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### The period of GT Gem

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**Abstract:** *The authors present a phased light curve and an improved period of GT Gem.*

### Observations

400mm ASA Astrograph f/3.7

f = 1471 mm

FLI Proline 16803 CCD-Camera

V-filter

t = 120 sec.

Wolfgang Moschner, Astrocamp/Nerpio, Spain

102mm f/5.0 TeleVue Refractor

f = 510 mm

SIGMA 1603 CCD-Camera, Kodak KAF1603ME

IR & UV cut-off filter

t = 90 sec.

Peter Frank, Velden, Germany

### Data analysis

Muniwin [1] and self-written programs by Franz Agerer and Lienhard Pagel were used for the analysis of the frames, after bias, dark and flatfield correction of the exposures. The weighted average of five comparison stars was used.

### **Explanations:**

HJD = heliocentric UTC timings (JD) of the observed minima  
mag = (raw instrumental) magnitude

G-band mean magnitude (Vega)	= 350-1000 nm
Integrated BP mean magnitude (Vega)	= 330- 680 nm
Integrated RP mean magnitude (Vega)	= 640-1000 nm

Explanations to the light curve:

The colors of the symbols denote different nights.

All coordinates are taken from the Gaia DR2 catalogue [4].

The coordinates (epoch J2000) are computed by VizieR, and are not part of the original data from Gaia (note that the computed coordinates are computed from the positions and the proper motions).

## **GT Gem**

Cross-ID

- = **2MASS J06313304+2017249**
- = **Gaia DR2 3372923716898449024**
- = **ASASSN-V J063133.06+201725.4**
- = **ATOID J097.8877+20.2902**
- = **SON 3976**
- = **CSV 767**

Right ascension: 06h31m33.0482s at Epoch=J2000

Declination: +20° 17' 24.929" at Epoch=J2000

Barycentric right ascension (ICRS) at Epoch=2015.5: 97.887697206° +/- 0.04 mas

Barycentric declination (ICRS) at Epoch=2015.5: +20.290253241° +/- 0.04 mas

Gaia DR2 Catalog:

- 14.8591 mag G-band mean magnitude (Vega)
- 14.9889 mag Integrated BP mean magnitude (Vega)
- 14.5747 mag Integrated RP mean magnitude (Vega)

### **Periods known so far:**

Lichtenknecker Database	no information
Simbad (GCVS3)	0.86 d
VSX (AAVSO)	0.86: d
GCVS5	0.86 d
ASAS-SN	1.766634 d
ATLAS	0.883276 d
Kreiner	no information

## **Results**

GT Gem was discovered by C. Hoffmeister in Sonneberg [2] and classified as eclipsing binary. The amplitude is given as 0.9 mag, 15.1-16.0 mag (p). The period is only given to two decimal places. With this information, GT Gem is listed in the GCVS.

Very few minima of this star have been observed so far. Because different periods are mentioned in the publicly available sources, we have examined the period of GT Gem. ASAS-SN also lists GT Gem as an EA star and presents a phased light curve with Min. I and Min. II of approximately the same depth. The amplitude here is only 0.40 mag (Min I) or 0.35 mag (Min II).

The star has a faint companion which has probably influenced the measurement result. This explains the smaller amplitude. In February 2020, the authors measured a minimum of only about 0.1 mag depth. The suspicion arose immediately that the ASAS-SN period should be halved. Based on this halved ASAS-SN period, the authors determined the new period presented here. The three existing Min. I and the new Min. II can thus be represented very well.

The elements which we present were determined with the method of least squares, by taking all O-C values into account (see table 1). The given amplitudes are uncorrected instrumental values.

### GT Gem      new elements

Amplitude: Min I: 0.55 mag (instr.)      Min II: 0.10 mag (instr.)  
 Type: EA type eclipsing binary

Min I =      HJD 2458167.3170 + 0.8832711\*E  
 +-0.0011 +-0.0000024

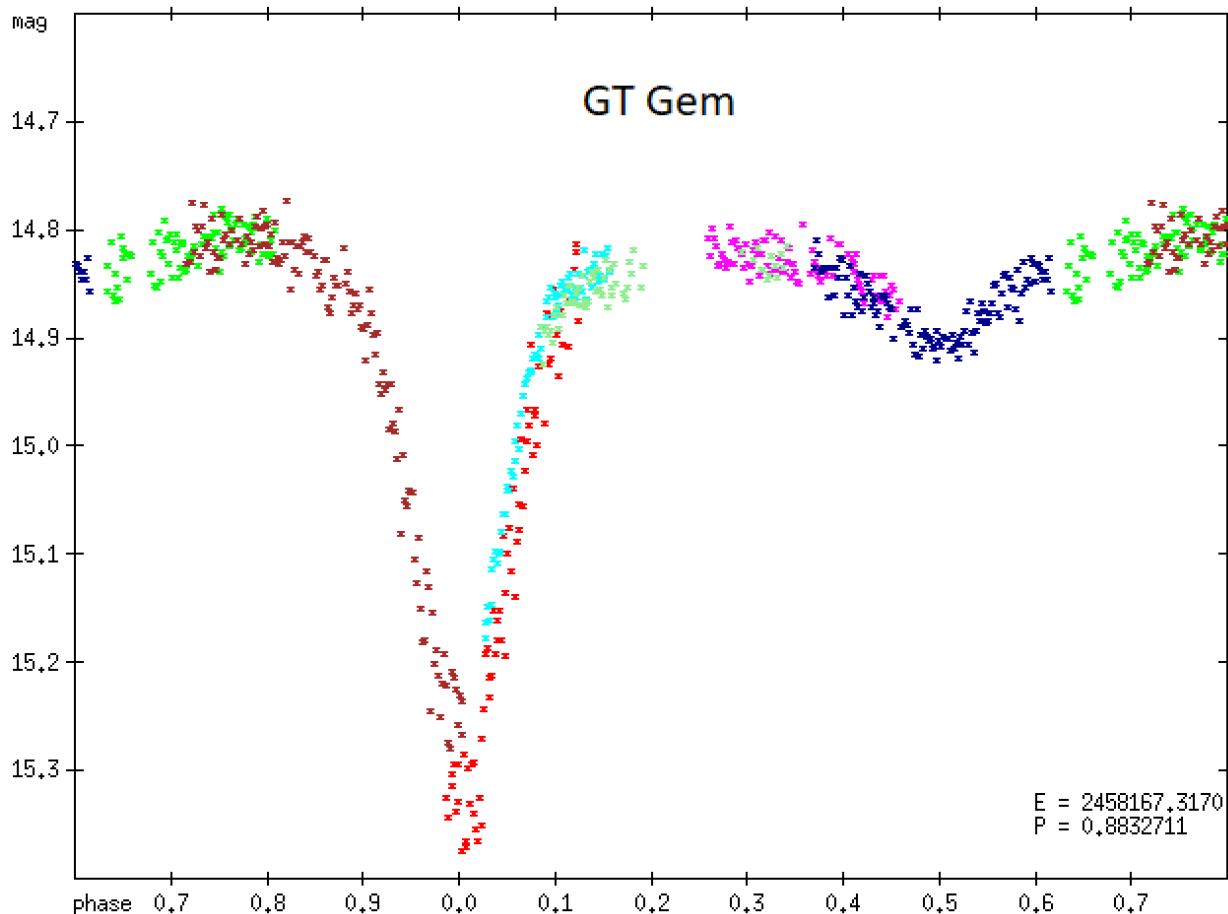


Fig 1: Phased light curve of GT Gem using the ephemeris given by the authors.  
 The vertical axis shows raw instrumental magnitudes. A FLI Proline 16803 + a V-filter (2016-2020) was used. Presented elements were calculated by taking into account all minima (see table below) with the method of least squares.

Observer	HJD-Date					Source
	Minimum	Type	Epoch	O-C (d)		
P. Frank	2456714,3353	I	-1645	-0,0007		
W. Moschner	2458167,3170	I	0	0,0000		
W. Moschner	2458429,6461	I	297	-0,0024		
W. Moschner	2458904,4062	II	834,5	-0,0005		

Table 1: Minima GT Gem, O-C using the ephemeris given by the authors.

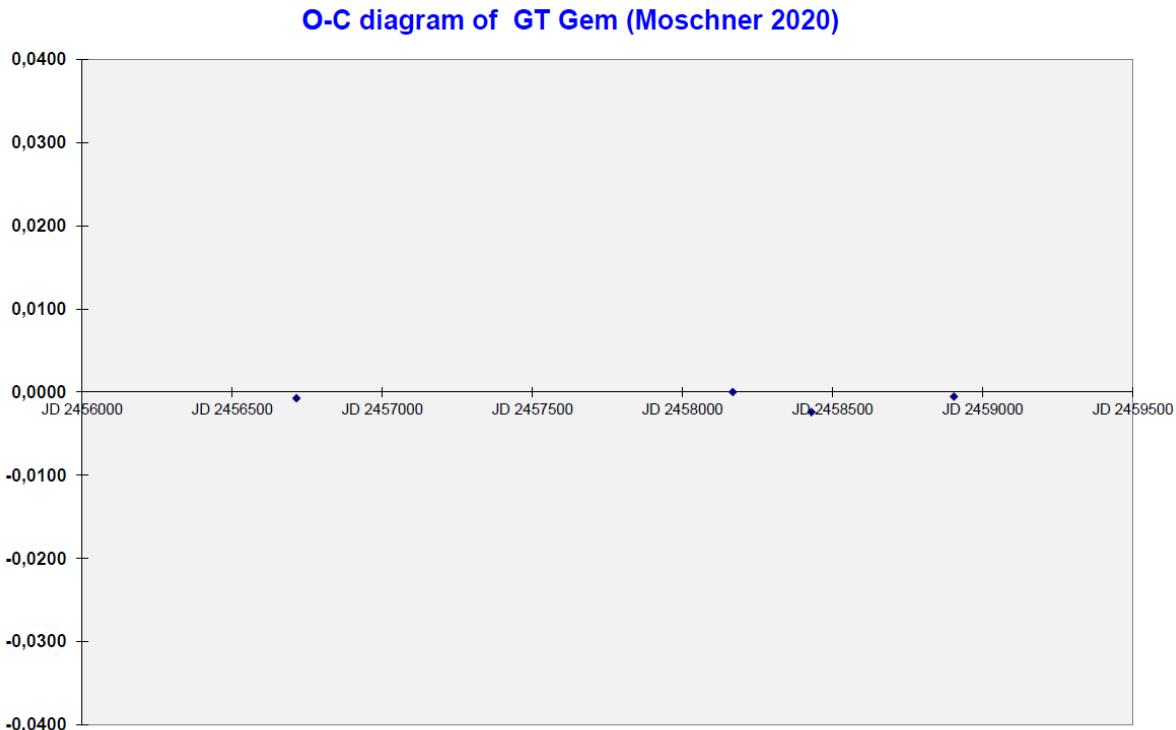


Fig 2: O-C-diagram for GT Gem using the ephemeris given by the authors.

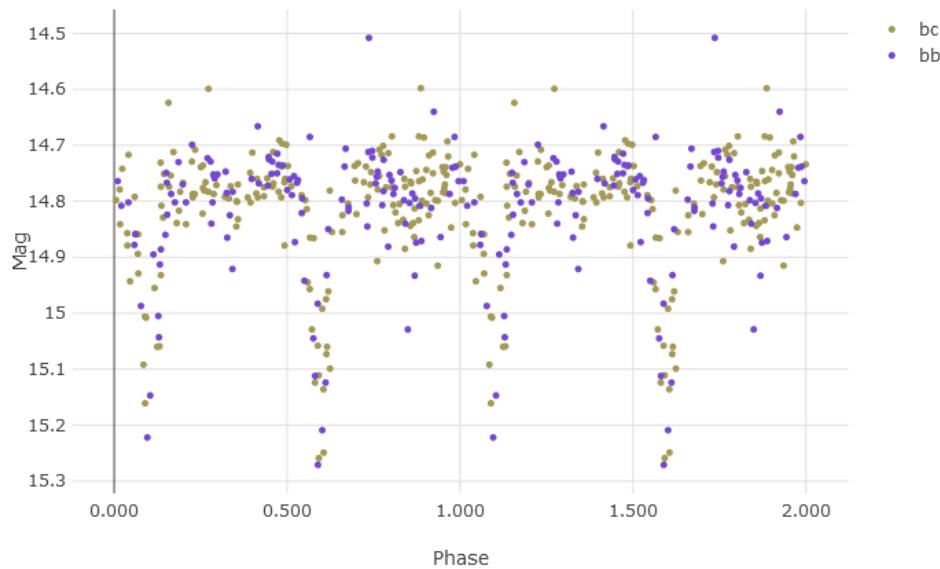


Fig 3: Phased light curve of GT Gem using the ephemeris and data from ASAS-SN with the period 1.766634 d.

After completing these studies, we found a period at the ATLAS project [5] that is similar to ours. Several periods are offered there in the extensive GT Gem data set.

GT Gem (ATLAS 2020)

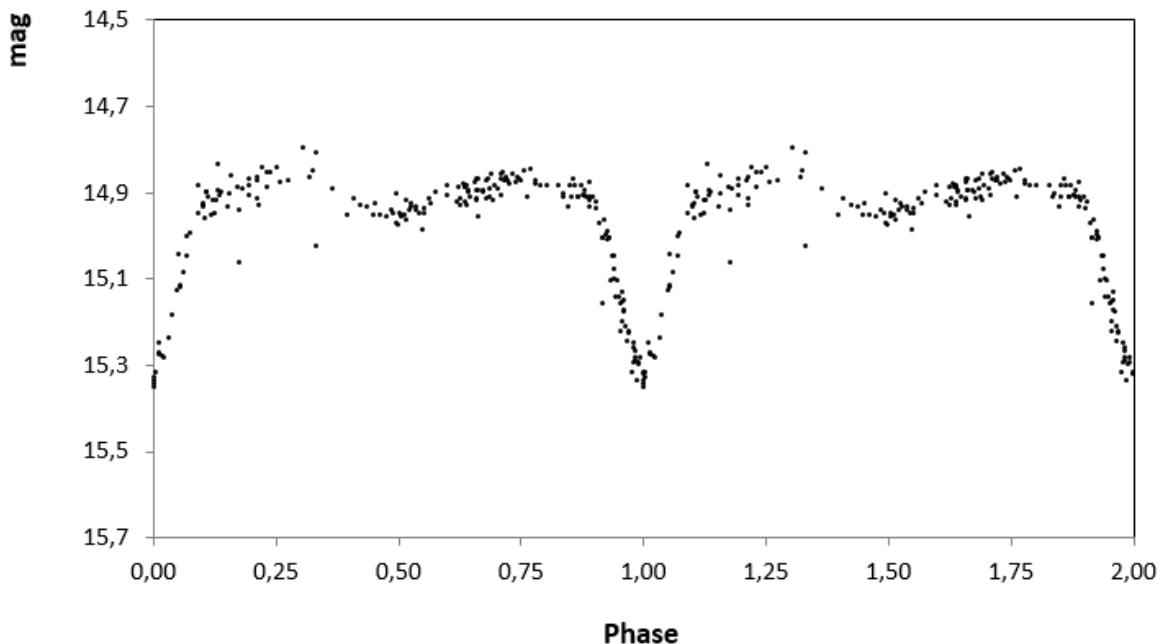


Fig 4: Phased light curve of GT Gem using the ATLAS data and the ephemeris  $\text{HJD } 2458167.317 + 0.883276 \text{ d}^*E$ .

O-C diagram of GT Gem (ATLAS 2018)

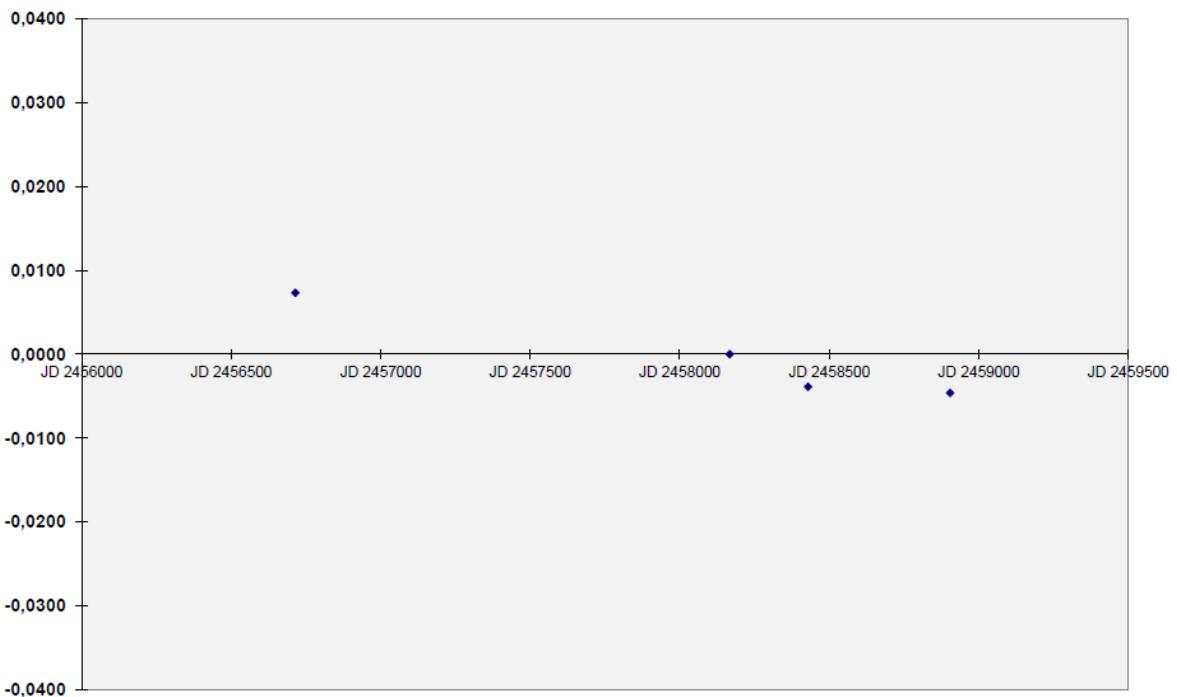


Fig 5: O-C-diagram for GT Gem using the ATLAS data and the ephemeris  $\text{HJD } 2458167.317 + 0.883276 \text{ d}^*E$ .

## Acknowledgements

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European Space Agency.  
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- [5] A first catalog of variable stars measured by ATLAS (Heinze+, 2018)  
<http://vizier.u-strasbg.fr/cgi-bin/VizieR-3?-source=J/AJ/156/241/table4>