

V794 SAGITTARII, AN RV TAURI STAR WITH UNEQUAL MAXIMA

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Abstract

Changes in the shape of the light curve of V794 Sagittarii, an RV Tauri (RVb) variable star, are noted and described. A revised period and epoch are offered:

$$JD(\text{min}) = 2435626.6 + 174.9 E.$$

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H. H. Swope (1940) presented two periods for V794 Sagittarii, 173.48 days for the years 1889 to 1924, and 175.2 for the years 1925 through 1939. The folded light curve of the data after 1924 reveals two similar maxima per period, separated by one deep and one shallower minimum, as is typical for RV Tauri stars. L. Plaut (1948) presented data on V794 Sgr for the years 1934 to 1938, deriving a period of about 160 days, and noting less difference in minima than in the Harvard curve. In his plot of magnitude against Julian date, especially in the later years (JD 2428300 and beyond), one can see fluctuations begin in the magnitudes of the maxima.

Data from V794 Sgr for the years 1956 to 1988 were obtained visually from the photographic plate collection at the Maria Mitchell Observatory by Ataollah Sarajedini and the present author. A date-compensated discrete Fourier transform (Belserene 1986) on this data set (without the single low-weight point in 1956) gives 87.45 days as the strongest component. This is evidently the half-period, the average interval between successive minima or successive maxima. Periods in the range 173-176 days also appeared in the Fourier period searches on the 32-year data set and various subsets. The strongest sinusoidal component in RV Tauri stars is typically the half-cycle, 87.45 days in this case. Multiplying by two to obtain the entire period yields 174.9 days as the best RV Tauri period for the interval 1957-1988.

Figure 1 shows plots of photographic magnitude against JD for 1956-1988, three years to a panel. Sagittarius is high enough to observe from Nantucket for about three months of the year, approximately half of the cycle. The behavior of successive half cycles, therefore, is not apparent. Figure 2 shows the folded light curves for four subsets of the data with phases based on the elements:

$$JD(\text{max}) = 2435660.3 + 174.9 E. \quad (1)$$

They confirm that the variation is cyclical but not perfectly periodic, that alternating half-cycles are not alike, and that the 174.9-day period provides a good representation.

Folded light curves for V794 Sgr published by Swope (1940, Figure 2) display the characteristic RV Tauri shape with alternating deep and shallow minima. By contrast, the data gathered from the Maria Mitchell plate collection show more change in the brightness of the two maxima within the full cycle. The folded light curves display a small fluctuation in minima, but do not show as striking a difference as expected from an RV Tauri variable. The maximum magnitude in Figures 2b and 2d (representing the years 1962-70 and 1980-88) fluctuates about

one magnitude while the minimum consistently returns to the same magnitude. Bright and faint maxima seem to have changed places between Figures 2b and 2d, reminiscent of interchanges of deep and shallow minima in typical RV Tau stars. Figures 2c and 2d show that, although the star appears to be following the elements (1) very poorly for one nine-year span, it produces a relatively smooth light curve for the nine years immediately following. Even with inconsistencies, there is a general pattern of alternating brightness in maxima throughout Figure 2. Apparently the star changed its pattern of variations in the time between the observations ending in 1939 and those beginning in 1957, to the rather curious end that the folded light curves now appear to be almost an inversion of the 1940 curves. Equation (1) is equivalent to the following equation for minimum:

$$JD(\text{min}) = 2435626.6 + 174.9 E. \quad (2)$$

V794 Sagittarii has been observed during the years 1957 to 1988 to have a period of approximately 174.9 days. The period of the star for smaller time intervals differs slightly. Data for years prior to 1940 display more characteristic RV Tauri light curves, whereas recent light curves deviate from the expected shape. Folded light curves for the Maria Mitchell data show brighter and fainter maxima, each occurring once per period.

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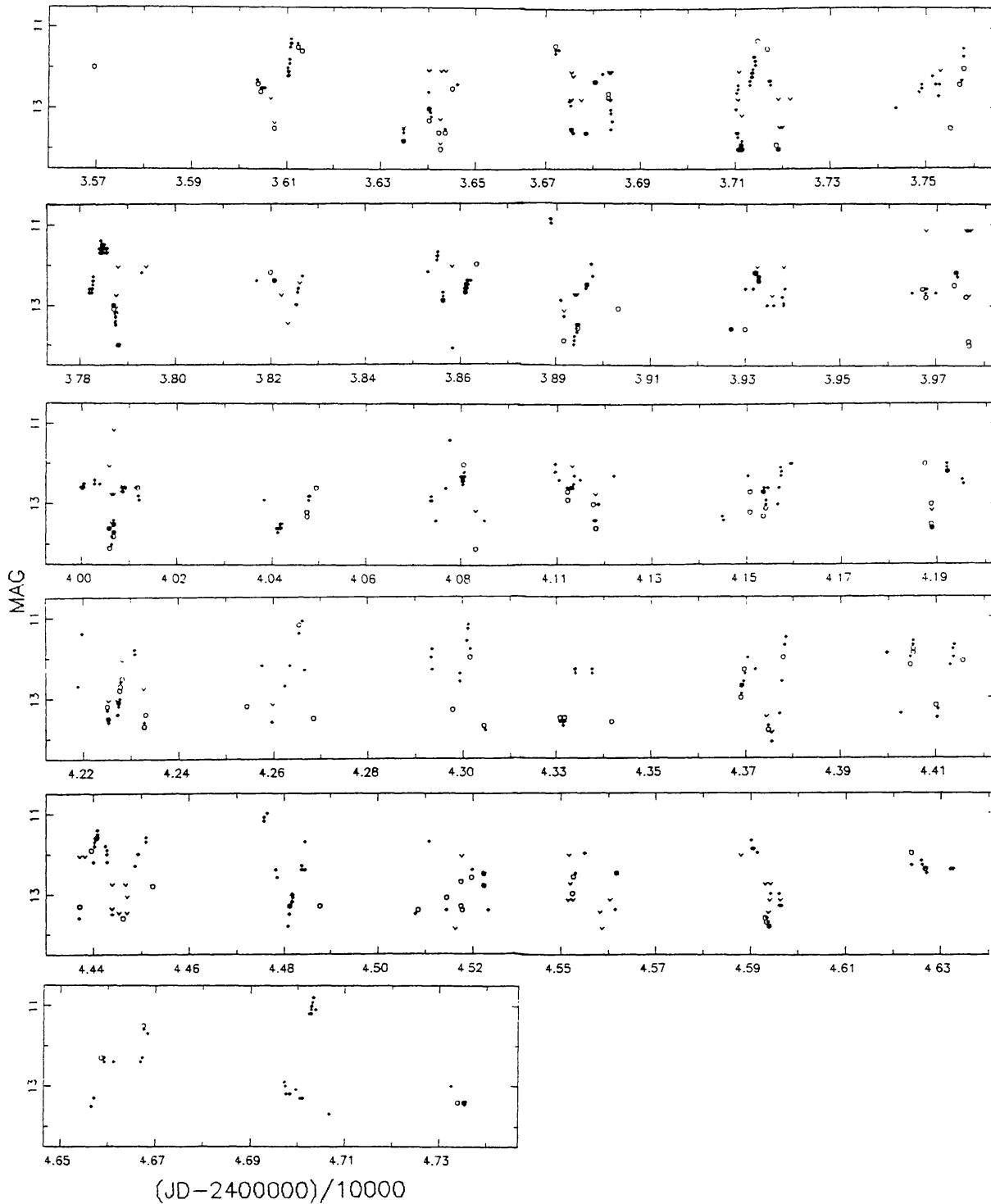


Figure 1. Light curve of V794 Sgr, 1956-1988. Each panel shows six years. The magnitudes are photographic. Open circles indicate low weight. The V symbols mean fainter than.

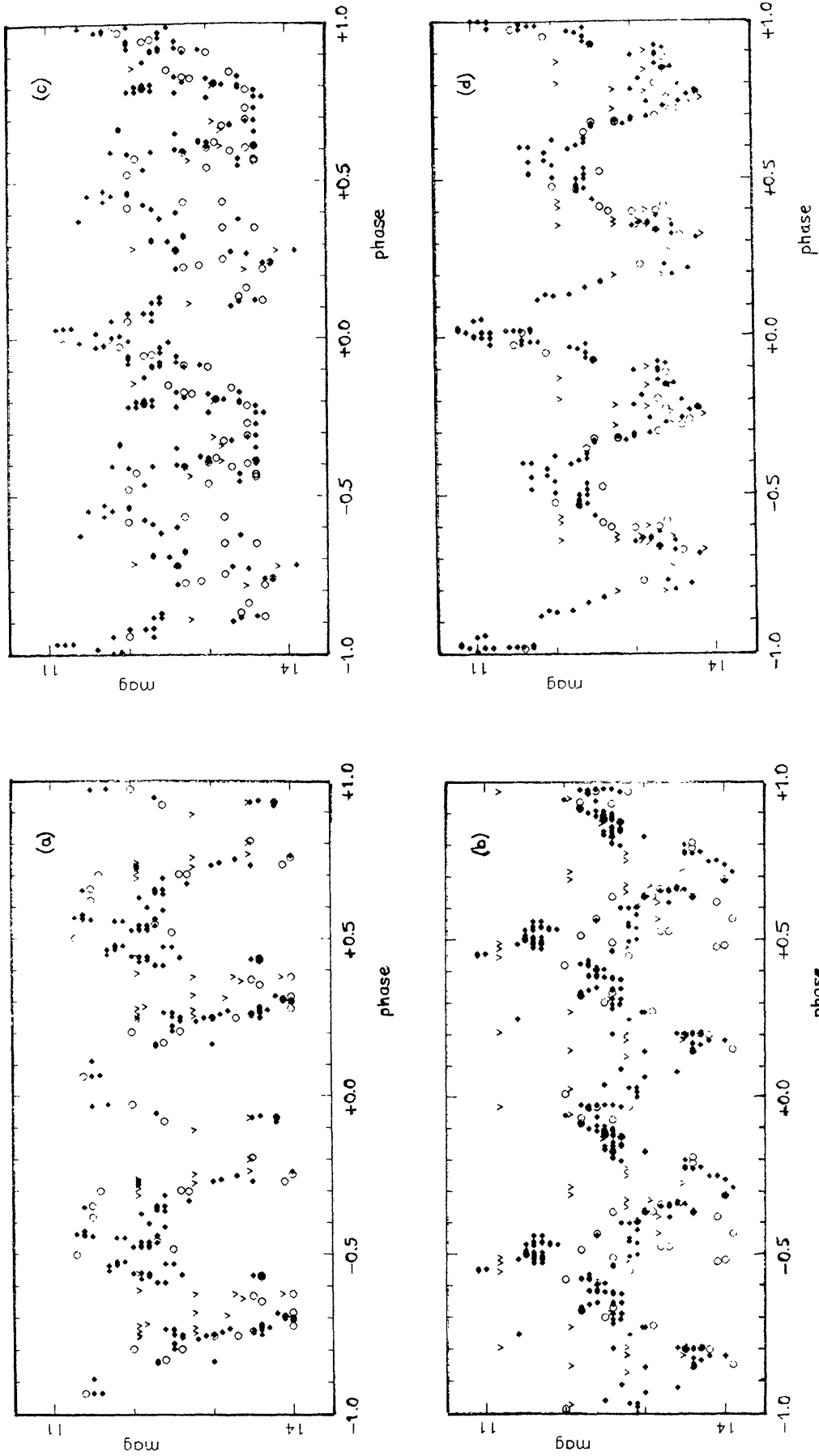


Figure 2. Folded light curves of V794 Sgr with phases based on the elements in equation (1). Symbols as for Figure 1. (a) 1956-1961, (b) 1962-1970, (c) 1971-1979, (d) 1980-1988.