THE SEARCH FOR SS433 OBJECTS: Hα PHOTOMETRY OF BLUE STARS IN M33.

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ABSTRACT 549 blue stars with Hα excess in the galaxy M 33 selected as candidates into unique objects of SS 433 and LBV (luminous blue variables) types are studied. These objects were divided by morphological types on Hα images in the following way: 81 stars, 154 diffuse nebulae, 180 bubble-type nebulae and 117 common intermediate objects. The diffuse objects are HII regions with an exciting star. The bubbles are probably the envelopes around WR stars or the remnants of supernovae. Among the stars a group of 20 brightest ones is selected which by their average properties agree satisfactory with the parameters of blue super-supergiants or the objects of LBV type. The interstellar absorption determined by bright stars is equal to $A_V = 0.93 \pm 0.05$.

Key words: galaxies: M33: stars – LBV: nebulae – diffuse – bubble

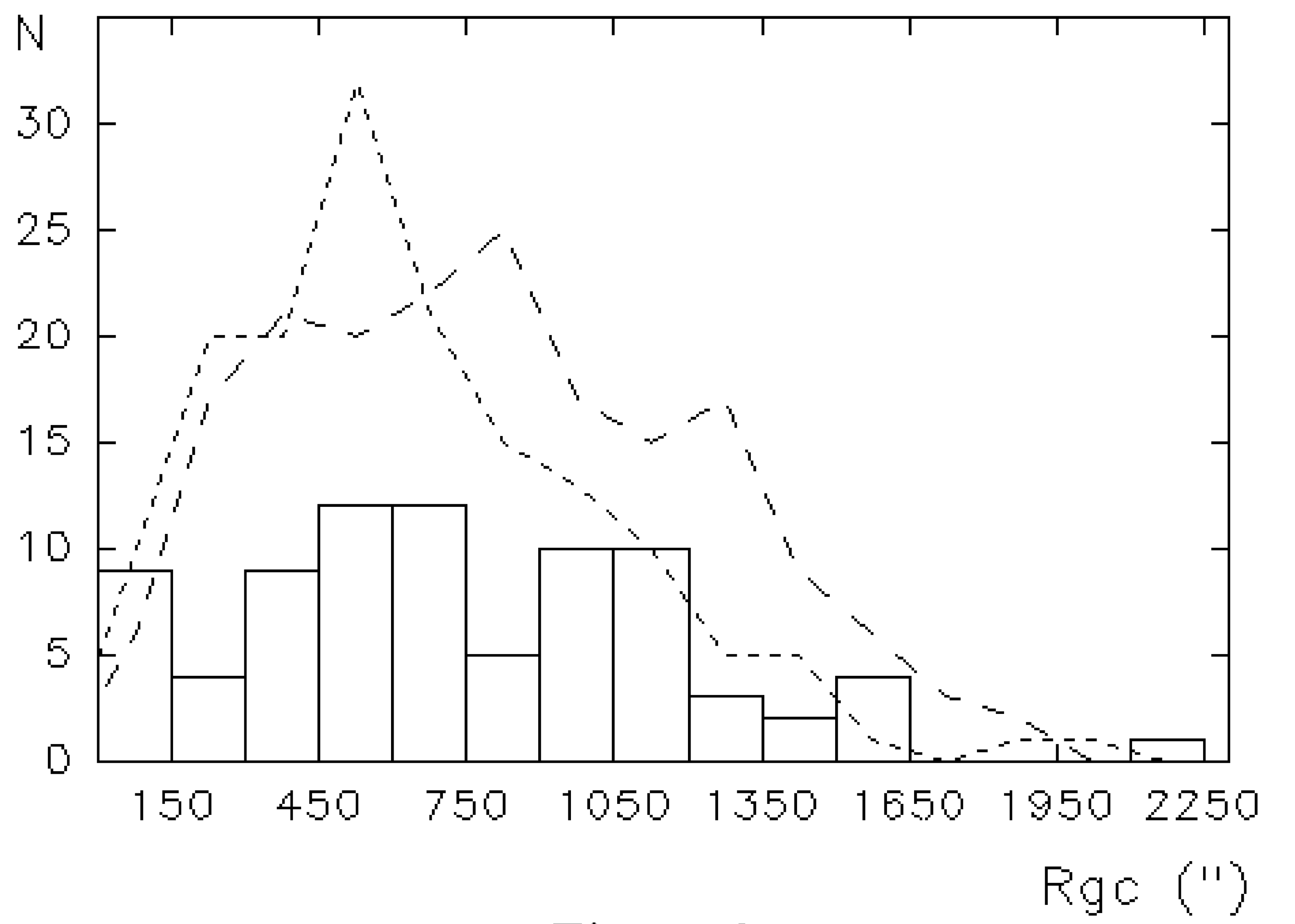

Figure 2

The blue objects with Hα excess in the galaxy M 33 selected in (Fabrika et al., 1996a) as candidates into unique objects of SS 433 and LBV type are studied. The basic criterion of selection was the presence of a hot star with a strong emission line Hα. To select objects an identification and photometry of blue stars was fulfilled from the catalog by Ivanov et al. (1993) in Hα images of M 33 by Courtes et al. (1987). 549 candidates with emission were selected from 2332 OB stars with $((U-B)<0, (B-V)<0)$ up to $V = 19.5$ by the criterion of exceeding flux in Hα line in comparison to stars of the same stellar magnitude in V filter (see Fig. 1).

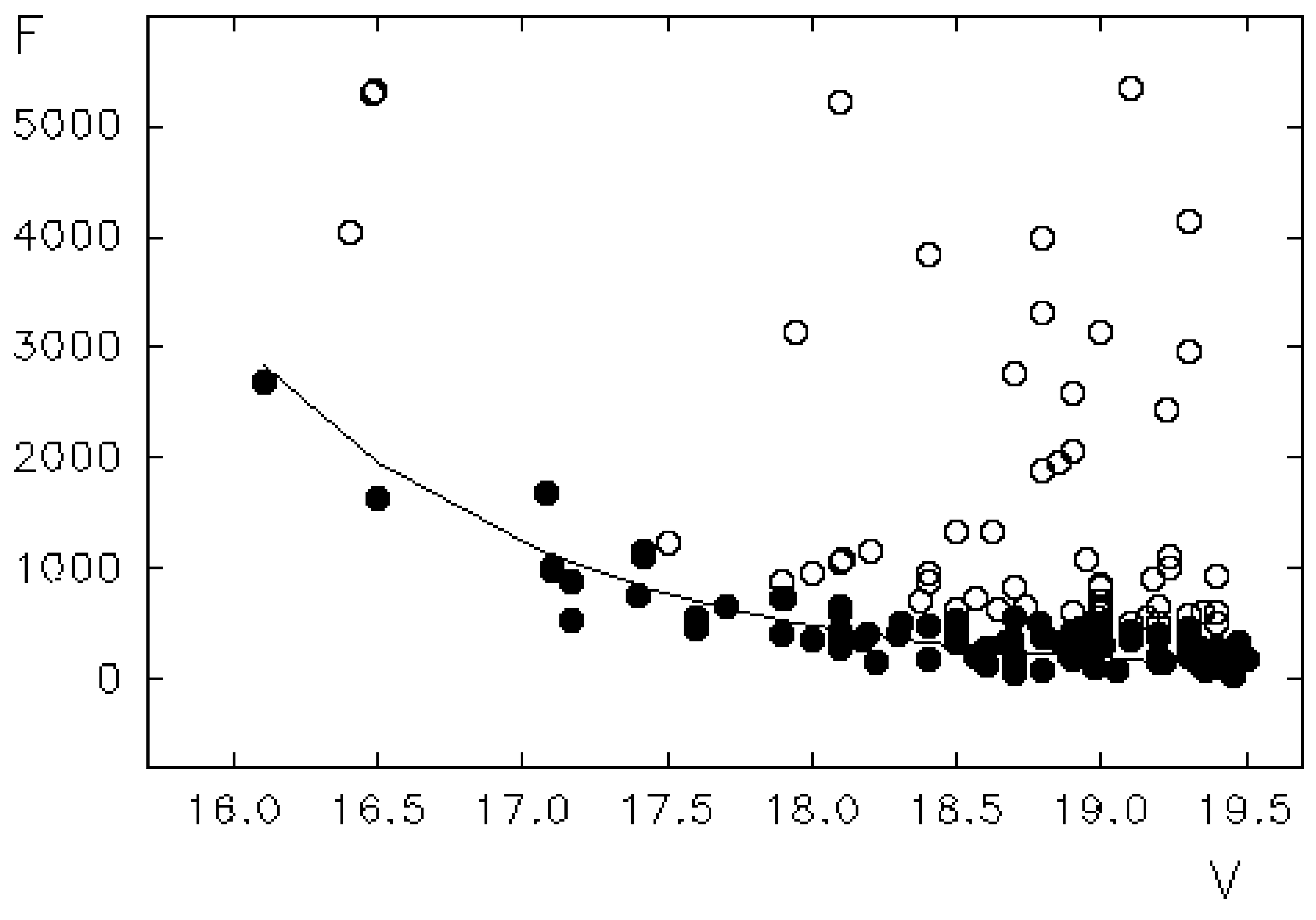

Figure 1

Upon analyzing objects in Hα the objects were divided into 5 groups by morphological types. In Table 1 we adduce the average values of basic characteristics of these objects: 81 stars (s), 154 diffuse nebulae (d), 180 bubble-type nebulae (b), 117 common intermediate nebulae (c) and 17 objects with nominally zero size (zs). The table columns give the object types, number of objects, stellar magnitude V, the colors $U-B$, $B-V$ and $V-\mathrm{H}\alpha$, surface brightness SB (the flux in Hα in relative units over a square arcsecond) and also the S parameter by which the emission objects were selected. This parameter is the excess of flux in Hα line in $(\mathrm{F(H\alpha)}, V)$ diagram over the basic sequence of stars without emission (see Fig.1) expressed in standard deviations of the stars of the basic sequence.

The objects of these groups are distinguished by a number of characteristics (Fabrika et al., 1996b): luminousity, color, flux and surface brightness in Hαline, size, and their distribution over the galaxy. The maximum of nebula size distribution falls onto the size FWHI = 10 − 14 pc. The disposition and properties of nebulae are determined by parameters of interstellar

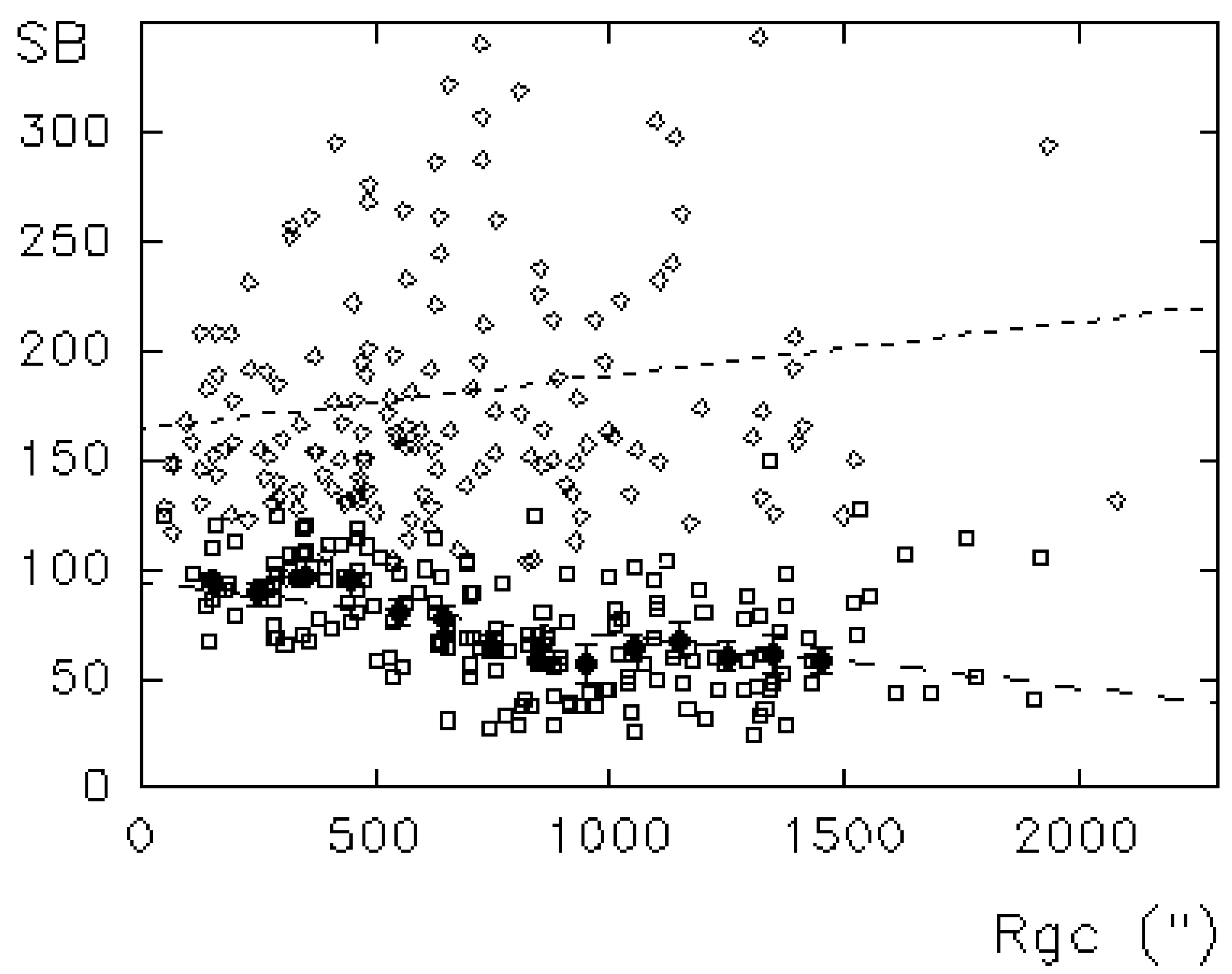

Figure 3

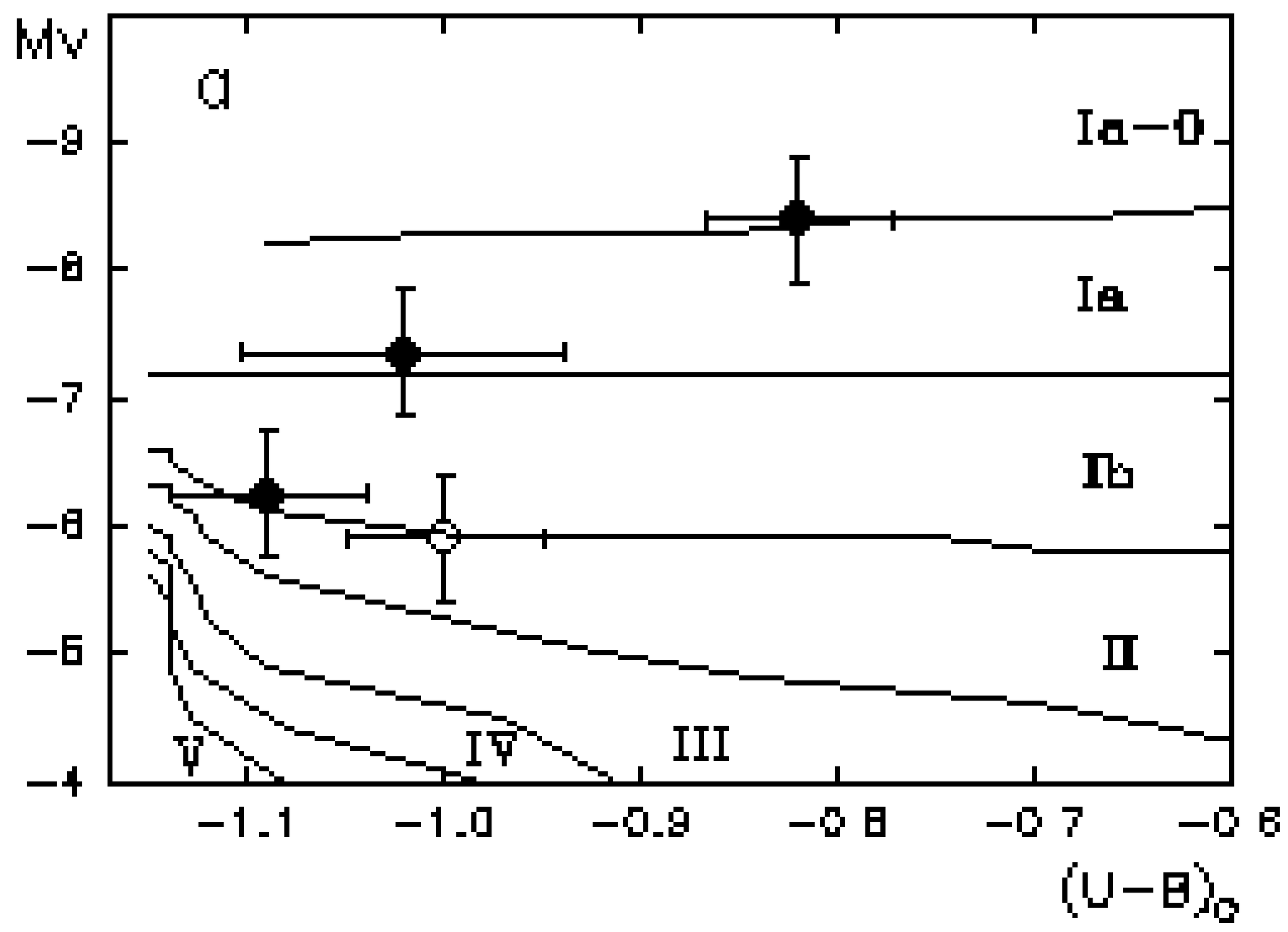

Figure 4

gas and are related to spiral branches.

Figure 2 shows the distributions of selected objects over galacto-centric distance R_{gc}. The solid lines show the star distribution histogram, the long-dashed line is for nebulae of b type, the short-dashed line is for diffuse ones. From this figure it follows that all the three types of objects belong to different populations.

An analysis shown (Fabrika et al.,1996b), that diffuse objects are HII regions with an exciting star. The bubbles are probably the envelopes around WR stars or the remnants of supernovae. It is well seen, for example, from the dependence of surface brightness in Hα SB = F(Hα)/d^2 on the galacto-centric distance of the objects (Fig.3). Beside an evident division of nebulae into two types (the bubbles are denoted by squares, and the diffuse are diamonds), the surface brightness reveals also the effect of its decrease for bubbles with the ditance from the galaxy center and when the nebula is in a spiral. The size of bubbles depends on gravitational potential and on the pressure of interstellar gas.

Figure 4 shows the color-luminosity diagram for stars. Among them a group of 20 the brightest ones is selected which by their average characteristics agree satisfactory with parameters of blue super-supergiants or LBVs. The stars of intermediate luminosity correspond perfectly to the brightest supergiants with a mean spectral class of B1Ia. The interstellar absorption determined by these two types of stars is equal to $A_V = 0.93 \pm 0.05$. At such an absorption it is impossible to classify the weakest stars (the lower filled circle). They correcpond to blue Ib supergiants and their average absorption is $A_V = 0.6$. They are not seen through the whole thickness of the galaxy, but only in the part nearer to an observer.

Table 1. Parameters of emissions objects
(r. m. s. are in the bottom)

Type	n	m_V	U-B	B-V	V-$H\alpha$	SB	S
s	81	18.23	– 0.78	0.08	2.26	277	19.7
		0.10	0.04	0.03	0.11	9	2.0
d	154	18.35	– 0.85	0.08	2.52	180	28.0
		0.07	0.03	0.02	0.11	5	2.9
b	180	18.83	– 0.68	0.04	1.65	75	6.9
		0.03	0.02	0.02	0.05	2	0.6
c	117	18.85	– 0.82	0.05	1.60	625	4.2
		0.04	0.03	0.02	0.05	218	0.2
zs	17	18.55	– 0.98	0.01	3.14		92.9
		0.20	0.07	0.09	0.36		34.5

References

Courtes G., Petit H., Sivan. J.-P., Dodonov S., Petit M.: 1987. *Astron. and Astrophys.*, **174**, 28.

Fabrika S. N., Sholukhova O.N. , Zakharova S.A: 1996a, *Astron. Zhurn.*, (in press)

Fabrika S. N., Sholukhova O.N.: 1996. *Astron. Zhurn.* 1996b. (in press)

Ivanov G.R., Freedman W.L., Madore B.F.: 1993, *Astrophys. J. Suppl. Ser.*, **89**, 85.