OBJECTIVE-PRISM SURVEYS OF THE GALAXY

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1. The Surveys

The main sources of data for low dispersion objective-prism surveys of the Milky Way undertaken in the last fifteen years for the study of the distribution of late type stars, namely M and C stars, are summarized in Table 1.

Table 1. Low dispersion spectral surveys of the Milky Way

No.	Observer	S	I	V	N	New	Ref
1	Fuenmayor (1981)	650	13.0		290	125	1
2	MacConnell (1979)	1200		16.0		500	2
3	Maehara et al. (1991	1075	13.0		749	210	3
4	Present sur (1989)	1350		16.0	1330	790	4
5	Present sur (1988)	300	15.0		500	400	5
6	Aaronson et al. (1990)	400	15.0		983	460	6
7	Stephenson (1989)	2400	14.0				7

Among them two surveys, numbers 4 and 5, were made at Abastumani. All observations were carried out by the Abastumani Astrophysical Observatory 70 cm meniscus telescope equipped with a two degree prism giving reciprocal linear dispersions 125 nm/mm at Hγ and nearly 700 nm/mm at the atmospheric A band. Hypersensitized (in dry air or in dry nitrogen) Kodak IIIa-J and IIIa-F spectroscopic plates were used (sometimes in combination with a GG495 filter) in a yellow-red spectral survey of the region from $l = 308$ to $l = 1658$ and $|b| < 58$. For the spectral survey of the region from $l = 508$ to $l = 1158$ and $|b| < 58$ in the near infrared silver-nitrate treated Kodak IV-N plates were used in combination with an RG695 filter. The plates were exposed for 30 - 60 min. and spectra unwidened. This procedure resulted in a visual limiting magnitudes of 16.0 (J, F) and 18.0 (IV-N, $\langle V\text{-}I \rangle 3.0$, $I = 15.0$).

Carbon stars were identified by the presence of the pronounced cyanogen (CN) bands at 794 nm, 812 nm and 832 nm.

All the Galactic belt surveys contained in Table 1 with one exception (No. 4) have been done in the near infrared spectral region. The surveys nos. 4, 5 and 6 can be considered as widest and

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deepest. The goal of survey no. 4 was described in Fuenmayor (1981). The main purpose of survey No. 5 was to reach the farthest outer parts of the Galaxy in the given directions. In the Milky Way anticentre direction it was practically realized by surveys Nos. 1 and 4 and later by survey No. 7. As a result of both Abastumani surveys, more than 1800 carbon stars were revealed, among them more than nearly 1200 new ones. It should be noted that in survey No. 4 of the C stars more early subclasses were detected, i.e. R type, while in the near infrared N type stars were revealed on the whole.

2. The Distribution of C Stars

A detailed study of the surface distribution of C stars on the basis of survey No. 4, the results of which are summarized in Table 2, show that the latitude distribution is uniform while the longitude distribution is nonuniform. The surface density of Carbon stars varies from 0.5 to 1.3 per sq. degree and reaches maximum values in the Cas-Cyg directions. Among the 1330 C stars detected in survey No. 4, more than 790 are new ones. The mean surface density of Carbon stars in the studied regions equals one per sq. degree, i.e. it has increased 2.5 times.

Table 2. Data on survey No. 4

Region	New	Known	All	N/S
308-508	85	26	111	.56
50-70	145	72	217	1.09
70-90	156	108	264	1.32
90-115	146	132	278	1.11
115-130	115	66	181	1.12
130-145	79	43	122	.81
145-165	83	89	172	.86
50-165	724	510	1234	1.07

The statistical significance of the mean density increase from anticentre and centre to Cas-Cyg direction was checked by different statistical methods. It was shown than the effect is real at the 0.05 confidence level.

The pairing tendency of C stars was studied by nearest-neighbour method. The expected number of chance pairs was compared with observed ones. The observed number of C-C pairs with separations larger than 08.05 is equal to the expected one. The observed number of C-C pairs with separations smaller than 08.05 are larger than expected, but, nevertheless, they lie in the 0.05 confidence level interval of the Poisson distribution, i.e. there is no pronounced pairing tendency of C stars in the northern Milky Way as was reported by Westerlund for the southern hemisphere.

By applying the same method it was shown that the number of C stars in the direction of the open clusters and dark clouds is equal to the expected one.

On the basis of the survey the C/M5 ratio has been determined for more than one hundred survey fields at latitudes -38.6, 08.0, +38.6. Their numbers were counted in squares of 28 x 28 deg^2. The results are summarized in Table 3. As it is seen this ratio varies more than

ten times from the centre to the anticentre direction. It might be noted that this ratio is equal to 1.7 and 25.0 for the LMC and SMC respectively. As was shown earlier the C/M5 ratio significantly correlates with the metal content of star systems.

Table 3.

Region	C/M5
308 - 508	.02
50 - 70	.04
70 - 90	.06
90 - 115	.09
115 - 130	.09
130 - 145	.14
145 - 165	.25

3. Further Prospects

A few years ago we proposed to use the first Markarian survey for the detection of Carbon stars at high galactic latitudes and during a preliminary search of plates a few dozen new faint C stars were revealed (Kurtanidze & Nikolashvili 1990).

To probe the farthest outer and inner parts of our galaxy and to study the variation of Carbon star characteristics with galactocentric distances, deeper surveys must be undertaken. Such surveys might be done in the near-infrared with a wide-field telescope equipped with thin prism and giving reciprocal linear dispersion as low as 500-700 nm/mm at the A band at which late type stars are still identifiable.

For the spectral survey of the southern Milky Way the use of the AAO Schmidt telescope is necessary. The limiting magnitude, I = 18.0, may be reached in a 90 min. exposure using silver-nitrate treated Kodak IV-N plates in combination with the RG715 filter.

References

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