Some Results of an Hα Survey in the Taurus Dark Clouds

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Abstract

From a series of 4.degree objective-prism plates obtained on the 1m Schmidt telescope of the Byurakan astrophysical observatory 20 new Hα emission line stars were found. The intensity of Hα emission line was evaluated for these stars. An additional sample of probable Hα emission stars was also found. We present here details and some observational features of these stars. The total number of Hα emission line stars estimated for the surveyed area is about 80.

Keywords: objective prism survey; Hα objects; Pre-Main-Sequence stars

1 Introduction

Hα emission in stellar spectra is one of the distinct indicators of chromospheric activity of dwarf stars, especially in the early stages of their evolution. These stars usually form so-called T-associations and are often T Tauri type stars when studied in detail. Stars with strong Hα emission can be found in large-scale spectral surveys of star forming regions (hereafter SFR) carried out using wide field cameras equiped with an objective prism. We have used this method to search for and study Hα emission line stars in the nearest SFR in the Taurus dark clouds (hereafter TDC). Preliminary results were presented by Parsamian & Hojaev(1985).

2 Observations

The observations were carried out on the 1m (40-inch) Schmidt telescope of the Byurakan Astrophysical Observatory with a 4 deg. objective prism. We used a Schott RG1 filter with Kodak 103a-E, IIa-E and 103-F type plates. The observational details are presented in Table 1. Plate 1 was obtained by E.Parsamian.

Table 1: Hα observations in the region of TDC. Note: *a* designations as in Fig.1; *b* obtained by E.Parsamian.)

Number of the plates	Type of the plates	Exposing times	Date of the observations	Alphabetical symbol of the area embraced[a]
1[b]	Kodak IIa-E	90 min	25.10.1970	B
2	Kodak 103a-E	43	29.12.1983	A
3	Kodak 103a-E	60	30.12.1983	A
4	Kodak 103a-E	2x10	31.12.1983	A
5	Kodak 103a-E	60	31.12.1983	C
6	Kodak 103a-E	75	31.12.1983	C
7	Kodak 103a-E	90	31.12.1983	A
8	Kodak 103a-E	2x7	01.01.1984	C
9	Kodak 103a-E	3x10	01.01.1984	B
10	Kodak 103a-E	5;8	01.01.1984	A
11	Kodak 103a-E	60	01.01.1984	A
12	Kodak 103a-F	60	02.01.1984	B

Table 2: New stars with the emission in the Hα line in the TDC region

BH-a number	R.A. (1950.0)	Decl. (1950.0)	m(Pg)	I[H-a]	BH-a number	R.A. (1950.0)	Decl. (1950.0)	m(Pg)	I[H-a]
1	$4^h17.5^m$	+27°10'	15.6^m	2-4	11	$4^h27.3^m$	25°03'	16.0^m	4
2	4 18.0	27 43	19.0	2-3	12	4 30.2	22 43	19.2	4-5
3	4 19.3	24 36	16.6	2-4	13	4 30.5	24 10	17.0	2-3
4	4 19.4	26 46	20.0	4	14	4 30.6	23 18	16.6	2
5	4 19.9	27 53	19.5	5	15	4 31.8	22 37	16.5	3-5
6	4 20.1	24 31	17.0	3-5	16	4 33.0	23 27	15.9	4
7	4 21.8	26 02	17.3	3-4	17	4 34.3	22 57	17.1	4
8	4 23.9	25 58	20.5	3-5	18	4 34.6	22 55	16.5	3
9	4 26.3	24 37	16.7	3-5	19	4 37.7	25 45	16.9	4
10	4 26.7	24 28	19.9	2-5	20	4 38.6	25 57	16.4	3

Table 3: Stars with the possible emission in the Hα line

SBH-a number	R.A. (1950.0)	Decl. (1950.0)	m(Pg)	SBH-a number	R.A. (1950.0)	Decl. (1950.0)	m(Pg)
1	$4^h18.8^m$	+26°50'	16.1^m	10	$4^h29.3^m$	+24°56'	16.8^m
2	4 19.5	26 45	19.5	11	4 30.3	22 49	18.5
3	4 20.1	27 56	18.5	12	4 30.3	24 07	20.5
4	4 24.0	25 38	13.9	13	4 33.7	26 05	20.5
5	4 24.3	25 27	17.1	14	4 34.2	23 28	18.5
6	4 25.2	24 18	19.9	15	4 36.2	24 48	18.2
7	4 27.2	24 25	15.7	16	4 38.1	22 53	15.8
8	4 28.0	25 33	16.2	17	4 39.7	25 29	12.8
9	4 28.7	25 17	19.3	18	4 42.7	25 30	13.7

The total survey region patrol time was about 10 hours. Since the observations covered a few superposed fields along the extent of the dark clouds (see Fig.1), the overall survey area was approximately 50 sq.deg. with the common centre at R.A.(1950.0)=04^h30^m and Decl.(1950.0)=$+24deg$. (the region of the Taurus1- Taurus3 T-associations). Different exposure times were selected to clearly reveal Hα emission in stars of different brightness. The survey's limiting magnitude was $M_{pg} > 19.5$. The evaluation of the relative Hα emission intensity was made using the conventional five-grade scale proposed by Haro(1953).

3 New Hα emission line stars

Examination of the plates revealed 20 new stars with significant Hα line emission. The emission intensities were evaluated for all these stars. The data on these new stars are given in Table 2. In the consecutive columns we present the Byurakan star number (BH-a), the 1950 coordinates, Photographic magnitude and Hα line intensity (I[H-a]).

4 Probable Hα emission stars

A further 18 suspected Hα emission stars were found. These stars had very weak Hα lines or their Hα line emission was detected on one plate only. Details of these stars are given in Table 3.

5 Discussion

The spatial distribution of the new Hα stars in the TDC region is shown in Fig.1. The solid lines represent the contours of the dark clouds with visual absorption A(V) $\geq$ 2.0. The intermittent ones outline the fields surveyed. As seen in Fig.1 the new Hα emission line stars are concentrated in the clouds themselves and have the same type of location as known Hα emission line stars and Pre-Main-Sequence (thereafter PMS) stars in general. Consideration of known and newly discovered stars shows a grouping effect to the local centers. Many previously discovered stars with Hα emission (Joy,1949;Haro et al, 1953) have turned out to be PMS stars with stochastic or irregular variability (Cohen & Kuhi,1979; Kholopov et al,1987; Herbig & Bell,1988 and so on). Some of the Hα line stars discovered during our research, for example BV 5 (Hojaev,1986), B 41 and SB 33(Hojaev,1984), B 4 (Hojaev,1983), are also such stars. It is

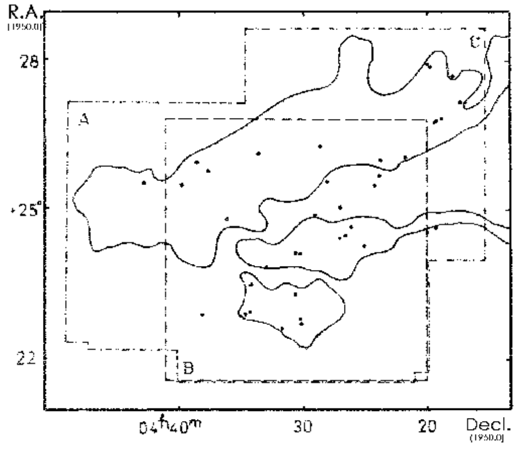

Figure 1: Spatial distribution of the new Hα stars in the Taurus Dark Cloud region.

clear the spectral variability of these young stars has a connection with their photometric variability and is irregular in nature. The latter allows us to apply the method for an estimation of the total number of irregular variable stars in the clusters suggested by Ambartsumian(1977) and Parsamian (1981) in order to calculate the total number of the Hα emission line stars in the TDC region. We have used 36 stars having evaluations of Hα line intensities for four periods: 1952(Haro et al,1953), 1958-62(Dolidze,1975), 1970 and 1983-84(this work). We evaluated the expected total number of the TDC's stars with Hα line emission according to the formulae given in Parsamian& Hojaev (1985) as N = 77. The total number of stars with Hα emission which can be revealed from our plates should be about 80 for the surveyed TDC area (i.e. about 1.6 per sq.deg.).

In summary, 20 new stars with Hα line emission were found in the TDC region. The fact that the Hα line emission of these stars was not discovered earlier can be explained as either variability of the line intensity or the weakness of the line in the studied stars. We can assume that these stars do not differ from the Orion population stars by the nature of the Hα emission line variability.

The existence of the large number of young stars and related objects as well as the other indicators of youth (e.g. infrared sources, molecular clouds, cometary nebulae, Herbig-Haro objects, flare stars, T Tauri stars and other PMS stars) allows us to presume that the associations of SFR in the TDC, including this sample, have the same age as the associations in Orion's and Monocerotis' SFRs.

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