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

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ABSTRACT. The results of follow-up spectroscopy of 56 galaxies from the Second Byurakan Survey are presented. The observations are carried out with the 6 m telescope of the SAO RAS. The redshifts and luminosities of all the galaxies are determined. It is shown, that SBS 1515+579, SBS 1524+604, SBS 1536+577 and SBS 1624+575 are the galaxies of Seyfert type, and SBS 1426+573 is a possible Seyfert type galaxy. Four physical pairs of galaxies are found.

1. OBSERVATIONS

In the previous five papers of this series (Markarian et al., 1984; Lipovetsky et al., 1988; Stepanian et al., 1991; 1993) the results of studying of the slit spectra of 263 galaxies of the Second Byurakan Sky Survey (SBS) are presented. In the present paper we have compiled together the data on the slit spectra for 56 galaxies as well, 34 from which are situated in the field of the SBS survey with the center coordinates $\alpha=15^{\rm h}30^{\rm m}$, $\delta=+59^{\circ}00'$ (Markarian et al., 1986), the remainder are out of the investigated fields of SBS survey in the region $\alpha=13^{\rm h}00^{\rm m}-17^{\rm h}15^{\rm m}$, $\delta=+49^{\circ}-+61^{\circ}$.

Most spectral observations have been carried out using the 1000-channel TV spectral scanner, placed in the Nasmyth focus of the 6 m telescope of SAO RAS (Drabek et

al., 1986). Two diffraction gratings were used giving spectral resolutions 1.9 Å and 3.5 Å per channel. Some objects were observed consecutively on both strobes of the scanner at identical integration times, thereby making it possible to subtract the night-sky spectrum more accurately, to reduce the noise in the spectra of the objects.

Earlier for some galaxies the spectral observations have been carried out in the prime focus of the 6 m telescope with the UAGS spectrograph plus image tubes UMK-91B or UM-92. As a rule, unwidened spectra in the blue and sometimes in the red range with a linear dispersion of 90 Å/mm and a spectral resolution of about 5 Å were taken, A-600N photographic emulsion being used.

For some objects additional spectra are obtained for better definition of spectral type of an object.

Table 1 presents the data on the objects investigated: 1 - SBS designation in accordance with (Markarian et al., 1986), 2 - date of observations, 3 - observed spectral region in Å, 4 - exposure time in seconds, 5 - redshifts determined from the most confident emission or absorption lines, corrected for the solar motion, $\Delta z = 0.001 \mathrm{sinl^{II}} \mathrm{cosb^{II}}$, 6 - apparent magnitude in the blue spectral region according to (Markarian et al., 1986), 7 - luminosities corrected for extinction in our Galaxy (H=75 km s⁻¹Mpc⁻¹), 8 - Survey type (Markarian et al., 1986). Coordinates and finding charts for the objects which are outside of the published fields of SBS Survey will be published later.

In the description the results of investigation of the slit spectra are presented: morphology of the objects, observed emission and absorption lines, visual estimations of the intensity ratios of emission lines, spectral type of a galaxy.

Table 1.

1	Designation SBS	Date of observation	Spectral range Å	Exposure time(s)	z _o	m _B	$M_{_{\mathbf{B}}}$	Survey type
1305+547	1	2	3	4	5		7	8
1307+562			3650-5560			17	-18.7	1e
1319+579 A 26.01.90 3640-5460 1931 0.0082 18.5 -14.4 sle 1342+562 17.04.90 3680-5640 2128 0.0712 17 -20.6 sle 1342+562 17.04.90 3680-5640 2128 0.0712 17 -20.6 sle 1342+562 B 17.04.90 3680-5640 1103 0.0709 18 -19.5 s2e 3261408+551 A 22.04.90 3630-5590 2300 0.0783 17.5 -20.2 dse 408+551 B 22.04.90 3630-5590 214 0.0408 18 -18.3 s2e 1423+518 17.04.90 3680-5640 1170 0.0077 16.5 -16.2 sde 1426+574 19.02.82 5500-7700 660 0.0435 18.5 -18.0 ds3e 12.02.92 3520-5570 312 1430-521 27.01.90 3640-5560 2248 0.0262 18 -17.4 sle 432+530 17.04.90 3680-5640 2240 0.0456 17.5 -19.1 ds1e 1430+521 27.01.90 3640-5560 2248 0.0262 18 -17.4 sle 1430+521 27.01.90 3640-5560 2248 0.0262 18 -17.4 sle 1430+530 17.04.90 3680-5640 1160 0.0275 17.5 -19.1 ds1e 1437+540 17.04.90 3680-5640 1160 0.0275 17.5 -19.1 ds1e 1515+602 31.08.86 3830-5580 1104 1155+590 31.08.86 3830-5580 1108 0.0580 18 -19.2 sde 1515+590 31.08.86 3830-5580 1108 0.0580 18 -19.2 sde 1515+579 31.08.86 3830-5580 1108 0.0580 18 -19.2 sde 1515+579 31.08.86 3830-7210 1268 08.10.88 5330-7210 1268 08.10.88 5330-7210 1268 08.10.88 5330-7210 1272 1516+588 10.10.88 5300-6900 1288 0.1736 17 -22.5 de 1516+579 22.02.82 3700-5700 720 0.0408 18 -18.4 BSO 1524+504 11.11.85 3640-5420 891 27.09.90 3000-7120 2810 27.09.90 3000-7120 2810 27.09.90 3000-7120 2810 27.09.90 3000-7120 2810 27.09.90 3000-7120 2810 27.09.90 3000-7120 2810 3000-7120 3000-71	1305+547	27.01.90	3650-5560	2247	0.0328	16	-19.8	sd2e
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1521+588		27.09.90	3300-7120	2810				
1521+588	1520+572	17.09.88	3700-5520	582	0.0722	18.5	-19.1	sd2e
16.09.88 5230-7100 1976 16.09.88 3700-5540 1147 1523+589 10.10.88 3450-6960 1168 0.0602 18.5 -18.7 de 1524+604 09.04.81 5500-7700 480 0.0788 16.7 -21.8 sd1e 11.11.85 4240-6060 1601 1524+575 A 09.04.81 5500-7700 900 0.0304 17.5 -18.2 sd1e 09.10.88 3320-6840 954 1524+575 B 17.09.88 3710-5510 2349 0.0408 18 -18.4 ds3e 1525+580 A 07.09.86 3660-5500 1120 0.0712 17.5 -20.1 sde 1526+585 A 07.09.86 3660-5500 120 0.0588 17.5 -19.7 s2e 1526+585 B 07.09.86 3660-5540 695 0.0308 18 -17.8 sd2e 1528+589 21.03.86 3800-5600 1480 0.0621 18.5 -18.8 s1e 1528+577 B 07.09.86 3660-5520 981 0.0766 17.5 -20.2 sd1e 1531+572 A 07.09.86 3660-5520 1203 0.0766 17.5 -20.2 sd1e 1533+574 A 04.09.86 3690-5570 388 0.0126 18 -20.5 ds2e 1533+574 B 04.09.86 3690-5570 388 0.0126 18 -15.8 ds1e 13.09.88 3770-5570 1115	1521+588	16.09.88	3930-5770	2016				
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1021.010 K				0.0304	17.5	-18.2	sale
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					an a faranara		10.0	abic
13.09.88 5230-7100 1130			5230-7100	1130				

Table 1 (continued).

1	2	3	4	5	6	7	8
1536+573	07. 09. 86	3660-5530	1274	0.0745	17.5	-20.2	s3
1536+576	14.09.88	3720-5520	990	0.0759	18.5	-19.2	d2
1536+588	07.09.86	3660-5500	582	0.0708	18	-19.6	sd1e
1536+577	07.09.86	3660-5510	2340	0.0745	17.5	-20.2	sd2e
	05.10.88	5280-7270	1971				
	05.10.88	3690-5510	1317				
1538+574	09.04.81	5500-7700	600	0.0821	17.5	-20.4	s1e
	14.05.85	3990-5390	692				
	18.09.88	3700-5500	855				
	18.09.88	5280-7160	847				
1538+584	16.09.90	3710-5720	3447	0.0441	19.5	-17.1	se
1539+597	09.03.81	5500-7700	660	0.0099:	16.5	-16.8	sd3e
	14.11.85	3640-5410	2042				
1542+574	19.07.88	3700-5510	1582	0.0143	18	-16.1	d2e
	19.07.88	5280-7170	2726				
1542+573 A	16.09.88	3700-5520	1558	0.0143	18	-16.1	de
	16.09.88	5220-7110	1635				
1545+592	29.04.89	3500-7000	837	0.0214:	17.5	-16.8	sd2e
1552+602 B	17.09.90	3710-5710	2521	0.0104	18.5	-14.9	sd1e
1559+604	26.08.89	3700-5570	2570	0.0425	17.5	-19.0	sd1e
	26.08.89	5290-7210	1123				
620+577	27.08.89	3700-5580	4122	0.0198	19	-15.8	s1e
624+575	15.11.85	3630-5400	1051	0.0675	17.5	-20.0	s1e
	15.11.85	4570-6570	1148			2. 1 1 7	Pg.
.650+535	16.09.90	3710-5710	1649	0.1050	16	-22.5	s3e
651+605	23.09.90	3140-7000	897	0.0558	18.5	-18.6	sd1e
657+598	28.12.84	4900-7300	630	0.0310	16.5	-19.4	s2e
706+608 A	28.12.84	4800-7200	480	0.0109	15	-18.6	de
706+608 B	28.12.84	4900-7300	300	0.0108	15	-18.6	sde

DESCRIPTION

- 1305+542 In the blue region of spectrum the emission lines N $_1$, N $_2$, H $_\beta$, [OIII] λ 4363, H $_\gamma$, [OII] λ 3727 are observed. The ratios N $_1$ /H $_\beta$ < 3, [OIII]/H $_\beta$ ~ 2.
- 1305+547 The following emission lines N_1 , N_2 , H_β , H_γ , H_δ , [NeIII] λ 3968 + H_ϵ , [NeIII] λ 3869 and [OII] λ 3727 are present. $N_1/H_\beta > 3$, [OII] λ 3727/ $H_\beta \sim 2$.
- 1307+562 The spectrum shows N_1 , N_2 , H_{β} , [OIII] $\lambda 4363$, H_{γ} , H_{δ} , [NeIII] $\lambda 3968+H_{\epsilon}$, [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ in emission. $N_1/H_{\beta} > 3$, [OII] $\lambda 3727 \sim H_{\beta}$.
- 1319+579 A- N_1 , N_2 , H_{β} , [OIII] $\lambda 4363$, H_{γ} , H_{δ} , [NeIII] $\hat{\lambda} 3968 + H_{\epsilon}$, [NeIII] $\lambda 3727$ emission lines are seen in the spectrum. $N_1/H_{\beta} > 3$, [OII] $\lambda 3727 \sim H_{\beta}$.
- 1319+579 B- The emission lines N_1 , N_2 , H_{β} , [OIII] $\lambda 4363$, H_{γ} , H_{δ} , [NeIII] $\lambda 3968+H_{\epsilon}$, [NeIII] $\lambda 3869$, H_8 H_{11} and [OII] $\lambda 3727$ are observed. $N_1/H_{\beta} > 3$, [OII] $\lambda 3727 < H_{R}$.
- 1342+562 There are N_1 , N_2 , H_β , [OIII] $\lambda 4363$, H_γ , H_δ , [NeIII] $\lambda 3968+H_\epsilon$, HeI $\lambda 4471$, [NeIII] $\lambda 3868$ and [OII] $\lambda 3727$ in emission. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \sim 2$.
- 1342+562 B- This is a companion of SBS 1342+562. The emission spectrum is similar to

- that of SBS 1342+562. The emission lines N₁, N₂, H_{β}, H_{γ}, [NeIII] λ 3868 and [OII] λ 3727 are seen. N₁/H_{β} < 3, [OII] λ 3727/H_{β} ~ 4.
- 1408+551 A- The following emission lines N_1 , N_2 , H_8 , [OII] $\lambda 3727$ are present.
- 1408+551 B- N_1 , N_2 , H_{β} , HeII $\lambda 4686$, [OIII] $\lambda 4363$, H_{γ} , H_{δ} , [NeIII] $\lambda 3968+H_{\epsilon}$, H_{δ} and [OII] $\lambda 3727$ are observed in emission. $N_1/H_{\beta} < 3$, [OII] $\lambda 3727 \sim H_{\beta}$.
- 1423+518 The spectrum shows N_1 , N_2 , H_{β} , H_{γ} , H_{δ} , [NeIII] $\lambda 3968+H_{\epsilon}$, [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ emission lines. $N_1/H_{\beta} > 3$, [OII] $\lambda 3727 \sim H_{\beta}$.
- 1426+574 The extended emission lines H_{α} and [NII] are observed. $H_{\alpha}/[NII]$ $\lambda 6584$ ~2. In the blue region of the spectra there are N_1 , N_2 , H_{β} , H_{γ} , [OIII] $\lambda 4363$, H_{δ} , [NeIII] $\lambda 3968 + H_{\epsilon}$, [OII] $\lambda 3727$ in emission. N_1/H_{β} ~10, [OII] $\lambda 3727 H_{\beta}$. Possible Seyfert type galaxy.
- 1430+521 The blue region of the spectrum shows the following emission lines: N₁, N₂, H_β, H_γ, H_δ, [NeIII] λ 3968+H_ε, [NeIII] λ 3869 and [OII] λ 3727. N₁/H_β>3, [OII] λ 3727 ~ H_β.
- 1432+530 N_1 , N_2 , H_β , H_γ , H_δ , [NeIII] $\lambda 3968 + H_\epsilon$, [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ are seen in emission. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta \sim 3$.
- 1444+588 H_{β} , H_{γ} , [OII] $\lambda 3727$ emission lines are observed. $H_{\beta} \sim$ [OII] $\lambda 3727$. The Balmer lines $H_{\delta}-H_{10}$ are seen in absorption. In the red spectral range H_{α} , [NII] $\lambda \lambda 6548/84$, [SII] $\lambda \lambda 6717/31$ are present in emission.
- 1457+540 There are N₁, N₂, H_{β} and [OII] λ 3727 in emission, and Balmer lines H_{γ}- H_{δ} in absorption. N₁/H_{β} \leqslant 3.
- 1515+602 N₁, N₂, H_B and [OII] λ 3727 emission lines are observed. N₁/H_B \leq 3.
- 1515+590 G-band, H and K CaII are observed in absorption.
- 1515+606 H and K Ca II, and G-band are observed in absorption.
- 1515+579 H_{α} , [NII] $\lambda\lambda6548/84$, [SII] $\lambda\lambda6717/31$, N_1 , N_2 , H_{β} , [NeIII] $\lambda3869$ and [OII] $\lambda3727$ emission lines are present. A Seyfert 2 type galaxy.
- 1516+588 Low-contrast lines N₁, N₂, H $_{\beta}$, [OIII] $\lambda4363$, H $_{\gamma}$ and [OII] $\lambda3727$ are observed in emission.
- 1516+579 [OII] $\lambda 3727$ is suspected to be in emission.
- 1520+572 There are N₁, N₂, H_{β}, H_{γ}, [OII] λ 3727 in emission, and HKG in absorption. H_{β}/N₁ > 1, [OII] ~ H_{β}.
- 1521+588 H_{α} , [SII], N_1 , N_2 , H_{β} , H_{γ} and [OII] $\lambda 3727$ are observed in emission. $N_1/H_{\beta}\sim 3$.
- 1523+589 The spectrum shows the following emission lines: H_{α} , [OI] $\lambda6300$, N_{1} , N_{2} , H_{β} , H_{γ} and [OII] $\lambda3727$. $N_{1}/H_{\beta} > 3$, [OII] $\lambda3727/H_{\beta} \sim 1.5$.
- 1524+604 The broad lines N₁, N₂, H_{β} are observed in emission. N₁/H_{β} ~ 3. A Seyfert 1 type galaxy.
- 1524+575 A- In emission the following lines are present: H_{α} , [SII] $\lambda\lambda6717/31$, N_{1} , N_{2} , H_{β} , H_{γ} and [OII] $\lambda3727$. $N_{1}/H_{\beta}\sim1.5$, [OII]/ $N_{1}>3$.
- 1524+575 B- N₁, N₂, H_{eta}, and [OII] λ 3727 emission lines are observed. N₁/H_{eta} \sim 3, [OII]/H_{eta} \sim 2.

- 1525+580 A- The strong lines HKG are seen in absorption.
- 1526+585 A- Only HKG are observed in absorption.
- 1526+585 B- There are the following emission lines: N_1 , N_2 , H_β , HeII $\lambda 4686$, H_γ and [OII] $\lambda 3727$. H_β and H_γ have a broad absorption component. $N_1/H_\beta > 3$, [OII]/ $H_\beta \sim 2.5$. Balmer series lines H_δ H_{10} are observed in absorption.
- $1527+583 [OII] \lambda 3727$ is suspected in emission.
- 1528+589 [OII] λ 3727 emission and H and K CaII, and G-band absorption lines are present.
- 1528+577 B- Comparable intensity H $_{\beta}$ and [OII] λ 3727 are present in emission, and the Balmer H $_{\gamma}$ -H $_{11}$ and strong HKG lines are observed in absorption.
- 1531+572 A- The absorption lines ${\rm H}_{_{\boldsymbol{\gamma}}}$ and HKG are seen.
- 1532+585 B- The spectrum shows weak emission line [OII] λ 3727 and the Balmer series lines H_{χ}-H_{χ} in absorption.
- 1533+574 A- N₁, N₂, H_{β}, and [OII] λ 3727 emission lines are observed. N₁/H_{β} > 3, [OII] λ 3727 ~ H_{β}.
- 1533+574 B- There are N₁, N₂, the Balmer series lines ${\rm H}_{\beta}{\rm -H}_{8}$, [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ in emission.
- 1536+573 The weak emission line [OII] λ 3727, the absorption lines H $_{\gamma}$ -H $_{8}$, and strong HKG are observed.
- 1536+576 The emission lines N₁, N₂, H_{β}, and [OII] λ 3727 are present. N₁/H_{β} < 1, [OII] λ 3727/H_{β} ~ 1.
- 1536+588 The emission lines N_1 , N_2 , the Balmer series lines $H_\beta H_\epsilon$, [NeIII] λ 3869 and [OII] λ 3727 are observed. The continuum is weak. $N_1/H_\beta > 3$, [OII]/ $H_\beta \sim 1.5$.
- 1536+577 The broad low-contrast hydrogen lines H_{α} , H_{β} , H_{γ} as well as HeII $\lambda 4686$ are observed. $N_{1}/H_{\beta} < 0.6$. A Seyfert 1 type galaxy.
- 1538+574 H_{α} , [NII] $\lambda6584$, N_{1} , N_{2} , H_{β} , H_{γ} and [OII] $\lambda3727$ emission lines are seen. [OII] $\lambda3727 \sim H_{\beta}$. This object is double with redshift difference between components $\Delta V \sim 90$ km/s according to long slit spectra.
- 1538+584 N₁, N₂, H_{β}- H_{ϵ}, [OII] λ 3727 emission lines are observed. The continuum is very weak.
- 1539+597 The low-contrast emission lines ${\rm H}_{\alpha}$ and [NII] $\lambda 6584$ and absorption lines ${\rm H}_{\beta}{\rm -H}_{\epsilon}$ are observed. ${\rm H}_{\beta}$ has a narrow emission core.
- 1542+574 There are the following emission lines: H_{α} , N_{1} , N_{2} , H_{β} and [OII] $\lambda 3727$ in the spectra. $N_{1}/H_{\beta}\sim 2.5$, [OII]/ $H_{\beta}\sim 1$.
- 1542+573 A- The spectra show ${\rm H_{\alpha}}$, ${\rm N_1}$, ${\rm N_2}$, ${\rm H_{\beta}}$ and [OII] $\lambda 3727$ in emission. This object is a superassociation in the galaxy, for which SBS 1542+574 is its nucleus.
- 1545+592 [OII] $\lambda 3727$ is suspected in emission. H and K CaII and G-band are observed in absorption.
- 1552+602 B- The emission lines $\rm N_1$, $\rm N_2$, $\rm H_{eta}$, $\rm H_{\gamma}$, and [OII] $\lambda 3727$ are seen on the

- weak continuum. $N_1/H_{\beta} > 3$.
- 1559+604 The emission lines of the Balmer series ${\rm H_\alpha-H_E}$, ${\rm N_1}$, ${\rm N_2}$ and [OII] $\lambda 3727$ are observed. [OII] $\lambda 3727/{\rm H_R}$ > 1.
- 1620+577 There are the following emission lines: N₁, N₂, H_{β} and weak [OII] λ 3727. N₁/H_{β} ~ 3.
- 1624+575 The broad emission lines ${\rm H_{\beta}-H_{\delta}}$ are observed. ${\rm N_1/H_{\beta}}$ < 0.5. H and K CaII and G-band are present in absorption. A Seyfert 1 type galaxy.
- 1650+535 N₁, N₂, H_{β} and [OII] λ 3727 emission lines are observed. N₁/H_{β} ~ 3, and [OII] λ 3727/H_{α} > 1.
- 1651+605 The spectrum shows H $_{\alpha}$, N $_{1}$, N $_{2}$, H $_{\beta}$ and [OII] $\lambda 3727$ in emission. N $_{1}$ /H $_{\beta}$ ~ 3, and [OII]/H $_{\alpha}$ ~ 1.
- 1657+598 H_{α} and [NII] $\lambda\lambda$ 6548-84 emission lines are observed. H_{α} ~ [NII] λ 6584.
- 1706+608 A- The strong emission lines H_{α} , H_{β} and moderate intensity [NII] λ 6584 are present. [SII] λ λ 6717/31 is suspected.
- 1706+608 B- The absorption lines D Na, H and K CaII, G-band are observed. Probably it is a physical pair with SBS 1706+608 A.

RESULTS

At the present time the slit spectra of 319 galaxies of SBS have been investigated, 56 from which are presented in this paper.

Four Seyfert type galaxies are discovered: SBS 1515+579 and SBS 1524+604 are Sy 2 type galaxies, SBS 1536+577, and SBS 1624+575 are Sy 1 type ones. SBS 1426+574 is a possible Seyfert type galaxy.

One object, SBS 1516+579, on the Survey plates and on the Palomar charts does not differ from stars and has a survey type as BSO. It turned out to be an emission line moderate luminosity galaxy.

Four physical pairs of galaxies were discovered: SBS 1319+579 A and B, SBS 1533+574 A and B, SBS 1542+573 A and SBS 1542+574, SBS 1706+608 A and B. In the first three pairs both components are emission ones, whereas in the last pair one galaxy has emission lines, the other has only absorption lines in the spectrum.

SBS 1535+595 is a projection of the star on a galaxy.

Six galaxies have only absorption lines in their spectra.

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