PERIOD UPDATE FOR V418 CASSIOPEIAE

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Abstract

While conducting separate photographic sky patrols both authors captured recent maxima of the long period variable V418 Cassiopeiae. It was noticed that the maxima were both brighter and earlier than published elements would indicate. New elements are given.

V418 Cas was discovered by Hoffmeister (1966) and is located at RA $0^h\ 09^m\ 36^s$, Dec $+61^\circ\ 55'$(1950). It is listed in the *General Catalogue of Variable Stars* (GCVS) (Kholopov *et al.* 1985) as a long period variable with photographic maximum of magnitude 14.6 and minimum fainter than magnitude 20. The period was determined from a study of 360 plates by Gessner and Meinunger (1973), who found five maxima and determined the following light elements:

$$JD_{max} = 2428235 + 480\ E. \qquad (1)$$

The authors are independently conducting photographic sky patrol programs using 35-mm cameras and 135-mm lenses (MacRobert 1988; Ridpath 1991). Collins detected V418 Cas on November 23, 1989, on unfiltered Kodak Technical Pan 2415 film (TP), and he estimated it to be at magnitude 10.4. Kaiser detected the same maximum independently on photographs taken on the same date. Using Kodak Ektachrome 400 color slide film he estimated a magnitude of 10.1.

Assuming a B-V color index of 1.5 to 2.0 for a typical Mira variable, V418 Cas was about two magnitudes brighter than would be expected from its catalogue value at maximum and appeared two months earlier than the published elements would predict. The authors initially thought it was a nova candidate. Eventually, an improved position and an examination of Hoffmeister's original chart showed that the variable was V418 Cas.

Examination of Palomar Sky Survey (POSS) blue and red plates showed no star at this location. The amplitude of V418 Cas must therefore be on the order of at least 10 magnitudes. A second unusual feature is the very sharp rise to maximum, which contributed to the impression that the star was a nova. Hoffmeister (1966), in fact, called the variable "nova-like" in his discovery report.

To determine just how rapidly V418 Cas rises to maximum, Kaiser began photographing the field in September 1990, using hypersensitized 2415 TP and a 20-cm Schmidt-Cassegrain telescope. Using the *Guide Star Catalog* (ST ScI 1989)(GSC) for comparison stars, it was noted that 10-minute unfiltered and 15-minute V filtered exposures recorded stars fainter than the 16th magnitude limit of the catalogue. Figure 1 is a finder chart for V418 Cas and Table 1 contains comparison star magnitudes from the GSC.

V418 Cas was first detected February 21, 1991, at about magnitude 15 (unfiltered TP). It rose rapidly (3.4 magnitudes) to 11.6 in 27 days (Figure 2). This maximum was more than a magnitude fainter than the previous maximum in November 1989.

Table 1. Comparison stars for V418 Cas finder chart (Figure 1).

Star	*GSC Magnitude*	*Star*	*GSC Magnitude*
A	8.2	F	10.8
B	9.0	G	11.3
C	9.5	H	11.5
D	9.9	I	11.9
E	10.5		

It must also be noted that magnitude estimates for V-filtered TP photographs of V418 Cas were 0.5 magnitude fainter than unfiltered photographs. We attribute these results to the high red sensitivity of the TP emulsion and suspect V418 Cas to have a large B-V.

When the 1989 and 1991 maxima are phased to the published elements they both fall at phase 0.875, two months early. A least-squares analysis of all seven maxima (Table 2) results in the following improved light elements:

$$JD_{max} = \underset{\pm 8.2}{2438294.5} + \underset{\pm 0.50}{478.55}\ E. \qquad (2)$$

Table 2. List of O-C for both the original 480-day period (equation 1) and the new 478.55-day period (equation 2).

JD_{max}	*480-day Period*		*478.55-day Period*	
	Epoch	*O-C*	*Epoch*	*O-C*
2428250	+0	+15	+0	+5
2429200	+2	+5	+2	-2.1
2430615	+5	-20	+5	-22.7
2438295	+21	-20	+21	+0.4
2439770	+24	+15	+24	+39.8
2447854	+41	-61	+41	-11.6
2448335	+42	-60	+42	-9.1

V418 Cas is a Mira variable with a long period, a very large and, indeed, still unknown total amplitude, and an unusually rapid rise to maximum.

We wish to thank Martin Burkhead of Indiana University for access to and help with the POSS plates, and the Libraries of the Royal Astronomical Society and the American Association of Variable Star Observers for access to Hoffmeister's paper and the Gessner and Meinunger reference.

References

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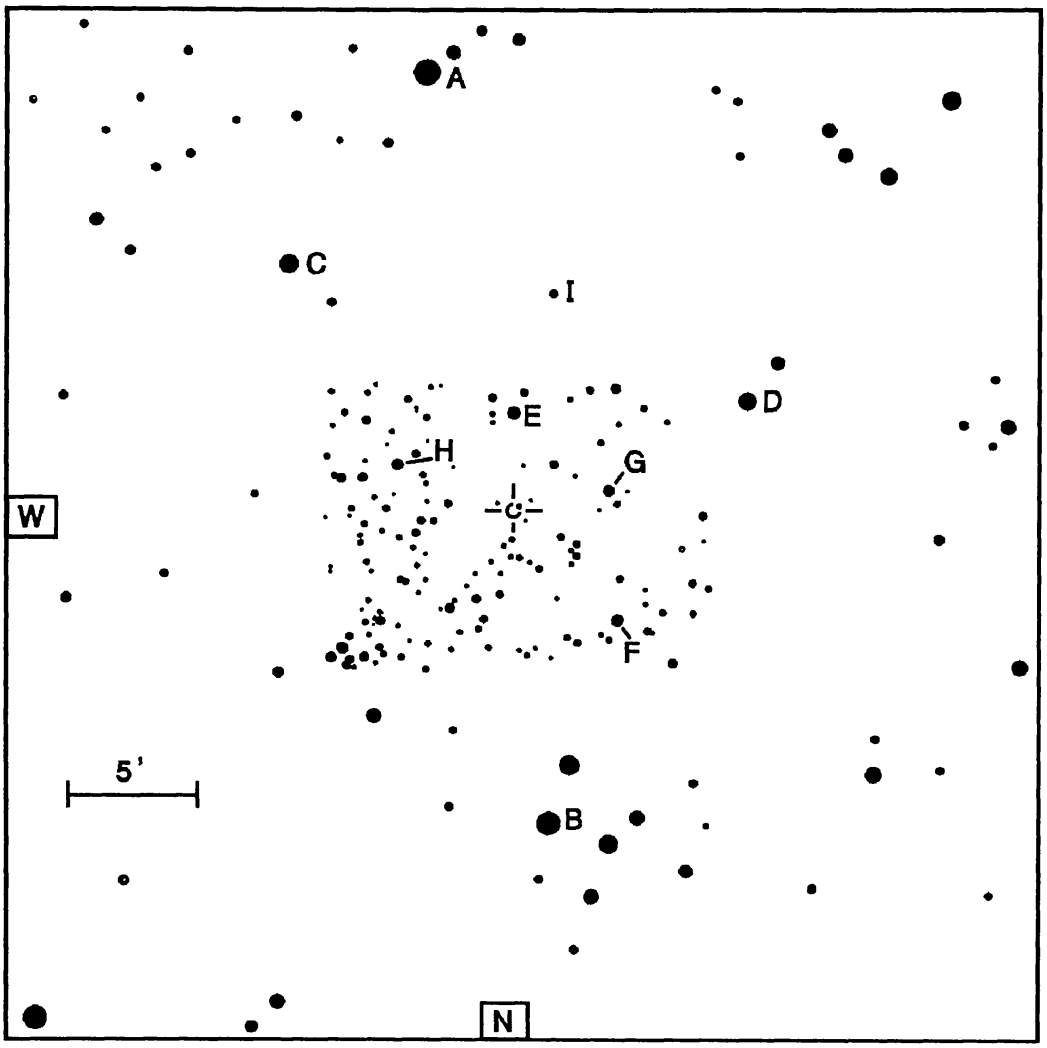

Figure 1. V418 Cas finder chart with V comparison stars from the *Guide Star Catalog* and with central detail from a Stamford Observatory photograph. The chart is reproduced with the kind permission of *The Astronomer* (Hurst 1991) and the UK Nova/Supernova Patrol. The comparison star magnitudes are given in Table 1.

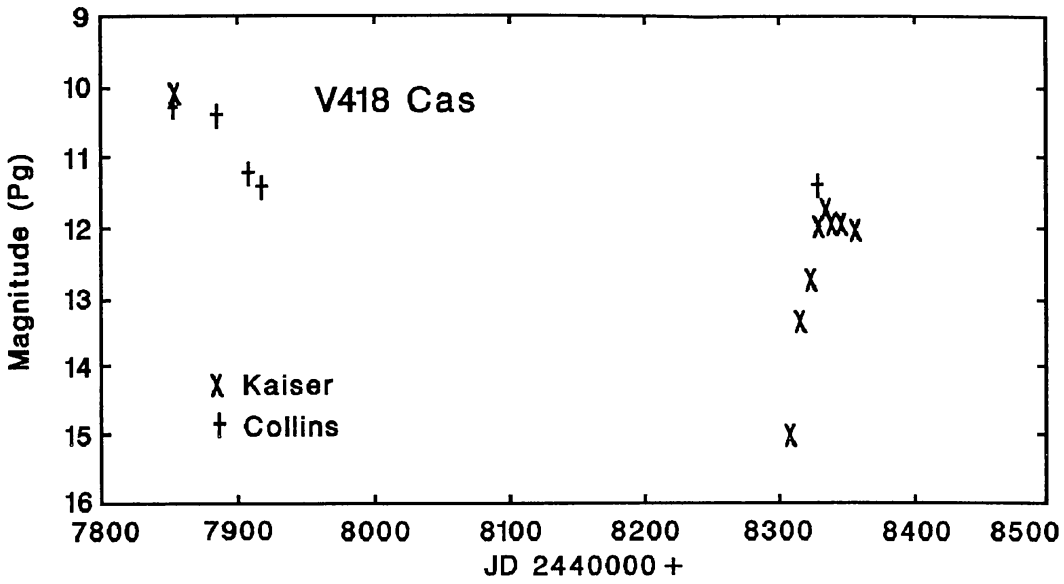

Figure 2. Photographic observations of V418 Cas showing both the 1989 maximum and the 1991 sharp rise to maximum.