A New Eclipsing Binary Star in Delphinus

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Abstract This paper highlights the discovery of a new eclipsing variable star in Delphinus, an accomplishment of our comet-and-asteroid search program CN3t. The star, TYC 1100-01182-1, varies more than a full magnitude over 14.6 hours. We also are using this new variable as an example of the kind of work we can do with our asteroid and comet search program with a remotely controlled 25-inch Ritchey-Chretien telescope.

1. Background

On April 6, 2004, we began a search for asteroids and comets with a 63.5-cm Ritchey-Chretien telescope and Finger Lakes CCD system. The program, called CN3t, is one portion of a program called CN3 that began in December 1965 and which, over the past forty years, involves visual, photographic, and electronic searching for comets.

Our collaboration is part of a comet survey that Levy has run for forty years since December 17, 1965. It began as a visual program, and between 1989 and 1996 the program worked in conjunction with Eugene and Carolyn Shoemaker, whose discoveries included Comet Shoemaker-Levy 9 that collided with Jupiter. Since 2003, the program acquired a series of telescopes to begin a CCD component of the search.

The present association (CN3t) began in June of 2001, when Glinos and the Levys met to discuss using the Jarnac Observatory (Vail, Arizona) as the site for a large amateur telescope that Glinos was planning. Over the next two years we planned and set up an observatory. Our first idea was to house a 20-inch Ritchey-Chretien (RC) telescope in a dome, but as the project evolved to a 25-inch RC it was decided to construct a larger roll-off roof observatory (Figures 1–4).

The 25-inch joined the program with regular observations in April of 2004, and since then the project has discovered over 150 asteroids. The observing procedure begins with the photographing of a set of several regions of sky, and then repeating the set twice more. The telescope is an RC-Optical 25-inch reflector, and the 45-second photographs are taken with a Finger Lakes DM CCD system.

With CN3t, we image each selected area of sky three times over the course of

a night. We use "Astronomer's Control Program" (ACP, Denny 2006a) to control the CCD and the telescope. ACP moves the telescope from target to target, and it measures the position of every image using a software component called VISUAL PINPOINT (Denny 2006b). This excellent program was written and produced by Robert Denny, and we have found it extremely useful. Once the observing list for the night is prepared, ACP works with the telescope and CCD, photographing each field three times. ACP, in turn, controls MAXIM DL (George 2000), which operates our camera and which was written by Douglas George of Cyanogen.

After the session is over, we use VISUAL PINPOINT to scan each trio of photographs. Again this process is automated; we do not even see the images unless the program has detected what could be an asteroid or comet. Then the three images will blink one after the other, while a cross shows the position of the suspected object.

2. Discovery

In three of our images taken on June 8, 2005, Tom Glinos discovered an eclipsing variable star in Delphinus. It is designated GSC 01100-01182, or TYC 1100-01182-1 (from the *Tycho-2 Catalogue*, Høg *et al.* 2000), at the following position: (J2000.0) R.A. 20^h 37^m 56.5^s, Dec. +13° 37' 53.34". Over the course of a night it varies by about a full magnitude (12.08–13.26 *V*)in our unfiltered CCD images (Figures 5, 6). The light curve was derived from 1,964 data points obtained over seventeen evenings between June 8 and July 5, 2005.

While helping determine the nature and history of this star, Elizabeth Waagen of the AAVSO found that the automated Northern Sky Variability Survey (NSVS, Wozniak *et al.* 2004) had some data on it, but the variation it recorded was only about 0.5 magnitude with a period of 0.6085442 day. Our data show a far greater variation of at least a full magnitude, and minimum that is a full magnitude fainter. We suspect that the NSVS data include light at least from the nearby star that is approximately as bright as the variable is at maximum light, and possibly from other nearby stars as well. These data do not reveal which star is variable.

From our data offered below (Figure 7), it would appear that this star is an eclipsing binary with a period of 14.6 hours. Folding the light curves with periods of 29.18 and 53.368 hours suggests interaction or activity between the component stars.

3. Conclusion

Although our program is set up for solar system discovery, this paper shows that it the tools we use are useful in finding previously unknown variable stars. Even though the NSVS yields many variable star discoveries, in our case it failed to differentiate between two stars and did not tell which of these stars was variable, possibly due to a lack of spatial sensitivity. Although we discovered this variable independently of NSVS, we believe that programs like ours can help narrow the discovery parameters for many types of variable stars.

4. Acknowledgements

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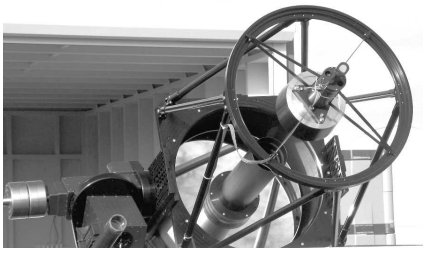

Figure 1. Jarnac Observatory "J3" building and 25-inch RC telescope.

Figure 2. The CN3t project building at sunset.

Figure 3. The building open in the evening (*photo by Leonard Wikberg III*).

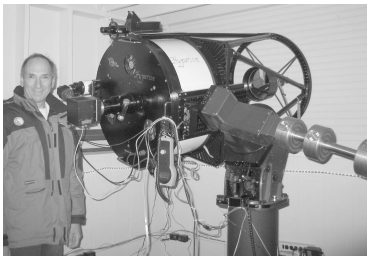

Figure 4. David Levy stands next to the telescope.

Figure 5. Delphinus variable (TYC 1100-01182-1) at maximum, north up, east left.

Figure 6. Delphinus variable (TYC 1100-01182-1) at minimum, north up, east left.

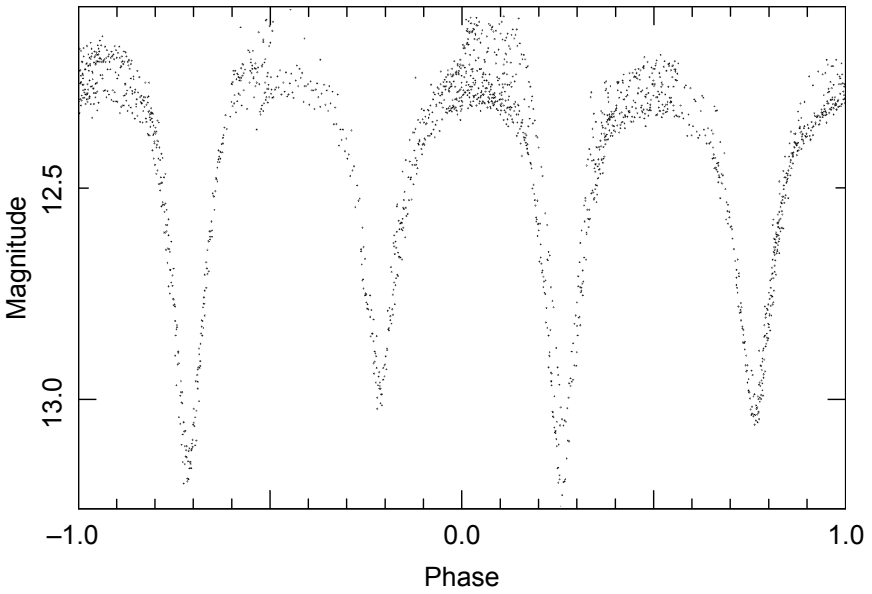

Figure 7. A phase plot diagram of our new variable star in Delphinus. Several nights of data have been combined into this two-cycle diagram. Time is plotted along the X axis; Magnitude along the Y axis. Maximum magnitude was 12.08 at JD 2453530.8732; minimum 13.26 at JD 2453557.8787.