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**$\delta$  SCUTI COMPONENT DISCOVERED IN  
ECLIPSING BINARY SYSTEM BO Her**

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BO Her (HD 336759) is listed as a likely semidetached eclipsing binary system in the catalog of Budding et al. (2004). The General Catalogue of Variable Stars (GCVS), 4th Edition (Kholopov, 1985) describes BO Her as having a period of 4.272843 days, magnitude of  $V=10.8$ , and depth of primary minimum of 2.1. An  $O - C$  diagram for this system spanning 60 years shows subtle variations that have not yet been examined (Kreiner et al., 2001).

In a recent publication, E. Soydugan et al. (2006) identified the primary component of BO Her (spectral type A7) as lying in the  $\delta$  Scuti region of the Cepheid instability strip and have placed it on a list of eclipsing binary systems that might contain pulsating components. At present there are only about three dozen known binary systems with one or more  $\delta$  Scuti components (E. Soydugan et al., 2006; Pigulski & Michalska, 2007; E. Soydugan & F. Soydugan, 2007; Christiansen et al., 2007). Most are semidetached systems; such stars are also called oscillating eclipsing Algol (oEA) stars.

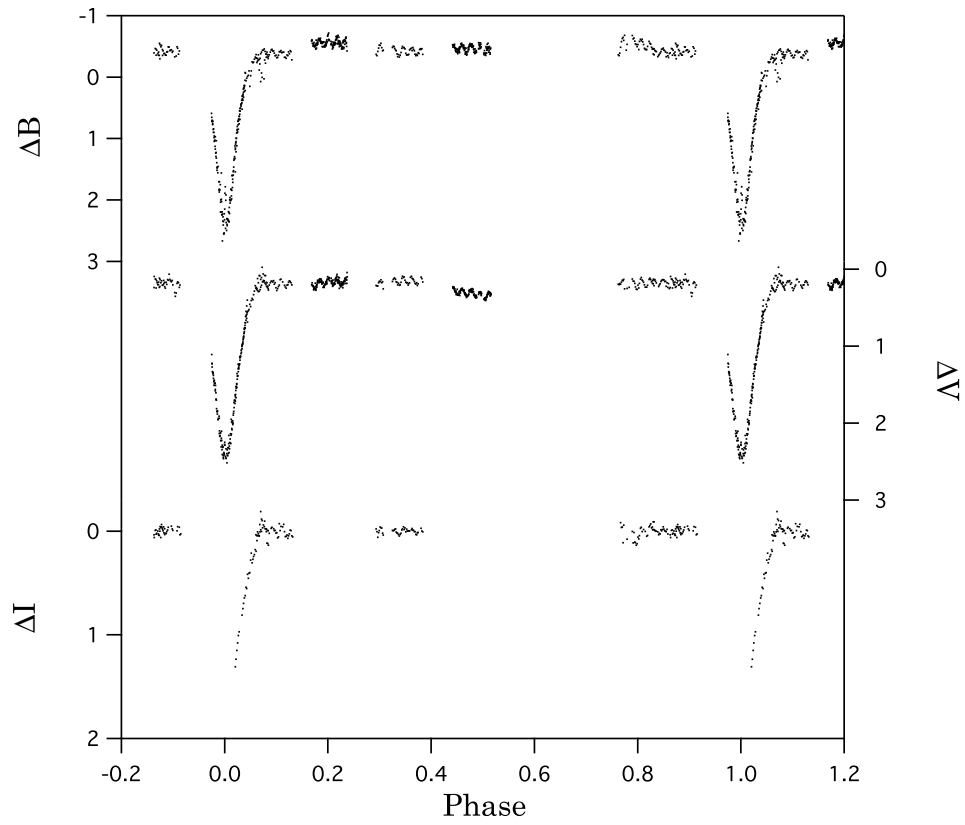
We chose to conduct multifilter photometry of BO Her as part of an ongoing project to determine complete light curves of selected Algol-type (semidetached) binary systems, initially unaware of its potential to contain a pulsating component. We observed BO Her during ten nights between June 14 and July 25, 2007 at the Truman State University Observatory using a 20-cm Meade LX200-GPS telescope. We used both a SBIG ST-7XME CCD camera with  $B$  and  $V$  filters, and a SBIG ST-402ME CCD camera with  $B$ ,  $V$ , and  $I$  filters. The stars HD 336745, HD 336750 and a third uncatalogued star were used as comparisons. MPO Connections was used to control the telescope and CCD camera; MPO Canopus was used for image reduction and data analysis.<sup>1</sup> At present, the light curve for BO Her is about 50% complete, and is shown in Figure 1.

There is some confusion in the literature about the period of BO Her. The GCVS gives a period of 4.272843 days, but the Budding catalog (2004) lists two periods, the GCVS value and 3.087357 days, citing Kreiner et al. (2001). This shorter period is further quoted by E. Soydugan et al. (2006). Our observations show a period of 4.2731 days, in agreement with the GCVS value. The erroneous period of 3.087357 days actually belongs to BC Her, which appears immediately before BO Her in Kreiner's list.

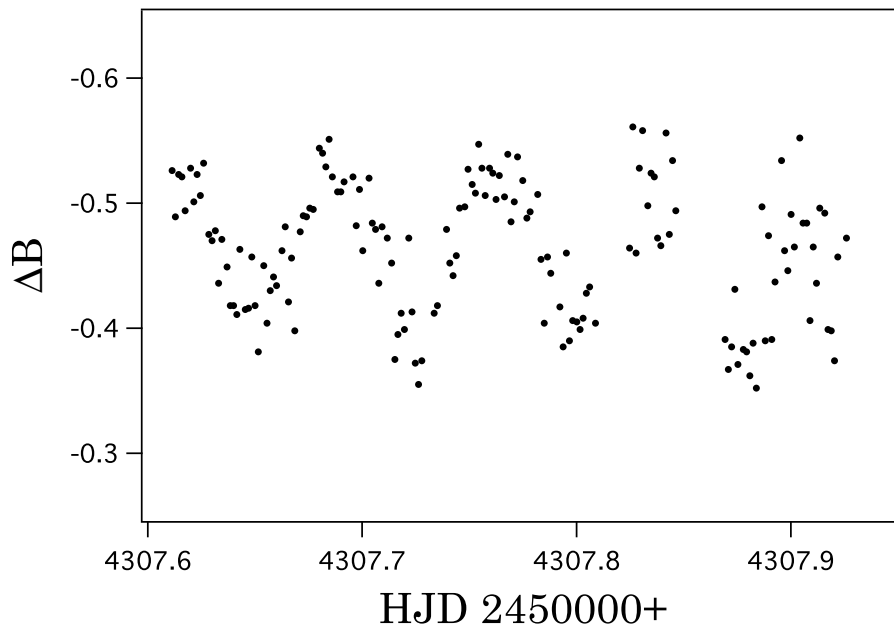
Upon inspection of a single night's worth of data where an eclipse is not present, it became apparent that the binary nature of BO Her was not the only source of variability.

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<sup>1</sup>Bdw Publishing, Colorado Springs, CO, <http://www.minorplanetobserver.com>



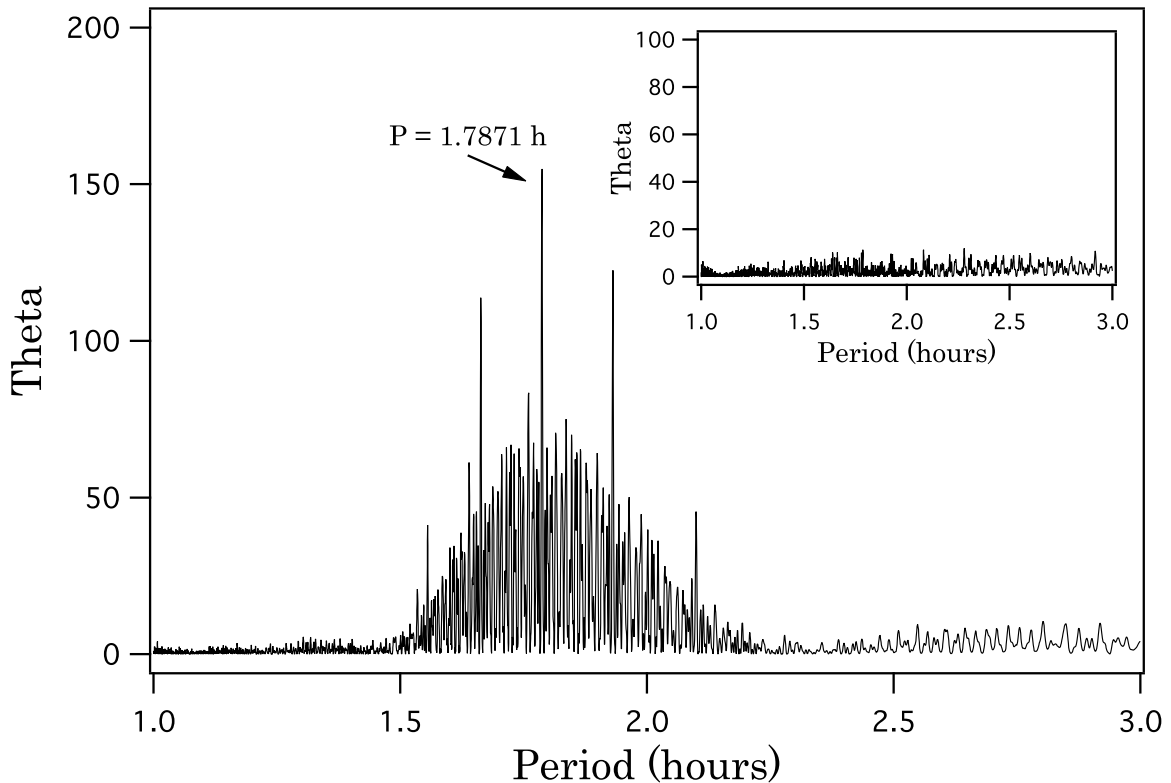
**Figure 1.** Phased  $B$ ,  $V$ , and  $I$  light curves of BO Her.



**Figure 2.** Light curve of BO Her on July 25, 2007 ( $B$  filter), showing short-period oscillations.

Figure 2 shows 6.5 hours of data from the night of July 25, 2007, which reveals a rapid, low amplitude variation that we attribute to the presence of a  $\delta$  Scuti component in this system. On one night we were able to observe about half of the shallow secondary eclipse, which is most clearly seen in the  $V$ -filter light curve of Figure 1. Because the short-period variability is present during the secondary eclipse, we can identify the primary star of the system as the  $\delta$  Scuti component.

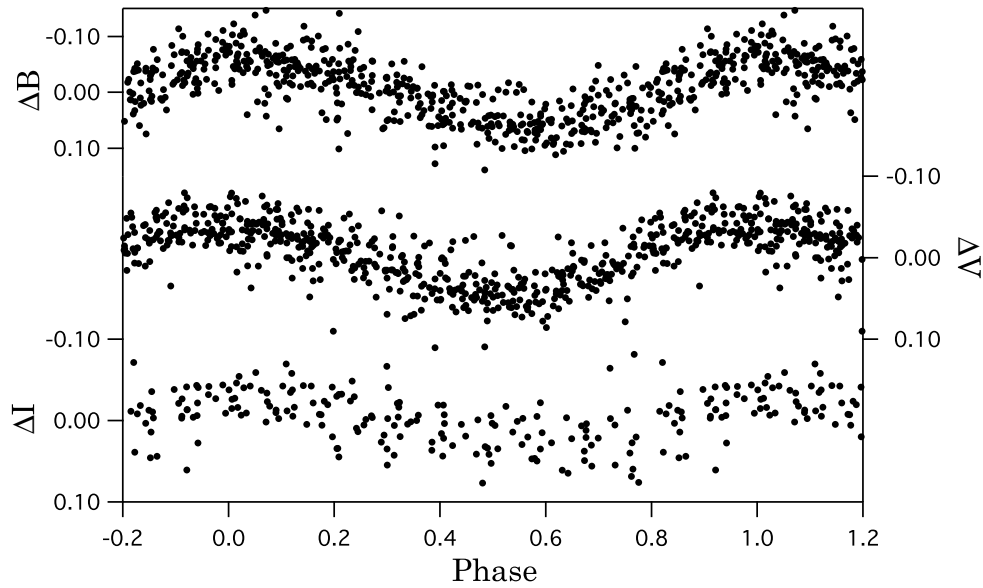
After removing the nightly trends in the data due to the binary nature of the system, we performed a period analysis on the short-period variability using Peranso.<sup>2</sup> Figure 3 shows the power spectrum generated using the Lomb-Scargle method, which reveals only a single period, suggesting that the  $\delta$  Scuti component pulsates in a single mode. Using the discovered period of  $P = 1.7871^{\text{h}} \pm 0.0007$ , the data set was folded to reveal the characteristic light curve of a  $\delta$  Scuti star with an amplitude of approximately 0.12 in  $B$ , 0.08 in  $V$ , and 0.05 in  $I$ ; see Figure 4.



**Figure 3.** Lomb-Scargle power spectrum of small-amplitude oscillations ( $V$  filter). The insert shows the residual power spectrum after prewhitening and removal of dominant period of  $1.7871^{\text{h}}$ .

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<sup>2</sup>T. Vanmunster, Landen, Belgium, <http://www.peranso.com>



**Figure 4.**  $B$ ,  $V$ , and  $I$  light curves for BO Her with variations due to eclipses removed. Data has been folded with a period of 1.7871 hours.

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