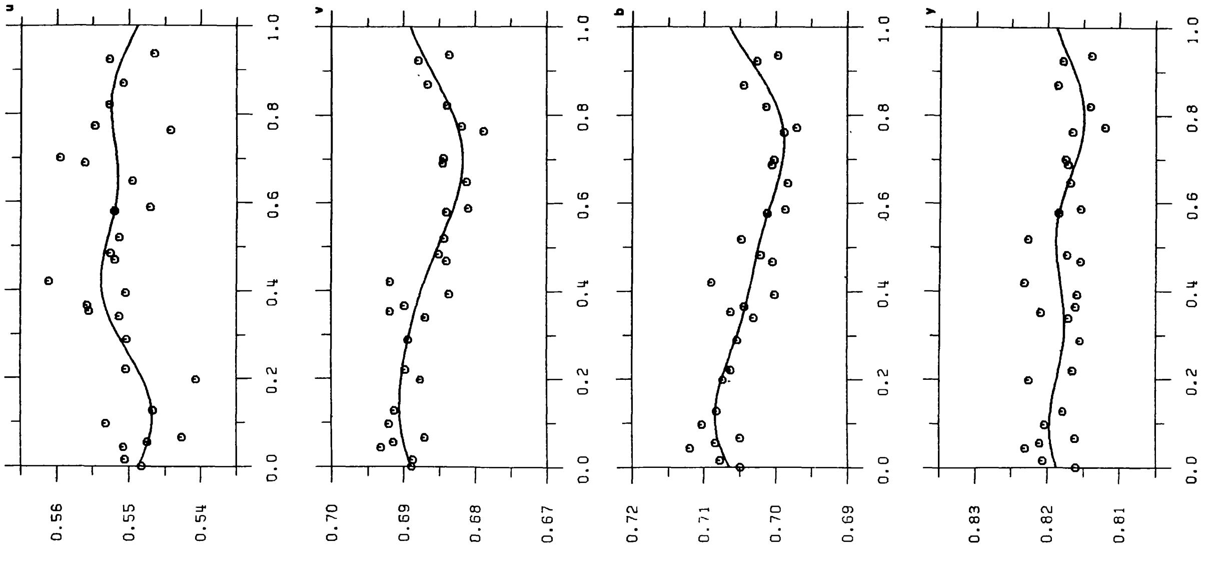

FIGURE 36. — Lightcurves of HD 112381.

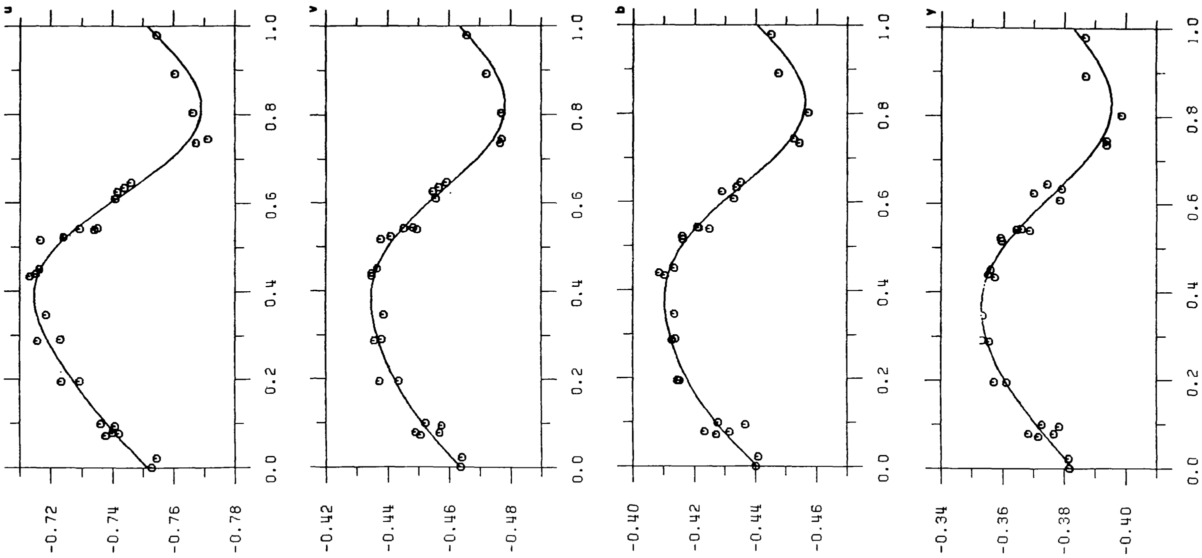

FIGURE 39. — Lightcurves of HD 122532.

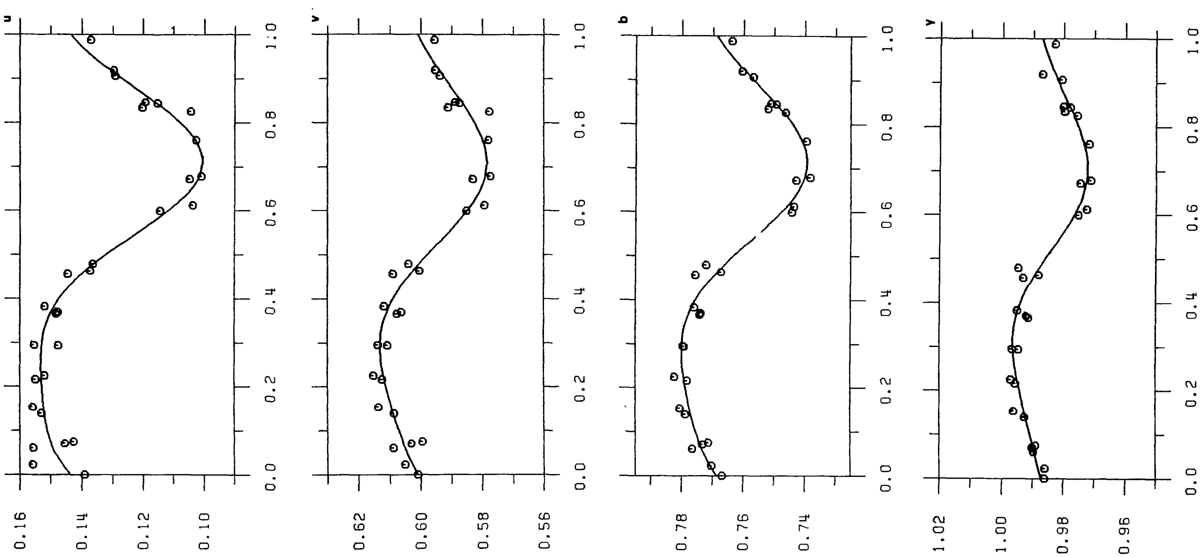

FIGURE 38. — Lightcurves of HD 119419.

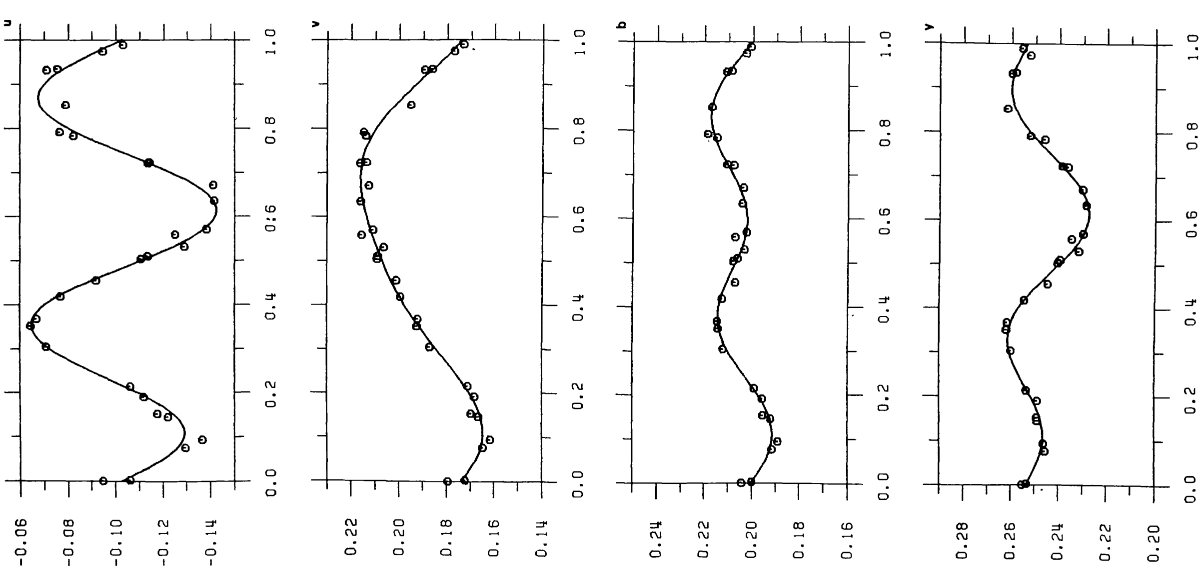

FIGURE 37. — Lightcurves of HD 114365.

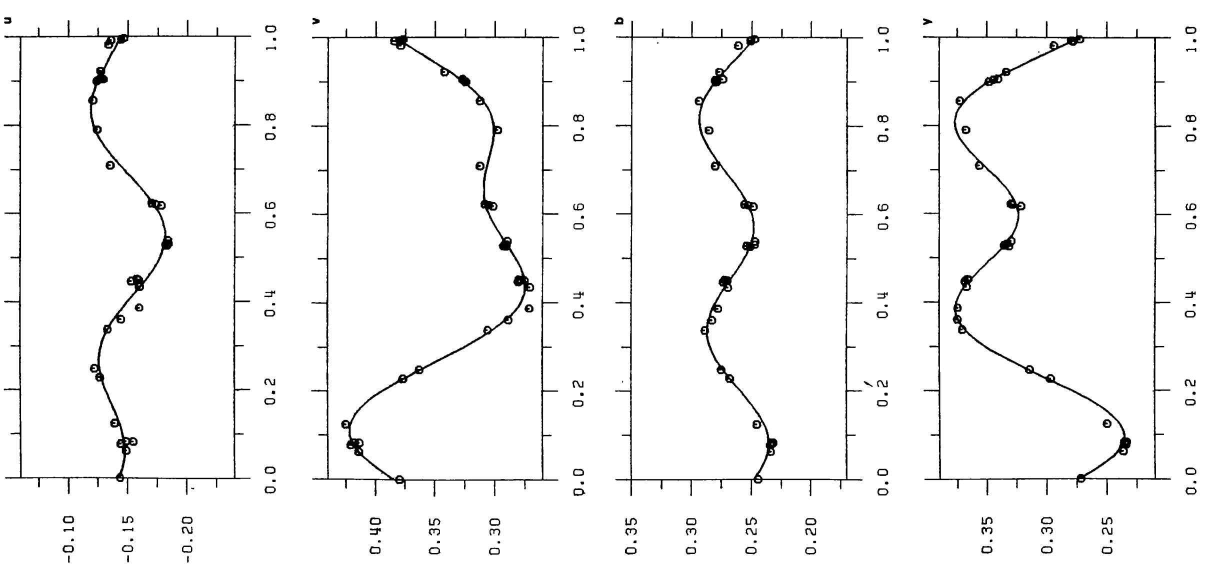

FIGURE 40. — Lightcurves of HD 125630.

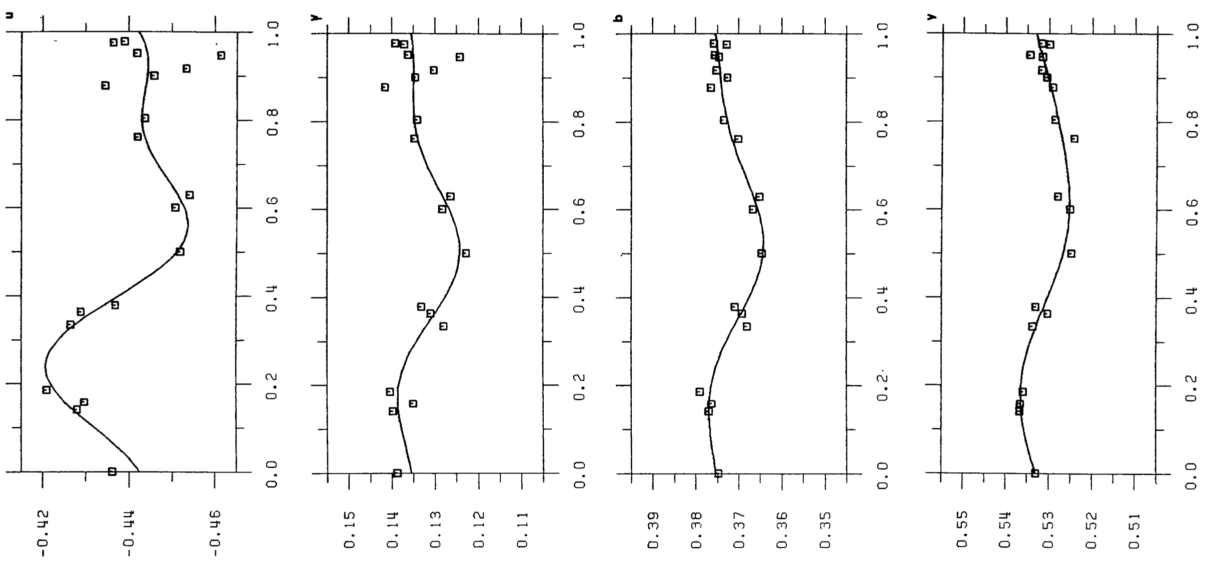

FIGURE 41. — Lightcurves of HD 143658.

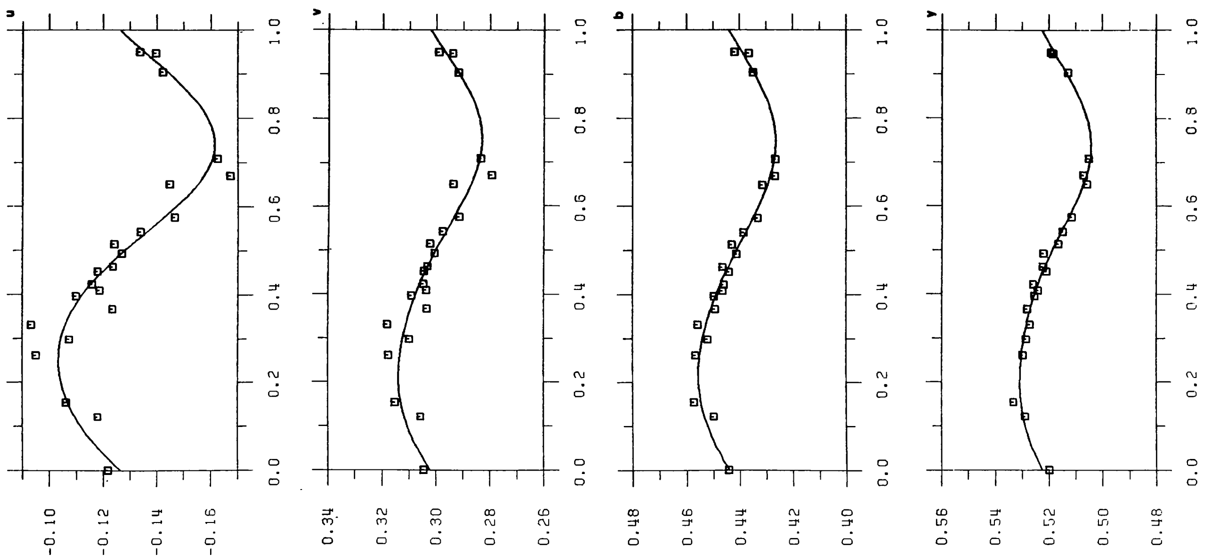

FIGURE 42. — Lightcurves of HD 144231.

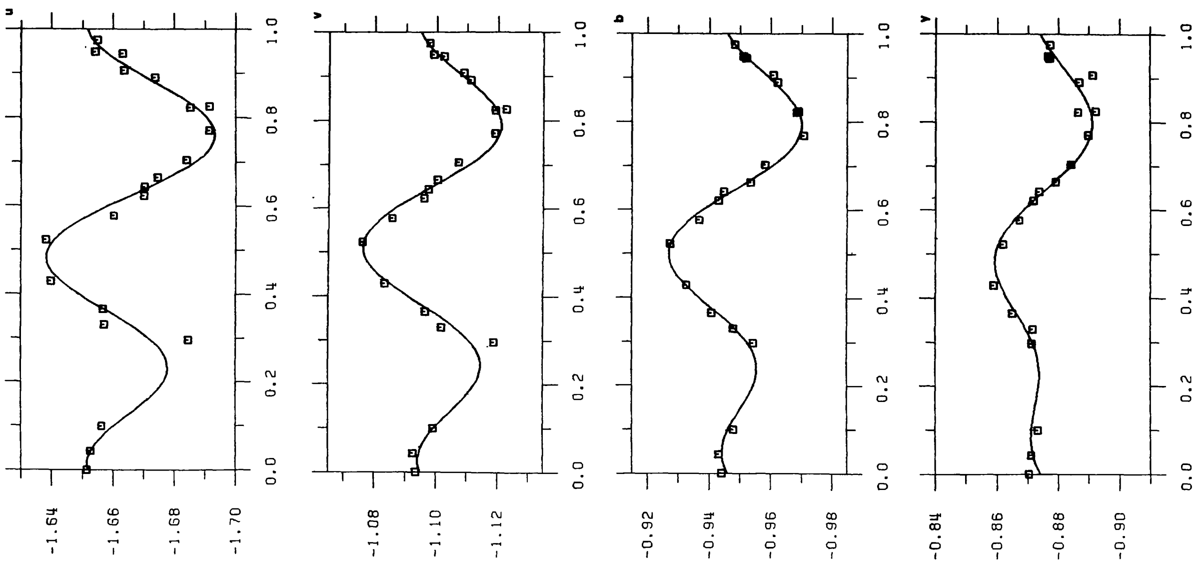

FIGURE 45. — Lightcurves of HD 150549.

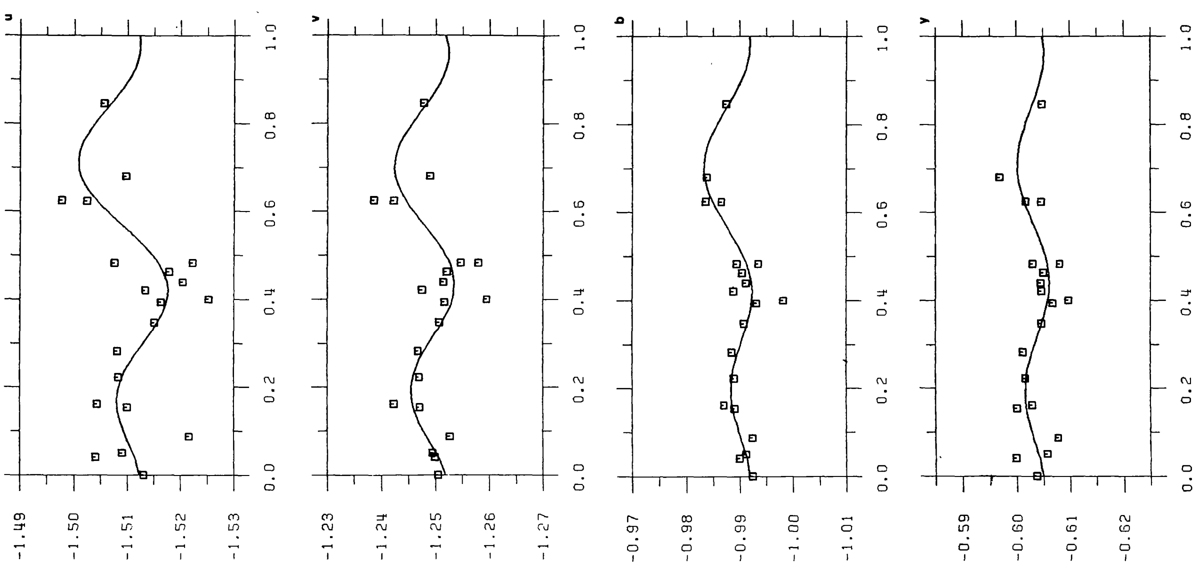

FIGURE 44. — Lightcurves of HD 148898 with the period 4.65 d.

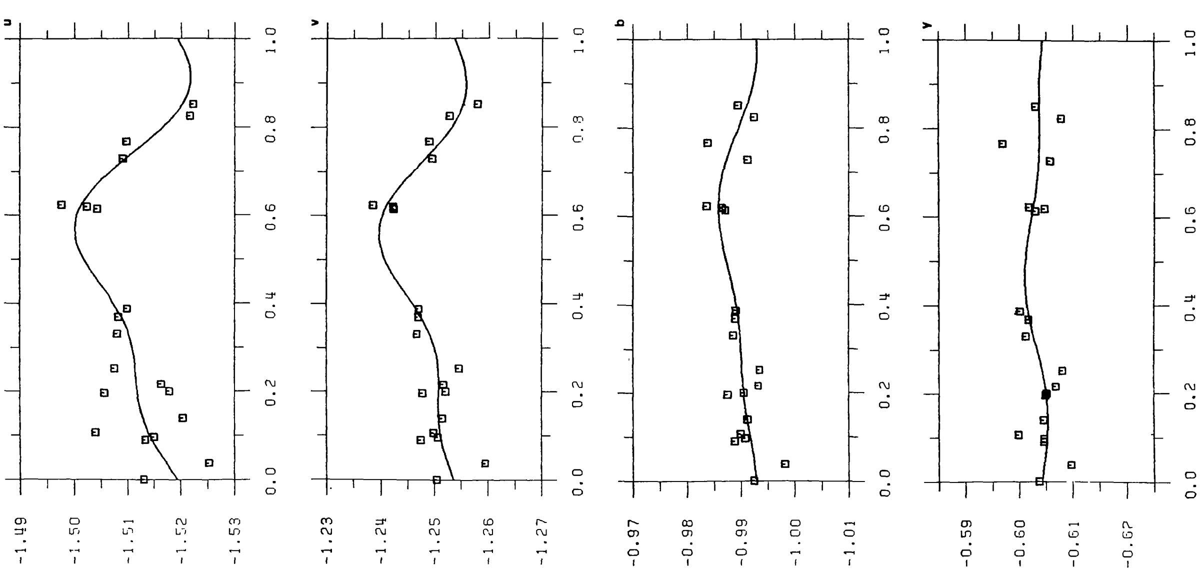

FIGURE 43. — Lightcurves of HD 148898 with the period 1.79 d.

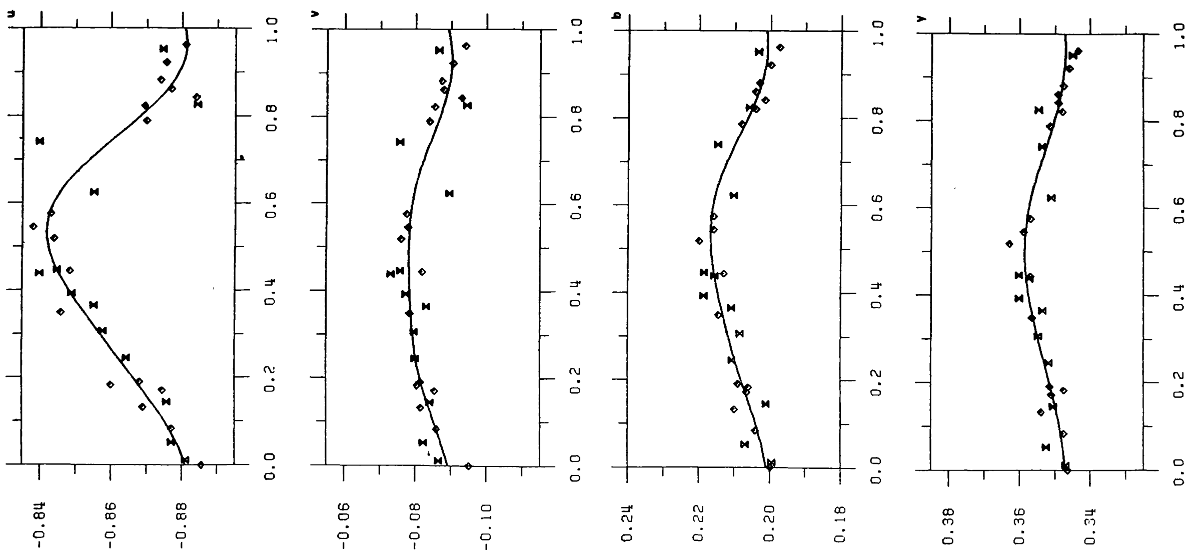

FIGURE 48. — Lightcurves of HD 166469.

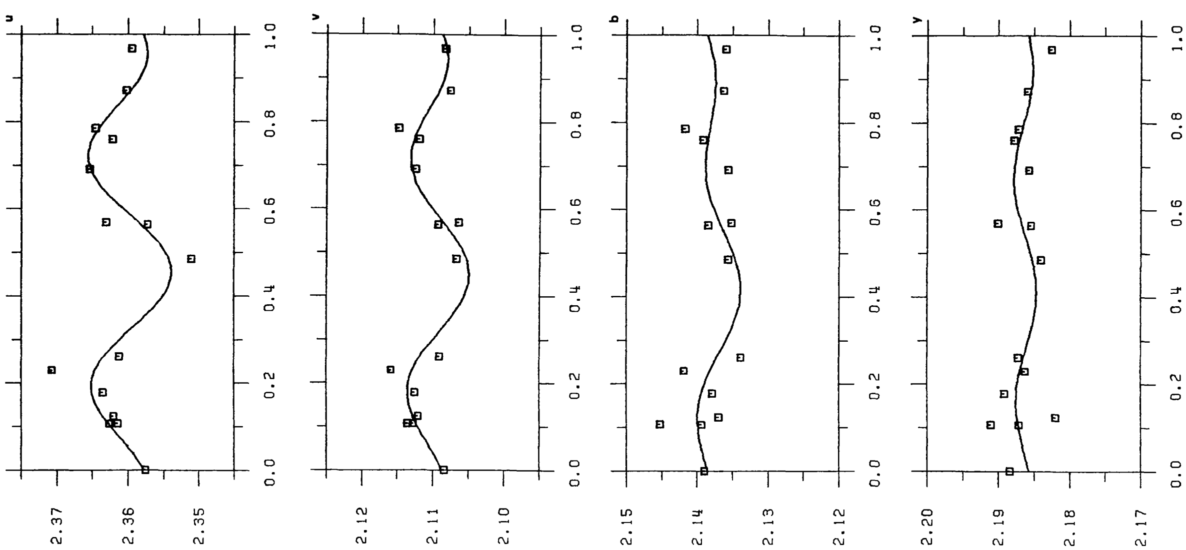

FIGURE 47. — Lightcurves of HD 164258.

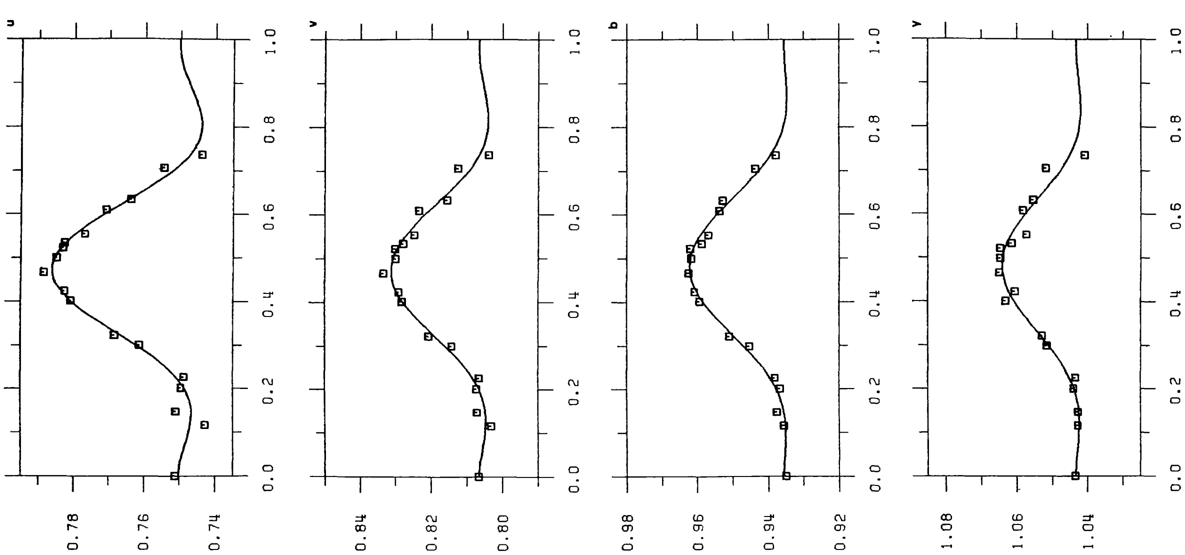

FIGURE 46. — Lightcurves of HD 159376.

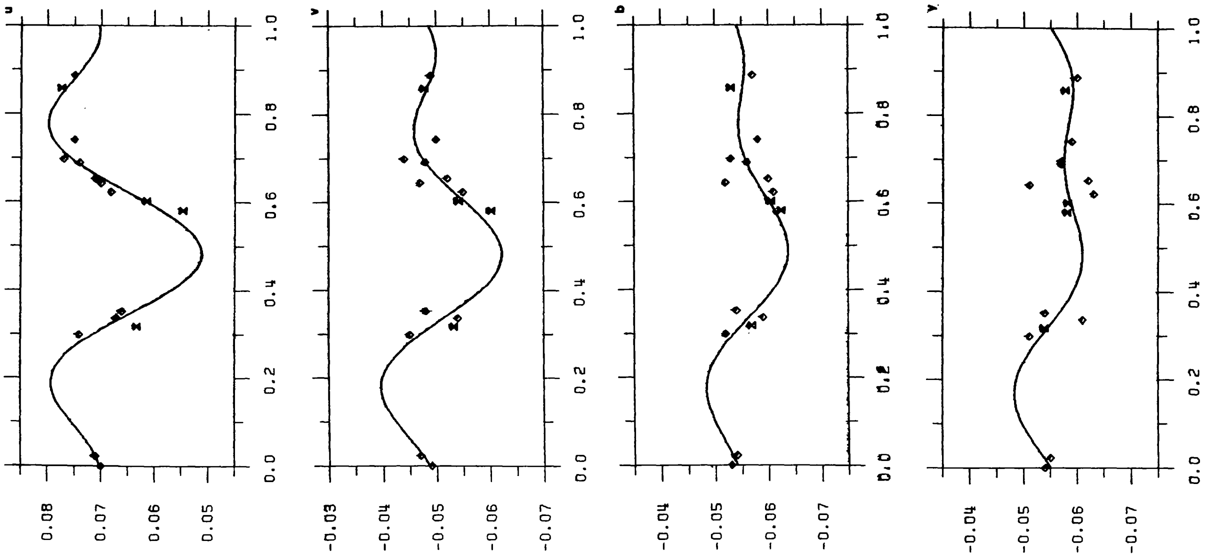

FIGURE 51. — Lightcurves of HD 177517.

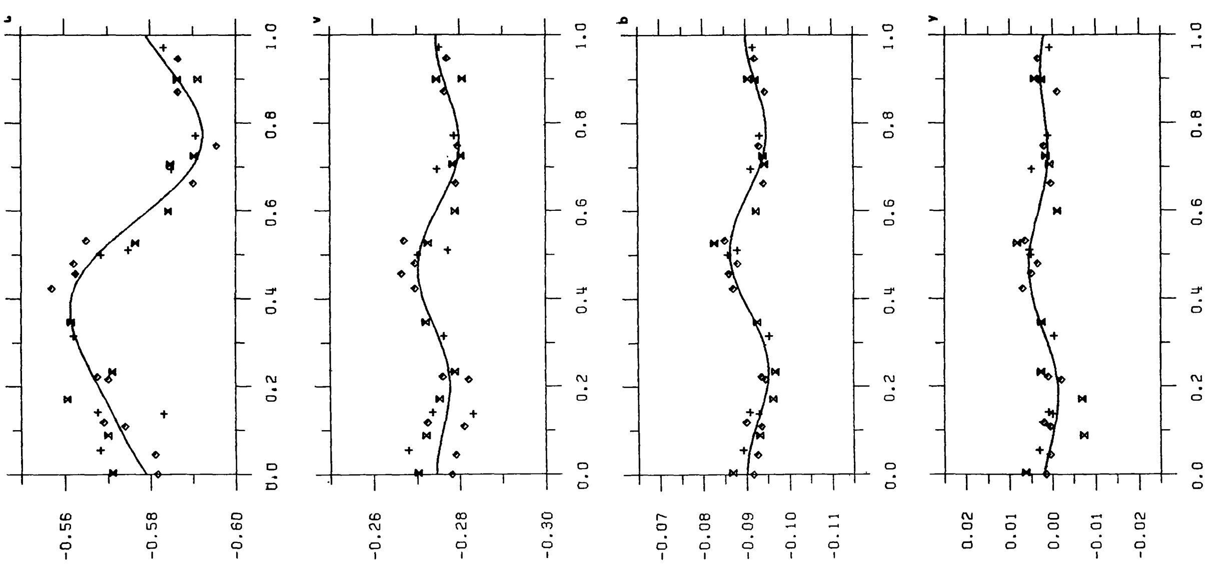

FIGURE 50. — Lightcurves of HD 170397.

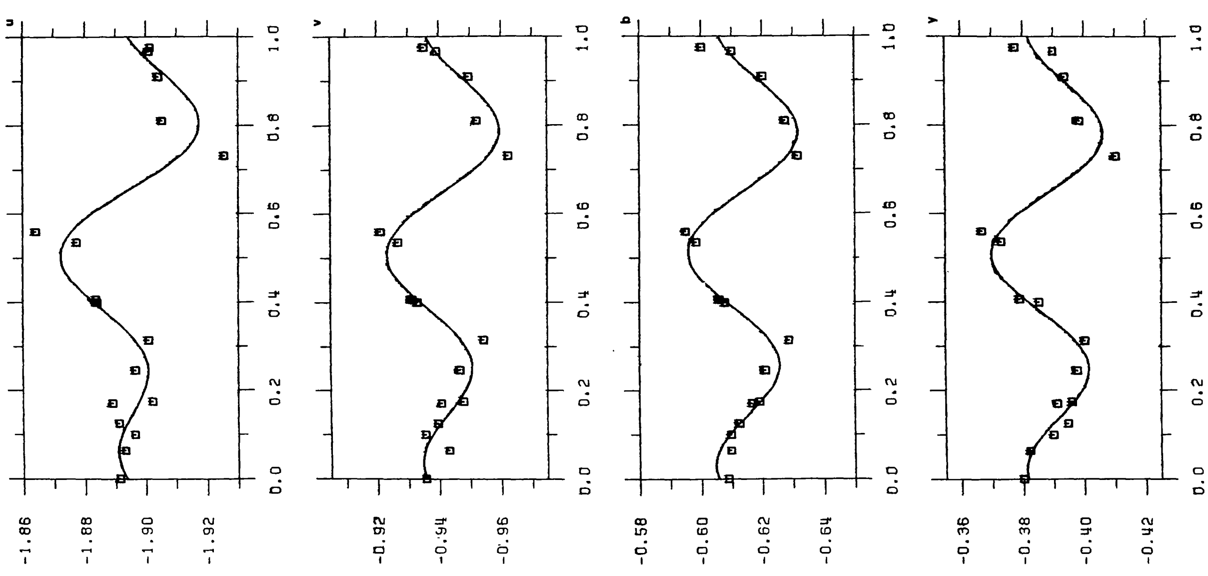

FIGURE 49. — Lightcurves of HD 166596.

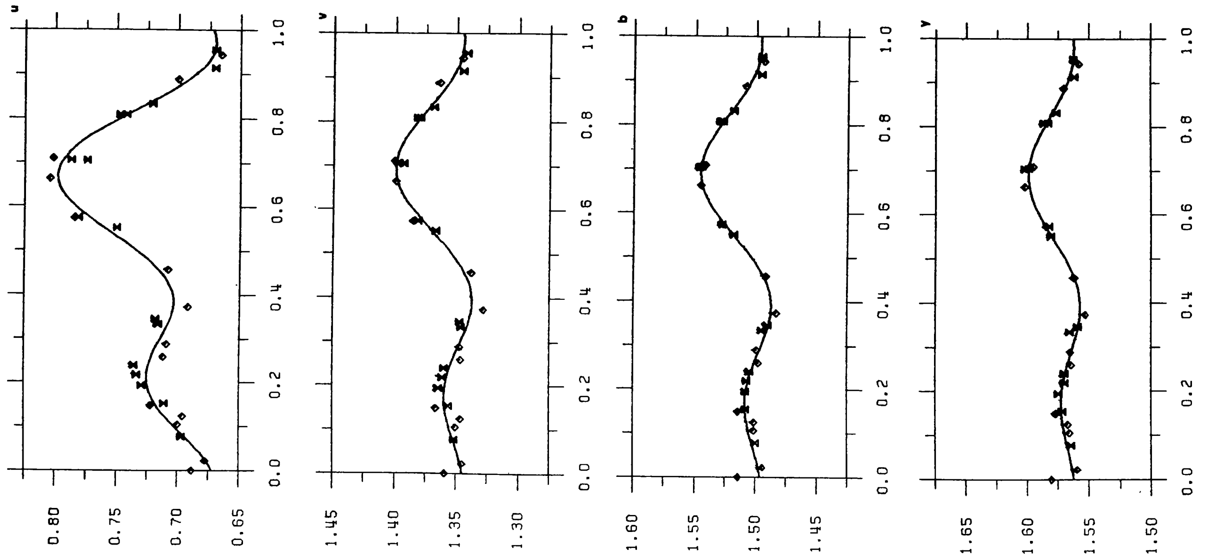

FIGURE 54. — Lightcurves of HD 199728.

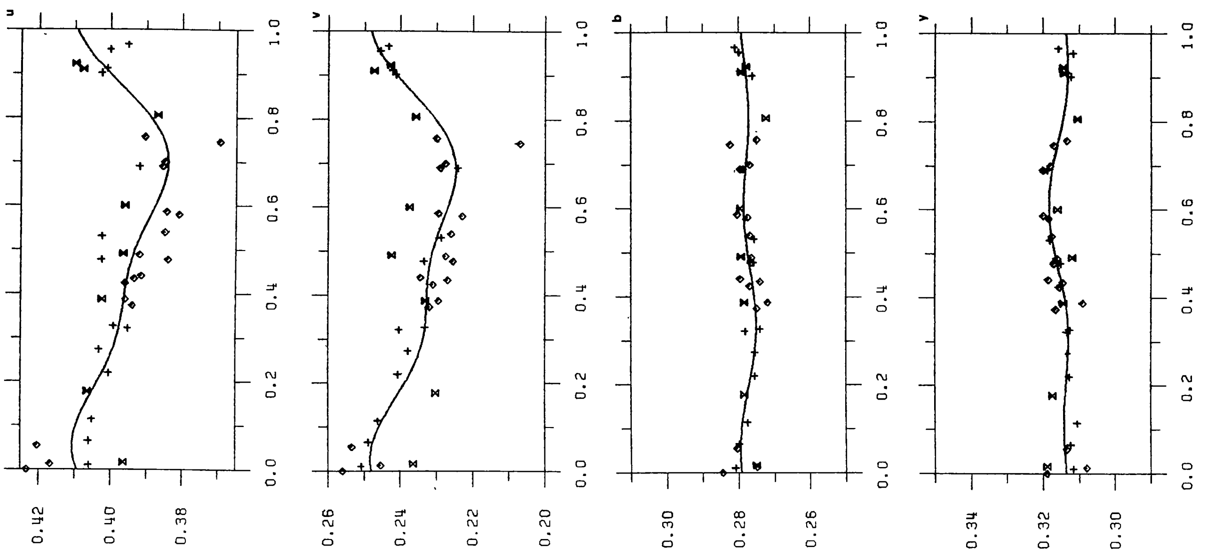

FIGURE 53. — Lightcurves of HD 189832.

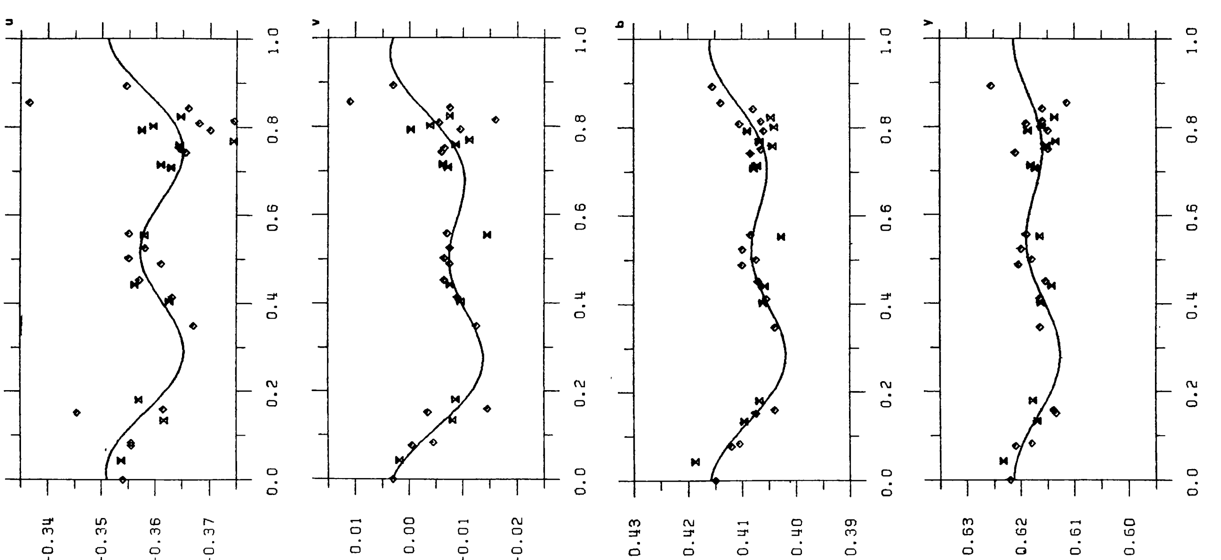

FIGURE 52. — Lightcurves of HD 183806.

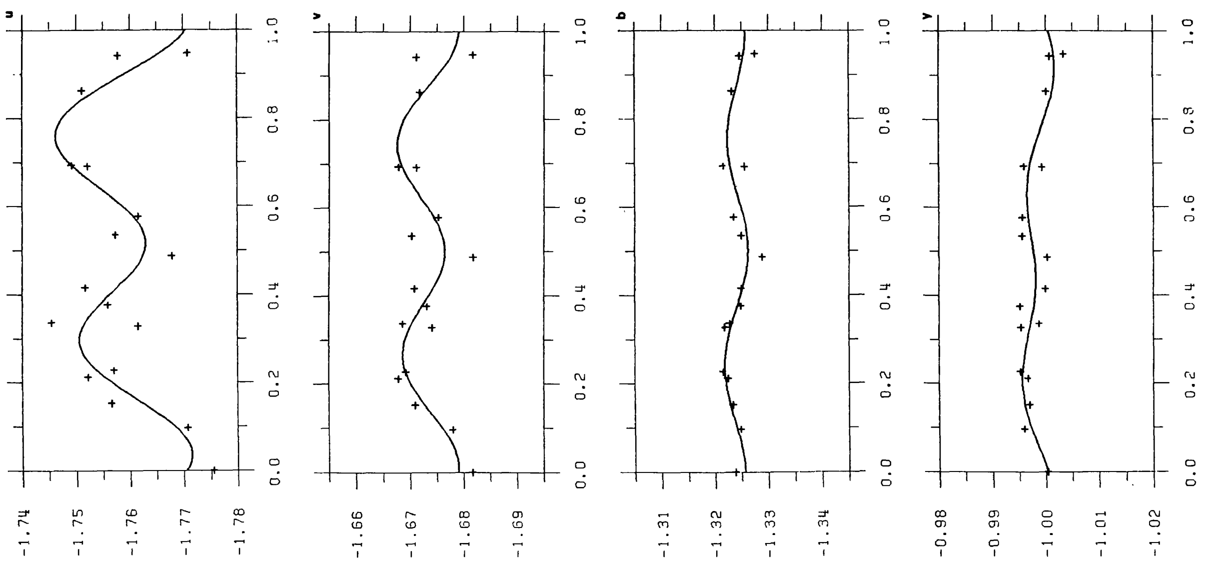

FIGURE 57. — Lightcurves of HD 216494 with the period 0.724 d.

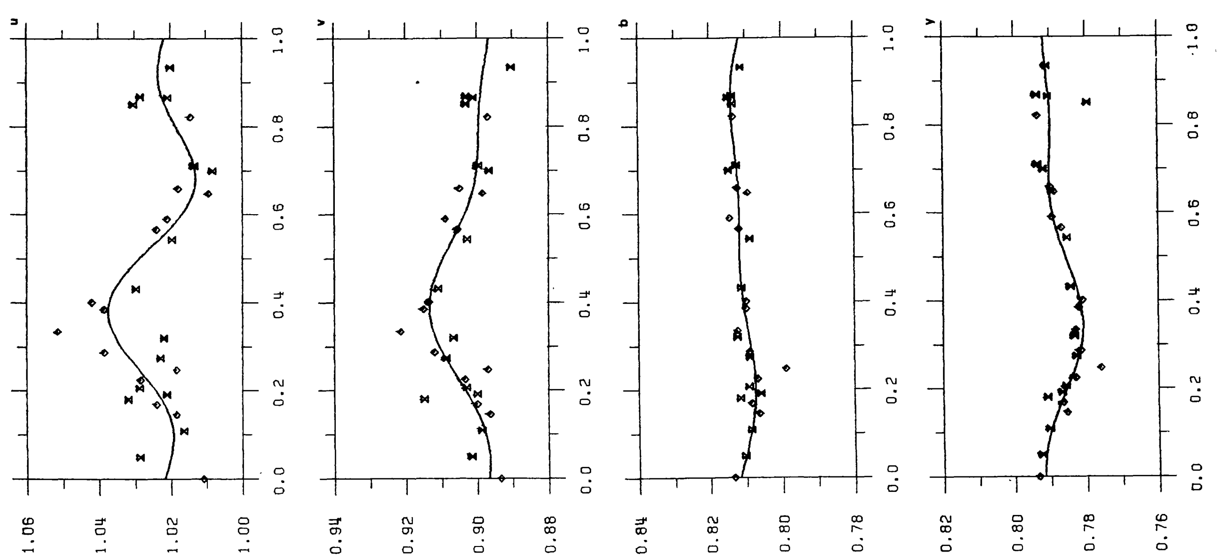

FIGURE 56. — Lightcurves of HD 212385.

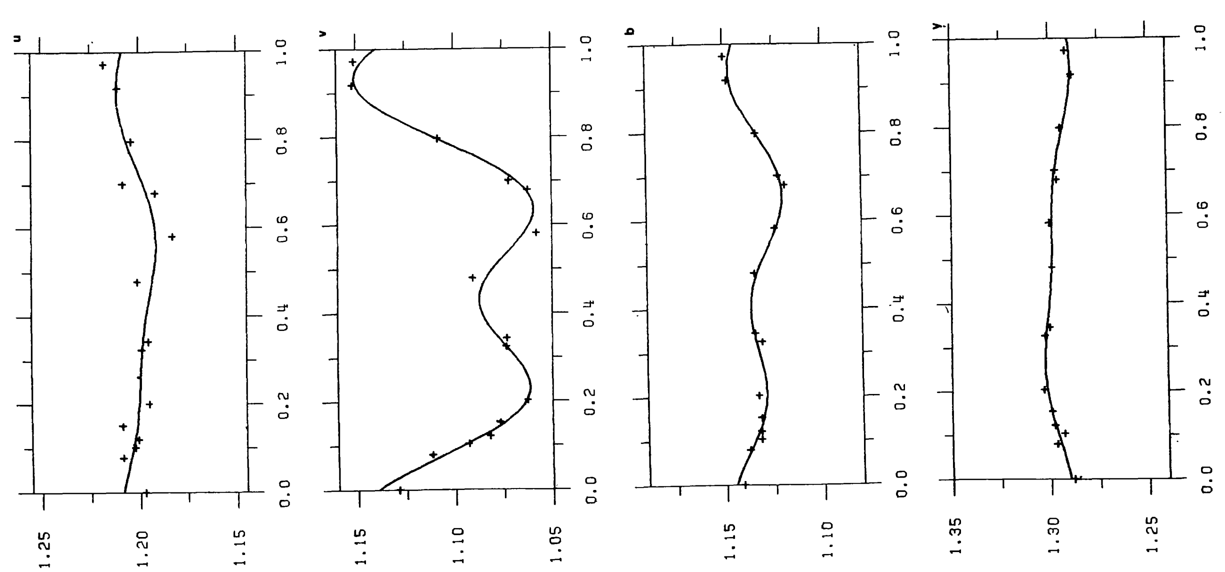

FIGURE 55. — Lightcurves of HD 208217.

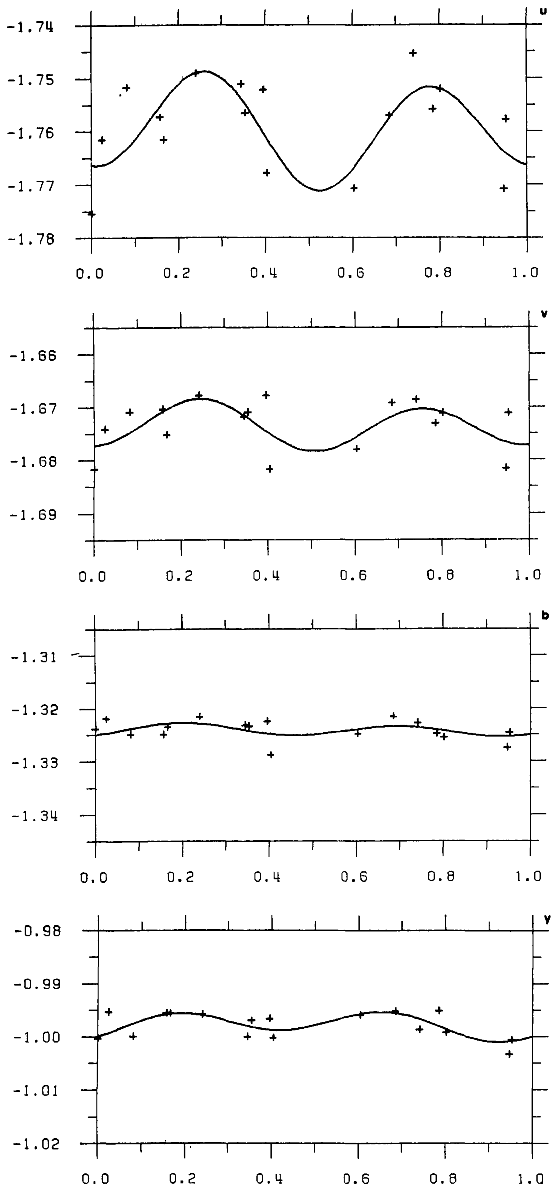

FIGURE 58. — Lightcurves of HD 216494 with the period 1.27 d.

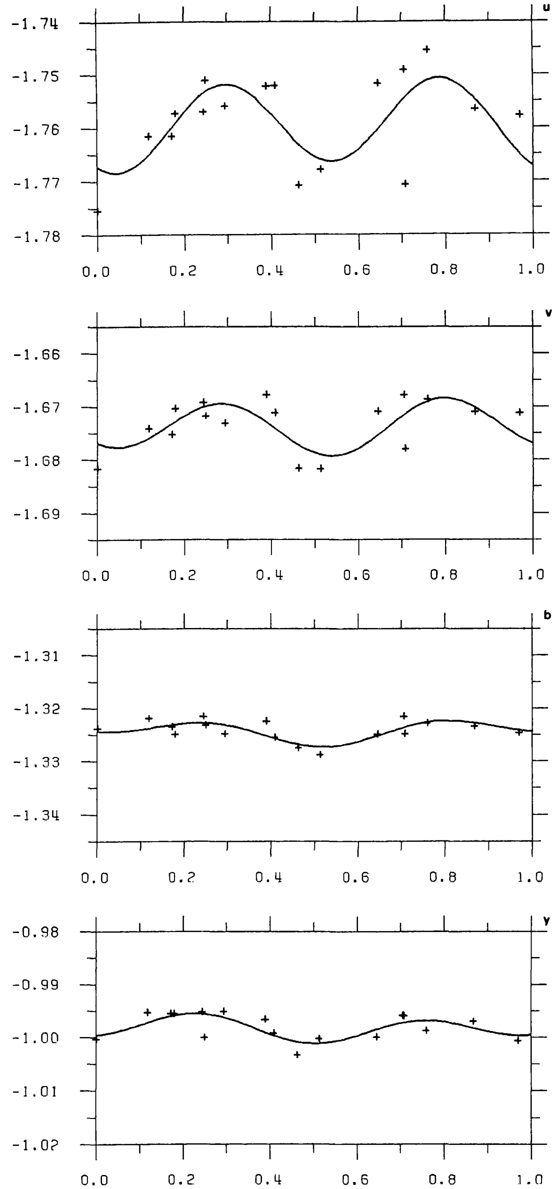

FIGURE 59. — Lightcurves of HD 216494 with the period 3.40 d.

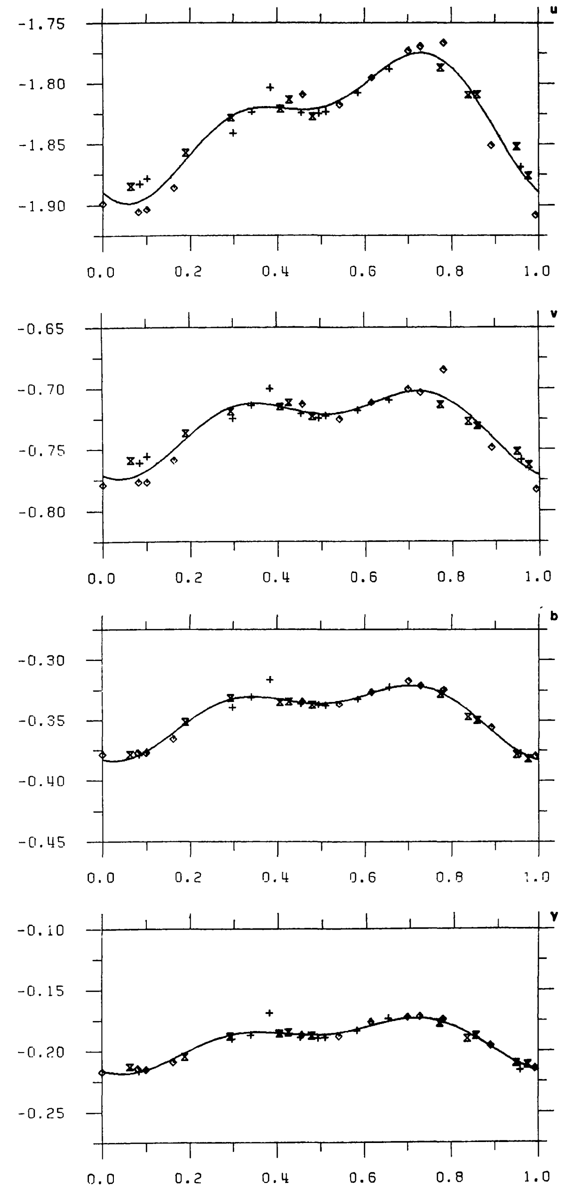

FIGURE 60. — Lightcurves of HD 221006.