Journal of the Arkansas Academy of Science

Volume 59 Article 31

2005

New Pulsating Variable Discovered in the Constellation Andromeda

Jeff W. Robertson
Arkansas Tech University, jeff.robertson@atu.edu

Follow this and additional works at: http://scholarworks.uark.edu/jaas

Part of the Stars, Interstellar Medium and the Galaxy Commons

Recommended Citation
Robertson, Jeff W. (2005) "New Pulsating Variable Discovered in the Constellation Andromeda," *Journal of the Arkansas Academy of Science*: Vol. 59 , Article 31.
Available at: http://scholarworks.uark.edu/jaas/vol59/iss1/31

This article is available for use under the Creative Commons license: Attribution-NoDerivatives 4.0 International (CC BY-ND 4.0). Users are able to read, download, copy, print, distribute, search, link to the full texts of these articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.
This General Note is brought to you for free and open access by ScholarWorks@UARK. It has been accepted for inclusion in Journal of the Arkansas Academy of Science by an authorized editor of ScholarWorks@UARK. For more information, please contact scholar@uark.edu.

New Pulsating Variable Discovered In The Constellation Andromeda

JEFF W. ROBERTSON

Arkansas Tech University, Department of Physical Sciences, 1701 N. Boulder, Russellville, AR 72801-2222

Correspondent: jeff.robertson@atu.edu

A new pulsating variable star, HH95 HV And-7, is found near the cataclysmic variable HV And, which is a part of the Indiana University RoboScope observing program (Honeycutt and Turner, 1992). A finding chart generated with Aladin software (Bonnarel et.al., 2000) is shown in Fig. 1. Its coordinates are (J2000) 00°40'46.23" +43°23'57.9". This star was initially calibrated as a secondary photometric standard star with V=15.277 and B-V=0.281 for the field of HV And (Henden & Honeycutt, 1995), but it suspiciously had the largest standard deviation of the group of standards ($\partial_v = 0.14$). Its variability detailed here means that it can not be used as a photometric standard.

RoboScope is an 0.41-m telescope fully automated for unattended differential CCD photometry of cataclysmic variables and related objects located in the Morgan-Monroe state forest north of Bloomington Indiana. It uses a liquid nitrogen cooled, thinned SITe CCD with 24 micron pixels in an array of size 512_512 pixels yielding a 14x14 arcminute field of view and typically obtains 1-2 exposures per clear night for ~150 objects. The field of HV And was observed on 318 separate nights from HJD 2448473 (UTD 1991-08-04) through HJD 2450141 (UTD 1996-02-27) through a standard Johnson V filter. The inhomogeneous ensemble photometry (Honeycutt, 1992) used on the RoboScope database can yield the light curve for every star in the field of interest. The variability was revealed by the large 0.14 sigma uncertainty in its instrumental ensemble magnitude shown in Fig. 2.

A period search of the RoboScope data for this star using the method of Horne and Baliunas (1986) is shown in Fig. 3. A total of 5000 individual frequencies were tested from 0.1 to 2.0 days. The strongest peak at 0.4661 day is flanked by spurious peaks at 0.32, 0.87, 0.34, 0.53 days. These represent aliases of the true period (*P*) due to the time sampling frequency (*t*) of the data (~1 day). They correspond to spurious periods (P) found from

$$1/P = 1/P \pm e/t$$

(Lafler & Kinman, 1965) for values of e = +1, -1, +1/2, and -1/4 respectively. Power spectra were also generated for several data sets constructed such that the time of true observations was preserved, but the magnitudes were randomly shuffled and assigned to these times. This has the effect of evaluating the "windowing" function for the period search, discriminating against periods associated with the time sampling of the data and further checking the validity of the power found in the strongest peak. No peaks with power larger than ~5 were found compared to ~120 for the true period.

The search results reveal a pulsating variable with a period of 0.46614(5) days as shown in the phased light curve for integer cycle (N) in Fig. 4 using the ephemeris

$$\textbf{Maximum} = 2448400.0(0) + 0.46614(5)\ \_\ N.$$

The accuracy in the period was estimated by minimizing the total distance (string-length) between phased data points for various periods near the peak period. Since the observational data is over a timescale much larger than a single period, the folding of the data in phase allows the period to be obtained to high accuracy since different periods would cause larger string-lengths in the phased light curve. The taxonomy of its light curve, namely the 0.5 magnitude amplitude, the ~1/2 day period and symmetric sinusoidal shape is indicative an RR Lyrae pulsating variable, most likely RRc (Feast, 1996).

Since it is not associated with a known globular cluster, it is likely a galactic halo object or old, thick disk member of our galaxy (Feast, 1999). Using its mean magnitude of mv=15.3 and a simple Period-Luminosity relationship for RR Lyrae stars MV = -2.8 log P – 0.6 (Eggen, 1994), yields an absolute magnitude of MV = 0.328 and a distance of ~10,000 parsecs (=32,600 Ly).

ACKNOWLEDGMENTS.–I gratefully acknowledge the ever-changing vanguard of RoboScope "baby-sitters" who keep the RoboScope system operational and always include Kent Honeycutt, Brice Adams, George Turner, and Bill Kopp.

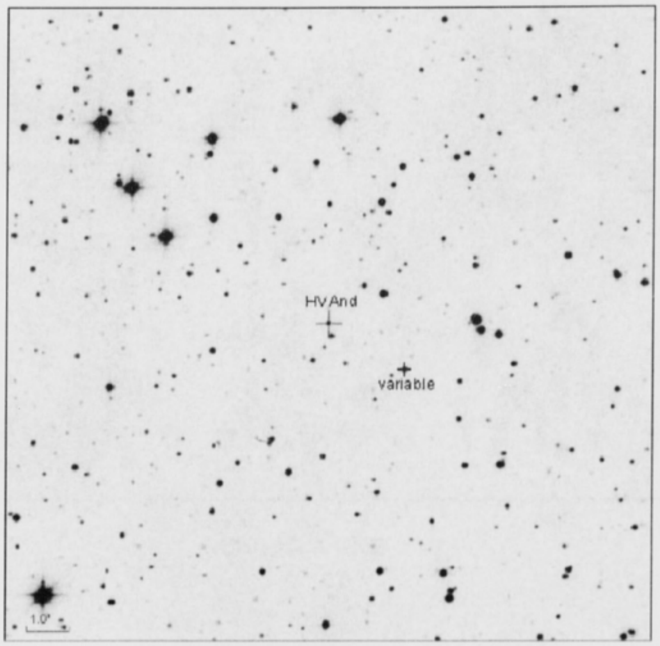

Fig. 1. A 14x14 arcminute finding chart for the new variable, HH95 HV And-7, near the cataclysmic HV And. North is up and East is to the left in the figure.

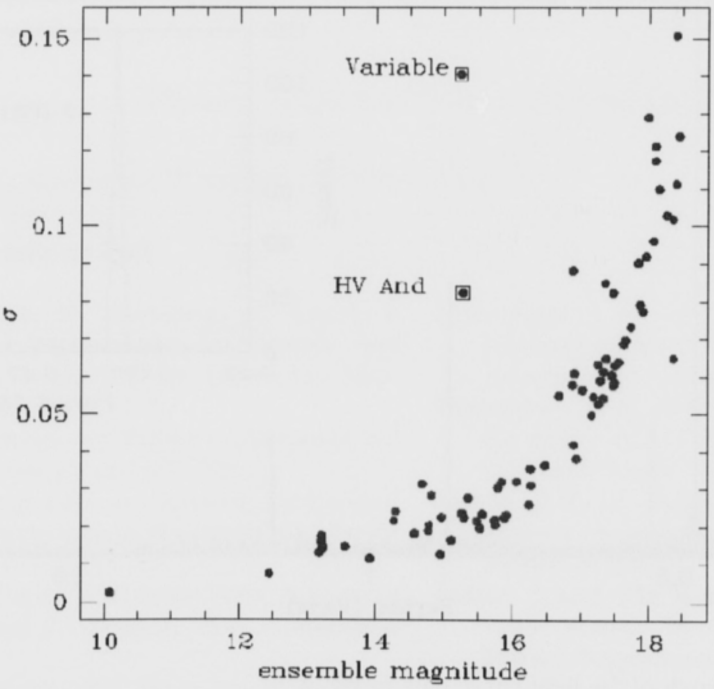

Fig. 2. Standard deviation of ensemble magnitudes for nearby stars in the field revealing variability.

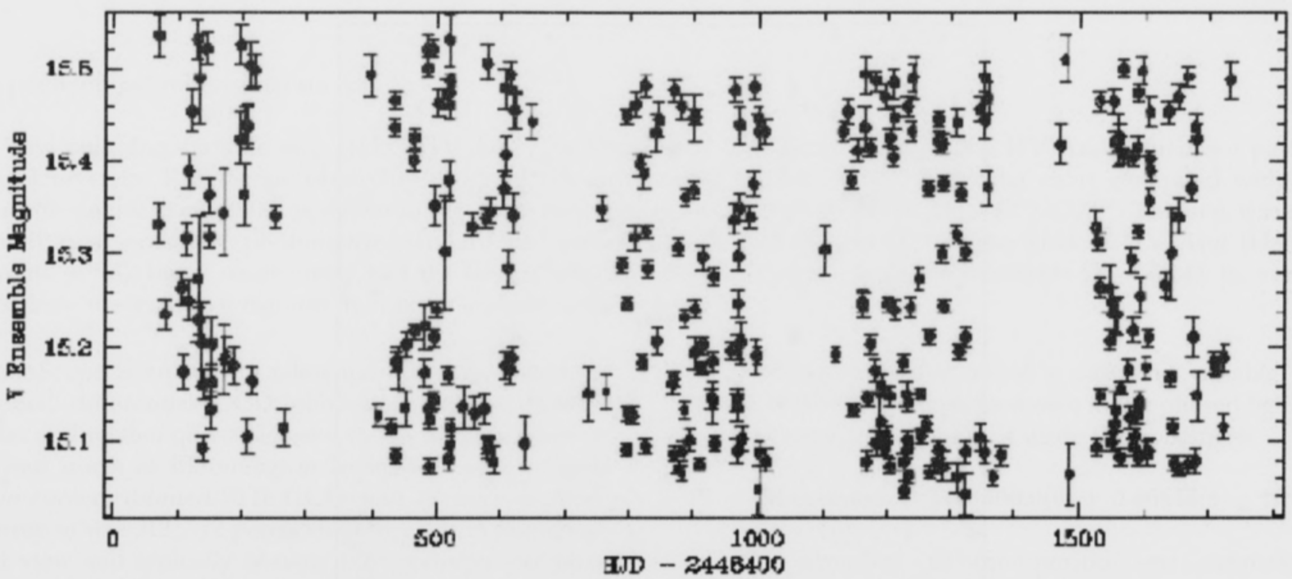

Fig. 3. Differential ensemble photometry of HH95 HV And-7.

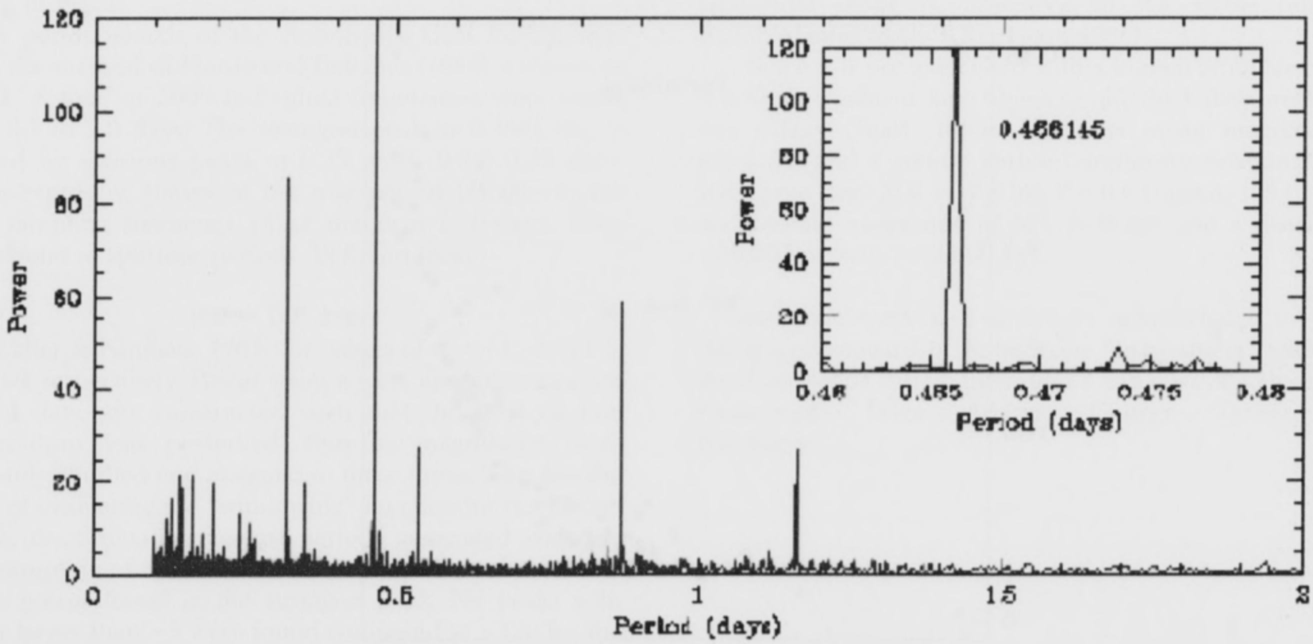

Fig. 4. A power spectrum period search of the light curve data in Fig. 3.

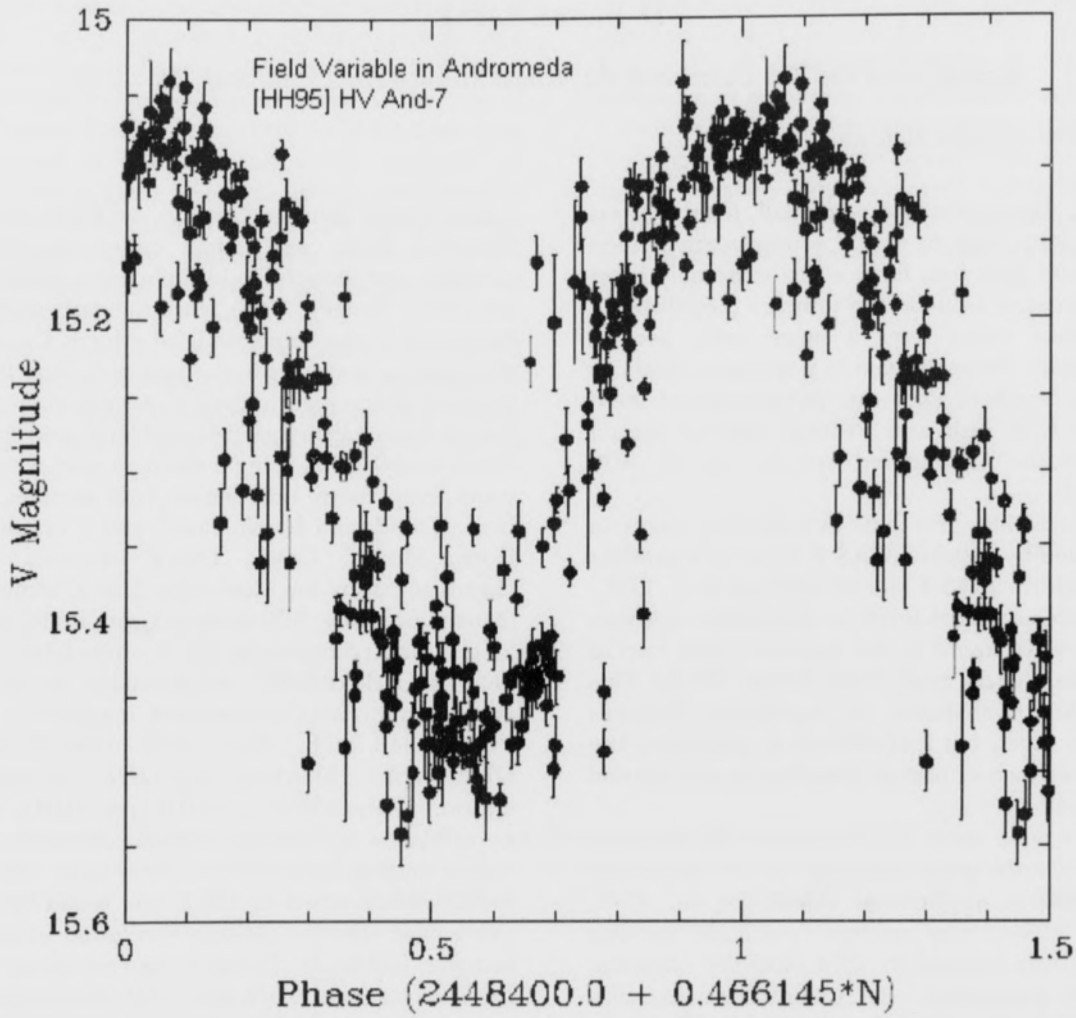

Fig. 4. A power spectrum period search of the light curve data in Fig. 3.

Literature Cited

Bonnarel, F., P. Fernique, O. Bienayme, D. Egret, F. Genova, M. Louys, F. Ochsenbein, M. Wenger, and J.G. Bartlett. 2000. The ALADIN Interactive Sky Atlas. Astronomy and Astrophysics 143:33.

Eggen, O J. 1994. Photometry of F-K type bright giants and supergiants. Astronomical Journal 107:2131.

Feast, MW. 1999. Cepheids as distance indicators. Publications of the Astronomical Society of the Pacific 111:775.

Feast, MW. 1996. Light Curves of Variable Stars, A Pictorial Atlas (C. Sterken. and C. Jaschek, eds.), Cambridge University Press.

Henden, A A, RK Honeycutt. 1995. Secondary photometric standards for northern nova-like cataclysmic variables. Publications of the Astronomical Society of the Pacific 107:324.

Honeycutt, R K. 1992. CCD ensemble photometry on an inhomogeneous set of exposures. Publications of the Astronomical Society of the Pacific 104:435.

Honeycutt, R K, GW Turner. 1992. Robotic telescopes in the 1990's (A. V. Filippenko, ed.) Astronomical Society of the Pacific Conference Series 34:77.

Horne, J H, SL Baliunas. 1986. A prescription for period analysis of unevenly sampled time series. Astrophysical Journal 302:757.

Lafler, J and TD Kinman. 1965. The Calculation of RR Lyrae Periods by Electronic Computer. Astrophysical Journal Supplementary Series 11:216.