A Search for Trapezium Type Multiple Systems in T-Associations

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A high percentage of double and multiple stars among those in T-associations was first paid attention to by Prof. V.A.Ambartsumian. Further at the beginning of sixties many investigators of variable stars (Kukarkin, Herbig et al.) paid attention to the necessity of studying duplicity of stars in T-associations. Just then the first lists of wide pairs in T-associations appeared [1,2,3,4].

We set a task to search for the Trapezium type multiple stars in T-associations involving the groupings of T Tau type variable stars from Kholopov's list [5] at a distance up to 500 pc. Such associations proved to amount 19, but out of them we succeeded in searching only in 12 ones.
The method of work and the criteria for excluding optical systems are described in paper [6] .

The search was performed on the Palomar charts. Around each star in question within the radius of 1 arc min for all stars the distances, position angles and diameters were measured.

After the optical systems had been excluded the multiple systems and double stars were listed.

To ascertain the percentage of the Trapezium type multiple systems revealed in total number of multiple systems investigated in T-associations we made some calculations in terms of the above lists. The results are given in Table 1. As it is seen Trapezium type multiple stars in T-associations Ori T1 make 75% of the total number of multiple ones; in Ori T2 - 90%; in Ori T3 - 94%; in Ori T4 - 93%; in Tau T1, T2 T3 T4 - 100%.

https://doi.org/10.1017/S0252921100009817 Published online by Cambridge University Press

Table 1

Name of Association	Total Number of Variables	Number of Stars				Optical trapezia	Number of Stars entering trapezia
		revised	double	multiple	trapezia		
Ori T1	39	38	11	12	9	3	12
Ori T2	648	444	113	60	54	4	70
Ori T3	58	56	15	17	16	3	17
Ori T4	19	18	3	15	14	5	14
Tau T1	16	16	4	4	4	0	4
Tau T2	9	9	2	1	1	0	1
Tau T3	57	56	11	8	8	1	10
Tau T4	3	2	-	2	2	0	2
Aur T1	8	8	4	3	2	1	2
Cep T2	2	1	-	1	1	0	1
Oph T1	2	2	-	2	2	1	2
Sco T1	28	19	2	9	7	2	8

From Table 1 it is also seen that out of 120 Trapezium no more than 20 ones can represent optical systems.

Hence, about 85% of the Trapezia in Table 1 are physical systems.

On the basis of our lists of Trapezium we have compiled the list of such Trapezia in which besides the primary star at least one of the components is a variable (Table 2).

Table 2

No.	Name of association	Star	Multiplicity	Component	Star
1.	Ori T1	GX	four-fold	B	V370
				C	V443
				D	V444
2.2.	Ori T2	AH	three-fold	B	V419
3.		BF	" "	B	V865
4.		IP	" "	B	IQ
5.		KV	six-fold	B	V780
6.		MO	five-fold	B	LX
				C	LX
7.		MX	three-fold	B	V357
8.		V569	" "	B	V363
				C	V388
9.		V724	" "	B	V544
10.		V753	four-fold	B	V761
11.		V776	three-fold	B	V373
				C	KK
12.		V938	five-fold	B	XX
				C	V981
13.	Ori T3	TX	three-fold	B	TY
14.	Tau T3	DI	" "	B	DH
15.		HS	" "	B	HR
16.	Sco T1	SPZ 1799	four-fold		SPZ 1798

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As it is seen from Table 2 all the components of one four-fold system with the primary star GX Ori (No.1) and two three-fold systems with their primaries V569 Ori (No.8) and V776 Ori (No.11) are variables.

As it is clear, basically the trapezia components located in Ori T2 association are the variables. This seems to be the reason of more thorough investigation of Ori T2 association.

The distribution of Trapezia in T-associations under investigation according to the value of maximum distance between the components shows that in 16 associations of Ori the maximal distance lies within 2-6 thousand a.u. when the distance to the association equals 400 pc.

Out of 27 Trapezia in T-association of Tau, Ceph, Aur and Sco, maximal distances between the components for 8 trapezia is within 2-4 thousand a.u. suggesting the distance to the association to be 200 pc. This latter points to the fact that the trapezia mentioned are younger than others revealed by us.

It should be noted that the primary stars of five wider trapezia are close binary systems.

Studying of the above systems is of great interest as much as they seem to be at the earliest stage of their evolution.

Comparison of the Trapezia lists with the Atlas of Galactic Dark Nebulae by J.Sh.Khavtasi [7] showed that the majority of Trapezia are located in dark and bright nebulae and at the same time they are mainly in groups.

It should be noted that all the Trapezia with their components of variable stars are located in dark and bright nebulae.

On the basis of the above statement one principal conclusion can be drawn:

Among the chosen stars in T-associations under investigation many are double multiple systems and among multiple ones Trapezium type systems make a high percentage and out of them 85% are physical systems.

https://doi.org/10.1017/S0252921100009817 Published online by Cambridge University Press

The results of searching of Trapezium type multiple systems as well as double stars in T-associations of Table 1 in some details will appear in the mearest issue of the Bulletin of Abastumani Astrophysical Observatory

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https://doi.org/10.1017/S0252921100009817 Published online by Cambridge University Press