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SPECTROPHOTOMETRY OF V711 TAURI

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Abstract. Spectrophotometric observations of the RS CVn binary system V711 Tau (HR 1099), covering the wavelength interval $\lambda\lambda$3300–7100 Å, have been presented. A comparison of the standard spectral scans of V711 Tau with the spectral scans of the stars of known spectral types and luminosity classes taken from the Breger (1976) catalogue shows that, at all phases shown in the diagram, the spectral-luminosity type of the star is K0IV or K0III. The magnitude of the system fluctuates from $5^m.71$ to $5^m.79$ average being $5^m.75$ approximately, the faintest being near $0^p.43$ and the brightest near $0^p.78$. The region around Balmer jump and near Hα region is apparently variable.

1. Introduction

V711 Tauri (= HR 1099 = HD 22468 = ADS 2644A, $V = 5^m.8$) is a bright RS CVn binary. Earlier photometric observations by Cousins (1963), Bopp *et al.* (1977), and Landis *et al.* (1978) have indicated that V711 Tau is a non-eclipsing binary system. However, quasi-sinusoidal variations of $0^m.1$ are noted. Bopp and Fekel (1976) found it to be a double-lined spectroscopic binary. The spectral type of the components being G5V and later than G5, respectively. Hα profile variations have also been found, but they are mostly phase-independent. Ca II H and K emissions have also been observed. Owen *et al.* (1976) and Feldman *et al.* (1978) have found variable radio emission and radio flares in V711 Tau. Recent photometries by Parthasarathy *et al.* (1981), Mekkaden *et al.* (1982), Wacker and Guinan (1986, 1987), and Mekkaden (1987) have shown that the light curve is variable with strong asymmetries, and normally the presence of spot have been invoked to explain its variability. The wave migration has been found both direct and retrograde with variable period of migrating wave ranging from 13 years to nearly 6 years.

2. Observations

Scanner observations of V711 Tau (HR 1099), covering the wavelength-interval $\lambda\lambda$3300–7100 Å have been secured on three nights, 19 February, 30 October, and 5 November, 1986 through the 104-cm reflector of the Uttar Pradesh State Observatory, Nainital. The scanner consists of a monochromator containing 600 lines mm^{-1} grating, giving a dispersion of 70 Å mm^{-1} at the exit slit. A cooled (-20 °C) EMI 9658B photomultiplier, and standard dc techniques were used for recording the scans. The scans were obtained with 0.4 mm exit slit. The visual companion has been included in the field. The absolute flux (or magnitude) values correspond to the calibration of ξ^2 Cet given by Taylor (1984). Two scans each of V711 Tau have been secured on J.D. 2446480 and J.D. 2446734 and their mean have been obtained. On J.D. 2446740

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only one scan could be obtained. The mean and individual scans have been displayed in Figure 1. The standard observations have been given in Table I. The phases have been calculated from the ephemeris:

$$\text{J.D. } 2442766.069 + 2^{d}.83782E \quad \text{(Bopp and Fekel, 1976)}.$$

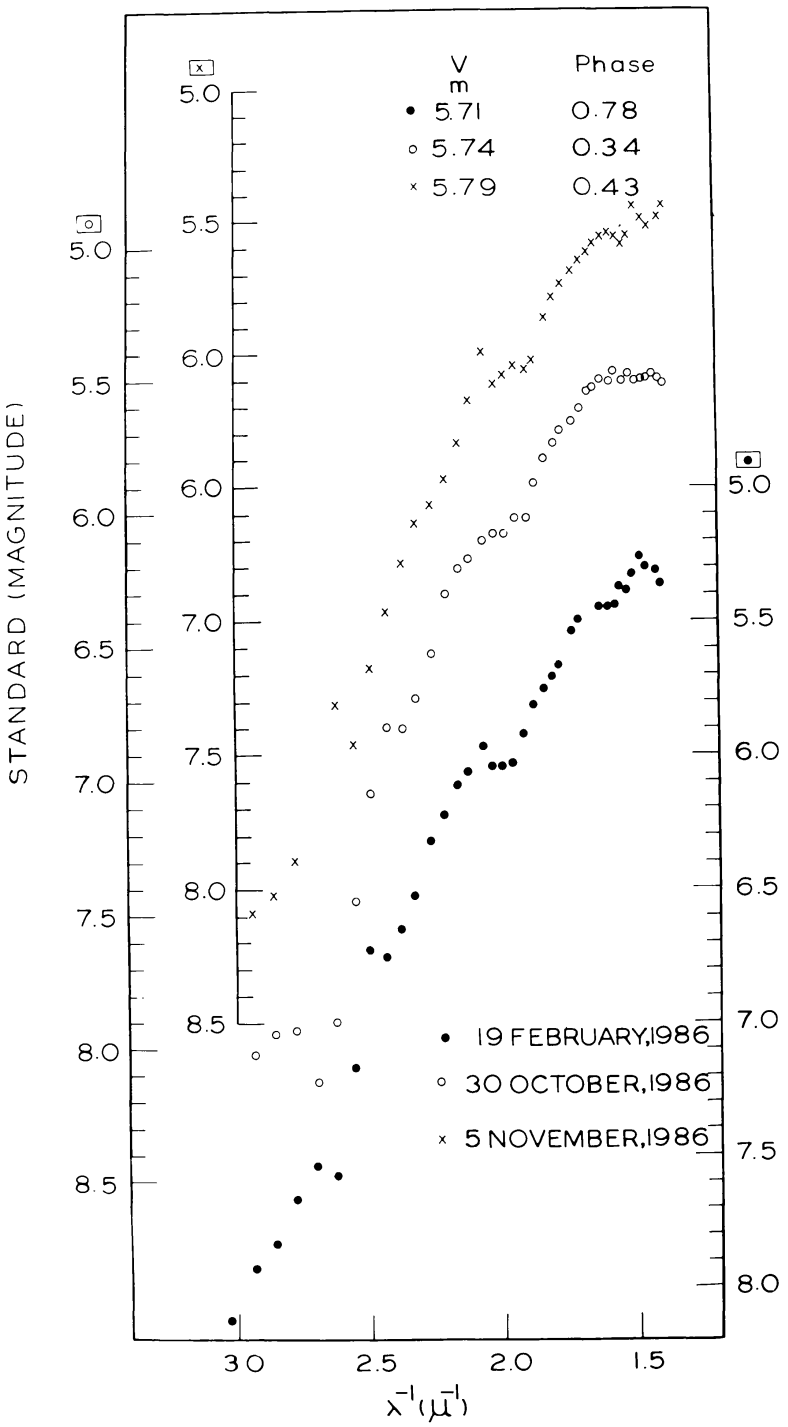

Fig. 1. Standard spectral scans of V711 Tau.

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TABLE I

Standard magnitudes of V711 Tauri

$\lambda^{-1}(\mu)^{-1}$	J.D. 2446480	J.D. 2446734	J.D. 2446740
3.03	$8^m.006$	–	–
2.94	7.926	$8^m.024$	$8^m.087$
2.86	7.819	7.942	8.021
2.78	7.660	7.927	7.887
2.70	7.551	8.127	–
2.63	7.564	7.893	7.313
2.56	7.140	7.444	7.462
2.50	6.702	7.046	7.167
2.44	6.688	6.800	6.956
2.38	6.651	6.807	6.794
2.33	6.525	6.698	6.644
2.27	6.325	6.526	6.568
2.22	6.247	6.306	6.465
2.17	6.115	6.204	6.327
2.13	6.055	6.174	6.176
2.08	5.973	6.098	5.994
2.04	6.024	6.071	6.112
2.00	6.075	6.071	6.081
1.96	6.028	6.014	6.039
1.92	6.920	6.025	6.048
1.89	5.803	5.889	6.027
1.85	5.773	5.794	5.874
1.82	5.711	5.736	5.785
1.79	5.657	5.688	5.737
1.75	5.532	5.656	5.685
1.72	5.501	5.604	5.648
1.69	–	5.543	5.620
1.67	–	5.532	5.586
1.64	5.456	5.499	5.555
1.61	5.457	5.503	5.548
1.59	5.459	5.469	5.559
1.56	5.387	5.509	5.588
1.54	5.391	5.482	5.555
1.52	5.316	5.506	5.438
1.49	5.260	5.503	5.485
1.47	5.318	5.499	5.524
1.45	5.200	5.480	5.486
1.43	5.336	5.499	5.444
1.41	–	5.525	5.530
V (λ5500 Å)	5.71	5.74	5.79

The errors of individual observations before and after λ5000 Å, respectively, are $0^m.05$ and $0^m.07$. No special features of Ca II H and K and Hα-lines are visible in the scans (except some fluctions in Hα-region). However, some variations are apparent in the wavelength interval $\lambda\lambda$3300–3700 Å, around the region of the Balmer jump.

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3. Variation in Brightness

The mean spectral scans of the star on J.D. 2446480, 2446734, and individual scan on J.D. 2446740 correspond, respectively, to phases $0^p.78$, $0^p.34$ and $0^p.43$. The V (λ = 5500 Å) magnitudes at these phases are $5^m.71$, $5^m.74$, and $5^m.79$, respectively. These values indicate that the brightness of V711 Tau varied from $5^m.71$ to $5^m.79$ showing an amplitude of $0^m.08$. The system being brightest at phase $0^p.78$ and faintest at $0^p.43$ (these observations are about 0.7 year apart). This change in the V magnitude of the star is usually found. Recent observations (Table II) suggest that during the past four years the maximum and the minimum light of the system remained nearly at the same phase, which fact indicates that the spot positions have not drifted significantly during past four years. The present results are consistent with the results of past four years.

TABLE II
Phases of maximum and minimum light of V711 Tau

Sl. no.	Source	Year of observations	Max. light phase	Min. light phase
1.	Mekkaden *et al.* (1982)	1980–1981	0.77	0.43
2.	Wacker and Guinan (1987)	1983–1984	0.73	0.43
3.	Villanova unpublished (cf. Wacker and Guinan, 1986)	1984–1985	0.78	0.40
4.	Wacker and Guinan (1986)	1985–1986	0.80	0.41
5.	Joshi *et al.* (present study)	1986	0.78	0.43

4. Spectral Type

The scans normalized to λ5000 Å, were compared with the scans of several stars in the appropriate spectral range, given by Breger (1976). This comparison showed that the average spectral and luminosity class of the system is K0IV or K0III, which is near to the spectral-luminosity type of the fainter, more active component. Since strong emission, and variability is not visible in Ca II H and K and Hα regions except for some fluctuations, it is inferred that the system may be just emerging from the quiescent phase.

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