COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4796

Konkoly Observatory
Budapest
9 November 1999

HU ISSN 0374 – 0676

REDUCED AMPLITUDE OF V959 OPHIUCHI

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V959 Ophiuchi ($\alpha_{2000} = 18^{\rm h}11^{\rm m}02\overset{\rm s}{.}9$, $\delta_{2000} = +03°10'36\overset{''}{.}8$, GSC 00435-00926) was first reported as a variable star (S4211 Oph) by Götz (1957). The star was observed on photographic plates over a span of 60 d. From the data Götz classified the star as an RRc variable with a period of $0\overset{\rm d}{.}084857$, an amplitude of $0\overset{\rm m}{.}7$ and an average magnitude of $m_p = 12.7$. Götz (1957) found that V959 Oph had two distinct amplitudes for the maxima of 0.4 and 0.7 mag. From the description in Götz (1957) the star may have shown oscillations similar to those found in stars like SX Phoenicis, or other multiperiodic variable stars. Since that time, the star has received effectively no attention.

Because of its high amplitude and possible similarity to SX Phe, we chose to observe V959 Oph in August 1997. These observations were made with the Burrell Schmidt Telescope (hereafter BST) at Kitt Peak National Observatory, with the S2KA CCD camera through a V filter modeled after Bessell (1990). Four nights of supplemental data were obtained with the David Derrick 16″ Telescope of the Orson Pratt Observatory at Brigham Young University (hereafter DDT). These data were secured with a Pictor 416 XT CCD mounted at the Newtonian focus of the DDT through the same V filter mentioned above. The four nights ranged from 31 May until 19 July 1998. The CCD field for the DDT is shown in Fig. 1.

All frames were reduced using standard IRAF functions. Differential magnitudes were determined using the eight comparison stars and the methods detailed in Hintz et al. (1997). A mean apparent magnitude of $\langle m_V \rangle = 11.4$ was determined for V959 Oph from one night of data on which observations of SA 110 (Landolt 1992) were also secured. This is different from the published photographic magnitude of $m_p = 12.7$, even with a reasonable color correction. We were confident in our identification of V959 Oph from the finder in Götz (1957), but carefully checked all surrounding stars of similar brightness to determine if the star had been mis-identified. However, no other short period variables were found in the region. We concluded that we indeed monitored the correct star.

Using the Period98 package the first term of a Fourier series was fit to all five nights of data. From this we determined a period of $0\overset{\rm d}{.}09880 \pm 0\overset{\rm d}{.}0005$ and an amplitude of 0.0075 ± 0.0010. This is clearly different than the period reported by Götz (1957). From the times of maximum light list in Götz (1957) we used a linear regression to re-calculate the period. A period of $0\overset{\rm d}{.}093042 \pm 0\overset{\rm d}{.}00001$ was found.

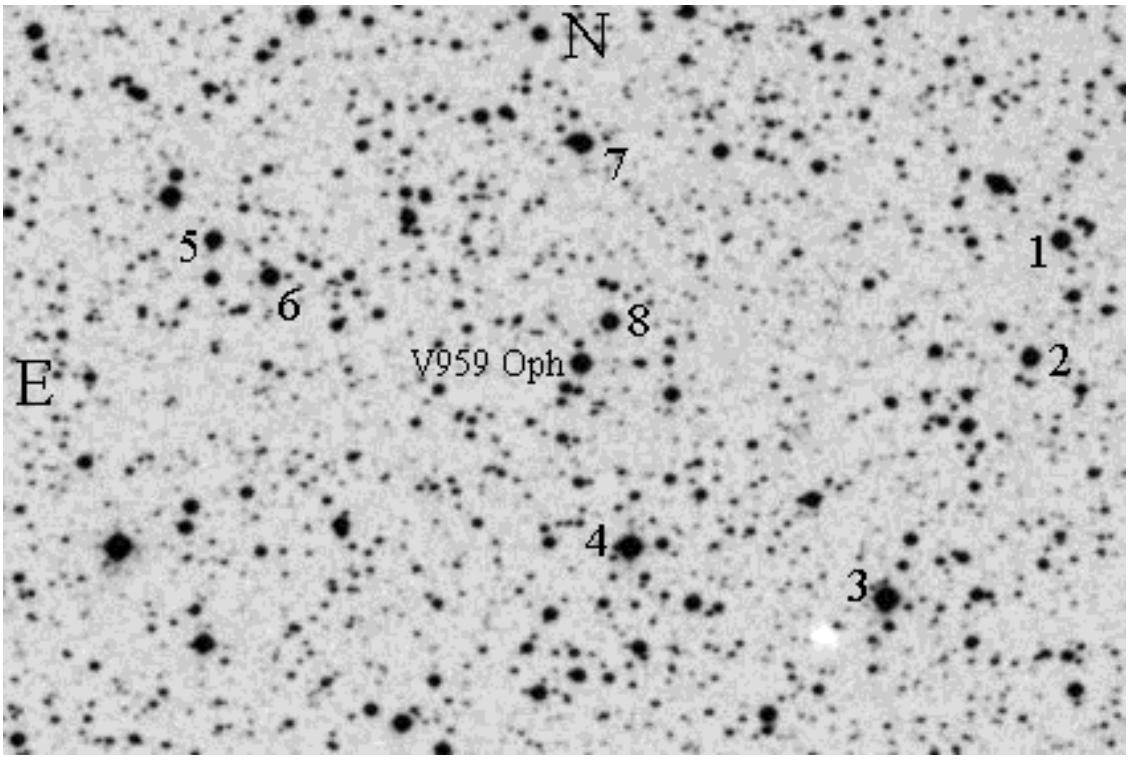

Figure 1. CCD field of V959 Oph with comparison stars labeled. The field of view is $8' \times 12'$.

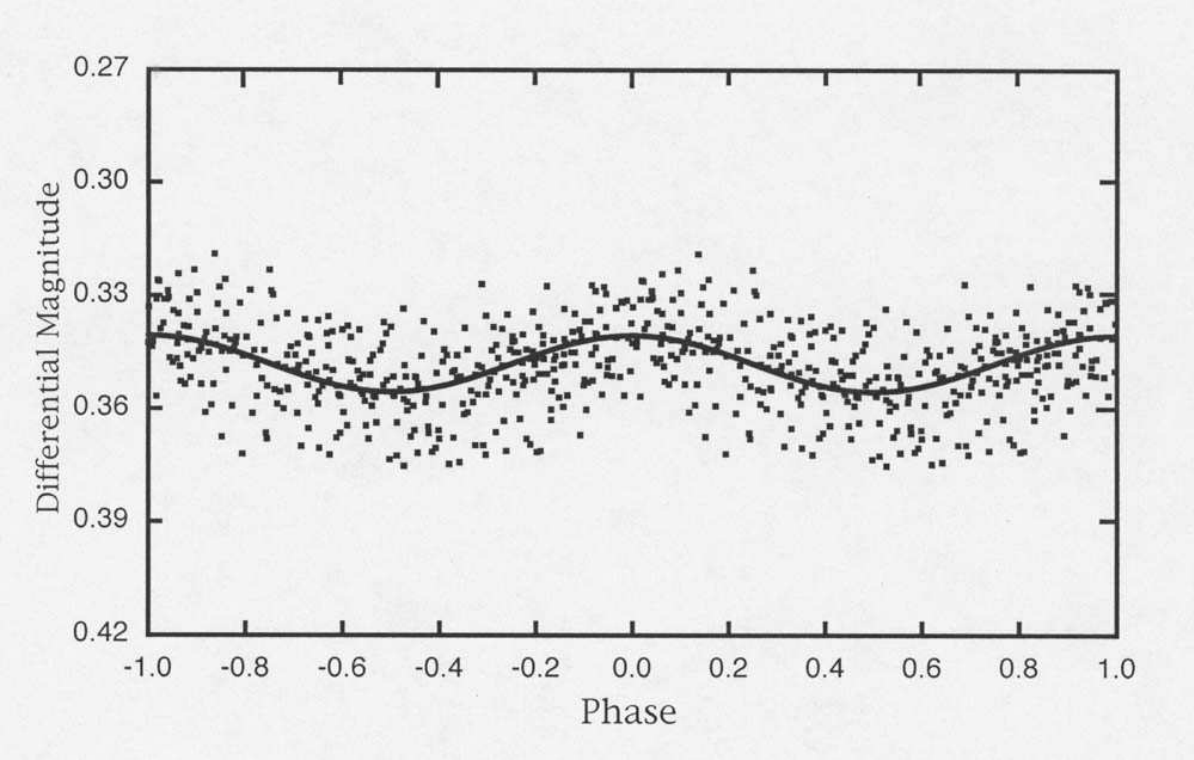

Figure 2. Phased light curve of V959 Ophiuchi. The solid line is the first term of a Fourier fit.

Table 1: New Times of Maximum Light for V959 Ophiuchi

HJD 2400000.0+	Telescope	Detector	Cycle
50665.797	BST	S2KA	0
50964.779	DDT	Pictor 416	3027
50964.880	DDT	Pictor 416	3028
50965.767	DDT	Pictor 416	3037
50985.718	DDT	Pictor 416	3239
51013.773	DDT	Pictor 416	3523

This period is different than both the Götz (1957) value and that given by our Fourier fit. Using the period from the Fourier fit all five nights of new data were phased, as shown in Figure 2. Matching each night's data to the phased curve six times of maximum light were determined. These times are collected in Table 1. From these six times of maximum light a new ephemeris for V959 Oph was determined as given in Eq. 1.

$$\mathrm{HJD_{max}} = 2450665.7968 + 0.098772(\pm 0.000001) \times E. \quad (1)$$

This agrees with the value from the Fourier fit, but is clearly different than the value from the Götz data. The exact nature of the period change in V959 Oph is unclear due to the lack of available data. However, there has been a change at some point during the last 40 years.

In addition to the period change there was a substantial decrease in the amplitude of V959 Oph. A less dramatic example of a similar effect was seen in V1162 Orionis by Hintz et al. (1998). For comparison with V1162 Ori two pieces of information would be useful, Strömgren indices and the rotational velocity. The Strömgren indices would give V959 Oph's position with respect to the instability strip. The rotational velocity of V959 Oph should be compared to the values for other high amplitude δ Scuti stars. Solano & Fernley (1997) found a rotation velocity for V1162 Ori of 46.4 km s^{-1}. This is the highest measured rotation rate for any high amplitude δ Scuti star. The difference in rotation velocities between high and low amplitude δ Scuti stars has been discussed by Breger (1980), Andreasen (1983), and McNamara (1985). Perhaps the disparity in the relative number of high and low amplitude δ Scuti stars can be traced to the rotational velocity. Perhaps more stars started as high amplitude stars but have become low amplitude stars.

We thank the Brigham Young University, Department of Physics and Astronomy for their support of research efforts using the BST. We also wish to thank Case Western Reserve University for the use of the BST. We also acknowledge the assistance of Janet Mattei and Ennio Poretti.

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