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THE PERIODS OF THE SEMIREGULAR VARIABLE V370 And

LLOYD[1], C.; PICKARD[2], R. D.; CHAMBERS[2], R. H.

[1] Space Science Department, Rutherford Appleton Laboratory, Chilton, Didcot, Oxon. OX11 0QX, UK, e-mail: cl@ast.star.rl.ac.uk

[2] Crayford Manor House Astronomical Society, The Manor House, Mayplace Road East, Crayford, Kent DA1 4HB, UK, e-mail: rdp@star.ukc.ac.uk

V370 And (HD 11979, HIP 9234, $01^h58^m44^s.33$ $+45°26'06''.9$ (2000)) is a bright, $V = 7^m.60$, late-type giant of spectral type M7 III. It is one of the variables discovered by Hipparcos and was initially classified as In, probably on the basis of a single bright excursion. The range is a little over one magnitude. Closer inspection of the Hipparcos light curve suggests coherent variations on a time scale of 200-300 days which led Hoffleit (1998) to suggest that it is an SRV with a period of around 240 days. A periodogram of the Hipparcos data shows a clear period near 228 days, but the phase diagram, in Figure 1, shows some particularly large deviations around maximum light. From the light curve, shown in Figure 2, it is clear that these deviations are not simply due to alternately high and low maxima. The light curve also reveals small, but significant, features that are inconsistent with a single period and suggest variations on a shorter time scale. When the principal period is removed the dominant remaining period is approximately half this value, but it is clearly not a simple harmonic. This period ratio of $\sim 2:1$ is seen in approximately half the semiregular variables (Kiss et al. 1999). The best two-period fit yields periods of 228 ± 1 and 123 ± 1 days, with amplitudes of $0^m.32$ and $0^m.20$ respectively, giving the longer period the larger amplitude. A least squares fit to the data is shown in Figure 2.

In an effort to follow the earlier behaviour of V370 And, additional observations have been taken from the films of the Hewitt Camera Archive held by the Variable Star Section of the British Astronomical Association. Details of the Hewitt Camera and film archive are given by Howarth (1992). The films are unfiltered and a variety of panchromatic emulsions have been used, Ilford HP3, FP4, HPS and Kodak Professional Royal Pan 4141, which are sensitive from below 4500Å to above 6000Å. As the images are trailed they cover more emulsion, are less saturated and are easier to estimate than point images. Previous experience suggests that photometry from the archive films is particularly consistent for this type of medium, with $\sigma < 0^m.1$ over small ranges of $\sim 0^m.5$.

The magnitude of V370 And has been estimated visually, using a fixed microscope and light table, on 20 films taken between 1971 and 1989. The comparison star details, given in Table 1, are taken from the Hipparcos catalogue (Perryman et al. 1997). The light curve, in Figure 3, shows a range of variation of $1^m.5$ which is slightly larger than the Hipparcos data, but again this is due mostly to a single bright excursion. Generally the variation is within $0^m.5$. Unfortunately the photographic observations are rather sparse and it is not possible to follow the variations of the star. The periodogram of the photographic

Table 1: V370 And comparison stars information

Comparison	V	Sp	Comparison	V	Sp
HD 11884 = GSC 03284-00763	6.48	K0	HD 13076 = GSC 03281-01262	7.59	F5
HD 11188 = GSC 03283-01694	7.27	B8	HD 12157 = GSC 02841-00508	7.66	G5
HD 11252 = GSC 03283-00900	7.45	G5	HD 11969 = GSC 03280-00350	7.99	K5

data is not surprisingly dominated by noise, with only the weakest indication of the 228-day period. To refine the period the photographic and Hipparcos data have been simply combined and this ephemeris has been used to produce the phase diagram of the photographic data in Figure 4. Most of the points are distributed in the fainter half of the light curve but even so there is very little sign of the periodic variation.

The photographic observations of V370 And over some 18 years show the same behaviour as the Hipparcos data, a basic variation of $\sim 0\overset{m}{.}5$ with brighter excursions. However, there is no compelling evidence to suggest that the dominant period visible in the Hipparcos data was also present at that time. A single period would probably have been revealed, and in semiregular variables with two periods, the dominant period is usually visible in all sensible subsets of the data. However, in this case is possible that there are too few observations to reveal this period against the competing variations.

V370 And would clearly benefit from an analysis of many more observations over a longer period, but as a complex, relatively low-amplitude, variable a few seasons of photoelectric photometry would probably yield much about the nature of its variations.

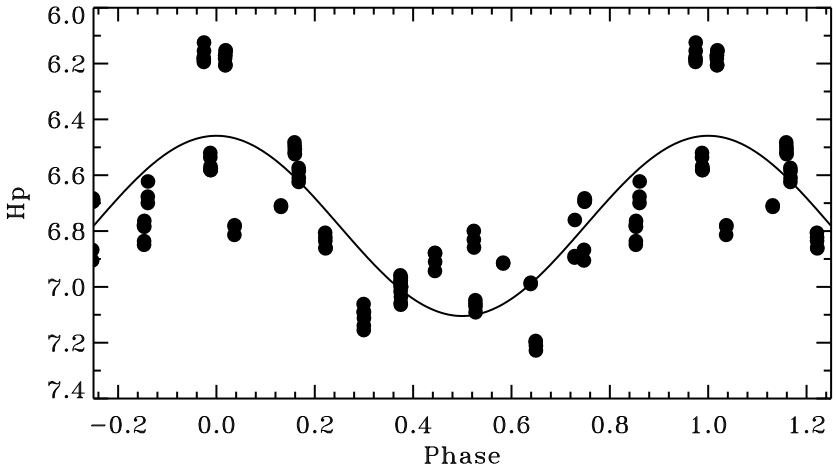

Figure 1. The phase diagram of the Hipparcos data folded with the 228-day period.

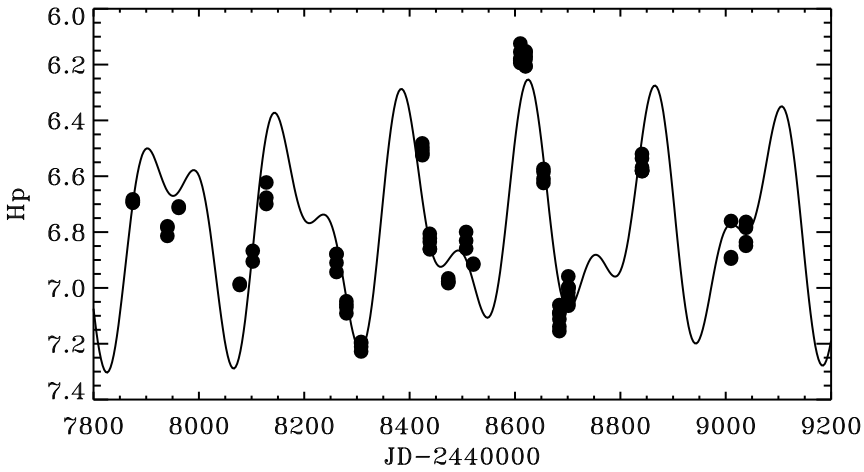

Figure 2. The light curve of the Hipparcos data from 1990 – 1992 with the two-period fit over plotted.

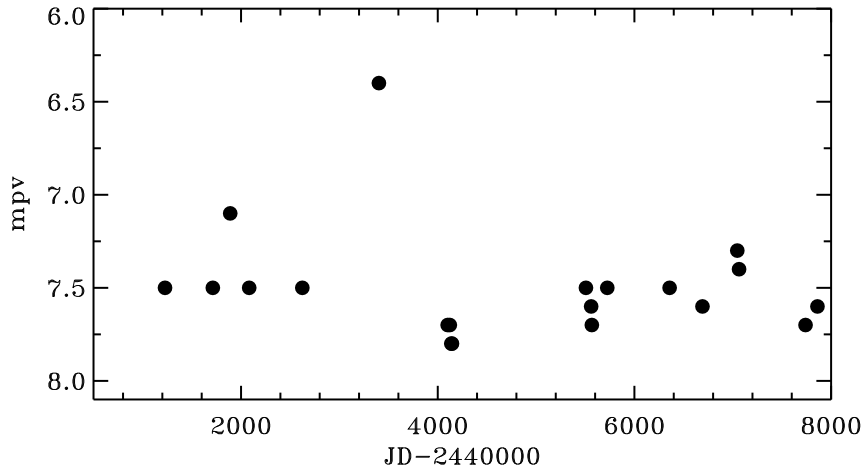

Figure 3. The light curve of the photographic data from 1971 – 1989.

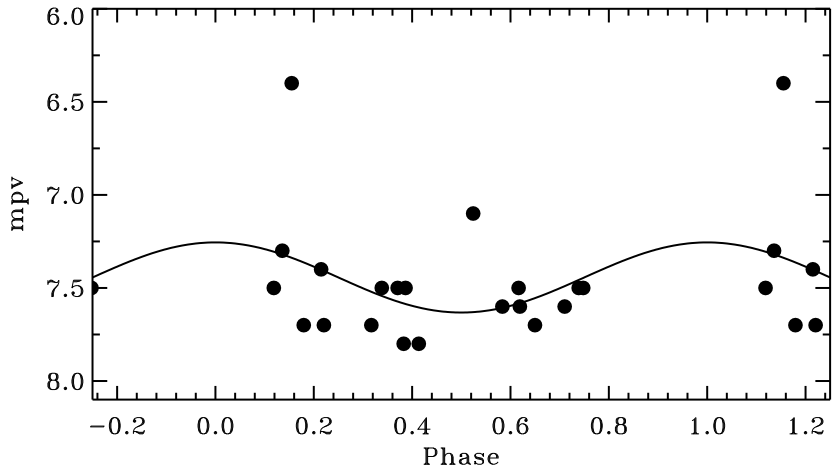

Figure 4. The phase diagram of the photographic data folded with the 228-day period. This plot has the same phasing as Figure 1.

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