U PISCIS AUSTRINI—AN RR LYRAE TYPE VARIABLE

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Abstract

We present visual and CCD observations which show that the previously unclassified star U Piscis Austrini is an RR Lyrae type variable with a period of 0.54187 day. There does not appear to be a secondary beat period.

1. Introduction

U Piscis Austrini is unclassified in the *General Catalogue of Variable Stars* (GCVS) (Kholopov 1985) and is assigned a spectral class of G0:. The lack of variability type is surprising for a star with this early a designation in its constellation, although its variation range from 12.5 to <14.0 photographic and the lack of a good comparison sequence do not make it an attractive object for routine visual observing. Williams (1993) had drawn attention to this lack of classification type and later, Williams (1994), attributed possible periods of 117 and 235 days to the star.

Bateson (1998) analysed visual observations and concluded that it was a semiregular variable, SRd, with a period of ~35 days. He noted that "one observer recorded slight fluctuations on the rises and falls but that other observers did not." The light curves presented in that paper do not support a 35-day periodicity, nor the maxima listed in an included table.

The authors suspected, because of the short term fluctuations observed visually by Stubbings, that the star might have been a previously unknown cataclysmic variable. This led to the initial analysis and its being targeted for CCD measures during the 2000 season.

2. The Observations

This paper analyses 643 positive visual observations made by Stubbings over the period 1996 to 2000. It also presents 1418 CCD measures made during 2000 at Wharemaru Observatory by Walker.

The visual measures were made using a 32cm telescope. In the absence of a sequence, values were assigned to comparison stars based upon the observer's experience. The CCD measures were made using a 25cm Schmidt-Cassegrain telescope and an SBIG ST6B CCD camera in the unfiltered mode. Thus the spectral response is near R in the BVRI system. The comparison star used was GSC 6960 128 and CCD values are relative to this.

The visual amplitude is ~1.3 magnitudes, compared to the ~1.1 derived with the CCD measures, as would be expected. However, the slightly differing decline shapes suggest that the visual sequence is not entirely correct, but it is adequate for the purposes of classification of U PsA. Since the star is of a type that neither of the authors normally follow, it is not planned to observe it further or to prepare a reliable visual comparison sequence.

3. Analysis

The visual measures up to 1999 were initially subjected to a period search using Discrete Fourier Transformation (DFT) techniques. This revealed several periodicities—a weak one at ~6.35 days and another stronger possibility at 1.185 days. The folded light curves were suggestive of a pulsating variable but did not exclude a CV. Reluctance to search below the average one day sampling frequency meant that initially the true period was overlooked.

More concentrated visual measures in the 2000 season suggested an even shorter period and finally a good fit to the dataset was obtained. CCD measures confirmed this value of 0.54187 day. All observations can be fitted by the light elements of maxima determined from the visual observations:

$$\text{HJD } 2450244.070 + 0.54187\text{E}$$

The visual and CCD measures are presented in Figures 1 and 2.

4. Conclusions

The shape, period, and amplitude of the light curve indicate that U PsA is almost certainly an RR Lyrae variable star, subtype RRab. The rather uncertain GCVS spectral class is a little late for this and could perhaps be rechecked.

A DFT search as shown in Figure 3 revealed no evidence of a secondary pulsation mode near the expected values of 0.40 or 0.73 day. The DFT of the visual observations shows the two other frequencies mentioned, but these must be aliases introduced in some manner by the low time resolution of the visual measures when compared to the period of the star.

The results of this analysis indicate that before assigning a category of variability it is always sensible to search visual databases for a wide range of periods. In this case a simple DFT check indicated possible frequencies and a probable period which was readily resolved with a few hours of CCD measures. It should be noted that the period was determined before the CCD data were available.

5. Acknowledgements

Visual measures of U PsA were commenced after several mentions of this star in *Sky & Space* by Peter Williams, and his comments have been helpful.

References

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Williams, P. 1993, *Sky & Space*, **6**, 54.
Williams, P. 1994, *Sky & Space*, **7**, 57.

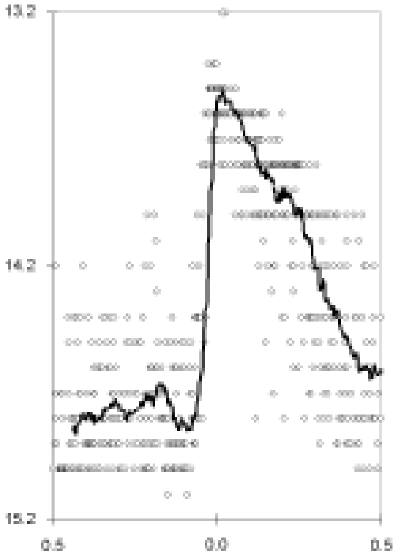

Figure 1. The visual measures from 1996–2000 folded with the light elements as noted in the text and plotted phase versus magnitude. A 30-point moving average has been superimposed on the data to make the mean light curve more visible.

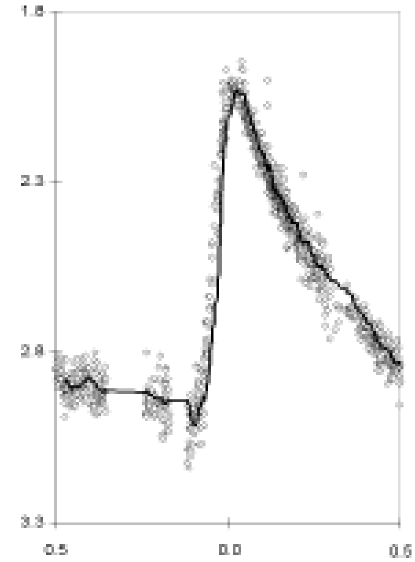

Figure 2. The CCD observations in 2000 folded to the same ephemeris as the visual data with a similar trend line and plotted phase versus amplitude.

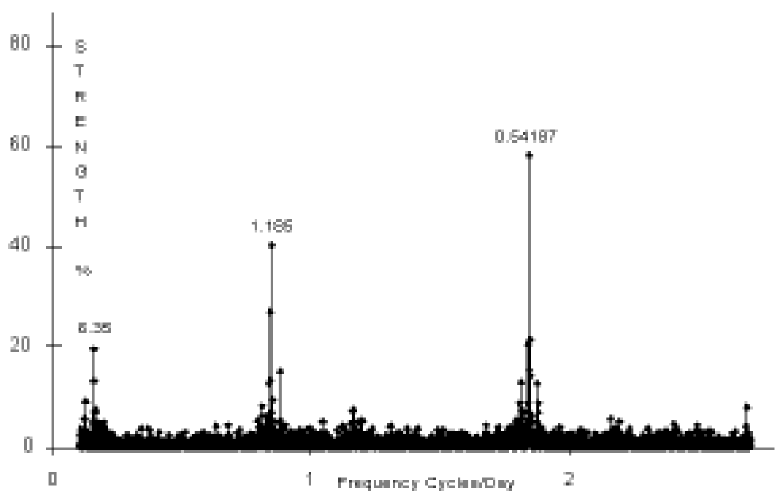

Figure 3. A periodogram of the 643 positive visual measures showing the true period of 0.54187 day and the two aliases. The CCD measures have too short a baseline for a periodogram to have any value.