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HD 136905: A NEW RS CVn VARIABLE STAR

According to Bidelman and MacConnell (1973), HD 136905 (= SAO 14099) is a K1 III + F binary with Ca II H & K in emission, although they considered the emission uncertain. Because this made us suspect it was an RS CVn binary, we began observing it spectroscopically to search for radial velocity variations and photometrically to search for light variations.

As part of a program to obtain spectroscopic observations of Ca II H & K emission stars listed by Bidelman and MacConnell (1973), Fekel observed HD 136905 with the 91-cm reflector at Goddard Space Flight Center and with the 2.7-m reflector at McDonald Observatory of the University of Texas. The 4 Goddard observations with a dispersion of 40 Å/mm and a resolution of 2.5 Å all showed weak to moderate strength Ca II H & K emission lines. On 8 nights between JD 2444355.9 and 2444739.8 red spectrograms were obtained at McDonald with a dispersion of 4.4 Å/mm. These observations show a single component of spectral type K0 IV or III whose lines are broadened with V sin i $\sim$ 25-30 km/sec and whose radial velocity is variable. A period-search program applied to the 8 radial velocities yielded several possible values, but the best seemed to be $11^{d}.12$ with an uncertainty of about $\pm 0^{d}.05$. A comparably good fit was given by a period with half that value, but this was considered less likely because the shape of the resulting radial velocity curve would imply an orbital eccentricity of $e \approx 0.5$, unusually large for such a short orbital period. Spectroscopic observations are being continued to determine the orbital elements.

Differential photoelectric measurements were made at two different observatories on a total of 16 different nights in 1980 between JD 2444675.90 and 2444783.80. Burke observed with the No. 4 16-inch reflector at Kitt Peak National Observatory; Henry observed with that same telescope and also with the Seyfert 24-inch reflector at Dyer Observatory. The Kitt Peak ob-

servations were made to match V of the UBV system, while those at Dyer were made to match V and B. Both observers used BD $-6^{\circ}4181$ as the comparison star. The individual differential magnitudes of Henry and the nightly means of Burke, corrected for differential atmospheric extinction with mean coefficients appropriate for each observatory and transformed to the UBV system with coefficients determined during the observing run or previously, have

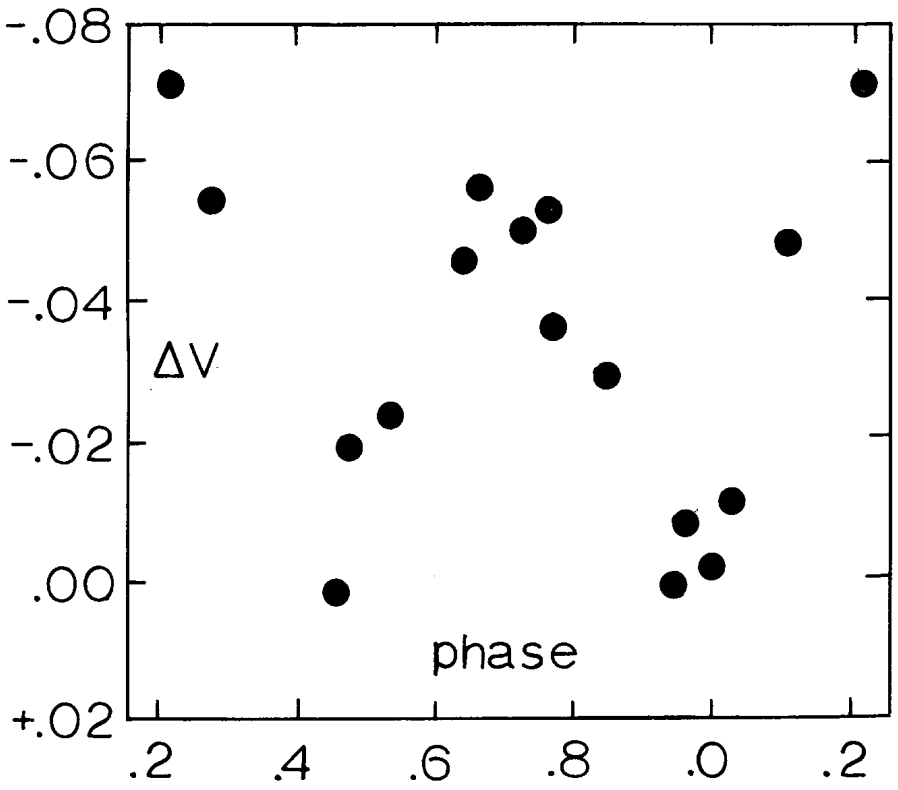

Figure 1

been deposited in the I.A.U. Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 96. In the reductions we used a mean color difference of $\Delta(B-V) = -0^m.11$, in the sense variable minus comparison.

The light curve in V is plotted in the figure below, where each point is a nightly mean. Phase has been computed with the ephemeris

$$JD(hel.) = 2444678.4 + 11^d.12\ n,$$

where the initial epoch is a time of minimum light and the period is the same one found by Fekel. It can be seen that HD 136905 is definitely variable in light, with a range of $\Delta V = 0^m.07$. Further it can be seen that this light curve shows <u>two</u> comparably high maxima and <u>two</u> comparably deep minima per cycle. It is not surprising, therefore, that the photometric data can be fit almost as well by a period half that value. There is some indication that the photometric data would be fit marginally better by a period about 0.5% shorter than the orbital period, but the temporal baseline of only 108 days is sufficiently short that this should not be considered firmly established.

Recent BVRI photometry obtained by Moffett (1982) on three nights indicates $V = 7^m.31$ and $B-V = +1^m.02$.

We conclude by saying that HD 136905 is definitely an RS CVn binary and definitely variable in light, although the Ca II H & K emission is not very strong and we are not sure whether the orbital period is around $11^d.1$ or half that. If the former is true, then HD 136905 would be interesting as another example of an RS CVn binary in which one stellar component has <u>two</u> comparably large spots or spot groups, on opposite hemispheres. If the latter is true, then HD 136905 would be interesting as a rather short-period binary with a very large orbital eccentricity. Additional spectroscopy and/or photometry should be able to resolve this ambiguity.

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EDWARD W. BURKE[a]
JAMES E. BAKER

Department of Physics
King College
Bristol, Tennessee 37620

FRANCIS C. FEKEL

Code 685
Goddard Space Flight Center
Greenbelt, Maryland 20771

DOUGLAS S. HALL[a]
GREGORY W. HENRY[a]

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

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