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A REPORT OF NEW CCD TIMES OF MINIMA OBSERVED AT THE SOBAEKSAN OPTICAL ASTRONOMY OBSERVATORY

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Abstract: We present 101 times of minima determined from CCD photometric observations for 47 eclipsing binaries performed at the Sobaeksan Optical Astronomy Observatory (SOAO) in Korea between 2020 and 2024.

1 Introduction

A study on the orbital period variations in eclipsing binary allows us not only to study the dynamical properties of the components that make up the system but also to obtain important clues for interpreting their evolutionary properties. In order to closely examine the characteristics of the orbital period variations, the eclipse timing observations accumulated over several years to decades are generally required. This report is a result of the long-term observation program being carried out at the Sobaeksan Optical Astronomy Observatory (SOAO), which aims to contribute to understanding the characteristics of eclipsing binaries through continuous monitoring of the eclipse timing.

2 Observations and Data Reduction

We were performed the eclipse timing observations for 47 eclipsing binaries at the SOAO in Korea from 2020 to 2024. The details of the observations and data reduction are summarized as follows:

- Location: 36° 56′ 03″.88 N, 128° 27′ 27″.36 E (Timezone = -9), Altitude 1378 m
- Telescope: 61cm Boller & Chivens reflector
- Filter: R (Johnson-Cousins $BVRI$ photometric system)
- Detector: FLI PL-16803 4K CCD Camera (FoV 15′.2 X 15′.2)
- All CCD images were corrected for flat, bias, and dark images using the IRAF/CCDRED package, and then aperture photometry for the stars using the IRAF/PHOT package (More information about IRAF can be found at the IRAF-community[1]). This is the same process that was performed by Park & Lee (2022) and Park et al. (2023).

[1]https://iraf-community.github.io/

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3 Results

We were organized all obtained photometric data as shown in Figures 1–4, and determined the new times of minima and their errors using the method of Kwee & van Woerden (1956). The results are listed in Table 1, where column 1 is the object name, columns 2 and 3 are the heliocentric Julian dates (HJD) of the eclipse minima and their uncertainties, and column 4 is the eclipse type.

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References

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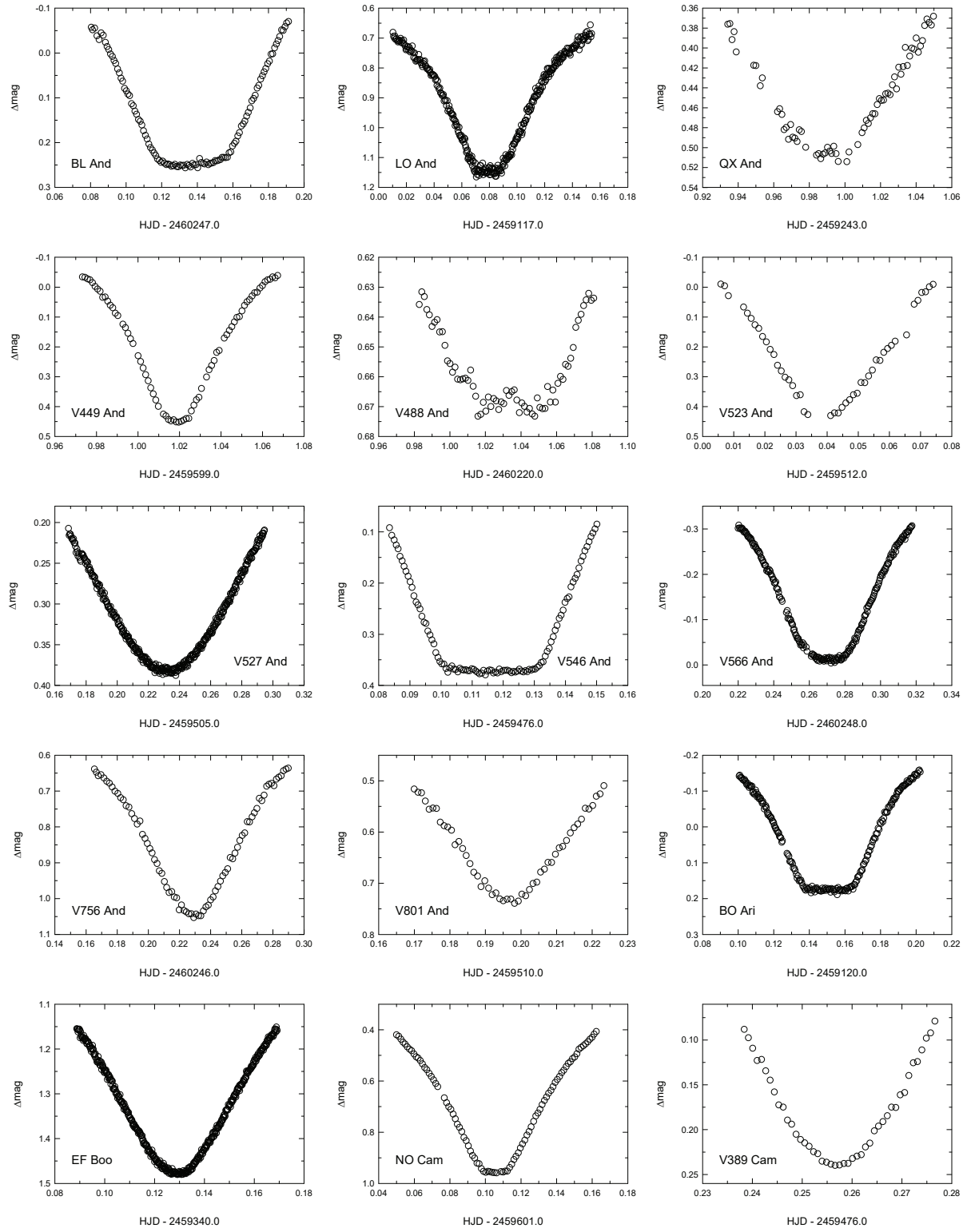

Figure 1: The eclipse light curve samples for 15 objects (BL And, LO And, QX And, V449 And, V488 And, V523 And, V527 And, V546 And, V566 And, V756 And, V801 And, BO Ari, EF Boo, NO Cam, and V389 Cam). The circles represent the individual observations.

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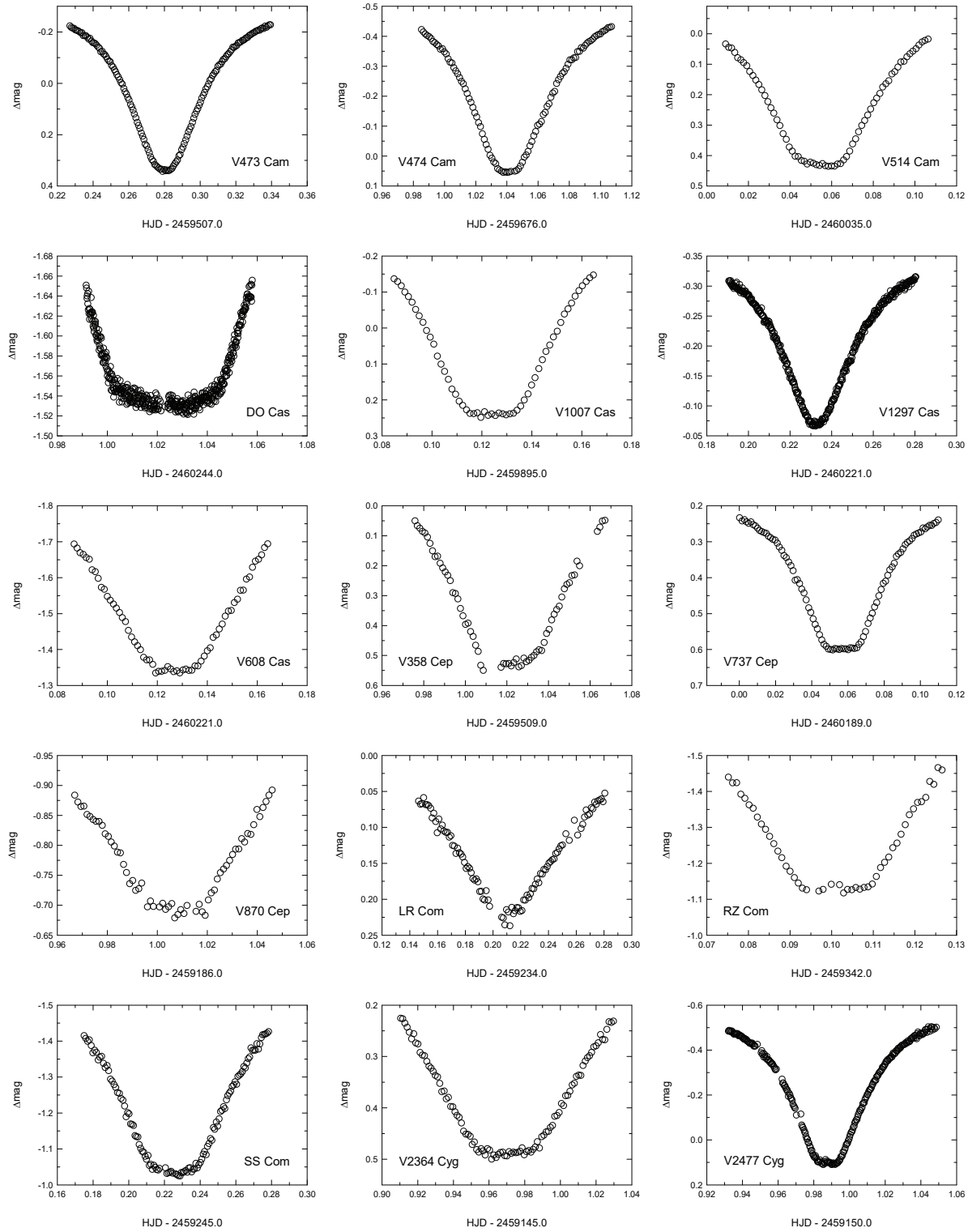

Figure 2: The eclipse light curve samples for 15 objects (V473 Cam, V474 Cam, V514 Cam, DO Cas, V1007 Cas, V1297 Cas, V608 Cas, V358 Cep, V737 Cep, V870 Cep, LR Com, RZ Com, SS Com, V2364 Cyg, and V2477 Cyg). The circles represent the individual observations.

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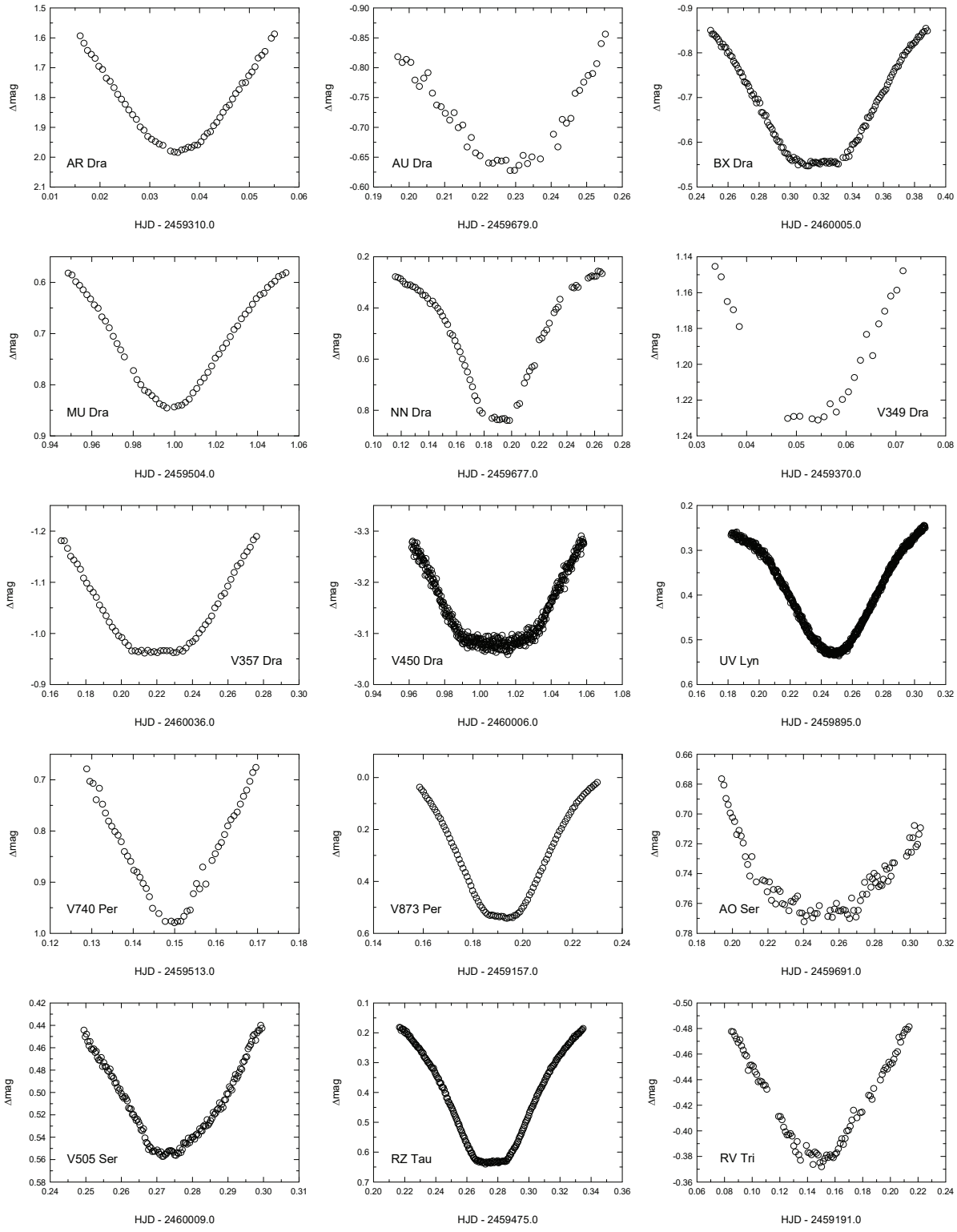

Figure 3: The eclipse light curve samples for 15 objects (AR Dra, AU Dra, BX Dra, MU Dra, NN Dra, V349 Dra, V357 Dra, V450 Dra, UV Lyn, V740 Per, V873 Per, AO Ser, V505 Ser, RZ Tau, and RV Tri). The circles represent the individual observations.

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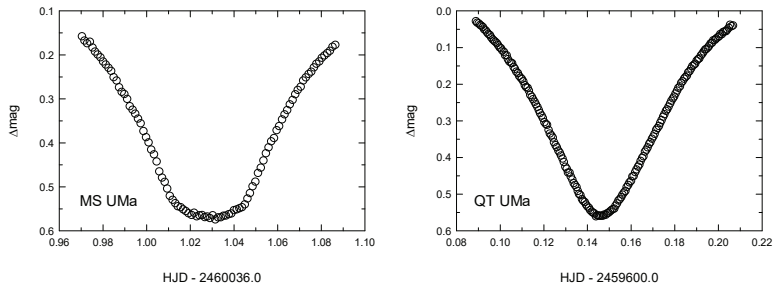

Figure 4: The eclipse light curve sample for MS UMa and QT UMa. The circles represent the individual observations.

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Table 1: Observed Times of Minimum Light.

Object	HJD (2400000+)	Error	Type[a]
BL And	60247.13680	0.00008	I
LO And	59117.07995	0.00006	II
	59151.12974	0.00007	I
	59475.07634	0.00005	II
	60248.13055	0.00004	II
QX And	59243.99044	0.00030	II
	59895.02267	0.00014	I
	60247.02214	0.00005	I
V449 And	59600.01885	0.00009	II
	60247.25916	0.00012	II
	60337.97911	0.00024	II
V488 And	60221.03333	0.00039	II
V523 And	59512.04024	0.00031	I
	60273.14161	0.00006	I
V527 And	59505.23190	0.00004	II
V546 And	59476.11627	0.00003	I
	59893.98515	0.00003	I
	60240.99772	0.00023	I
	60249.04008	0.00007	I
V566 And	60248.26969	0.00005	I
V756 And	60246.22854	0.00017	I
V801 And	59510.19687	0.00010	II
	59512.19757	0.00014	I
	59892.04628	0.00027	II
BO Ari	59120.15022	0.00006	I
	59184.10796	0.00004	I
	59187.13041	0.00005	II
	59234.06369	0.00005	I
	59235.01846	0.00005	I
EF Boo	59340.12887	0.00002	II
	59661.19252	0.00021	I
	59689.15624	0.00003	II
	59753.07477	0.00003	II
	60035.23960	0.00002	II
	60367.23661	0.00003	I
NO Cam	59601.10541	0.00003	I
	60006.02079	0.00005	I
	60273.30842	0.00004	II
V389 Cam	59476.25711	0.00008	I
	59570.17205	0.00019	II
	59661.01095	0.00032	I
V473 Cam	59507.28041	0.00005	II
	59689.03102	0.00005	II
	60007.16807	0.00008	II

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	60274.12250	0.00005	I
V474 Cam	59677.04166	0.00013	II
V514 Cam	60035.05510	0.00011	II
	60338.11814	0.00008	I
DO Cas	60245.02405	0.00002	I
V1007 Cas	59895.12384	0.00005	II
	60305.98097	0.00005	I
V1297 Cas	60221.23304	0.00003	II
V608 Cas	60221.12642	0.00011	II
V358 Cep	59510.02116	0.00022	I
V737 Cep	60189.05653	0.00005	I
	60273.00952	0.00005	I
V870 Cep	59187.00747	0.00021	I
	59191.97600	0.00012	II
	60274.01390	0.00010	II
LR Com	59234.21041	0.00020	II
RZ Com	59342.10059	0.00007	II
SS Com	59245.22555	0.00011	I
	59690.03681	0.00004	II
V2364 Cyg	59145.96992	0.00013	II
V2477 Cyg	59150.98812	0.00004	II
	59157.05776	0.00004	I
	59507.99282	0.00005	II
	59723.22157	0.00006	I
	60247.98965	0.00002	I
AR Dra	59310.03547	0.00003	I
	59600.30847	0.00004	II
	59690.19552	0.00006	II
AU Dra	59679.22800	0.00027	I
BX Dra	60005.31746	0.00007	II
MU Dra	59504.99874	0.00021	II
	59689.27058	0.00009	II
NN Dra	59677.19002	0.00022	I
V349 Dra	59370.05267	0.00016	I
	59691.10379	0.00013	II
	59724.04519	0.00010	I
	60371.21542	0.00008	I
V357 Dra	60036.22079	0.00007	II
V450 Dra	60007.00927	0.00002	I
	60306.24455	0.00008	I
UV Lyn	59895.24712	0.00008	I
	60367.08702	0.00007	I
V740 Per	59513.14913	0.00007	I
V873 Per	59157.19204	0.00005	I
	59892.23171	0.00006	II
	60189.20044	0.00009	II
AO Ser	59691.25117	0.00110	II

	60008.25611	0.00003	I
V505 Ser	60009.27438	0.00010	I
RZ Tau	59475.27613	0.00003	II
RV Tri	59191.14832	0.00032	II
	59239.00604	0.00008	I
MS UMa	60037.02897	0.00006	II
QT UMa	59600.14687	0.00006	I
	59723.02913	0.00009	II
	60009.04659	0.00007	II
	60005.02347	0.00038	I

[a] I-primary minimum, II-secondary minimum