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DISCOVERY OF SHORT-PERIOD OSCILLATIONS IN THE MASS-ACCRETING COMPONENT OF TT Vel

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The "Thai Sky Survey for oEA Stars" (THASSOS) project is focused on searching for and studying new mass-accreting pulsating components of semi-detached Algol-type systems, the class of pulsators called oEA stars (Mkrtichian et al., 2002, 2004). Up to now, within the frame of the THASSOS project, four new oEA stars, VY Hya (Gunsriwiwat & Mkrtichian, 2016), GQ TrA (Mkrtichian et al., 2016), BD Vir (Mkrtichian et al., 2017a), and UW Vir (Mkrtichian et al., 2017b) were discovered.

TT Vel is a semi-detached Algol-type eclipsing binary system with a 2.1084 day orbital period. The system is photometrically-neglected and there is no accurate photometric light curve of the system. The A5 V primary component of the system can be pulsating as it is within in the instability strip. For these reasons it was included to the THASSOS oEA candidate list.

12 nights of photometric observations for TT Vel were acquired from March 28 to April 16, 2014 using the 0.6-meter Thai Southern Hemisphere Telescope (TST) PROMPT8 at Cerro Tololo Inter-American Observatory (CTIO). The telescope is equipped with an Apogee Alta E42 CCD camera. Three second exposure times through Johnson B filter were used. All stars in the field of view were reduced with the MaxIm DL 5 software using aperture photometry. HD 89623 (V = 8.09 mag, $B - V$ = 0.00 mag) was used as a comparison star. The phased differential light curve, folded according to HJD = 2456751.320 + 2.1083805×E, is shown in Figure 1.

During the search for pulsational variations in the primary component, we omitted all data at primary minima. The slow orbital variations in out-of-eclipse parts of light curves were removed using low-order polynomial fits. The residual light curves are shown in Figure 2.

Table 1: Pulsation frequencies and amplitudes.

Frequency (c/d)	Amplitude (mag)
f_1=16.455±0.002	0.0046± 0.0003
f_2=15.485±0.003	0.0023± 0.0003

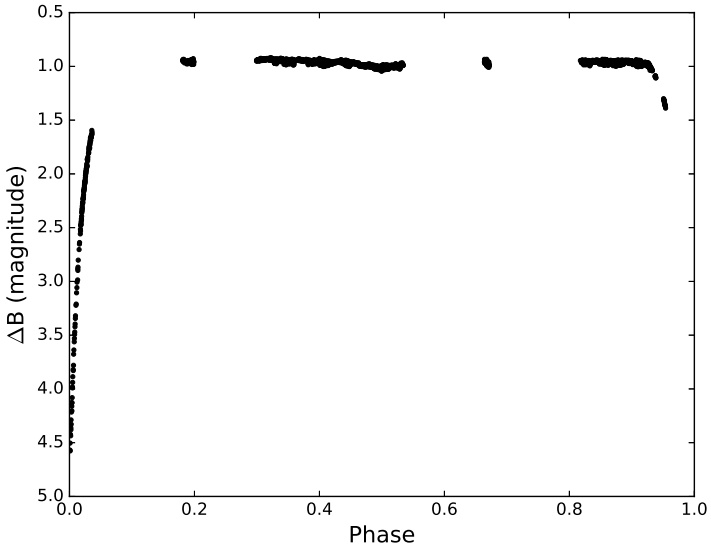

Figure 1. The phased orbital light curve of TT Vel (dots).

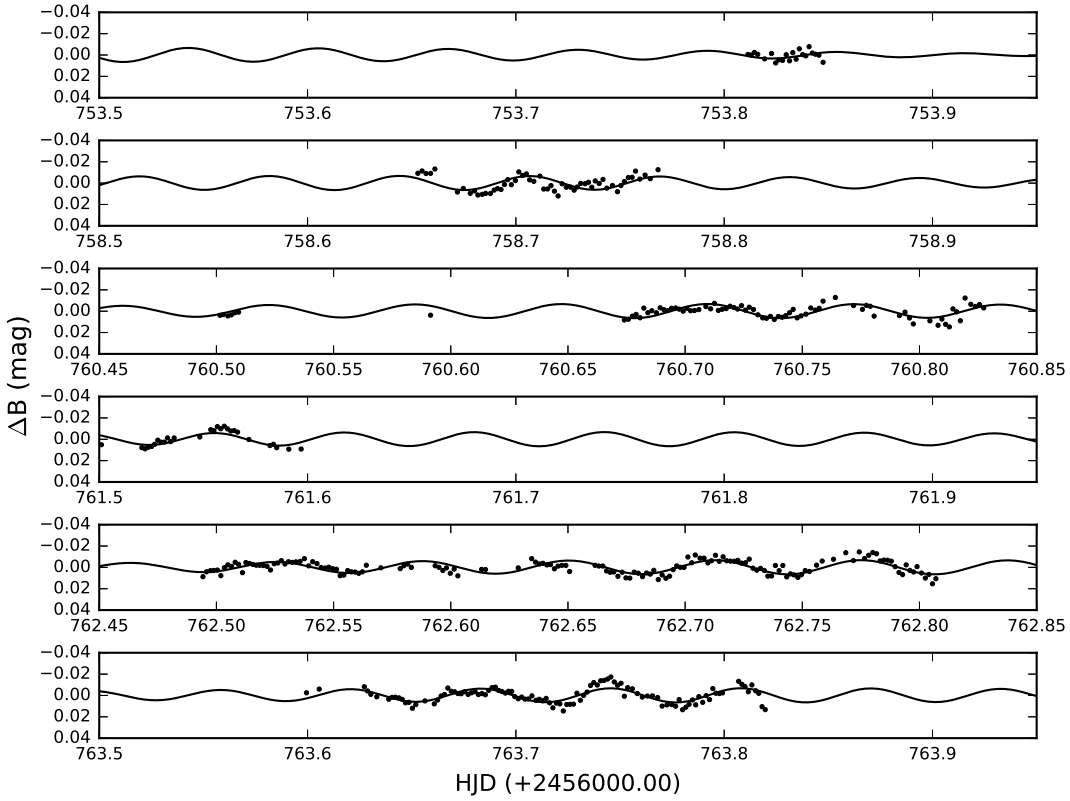

Figure 2. The nightly residual light variations of TT Vel (dots). The solid line is a two-frequency fit to the data.

The periodic signals in the residual data were analysed using the Period04 software (Lenz & Breger, 2005), designed for the Discrete Fourier Transform (DFT) analysis and the pre-whitening technique for consecutive detection of signals in the data. The frequency spectra of consecutive steps of the DFT analysis are shown in Figure 3, from top to bottom. As a result, we detected two periodic signals at frequencies 16.455 c/d and 15.485 c/d. The frequencies and amplitudes of signals are given in Table 1.

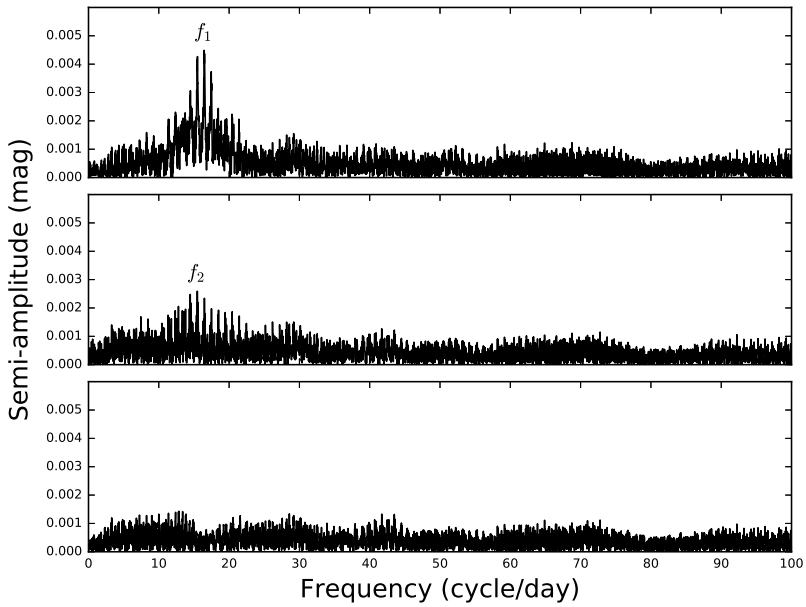

Figure 3. The DFT frequency spectra of the primary component. Top panel - the DFT of the residual light curve, highest peak is at 16.455 c/d. Middle panel - the DFT of the residuals after removal of 16.455 c/d, the highest peak is at 15.485 c/d. Bottom panel - the DFT after removal of 16.455 and 15.485 c/d.

Conclusion: We discovered short-period, δ Scuti-type multiperiodic pulsations in the primary component of the semi-detached, Algol-type binary system TT Vel. We conclude that TT Vel is a new member of the oEA group of pulsators.

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