

THE SLIT SPECTRA OF GALAXIES OF THE SECOND BYURAKAN SKY SURVEY. VII

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ABSTRACT. *The results of follow-up spectroscopy of 49 galaxies from the Second Byurakan Sky Survey are presented. The observations were carried out on the 6 m telescope of the Special Astrophysical Observatory of RAS. The emission lines are found in the spectra of most of galaxies. The redshifts and luminosities are determined for all the galaxies. SBS 0936+531 and SBS 1221+585 are possible Seyfert type galaxies. Four physical pairs of galaxies are found.*

OBSERVATIONS

In the previous papers of this series (Markarian et al., 1984, Stepanian et al., 1991, 1993a,b; Lipovetsky et al., 1988;) the results of studying of the slit spectra of 319 galaxies from the Second Byurakan Sky Survey have been presented. This paper reports the results of investigations of the slit spectra of 49 galaxies. They are located in the region of the Second Byurakan Survey (SBS) $\alpha=07^{\text{h}}00^{\text{m}} - 13^{\text{h}}00^{\text{m}}$.

$\delta=+49^\circ - +61^\circ$. Most of these objects are outside of the investigated fields of the Second Survey.

The spectral observations were carried out with the 1000-channel TV scanner, mounted in the Nasmyth focus of the 6 m telescope (Drabek et al., 1986). A diffraction grating giving a dispersion of about 100 \AA/mm and a spectral resolution of 1.9 \AA/channel was used.

For some objects additional spectra were taken for better definition of their spectral types.

Table 1 presents the data on the investigated objects: 1 - SBS designation, 2 - date of observations, 3 - observed spectral region in \AA , 4 - exposure time in seconds, 5 - redshifts determined from the most confident emission or absorption lines, corrected for the solar motion, $\Delta z = 0.001 \sin l^{\text{II}} \cos b^{\text{II}}$, 6 - apparent magnitude in the blue spectral region, 7 - luminosities corrected for extinction in our Galaxy for $H=75 \text{ km s}^{-1} \text{Mpc}^{-1}$, 8 - Survey type. The Survey lists of these objects with their finding charts will be published later.

In the descriptions we give the results for each object: morphological peculiarities of the objects, observed emission and absorption lines, eye estimations of relative intensities of some common lines, spectral type of a galaxy.

Table 1.

Designation SBS	Date of observation	Spectral range \AA	Exposure time(s)	z_o	m_B	M_B	Survey type
1	2	3	4	5	6	7	8
0749+582	12.02.91	3600-5630	168	0.0320	19.0	-17.0	se
0750+559	12.02.91	3600-5630	294	0.0256	16.5	-19.0	dse
	07.04.91	3690-5700	1826				
0751+583	11.02.91	3520-5560	398	0.0577	18.0	-19.3	sde:
0752+560 B	12.02.91	3600-5630	245	0.0282	17.5	-18.2	s2e
	07.04.91	3690-5700	1574				
0755+536	11.02.91	3520-5550	299	0.0353	16.0	-20.2	s3e
	07.04.91	3690-5700	1739				
0756+553	12.02.91	3600-5630	255	0.0358	18.0	-18.2	sde
0814+579 A	13.11.90	3640-5640	1518	0.0277	17.5	-18.2	dse
	14.11.90	3640-5640	1533				
0814+579 B	14.11.90	3640-5650	1429	0.0280	18.0	-17.7	de
	14.11.90	3650-5650	2619				
0907+593	20.03.91	3640-5640	172	0.0303	19.0	-16.8	se
0936+531	11.02.91	3530-5540	725	0.0254	18.0	-17.4	ds2e
0941+569 A	17.11.90	3630-5640	1307	0.1378	18.5	-20.6	de:
0944+514	17.11.90	3650-5640	1346	0.1415	18.0	-21.1	de
0946+495	17.11.90	3630-5640	1854	0.0467	18.0	-18.7	sde
1028+576	20.03.91	3640-5640	228	0.0248	16.5	-18.8	ds3e
1032+496	20.03.91	3640-5640	197	0.0291	17.0	-18.6	s2e
1040+560	15.03.91	3660-5670	182	0.0263	15.5	-19.9	sd2e
1054+504	15.03.91	3660-5670	155	0.0050	17.0	-14.8	ds2e
1054+596	12.02.91	3600-5630	159	0.0337	18.5	-17.5	d2e
1057+512	15.03.91	3660-5670	205	0.0099	14.5	-18.8	de
1057+511	15.03.91	3660-5670	164	0.0094	17.5	-15.7	sd1e

Table 1 (continued).

1	2	3	4	5	6	7	8
1103+526	15.03.91	3660-5670	230	0.0220	17.0	-18.0	ds2e
1113+560	11.02.91	3530-5550	184	0.0343	17.0	-19.0	sd1e
1119+586	11.02.91	3520-5560	631	0.0065	19.5	-12.8	de:
1125+525	15.03.91	3660-5670	238	0.0100	17.0	-16.3	sd2e
1127+527	15.03.91	3660-5670	232	0.0273	17.5	-18.0	sd1e
1135+598	12.02.91	3600-5630	347	0.0323	19.0	-16.8	de
1137+589	11.02.91	3530-5560	256	0.0064	18.0	-14.3	se
1154+534	12.02.91	3600-5630	223	0.0040	14.0	-17.3	de
1155+588	11.02.91	3520-5560	255	0.0650	17.5	-19.9	ds2e
1159+517 B	11.02.91	3520-5560	256	0.0144	17.5	-16.6	de
1200+589 B	11.02.91	3520-5560	216	0.0325	19.0	-16.9	de
1200+589 C	11.02.91	3520-5560	249	0.0326	18.5	-17.4	sde
1203+592	11.02.91	3520-5560	154	0.0117	17.0	-16.6	d2e
1214+558	01.01.85	3550-5700	900	0.0314	17.5	-18.3	ds2e
	11.02.91	3520-5560	233				
1221+602	12.02.91	3600-5630	329	0.0148	18.0	-16.1	d1e
1221+585	12.02.91	3600-5630	298	0.0148	18.0	-16.1	ds3e
1222+603	14.04.91	3690-5700	445	0.0522	18.0	-18.9	d2e
1222+614	15.03.91	3670-5660	128	0.0029	17.0	-13.3	dse
1223+537 A	11.02.91	3520-5560	198	0.0519	18.5	-18.4	s3
1223+537 B	11.02.91	3520-5560	177	0.0526	18	-18.9	ds1e
1225+571	12.02.91	3600-5630	285	0.0277	17.5	-18.0	de
1226+542	11.02.91	3520-5560	174	0.0413	19.5	-16.9	de
1229+578	12.02.91	3600-5630	259	0.0558	17.5	-19.5	d2
1235+559	15.03.91	3660-5670	312	0.0302	18.5	-17.2	de
1240+554 A	15.03.91	3660-5670	216	0.0648	18.0	-19.3	sd2e
1240+554 B	15.03.91	3660-5670	220	0.0164	16.5	-17.9	sde
1241+549	11.02.91	3520-5560	366	0.0167	17.0	-17.4	sd1e
	15.03.91	3660-5670	228				
1242+549	11.02.91	3520-5560	264	0.0165	16.0	-18.4	dse
1250+594	12.02.91	3600-5630	188	0.0447	18.0	-18.5	sd2e

DESCRIPTION

- 0749+582 - N_1 , N_2 , H_β , H_γ , [OIII] $\lambda\lambda 4363$, H_δ , [NeIII] $\lambda 3968+H_\epsilon$, H_8 , [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ emission lines are observed in the blue region of the spectrum. The ratios $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \leq 1$.
- 0750+559 - There are the following emission lines N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ in the spectra. The Balmer series lines $H_\delta-H_{10}$ are seen in absorption. $N_1/H_\beta \sim 1$, [OII] $\lambda 3727/H_\beta \geq 1$.
- 0751+583 - N_1 , H_β and suspected [OII] $\lambda 3727$ are seen in emission.
- 0752+560 B- The strong N_1 , N_2 , H_β , [OII] $\lambda 3727$, moderate intensity H_γ are observed in emission. In absorption are seen $H_\delta-H_8$. [OII] $\lambda 3727/H_\beta > 2.5$, $N_1/H_\beta \sim 3$. Probably LINER.
- 0755+536 - The strong H_β and [OII] $\lambda 3727$, weak [OIII] $\lambda\lambda 4959-5007$ are observed in emission. The lines of the Balmer series $H_\delta-H_{10}$, H and K CaII are present in absorption. [OII] $\lambda 3727/H_\beta \sim 1$, $N_1 \ll H_\beta$.

- 0756+553 - N_1 , H_β , [OII] $\lambda 3727$ emission lines of comparable intensity are observed.
- 0814+579 A- There are the following emission lines N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$. [OIII] $\lambda 5007$, H_β and [OII] $\lambda 3727$ have approximately equal intensity. This object consists of two condensations with close redshifts.
- 0814+579 B- N_1 , N_2 , H_β and [OII] $\lambda 3727$ emission lines are present.
- 0907+593 - There are N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ emission lines in the blue region of the spectrum. $N_1/H_\beta > 3$, [OII] $\lambda 3727 \sim H_\beta$.
- 0936+531 - N_1 , N_2 , H_β , [OII] $\lambda 3727$ are observed in emission. $N_1/H_\beta \sim 3$. A possible Seyfert type galaxy.
- 0941+569 A- The absorption lines H and K CaII, G-band are seen.
- 0944+514 - The emission line [OII] $\lambda 3727$ is suspected. There are H CaII and G-band in absorption.
- 0946+495 - The strong emission lines N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ are observed. $N_1/H_\beta \sim 1.5$, [OII] $\lambda 3727/H_\beta > 2$. Probably LINER.
- 1028+576 - N_1 , N_2 , H_β and [OII] $\lambda 3727$ emission lines are present. $N_1/H_\beta \sim 3$. The absorption lines of the Balmer series H_γ - H_ϵ are also present. The galaxy consists of a few condensations with the same redshifts.
- 1032+496 - There are N_1 , N_2 , the Balmer lines H_β - H_ϵ , [OII] $\lambda 3727$ in emission. $N_1/H_\beta = 3$, [OII] $\lambda 3727/H_\beta > 2.5$.
- 1040+560 - In this spectrum the following emission lines N_1 , N_2 , H_β , and [OII] $\lambda 3727$ are observed. $N_1/H_\beta < 3$.
- 1054+504 - N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ are present in emission. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727 \sim H_\beta$.
- 1054+596 - N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ emission lines are observed. $N_1/H_\beta < 3$.
- 1057+512 - H_β , H_γ emission lines are suspected. MgI b is in absorption.
- 1057+511 - The spectrum shows the emission lines N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$. $N_1/H_\beta \leq 3$.
- 1057+502 - H and K CaII, G-band are observed in absorption.
- 1103+526 - N_1 , N_2 , H_β , [OII] $\lambda 3727$ are seen in emission. $N_1/H_\beta < 3$, [OII] $\lambda 3727 \sim H_\beta$.
- 1113+560 - The blue region of this spectrum shows N_1 , N_2 , H_β - H_δ , [OII] $\lambda 3727$ emission lines. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 2.5$. The object has a complex structure, and consists of some knots with equal redshifts.
- 1119+586 - N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ emission lines are observed. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \sim 1$.
- 1125+525 - The strong emission lines N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ are present in the spectrum. $N_1/H_\beta \geq 1$, [OII] $\lambda 3727/H_\beta \sim 1$.
- 1127+527 - In this spectrum N_1 , N_2 , H_β and [OII] $\lambda 3727$ emission lines are present.
- 1135+598 - The moderate intensity emission lines N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ are seen. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 1$.
- 1137+589 - N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ are observed in emission. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 1$.

- 1154+534 - N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ emission lines are observed. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 1$.
- 1155+588 - N_1 , N_2 , H_β , H_γ , [NeIII] $\lambda 3869$, [OII] $\lambda 3727$ are seen in emission. [OII] $\lambda 3727/H_\beta > 2.5$, $N_1/H_\beta \geq 3$.
- 1159+517 B- There are the following emission lines N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$. $N_1/H_\beta \sim 3$.
- 1200+589 B- The emission lines N_1 , N_2 , H_β , H_γ , H_δ , [OII] $\lambda 3727$ are observed. $N_1/H_\beta \sim 3$.
- 1200+589 C- N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ are seen in emission. $N_1/H_\beta \sim 3$.
- 1203+592 - The blue region of the spectrum shows N_1 , N_2 , H_β - H_ϵ , H_δ , [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta > 2.5$. It consists of two condensations.
- 1214+558 - N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ are observed in emission. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 1$.
- 1221+602 - N_1 , N_2 , H_β , H_γ and [OII] $\lambda 3727$ are seen in emission. $N_1/H_\beta \sim 3$.
- 1221+585 - The emission lines N_1 , N_2 , H_β , H_γ , weak [OII] $\lambda 3727$ and the absorption lines H and K CaII, G-band are present. $N_1/H_\beta > 3$. Probably a Seyfert type galaxy.
- 1222+603 - In this spectrum the emission lines N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ are observed. $N_1/H_\beta \sim 3$.
- 1222+614 - The emission lines N_1 , N_2 , H_β , [OIII] $\lambda 4363$, H_γ , H_δ , H_ϵ , H_δ , [NeIII] $\lambda 3869$, [OII] $\lambda 3727$ are present. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta \sim 1$. A low luminosity galaxy.
- 1223+537 A- N_1 , N_2 , H_β , H_γ , H_δ , [NeIII] $\lambda 3968 + H_\epsilon$, [NeIII] $\lambda 3869$, [OII] $\lambda 3727$ emission lines are seen in this spectrum. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \sim 1$.
- 1223+537 B- This spectrum is like the preceding one. N_1 , N_2 , H_β , H_γ , H_δ , [NeIII] $\lambda 3968 + H_\epsilon$, [NeIII] $\lambda 3869$, [OII] $\lambda 3727$ are observed in emission. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \sim 1$. These two objects are probably a physical pair.
- 1225+571 - In the blue region of the spectrum the following emission lines are observed: N_1 , N_2 , H_β and [OII] $\lambda 3727$. $N_1/H_\beta \sim 1$, [OII] $\lambda 3727/H_\beta > 2.5$.
- 1226+542 - N_1 , N_2 , H_β , H_γ , H_δ , [OII] $\lambda 3727$ are present in emission. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta > 1$.
- 1229+578 - H_β and [OII] $\lambda 3727$ are suspected in emission.
- 1235+559 - N_1 , N_2 , H_β , weak [OII] $\lambda 3727$ emission lines are observed. $N_1/H_\beta \sim 1$.
- 1240+554 A- The following emission lines are seen in the spectrum: N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$. The lines [OIII] $\lambda 5007$, H_β and [OII] $\lambda 3727$ have comparable intensity.
- 1240+554 B- The spectrum of this object is like the one of SBS 1240+554 A. The emission lines N_1 , N_2 , H_β , H_γ [OII] $\lambda 3727$ with similar intensity ratios are observed.
- 1241+549 - N_1 , N_2 , H_β , [OII] $\lambda 3727$ emissions are present. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727 \sim H_\beta$.

- 1242+549 - N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ are observed in emission. $N_1/H_\beta \sim 3$,
[OII] $\lambda 3727 \sim H_\beta$.
- 1250+594 - N_1 , N_2 , H_β , H_γ , [OII] $\lambda 3727$ emission lines are observed. $N_1/H_\beta \sim 3$,
[OII] $\lambda 3727/H_\beta > 2.5$.

CONCLUSION

Emission lines in the spectra of a great part of galaxies are discovered.

Two galaxies, SBS 0936+531 and 1221+585, are possible Seyfert type ones.

There are four pairs of galaxies with two components separated by small angular distances and have approximately the same redshifts. So, SBS 0814+579 A and B, SBS 1200+589 B and C, SBS 1223+537 A and B are probable physical pairs. SBS 1057+512 is a weak companion of SBS 1057+511.

14 galaxies are discovered with the luminosities less than -17^m , two of them, SBS 1119+586 and SBS 1222+614, have $M=-12.8$ and $M=-13.3$ respectively.

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