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Photoelectric Photometry Of FP Virginis

FP Virginis (HD 118289, BD +09 2785, SAO 120026) is an old galactic disk gM4 red giant with a (B-V) of 1.65. It is probably a low mass star (less than 3 solar masses), as younger disk population stars of larger masses do not reach the instability regions of small amplitude red variables of the galactic disk and halo populations (Eggen, 1973). Small amplitude red variables are M giants and also possibly asymptotic giant-branch stars, that pulsate with small amplitudes and long periods of up to 200 days (Percy et al, 1989). As part of the AAVSO Small Amplitude Red Variable (SARV) program, observations were recently taken of FP Virginis to more accurately determine its periodicity, if any, and amplitude range. Previous observations of this star have indicated various period ranges from about 40 days to about 68 days, with maximum amplitude ranges from 0.40 to 0.60 magnitude (Eggen 1971, 1973, Ashbrook 1976, AAVSO 1983, 1990). Additionally, previous photometry indicates a red magnitude of 5.3, an infrared magnitude of 3.9, and a bolometric magnitude of -4.15.

The observations were made on 37 separate nights from JD 2448290 (02 Feb 91) to JD 2448453 (15 Jul 91). The detector was a silicon PIN photodiode in a solid-state SSP-3 photoelectric photometer, which was mated to an f/10 8-inch Schmidt-Cassegrain. The observations were made through a SSP-3 Schott visual filter, with the variable star measurements flanked by the comparison star and sky readings. A check star was observed on 35 of the 37 nights. The comparison and check stars used were HD 119288 (V=6.16, B-V=0.42, dF4) and HD 117404 (V=6.17, B-V=1.47, K5), respectively. The mean magnitude difference between these two stars was 0.04 with a standard deviation of 0.016 magnitude. The data were reduced by computer programs written by the author, with all comparison and sky readings being interpolated. Also taken into account in the programs were atmospheric extinction, mean transformation to the standard UBV system computed by observations of UBV standard stars, and corrections to heliocentric time. The maximum internal standard error for all of the observations, calculated for each individual night, was 0.02 magnitude.

The resulting light curve is constructed from the data in Table II and is plotted below. It represents the most complete continuous light curve on this star published to date. The maximum amplitude range is 0.58 magnitude, occurring between JD 2448299 and JD 2448331. This compares fairly well with the earlier measured amplitude ranges. Since the star is classified as a SRb, it has quasi-periodic variations; however, during this most recent observing season the variation in brightness was fairly regular. A peak-to-peak period of 72 days was observed from JD 2448299 to JD 2448371, with the second peak-to-peak period of 63 days from JD 2448371 to JD 2448434. Additionally there is a minimum-to-minimum period of 78 days, observed from JD 2448331 to JD 24484309.

Table I: FP Virginis Period Data

Data Source	Ave. Period (Days)	Amplitude (Magnitude)
Eggen, 1971	40	0.56
Eggen, 1973	44	0.40
Ashbrook, 1976	55	0.60
AAVSO, 1983	64	0.45
AAVSO, 1990	68	0.40
AAVSO, 1991	71	0.58

FP VIRGINIS

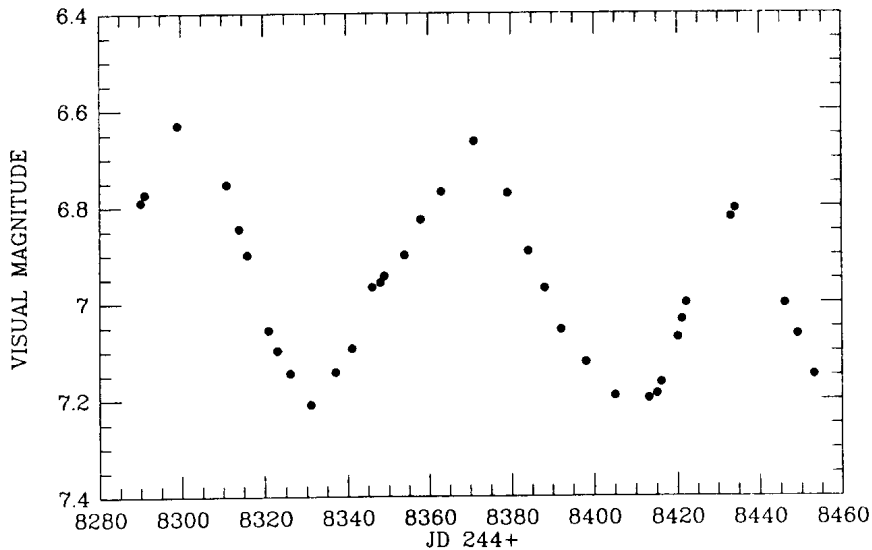


Figure 1

Based on this most recent data, and analyzing earlier data, it appears that the period of FP Virginis is getting longer, although the rate of increase seems to be quite slow. Over the past two decades there has been about a 30 day increase in the period. These results are tabulated in Table I. The 1971 and 1973 data are average periods measured directly from the published Eggen light curves. The 1983 and 1990 periods were extrapolated from AAVSO half-period measurements, and the 1991 period is an average of the three measured periods stated above. The 1976 period was just stated by Ashbrook with no published light curve or data. There does not, however, seem to be any trend toward a steady increasing or decreasing amplitude.

Table II: FP Virginis Light Curve Data

JD 244+	Visual Magnitude
8290.811	6.79
8291.808	6.77
8299.793	6.63
8311.773	6.75
8314.719	6.85
8316.726	6.90
8321.747	7.06
8323.710	7.10
8326.702	7.15
8331.691	7.21
8337.706	7.14
8341.698	7.09
8346.695	6.97
8348.697	6.96
8349.684	6.94
8353.658	6.90
8358.652	6.83
8363.641	6.77
8371.642	6.66
8379.611	6.77
8384.573	6.89
8388.572	6.97
8392.578	7.06
8398.578	7.12
8405.582	7.19
8413.644	7.20
8415.599	7.19
8416.596	7.16
8420.607	7.07
8421.612	7.04
8422.602	7.00
8433.602	6.82
8434.596	6.80
8446.600	7.00
8449.552	7.07
8453.576	7.15

Additional observations will be taken to clarify any persistent periodicities and to see if the trend toward a longer period continues. A multiplicity of apparent periods is, of course, a major characteristic of semi-regular SRb variable stars (Petit, 1982). Thus these observations support the classification of FP Virginis as an SRb variable star with a small amplitude range, and quasi-periodic variations. Acknowledgement is given to Howard Landis of the AAVSO for kindly supplying the SARV archival data for analysis.

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