

GSC 3203-0780 - A NEW ALGOL-TYPE ECLIPSING BINARY

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Abstract: GSC 3203-0780 is identified as an eclipsing binary for the first time. Nine timings of primary and secondary minima were obtained. The well-defined and sharp begin and end of minima imply that GSC 3203-0780 is an EA-type binary with a period $P=0^d.824846$.

During the observation of DE Lac, a high-amplitude δ Scuti star, GSC 3203-0780 was within the field of view, which was found to be variable. Follow-up observations in 2008 and 2009 provides first indication on the type of light curve morphology. The star is located at $\alpha_{2000}=22^h11^m33^s.4$, $\delta_{2000}=+40^\circ41'51''.3$ and is also identified as USNO-B1.0 1306-0470210 and N2X8000197 (GSC 2.3). In GSC 2.3 the magnitude of the V photographic band is listed as $V=13^m90$.

First photometric observations of the eclipsing binary GSC 3203-0780 were carried out over three nights in 2008 and 2009 with a SBIG ST10XME CCD camera and IR cut-off filter attached at a 60 mm (2.4 inch) f/11.7 refractor. The effective field of view of the CCD photometric system is about $73' \times 49'$ and the size of each pixel is $2.0'' \times 2.0''$. Due to the low brightness of the variable star, the exposure times were set to 180 or 300 seconds for each CCD image.

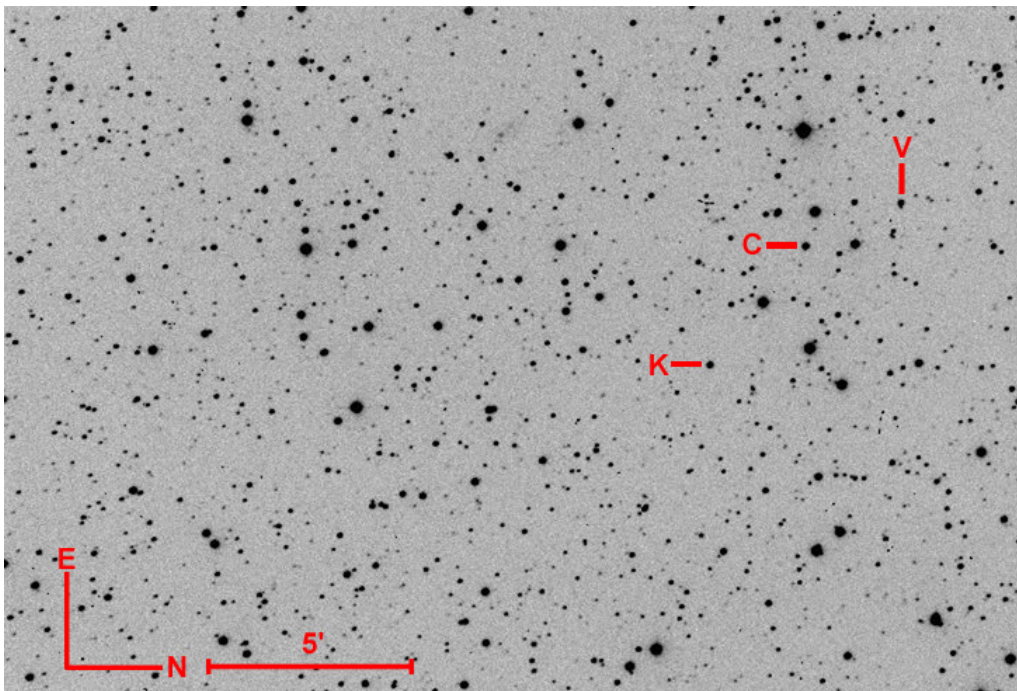


Figure 1: Typical V filter frame of the GSC 3203-0780 field. The field is $24' \times 16'$. GSC 3203-0780 is labeled as star V; stars C and K are the selected comparison and check stars.

Further time-series CCD photometry was obtained for GSC 3203-0780 during 11 nights between 15 July 2010 and 18 July 2011 using a 14 inch cassegrain telescope at f/6 equipped with a CCD SBIG ST10XME and V filter in Gemmingen (Germany). The CCD was configured in a 3x3 binning mode resulting in an angular resolution of 2.0"/pixel (the field of view is 24'x 16'). The typical integration time was 300 seconds.

The CCD images were reduced with standard procedures in Mira AP¹. The flatfield correction utilized sky-flat images taken during the morning twilight. Aperture photometry was also performed in Mira AP and differential magnitudes were calculated. In total 763 data points were used in the analysis obtained during 61.3 hours of observation.

GSC 3203-0150 and N2X8001356, which are located in the vicinity of GSC 3203-0780 and have similar magnitudes, were used as comparison and check stars (see Fig.1).

The standard deviations of the comp-check magnitudes in different nights are ranging from 0^m006 to 0^m028.

The following times of primary and secondary minima have been determined using the Kwee and Van Woerden method (Kwee et al. (1956)).

Table 1: New times of primary (I) and secondary (II) minima of GSC 3203-0780.

date (yyyy-mm-dd)	minimum time HJD 24. . .	\pm	type	E	O-C [d]	filter	N
2008-10-18	54758.3950	.0008	I	0	-0.0003	IR cut-off	49
2009-06-29	55012.4478	.0003	I	308	-0.0002	IR cut-off	77
2010-07-15	55393.5264	.0005	I	770	-0.0003	V	26
2010-07-30	55408.3760	.0009	I	788	+0.0020	V	77
2010-09-20	55460.3394	.0004	I	851	0.0000	V	58
2010-10-11	55481.3755	.0003	II	876.5	+0.0026	V	80
2010-10-25	55495.3974	.0003	II	893.5	+0.0021	V	32
2011-07-15	55758.5214	.0002	II	1212.5	+0.0003	V	48
2011-07-18	55761.4074	.0003	I	1216	-0.0007	V	53

A linear fit to the 6 times of primary minima provides the following ephemeris:

$$\text{HJD}_{\text{MinI}} = 2454758.3953 + 0.824846 \times E.$$

± 8 ± 1

Figure 2 shows the phased light curve for GSC 3203-0780 from all the V filtered data relative to GSC 3203-0150.

To estimate the observed eclipse depths, polynomial fits of fourth degree were carried out to each of the primary and secondary minimum of the data sets individually. Finally, the mean differential magnitudes were calculated.

As a result of the fitting procedure we obtain an amplitude $\Delta V = 0^m68 \pm 0^m03$ for the primary and $\Delta V = 0^m63 \pm 0^m02$ for the secondary minimum.

¹Mira AP software by Mirametrics, Inc. (USA)

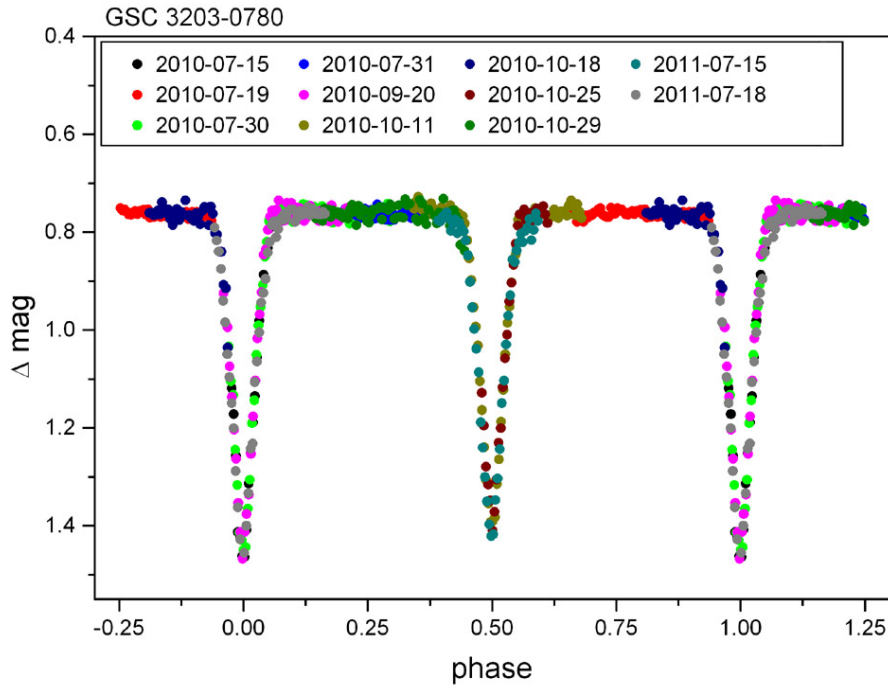


Figure 2: Phased light curve for GSC 3203-0780 from all the V filtered data calculated with $E_0 = 2454758.3953$ and $P = 0^d824846$ (differential magnitudes with respect to GSC 3203-0150).

By assuming a magnitude of 13^m58 in the V photographic band listed in the Guide Star Catalog (GSC 2.3) for the comparison star GSC 3203-0150, the following magnitudes in the instrumental system can be derived: 14^m34 (Max), 15^m02 (MinI) and 14^m97 (MinII), respectively.

The shape of the light curve, an amplitude of $0^m68 \pm 0^m03$ (primary minimum) and the period suggests that GSC 3203-0780 is a low amplitude EA-type eclipsing binary (Kukarkin et. al (1969)).

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References

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