CONTRACTION PHASE OF THE SHELL OF ζ TAURI

The shell star ζ Tauri has been observed from November 16, 1961 to March 26, 1962 (17 spectrograms); from February 5, 1963 to April 14, 1963 (8 spectrograms), and from October 8, 1963 to January 26, 1964 (11 spectrograms), with the grating spectrograph of the Merate Observatory (dispersion: 23 and 35 A/mm). The measurements of the radial velocities of the hydrogen and metallic lines of the shell spectrum indicate that the shell is contracting and that the contraction velocity is decreasing from 1961 to 1964; moreover the shell spectrum was very weak in the period 1961-62. On the spectrograms of 1963 and 1963-64 several metallic shell lines become stronger.

The radial velocity curve for the shell lines is roughly parallel to the orbital velocity curve of the star. We give here only the mean values for each period and we compare them with the zero velocity of the binary star, which is equal to + 22.5 Km/sec.

TABLE I

Epoch	Mean radial velocities	$V_{shell} - \gamma$ velocity
Nov. 1961 - March 1962	H I + 75 km/sec	+ 53
	Fe II 85	63
	Ca II 82	60
	Si II 95	73
	Mg I 94	72
Febr. 1963 - Apr. 1963	H I + 60	+ 38
	Fe II 60	38
	Ca II 57	35
	Si II 51	29
	Mg I 57	35
	Ni II 80	58
Oct. 1963 - Jan. 1964	H I + 36	14
	Fe II 34	12
	Ca II 33	11
	Si II 37	15
	Mg I 37	15
	Ni II 31	9

We remark that during the period 1961-62 there is a systematic difference between the radial velocity given by the hydrogen lines, by the Fe II and Ca II lines and by the Si II and Mg I lines. During the second period only the Ni II lines give higher velocities, and during the third period there is a general agreement among all the lines.

If we compare these results with the previous results of 1958-59 ([1], [2]) and of 1960 ([3]) we see that the shell has passed a period of expansion (V_∞ — 80 km/sec in 1959), then a period of quiescency in 1960, and finally a phase of contraction which is now slowing down. Pringle and McNamara ([4]) observed ζ Tauri in Jan. 1958 and found a systematic difference between the velocities derived from absorption lines below the Balmer discontinuity ($\lambda < 3647$) and those above this limit. They suggested that this behavior can be explained if the expansional velocity of the shell decreases with height. This suggestion explains also our observations of 1958-59 based on lines at $\lambda > 3647$: the Balmer line cores which are formed in the outer parts of the shell indicate a lower velocity than the Fe II and Ti II lines which are formed in lower parts of the shell. A similar explanation can be applied also to our observations of 1961-62: the systematic difference between velocities derived by H I lines (+ 75 km/sec), by Fe II and Ca II (+ 84 km/sec) and by Si II, Mg I (+ 95 km/sec) suggests a stratification in the shell, the outer parts of which are contracting with a lower velocity than the internal parts of the shell.

Measurements of the total intensities of the shell spectrum lines are in progress, for the study of the variations of the physical conditions into the shell.

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