

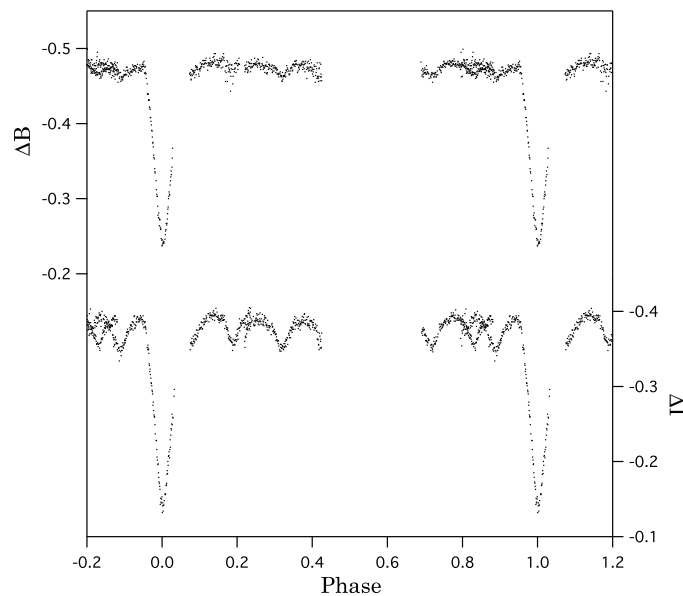
**EVIDENCE FOR A VARIABLE COMPONENT  
 IN THE ECLIPSING BINARY SYSTEM V417 AURIGAE**

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The bright eclipsing binary star V417 Aurigae (HD 33671; RA=05<sup>h</sup>13<sup>m</sup>31<sup>s</sup>.80, Dec=+35°39'11"0;  $V = 7.9 - 8.2$ ; period 1.86553 days; spectral type A0) was identified by E. Soydugan et al. (2006a) as a likely candidate to contain a pulsating  $\delta$  Scuti component. This system appears in Soydugan's Table 5, which uses  $B - V$  colors and spectral type information from the Hipparcos mission to identify those Hipparcos eclipsing binary systems where one or both of the components lies in the  $\delta$  Scuti region of the Cepheid instability strip.

Recently, Dvorak (2009) published the results of a search for pulsations in 35 eclipsing binary systems from the Soydugan catalog, including several from the Hipparcos list. Dvorak observed V417 Aur for five nights, but reported finding no statistically significant evidence of pulsations with frequencies between 6 and 50 cycles/day.

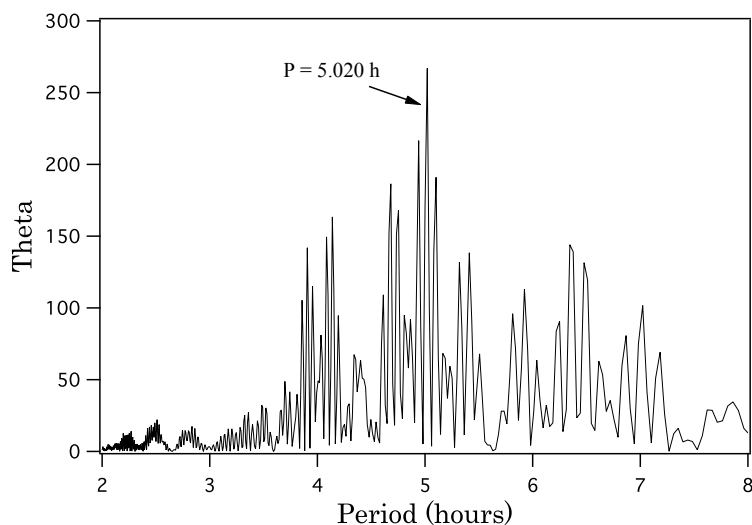


**Figure 1.**  $B$  and  $I$  light curves of V417 Aur, phased according to the eclipsing binary period.

Independent of Dvorak's investigations, a study of V417 Aurigae was undertaken at the Truman State University Observatory. V417 Aur was observed on four nights between November 2009 and February 2010, for no less than seven hours each night. All data were acquired with a 20-cm Meade LX200GPS Schmidt-Cassegrain telescope with an SBIG-ST9 CCD using Bessell standard  $B$  and  $I$  filters. The star HD 33688 was used as a

comparison, and HD 280704 was used as a check star. All images were processed using normal dark and flat frame processing; differential magnitudes for the target and check stars were produced with MaximDL.<sup>1</sup>

Figure 1 shows all of the data acquired for V417 Aur (which is available through the IBVS website as `5948-t1.txt`), phased according to the eclipsing binary period of 1.86553 days. Significant out-of-eclipse variations are evident in both *B* and *I* filter data, indicating that one of the stars in the binary system is a short period, low amplitude variable star. Analysis of the out-of-eclipse variations with the period search software Peranso<sup>2</sup> using the Lomb-Scargle method generated the power spectrum shown in Figure 2, resulting in a most probably frequency of  $f = 4.7808 \pm 0.0192$  cycles/day, with a peak-to-peak amplitude of approximately 0.02 in *B* and 0.05 in *I*. The phased light curves for the oscillating component are presented in Figure 3.



**Figure 2.** Lomb-Scargle power spectrum of small-amplitude oscillations of V417 Aur (*I* filter).

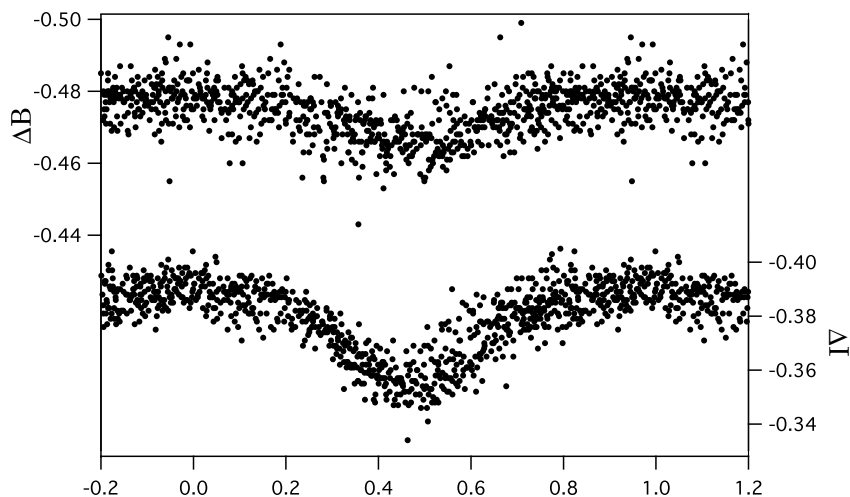
Despite the fact that V417 Aur appears in Soydugan’s catalog of candidate eclipsing binary systems with  $\delta$  Scuti components, it is not possible to definitively classify the variable component as a  $\delta$  Scuti star based upon the photometric data alone. The apparent pulsation period ( $5.020 \pm 0.020$  hours) is at the generally accepted upper limit of  $\delta$  Scuti variable periods; in fact, it seems likely that Dvorak failed to recognize the oscillating nature of one of the stars in the V417 Aur system because he only searched his data for periods up to 4 hours. The *B* – *V* color of 0.100 and A0 spectral type derived by Hipparcos place V417 Aur just outside the  $\delta$  Scuti region of the Cepheid instability strip (Rodríguez & Breger, 2001). Furthermore, the amplitude of pulsation for  $\delta$  Scuti variables is generally larger at shorter wavelengths, while for V417 Aur the amplitude is larger in infrared than in blue.

V417 Aurigae merits follow-up observation for several reasons. First, of course, it is important to accurately classify the putative pulsating star in this eclipsing binary system. Second, although the smoothness and symmetry of the light curve near primary eclipse suggest that the primary star in the system is the oscillating component, this cannot be confirmed without photometric observations at secondary eclipse. Finally, it has been noted that there exists an approximately linear relationship between the orbital

<sup>1</sup>Diffraction Limited, Ottawa, Ontario, Canada, <http://www.cyanogen.com>

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

period and the pulsation period for those eclipsing binary systems that contain a  $\delta$  Scuti component (Soydugan et al., 2006b; Hoffman & Harrison, 2009). If it happens that the variable component of V417 Aur is indeed a  $\delta$  Scuti star, it would stand well apart from similar systems on a plot of the pulsation period versus the orbital period.



**Figure 3.** *B* and *I* light curves for the oscillating component of V417 Aur. Data has been folded with a period of 5.020 hours.

#### References:

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