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RADIAL VELOCITY VARIATIONS IN THE Ca II EMISSION STAR HD 36705

We present radial velocity measurements which suggest that the star HD 36705, previously thought to be single, is in fact a single lined binary.

HD 36705 (K1 IIIp, Houk and Cowley, 1975) shows strong Ca II H & K emission, and was suggested as a possible RS CVn star (Weiler and Stencel, 1979). However Collier (1982) found no radial velocity variations in ten spectrograms of this star, and concluded that it is probably a member of the FK Comae class of rapidly rotating single late type giants (Bopp and Stencel, 1981). Pakull (1981) identified HD 36705 with a flaring X-ray source observed by the EINSTEIN satellite. He also obtained extensive photometric observations, finding a period of 0.51423 ± 0.00005 day, and a light curve which changes significantly on short time scales. Rucinski (1983) obtained further photometry, confirming the short period and the rapidly varying light curve. Collier et al.(1982) and Slee et al.(1984) report a possible detection of this star at radio frequencies.

We obtained 14 spectra of HD 36705 at a dispersion of approximately 10 Å mm^{-1} with the Cassegrain echelle spectrograph on the 1.0 m telescope of the Australian National University at Siding Spring Observatory on 1984 February 16, 19, 20 and 21. The detector was the Mount Stromlo red two dimensional Photon Counting Array. All data reduction was done with the Mount Stromlo PANDORA reduction program.

We also made eleven measurements of four stars whose radial velocities are accurately known from the work of Griffin (1972). The mean deviation of our results from those of Griffin is -0.9 km s^{-1}, with an rms error of 2.5 km s^{-1}. The measured radial velocities of HD 36705 are likely to be less precise, due to the high rotational broadening ($v \sin i = 70 \pm 10$ km s^{-1}, Collier, 1982).

Only about 0.8 of the approximately half day period was covered by our observations, with only about 0.6 well covered. The data indicate a radial velocity variation of at least 20 km s^{-1}.

We combined our data with those previously published by Collier (1982). We retained the epoch of Pakull (1981) of HJD 2444296.575, but the combined radial velocity data spanning four years are better fitted by a period of 0.51425 day. Our derived period is consistent with that of Pakull within his quoted uncertainty.

The radial velocity data are plotted in Figure 1, (open circles: Collier, 1982; closed circles: our results) with the epoch and period given above. A best fitted sine wave is also plotted; the equation is

$$V = 36.9 + 10.9 \sin 2\pi(\phi - 0.137)$$

where ϕ = phase as computed from the given epoch and period.

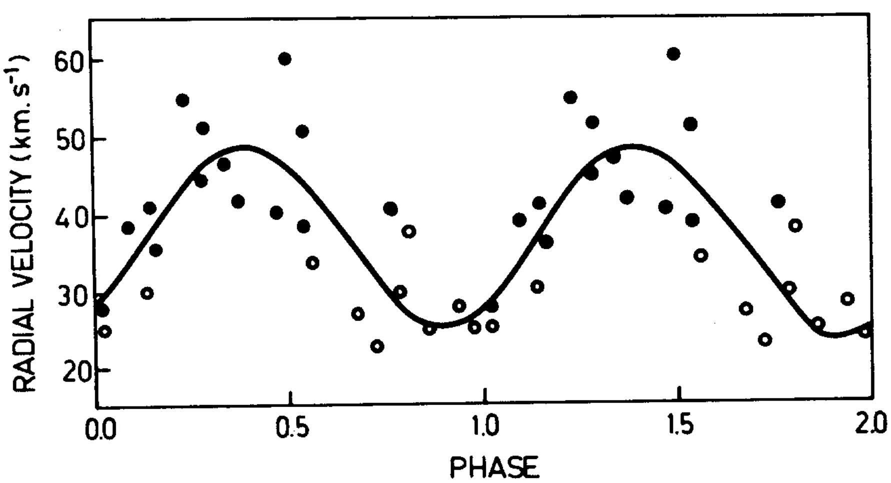

Figure 1

Although the data are scattered, we believe the variations to be real. We suggest that Collier's (1982) conclusion can be explained by the fact that his measurements were made when the velocity was not changing greatly with phase.

The amplitude of the line of sight orbital velocity is about 10 km s^{-1} and the line of sight rotational velocity is 70 ± 10 km s^{-1} (Collier, 1982). Assuming synchronous rotation, these results imply that the centre of mass of the system is well within the visible component and that the mass ratio q is < 0.1.

The large rotational velocity of the primary implies that it cannot be a giant, because of equational break up; thus the secondary must be a very low mass object.

Hearnshaw (1979) obtained eleven spectra of this star, and suggested that radial velocity changes may be present. However, no numerical results were given, so we cannot compare Hearnshaw's results with our data.

Figure 2 is a photoelectric V light curve obtained during 1984 February

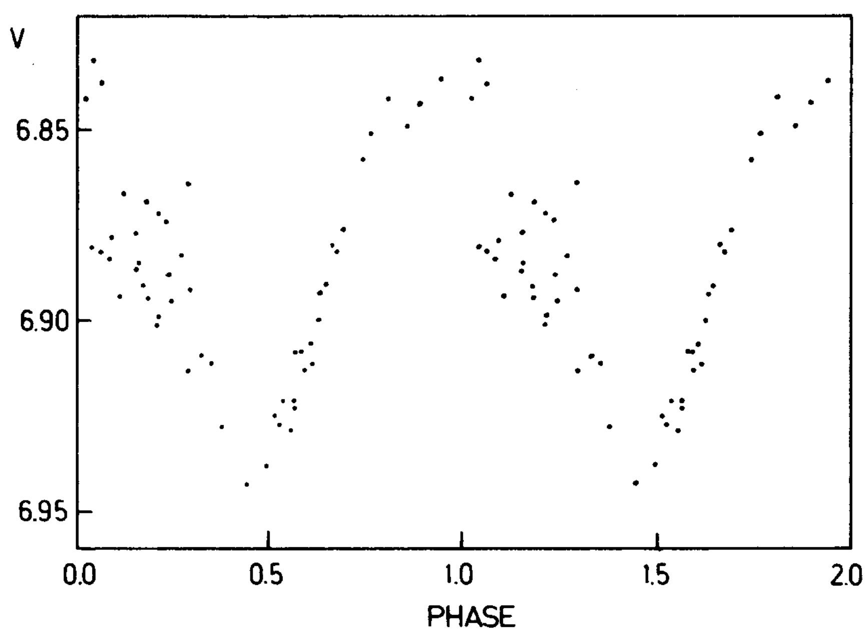

Figure 2

to April, with the Monash Observatory 0.25 m telescope, using a 1P21 photomultiplier tube. All measurements were made differentially using HD 37297 as a comparison star, as used by Pakull (1981). These data are plotted with the same epoch and period as Figure 1. The results suggest that minimum light occurs near radial velocity maximum. If the photometric variations are due to dark starspots then maximum spot visibility must also occur at this orbital phase.

We are preparing a fuller account of this work for publication elsewhere. We thank Mount Stromlo and Siding Spring Observatories for access to the 1.0 m telescope and other facilities.

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