

# Times of Minima of Selected Eclipsing Binaries Obtained in 2024-2025

Sibel Ötken<sup>1,2</sup>  , Sezer Özel<sup>1,2</sup> , Muhammed Baki Bayram<sup>1,2</sup> ,  
İrem Zeynep Kelkitli<sup>1,2</sup> , Mehmet İçen<sup>1,2</sup> , Zeynep Erol<sup>1,2</sup> , Zafer Toy<sup>1,2</sup> ,  
Batıkan Demirel<sup>1,2</sup> 

<sup>1</sup> Istanbul University Observatory Research and Application Center, 34116 Istanbul, Turkey

<sup>2</sup> Department of Astronomy and Space Sciences, Faculty of Science, Istanbul University, 34116 Istanbul, Turkey

Accepted: June 18, 2025. Revised: June 18, 2025. Received: June 12, 2025.

## Abstract

We present 89 times of minima of 41 eclipsing binaries obtained with the IST40 telescope of the Istanbul University Observatory in the period between 1 May 2024 - 31 May 2025.

**Key words:** binaries: eclipsing – methods: observational – techniques: photometric

## 1 Introduction

In the framework of monitoring variable stars from Istanbul University Observatory, we obtained minima times of various eclipsing binaries. Monitoring eclipse timings can be very useful as due to various mechanisms such binary systems show orbital period variations. These mechanisms can be caused by mass transfer between companions, magnetic activity, mass loss from the system or orbital period modulation due to an unseen companion. In the latter case, eclipse timings variation (ETV) is used as a fundamental tool to detect exoplanets or stellar third bodies. The presented minima times in this study can be used to update ephemeris of those eclipsing binaries together with the ones that can be collected from the literature.

Target systems were selected based on their brightness ( $V < 15$ ) and orbital period ( $P < 1^d$ ). Targets were selected from the General Catalogue of Variable Stars (GCVS) (Samus' et al. 2017) and The Zwicky Transient Facility Catalog of Periodic Variable Stars (Chen et al. 2020). As the transparency of the sky at the Beyazit Campus is very variable, we focus mainly on short period binaries displaying W UMa (EW) and Algol-type (EA) light variations in order to obtain their entire light curves or only minima profiles for the measurements of light minima of a given eclipsing binary in a single observation.

The variable star monitoring program is conducted as a training for the undergraduate students of the Astronomy and Space Sciences Department of Istanbul University. The program is performed mainly by the 2nd, 3rd and 4th-year students with an increasing interest from the junior and MSc students as well.

## 2 Observations and Data Reduction

All observations presented in this study were carried out with the 0.4 m Schmidt-Cassegrain telescope (aka. IST40) of the Istanbul University Observatory. The telescope is located in the university campus at Beyazit, Istanbul (N 41.01167°, E 28.96528°, altitude 65 m).

\* sibel.otken@ogr.iu.edu.tr

Observations were performed with a thermoelectrically cooled CCD consisting a KAF-8300 chip which has 3358x2536 pixels. Pixel size of 5.4  $\mu\text{m}$  yields 0.27'' pixel<sup>-1</sup> resolution at the focal plane and this resolution allows to capture 16x12' field of view.

All frames were bias, dark and flat-field corrected in a standard manner. Several bias and dark frames were combined in order to create a master calibration frame. Flat-fielding was performed using sky flats obtained at dusk. Calibration images were taken each observing night. The log of observations is given in Table 1.

Instrumental magnitudes were determined with aperture photometry using Muniwin software of the C-Munipack package (Hroch 2014). Photometry procedures of the C-Munipack package are based on the well-known DAOPHOT (Stetson 1987) package. To give an impression to the reader, we provide some example light curves for V1851 Ori, RW Com, PY Boo and TY Boo in Fig. 1.

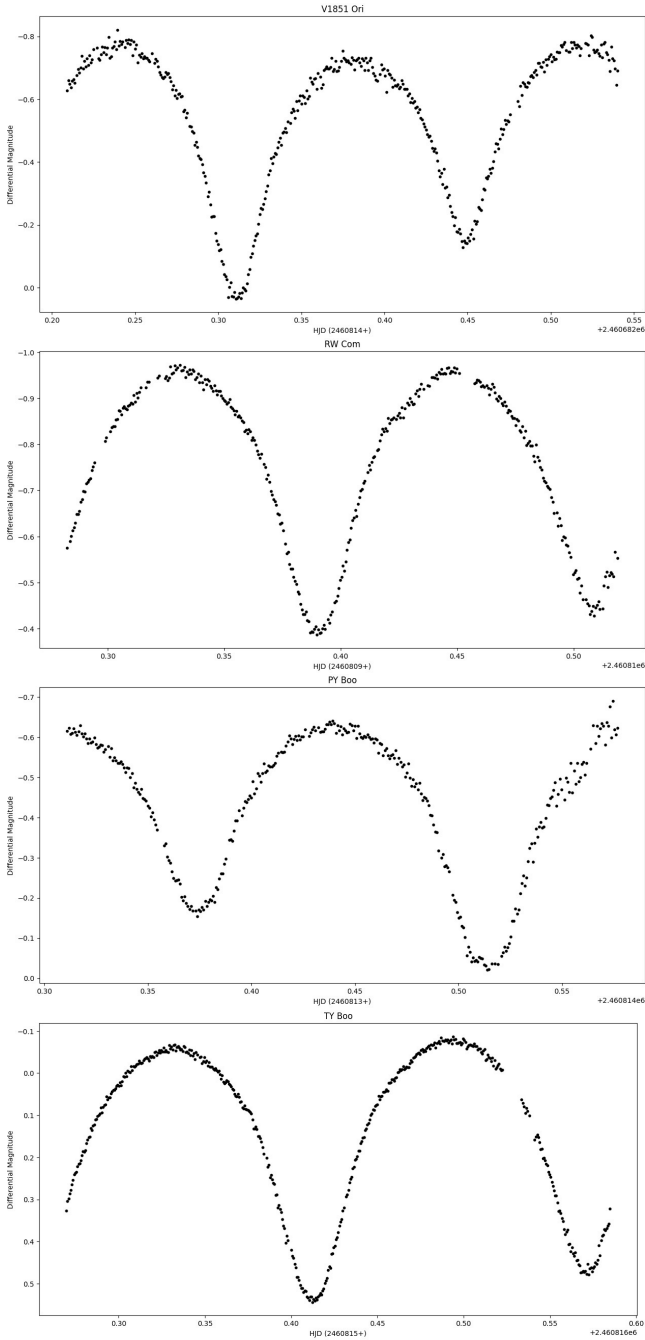
Minimum times of eclipsing binaries were computed with the help of Peranso software (Paunzen & Vanmunster 2016) which uses Kwee and van Woerden method (Kwee & van Woerden 1956). This method requires a homogeneous temporal coverage of the minimum light with an odd number of data points forming a symmetrical profile. Thus, we use the data halfway from the eclipse center at each side. In result, we omit eclipses when the descending or the ascending portion of the light curve is not complete. In this way, we ensure the precision of the minima times given in Table 2. All times in the table were converted into Heliocentric Julian Date (HJD).

## 3 Results

Table 2 lists the minima times that we obtained in this study. Date (UT), minimum time and its uncertainty, filter used in the acquisition of the light curve (B, V, R and I are standard Johnson filters), and the type of the minimum are given in the table as well as the star name. Minimum types I and II refer to the primary and the secondary minimum, respectively. The primary minimum is when the bright companion is eclipsed.

**Table 1.** Log of observations. Date is in “YYYY-MM-DD” format; JD Interval has a prefix of “2460000+”;  $D$ : Duration,  $T_{var}$ : Variable Type;  $N_{fr}$ : Number of frames;  $t$ : Exposure time. Observers are as follows; AAM: Amani Al-Mseree, AK1: Ayşenur Köse AK2: Ada Köken, ANA: Asuman Nura Altınöz, ANO: Aleyna Nur Öztürk, BAD: Bahadır Dilmaç, BD: Batikan Demirel, BG: Baran Günday, CB: Canday Beyaz, DI: Dilara İşler, EED: Elif Ece Devecioğlu, EG: Elanur Güler, EK: Ege Kırhan, EY: Emre Yılmaz, FG: Feyza Genç, FS: Fırat Seven, HA: Hayrunnisa Aykan, HE: Hilal Erişti, IE: Ilgın Ertekin, IK: İrem Kişmir, IO: İrem Özdemir, IOS: İrem Oskaylar, IIT: Irmak İrem Tunçel, IZK: İrem Zeynep Kelkitli, KD: Kardelen Demir, LFT: Latife Fatıma Türkoğlu, MAS: Muhammet Ali Süre, MBB: Muhammed Baki Bayram, MI: Mehmet İçen, MIE: Melike İlayda Eryılmaz, MuO: Muhammet Özcan, NK: Nurbanu Kurt, NNK: Nisa Nur Kılınç, RA: Rafi Al Harits, SA: Samet Ayhan, SF: Sajed Fateh, SK: Selin Kedik, SO: Sibel Ötken, SOZ: Sezer Özel, ST: Sudenur Tırak, UY: Umut Yıldız, VMT: Verda Melek Tekin, YA: Yusuf Avcioğlu, YAL: Yağız Altıkulaç, YEC: Yunus Emre Çetinkaya, YH: Yusuf Hacıoğlu, ZE: Zeynep Erol, ZIC: Zeynep Irmak Cankara, ZT: Zafer Toy.

| Date       | JD Interval               | $D$ (h) | Star      | $T_{var}$ | $N_{fr}$ | Filter | $t$ (s) | Observers                    |
|------------|---------------------------|---------|-----------|-----------|----------|--------|---------|------------------------------|
| 2024-05-05 | 436.2821840 - 436.5442286 | 6.29    | QQ Boo    | EW        | 583      | V      | 32      | SB,IK,BD                     |
| 2024-05-07 | 438.2941422 - 438.4179975 | 2.97    | NW Leo    | EW        | 289      | R      | 30      | IZK,ZT,AK1                   |
| 2024-05-13 | 444.3712713 - 444.5454354 | 4.18    | VY UMi    | EW        | 283      | V      | 45      | ZE,MuO,SF,EG                 |
| 2024-05-17 | 448.2947933 - 448.5890770 | 7.06    | GN Boo    | EW        | 375      | V      | 60      | MBB,SOZ,SO                   |
| 2024-05-21 | 452.2833757 - 452.3957627 | 2.70    | PY Com    | EW        | 142      | R      | 60      | ZT,SK,ANO                    |
| 2024-05-28 | 459.3589045 - 459.4664226 | 2.58    | QX Vir    | EW        | 199      | R      | 40      | AK1,IZK,ZT                   |
| 2024-05-29 | 460.3959525 - 460.5461999 | 3.61    | HH Boo    | EW        | 193      | V      | 60      | MBB,SOZ,SO,SK                |
| 2024-05-31 | 462.3858329 - 462.5501399 | 3.94    | TU Boo    | EW        | 184      | V      | 70      | MBB,SOZ,SO,EY,NK             |
| 2024-06-03 | 465.3212117 - 465.5641404 | 5.83    | TY Boo    | EW        | 265      | V      | 70      | MBB,SOZ,SO                   |
| 2024-06-05 | 467.2863173 - 467.4985081 | 5.09    | V1103 Her | EW        | 252      | V      | 60      | MBB,MI,UY,SOZ,SO             |
| 2024-06-07 | 469.2862097 - 469.5389006 | 6.06    | V1167 Her | EW        | 308      | V      | 60      | MBB,SOZ,SO                   |
| 2024-06-10 | 472.3181183 - 472.5056466 | 4.50    | V384 Ser  | EW        | 443      | V      | 30      | MIE,ZE,MuO,MI,YEC,SF,EED,YAL |
| 2024-06-13 | 475.3524267 - 475.5052816 | 3.67    | V1183 Her | EW        | 135      | V      | 90      | MBB,SO,SOZ                   |
| 2024-06-20 | 482.3195885 - 482.5363883 | 5.20    | V2851 Oph | EW        | 230      | I      | 75      | HE,IZK,CB,SA,BG              |
| 2024-06-21 | 483.2866838 - 483.5805516 | 7.05    | V1197 Her | EW        | 306      | V      | 70      | MBB,EK,ST                    |
| 2024-06-24 | 486.3723199 - 486.5615341 | 4.54    | V404 Dra  | EW        | 295      | V      | 40      | ZE,MuO,SOZ,SO                |
| 2024-06-27 | 489.3236745 - 489.5568755 | 5.60    | V1497 Her | EW        | 245      | R      | 75      | SOZ,CB,SA                    |
| 2024-06-28 | 490.2931009 - 490.5672318 | 6.58    | V1321 Her | EW        | 649      | V      | 30      | MBB,SO,SOZ,NK                |
| 2024-06-30 | 492.2963208 - 492.4859359 | 4.55    | V1284 Her | EW        | 289      | V      | 50      | MBB,SO,SOZ,NK                |
| 2024-07-02 | 494.3275988 - 494.3933362 | 1.58    | V1172 Her | EW        | 109      | R      | 45      | IZK,ZT                       |
| 2024-07-12 | 504.2827631 - 504.4891791 | 4.95    | V496 Vul  | EW        | 376      | V      | 40      | MBB                          |
| 2024-08-07 | 530.2808288 - 530.4952446 | 5.15    | BX Peg    | EW        | 434      | V      | 30      | ZE,MuO,UY                    |
| 2024-08-15 | 538.3070836 - 538.5871250 | 6.72    | V685 Peg  | EW        | 270      | R, I   | 75      | ZT                           |
| 2024-08-18 | 541.3132471 - 541.5879279 | 6.59    | V685 Peg  | EW        | 260      | R, I   | 75      | ZT,CB                        |
| 2024-08-20 | 543.3240293 - 543.5167719 | 4.63    | V685 Peg  | EW        | 190      | R, I   | 75      | ZT,SK,ANO                    |
| 2024-08-23 | 546.3089665 - 546.5734696 | 6.35    | V596 Peg  | EW        | 332      | V      | 60      | FG,NNK                       |
| 2024-09-25 | 579.2656068 - 579.5620390 | 7.11    | V576 Peg  | EW        | 547      | V      | 40      | MI,ST,UY,EK,IO,SO,SOZ        |
| 2024-10-04 | 588.2643294 - 588.5114604 | 5.93    | KW Psc    | EW        | 314      | V      | 60      | MBB,SOZ,SO,NK,IIT,FG,EK      |
| 2024-10-15 | 599.4187459 - 599.5137670 | 2.28    | V685 Peg  | EW        | 101      | R      | 75      | SOZ,SK,ANO,SO                |
| 2024-10-25 | 609.1932263 - 609.4462661 | 6.07    | V483 And  | EW        | 384      | V      | 30      | SO,IK,BAD,SA                 |
| 2024-11-02 | 617.1773744 - 617.3730926 | 4.70    | V801 And  | EW        | 213      | V      | 70      | SOZ,NNK,YA,YEC               |
| 2024-11-30 | 645.3932816 - 645.6342752 | 5.78    | V2790 Ori | EW        | 285      | V      | 65      | SOZ,YA,NNK                   |
| 2024-12-14 | 659.2817529 - 659.5028845 | 5.31    | V1848 Ori | EW        | 635      | R      | 25      | SOZ,NK                       |
| 2025-01-06 | 682.2090797 - 682.5402215 | 7.95    | V1851 Ori | EW        | 431      | V      | 60      | ZE,SK,MAS                    |
| 2025-01-17 | 693.5939729 - 693.4068701 | 4.49    | LX Leo    | EW        | 174      | V      | 80      | SO,IK,BAD,NK,FG,YA,SOZ       |
| 2025-01-25 | 701.2317405 - 701.4413442 | 5.03    | V2841 Ori | EW        | 271      | V      | 60      | SOZ,YEC                      |
| 2025-01-27 | 703.1905240 - 703.3938973 | 4.88    | V801 And  | EW        | 311      | V      | 50      | SO,SOZ                       |
| 2025-03-07 | 742.3732773 - 742.5837548 | 5.05    | RW Com    | EW        | 506      | V      | 30      | SO,KD,SK,SOZ                 |
| 2025-03-08 | 743.3464652 - 743.5699855 | 5.36    | DR CVn    | EW        | 416      | V      | 40      | SOZ,LFT,YEC,SO               |
| 2025-03-13 | 749.2671866 - 749.4814812 | 5.14    | LX Leo    | EW        | 281      | V      | 60      | MBB,SO,AAM,SK,IHK            |
| 2025-03-21 | 756.6447121 - 756.6486010 | 0.09    | QQ Boo    | EW        | 410      | V      | 50      | SO,SOZ                       |
| 2025-03-21 | 756.3200134 - 756.3877564 | 1.63    | V548 Dra  | EW        | 164      | V      | 30      | SO,SOZ                       |
| 2025-04-12 | 778.3912368 - 778.5863536 | 4.68    | QQ Boo    | EW        | 250      | V      | 60      | SOZ,NNK,FG                   |
| 2025-05-03 | 799.2571075 - 799.4979265 | 5.78    | QW Boo    | EW        | 404      | V      | 50      | SOZ                          |
| 2025-05-08 | 804.308997 - 804.4671996  | 3.80    | NX Boo    | EW        | 108      | V      | 60      | ZE,IE,MuO,ZIC,YH             |
| 2025-05-13 | 809.2712901 - 809.4414722 | 4.08    | QW Boo    | EW        | 240      | V      | 60      | SOZ,SO,YA,IIT                |
| 2025-05-14 | 810.2825469 - 810.5189530 | 5.67    | RW Com    | EW        | 375      | V      | 45      | IZK,MAS,SOZ,SO               |
| 2025-05-18 | 814.3110225 - 814.5768840 | 6.38    | PY Boo    | EW        | 342      | V      | 60      | SOZ                          |
| 2025-05-19 | 815.3160708 - 815.5151151 | 4.78    | TY Boo    | EW        | 300      | V      | 50      | MI,EG,DI,AK2,RA              |
| 2025-05-20 | 816.2728921 - 816.5881127 | 7.57    | TY Boo    | EW        | 475      | V      | 50      | MI,ZIC,FS,BG,BD              |
| 2025-05-21 | 817.3046433 - 817.5767286 | 6.53    | TY Boo    | EW        | 385      | V      | 50      | IZK,OS,ANA,BG                |
| 2025-05-22 | 818.3762076 - 818.5746960 | 4.76    | NX Boo    | EW        | 247      | V      | 60      | ZE,YAL,SK,MuO                |
| 2025-05-23 | 819.3463322 - 819.5825913 | 5.67    | AV CrB    | EW        | 350      | V      | 60      | SO,SOZ,SK,NK,HA              |



**Figure 1.** Example light curves for V1851 Ori, RW Com, PY Boo and TY Boo obtained with IST40 telescope. Light curves are given in differential magnitudes and Heliocentric Julian Day fraction. Details can be seen in Table 2.

Some stars were observed extensively and have many times of minimum. In the table we present all the minima times obtained in different photometric filters when available. Thus, we did not average those times and left this decision to the prospective reader.

#### Acknowledgment

IST40 is one of the observational facilities of the İstanbul University Observatory. This study was funded by the Scientific

**Table 2.** List of minimum times. Table lists UT date (YYYY-MM-DD), minimum time ( $T_{\min}$ ) in HJD 2400000+, uncertainty of the minimum ( $\Delta_{\min}$ ) in days, filter of observation and the type of the minimum (Type). For the minimum type, I and II denotes the primary and the secondary minimum, respectively.

| Star      | UT Date    | $T_{\min}$   | $\Delta_{\min}$ | Filter | Type |
|-----------|------------|--------------|-----------------|--------|------|
| V483 And  | 2024-10-25 | 60609.335734 | 0.000856        | V      | II   |
| V801 And  | 2024-11-02 | 60617.225167 | 0.000163        | V      | I    |
| V801 And  | 2024-11-02 | 60617.359929 | 0.000726        | V      | II   |
| V801 And  | 2025-01-27 | 60703.354063 | 0.000221        | V      | I    |
| V801 And  | 2025-01-27 | 60703.224019 | 0.000256        | V      | II   |
| V338 Aqr  | 2024-09-26 | 60580.387666 | 0.000281        | V      | I    |
| GN Boo    | 2024-05-17 | 60448.525903 | 0.000421        | V      | I    |
| GN Boo    | 2024-05-17 | 60448.377774 | 0.000392        | V      | II   |
| HH Boo    | 2024-05-29 | 60460.454741 | 0.000231        | V      | II   |
| NX Boo    | 2025-05-08 | 60804.407906 | 0.000659        | V      | II   |
| NX Boo    | 2025-05-22 | 60818.470440 | 0.000354        | V      | II   |
| PY Boo    | 2025-05-18 | 60814.513252 | 0.000174        | V      | I    |
| PY Boo    | 2025-05-18 | 60814.373733 | 0.000155        | V      | II   |
| QQ Boo    | 2024-05-05 | 60436.430364 | 0.001861        | V      | I    |
| QQ Boo    | 2025-03-21 | 60756.531094 | 0.000346        | V      | I    |
| QQ Boo    | 2025-04-12 | 60778.510929 | 0.000376        | V      | II   |
| QW Boo    | 2025-05-03 | 60799.279365 | 0.000399        | V      | I    |
| QW Boo    | 2025-05-13 | 60809.316546 | 0.000246        | V      | II   |
| TU Boo    | 2024-05-31 | 60462.459702 | 0.000125        | V      | II   |
| TY Boo    | 2024-06-03 | 60465.336752 | 0.000076        | V      | I    |
| TY Boo    | 2024-06-03 | 60465.495622 | 0.000122        | V      | II   |
| TY Boo    | 2025-05-19 | 60815.463913 | 0.000103        | V      | I    |
| TY Boo    | 2025-05-20 | 60816.414831 | 0.000261        | V      | I    |
| TY Boo    | 2025-05-20 | 60816.573731 | 0.000316        | V      | II   |
| TY Boo    | 2025-05-21 | 60817.367101 | 0.000067        | V      | I    |
| DR CVn    | 2025-03-08 | 60743.360621 | 0.000511        | V      | I    |
| DR CVn    | 2025-03-08 | 60743.524245 | 0.000219        | V      | II   |
| RW Com    | 2025-03-07 | 60742.508514 | 0.000095        | V      | I    |
| RW Com    | 2025-03-07 | 60742.389007 | 0.000199        | V      | II   |
| RW Com    | 2025-05-14 | 60810.389808 | 0.000061        | V      | I    |
| RW Com    | 2025-05-14 | 60810.508278 | 0.000228        | V      | II   |
| PY Com    | 2024-05-21 | 60452.348137 | 0.000141        | R      | II   |
| AV CrB    | 2025-05-23 | 60819.501226 | 0.000176        | V      | I    |
| V404 Dra  | 2024-06-24 | 60486.536284 | 0.000411        | V      | II   |
| V548 Dra  | 2025-03-21 | 60756.342980 | 0.000176        | V      | II   |
| V1103 Her | 2024-06-05 | 60467.467887 | 0.000414        | V      | I    |
| V1103 Her | 2024-06-05 | 60467.324278 | 0.000872        | V      | II   |
| V1167 Her | 2024-06-05 | 60469.475340 | 0.001384        | V      | I    |
| V1167 Her | 2024-06-07 | 60469.338992 | 0.000417        | V      | II   |
| V1172 Her | 2024-07-02 | 60494.366329 | 0.000191        | R      | I    |
| V1183 Her | 2024-06-13 | 60475.387997 | 0.000945        | V      | I    |
| V1197 Her | 2024-06-21 | 60483.478629 | 0.000277        | V      | I    |
| V1197 Her | 2024-06-21 | 60483.347471 | 0.000661        | V      | II   |
| V1284 Her | 2024-06-30 | 60492.368398 | 0.000121        | V      | II   |
| V1321 Her | 2024-06-28 | 60490.488701 | 0.000335        | V      | I    |
| V1321 Her | 2024-06-28 | 60490.351611 | 0.000263        | V      | II   |
| V1497 Her | 2024-06-27 | 60489.434084 | 0.000150        | R      | I    |
| LX Leo    | 2025-01-17 | 60693.530030 | 0.000752        | V      | I    |
| LX Leo    | 2025-04-17 | 60693.412176 | 0.000517        | V      | II   |
| LX Leo    | 2025-03-14 | 60749.284121 | 0.000301        | V      | I    |
| LX Leo    | 2025-03-14 | 60749.401509 | 0.000262        | V      | II   |
| NW Leo    | 2024-05-07 | 60438.328307 | 0.000138        | R      | I    |
| V2851 Oph | 2024-06-20 | 60482.330041 | 0.000705        | I      | I    |
| V2851 Oph | 2024-06-20 | 60482.467186 | 0.000908        | V      | II   |
| V1848 Ori | 2024-12-14 | 60659.411045 | 0.000164        | R      | I    |
| V1851 Ori | 2025-01-06 | 60682.311200 | 0.000197        | V      | I    |
| V1851 Ori | 2025-01-06 | 60682.448520 | 0.000163        | V      | II   |
| V2790 Ori | 2024-11-30 | 60645.547467 | 0.000143        | V      | II   |
| V2841 Ori | 2025-01-25 | 60701.276289 | 0.000324        | V      | I    |
| V2841 Ori | 2025-01-25 | 60701.391551 | 0.000205        | V      | II   |

Table 2 – continued.

| Star     | UT Date    | $T_{\min}$   | $\Delta_{\min}$ | Filter | Type |
|----------|------------|--------------|-----------------|--------|------|
| BX Peg   | 2024-08-07 | 60530.297362 | 0.000716        | V      | I    |
| BX Peg   | 2024-08-07 | 60530.439480 | 0.000264        | V      | II   |
| V576 Peg | 2024-09-25 | 60579.363288 | 0.000166        | V      | I    |
| V576 Peg | 2024-09-25 | 60579.493000 | 0.000258        | V      | II   |
| V596 Peg | 2024-08-23 | 60546.506395 | 0.000231        | V      | I    |
| V596 Peg | 2024-08-23 | 60546.365489 | 0.000185        | V      | II   |
| V685 Peg | 2024-08-15 | 60538.556355 | 0.000549        | R      | I    |
| V685 Peg | 2024-08-15 | 60538.397751 | 0.000143        | R      | II   |
| V685 Peg | 2024-08-15 | 60538.556640 | 0.000253        | I      | I    |
| V685 Peg | 2024-08-15 | 60538.397902 | 0.000124        | I      | II   |
| V685 Peg | 2024-08-20 | 60541.570162 | 0.000695        | R      | II   |
| V685 Peg | 2024-08-20 | 60541.570524 | 0.000247        | I      | II   |
| V685 Peg | 2024-08-22 | 60545.377474 | 0.000175        | R      | II   |
| V685 Peg | 2024-08-22 | 60545.377457 | 0.000134        | I      | II   |
| V685 Peg | 2024-08-27 | 60550.454055 | 0.000501        | R      | I    |
| V685 Peg | 2024-08-27 | 60550.453725 | 0.000247        | I      | I    |
| V685 Peg | 2024-10-15 | 60599.471115 | 0.000182        | R      | I    |
| V685 Peg | 2024-10-18 | 60541.411894 | 0.000386        | R      | I    |
| V685 Peg | 2024-10-18 | 60541.570646 | 0.000379        | R      | II   |
| V685 Peg | 2024-10-18 | 60541.411978 | 0.000440        | I      | I    |
| V685 Peg | 2024-10-18 | 60541.570677 | 0.000100        | I      | II   |
| V596 Peg | 2024-09-27 | 60581.518625 | 0.000132        | V      | I    |
| KW Psc   | 2024-10-04 | 60588.362623 | 0.000072        | V      | I    |
| KW Psc   | 2024-10-04 | 60588.480071 | 0.000276        | V      | II   |
| V384 Ser | 2024-06-10 | 60472.462692 | 0.000474        | V      | I    |
| V384 Ser | 2024-06-10 | 60472.328742 | 0.000886        | V      | II   |
| VY UMi   | 2024-05-13 | 60444.438372 | 0.000188        | V      | I    |
| QX Vir   | 2024-05-28 | 60459.390719 | 0.000216        | R      | II   |
| V496 Vul | 2024-07-12 | 60504.330644 | 0.000347        | V      | I    |

Research Projects Coordination Unit of İstanbul University with project numbers: BAP-3685 and FBG-2017-23943.

Authors are grateful to Dr. Sinan Alis for his continuous guidance and support during the IST40 observations. Authors are also grateful for all the observers who contributed and took part in this monitoring program at the İstanbul University Observatory.

IST40 team is grateful to M. Baki Bayram for developing Ufuksal, an observation planning software for variable stars, and making it available to the team's access. This research made use of [Peranso](#), a light curve and period analysis software.

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