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Pulsation Investigation of V647 Tau – Preliminary Results of STEPHI Campaign in 1997

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Abstract. V647 Tau was observed during a 1997 STEPHI campaign; 228 hr of observations in v were obtained, together with another 50 hr of simultaneous data in y. The data were analyzed and main results are discussed in the text.

1. Observation

From 1997 November 19 to December 13, high-speed, high-accuracy photometry of the δ Scuti star V647 Tau in the Pleiades cluster was carried out by STEPHI (STEllar PHotometry International). Chevreton four-channel photometers were used in San Pedro Mártir, Observatoire de Haute-Provence, and Observatorio del Teide with a v filter. In Xinglong, simultaneous v and y were measured using a six-channel photometer. The long observational time base (228 hr) gives rise to a frequency resolution $\Delta\nu = 0.5\,\mu$Hz, with an effective time coverage of 38%.

2. Analysis

Each night data of every observatory was normalized to zero point and merged into one time series after correcting the effects of instrumental drift, atmospheric extinction and fluctuation in transparency. Fourier transforms were performed using code MFA (Hao 1991). Five frequencies listed in Table 1 were unambiguously determined. To confirm the result, the above procedures were also

repeated on data from the two comparison stars. None of the five frequencies is found in the power spectra of the comparison stars. The five-frequency solution was then applied to the v and y datasets of Xinglong in an effort to obtain the corresponding amplitude and phase by means of least squares. The amplitude ratio and phase shift between the two filters were derived. Theoretical values were also calculated according to Garrido, García-Lobo, & Rodríguez (1990).

3. Discussion

An earlier observation of V647 Tau gave a frequency $f = 20.41$ d^{-1} and light variation $\Delta V = 0.01$ (Breger 1972). This is, in fact, none other than ν_2 in Table 1, with a decreased amplitude. The global parameters are derived from photometric calibration according to Domingo & Figueras (1999). They are $T_{\rm eff} = 7881 \pm 270$ K, $\log g = 4.26 \pm 0.18$, and $M_V = 2.39 \pm 0.22$. The Q-values are then calculated and listed in Table 1. Note that the period ratio $P_3/P_2 \approx 0.75$. Q_2 and Q_3 are typical of radial pulsation, satisfying the relation between radial fundamental and first overtone. A model calculation also shows that ν_2 has a large positive phase shift, while the others are negative. Presently, we can only say that ν_2 and ν_4 are radial and $\ell = 2$ nonradial modes respectively; the other three modes cannot be determined, considering their error bars.

Table 1. The results of a period analysis for V647 Tau.

No.	Frequency d^{-1}	Amp. mmag	Phase ($\times 2\pi$ rad)	A(v)/A(y)	$\phi(v) - \phi(y)$ degree	Q ($\times 10^{-2}$)
1	32.3494	3.12	0.279	1.443	−2.270	1.95
	±4	±5	±6	±0.040	±1.634	
2	20.4375	2.13	0.897	1.196	3.930	3.09
	±6	±5	±8	±0.049	±2.342	
3	27.2616	1.93	0.926	1.428	−6.217	2.31
	±7	±6	±9	±0.076	±3.066	
4	38.3704	1.43	0.599	1.308	−15.928	1.64
	±9	±5	±12	±0.076	±3.341	
5	26.3206	1.30	0.976	1.433	−9.319	2.40
	±10	±6	±14	±0.103	±4.069	

References

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