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GSC 02505-00411: A NEW δ Sct STAR IN THE FIELD OF RZ LMi

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GSC 02505-00411 ($RA_{2000}=09^{\text{h}}51^{\text{m}}27^{\text{s}}.4$; $DEC_{2000}=+34^{\circ}13'08''.0$) is a moderately bright star ($B=14^{\text{m}}32$, $V=14^{\text{m}}16$; Henden et al. 2015, $R=14^{\text{m}}17$; Ofek et al. 2012), located nearby RZ LMi, a cataclysmic variable known with extremely frequent outbursts. Gontcharov et al. (2011) selected this star as an evolved subdwarf at a distance of 1512 pc with an absolute Ks magnitude of 2.65, based on its proper motion and photometric information taken from several all-sky survey catalogs. A low-resolution spectrum was taken by LAMOST project and this star is classified as an A1IV star (Luo et al. 2016). Owing to its location, this star has been observed coincidentally with RZ LMi, and its variability with small amplitude and short period was detected by one of the authors (RK). In this paper, we present our results of time-series observations and discuss its properties.

Observations were done by “East” Zeiss-1000 telescope equipped with Apogee U16M D9 CCD at Tien-Shan Astronomical Observatory in 2017. Exposure time was 90 sec except for a night with the exposure time of 30 sec. Images were reduced in the standard way, and we measured differential magnitude against a comparison star, GSC 02505-00363 ($B=14^{\text{m}}68$, $V=13^{\text{m}}95$; Henden et al. 2015, $R=13^{\text{m}}60$; Ofek et al. 2012), whose constancy was examined with a check star, GSC 02505-00469. Figure 1 shows the light curves of GSC 02505-00411 (black lines). The data are available electronically through the IBVS website as `6205-t2.txt`.

The light curves clearly show variability with a period of ~ 30 min and amplitude changing with the range from <0.01 mag to ~ 0.03 mag. Using the discrete Fourier transform analysis program against the data removed nightly average magnitudes and long term variabilities, we detected the strongest peak at 43.8422 c/d ($0^{\text{d}}022809$), the secondary peak at 27.8976 c/d ($0^{\text{d}}035845$), and a possible third peak at 44.5365 c/d ($0^{\text{d}}022453$), which are listed in Table 1. The power spectrum is shown in Figure 2. Figure 3 shows phase folded light curves with the detected periods, after prewhitening for the other periods. We show the 3-frequency model generated from our Fourier solution overlaid in Figure 1 (red lines). It is clear that additional frequencies exist, however, the quality of our data sets is not enough to detect them.

Based on the amplitude and period of its variations in addition to its spectral type of A1IV, we concluded that GSC 02505-00411 is a δ Sct star. δ Sct stars are pulsating variables of spectral types A to early F with luminosity classes V to III. The pair of short

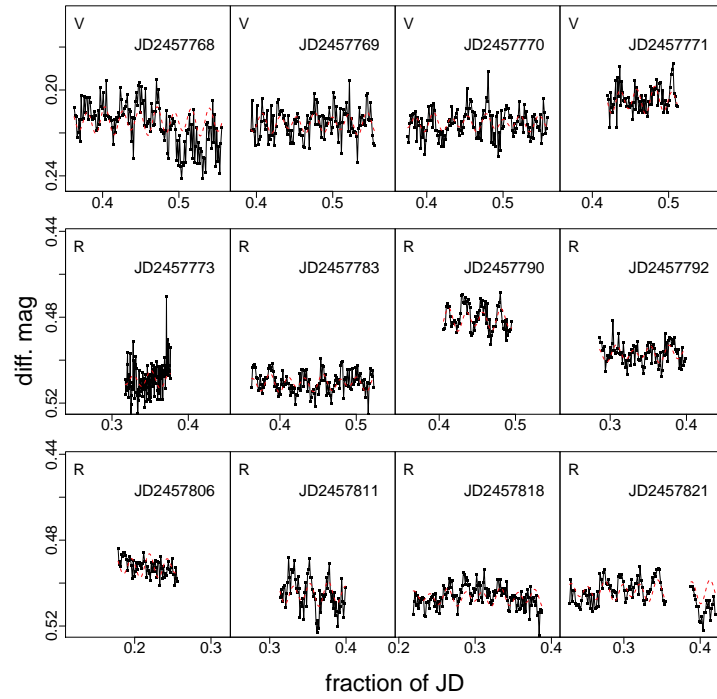


Figure 1. Light curves of GSC 02505-00411 (black line). Two frequency model generated from our Fourier solution is overlaid (red line).

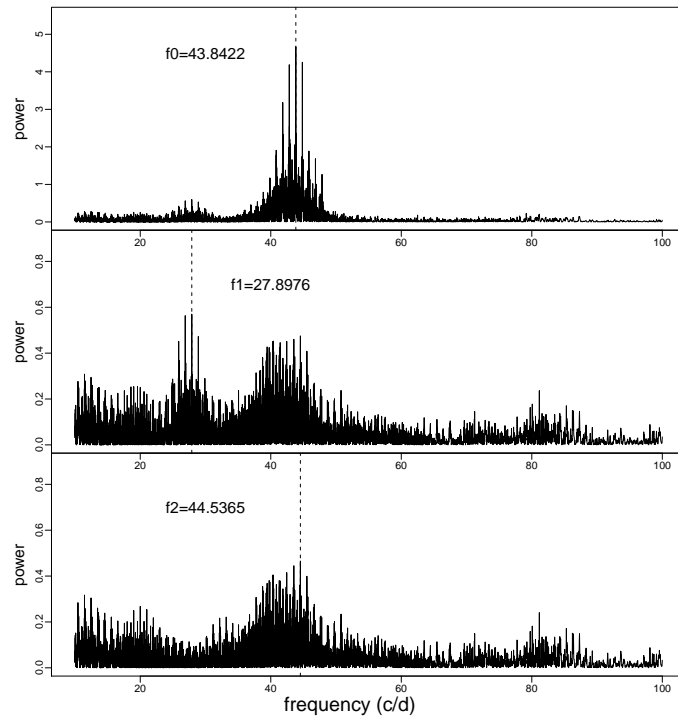


Figure 2. Power spectra of GSC 02505-00411.

Table 1: Frequencies detected in GSC 02505-00411

Mode	Freq. (c/d)	Ampl. (mmag)
f_0	43.8422 ± 0.0025	41
f_1	27.8976 ± 0.0028	15
f_2	44.5365 ± 0.0063	14

pulsation period of 33 min and early spectral type of A1IV is consistent with the relation between spectral type and period for the δ Sct stars (eg. see Figure 6 in Chang et al. 2013). The 2MASS colors of GSC 02505-00411 ($J - H = 0.15$ $H - K = 0.01$; Cutri et al. 2003 & Skrutskie et al. 2006) fall within the region for the class of δ Sct stars in 2MASS colour space (Debosscher et al. 2011).

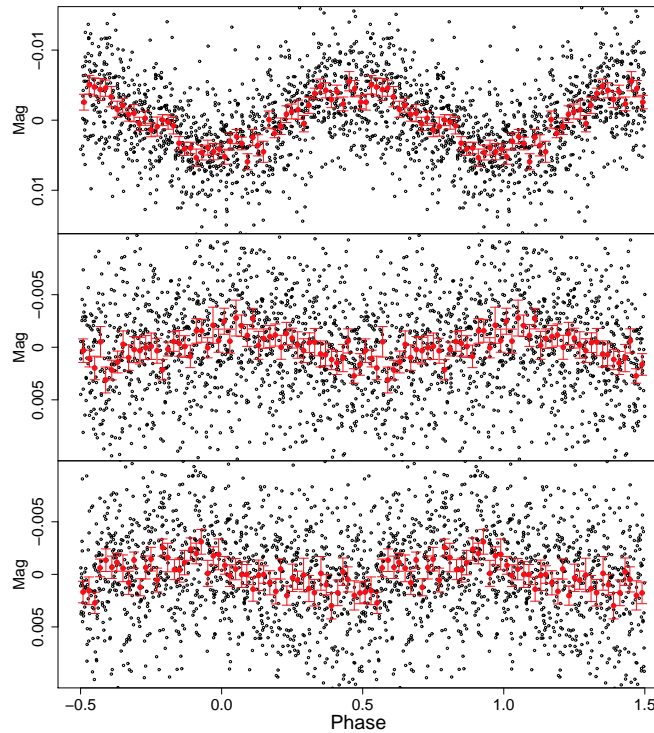


Figure 3. Phase folded light curves of GSC 02505-00411. From top to bottom, for the primary period of 0.022809 d, the secondary period of 0.035845 d, and the possible third period of 0.022453 d after prewhitening for the other periods, respectively.

GSC 02505-00411 is a δ Sct star with multiple frequencies with the primary frequency of 43.84 c/d. This star is in the field of RZ LMi, which means further data will be provided from the observations for this famous cataclysmic variable star.

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analysis was written by Dr. T. Kato.

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