

Observations of Variable Stars on digitized plates of Sonneberg Field Patrol plates in the field beta Delphini

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Abstract The results of estimations on digitized data of 224 photographic plates of the Sonneberg Field Patrol are presented. For 23 eclipsing binaries and 44 RR Lyrae stars elements, light-curves and minima/maxima are given.

Objects VV Del, BE Del, BF Del, BL Del, BM Del, BO Del, BP Del, BQ Del, BS Del, BT Del, CG Del, CN Del, CP Del, CV Del, CW Del, CY Del, DD Del, DE Del, DG Del, DH Del, DI Del, DQ Del, DS Del, DU Del, DW Del, EF Del, EM Del, EO Del, EQ Del, EW Del, FG Del, FI Del, FK Del, FL Del, FO Del, FP Del, FQ Del, FS Del, FT Del, FY Del, GK Del, GL Del, GO Del, GQ Del, GR Del, GS Del, GV Del, GX Del, GZ Del, HN Del, HS Del, HT Del, HV Del, II Del, IK Del, IL Del, IP Del, IU Del, IV Del, IW Del, KL Del, KM Del, OS Del, CZ Sge, DF Sge, GQ Sge, V373 Sge

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The observation of the stars relies on digitized photographic plates of Sonneberg Observatory. The exposures taken with the Sonneberg 40-cm-Astrographs have been digitized with a resolution of 20 micron. The raw data of one plate sums up to 400 MByte. I have used a JPEG compressed version of the raw data yielding roughly 20 MByte per plate. Probably owing to compression techniques I have observed the limiting magnitude of the original plates being about 17.^m5, while the digital data show about 17^m only.


The brightness of the stars have been estimated on

the PC monitor using Argelander's method. Magnitudes of comparison stars were derived from USNO A2.0 data.

The stars I observed are in the brightness region between 12^m and 17^m. Fainter stars could hardly be distinguished from the background.


To facilitate finding the stars I have add the USNO A2.0 catalogue number to every investigated variable.

The following two tables list short-period eclipsing and RR Lyrae stars.

Table 1. Short-period eclipsing binaries. 

Star	Type	Epoch 0	Period (d)	D	m _{max}	m _{min}
VV Del	EB	243 8268.249	2.60574 (var.)		15.1	15.7
BE Del	EA		GCVS	0.1	12.7	14.3
BF Del	EA	242 5808.519	3.76007 (var.)	0.1	13.8	14.8
BL Del	EA		GCVS	0.09	15.1	16.9
BO Del	EB	242 5938.236	0.51667		14.7	15.7/15.1
BP Del	EA	51378.624	5.3501638	0.1	14.0	14.8
BQ Del	EA	242 5830.393	3.4265173	0.12	15.2	16.9
BS Del	EB	244 8832.509	2.977457		13.3	14.6/13.7
BT Del	EA		GCVS	0.12	14.5	16.5/15.2
CN Del	EW	244 9625.388	0.567073		15.0	15.5/15.5
EQ Del	EA		GCVS	0.1	13.0	14.4
EW Del	EW	244 6298.566	0.488068 (var.)		14.7	15.4/15.2
FK Del	EW	242 9790.435	0.666795		14.6	15.0/15.0
FO Del	EA	242 5535.412	1.1954073	0.11	13.6	15.2
GS Del	EA	243 0608.455	9.265514	0.06	15.6	17.1
HN Del	EA	244 7849.274	2.850787 (var.)	0.06	14.6	16.9
IL Del	EB	244 9742.497	0.7800036		14.4	15.2/14.9

IP Del	EA	243 0607.422	2.0437799	0.12	15.2	17.0
IU Del	EA	244 9567.449	1.859994	0.11	15.4	17.0
IV Del	EA	244 7804.387	1.788687	0.08	14.4	15.5
IW Del	EA	244 9446.586	4.11833	0.11	15.4	17.0
CZ Sge	EA	242 5527.37	2.3481856 (var.)	0.08	14.3	16.3
GQ Sge	EA	243 0614.457	1.481366		12.7	14.0

Table 2. RR Lyrae stars. 

Star	Type	Epoch 0	Period (d)	M-m	m _{max}	m _{min}
BM Del	RRab	244 9568.525	0.541009 (var.)	0.14	13.3	14.7
CG Del	RRab	242 5795.408	0.630939	0.2	13.5	15.4
CP Del	RRab	242 5830.380	0.5274752	0.15	14.2	15.8
CV Del	RRab	GCVS		0.11	13.3	14.6
CW Del	RRab	244 5524.550	0.582072 (var.)	0.14	13.5	15.3
CY Del	RRab	244 8504.340	0.4523684 (var.)	0.15	14.6	15.9
DD Del	RRab	242 5535.419	0.4902493	0.13	14.4	16.6
DE Del	RRab	244 9547.511	0.422692 (var.)	0.15	14.5	16.0
DG Del	RRab	242 9789.435	0.49047	0.14	14.9	16.1
DH Del	RRab	242 5807.518	0.5929394	0.11	14.3	15.4
DI Del	RRab	242 9791.524	0.5893295	0.14	14.5	16.7
DQ Del	RRab	242 5862.418	0.5349607 (var.)	0.12	14.2	15.1
DS Del	RRab	242 5885.411	0.476125 (var.)	0.16	12.9	14.2
DU Del	RRab	242 5478.445	0.651486 (var.)	0.14	14.6	15.6
DW Del	RRab	242 5865.411	0.6607705 (var.)	0.13	14.7	15.9
EF Del	RRab	242 5535.392	0.4475789	0.11	14.1	15.2
EM Del	RRab	242 9791.465	0.582615	0.1	13.1	14.2
EO Del	RRab	245 1325.848	0.5800469 (var.)	0.13	13.5	14.9
FG Del	RRab	242 9846.572	0.7039673 (var.)	0.15	13.8	15.3
FI Del	RRab	242 9846.530	0.4516646	0.25	15.1	16.6
FL Del	RRab	242 9844.507	0.480292	0.15	15.1	16.6
FP Del	RRc	242 9791.45	0.30066 (var.)	0.36	14.0	14.8
FQ Del	RRab	244 9547.546	0.5766005	0.15	14.9	15.6
FS Del	RRab	242 9846.577	0.546818 (var.)	0.1	14.5	15.3
FT Del	RRab	242 9790.512	0.581904	0.18	15.1	15.7
FY Del	RRab	242 9846.405	0.53481	0.12	15.3	16.9
GK Del	RRab	244 8862.499	0.5045799 (var.)	0.12	15.7	17.0
GL Del	RRab	244 9543.562	0.4807509 (var.)	0.1	15.7	17.1
GO Del	RRab	244 9543.574	0.5459746 (var.)	0.15	16.1	16.9
GQ Del	RRab	242 9846.381	0.5686226 (var.)	0.1	14.5	16.5
GR Del	RRab	242 9846.446	0.5665555	0.11	15.7	16.9
GV Del	RRab	242 9846.412	0.541209	0.15	15.4	15.9
GX Del	CW	242 9845.491	1.640856	0.18	13.7	15.2
GZ Del	RRab	244 0452.386	0.50562 (var.)	0.15	15.2	16.6
HS Del	RRab	242 9844.516	0.326411 (var.)	0.16	16.1	17.2
HT Del	RRab	244 0453.410	0.569913 (var.)	0.18	15.7	16.6
HV Del	RRab	242 9845.470	0.5649245	0.15	15.3	16.1
II Del	RRc	244 4871.360	0.4078105 (var.)	0.35	14.4	15.1
IK Del	RRab	242 9789.539	0.51480	0.1	15.0	15.7
KL Del	RRab	244 0483.386	0.3058124 (var.)	0.1	14.4	15.0
KM Del	RRab	244 8769.534	0.537707	0.15	15.5	17.0
OS Del	RRab	245 4362.549	0.5910912	0.17	14.1	15.3
DF Sge	RRab	242 9790.526	0.482627	0.11	13.8	15.4
V373 Sge	RRab	242 9791.456	0.542046	0.1	13.6	14.5

VV Del = USNO-A2.0 1050-17436316 (EB)

First elements with a period of 2.60595 days have been derived by Jensch (GCVS, Samus et al. 2012). By estimating VV Del on 220 exposures I found a period change at around epoch 4800.

The following elements could be derived:

JD 242 5800 to 243 8000:

$$\text{Min} = 242\,5827.492 + 2.605896 E_1$$

from JD 243 8000 on:

$$\text{Min} = 243\,8268.249 + 2.6057403 E_2$$

Minima are listed in table 58 in the appendix.

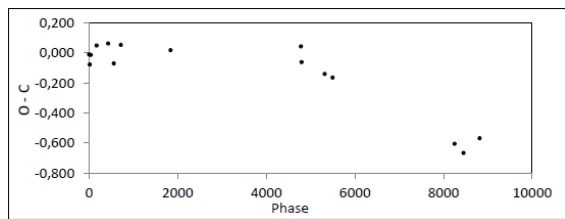



Figure 1: O-C curve of VV Del.

BE Del = USNO-A2.0 0975-18816842 (EA)

Only one minimum could be extracted out of 224 observations. This minimum is in good agreement with elements given in GVCS (Samus et al. 2012).

Table 3: Minimum of BE Del. 

JD hel.	Epoch	0-C	Obs.
244 8837.482	3641	0.008	Hau

BF Del = USNO-A2.0 0975-18871008 (EA)

The period of 3.^d76016 given by Hoffmeister (Ahnert et al. 1947) appears too large. For calculation of new elements I have used only the deepest minima of Hoffmeister. The period is variable, in particular changing at around epoch 4800.

The following elements could be derived:

JD 242 5000 to 244 5000:

$$\text{Min} = 242\,5808.519 + 3.76007 E_1$$

from JD 244 5000 on:

$$\text{Min} = 244\,4131.408 + 3.7597684 E_2$$

Figure 2 shows the normalized light-curve of BF Del using the two derived periods. A secondary minimum with an amplitude of 0.1 mag and $d \approx 0.03$ is clearly seen.

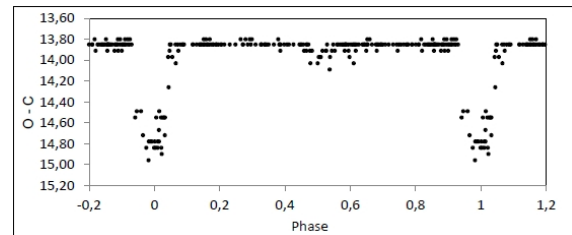


Figure 2: Normalized light-curve of BF Del.

Minima are listed in table 59 in the appendix.

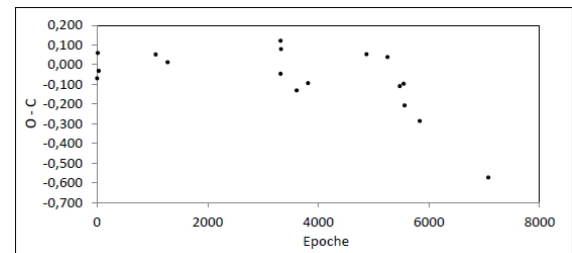



Figure 3: O-C curve of BF Del.

BL Del = USNO-A2.0 1050-18060326 (EA)

The observations are in good agreement with GCVS elements.

Table 4: Minima of BL Del (this paper, Richter 1961, OEJV O-C gateway). 

JD hel.	Epoch	0-C	Obs.
242 5863.485	0	0.000	Ric
243 8652.306	3335	0.163	Hau
244 2713.260	4394	0.191	Hau
244 3748.487	4664	0.054	Hau
244 5585.377	5143	0.133	Hau
244 6298.528	5329	0.033	Hau
244 7391.468	5614	0.089	Hau
244 7414.399	5620	0.012	Hau
244 8503.440	5904	0.004	Pas
244 9546.493	6176	0.024	Hau
244 9569.504	6182	0.027	Hau
244 9592.482	6188	-0.003	Pas

BM Del = USNO-A2.0 1050-18147870 (RRab)

Hoffmeister's period of 0.^d351 (Ahnert et al. 1947) is obviously incorrect. Another period given by Derevyagin and Shugarov (1979) can be applied only to the interval JD 245 8000 to 244 4000.

221 plate observations between JD 242 5000 and 245 0000 yield a significantly variable period with following elements:

JD 242 5000 to 243 1000:

$$\text{Max} = 242\,5478.431 + 0.5409159 E_2$$

JD 243 8000 to 244 4000:

$$\text{Max} = 243\,9739.405 + 0.5411429 E$$

from JD 244 4000 on:

$$\text{Max} = 244\,9568.525 + 0.5410088 E_1$$

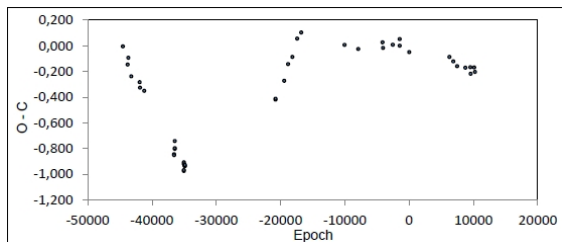


Figure 4: O-C curve of BM Del.

Maxima are listed in table 60 in the appendix.

BO Del = USNO-A2.0 0975-19383546 (EB)

Hoffmeister (Ahnert 1947) classified BO Del as of RW Aur type, while Meinunger (Gessner & Meinunger 1973) figured out its eclipsing nature with a period of 1.287 days.

From 223 plate estimations I could derive the following elements:

$$\text{Min} = 242\,5938.236 + 0.51667 E$$

Apparently, the stars belongs to EB type.

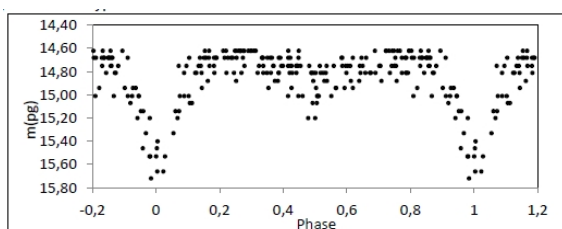


Figure 5: Normalized light-curve of BO Del.

Table 5: Minima of BO Del (this paper, Gessner & Meinunger 1973, Safar & Zejda 2002, OEJV O-C gateway 2012).

JD hel.	Epoch	0-C	Obs.
242 5938.251	0	0.015	Mei
242 6592.364	1266	0.024	Mei
242 9789.500	7454	0.006	Mei/Hau
243 0606.339	9035	-0.010	Hau
243 0608.428	9039	0.012	Mei/Hau
243 0612.537	9047	-0.012	Hau
243 8323.303	23971	-0.030	Hau
243 9380.408	26017	-0.031	Hau
244 0452.493	28092	-0.037	Hau
244 6650.490	40088	-0.013	Hau
244 7822.310	42356	-0.001	Hau
244 8504.342	43676	0.027	Hau
244 8834.445	44315	-0.022	Hau
245 1435.385	49349	0.001	Zej
245 4327.455	54946.5	0.011	Agr

BP Del = USNO-A2.0 1050-18368699 (EA)

Hoffmeister (Ahnert et al. 1947) has investigated this star but failed to derive elements. He published five minima only, another minimum was found by Otero (2007), who was able to calculate first elements. I have found seven minima in addition and could improve the period:

$$\text{Min} = 245\,1378.624 + 5.3501638 E$$


Table 6: Minima of BP Del (this paper, Ahnert et al. 1947, Otero 2007).

JD hel.	Epoch	0-C	Obs.
242 5478.476	-4841	-0.005	Hof
242 5826.410	-4776	0.168	Hof
242 7281.510	-4504	0.024	Hof
242 7693.360	-4427	-0.089	Hof
243 0614.541	-3881	-0.097	Hof/Hau
244 0453.451	-2042	-0.139	Hau
244 1903.409	-1771	-0.075	Hau
244 1930.335	-1766	0.100	Hau
244 6713.399	-872	0.118	Hau
244 9163.527	-414	-0.129	Hau
244 9511.524	-349	0.107	Hau
244 9543.530	-343	0.012	Hau
245 1378.620	0	-0.004	Ote

BQ Del = USNO-A2.0 0975-19527851 (EA)

The elements given in GCVS (Samus et al. 2012) could slightly be improved:

$$Min = 242\ 5830.393 + 3.4265173 E$$

Table 7: Minima of BQ Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	0-C	Obs.
242 5830.360	0	-0.033	Hof
242 6649.280	239	-0.051	Hof
242 9791.483	1156	0.036	Hau/Hof
243 8289.314	3636	0.104	Hau
244 0499.353	4281	0.039	Hau
244 2637.443	4905	-0.017	Hau
244 4131.393	5341	-0.029	Hau
244 8767.449	6694	-0.051	Hau

BS Del = USNO-A2.0 1050-18814699 (EB)

Obviously the star has a variable period. The elements given by Hoffmeister (Ahnert et al. 1947) could be improved:

$$Min = 244\ 8832.509 + 2.977457 E.$$

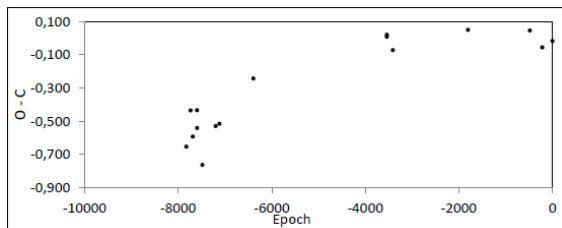



Figure 6: O-C curve of BS Del.

Table 8: Minima of BS Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	0-C	Obs.
242 5527.300	-7827	-0.653	Hof
242 5795.490	-7737	-0.434	Hof
242 5938.250	-7689	-0.592	Hof
242 6206.380	-7599	-0.433	Hof
242 6209.250	-7598	-0.541	Hof
242 6545.480	-7485	-0.763	Hof
242 7394.290	-7200	-0.529	Hof
242 7632.500	-7120	-0.515	Hof
242 9791.430	-6395	-0.241	Hof
243 8286.367	-3542	0.011	Hau

Table 8 (cont'd).

243 8289.356	-3541	0.022	Hau
243 8670.378	-3413	-0.070	Hau
244 3449.319	-1808	0.052	Hau
244 7391.468	-484	0.048	Hau
244 8186.347	-217	-0.054	Hau
244 8832.494	0	-0.015	Hau

BT Del = USNO-A2.0 1050-18839178 (EA)

To calculate the O-C data elements given in GCVS (Samus et al. 2012) have been used.

Table 9: Minima of BT Del (this paper). 

JD hel.	Epoch	0-C	Obs.
243 9683.503	3896	0.088	Hau
244 3013.454	4836	-0.013	Hau
244 5284.251	5477	-0.028	Hau
244 5585.377	5562	-0.024	Hau
244 6708.451	5879	0.043	Hau
244 7413.397	6078	0.009	Hau
244 8458.502	6373	0.045	Hau
244 9542.480	6679	-0.016	Hau

CG Del = USNO B₁ 1075-0626115 (RRab)

The elements given in GCVS (Samus et al. 2012) could slightly be improved:

$$Max = 242\ 5795.408 + 0.630939 E.$$

Table 10: Maxima of CG Del (this paper). 

JD hel.	Epoch	0-C	Obs.
242 9790.485	6332	-0.029	Hau
243 0612.583	7635	-0.044	Hau
243 0614.499	7638	-0.021	Hau
243 0619.529	7646	-0.039	Hau
243 7145.398	17989	0.028	Hau
243 8287.396	19799	0.027	Hau
243 8289.314	19802	0.052	Hau
243 8311.354	19837	0.009	Hau
243 8318.267	19848	-0.018	Hau
243 8323.303	19856	-0.030	Hau
243 8670.378	20406	0.029	Hau
243 9388.342	21544	-0.016	Hau
244 0149.273	22750	0.003	Hau
244 0441.457	23213	0.062	Hau
244 0453.397	23232	0.014	Hau
244 6650.490	33054	0.024	Hau
244 7804.439	34883	-0.014	Hau

Table 10 (cont'd).

244 9546.493	37644	0.017	Hau
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CN Del = USNO-A2.0 0975-18879549 (EW)

The first period derived by Hoffmeister (Ahnert et al. 1947) is incorrect. The period is variable:

JD 242 9000 to 243 1000:

$$\text{Min} = 242\,9790.486 + 0.567078 E$$

from JD 243 7000 on:

$$\text{Min} = 244\,9625.388 + 0.567073 E$$

The star belongs to EW type stars.

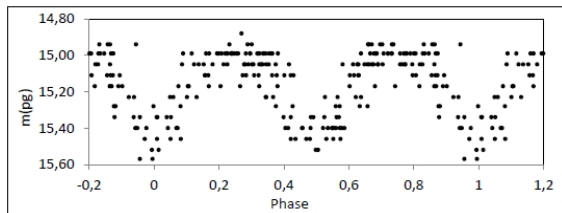


Figure 7: Mean light-curve of CN Del.

Table 11: Minima of CN Del (this paper, Ahnert et al. 1947, OEJV O-C gateway). 

JD hel.	Epoch	O-C	Obs.
242 9790.510	-34977.5	-0.082	Hof/Hau
242 9846.384	-34879	-0.065	Hof/Hau
243 0608.471	-33535	-0.124	Hof/Hau
243 0613.555	-33526	-0.144	Hof/Hau
243 8289.314	-19990.5	-0.001	Hau
243 8290.395	-19988.5	-0.054	Hau
243 8296.390	-19978	-0.014	Hau
243 8318.267	-19939.5	0.031	Hau
243 8323.303	-19930.5	-0.037	Hau
243 8325.308	-19927	-0.016	Hau
243 8670.378	-19318.5	-0.010	Hau
243 9380.408	-18066.5	0.044	Hau
243 9385.443	-18057.5	-0.024	Hau
243 9683.503	-17532	0.039	Hau
244 0149.332	-16710.5	0.017	Hau
244 0483.355	-16121.5	0.034	Hau
244 2359.247	-12813.5	0.049	Hau
244 2637.394	-12323	0.047	Hau
244 4871.359	-8383.5	0.027	Hau
244 6351.395	-5773.5	0.003	Hau
244 6650.490	-5246	-0.033	Hau


Table 11 (cont'd).

244 6714.301	-5133.5	-0.018	Hau
244 7366.480	-3983.5	0.027	Hau
244 7414.399	-3899	0.029	Hau
244 7475.286	-3791.5	-0.045	Hau
244 7769.399	-3273	0.041	Hau
244 7776.397	-3260.5	-0.049	Hau
244 7849.253	-3132	-0.062	Hau
244 8559.287	-1880	-0.004	Hau
244 8770.537	-1507.5	0.012	Hau
244 8837.482	-1389.5	0.042	Hau
244 9163.527	-814.5	0.020	Hau
244 9213.439	-726.5	0.030	Hau
244 9516.507	-192	-0.003	Hau
244 9567.517	-102	-0.030	Hau
244 9625.363	0	-0.025	Hau
245 0334.462	1250.5	-0.051	Die

CP Del = USNO-A2.0 0975-18902943 (RRab)

The 222 observations fit better with a slightly increased period (compared to GCVS, Samus et al. 2012).

$$\text{Max} = 242\,5830.380 + 0.5274752 E$$


Table 12: Maxima of CP Del. 

JD hel.	Epoch	O-C	Obs.
243 8290.395	23622	-0.004	Hau
243 8318.351	23675	-0.004	Hau
243 8318.368	23675	0.013	Hau
244 0441.457	27700	0.014	Hau
244 5585.377	37452	-0.004	Hau
244 6298.528	38804	0.000	Hau
244 7325.529	40751	0.007	Hau
244 7391.468	40876	0.012	Hau
244 8559.287	43090	0.001	Hau
244 8832.494	43608	-0.025	Hau
244 9215.483	44334	0.017	Hau
244 9542.480	44954	-0.020	Hau

CV Del = USNO-A2.0 1050-17903395 (RRab)

Table 14 (cont'd).

The elements in GCVS (Samus et al. 2012) are correct.

Table 13: Maxima of CV Del. 

JD hel.	Epoch	0-C	Obs.
243 8288.355	16846	0.010	Hau
243 8311.269	16877	0.001	Hau
243 8325.308	16896	-0.010	Hau
244 0453.451	19774	-0.021	Hau
244 2713.260	22830	0.011	Hau
244 5556.481	26675	0.024	Hau
244 6351.395	27750	0.023	Hau
244 6709.293	28234	0.024	Hau
244 7412.478	29185	-0.013	Hau
244 8096.485	30110	-0.003	Hau
244 8834.445	31108	-0.020	Hau
244 9163.527	31553	0.004	Hau
244 9569.474	32102	-0.010	Hau

242 6651.300	-32423		Hof
242 7280.490	-31342	-0.750	Hof
242 7624.470	-30751	-0.775	Hof
242 7933.550	-30220	-0.775	Hof
242 9790.470	-27030	-0.666	Hof/Hau
242 9846.333	-26934	-0.682	Hof/Hau
243 0608.340	-25625	-0.607	Hof/Hau
243 0613.580	-25616	-0.606	Hof/Hau
243 8290.310	-12428	-0.246	Hau
243 8318.267	-12380	-0.228	Hau
243 8652.392	-11806	-0.212	Hau
244 0116.321	-9291	-0.195	Hau
244 0499.301	-8633	-0.219	Hau
244 5524.511	0	-0.039	Hau
244 6644.460	1924	0.003	Hau
244 6714.301	2044	-0.005	Hau
244 7325.474	3094	-0.008	Hau
244 7413.397	3245	0.022	Hau
244 8800.503	5628	0.050	Hau
244 8832.494	5683	0.027	Hau
245 1281.812	9891	-0.015	Pas
245 2735.245	12388	-0.017	Pas
245 2809.766	12516	-0.001	Hau/ASAS
245 3178.763	13150	-0.038	Hau/ASAS
245 3561.786	13808	-0.018	Hau/ASAS
245 3641.564	13945	0.016	Hau/ASAS
245 3561.809	13808	0.005	Hau/ASAS
245 3617.662	13904	-0.021	Hau/ASAS
245 3673.529	14000	-0.033	Hau/ASAS
245 4256.817	15002	0.018	Hau/ASAS
245 4277.750	15038	-0.003	Hau/ASAS
245 4558.913	15521	0.019	Hau/ASAS
245 4611.882	15612	0.019	Hau/ASAS
245 4758.559	15864	0.014	Hau/ASAS

CW Del = USNO-A2.0 0975-19128508 (RRab)

The period given by Hoffmeister (Ahnert et al. 1947) appears as too large. Three maxima given by Hoffmeister are slight brightenings only. The period is variable.

JD 242 6000 to 244 1000:

$$\text{Max} = 242\ 9790.498 + 0.5820624\ E$$

from JD 244 1000 on:

$$\text{Min} = 244\ 5524.550 + 0,5820723\ E$$

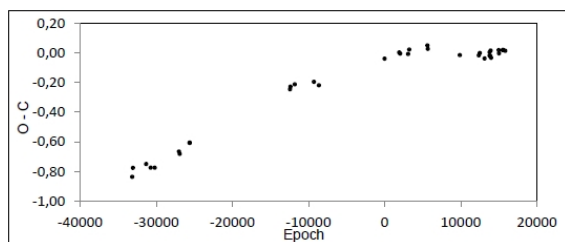



Figure 8: O-C curve of CW Del.

Table 14: Maxima of CW Del (this paper, Ahnert et al. 1947, GEOS database 2012). O-C calculated with respect to the second elements. 

JD hel.	Epoch	0-C	Obs.
242 5938.250	-33648		Hof
242 6209.390	-33182	-0.837	Hof
242 6265.330	-33086	-0.776	Hof
242 6619.320	-32478		Hof

CY Del = USNO-A2.0 0975-19183697 (RRab)

The period of Hoffmeister (Ahnert et al. 1947) had to be increased slightly in order to fit the observations.

$$\text{Max} = 244\ 8504.340 + 0.4523684\ E$$

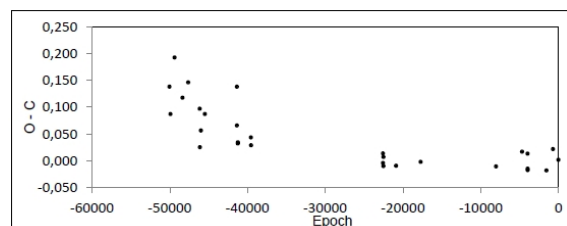



Figure 9: O-C -curve of CY Del.

Table 15: Maxima of CY Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	0-C	Obs.
242 5863.440	-50050	0.138	Hof
242 5921.292	-49922	0.087	Hof
242 6162.510	-49389	0.193	Hof
242 6624.303	-48368	0.118	Hof
242 6956.370	-47634	0.146	Hof
242 7624.469	-46157	0.097	Hof
242 7637.516	-46128	0.026	Hof
242 7696.355	-45998	0.057	Hof
242 7927.546	-45487	0.087	Hof
242 9789.473	-41371	0.066	Hof
242 9790.450	-41369	0.138	Hof
242 9845.533	-41247	0.032	Hof
242 9846.440	-41245	0.035	Hof
243 0606.428	-39565	0.044	Hof
243 0614.556	-39547	0.029	Hof
243 8289.423	-22581	0.014	Hau
243 8290.310	-22579	-0.004	Hau
243 8318.351	-22517	-0.010	Hau
243 8318.368	-22517	0.007	Hau
243 9054.355	-20890	-0.009	Hau
244 0483.394	-17731	-0.002	Hau
244 4871.359	-8031	-0.010	Hau
244 6387.273	-4680	0.017	Hau
244 6708.451	-3970	0.014	Hau
244 6713.399	-3959	-0.015	Hau
244 6714.301	-3957	-0.017	Hau
244 7805.413	-1545	-0.018	Hau
244 8186.347	-703	0.022	Hau
244 8504.342	0	0.002	Hau

DD Del = USNO-A2.0 1050-18114862 (RRab)

The observations can fairly good be represented by the following elements:

$$\text{Max} = 242\ 5535.419 + 0.4902493 E$$

Table 16: Maxima of DD Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	0-C	Obs.
242 5535.408	0	-0.011	Hof
242 5807.505	555	-0.002	Hof
242 5831.516	604	-0.014	Hof
242 5862.451	667	0.036	Hof
242 6592.368	2156	-0.028	Hof
242 6649.281	2272	0.016	Hof
242 6677.240	2329	0.030	Hof

243 0608.490	10348	-0.029	Hof/Hau
243 0612.451	10356	0.010	Hof/Hau
243 0613.400	10358	-0.021	Hof/Hau
243 0614.368	10360	-0.034	Hof/Hau
243 8286.324	26009	0.011	Hau
243 8311.333	26060	0.017	Hau
243 8315.285	26068	0.047	Hau
243 9385.443	28251	-0.009	Hau
243 9683.503	28859	-0.021	Hau
244 0441.457	30405	0.008	Hau
244 0499.301	30523	0.003	Hau
244 1930.335	33442	-0.001	Hau
244 2713.260	35039	-0.004	Hau
244 6351.395	42460	-0.009	Hau
244 6708.293	43188	-0.013	Hau
244 6709.293	43190	0.007	Hau
244 8458.502	46758	0.006	Hau
244 8861.467	47580	-0.014	Hau
244 9486.544	48855	-0.005	Hau

DE Del = USNO-A2.0 1050-18133521 (RRab)

The period ($P=0.^d297$) given by Hoffmeister (Ahnert et al. 1947) is wrong. The star has a variable period. Apparently, a period change happend at around epoch -35,000.

JD 242 5000 to 243 1000:

$$\text{Max} = 243\ 0614.596 + 0.422706 E$$

from JD 243 7000 on:

$$\text{Min} = 244\ 9547.511 + 0.422692 E$$

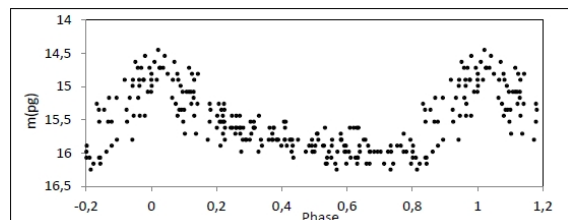


Figure 10: Mean light-curve of DE Del.

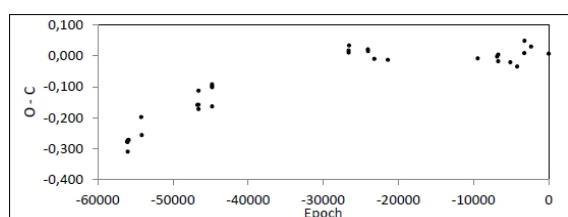



Figure 11: O-C curve of DE Del.

Table 17: Maxima of DE Del (this paper, Ahnert et al. 1947). The O-C values are calculated using the second elements. 

JD hel.	Epoch	O-C	Obs.
242 5830.408	-56109	-0.278	Hof
242 5857.459	-56045	-0.279	Hof
242 5865.459	-56026	-0.310	Hof
242 5882.404	-55986	-0.273	Hof
242 5921.292	-55894	-0.272	Hof
242 6624.303	-54231	-0.198	Hof
242 6651.297	-54167	-0.256	Hof
242 9789.460	-46743	-0.159	Hof
242 9846.510	-46608	-0.172	Hof
242 9846.524	-46608	-0.158	Hau
242 9847.415	-46606	-0.113	Hof
243 0608.281	-44806	-0.092	Hof
243 0613.344	-44794	-0.102	Hau
243 0613.348	-44794	-0.098	Hof
243 0614.550	-44791	-0.164	Hau
243 8290.395	-26632	0.017	Hau
243 8296.306	-26618	0.011	Hau
243 8318.309	-26566	0.034	Hau
243 9378.408	-24058	0.021	Hau
243 9381.361	-24051	0.015	Hau
243 9739.356	-23204	-0.010	Hau
244 0499.353	-21406	-0.013	Hau
244 5556.445	-9442	-0.008	Hau
244 6644.460	-6868	-0.002	Hau
244 6707.426	-6719	-0.017	Hau
244 6708.293	-6717	0.004	Hau
244 7390.493	-5103	-0.021	Hau
244 7776.397	-4190	-0.035	Hau
244 8176.307	-3244	0.009	Hau
244 8187.337	-3218	0.049	Hau
244 8559.287	-2338	0.030	Hau
244 9547.518	0	0.007	Hau

DG Del = USNO-A2.0 0975-19268454 (RRab)

The elements ($P=0.^d3269$) given by Hoffmeister (Ahnert et al. 1947) do not fit my observations. New elements:

$$\text{Max} = 242\ 9789.435 + 0.4904699 E$$

Table 18: Maxima of DG Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	O-C	Obs.
242 9789.456	0	0.021	Hof/Hau
242 9790.429	2	0.013	Hof/Hau
242 9791.402	4	0.005	Hof/Hau

Table 18 (cont'd).

242 9846.340	116	0.010	Hof/Hau
243 0608.479	1670	-0.041	Hof/Hau
243 8286.324	17324	-0.012	Hau
243 0613.390	1680	-0.034	Hof/Hau
243 0614.377	1682	-0.028	Hof/Hau
243 8284.385	17320	0.011	Hau
243 8288.313	17328	0.016	Hau
243 8311.354	17375	0.004	Hau
243 8315.285	17383	0.012	Hau
243 8670.378	18107	0.005	Hau
244 0116.321	21055	0.042	Hau
244 0441.457	21718	-0.003	Hau
244 0499.356	21836	0.020	Hau
244 2359.247	25628	0.049	Hau
244 3013.454	26962	-0.030	Hau
244 4871.359	30750	-0.025	Hau
244 6644.460	34365	0.027	Hau
244 7412.478	35931	-0.031	Hau
244 7473.310	36055	-0.017	Hau
244 7475.286	36059	-0.003	Hau
244 8747.564	38653	-0.004	Hau
244 9215.483	39607	0.007	Hau
244 9547.518	40284	-0.006	Hau

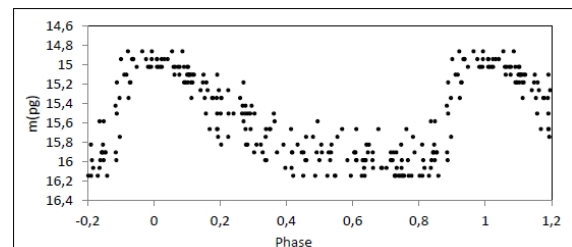



Figure 12: Mean light-curve of DG Del.

DH Del = USNO-A2.0 0975-19308912 (RRab)

The elements given by Hoffmeister (Ahnert et al. 1947) had slightly to be improved:

$$\text{Max} = 242\ 5807.518 + 0.5929394 E$$

Table 19: Maxima of DH Del (this paper, Ahnert et al. 1947, GEOS database, 2012). 

JD hel.	Epoch	O-C	Obs.
242 5807.505	0	-0.013	Ahn
242 5883.406	128	-0.008	Ahn
242 6651.297	1423	0.026	Ahn
242 7274.468	2474	0.018	Ahn
242 7281.512	2486	-0.053	Ahn

Table 19 (cont'd).

242 9791.458	6719	-0.020	Ahn/Hau
242 9845.442	6810	0.007	Ahn/Hau
242 9851.372	6820	0.007	Ahn/Hau
243 0608.545	8097	-0.003	Ahn/Hau
243 0614.482	8107	0.004	Ahn/Hau
243 8288.313	21049	0.014	Hau
243 8323.264	21108	-0.019	Hau
243 8652.392	21663	0.028	Hau
243 9683.503	23402	0.017	Hau
244 0116.321	24132	-0.011	Hau
244 0452.550	24699	0.022	Hau
244 0483.394	24751	0.033	Hau
244 0499.388	24778	0.018	Hau
244 3013.454	29018	0.020	Hau
244 5524.511	33253	-0.021	Hau
244 5973.357	34010	-0.030	Hau
244 6387.273	34708	0.014	Hau
244 7390.493	36400	-0.019	Hau
244 7415.401	36442	-0.015	Hau
244 7475.286	36543	-0.016	Hau
244 7744.481	36997	-0.016	Hau
244 7769.399	37039	-0.001	Hau
244 8771.504	38729	0.036	Hau
244 8800.503	38778	-0.019	Hau
244 9268.327	39567	-0.024	Hau
244 9486.544	39935	-0.009	Hau
245 1282.002	42963	0.029	Pas
245 4987.8419	49213	-0.003	ASAS/Hau
245 5047.7441	49314	0.013	ASAS/Hau

DI Del = USNO-A2.0 0975-19304006 (RRab)

The period ($P=0.^d367$) derived by Hoffmeister (Ahnert et al. 1947) needs to be significantly corrected:

$$\text{Max} = 242\,9791.524 + 0.5893295 E$$

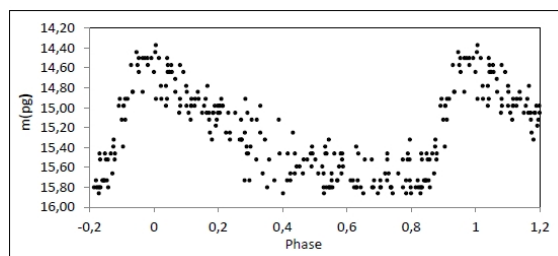


Figure 13: Mean light-curve of DI Del.

Table 20: Maxima of DI Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	0-C	Obs.
242 5527.300	-7348	0.037	Hof
242 5535.408	-7334	0.021	Hof
242 5889.411	-6724	0.023	Hof
242 5938.250	-6640	0.114	Hof
242 6243.432	-6114	0.043	Hof
242 7280.486	-4327	0.048	Hof
242 7655.425	-3681	0.094	Hof
242 7927.546	-3212	0.040	Hof
242 9790.440	-2	0.077	Hof/Hau
242 9791.483	0	-0.041	Hau
242 9791.508	0	-0.016	Hof
242 9845.497	93	0.002	Hof/Hau
243 0593.530	1382	-0.009	Hof/Hau
243 0606.326	1404	0.019	Hof
243 0606.339	1404	0.032	Hau
243 0607.467	1406	0.000	Hof/Hau
243 0613.330	1416	0.059	Hof/Hau
243 0614.415	1418	-0.016	Hof/Hau
243 7145.428	12672	-0.031	Hau
243 8286.367	14638	-0.020	Hau
243 8289.314	14643	0.025	Hau
243 8290.438	14645	-0.012	Hau
243 8311.312	14681	-0.029	Hau
244 2632.522	22127	0.047	Hau
244 3748.444	24050	-0.004	Hau
244 6709.293	29152	0.003	Hau
244 7414.399	30367	0.009	Hau
244 8834.445	32814	-0.011	Hau
244 9163.527	33381	0.024	Hau
244 9546.493	34041	-0.028	Hau

DQ Del = USNO-A2.0 0975-19435815 (RRab)


The star exhibits a variable period:

JD 242 5000 to 243 7000:

$$\text{Max} = 242\,5862.418 + 0.5349607 E$$

from JD 243 7000 on:

$$\text{Max} = 243\,7169.370 + 0.5349704 E$$

Table 21: Maxima of DQ Del (this paper, Ahnert et al. 1947). The O-C values are calculated with respect to the first elements. 

JD hel.	Epoch	O-C	Obs.
242 5862.451	0	0.033	Hof
242 5885.391	43	-0.030	Hof
242 5921.292	110	0.028	Wen
242 6162.511	561	-0.020	Hof
242 6206.385	643	-0.013	Hof
242 9846.300	7447	0.030	Hof
242 9847.345	7449	0.005	Hof
243 0593.595	8844	-0.015	Hof
243 0606.440	8868	-0.009	Hof
243 0612.368	8879	0.034	Hof
243 0613.400	8881	-0.004	Hof
243 0614.462	8883	-0.012	Hof
243 0907.490	9431	-0.142	Hof
243 7169.383	21136	0.036	Hau
243 8315.285	23278	0.052	Hau
243 8323.303	23293	0.045	Hau
243 9380.408	25269	0.068	Hau
244 0452.493	27273	0.092	Hau
244 4116.474	34122	0.127	Hau
244 5524.511	36754	0.147	Hau
244 5973.342	37593	0.146	Hau
244 6714.301	38978	0.185	Hau
244 7390.493	40242	0.187	Hau
244 8767.549	42816	0.254	Hau
244 9486.544	44160	0.261	Hau
244 9516.507	44216	0.267	Hau
244 9569.474	44315	0.273	Hau

DS Del = USNO-A2.0 0975-19501990 (RRab)

As the O-C diagram (Figure 14) displays the star has a significantly varying period. The O-C data are calculated with

$$\text{Max} = 242\,5885.411 + 0.476125 E.$$

From JD 244 6000 on the following elements are valid:

$$\text{Max} = 244\,5973.885 + 0.476225 E.$$

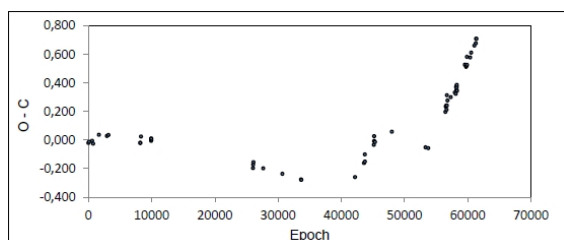


Figure 14: O-C curve of DS Del.

Table 22: Maxima of DS Del (this paper, Ahnert et al. 1947). 

JD hel.	Epoch	O-C	Obs.
242 5885.391	0	-0.020	Hof
242 5938.249	111	-0.012	Hof
242 6162.511	582	-0.005	Hof
242 6243.432	752	-0.025	Hof
242 6677.244	1663	0.037	Hof
242 7280.486	2930	0.029	Hof
242 7394.287	3169	0.036	Hof
242 9790.570	8202	-0.018	Hof
242 9791.520	8204	-0.020	Hof
242 9846.320	8319	0.025	Hof
243 0612.375	9928	-0.005	Hau
243 0613.333	9930	0.001	Hau
243 0614.296	9932	0.011	Hau
243 0619.532	9943	0.010	Hau
243 8286.367	26046	-0.196	Hau
243 8296.390	26067	-0.171	Hau
243 8318.309	26113	-0.154	Hau
243 9054.355	27659	-0.197	Hau
244 0499.356	30694	-0.236	Hau
244 1903.409	33643	-0.275	Hau
244 1924.356	33687	-0.278	Hau
244 5973.342	42191	-0.259	Hau
244 6650.490	43613	-0.161	Hau
244 6713.399	43745	-0.100	Hau
244 6714.301	43747	-0.150	Hau
244 7391.468	45169	-0.033	Hau
244 7412.478	45213	0.027	Hau
244 7413.397	45215	-0.006	Hau
244 7475.286	45345	-0.013	Hau
244 8747.564	48017	0.059	Hau
245 1281.8680	53340	-0.050	Hau/ASAS
245 1486.1200	53769	-0.056	Hau/ASAS
245 2783.8145	56494	0.198	Hau/ASAS
245 2812.8944	56555	0.234	Hau/ASAS
245 2836.7080	56605	0.241	Hau/ASAS
245 2866.6756	56668	0.213	Hau/ASAS
245 2894.3920	56726	0.314	Hau/ASAS
245 2898.6054	56735	0.243	Hau/ASAS
245 2940.5395	56823	0.278	Hau/ASAS
245 3185.7668	57338	0.301	Hau/ASAS
245 3492.9004	57983	0.334	Hau/ASAS
245 3563.8338	58132	0.324	Hau/ASAS
245 3588.6393	58184	0.371	Hau/ASAS
245 3617.6616	58245	0.350	Hau/ASAS
245 3620.5481	58251	0.380	Hau/ASAS
245 3628.6311	58268	0.369	Hau/ASAS
245 3639.5996	58291	0.386	Hau/ASAS
245 3659.5566	58333	0.346	Hau/ASAS
245 4245.8482	59564	0.528	Hau/ASAS
245 4338.6780	59759	0.513	Hau/ASAS
245 4361.5373	59807	0.518	Hau/ASAS

Table 22 (cont'd).

245 4402.5486	59893	0.583	Hau/ASAS
245 4411.5384	59912	0.526	Hau/ASAS
245 4645.8441	60404	0.579	Hau/ASAS
245 4720.6294	60561	0.612	Hau/ASAS
245 4965.8834	61076	0.662	Hau/ASAS
245 5071.5988	61298	0.678	Hau/ASAS
245 5101.6276	61361	0.710	Hau/ASAS
245 5111.6242	61382	0.708	Hau/ASAS

DU Del = USNO-A2.0 0975-19561218 (RRab)

The O-C values are calculated with the following elements:

$$\text{Max} = 242\,5478.445 + 0.651486 E.$$

The period appears as variable as shown in Figure 15. Quadratic elements can also be derived:

$$y = 3 \cdot 10^{-10} x^2 - 10^{-5} x + 0.0319$$

(with $y = O - C$ and $x = E$). Two maxima at epochs 43160 and 43186 do not fit the O-C curve.

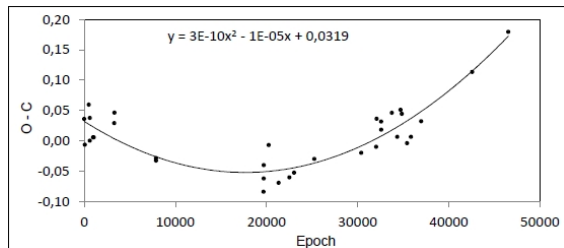


Figure 15: O-C curve of DU Del.

Table 23: Maxima of DU Del (this paper, Ahnert et al. 1947, GEOS database 2012).

JD hel.	Epoch	O-C	Obs.
242 5478.481	0	0.036	Ahn
242 5527.300	75	-0.006	Ahn
242 5807.505	505	0.060	Ahn
242 5880.412	617	0.000	Ahn
242 5882.404	620	0.038	Ahn
242 6119.513	984	0.006	Ahn
242 6162.511	1050	0.006	Ahn
242 7624.469	3294	0.029	Ahn
242 7637.516	3314	0.046	Ahn
243 0613.425	7882	-0.033	Ahn
243 0613.429	7882	-0.029	Hau
243 8296.348	19675	-0.084	Hau
243 8315.285	19704	-0.040	Hau
243 8670.378	20249	-0.007	Hau
243 9378.481	21336	-0.069	Hau

Table 23 (cont'd).

244 0145.289	22513	-0.060	Hau
244 0483.418	23032	-0.053	Hau
244 1930.391	25253	-0.030	Hau
244 5284.251	30401	-0.020	Hau
244 6351.395	32039	-0.010	Hau
244 6387.273	32094	0.036	Hau
244 6708.451	32587	0.032	Hau
244 6714.301	32596	0.018	Hau
244 7473.310	33761	0.046	Hau
244 7860.253	34355	0.006	Hau
244 8095.484	34716	0.051	Hau
244 8187.337	34857	0.044	Hau
244 8559.287	35428	-0.004	Hau
244 8837.482	35855	0.006	Hau
244 9568.475	36977	0.032	Hau
245 3215.575	42575	0.114	LBo
245 3596.497	43160	-0.084	LBo
245 3613.450	43186	-0.069	LBo
245 5797.480	46538	0.180	LBo

DW Del = USNO-A2.0 1050-18586317 (RRab)

The period of this star is variable as shows in Figure 16. I have calculated the O-C values with the following elements:

$$\text{Max} = 242\,5865.411 + 0.6607705 E.$$

Quadratic elements can also be derived:

$$y = 2 \cdot 10^{-10} x^2 - 6 \cdot 10^{-6} x + 0.045$$

(with $y = O - C$ and $x = E$).

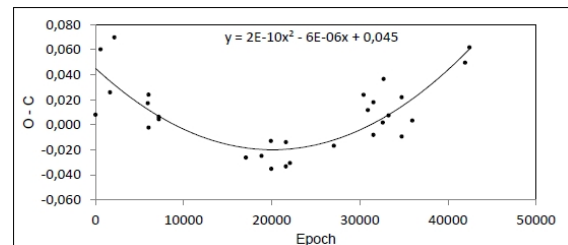


Figure 16: O-C curve of DW Del.

Table 24: Maxima of DW Del (this paper, Ahnert et al. 1947).

JD hel.	Epoch	O-C	Obs.
242 5865.419	0	0.008	Hof
242 6243.432	572	0.060	Hof
242 6956.369	1651	0.026	Hof


Table 24 (cont'd).

242 7281.512	2143	0.070	Hof
242 9790.405	5940	0.017	Hof
242 9844.595	6022	0.024	Hof
242 9846.551	6025	-0.002	Hof/Hau
243 0608.428	7178	0.006	Hof/Hau
243 0614.373	7187	0.004	Hof/Hau
243 7145.398	17071	-0.026	Hau
243 8318.267	18846	-0.025	Hau
243 9023.321	19913	-0.013	Hau
243 9054.355	19960	-0.035	Hau
244 0145.289	21611	-0.033	Hau
244 0149.273	21617	-0.014	Hau
244 0452.550	22076	-0.031	Hau
244 3748.487	27064	-0.017	Hau
244 5973.342	30431	0.024	Hau
244 6292.482	30914	0.012	Hau
244 6707.426	31542	-0.008	Hau
244 6713.399	31551	0.018	Hau
244 7412.478	32609	0.002	Hau
244 7475.286	32704	0.037	Hau
244 7849.253	33270	0.007	Hau
244 8832.494	34758	0.022	Hau
244 8834.445	34761	-0.009	Hau
244 9625.400	35958	0.003	Hau
245 3590.730	41959	0.050	Hau/ASAS
245 3913.859	42448	0.062	Hau/ASAS

EF Del = USNO-A2.0 0975-19725118 (RRab)

The elements of the maxima could slightly be improved:

$$\text{Max} = 242\ 5535.392 + 0.4475789 E.$$

Table 25: Maxima of EF Del. 

JD hel.	Epoch	0-C	Obs.
243 8291.396	28500	0.005	Hau
243 8296.306	28511	-0.008	Hau
243 8318.267	28560	0.022	Hau
243 9760.314	31782	-0.031	Hau
244 0499.301	33433	0.004	Hau
244 2637.394	38210	0.012	Hau
244 4131.393	41548	-0.007	Hau
244 5556.481	44732	-0.010	Hau
244 5674.207	44995	0.002	Hau
244 6351.395	46508	0.004	Hau
244 6351.395	46508	0.004	Hau
244 7414.399	48883	0.008	Hau
244 7475.286	49019	0.024	Hau
244 8096.485	50407	-0.017	Hau
244 8559.287	51441	-0.011	Hau
244 9163.527	52791	-0.003	Hau
244 9543.530	53640	0.006	Hau

Table 25 (cont'd).

244 9569.474	53698	-0.010	Hau
245 4385.460	64458	0.027	Age

EM Del = USNO-A2.0 0975-19847517 (RRab)

The period ($P=0.^d5782$) derived by Goetz et al. (1957) is too short. The maxima can better be represented with these new elements:

$$\text{Max} = 242\ 9791.465 + 0.582615 E.$$

Three maxima of Paschke and Wils (GEOS database 2012) fit now with different epochs.

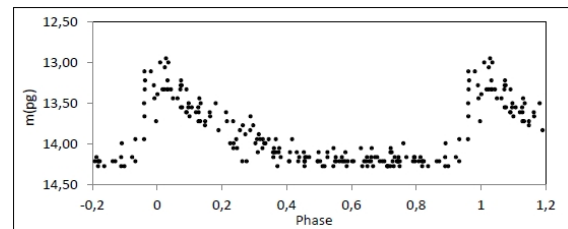



Figure 17: Mean light-curve of EM Del.

Table 26: Maxima of EM Del (this paper, GEOS database 2013). 

JD hel.	Epoch	0-C	Obs.
242 9791.454	0	-0.011	Hau
242 9844.499	91	0.016	Hau
242 9847.410	96	0.014	Hau
243 0613.555	1411	0.020	Hau
243 0619.350	1421	-0.011	Hau
244 0499.348	18379	0.002	Hau
244 4131.393	24613	0.025	Hau
244 5556.445	27059	0.001	Hau
244 6387.273	28485	0.020	Hau
244 6708.293	29036	0.019	Hau
244 8186.347	31573	-0.021	Hau
244 8832.494	32682	0.006	Hau
244 9268.327	33430	0.043	Hau
244 9569.474	33947	-0.022	Hau
245 1281.824	36886	0.022	Pas
245 1443.740	37164	-0.029	Wils
245 2804.785	39500	0.028	Pas

EO Del = USNO-A2.0 1050-18232947 (RRab)

The period is variable.

JD 242 8000 to 243 1000:

$$\text{Max} = 242\,9851.404 + 0.580861 E$$

JD 243 8000 to 244 5000:

$$\text{Max} = 243\,8318.432 + 0.5802014 E$$

from JD 244 5000 on:

$$\text{Max} = 245\,1325.848 + 0.5800469 E$$

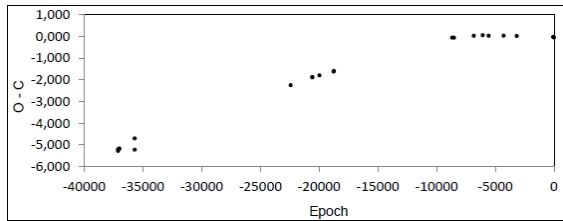




Figure 18: O-C curve of EO Del.

Table 27: Maxima of EO Del (this paper, Goetz et al. 1957, GEOS database 2012). O-C values are calculated with the latest elements. 

JD hel.	Epoch	0-C	Obs.
242 9790.454	-37118	-5.213	Goe/Hau
242 9791.550	-37116	-5.277	Goe
242 9845.600	-37023	-5.172	Goe
242 9851.399	-37013	-5.173	Goe/ Hau
243 0612.368	-35701	-5.226	Goe
243 0613.471	-35700	-4.703	Goe/Hau
243 8318.368	-22421	-2.248	Hau
243 9385.443	-20582	-1.880	Hau
243 9388.342	-20577	-1.881	Hau
243 9739.356	-19972	-1.795	Hau
244 0441.391	-18762	-1.617	Hau
244 0452.437	-18743	-1.592	Hau
244 6298.528	-8667	-0.054	Hau
244 6387.273	-8514	-0.056	Hau
244 7366.480	-6826	0.032	Hau
244 7804.439	-6071	0.056	Hau
244 8098.499	-5564	0.032	Hau
244 8837.482	-4290	0.035	Hau
244 9486.544	-3171	0.025	Hau
245 1288.127	-65	-0.018	Pas
245 1325.800	0	-0.048	Wils

EQ Del = USNO-A2.0 0975-19391998 (EA)

The O-C values fit well with GCVS elements (Samus et al. 2012).

Table 28: Minima of EQ Del (this paper). 

JD hel.	Epoch	0-C	Obs.
243 8290.353	4757	0.006	Hau
243 9378.408	5241	0.019	Hau
244 2359.247	6567	-0.016	Hau
244 3013.454	6858	0.017	Hau
244 8559.287	9325	-0.016	Hau
244 9213.439	9616	-0.037	Hau

EW Del = USNO-A2.0 1050-17070738 (EW)

The period ($P=0.^d394$) derived by Ahnert (1947) is not correct. Instead, new elements are given by:

JD 242 9000 to 244 6000:

$$\text{Min} = 242\,9844.518 + 0.488076 E_1$$

from JD 244 6000 on:

$$\text{Min} = 244\,6298.566 + 0.488068 E_2$$

The O-C values are listed in table 61 in the appendix.

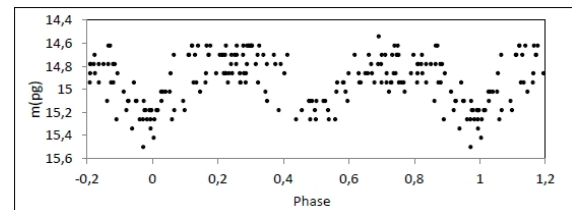


Figure 19: Mean light-curve of EW Del.

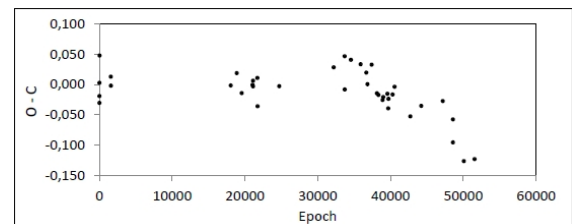


Figure 20: O-C curve of EW Del.

FG Del = USNO-A2.0 0975-19003468 (RRab)

The period ($P=0.^d4131$) derived by Huth (Goetz et al. 1957) is not correct. New elements can be given:

$$\text{Min} = 242\,9846.572 + 0.7039673 E$$

The period is variable, a change occurred at around epoch 28000.

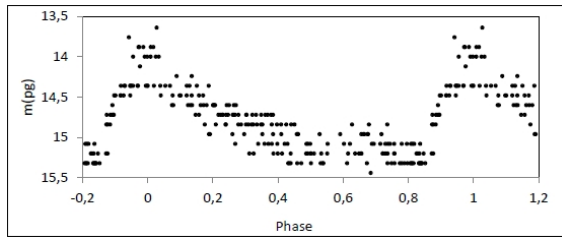


Figure 21: Mean light-curve of FG Del.

Table 29: Maxima of FG Del (this paper, GEOS database 2012). 

JD hel.	Epoch	O-C	Obs.
242 9846.551	0	-0.021	Hau
243 0619.529	1098	0.001	Hau
243 8291.396	11996	0.032	Hau
243 8296.348	12003	0.056	Hau
243 8315.285	12030	-0.014	Hau
243 9380.408	13543	0.007	Hau
244 0452.493	15066	-0.050	Hau
244 1903.409	17127	-0.011	Hau
244 1982.265	17239	0.001	Hau
244 3449.319	19323	-0.013	Hau
244 4871.359	21343	0.013	Hau
244 7413.397	24954	0.025	Hau
244 7475.286	25042	-0.035	Hau
244 9268.327	27589	0.001	Hau
245 1282.098	30450	-0.278	Pas
245 2404.973	32045	-0.231	Pas
245 5080.6222	35846	-0.362	Hau/ASAS

FI Del = USNO-A2.0 0975-19036689 (RRab)

The period ($P=0^d.4159$) derived by Huth (Goetz et al. 1957) is not correct. New elements can be given:

$$\text{Min} = 242\,9846.530 + 0.4516646 E$$

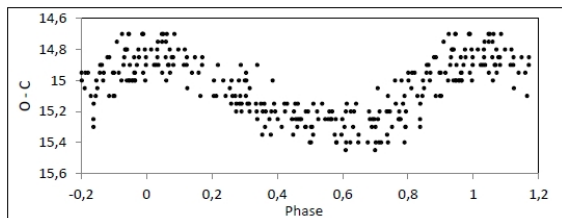



Figure 22: Mean light-curve of FI Del.

Table 30: Maxima of FI Del. 

JD hel.	Epoch	O-C	Obs.
242 9846.496	0	-0.034	Hau
243 0608.511	1687	0.023	Hau
243 0613.471	1698	0.015	Hau
243 0614.331	1700	-0.029	Hau
243 8290.395	18695	-0.005	Hau


Table 30 (cont'd).

243 8315.285	18750	0.044	Hau
243 9378.481	21104	0.021	Hau
244 0452.493	23482	-0.025	Hau
244 0453.397	23484	-0.024	Hau
244 1930.335	26754	-0.030	Hau
244 1982.334	26869	0.028	Hau
244 3013.454	29152	-0.002	Hau
244 3449.319	30117	0.006	Hau
244 4116.474	31594	0.053	Hau
244 5674.207	35043	-0.006	Hau
244 7391.468	38845	0.027	Hau
244 8504.342	41309	-0.001	Hau
244 9213.439	42879	-0.017	Hau
244 9511.524	43539	-0.031	Hau
244 9625.363	43791	-0.011	Hau

FK Del = USNO-A2.0 0975-19077067 (EW)

The period derived by Hoffmeister (Ahnert et al. 1947) needs slightly to be increased to fit the observations. New elements are:

$$\text{Min} = 242\,9790.435 + 0.666795 E$$

Table 31: Minima of FK Del (this paper, Ahnert et al. 1947, OEJV O-C database 2012). 

JD hel.	Epoch	O-C	Obs.
242 9790.457	0	0.021	Hof / Hau
242 9791.457	1.5	0.021	Hof / Hau
242 9846.445	84	-0.002	Hof / Hau
243 0593.567	1204.5	-0.024	Hof / Hau
243 8287.396	12743	-0.009	Hau
243 8288.397	12744.5	-0.008	Hau
243 8289.423	12746	0.018	Hau
243 8291.396	12749	-0.009	Hau
243 9739.356	14920.5	0.005	Hau
244 1903.409	18166	-0.025	Hau
244 3748.444	20933	-0.012	Hau
244 5528.477	23602.5	0.012	Hau
244 5556.481	23644.5	0.011	Hau
244 6702.339	25363	-0.019	Hau
244 7325.474	26297.5	-0.004	Hau
244 7366.480	26359	-0.005	Hau
244 7390.493	26395	0.003	Hau
244 7391.468	26396.5	-0.022	Hau
244 7412.478	26428	-0.016	Hau
244 7849.253	27083	0.008	Hau
244 7860.253	27099.5	0.006	Hau
244 8834.445	28560.5	0.010	Hau
245 3966.4425	36257	0.020	Age
245 3991.4293	36294.5	0.002	Age
245 4001.4271	36309.5	-0.002	Age

FL Del = USNO-A2.0 0975-19119211 (RRab)

Table 33 (cont'd).

The period given by Goetz (1957) was too short.
Improved elements are:

$$\text{Max} = 242\,9844.507 + 0.480292 E.$$

Table 32: Maxima of FL Del (this paper, Goetz et al. 1957). 

JD hel.	Epoch	O-C	Obs.
242 9844.526	0	0.019	Goe / Hau
242 9845.497	2	0.029	Goe / Hau
242 9846.440	4	0.012	Goe / Hau
242 9847.410	6	0.021	Goe / Hau
243 0613.429	1601	-0.025	Goe / Hau
243 0614.373	1603	-0.042	Goe / Hau
243 7145.398	15201	-0.028	Hau
243 8290.438	17585	-0.004	Hau
243 8291.396	17587	-0.006	Hau
243 8318.309	17643	0.010	Hau
244 0483.467	22151	0.012	Hau
244 0499.356	22184	0.051	Hau
244 1924.356	25151	0.025	Hau
244 4871.359	31287	-0.044	Hau
244 7380.462	36511	0.014	Hau
244 7822.310	37431	-0.007	Hau
244 8098.499	38006	0.014	Hau
244 8176.307	38168	0.015	Hau
244 8188.309	38193	0.010	Hau
244 8504.342	38851	0.011	Hau
244 8769.507	39403	0.054	Hau
244 9625.363	41185	0.030	Hau

FO Del = USNO-A2.0 0975-19424751 (EA)

The observed minima of this Algol type variable can be fitted very well with the following improved elements:

$$\text{Min} = 242\,5535.412 + 1.1954073 E.$$

Table 33: Minima of FO Del (this paper, Goetz et al. 1957). 

JD hel.	Epoch	O-C	Obs.
242 5535.408	0	-0.004	Goe
242 5853.373	266	-0.017	Goe
242 5938.250	337	-0.014	Goe
242 7394.287	1555	0.017	Goe
243 0606.343	4242	0.013	Goe/ Hau
243 0613.516	4248	0.014	Goe/ Hau
243 4987.494	7907	-0.004	Goe

243 8290.395	10670	-0.013	Hau
243 8296.390	10675	0.005	Hau
243 9054.287	11309	0.014	Hau
244 0149.273	12225	0.007	Hau
244 6292.482	17364	0.018	Hau
244 8097.517	18874	-0.012	Hau
244 8103.474	18879	-0.032	Hau
244 8770.537	19437	-0.007	Hau
244 8837.482	19493	-0.004	Hau
244 9516.507	20061	0.029	Hau

FP Del = USNO-A2.0 0975-19493267 (RRc)

This is a RRc star with a variable period.

JD 242 9000 to 244 1000:

$$\text{Min} = 242\,9791.458 + 0.30066 E_1$$

from JD 244 1000 on:

$$\text{Min} = 244\,1930.369 + 0.300602 E_2$$

Table 62 in the appendix lists the O-C values.

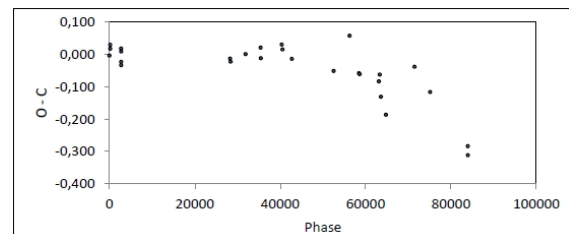



Figure 23: O-C curve of FP Del.

FQ Del = USNO-A2.0 1050-18530427 (RRab)

The elements given in the GCVS (Samus et al. 2012) can be improved:

$$\text{Max} = 244\,9547.546 + 0.57660 E.$$

Table 34: Maxima of FQ Del. 

JD hel.	Epoch	O-C	Obs.
242 9791.483	-34263	0.000	Hau
242 9844.526	-34171	-0.004	Hau
242 9847.410	-34166	-0.003	Hau
244 4871.359	-8110	0.043	Hau
244 7390.493	-3741	0.009	Hau
244 7744.481	-3127	-0.035	Hau
244 9543.530	-7	0.020	Hau
244 9547.518	0	-0.028	Hau

FS Del = USNO-A2.0 1050-18915607 (RRab)

The star has a variable period.

JD 242 9000 to 244 2000:

$$\text{Max} = 242\,9846.577 + 0.546818 E_1$$

from JD 244 2000 on:

$$\text{Max} = 244\,5524.511 + 0.546849 E_2$$

Table 63 in the appendix lists the O-C values.

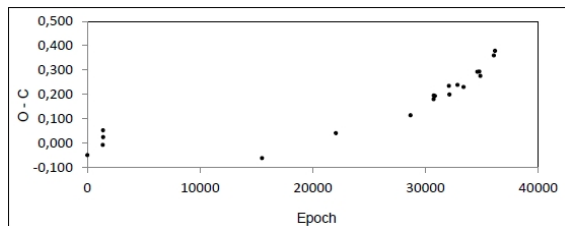


Figure 24: O-C curve of FS Del.

FT Del = USNO-A2.0 1050-18922833 (RRab)

The period given by Goetz et al. (1957) is not correct. Improved elements of this RRab star are:

$$\text{Max} = 242\,9790.512 + 0.581904 E.$$

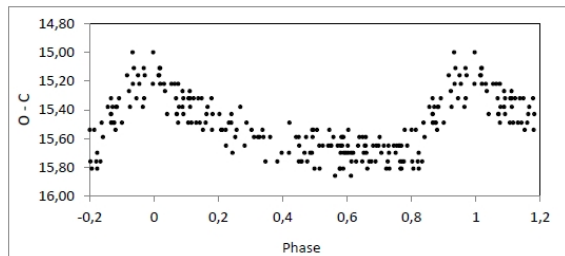


Figure 25: Mean light-curve of FT Del.

Table 35: Maxima of FT Del (this paper, Goetz et al 1975).

JD hel.	Epoch	O-C	Obs.
242 9790.513	0	0.001	Goe/Hau
242 9846.417	96	0.042	Goe/Hau
243 0593.524	1380	-0.016	Goe/Hau
243 0606.348	1402	0.007	Goe/Hau
243 0607.471	1404	-0.034	Goe/Hau
243 0613.348	1414	0.024	Goe/Hau
243 0614.460	1416	-0.028	Goe/Hau
243 8652.336	15229	0.008	Hau
243 8670.378	15260	0.011	Hau
244 0499.301	18403	0.010	Hau
244 1903.409	20816	-0.017	Hau
244 2632.522	22069	-0.029	Hau
244 5284.251	26626	-0.037	Hau

Table 35 (cont'd).

244 6298.528	28369	-0.019	Hau
244 6702.339	29063	-0.049	Hau
244 8095.484	31457	0.018	Hau
244 8834.445	32727	-0.039	Hau
244 8862.467	32775	0.051	Hau

FY Del = USNO-A2.0 0975-19400781 (RRab)

The period ($P=0.^d366$) derived by Goetz et al. (1957) is not correct. Improved elements of this RRab star are:

$$\text{Max} = 242\,9846.405 + 0.53481 E.$$

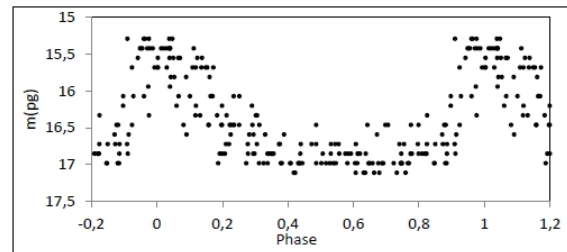


Figure 26: Mean light-curve of FY Del.

Table 36: Maxima of FY Del.

JD hel.	Epoch	O-C	Obs.
242 9846.412	0	0.007	Hau
243 0593.519	1397	-0.016	Hau
243 0606.381	1421	0.011	Hau
243 0608.511	1425	0.002	Hau
243 0613.344	1434	0.021	Hau
243 0614.373	1436	-0.019	Hau
243 8286.280	15781	0.038	Hau
243 8288.355	15785	-0.026	Hau
243 8289.423	15787	-0.027	Hau
243 8296.390	15800	-0.013	Hau
243 8311.354	15828	-0.024	Hau
243 8318.309	15841	-0.021	Hau
243 8325.308	15854	0.025	Hau
243 9054.287	17217	0.058	Hau
244 0499.301	19919	0.016	Hau
244 1982.334	22692	0.020	Hau
244 3013.454	24620	0.027	Hau
244 3449.319	25435	0.022	Hau
244 4871.359	28094	0.002	Hau
244 6714.301	31540	-0.011	Hau
244 7414.399	32849	0.020	Hau
244 7776.397	33526	-0.048	Hau
244 8188.309	34296	0.060	Hau
244 8504.342	34887	0.021	Hau
244 9567.517	36875	-0.007	Hau

GK Del = USNO-A2.0 0975-19189257 (RRab)


The star has a variable period.

JD 242 9000 to 243 1000:

$$\text{Max} = 242\,9846.331 + 0.5045535 E$$

from JD 243 1000 on:

$$\text{Max} = 244\,8862.499 + 0.5045799 E$$

Table 37: Maxima of GK Del (this paper, Gessner & Meinunger 1973). The O-C values are derived from the second elements. 

JD hel.	Epoch	O-C	Obs.
242 9846.310	-37688	0.418	Ges/Hau
242 9851.399	-37678	0.461	Hau
243 0593.570	-36207	0.395	Ges/Hau
243 0613.250	-36168	0.397	Ges/Hau
243 0614.270	-36166	0.408	Ges/Hau
243 8311.269	-20911	0.040	Ges/Hau
243 8318.290	-20897	-0.003	Ges/Hau
243 8323.340	-20887	0.001	Ges/Hau
243 8324.340	-20885	-0.008	Hau
243 8652.340	-20235	0.015	Ges/Hau
243 9378.408	-18796	-0.007	Hau
243 9385.443	-18782	-0.036	Hau
244 0145.359	-17276	-0.018	Hau
244 0483.400	-16606	-0.045	Hau
244 3013.454	-11592	0.045	Hau
244 5556.481	-6552	-0.010	Hau
244 5973.300	-5726	0.026	Hau
244 6707.426	-4271	-0.012	Hau
244 6708.451	-4269	0.004	Hau
244 7325.529	-3046	-0.020	Hau
244 7805.413	-2095	0.009	Hau
244 8176.307	-1360	0.037	Hau
244 8186.347	-1340	-0.015	Hau
244 8187.337	-1338	-0.034	Hau
244 8862.467	0	-0.032	Hau

GL Del = USNO-A2.0 0975-19229590 (RRab)


The period given by Gessner & Meinunger (1973) do not represent the observations. The elements with a variable period are:

JD 242 9000 to 243 1000:

$$\text{Max} = 243\,0606.424 + 0.4807456 E$$

from JD 243 1000 on:

$$\text{Max} = 244\,9543.562 + 0.4807509 E$$


Table 38: Maxima of GL Del (this paper, Gessner & Meinunger 1973). The O-C values are derived from the second elements. 

JD hel.	Epoch	O-C	Obs.
242 9844.499	-40976	0.186	Hau
243 0606.424	-39391	0.121	Ges
243 0608.344	-39387	0.118	Ges
243 8296.390	-23395	-0.005	Hau
243 8311.312	-23364	0.014	Ges
243 8323.303	-23339	-0.014	Ges
244 0483.355	-18846	0.024	Hau
244 1982.265	-15728	-0.047	Hau
244 5524.511	-8360	0.027	Hau
244 6298.528	-6750	0.035	Hau
244 6714.301	-5885	-0.042	Hau
244 8097.517	-3008	0.054	Hau
244 8458.502	-2257	-0.005	Hau
244 8834.445	-1475	-0.009	Hau
244 9543.530	0	-0.032	Hau

GO Del = USNO-A2.0 0975-19422999 (RRab)

The elements given by Gessner & Meinunger (1973) are valid only from JD 242 9000 to 243 1000. After JD 243 8000 the elements can be improved:

$$\text{Max} = 244\,9543.574 + 0.5459746 E$$

Table 39: Maxima of GO Del (this paper, Gessner & Meinunger 1973). All O-C values are calculated with the above given elements. 

JD hel.	Epoch	O-C	Obs.
242 9790.484	-36179	-0.275	Ges
242 9844.526	-36080	-0.284	Ges
243 0608.428	-34681	-0.201	Ges
243 0613.344	-34672	-0.199	Ges
243 0614.415	-34670	-0.220	Ges
243 8288.316	-20615	0.008	Ges
243 8289.400	-20613	0.000	Hau
243 8290.441	-20611	-0.051	Ges
243 8318.311	-20560	-0.025	Ges
243 8323.266	-20551	0.016	Ges
243 9054.287	-19212	-0.023	Hau
243 9381.361	-18613	0.012	Hau
243 9685.507	-18056	0.050	Hau
244 0452.550	-16651	-0.001	Hau
244 5528.456	-7354	-0.021	Hau
244 5674.228	-7087	-0.024	Hau
244 6644.460	-5310	0.011	Hau
244 6650.490	-5299	0.035	Hau
244 6702.339	-5204	0.017	Hau
244 6714.301	-5182	-0.033	Hau
244 7380.462	-3962	0.039	Hau

Table 39 (cont'd).

244 7415.401	-3898	0.036	Hau
244 7473.310	-3792	0.072	Hau
244 8187.337	-2484	-0.036	Hau
244 8800.503	-1361	0.000	Hau
244 9163.527	-696	-0.049	Hau
244 9542.480	-2	-0.002	Hau
244 9543.530	0	-0.044	Hau

GQ Del = USNO-A2.0 B₁ 1062-0568367 (RRab)

The star has a variable period.

JD 242 9000 to 243 8000:

$$\text{Max} = 242\,9846.381 + 0.5686226 E_1$$

from JD 243 8000 on:


$$\text{Max} = 243\,8290.421 + 0.5686293 E_2$$

Table 64 in the appendix lists the O-C values.

GR Del = USNO-A2.0 1050-18568612 (RRab)

The period given by Gessner & Meinunger (1973) needed to slightly be decreased:

$$\text{Max} = 242\,9846.446 + 0.5665555 E.$$

Table 40: Maxima of GR Del. 

JD hel.	Epoch	0-C	Obs.
243 8652.392	15543	-0.026	Hau
244 0145.289	18178	-0.003	Hau
244 0149.273	18185	0.015	Hau
244 0499.388	18803	-0.001	Hau
244 5556.445	27729	-0.018	Hau
244 6650.490	29660	0.008	Hau
244 6708.293	29762	0.022	Hau
244 7365.480	30922	0.005	Hau
244 7412.478	31005	-0.021	Hau
244 8770.537	33402	0.004	Hau

GS Del = USNO-A2.0 1050-18599687 (EA)

The Algol type star has the following elements:

$$\text{Min} = 243\,0608.455 + 9.265514 E.$$

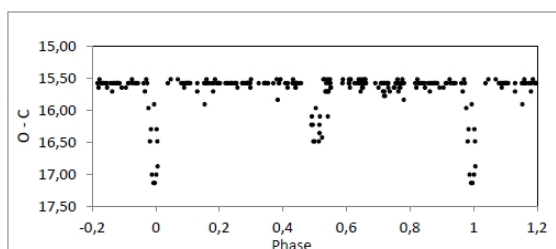



Figure 27: Mean light-curve of GS Del.

Table 41: Minima of GS Del. 

JD hel.	Epoch	0-C	Obs.
243 0608.386	0	-0.069	Hau
243 7145.350	705.5	0.075	Hau
243 8289.460	829	-0.106	Hau
243 9378.408	946.5	0.144	Hau
244 0499.356	1067.5	-0.035	Hau
244 5674.200	1626	0.019	Hau
244 6707.426	1737.5	0.140	Hau
244 9213.439	2008	-0.168	Hau

GV Del = USNO-A2.0 0975-19687377 (RRab)

The star has the following elements:

$$\text{Max} = 242\,9846.412 + 0.541209 E.$$

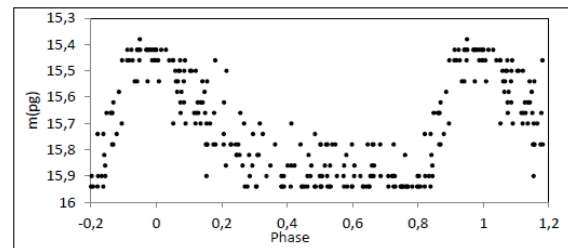



Figure 28: Mean light-curve of GV Del.

Table 42: Maxima of GV Del. 

JD hel.	Epoch	0-C	Obs.
242 9846.412	0	0	Hau
243 0608.428	1408	-0.006	Hau
243 0614.373	1419	-0.015	Hau
243 8284.385	15591	-0.017	Hau
243 8290.310	15602	-0.045	Hau
243 8291.396	15604	-0.041	Hau
243 8296.306	15613	-0.002	Hau
243 8652.392	16271	-0.032	Hau
243 9380.408	17616	0.058	Hau
243 9683.503	18176	0.076	Hau
244 0452.493	19597	0.008	Hau
244 2632.522	23625	0.047	Hau
244 2637.443	23634	0.097	Hau
244 3748.444	25687	-0.004	Hau
244 4116.458	26367	-0.012	Hau
244 5528.456	28976	-0.028	Hau
244 5973.342	29798	-0.016	Hau
244 6644.460	31038	0.003	Hau
244 6702.339	31145	-0.027	Hau
244 6708.293	31156	-0.027	Hau
244 7380.462	32398	-0.039	Hau
244 8747.564	34924	-0.031	Hau
244 8837.482	35090	0.046	Hau
244 9547.518	36402	0.016	Hau
244 9567.517	36439	-0.010	Hau

GX Del = USNO-A2.0 1050-18922589 (CW)

This star is of W Virginis type and has the following elements:

$$\text{Max} = 242\,9845.491 + 1.640856 E.$$

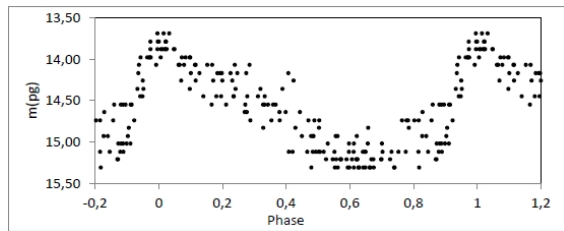



Figure 29: Mean light-curve of GX Del.

Table 43: Maxima of GX Del. 

JD hel.	Epoch	0-C	Obs.
242 9845.526	0	0.035	Hau
243 0608.471	465	-0.018	Hau
243 0613.386	468	-0.026	Hau
243 9385.443	5814	0.015	Hau
244 3748.487	8473	0.023	Hau
244 7325.474	10653	-0.056	Hau
244 7412.478	10706	-0.017	Hau
244 8769.507	11533	0.024	Hau
244 9268.327	11837	0.024	Hau
244 9486.544	11970	0.007	Hau

GZ Del = USNO-A2.0 0975-18755081 (RRab)

The elements by Hacke & Steiner-Sohn (1988) represent observation only between JD 242 9000 and 243 1000, but with large scattering. Using all available data I have derived new elements with a variable period.

JD 242 9000 to 243 9000:

$$\text{Max} = 242\,9846.376 + 0.5055625 E_1$$

from JD 243 9000 on:

$$\text{Max} = 244\,0452.386 + 0.505620 E_2$$

Table 65 in the appendix lists the O-C values. The following light curve is based on the two given elements.

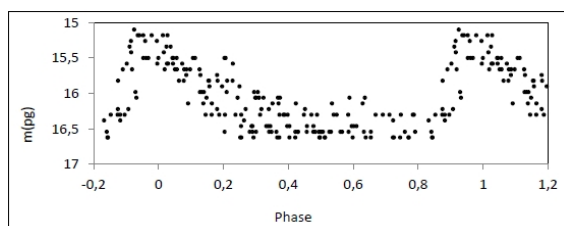


Figure 30: Mean light-curve of GZ Del.

HN Del = USNO-A2.0 0975-19200939 (EA)

The period of this Algol type star is variable. The O-C values are calculated with the following elements.

$$\text{Min} = 244\,7849.274 + 2.8507872 E.$$

In addition, a quadratic representation can be derived:

$$y = -8 \cdot 10^{-9} x^2 - 5 \cdot 10^{-5} x - 0.0371$$

(with $y = O - C$ and $x = E$).

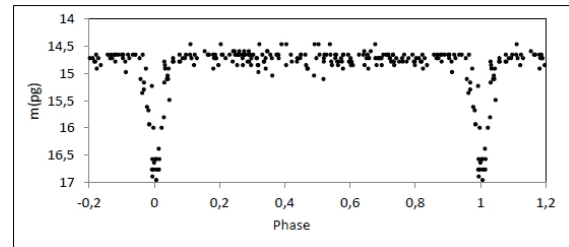



Figure 31: Mean light-curve of HN Del.

Table 44: Minima of HN Del. 

JD hel.	Epoch	0-C	Obs.
242 9789.512	-6335	-0.024	Hau
242 9846.496	-6315	-0.056	Hau
243 0613.429	-6046	0.015	Hau
243 8296.306	-3351	0.021	Hau
243 9023.321	-3096	0.085	Hau
244 0149.332	-2701	0.035	Hau
244 7769.399	-28	-0.052	Hau
244 7849.253	0	-0.020	Hau

HS Del = USNO-A2.0 1050-18828486 (RRab)

This star has a variable period.

JD 242 9000 to 244 0000:

$$\text{Max} = 242\,9844.516 + 0.326411 E_1$$

from JD 244 0000 on:

$$\text{Max} = 244\,5674.220 + 0.326421 E_2$$

Table 66 in the appendix lists the O-C values.

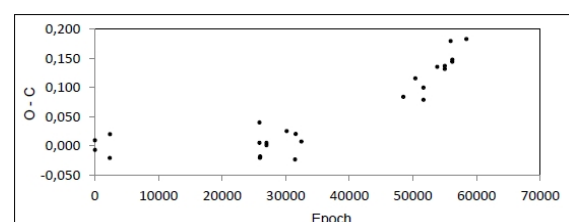


Figure 32: O-C curve of HS Del.

HT Del = USNO-A2.0 1050-18867775 (RRab)

The period ($P=0.^d362$) derived by Meinunger (Gessner & Meinunger 1973) does not represent the observations. The star has a variable period.

JD 242 9000 to 244 0000:

$$\text{Max} = 242\,9845.485 + 0.56992 E_1$$

from JD 244 0000 on:

$$\text{Max} = 244\,0453.410 + 0.569913 E_2$$

Table 67 in the appendix lists the O-C values.

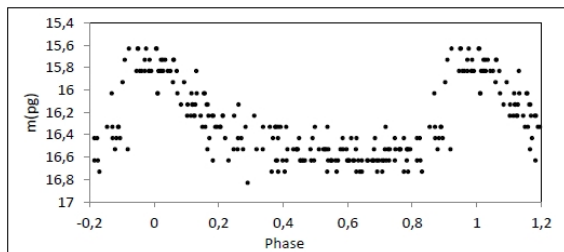



Figure 33: Mean light-curve of HT Del.

HV Del = USNO-A2.0 0975-19186104 (RRab)

The period ($P=0.^d721$) derived by Meinunger (Gessner & Meinunger 1973) is not correct. The elements are:

$$\text{Max} = 242\,9845.470 + 0.5649245 E.$$

Table 45: Maxima of HV Del. 

JD hel.	Epoch	0-C	Obs.
242 9845.497	0	0.028	Hau
243 0606.424	1347	0.002	Hau
243 0614.331	1361	0.000	Hau
243 0619.405	1370	-0.011	Hau
243 8323.264	15007	-0.027	Hau
243 9054.287	16301	-0.016	Hau
244 0452.493	18776	0.002	Hau
244 0499.388	18859	0.008	Hau
244 7391.468	31059	0.009	Hau
244 7769.399	31728	0.005	Hau
244 8096.485	32307	0.000	Hau
244 8186.347	32466	0.039	Hau
244 9567.517	34911	-0.031	Hau

II Del = USNO-A2.0 1050-18716842 (RRc)

This RRc star has a variable period.

JD 242 9000 to 244 1000:

$$\text{Max} = 242\,9790.577 + 0.4077965 E_1$$

from JD 244 1000 on:

$$\text{Max} = 244\,4871.360 + 0.4078105 E_2$$

Table 68 in the appendix lists the O-C values.

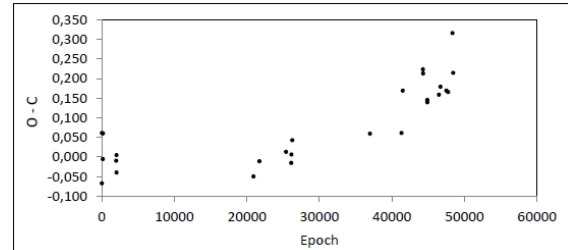


Figure 34: O-C curve of II Del.

IK Del = USNO-A2.0 1050-18788068 (RRab)

The period ($P=0.^d339$) derived by Gessner (Gessner & Meinunger 1973) does not fit the observations. Furthermore, maxima given by Gessner appear as brightenings only. Consequently, they are not listed in the table. New elements are:

$$\text{Max} = 242\,9789.539 + 0.51480 E_2$$

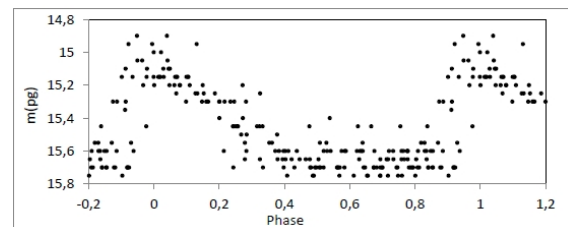


Figure 35: Mean light-curve of IK Del.

Table 46: Maxima of IK Del (this paper, Gessner & Meinunger 1973). 

JD hel.	Epoch	0-C	Obs.
242 9789.512	0	-0.027	Hau / Ges
243 8286.324	16505	0.011	Hau / Ges
243 8289.423	16511	0.021	Hau / Ges
244 5674.228	30856	0.020	Hau
244 6387.273	32241	0.067	Hau
244 8913.303	37148	-0.026	Hau
244 9546.493	38378	-0.040	Hau

IL Del = USNO-A2.0 1050-17186435 (EB)

SIMBAD lists this star as S 10685. This needs to be corrected: IL Del = S 10686.

The EB star has the following elements:

$$\text{Min} = 244\,9542.497 + 0.7800036 E.$$

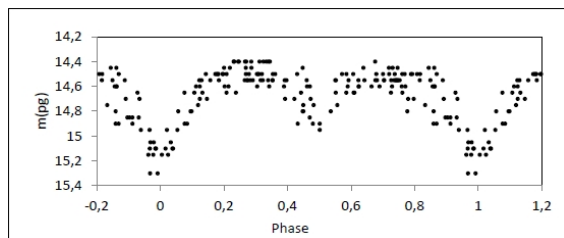



Figure 36: Mean light-curve of IL Del.

Table 47: Maxima of IL Del. 

JD hel.	Epoch	0-C	Obs.
242 9790.485	-25323	0.019	Hau
242 9847.410	-25250	0.004	Hau
243 0606.381	-24277	0.031	Hau
243 0613.344	-24268	-0.026	Hau
243 9381.361	-13027	-0.029	Hau
244 0441.391	-11668	-0.024	Hau
244 7365.520	-2791	0.013	Hau
244 7390.493	-2759	0.026	Hau
244 7805.413	-2227	-0.016	Hau
244 8504.342	-1331	0.030	Hau
244 8769.507	-991	-0.006	Hau
244 9542.480	0	-0.017	Hau
245 3909.743	5599	0.006	Hau/ASAS

IP Del = USNO-A2.0 1050-17769557 (EA)

This Algol type star has the following elements:

$$\text{Min} = 243\,0607.472 + 2.0437799 E.$$

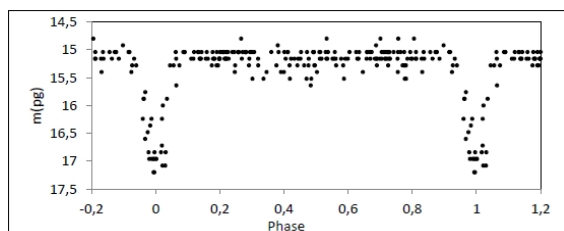



Figure 37: Mean light-curve of IP Del.

Table 48: Maxima of IP Del. 


JD hel.	Epoch	0-C	Obs.
243 0607.467	0	0.045	Hau
243 0613.555	3	0.002	Hau
243 7145.428	3199	-0.046	Hau
243 9054.355	4133	-0.009	Hau
243 9381.361	4293	-0.008	Hau
243 9385.443	4295	-0.014	Hau
244 0499.301	4840	-0.016	Hau
244 5674.228	7372	0.061	Hau
244 6708.293	7878	-0.027	Hau
244 7325.529	8180	-0.013	Hau
244 7366.480	8200	0.063	Hau
244 7413.397	8223	-0.027	Hau
244 7744.481	8385	-0.035	Hau
244 8770.537	8887	0.043	Hau
244 8862.467	8932	0.003	Hau
244 9516.507	9252	0.033	Hau
244 9567.517	9277	-0.051	Hau

IU Del = USNO-A2.0 1050-17960680 (EA)

The observations are calculated with the following elements:

$$\text{Min} = 244\,9567.449 + 1.859994 E.$$

This is almost identical with elements given by Kazenova (1993).

Table 49: Maxima of IU Del. 

JD hel.	Epoch	0-C	Obs.
243 0608.511	-10193	-0.019	Hau
243 8288.397	-6064	-0.048	Hau
243 8290.310	-6063	0.005	Hau
243 8318.267	-6048	0.062	Hau
243 9378.408	-5478	0.006	Hau
243 9683.503	-5314	0.062	Hau
244 0453.451	-4900	-0.027	Hau
244 1930.335	-4106	0.021	Hau
244 1982.334	-4078	-0.059	Hau
244 7415.401	-1157	-0.035	Hau
244 8187.337	-742	0.004	Hau
244 8559.287	-542	-0.045	Hau
244 8769.507	-429	-0.005	Hau
244 9567.517	0	0.068	Hau

IV Del = USNO-A2.0 0975-19194607 (EA)

This Algol type star can be described by this elements:

$$\text{Min} = 244\,7804.387 + 1.7886876 E.$$

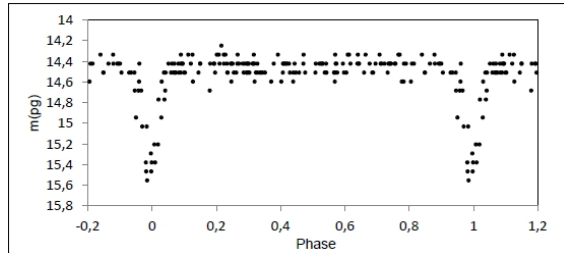



Figure 38: Mean light-curve of IV Del.

Table 50: Maxima of IV Del. 

JD hel.	Epoch	O-C	Obs.
242 9790.510	-10071	-0.004	Hau
243 0613.344	-9611	0.034	Hau
243 9685.507	-4539	-0.027	Hau
244 0499.353	-4084	-0.034	Hau
244 1930.335	-3284	-0.002	Hau
244 6296.491	-843	-0.032	Hau
244 7380.462	-237	-0.006	Hau
244 7475.286	-184	0.018	Hau
244 7804.439	0	0.052	Hau

IW Del = USNO-A2.0 0975-19239651 (EA)

This Algol type star can be described by this elements:

$$\text{Min} = 244\,9546.586 + 4.11833 E.$$

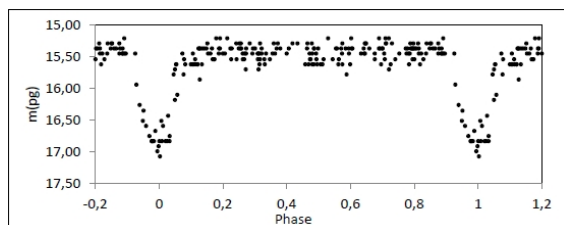



Figure 39: Mean light-curve of IW Del.

Table 51: Maxima of IW Del. 

JD hel.	Epoch	O-C	Obs.
242 9844.526	-4784	0.031	Hau
243 0606.381	-4599	-0.005	Hau
243 0614.541	-4597	-0.082	Hau
243 9378.408	-2469	-0.021	Hau
244 0453.397	-2208	0.084	Hau
244 5284.251	-1035	0.137	Hau
244 7413.397	-518	0.106	Hau
244 7804.439	-423	-0.093	Hau
244 8747.564	-194	-0.066	Hau
244 9542.480	-1	0.012	Hau
244 9546.493	0	-0.093	Hau

KL Del = USNO-A2.0 0975-19369451 (RRab)

The period of this star is variable.

JD 242 9000 to 244 1000:

$$\text{Max} = 242\,9790.530 + 0.3058335 E_1$$

from JD 244 1000 on:

$$\text{Max} = 244\,0483.386 + 0.3058124 E_2$$

Table 69 in the appendix lists the O-C values.

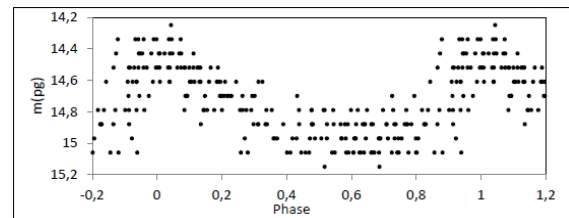



Figure 40: Mean light-curve of KL Del.

KM Del = USNO-A2.0 0975-19410967 (RRab)

This RR Lyrae type star has the elements:

$$\text{Max} = 244\,8769.534 + 0.5377072 E$$

Table 52: Maxima of KM Del. 

JD hel.	Epoch	O-C	Obs.
242 9846.524	-35192	-0.018	Hau
242 9851.399	-35183	0.017	Hau
243 0606.339	-33779	0.017	Hau
243 0608.471	-33775	-0.002	Hau
243 0613.344	-33766	0.031	Hau
243 0614.373	-33764	-0.015	Hau
243 8286.367	-19496	-0.027	Hau
244 0483.418	-15410	-0.048	Hau
244 5524.511	-6035	0.040	Hau
244 6707.426	-3835	-0.001	Hau
244 6713.399	-3824	0.057	Hau
244 7475.286	-2407	0.013	Hau


Table 52 (cont'd).

244 7805.413	-1793	-0.012	Hau
244 7860.253	-1691	-0.018	Hau
244 8559.287	-391	-0.003	Hau
244 8769.507	0	-0.027	Hau

OS Del = USNO-A2.0 0975-19062450 (RRab)

My observations can best be represented by the following elements:

$$\text{Max} = 245\,4362.549 + 0.5910912 E_2$$

Table 53: Maxima of OS Del (this paper, Samus et al. 2012, GEOS database 2012). 

JD hel.	Epoch	O-C	Obs.
242 9846.440	-41476	-0.010	Hau
243 0612.537	-40180	0.032	Hau
244 0452.423	-23533	0.023	Hau
244 5524.511	-14952	-0.042	Hau
244 5556.445	-14898	-0.027	Hau
244 6296.491	-13646	-0.027	Hau
244 7412.478	-11758	-0.021	Hau
244 8103.474	-10589	-0.010	Hau
244 9511.524	-8207	0.060	Hau
245 1311.920	-5161	-0.007	Wils u.a.
245 4362.583	0	0.034	Samus u.a.

CZ Sge = USNO-A2.0 1050-17248876 (EA)


The O-C values are calculated with the following elements.

$$\text{Min} = 242\,5527.370 + 2.3481856 E.$$

In addition, a quadratic representation can be derived:

$$y = -4 \cdot 10^{-9} x^2 + 4 \cdot 10^{-5} x - 0.0532$$

(with $y = O - C$ and $x = E$).

Table 54: Maxima of CZ Sge (this paper, Richter 1961). 

JD hel.	Epoch	O-C	Obs.
242 5527.298	0	-0.072	Ric
242 5938.251	175	-0.051	Ric
242 7274.463	744	0.043	Ric
242 7281.507	747	0.042	Ric
242 7666.479	911	-0.088	Ric
242 9162.321	1548	-0.040	Ric
243 0606.505	2163	0.010	Ric

Table 54 (cont'd).

243 0963.436	2315	0.016	Ric
243 3154.385	3248	0.108	Ric
243 6075.431	4492	0.011	Ric
243 6108.333	4506	0.039	Ric
244 0452.490	6356	0.055	Hau
244 2359.250	7168	0.083	Hau
244 5524.510	8516	-0.008	Hau
244 7325.530	9283	-0.048	Hau
244 7412.480	9320	0.018	Hau
244 7769.400	9472	0.015	Hau
244 7776.400	9475	-0.032	Hau
244 7849.250	9506	0.031	Hau
244 8187.340	9650	-0.024	Hau
244 8504.340	9785	-0.024	Hau
244 9213.440	10087	-0.079	Hau

DF Sge = USNO-A2.0 1050-17152722 (RRab)

This RR Lyrae type star is the western component of two stars appearing nearby on Sonneberg plates. The following elements could be derived:

$$\text{Max} = 242\,9790.526 + 0.482627 E.$$

Table 55: Maxima of DF Sge (this paper, Goetz et al. 1957). 


JD hel.	Epoch	O-C	Obs.
242 9790.510	0	-0.016	Goe
242 9845.526	114	-0.019	Goe
242 9846.496	116	-0.015	Goe
243 0613.429	1705	0.024	Hau
243 0614.373	1707	0.003	Goe
243 9381.361	19872	0.071	Hau
244 4131.393	29714	0.088	Hau
244 6713.399	35064	0.040	Hau
244 7391.468	36469	0.018	Hau
244 7769.399	37252	0.052	Hau
244 8187.337	38118	0.035	Hau
244 8188.309	38120	0.042	Hau
244 9543.53	40928	0.046	Hau

GQ Sge = USNO-A2.0 1050-17112079 (EB)

This eclipsing binary has the following elements:

$$\text{Min} = 243\,0614.457 + 1.481366 E.$$

The light curve was published by Haeussler (2012).


Table 56: Minima of GQ Sge. 

JD hel.	Epoch	0-C	Obs.
243 0614.456	0	-0.001	Hau
244 8103.474	11806.0	0.010	Hau
245 2809.7655	14983.0	0.002	Hau/ASAS
245 2858.6465	15016.0	-0.002	Hau/ASAS
245 2904.5846	15047.0	0.013	Hau/ASAS
245 3520.8228	15463.0	0.003	Hau/ASAS
245 3661.5648	15558.0	0.016	Hau/ASAS
245 3664.5174	15560.0	0.005	Hau/ASAS
245 4231.8733	15943.0	-0.002	Hau/ASAS
245 4234.8445	15945.0	0.007	Hau/ASAS
245 4306.665	15993.5	-0.018	Hau/ASAS
245 4683.6799	16248.0	-0.012	Hau/ASAS
245 4706.6758	16263.5	0.023	Hau/ASAS
245 4991.8291	16456.0	0.013	Hau/ASAS
245 5063.6474	16504.5	-0.015	Hau/ASAS

V373 Sge = USNO-A2.0 1050-17091288 (RRab)

The period ($P=0.^d2995$) derived by Martignoni (2004) is not correct. From 178 observations I could calculate new elements:

$$\text{Max} = 242\,9791.456 + 0.542046 E.$$

Table 57: Maxima of V373 Sge (this paper, Martignoni 2004). 

JD hel.	Epoch	0-C	Obs.
242 9791.454	0	-0.002	Hau
242 9844.526	98	-0.051	Hau
243 0608.386	1507	0.067	Hau
243 8318.368	15731	-0.014	Hau
243 9388.342	17705	-0.038	Hau
244 0483.355	19725	0.042	Hau
244 6387.273	30617	-0.005	Hau
244 6709.293	31211	0.039	Hau
244 8098.499	33774	-0.019	Hau
244 8186.347	33936	0.018	Hau
244 8800.503	35069	0.036	Hau
244 8832.494	35128	0.046	Hau
244 9516.507	36390	-0.003	Hau
244 9542.48	36438	-0.048	Hau
245 2912.4077	42655	-0.020	Mar

Observer Codes

Agr	Agerer, F.
Der	Derevyagin, V.G.
Die	Diethelm, R.
Ges	Gessner, H.
Goe	Goetz, W.
Hac	Hacke, G.
Hau	Haeussler, K.
Hau/ASAS	ASAS data (Pojmanski 1997) reduced by Haeussler, K.
Hof	Hoffmeister, C.
Hut	Huth, H.
Jen	Jensch, A.
Mar	Martignini, M.
Mei	Meinunger, I.
Ote	Otero, S.A.
Pas	Paschke, A.
Ric	Richter, G.A.
Wen	Wenzel, W.
Wil	Wils, P.
ZeJ	ZeJda, M.


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This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France.

Tables

Table 58: Minima of VV Del. 


JD hel.	E_1	$0 - C_1$	E_2	$0 - C_2$	Obs.
242 5827.482	0	-0.010			Jen
242 5866.503	15	-0.077			Jen
242 5921.291	36	-0.013			Jen
242 6265.332	168	0.049			Jen
242 6945.484	429	0.063			Jen
242 7281.512	558	-0.070			Jen
242 7693.367	716	0.053			Jen
243 0614.541	1837	0.018			Jen/Hau
243 8286.324	4781	0.043	0	0.075	Hau
243 8325.308	4796	-0.061	15	-0.027	Hau
243 9685.507	5318	-0.140	537	-0.025	Hau
244 0149.332	5496	-0.164	715	-0.021	Hau
244 7325.529	8250	-0.605	3469	-0.033	Hau
244 7849.253	8451	-0.666	3670	-0.063	Hau
244 8800.503	8816	-0.568	4035	0.092	Hau

Table 59: Minima of BF Del (this paper, Ahnert 1947, OEJV Database 2012). 

JD hel.	E_1	$0 - C_1$	E_2	$0 - C_2$	Obs.
242 5808.450	0	-0.070			Hof
242 5857.460	13	0.059			Hof
242 5921.290	30	-0.032			Hof
242 9790.485	1059	0.051			Hof/Hau
243 0606.381	1276	0.012			Hof/Hau
243 8284.385	3318	-0.047			Hau
243 8288.313	3319	0.121			Hau
243 8318.351	3327	0.078			Hau
243 9378.481	3609	-0.131			Hau
244 0149.332	3814	-0.095			Hau

Table 59 (cont'd).

244 4131.393	4873	0.052	0	-0.015	Hau
244 5556.445	5252	0.038	379	0.085	Hau
244 6387.273	5473	-0.110	600	0.004	Hau
244 6650.490	5543	-0.097	670	0.037	Hau
244 6714.301	5560	-0.208	687	-0.068	Hau
244 7744.481	5834	-0.287	961	-0.064	Hau
245 2406.681	7074	-0.573	2201	0.023	Pas

Table 60: Maxima of BM Del (this paper, Ahnert et al 1947, Derevyagin & Shugarov 1979). 

JD hel.	E_1	$0 - C_1$	E_2	$0 - C_2$	E	$O - C$	Obs.
242 5478.480	-44528	-0.005	0	0.049			Hof
242 5881.390	-43783	-0.147	745	-0.023			Hof
242 5938.249	-43678	-0.094	850	0.039			Hof
242 6180.476	-43230	-0.239	1298	-0.064			Hof
242 6893.480	-41912	-0.284	2616	0.013			Hof
242 6920.488	-41862	-0.327	2666	-0.025			Hof
242 7276.447	-41204	-0.351	3324	0.012			Hof
242 9789.480	-36558	-0.845	7970	-0.051			Hof/Hau
242 9790.555	-36556	-0.852	7972	-0.058			Hof/Hau
242 9846.389	-36453	-0.742	8075	0.062			Hof/Hau
242 9847.410	-36451	-0.803	8077	0.001			Hau
242 9847.415	-36451	-0.798	8077	0.006			Hof
243 0606.330	-35048	-0.919	9480	0.016			Hof/Hau
243 0608.437	-35044	-0.976	9484	-0.040			Hof/Hau
243 0614.395	-35033	-0.969	9495	-0.032			Hof
243 0614.456	-35033	-0.908	9495	0.029			Hau
243 0633.375	-34998	-0.924	9530	0.015			Hof
243 0672.315	-34926	-0.937	9602	0.010			Hof
243 0704.234	-34867	-0.937	9661	0.014			Hof
243 0705.324	-34865	-0.929	9663	0.023			Hof
243 8318.368	-20794	-0.420			-2626	0.004	Hau
243 8324.326	-20783	-0.413			-2615	0.010	Hau
243 9054.287	-19434	-0.273			-1266	-0.031	Hau
243 9378.481	-18835	-0.143			-667	0.018	Hau
243 9739.390	-18168	-0.087			0	-0.015	Der/Shu
244 0145.289	-17418	0.055			750	0.027	Hau
244 0483.467	-16793	0.103			1375	-0.009	Hau
244 4131.393	-10050	0.006			8116	0.072	Hau
244 5284.251	-7919	-0.025					Hau
244 7325.529	-4146	0.026					Hau
244 7365.520	-4072	-0.017					Hau
244 8187.337	-2553	0.007					Hau
244 8769.507	-1477	0.052					Hau
244 8770.537	-1475	0.000					Hau
244 9568.475	0	-0.050					Hau
245 2953.5296	6257	-0.087					Hau/ASAS
245 3278.6413	6858	-0.122					Hau/ASAS
245 3603.7503	7459	-0.159					Hau/ASAS
245 4297.8528	8742	-0.171					Hau/ASAS
245 4716.5973	9516	-0.167					Hau/ASAS
245 4743.5968	9566	-0.218					Hau/ASAS
245 5035.7907	10106	-0.169					Hau/ASAS
245 5106.6281	10237	-0.204					Hau/ASAS

Table 61: Minima of EW Del (this database, Ahnert et al. 1947, GEOS database 2012).


JD hel.	E_1	$0 - C_1$	E_2	$0 - C_2$	Obs.
242 9844.499	0	-0.019			Hau / Ahn
242 9845.497	2	0.003			Hau
242 9846.440	4	-0.030			Hau / Ahn
242 9851.399	14	0.048			Hau
243 0608.370	1565	0.013			Hau / Ahn
243 0614.456	1577.5	-0.002			Hau / Ahn
243 8652.336	18046	-0.001			Hau
243 9054.287	18869.5	0.019			Hau
243 9388.342	19554	-0.014			Hau
244 0116.321	21045.5	0.000			Hau
244 0145.359	21105	-0.003			Hau
244 0149.273	21113	0.006			Hau
244 0441.391	21711.5	0.011			Hau
244 0452.570	21734.5	-0.036			Hau
244 1903.409	24707	-0.003			Hau
244 5556.445	32191.5	0.028	-1520.5	-0.014	Hau
244 6292.482	33699.5	0.047	-12.5	0.017	Hau
244 6298.528	33712	-0.008	0	-0.038	Hau
244 6709.293	34553.5	0.041	841.5	0.018	Hau
244 7366.480	35900	0.034	2188	0.021	Hau
244 7744.481	36674.5	0.020	2962.5	0.014	Hau
244 7822.310	36834	0.001	3122	-0.004	Hau
244 8103.474	37410	0.033	3698	0.033	Hau
244 8458.502	38137.5	-0.014	4425.5	-0.009	Hau
244 8559.287	38344	-0.017	4632	-0.010	Hau
244 8837.482	38914	-0.025	5202	-0.014	Hau
244 8883.366	39008	-0.021	5296	-0.008	Pas
244 9163.527	39582	-0.015	5870	0.002	Hau
244 9215.483	39688.5	-0.039	5976.5	-0.021	Hau
244 9236.486	39731.5	-0.024	6019.5	-0.005	Pas
244 9511.524	40295	-0.016	6583	0.006	Hau
244 9641.365	40561	-0.004	6849	0.021	Pas
245 0700.441	42731	-0.053	9019	-0.010	Pas
245 1430.376	44226.5	-0.035	10514.5	0.019	Pas
245 2875.333	47187	-0.027	13475	0.051	Pas
245 3558.365	48586.5	-0.058	14874.5	0.032	Pas
245 3558.571	48587	-0.096	14875	-0.006	Pas
245 4289.678	50085	-0.126	16373	-0.025	Pas
245 5006.665	51554	-0.123	17842	-0.010	Pas

Table 62: Maxima of FP Del (this paper, Goetz et al. 1957, GOES database 2012).


JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9791.454	0	-0.004			Hau
242 9846.496	183	0.017			Hau/Goe
242 9847.410	186	0.029			Hau/Goe
243 0607.467	2714	0.018			Hau/Goe
243 0612.537	2731	-0.023			Hau/Goe
243 0613.429	2734	-0.033			Hau
243 0614.373	2737	0.009			Hau/Goe
243 8288.397	28261	-0.013			Hau
243 8323.264	28377	-0.023			Hau
243 9380.408	31893	0.001			Hau

Table 62 (cont'd).

244 0441.457	35422	0.020				Hau
244 0453.451	35462	-0.012				Hau
244 1930.335	40374	0.030	0	-0.034		Hau
244 1982.334	40547	0.015	173	-0.039		Hau
244 2637.443	42726	-0.014	2352	0.058		Hau
244 5585.377	52531	-0.051	12159	-0.012		Hau
244 6708.451	56266	0.057	15895	0.013		Hau
244 7366.480	58455	-0.058	18084	0.024		Hau
244 7412.478	58608	-0.061	18237	0.030		Hau
244 8770.537	63125	-0.084	22755	-0.031		Hau
244 8832.494	63331	-0.062	22961	0.002		Hau
244 8913.303	63600	-0.131	23230	-0.050		Hau
244 9268.327	64781	-0.186	24411	-0.037		Hau
245 1281.995	71478	-0.038	31110	-0.102	Pas/Rotse	
245 2383.836	75143	-0.116	34776	-0.268	Pas/ASAS	
245 5035.7907	83964	-0.284	43598	-0.224	Hau/ASAS	
245 5038.7693	83974	-0.312	43608	-0.252	Hau/ASAS	

Table 63: Maxima of FS Del. 


JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9846.529	0	-0.048			Hau
243 0593.524	1366	-0.006			Hau
243 0608.348	1393	0.054			Hau
243 0614.335	1404	0.026			Hau
243 8318.368	15493	-0.060			Hau
244 1903.409	22049	0.042			Hau
244 5524.511	28671	0.115	0	0.000	Hau
244 6644.460	30719	0.181	2048	0.002	Hau
244 6650.490	30730	0.196	2059	0.017	Hau
244 6708.451	30836	0.194	2165	0.012	Hau
244 7391.468	32085	0.235	3414	0.015	Hau
244 7414.399	32127	0.200	3456	-0.022	Hau
244 7805.413	32842	0.239	4171	-0.005	Hau
244 8098.499	33378	0.231	4707	-0.030	Hau
244 8769.507	34605	0.293	5934	-0.006	Hau
244 8862.467	34775	0.294	6104	-0.010	Hau
244 8913.303	34868	0.276	6197	-0.031	Hau
244 9568.475	36066	0.360	7395	0.016	Hau
244 9625.363	36170	0.379	7499	0.031	Hau

Table 64: Maxima of GQ Del (this paper, Gessner & Meinunger 1973). 

JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9846.398	0	0.017			Ges
243 0608.345	1340	0.010			Ges
243 0613.429	1349	-0.024			Ges
243 8286.413	14843	-0.033			Ges
243 8289.318	14848	0.029	-2	0.034	Ges
243 8290.420	14850	-0.007	0	-0.001	Ges
243 8318.270	14899	-0.019	49	-0.014	Ges
244 0145.289	18112	0.015	3262	-0.001	Hau
244 0149.273	18119	0.019	3269	0.003	Hau
244 0441.512	18633	-0.014	3783	-0.034	Hau

Table 64 (cont'd).

244 3013.454	23156	0.048	8306	-0.002	Hau
244 4131.393	25122	0.075	10272	0.012	Hau
244 7744.481	31476	0.135	16626	0.029	Hau
244 8559.287	32909	0.105	18059	-0.011	Hau
244 9215.483	34063	0.110	19213	-0.013	Hau

Table 65: Maxima of GZ Del. 


JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9846.320	0	-0.056			Hau
243 0612.364	1515	-0.034			Hau
243 8286.324	16692	0.056			Hau
243 8288.300	16696	0.009			Hau
243 8289.314	16698	0.012			Hau
243 8290.310	16700	-0.004			Hau
243 8296.390	16712	0.009			Hau
243 8652.336	17416	-0.005			Hau
244 0452.380	20976	0.014	0	-0.006	Hau
244 0453.397	20978	0.020	2	0.000	Hau
244 0499.388	21069	-0.001	93	-0.021	Hau
244 1930.335	23899	0.027	2923	0.022	Hau
244 6702.339	33337	-0.058	12361	-0.016	Hau
244 6707.426	33347	-0.027	12371	0.015	Hau
244 6708.451	33349	-0.013	12373	0.029	Hau
244 7390.493	34698	-0.059	13722	-0.011	Hau
244 7822.310	35552	-0.046	14576	0.007	Hau
244 8186.347	36272	-0.059	15296	-0.003	Hau
244 8187.337	36274	-0.080	15298	-0.024	Hau
244 8504.342	36901	-0.102	15925	-0.043	Hau
244 8831.494	37548	-0.090	16572	-0.027	Hau
244 9625.363	39118	-0.052	18142	0.019	Hau

Table 66: Maxima of HS Del (this paper, Gessner & Meinunger 1973). 


JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9844.526	0	0.010			Mei/Ges
242 9846.468	6	-0.006			Mei/Ges
243 0606.339	2334	-0.020			Mei/Ges
243 0614.540	2359	0.020			Mei/Ges
243 8289.427	25872	0.006			Mei/Ges
243 8290.441	25875	0.040			Mei/Ges
243 8311.271	25939	-0.020			Mei/Ges
243 8324.328	25979	-0.019			Mei/Ges
243 8325.309	25982	-0.018			Mei/Ges
243 8652.396	26984	0.006			Mei/Ges
243 8652.392	26984	0.002			Hau
243 9685.507	30149	0.026			Hau
244 0116.321	31469	-0.023			Hau
244 0149.332	31570	0.021			Hau
244 0441.457	32465	0.008			Hau
244 5674.228	48496	0.084	0	0.008	Hau
244 6292.482	50390	0.116	1894	0.021	Hau
244 6708.293	51664	0.079	3168	-0.029	Hau
244 6709.293	51667	0.100	3171	-0.008	Hau

Table 66 (cont'd).

244 7413.397	53824	0.135	5328	0.006	Hau
244 7804.439	55022	0.137	6526	-0.004	Hau
244 7805.413	55025	0.132	6529	-0.010	Hau
244 8103.474	55938	0.179	7442	0.029	Hau
244 8186.347	56192	0.144	7696	-0.009	Hau
244 8188.309	56198	0.148	7702	-0.006	Hau
244 8913.303	58419	0.183	9923	0.007	Hau

Table 67: Maxima of HT Del (this paper, Gessner & Meinunger 1973). 


JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9845.497	0	0.012			Mei/Hau
243 0606.339	1335	0.011			Mei/Hau
243 0612.583	1346	-0.014			Mei/Hau
243 0614.331	1349	0.024			Mei/Hau
243 0619.405	1358	-0.031			Mei/Hau
243 8289.423	14816	0.003			Mei/Hau
243 8325.308	14879	-0.017			Mei/Hau
243 9054.287	16158	0.035			Hau
243 9381.361	16732	-0.025			Hau
244 0441.457	18592	0.019			Hau
244 0453.397	18613	-0.009	0	-0.013	Hau
244 2359.247	21957	0.029	3344	0.048	Hau
244 3013.454	23105	-0.033	4492	-0.005	Hau
244 4871.359	26365	-0.067	7752	-0.017	Hau
244 5528.456	27518	-0.088	8905	-0.029	Hau
244 5556.445	27567	-0.025	8954	0.034	Hau
244 6709.293	29590	-0.125	10977	-0.052	Hau
244 7475.286	30934	-0.104	12321	-0.022	Hau
244 7769.399	31450	-0.070	12837	0.016	Hau
244 8096.485	32024	-0.118	13411	-0.028	Hau
244 8188.309	32185	-0.051	13572	0.040	Hau
244 8559.287	32836	-0.091	14223	0.004	Hau
244 8862.467	33368	-0.109	14755	-0.009	Hau
244 9486.544	34463	-0.094	15850	0.013	Hau
244 9543.530	34563	-0.100	15950	0.008	Hau

Table 68: Maxima of II Del. 

JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9790.510	0	-0.067			Hau / Ges
242 9791.454	2	0.061			Hau / Ges
242 9846.440	137	-0.005			Hau / Ges
242 9851.399	149	0.060			Hau / Ges
243 0593.519	1969	-0.009			Hau / Ges
243 0613.471	2018	-0.039			Hau / Ges
243 0614.331	2020	0.005			Hau / Ges
243 8318.368	20912	-0.049			Hau
243 8652.392	21731	-0.011			Hau
244 0145.359	25392	0.013			Hau
244 0441.391	26118	-0.015			Hau
244 0452.423	26145	0.007			Hau
244 0499.356	26260	0.043			Hau
244 4871.359	36981	0.060	0	-0.001	Hau

Table 68 (cont'd): Maxima of II Del.

244 6644.460	41329	0.061	2174	-0.060	Hau
244 6714.301	41500	0.169	2259.5	0.045	Hau
244 7849.253	44283	0.224	3651	0.061	Hau
244 7860.253	44310	0.213	3664.5	0.050	Hau
244 8095.484	44887	0.146	3953	-0.026	Hau
244 8097.517	44892	0.140	3955.5	-0.032	Hau
244 8747.564	46486	0.159	4752.5	-0.035	Hau
244 8834.445	46699	0.179	4859	-0.017	Hau
244 9163.527	47506	0.169	5262.5	-0.039	Hau
244 9268.327	47763	0.166	5391	-0.046	Hau
244 9511.524	48359	0.316	5689	0.096	Hau
244 9546.493	48445	0.215	5732	-0.007	Hau

Table 69: Maxima of KL Del. 

JD hel.	E_1	$O - C_1$	E_2	$O - C_2$	Obs.
242 9790.510	0	-0.020			Hau
242 9851.399	199	0.008			Hau
243 0614.456	2694	0.011			Hau
243 8323.303	27900	0.018			Hau
243 9023.321	30189	-0.017			Hau
244 0452.493	34862	-0.004			Hau
244 0483.394	34963	0.007	0	0.008	Hau
244 3449.319	44661	-0.041	9698	0.164	Hau
244 5674.228	51936	-0.071	16974	-0.018	Hau
244 7776.397	58810	-0.201	23848	-0.003	Hau
244 8097.517	59860	-0.206	24898	0.014	Hau
244 8188.309	60157	-0.247	25195	-0.020	Hau
244 9542.480	64585	-0.307	29623	0.013	Hau