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Slit spectra of galaxies from the Second Byurakan sky Survey. IX

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Abstract.
The results of follow-up spectroscopy of 76 galaxies from the Second Byurakan Survey (SBS) are presented. The SBS survey contains nearly 1700 galaxies and 1800 stellar objects with $m_{pg} < 19\overset{m}{.}5$. The observations were carried out with the 6 m telescope (Russia) during 1989 – 1997. Three Sy1 galaxies, SBS 0654+498, SBS 1118+541 and SBS 1320+551, one NLSy1, SBS 0748+499, one Sy2, SBS 1344+527, three possible LINERs, SBS 0807+593, SBS 1429+554A and SBS 1511+515, as well as 10 BCDG and 13 SBN were detected. Two physical pairs of galaxies, SBS 1609+580, SBS 1609+581 and SBS 1616+594 A and B, and five close binaries, SBS 0816+610, SBS 0830+563, SBS 0916+543, SBS 1244+533 and SBS 1404+571, were detected as well. The redshifts and luminosities of all observed galaxies, spectral classification, relative intensities of emission lines and other parameters, as well as the slit spectra of the majority of galaxies, are presented.

Key words: survey – active galaxies: UVX-galaxies: emission lines – galaxies

1. Introduction

The Second Byurakan Survey (SBS) (Markarian & Stepanian, 1983, 1984 a,b; Stepanian, 1994, and references therein) is a low-resolution objective-prism survey which has been carried out with the 1 m Schmidt telescope of the Byurakan observatory (but published only in part to date). It has been complemented with slit spectroscopic observations with the 6 m telescope of the Special Astrophysical Observatory (SAO), Russia, and with the 2.1 m telescope of the Gillermo Haro Observatory in Cananea (Mexico). The SBS was started in 1974 upon the completion of the First Byurakan Survey (FBS) (Markarian, 1967) and finished in 1991.

The primary goal of the SBS survey was the extension of the Markarian survey to fainter objects for obtaining a large, well–defined sample of AGNs and QSOs selected in a uniform way. Both the FBS and the SBS surveys have been carried out with the same Schmidt camera, but the SBS extends down to a limiting magnitude $m_{pg} \approx 19\overset{m}{.}5$ which is about 2.5 magnitudes fainter than the FBS limit. A continuous strip on the sky defined by $7^h40^m < \alpha < 17^h15^m$, $+49° < \delta < +61°$ have been covered by observations. The total area of the strip is about 1000 deg^2. The main result of the SBS survey is the selection of $\sim$ 1000 galaxies with ultraviolet emission excess (UVX), and $\sim$ 700 Emission-Line Galaxies (ELG) without significant UV excess. Moreover, 1800 star-like objects with an excess ultraviolet emission have been detected. Hence, the FBS and SBS constitute a rich source of new AGN and of other types of peculiar galaxies. The selection of peculiar galaxies in the FBS relied almost exclusively upon the ultraviolet excess in the continuum spectrum of galactic nuclei. The SBS, on the other hand, attempts to use also the emission lines alongside the ultraviolet continuum.

It is well known that 10% of the field galaxies are Markarian galaxies, and about 10% of Markarian galaxies turned out to be Sy galaxies. Hence, 1% of the field galaxies are Sy galaxies. A similar conclusion was made on the basis of other surveys on the search for UVX galaxies. However, the above mentioned results were obtained on the basis of samples of nearby and bright objects observed in a volume of about $100 \div 120h^{-1}$ Mpc. What are the relative numbers of Sy and UVX galaxies at distances greater than 120 Mpc? Do the nature, power, morphology of these

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objects differ at larger distances? Is there any relation between distant Sy galaxies and nearby QSOs? Some of the raised questions might be unswered on the basis of the SBS data.

To date the slit spectra have been obtained for nearly 600 SBS galaxies and published in a series of papers (Markarian et al., 1983, 1984a, b; Stepanian et al., 1991, 1993 a, b, c, d; Carrasco et al., 1997, 1998; Martel & Osterbrock, 1994).

Hundreds of new Seyfert galaxies, SBNs, HII, Blue Compact Dwarf Galaxies (BCDGs), Emission-Line Galaxies (ELGs), close binaries, and pairs of faint UVX galaxies have already been found.

In this paper we report the results of follow-up spectroscopy of 76 galaxies from the SBS sample observed at the 6 m telescope during 1989–1997.

2. Observations and data reduction

Spectral observations in 1989–1993 were carried out with the SP-124 spectrograph equipped with a 1024-channel photon counting system (IPCS) — scanner (Drabek et al., 1985) installed at the Nasmyth I focus of the SAO 6 m telescope. Later on, the spectrograph SP-124 equipped with a 530 × 580–pixel CCD was used. Since 1995 a long-slit spectrograph (LSS) equipped with a 530 × 580–pixel CCD (Afanasiev at al., 1995), installed at the prime focus has been used. The adopted slit width was 2 arcsec with an effective instrumental spectral resolution of about 6–12 Å for the IPCS and about 15 Å for the LSS. The wavelength range covered was 3400 to 7400 Å. The data reduction procedures — cosmic ray hits removal, bias and flat field corrections, wavelength linearization and flux calibration — were carried out with the SAO standard procedure of IPCS data reduction (Afanasiev et al., 1991) and with the CCD data reduction software packages developed at SAO (Vlasyuk, 1993).

Two diffraction gratings were used with the standard spectrograph SP-124, providing wavelength dispersions of about 100 and 200 Å/mm and spectral resolutions of 6 Å and 12 Å (FWHM), respectively. Four different instrumental configurations were used. They are given in column eight of Table 1.

The journal of observations is presented in Table 1, in the columns:

1 – the SBS designation (equinox B1950.0); 2,3 – the equatorial coordinates (J2000.0) with an accuracy of about ±1″; 4 – the eye-estimated m_{pg} magnitude given with an accuracy of about $\pm 0\overset{m}{.}5$ (for some objects the photographic magnitudes taken from Zwicky et al., 1961–1968 are given); 5 – the SBS spectral class; 6 – the date of observation; 7 – the exposure time; 8 – the instrument used; 10 – alternative designation of the object, when available.

All images were reduced with the CCD data reduction software packages developed at SAO (Vlasyuk, 1993). Each image was bias-corrected and divided by a normalized flat field to remove the pixel-to-pixel variations. Then the cosmic ray hits were removed and wavelength linearization and flux calibration were applied.

3. Results

The results of spectral observations are presented in Table 2, in which the following data are given:

1 – the SBS designation (equinox B1950);

2 – the emission-line redshift derived as the mean value of the redshifts of strong emission lines corrected for solar motion,

$$\Delta z = 0.001 \sin l^{II} \cos b^{II} \quad ;$$

3 – the absolute magnitude calculated by the expression

$$M_{pg} = m_{pg} - 5\log z - 0.24 \csc b^{II} - 43.01$$

for $H_o = 75$ km s^{-1} Mpc^{-1};

4 – the reddening coefficient $c(H_\beta)$;

5 – the H_β equivalent width $EW(H_\beta)$;

6–11 – the logarithms of the observed and reddening-corrected relative intensities normalized to H_α when H_β is absent (with an uncertainty of the intensity ratios less than 30%);

12 – the determined spectral type.

The value of the dust reddening coefficient $c(H_\beta)$ was determined from the observed ratio of $I(H_\alpha)$ to $I(H_\beta)$, assuming that the intrinsic ratio of $F(H_\alpha)$ to $F(H_\beta)$ is given by

$$F(H_\alpha)/F(H_\beta) = [I(H_\alpha)/I(H_\beta)]10^{c(H_\beta)f(\lambda)},$$

where $f(\lambda)$ is listed by Kaler (1976) for a standard Galactic reddening law (Whitford, 1958). The value of $c(H_\beta)$ was computed by assuming that the intrinsic ratio $F(H_\alpha)/F(H_\beta)$ is equal to 2.85 for narrow-emission-line galaxies and to 3.1 for Sy2's and for narrow-line components of Sy1.5's (Veilleux & Osterbrock, 1987).

The diagnostic diagrams of Seyfert and starburst galaxies, for which the ratios ($[OIII]\lambda5007)/(H_\beta)$, $([NII]\lambda6583)/(H_\alpha)$ and $([SII]\lambda6724)/(H_\alpha)$ could be measured, are shown in Figs. 1 and 2. The presented ratios are corrected for the reddening.

Table 1: *Log of observation*

SBS designation	α 2000.0	δ 2000.0	m pg	Survey type	Date of observation	Exp sec	Obs mode*	Other names
0654+598	06 58 46.31	+59 46 39.4	16	sle	1995 Nov.28	600	IV	
0743+591B	07 47 46.03	+59 00 26.6	18.5	se	1991 Feb.11	314	I	
0748+499	07 51 52.01	+49 48 51.1	15.1†	sd2e	1997 Dec.27	1200	IV	
0749+553	07 53 19.69	+55 11 14.1	17.5	de	1991 Dec.10	1528	I	
0751+574	07 55 15.12	+57 18 27.9	17	sde	1997 Dec.10	1200	IV	KUG
0756+556	08 00 06.32	+55 28 29.4	18	de	1991 Dec.10	1786	I	
0757+565	08 01 13.06	+56 22 42.4	17.5	de	1997 Dec.28	1200	IV	
0807+593	08 11 39.01	+59 13 21.0	18	de	1997 Feb.08	900	IV	KUG
0812+586	08 16 52.95	+58 30 21.2	18	de:	1997 Feb.08	600	IV	
0814+562	08 18 25.36	+56 04 51.9	16	dse	1995 Dec.03	300	IV	
0816+610	08 21 07.81	+60 51 04.6	17	de	1997 Dec.28	1200	IV	
0823+550	08 27 24.98	+54 52 36.2	16	s3e	1994 Feb.16	1505	II	
0830+563	08 34 27.18	+56 08 57.0	17	sd3e	1991 Dec.10	999	I	
					1991 Dec.11	1149	I	
0837+581	08 40 56.15	+57 57 22.3	17	ds3e	1997 Dec.27	600	IV	
0849+496	08 52 58.22	+49 27 37.8	15†	d2e	1995 Dec.03	300	IV	
0906+545	09 10 30.92	+54 23 40.7	16.5	sde	1994 Dec.05	480	III	
					1997 Dec.27	600	IV	
0909+570	09 13 30.21	+56 51 29.7	16.5	d2	1997 Dec.27	1200	IV	
0910+503	09 13 50.81	+50 09 53.3	16	sde	1994 Dec.05	480	III	
0911+552	09 15 25.90	+55 03 34.1	17	dse	1997 Dec.27	600	IV	
0916+543	09 20 12.87	+54 06 27.2	15.6	de	1990 Nov.16	1274	I	
0919+527	09 23 24.95	+52 34 39.9	17.5	sd3	1997 Dec.27	600	IV	KUG
0928+577A	09 32 25.01	+57 28 58.3	14.7†	sd2e	1994 Feb.17	439	II	NGC 2895
0943+561	09 46 46.57	+55 57 04.6	19	de:	1990 Jan.25	1626	I	
0945+594	09 48 41.58	+59 15 39.3	15.4†	sd2	1992 Apr.07	805	I	
0952+550	09 55 50.43	+54 46 39.4	19	dse	1991 Feb.12	1800	I	
0952+556	09 56 23.84	+55 27 32.5	17	de:	1997 Dec.27	600	IV	
1002+555	10 05 57.14	+55 15 41.9	15.7†	sde	1994 Feb.16	1106	II	
1016+563B	10 20 06.62	+56 06 13.7	16.5	sd2e	1992 Apr.06	585	I	
1033+541	10 36 58.58	+53 52 37.7	16.5	ds3	1997 Dec.28	1200	IV	
1035+543	10 38 07.81	+54 07 56.4	16.5	sd3e	1997 Dec.28.	1200	IV	
1105+559	11 08 19.43	+55 42 18.4	18.5	sl	1994 Feb.17	651	II	
1109+569	11 12 47.14	+56 41 06.7	17	s2e	1992 Apr.06	759	I	
1115+551	11 18 08.50	+54 50 27.2	16	sd2e	1992 Apr.06	682	I	
1118+541	11 21 08.55	+53 51 20.7	16.5	sl	1995 Nov.14	1800	IV	
1120+540	11 23 16.13	+53 47 14.3	16.5	sd2e	1992 Apr.06	562	I	
1132+558	11 35 38.33	+55 31 57.7	15.3†	de	1994 Feb.16	854	II	KUG
1207+531	12 10 14.00	+52 50 55.5	16.5	sd2e	1994 Feb.17	273	II	
1208+531	12 11 00.67	+52 49 57.3	16.5	sd2e:	1994 Feb.17	278	II	
1212+493	12 14 35.20	+49 06 47.4	17.5	sd2e:	1991 Mar.15	143	I	
1214+564	12 17 02.74	+56 08 27.7	16.5	de:	1991 Feb.12	275	I	
1224+533	12 26 52.63	+53 06 19.3	16.5	d2e+de	1991 Feb.11	331	I	
					1991 Mar.15	350	I	
1245+542	12 48 09.29	+54 01 25.6	14.9†	sde	1992 Apr.08	1129	I	
1312+563B	13 13 57.11	+56 07 37.4	17.5	dle	1992 Mar.03	256	I	
1312+566	13 14 08.78	+56 22 04.4	17	dsle	1992 Mar.03	356	I	
1317+523A	13 19 47.52	+52 04 13.9	15.4†	sde	1992 Mar.03	245	I	
1320+551	13 22 49.16	+54 55 28.3	15.6†	sdle	1994 Feb.15	1800	IV	
1330+504	13 32 29.59	+50 12 07.0	17	ds2e:	1992 Mar.03	247	I	
1331+493	13 33 23.27	+49 06 11.6	14.9†	s2e	1991 Feb.12	252	I	
1344+527	13 46 40.78	+52 28 36.2	15.5	d2e	1997 Dec.28	1200	IV	
1354+580	13 56 24.46	+57 45 47.4	17.5	sdle	1991 Feb.12	153	I	
1358+554	14 00 32.40	+55 14 46.1	17.5	sd2e	1991 Feb.12	471	I	
1401+490	14 03 44.68	+48 45 57.5	16.5	de	1991 Feb.12	260	I	CG 337
1401+564B	14 03 33.42	+56 13 03.4	17	s3e	1992 Apr.06	822	I	
1404+571	14 06 33.08	+56 56 41.2	16.5	sd2e	1991 Feb.12	286	I	
1408+558	14 09 47.04	+55 35 57.7	16.5	sd3	1991 Feb.20	290	I	CG 366
					1992 Apr.07	310	I	
1411+556A	14 12 47.50	+55 25 47.5	16.5	ds3e	1991 Feb.12	219	I	CG 377
1425+507	14 27 32.05	+50 31 51.3	17	sd2e:	1992 Mar.08	461	I	CG 913
1429+554A	14 30 52.29	+55 14 40.0	16	ds2e	1992 Apr.06	483	I	CG 458
1430+526	14 32 33.35	+52 24 48.8	17	ds2e	1991 Feb.12	255	I	CG 470
1445+491	14 47 21.07	+48 54 05.4	15.5†	sle:	1993 May.17	282	II	CG 544

Table 1: *Log of observation (continued)*

SBS designation	α 2000.0	δ 2000.0	m pg	Survey type	Date of observation	Exp sec	Obs mode*	Other names
1446+512	14 48 17.74	+51 00 19.7	17.5	sle:	1993 May.17	363	II	
1446+595	14 47 38.87	+59 21 51.6	18	d2e	1991 Feb.12	600	I	
1458+497	15 00 03.24	+49 32 53.7	17	dsle	1990 Feb.16	527	I	CG 922
					1991 Feb.11	350	I	
1503+531	15 04 31.92	+52 55 16.9	17	d3e:	1991 Feb.12	300	I	CG 618
1509+527	15 11 00.96	+52 33 29.0	15.6†	d3e:	1991 Feb.12	202	I	CG 652
1511+515	15 12 43.01	+51 23 33.7	16.5	ds2e	1991 Feb.12	259	I	CG 659
1519+496	15 20 50.20	+49 30 50.4	15.5†	d3e	1991 Feb.12	205	I	CG 690
1519+508A	15 21 07.36	+50 40 19.8	15.5†	ds3e:	1991 Feb.12	184	I	CG 692
1523+519	15 25 19.13	+51 44 53.2	17.5	d3e	1991 Feb.12	547	I	CG 707
1528+529	15 30 23.04	+52 44 46.3	17	sl	1991 Mar.20	380	II	CSO 762
					1991 Nov.09	353	I	
1609+580	16 10 52.11	+57 58 14.4	18	d2e	1990 Nov.15	415	I	
1609+581	16 10 52.19	+57 58 26.3	18	d2	1990 Nov.15	799	I	
					1991 Sep.10	415	I	
1616+594A	16 17 21.02	+59 19 12.1	14.8†	sle	1994 Feb.15	292	II	
1616+594B	16 17 27.51	+59 19 00.2	16.5	sdle	1993 May.17	530	II	
1617+593	16 18 24.72	+59 12 18.8	19	s2e:	1989 Sep.04	1088	I	
1646+551	16 47 25.67	+55 04 03.0	16.5	s2e	1993 May.18	855	II	

* I – Nasmyth focus; spectrograph SP-124; detector IPCS-1024-channel TV scanner. This combination produced spectra with a wavelength dispersion of ~100 Å/mm and resolution of 6 Å in wavelength range 3500–5500 Å.
II – Nasmyth focus; spectrograph SP-124; detector IPCS-1024-channel TV scanner, wavelength range 3500–7000 Å; resolution 12 Å (FWHM).
III – Nasmyth focus; spectrograph SP-124; detector CCD 580 × 530 pxl; wavelength range 4000–7000 Å; resolution 15 Å (FWHM).
IV – Prime focus; spectrograph UAGS; detector CCD 580 × 530 pxl; wavelength range 4000–7400 Å; resolution 15 Å (FWHM).
† – Magnitudes taken from Zwicky et al. (1961–1968).

Seyfert galaxies were classified in the system outlined by Osterbrock (1989, 1993). For the narrow-line objects, the diagnostic diagrams recommended by Veilleux & Osterbrock (1987) were used to separate Sy2 and LINERs from starburst galaxies (Sy2 $[OIII]/H_\beta > 3.0$, LINERs $[OIII]/H_\beta < 3$).

According to this classification scheme, three Sy1, one Sy2, and 13 starbursts were classified. A few objects with only one emission line were not classified.

Plots of the spectra in relative intensities of the observed objects are presented in Fig. 4.

4. Discussion and conclusions

The results of follow-up spectroscopy of 76 SBS galaxies observed with the 6 m telescope (Russia) during 1989–1997-th are presented. Four of the studied objects, SBS 0751+574, SBS 0807+593, SBS 0919+527, SBS 1132+558 are crossed with KUG galaxies (Takase et al., 1984, 1985, 1993), 15 objects are common with Case galaxies (including one stellar object, CSO 762 = SBS 1528+529) (Sanduleak & Pesch, 1989).

Spectral classification, redshifts, relative intensities of the prominent emission lines, and other spectroscopic parameters were determined for 72 emission line galaxies. Four objects, SBS 0756+556, SBS 0952+550, SBS 1002+555, and SBS 1617+593 have an absorption line spectrum.

Three galaxies, SBS 0654+598 (FWHM of $H_\beta \sim$ 5500 km/s $H_\gamma \sim$ 4000 km/s), SBS 1118+541 (FWHM of $H_\beta \sim$ 4000 km/s), and SBS 1320+551 (FWHM of $H_\beta \sim$ 7000 km/s) show broad permitted emission lines. In the spectrum of SBS 0654+598 a very strong FeII blend λ5190, λ5320, FeII λ6407, 6411, 6432, Fe-VII λ6087 and intensive HeI λ5876 are evidently present as well. These three galaxies are classified as Sy1 galaxies.

Two physical pairs of galaxies, SBS 1609+580 and SBS 1609+581, and SBS 1616+594 A and B; five close binaries, SBS 0816+610, SBS 0830+563, SBS 0916+543, SBS 1244+533 and SBS 1404+571, with an angular separation of the components of 3 – 7″ were found.

The galaxy SBS 0830+563 consists of two emission-line regions with an angular separation less than $\rho \leq 3''$, and the same redshift. The galaxy SBS 0916+543 is also a double system with an angular separation of the components of about $\rho \sim 6''$. Both components of this galaxy are embedded in a common nebular shell and have practically the same redshift. The galaxy SBS 1646+551A seems to have a similar morphology. The image of it consists of two star-like components surrounded by a nebular shell. The slit spectra show, however, that while the SE-component is a NELG, the NW-component is a foreground star.

Table 2: *Results of follow-up spectroscopy*

SBS designation	z_o	M_{pg}	$c(H\beta)$	EW $H\beta$	[OII]) 3727	[OIII] 5007	[OI] 6300	$H\alpha$ 6563	[NII] 6584	[SII] 6717+6731	Spec. type
0654+598	0.0691	-21.8									Sy1
0743+591B	0.0213	-16.6		140	0.21	0.60					BCDG
0748+499	0.0246	-20.4		8		0.54	-0.50	0.94	0.16		NLSy1
			1.41			0.47	-0.92	0.46	-0.33		
0749+553	0.0248	-17.9		13	0.29	0.32					
0751+574	0.0428	-19.6		11		0.44		0.56	-0.16	0.25	SBN
			0.29			0.43		0.46	-0.26	0.14	
0756+556	0.0302	-17.9									
0757+565	0.0270	-18.1						0.00	-0.63	-0.45	
0807+593	0.0272	-17.6		15	0.63	0.37		0.58	-0.19	0.10	LINER:
			0.36		0.73	0.35		0.46	-0.31	-0.03	
0812+586	0.0257	-17.5						0.00	-0.74		
0814+562	0.0263	-19.5						0.00	-0.51		
0816+610	0.0289	-18.7		5				0.95	0.38	0.30	
			1.45					0.46	-0.12	-0.22	
0823+550	0.0306	-19.9		13	0.36	0.16		0.53	-0.20		
			0.22		0.42	0.15		0.46	-0.28		
0830+563	0.0262	-18.5		18	0.07	0.29					
0837+581	0.0176	-17.6		7		0.45		0.70	0.20	0.41	SBN
			0.71			0.43		0.46	-0.05	0.15	
0849+496	0.0109	-18.6		7	0.20	0.04		0.96	0.38	0.51	
			1.15		0.54	0.00		0.46	-0.02	0.09	
0906+545	0.0135	-17.5		11		0.56		0.58	-0.53	0.02	BCG
			0.36			0.54		0.46	-0.64	-0.11	
0909+570	0.0413	-19.9						0.00	-0.55	-0.69	
0910+503	0.0342	-20.0		5	-0.20	-0.04		0.81	0.41		
			1.04		0.11	-0.09		0.46	0.05		
0911+552	0.0486	-19.8						0.00	-0.40	-0.34	
0916+543	0.0110	-18.1		69	0.10	0.52					BCG
0919+527	0.0256	-17.9				-0.30		0.00	-1.13		
0928+577A	0.0300	-20.8						0.00	-0.23	-0.53	
0943+561	0.0299	-16.7		116		0.74					BCDG
0945+594	0.0074	-17.3		16	0.21	-0.12					
0952+550	0.0442	-17.6									
0952+556	0.0464	-19.7						0.00	-0.36	-0.12	
1002+555	0.0250	-19.6									
1016+563B	0.0326	-19.4		77	0.61	0.27					
1033+541	0.0468	-20.2		6		-0.12		0.51	0.23	0.46	
			0.16			-0.12		0.46	0.18	0.39	
1035+543	0.1030	-21.9		15		-0.10	-0.65	0.62	0.39		SBN
			0.48			-0.12	-0.80	0.46	0.22		
1105+559	0.0477	-18.2			0.00	0.11		0.00			
1109+569	0.0478	-19.7		8	0.18						
1115+551	0.0062	-16.3		4	0.84	0.65					
1118+541	0.1043	-22.0									Sy1
1120+540	0.0093	-16.6		6	0.66	0.06					
1132+558	0.0205	-19.6		6	0.12			0.49	0.26	0.02	
			0.10		0.15			0.46	0.09	-0.02	
1207+531	0.0352	-19.5		34	0.33	0.43	-0.20	0.51	-0.49		SBN
			0.16		0.38	0.42	-0.25	0.46	-0.55		
1208+531	0.0025	-13.8		13	0.44	0.70					
1212+493	0.0126	-16.3		61	0.16	0.53					BCDG
1214+564	0.0521	-19.4		31	0.27	0.03					SBN:
1224+533	0.0313	-19.3		36	-0.60						
1245+542	0.0115	-18.7		5	0.59	-0.04					
1312+563B	0.0399	-18.8		45	0.11	0.56					SBN:
1312+566	0.0677	-20.4		31	-0.15	0.38					
1317+523A	0.0157	-18.9		18	0.27	0.35					SBN
1320+551	0.0651	-21.8									Sy1
1330+504	0.0282	-18.5		17	0.03	0.39					SBN

Table 2: *Results of follow-up spectroscopy (continued)*

SBS designation	z o	M pg	$c(H\beta)$	EW $H\beta$	[OII]) 3727	[OIII] 5007	[OI] 6300	$H\alpha$ 6563	[NII] 6584	[SII] 6717+6731	Spec. type
1331+493	0.0024	-15.3		369	-0.04	0.78					BCDG
1344+527	0.0295	-20.1		5		1.10	0.07	0.71	0.98	0.82	Sy2
			0.74			1.07	-0.15	0.46	0.72	0.55	
1354+580	0.0274	-18.0		25	0.53	0.60					BCG:
1358+554	0.0134	-16.4		34	0.26	0.47					
1401+490	0.0030	-14.2		91	0.36	0.56					BCDG
1401+564B	0.0720	-20.7		11	0.29	-0.11					
1404+571	0.0405	-19.8		24	0.31	0.05					SBN
1408+558	0.0264	-18.9		15	0.04	0.17					SBN
1411+556A	0.0415	-19.9		6	0.57	0.21					
1425+507	0.0360	-19.1		50	0.76	0.59					
1429+554A	0.0175	-18.5		12	0.34	-0.15					LINER:
1430+526	0.0109	-16.5		40	0.26	0.67					BCDG
1445+491	0.00724	-17.1		11	0.66	0.55		0.77		0.26	BCDG
			0.92		0.93	0.51		0.46		-0.07	
1446+512	0.1354	-21.5		50	0.19	0.44					SBN
1446+595	0.0078	-14.8		31	0.28	0.68					BCDG:
1458+497	0.0484	-19.7		21	0.43	0.26					SBN
1503+531	0.0187	-17.7		38	0.18	0.50					
1509+527	0.0119	-18.1		7	0.80	0.71					SBN
1511+515	0.0371	-19.2		47	0.27	-0.18					LINER:
1519+496	0.0147	-18.7		6	0.78	0.60					
1519+508A	0.0564	-21.6		26	0.02	-0.39					
1523+519	0.0127	-16.3		26	0.46	0.77					BCDG
1528+529	0.0756	-20.7		102	0.27	0.55		0.48			SBN
			0.07		0.29	0.55		0.46			
1609+580	0.0836	-20.0		26	0.10						
1609+581	0.0830	-20.0		21	0.24	-0.07					
1616+594A	0.0145	-19.4		68	-0.05	-0.16		0.51	-0.22		SBN
			0.16		0.00	-0.17		0.46	-0.28		
1616+594B	0.0154	-17.8			-0.38			0.00	-0.91	-0.24	
1617+593	0.0785	-18.8									
1646+551	0.0183	-18.2			-0.50			0.00	-0.52		

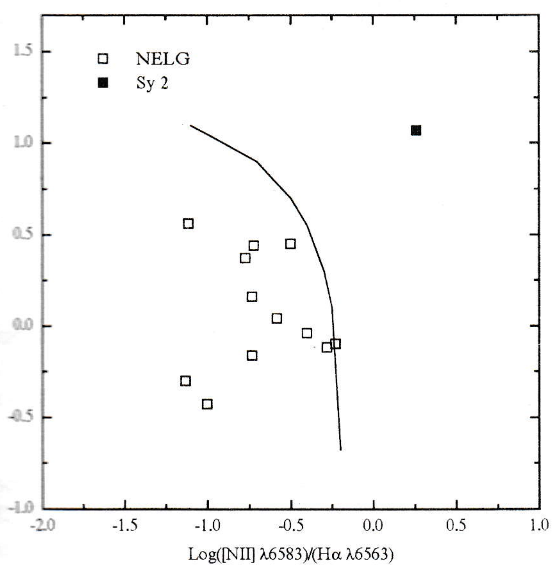

Figure 1: *Emission-line ratio classification diagram. The solid line marks the boundary between "HII region-like" galaxies and AGNs.*

Three galaxies, namely, SBS 1035+543, SBS 1105+559, and SBS 1528+529 (CSO 762), have images which are practically undistinguishable from stars on the Palomar sky survey plates, as well as on the SBS objective prism plates. The star-like image of the last object (CSO 762) was mentioned also by Sanduleak & Pesch (1989). These star-like objects are in fact extremely compact galaxies with luminosities in the range of $M = -15^m \div -23^m$. Such galaxies are, as a rule, missing in many galaxy surveys. There are different kinds of extragalactic objects — BCDGs, SBNs, LINERs and Sy galaxies — among them.

Ten objects were classified as BCDGs. Many of them are good candidates for metal-poor galaxies.

One of the important advantages of the SBS survey is the systematic revealing of LINERs, which are usually missing in other surveys (see, for example, the UM survey, Salzer, 1987). In the present paper we report the discovery of the three probable LINERs, SBS 0807+593, SBS 1429+554A and SBS 1511+515. In the SBS a few dozens of LINERs were discovered.

The redshift distribution of the whole sample of SBS galaxies, of the FBS (Markarian galaxies), as well as of the subsample presented in this paper is shown in Fig.3.

The surface densities of the SBS galaxies and some other samples of galaxies and of the field galaxies are given in Table 3.

Table 3 shows that the SBS is, perhaps, one of

Table 3: *The surface density of SBS, other samples and field galaxies*

Name of survey	Area $deg.^2$	Number	Surface density of galaxies up to the magnitude					Completeness mag.	Reference
			$15^m.0$	$15^m.5$	$16^m.0$	$16^m.5$	$17^m.0$		
FBS	17000	1500	0.09					$15^m.2$	Markarian, 1967
Tololo	1225	201	0.16					$15^m.0$	Smith, 1975
Wasilewski	825	96	0.12					$15^m.0$	Wasilewski, 1983
UM	667	349	0.12			0.52		$16^m.5$	Salzer, 1987
Case	184	161	0.12	0.23	0.30	0.47	0.72	$16^m.5$	Sanduleak & Pesch, 198
SBS	1000	1700	0.12	0.25	0.49	0.79	1.10	$17^m.0$	Stepanian, 1994
FIELD	1000	10000	0.6	1.3	2.5	5.0	10.0		

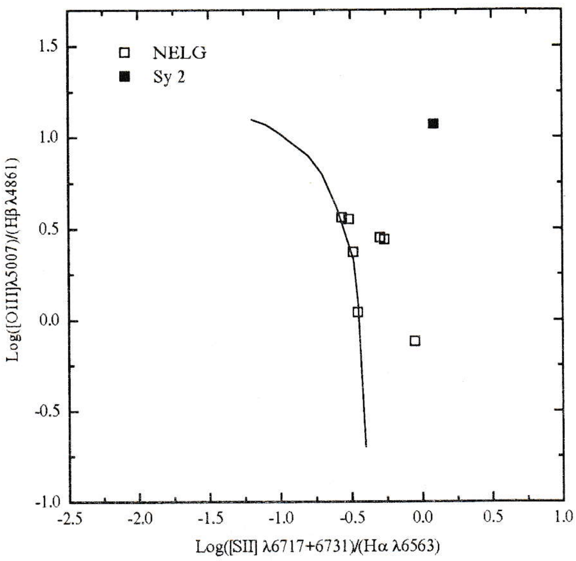

Figure 2: *Emission-line ratio classification diagram. The solid line marks the boundary between "HII region-like" galaxies and AGNs.*

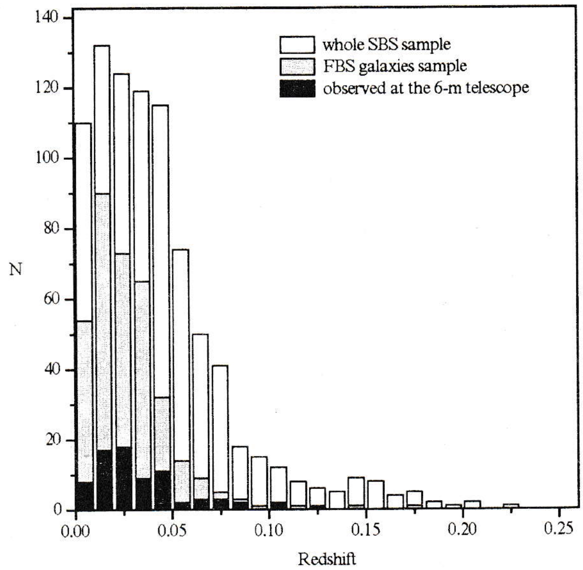

Figure 3: *The redshift distribution of galaxies of the whole sample of SBS, FBS (Markarian galaxies), and the subsample presented in this paper.*

the most complete surveys of galaxies up to $m \sim 17.0$ magnitude. The completeness level of the SBS galaxies may be estimated at $\sim 90\%$ for $m \leq 16^m.5$, and about 70 % for $m \leq 17^m.0$ galaxies.

The SBS covered considerably fainter magnitudes than the FBS. The SBS galaxies have on average noticeably larger redshifts than the FBS galaxies. The redshift distribution shows (Fig. 3) that the SBS increases the volume of reliable investigations to $\sim 250h^{-1}$ Mpc — ten times deeper than in the FBS.

Up to now spectral data have been obtained for about 75% of the whole sample. The follow-up spectroscopy of the remainder SBS galaxies, when finished, will provide the first complete sample of faint ($B \leq 17^m.5$) AGNs, as well as of other types of galaxies in the continuous 1000 deg^2 area of the northern sky. Because of their fainter magnitudes and higher redshifts, the SBS AGNs bridge the gap between the low-redshift Seyfert galaxies and QSOs and may provide new insights into the structure and evolution of AGNs in the nearby space.

Such a sample should allow one to study the luminosity function of AGNs, UVX galaxies, BCDGs and of other types of emission-line galaxies, to investigate the large-scale structure of the Universe out to distances of about 500 Mpc.

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References

Afanasiev V.L., Lipovetsky V.A., Michailov V.P., Nazarov E.A., & Shapovalova A.I., 1991, Astrofiz. Issled. (Izv. SAO), **31**, 121

Afanasiev V.L., Burenkov A.N., Vlasyuk V.V., & Drabek S.V., 1995, SAO technical report No. **234**

Carrasco L., Serrano A., Tovmassian H.M., Stepanian J.A., Chavushyan V.H. & Erastova L.K., 1997, Astron. J., **113**, 1527

Carrasco L., Tovmassian H.M., Stepanian J.A., Chavushyan V.H., Erastova L.K., & Valdés J.R., 1998, Astron. J., **115**, 1717

Drabek S.V., Kopylov I.M., Somov N.N. & Somova T.A., 1986, Astrofiz. Issled. (Izv. SAO), **22**, 64

Kaler J.B., 1976, Astrophys. J. Suppl. Ser., **31**, 517

Markarian B.E., 1967, Astrofizika, **3**, 55

Markarian B.E. & Stepanian J.A., 1983, Astrofizika, **19**, 639

Markarian B.E. & Stepanian J.A., 1984a, Astrofizika, **20**, 21

Markarian B.E. & Stepanian J.A., 1984b, Astrofizika, **20**, 513

Markarian B.E., Lipovetsky V.A. & Stepanian J.A., 1984a, Astrofizika, **20**, 213

Markarian B.E., Lipovetsky V.A. & Stepanian J.A., 1984b, Astrofizika, **21**, 35

Martel A. & Osterbrock D., 1994, Astron. J., **107**, 1283

Osterbrock D.E., 1989, Astrophysics of Gaseous Nebulae and Active Galactic Nuclei (University Science Books, Mill Valey)

Osterbrock D.E., 1993, Astrophys. J., **404**, 551

Salzer J.J., 1987, Ph.D. thesis, University of Michigan

Sanduleak N. & Pesch P., 1989, Astrophys. J. Suppl. Ser., **70**, 173

Smith M.G., 1975, Astrophys. J., **202**, 591

Stepanian J.A., Lipovetsky V.A., Erastova L.K. & Shapovalova A.I., 1991, Astrofizika, **34**, 206

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Shapovalova A.I. & Gyulzadian M.B., 1993a, Bull. Spec. Astrophys. Obs., **35**, 15

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Shapovalova A.I. & Hakopian S.A., 1993b, Bull. Spec. Astrophys. Obs., **35**, 24

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Gyulzadian M.B., Izotov Yu.I. & Guseva N.G., 1993c, Bull. Spec. Astrophys. Obs., **35**, 32

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Hakopian S.A., Izotov Yu.I. & Guseva N.G., 1993d, Bull. Spec. Astrophys. Obs., **35**, 38

Stepanian J.A., 1994, D.Sci. Thesis, Nizhnij Arkhyz

Takase B. & Miyauchi-Isobe N., 1984, Ann. Tokyo Astron. Obs. 2nd Ser., **18**, 55

Takase B. & Miyauchi-Isobe N., 1985, Ann. Tokyo Astron. Obs. 2nd Ser., **19**, 595

Takase B. & Miyauchi-Isobe N., 1993, Publ. Nat. Astr. Obs. Japan, **3**, 169

Veilleux S. & Osterbrock D.E., 1987, Astrophys. J., **63**, 295

Vlasyuk V.V., 1993, Bull. Spec. Astrophys. Obs., **36**, 107

Wasilewski A.J., 1983, Astrophys. J., **272**, 68

Whitford A.E., 1958, Astron. J., **63**, 201

Zwicky F., Herzog G., Wild P., Karpovicz M. & Kowal G., 1961 - 1968, Catalogue of galaxies and clusters of galaxies, vol. I-IV, Pasadena, California, Institute of Technology

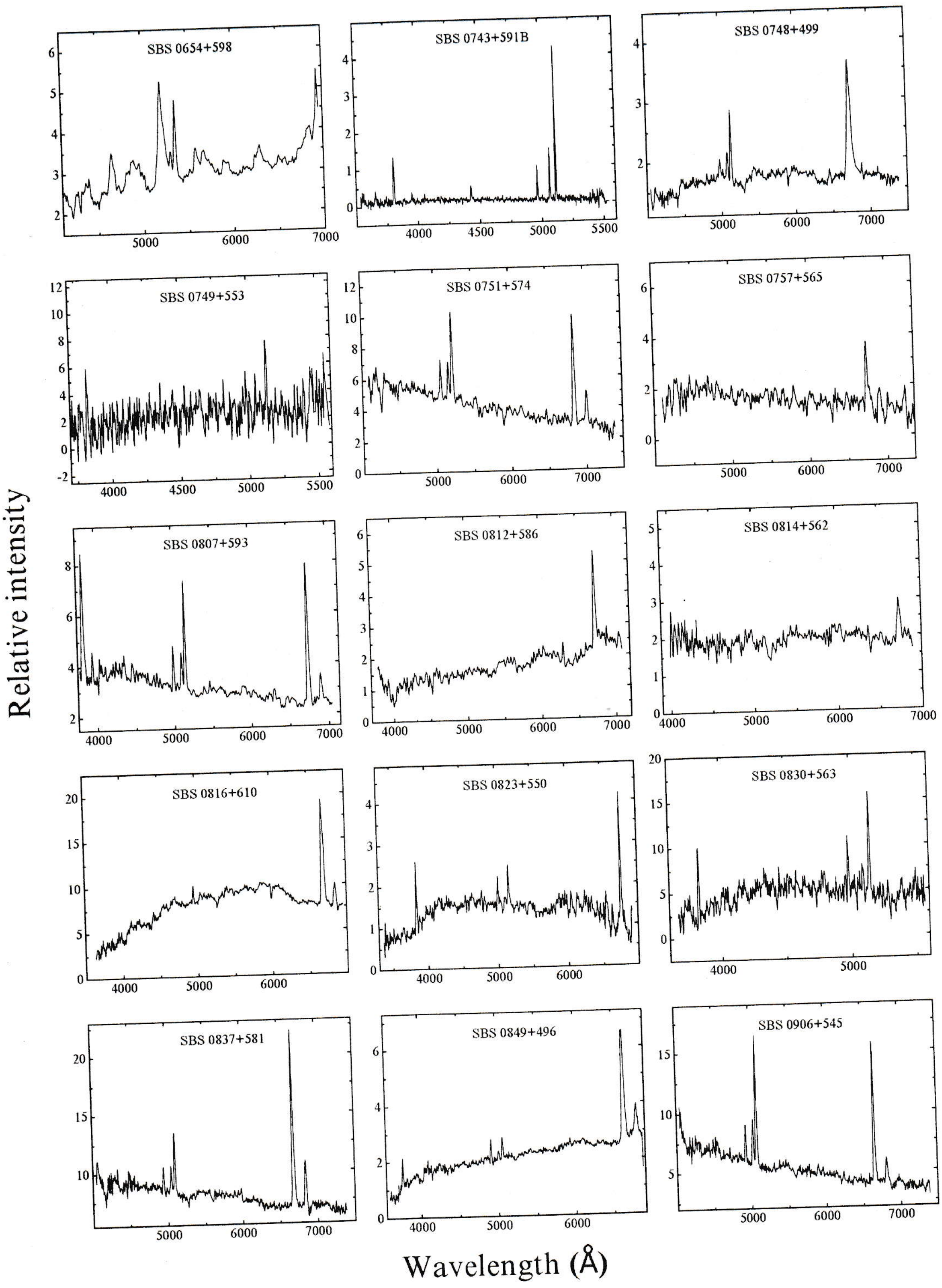


Figure 4: *Plots of the spectra in relative intensities of the observed objects.*

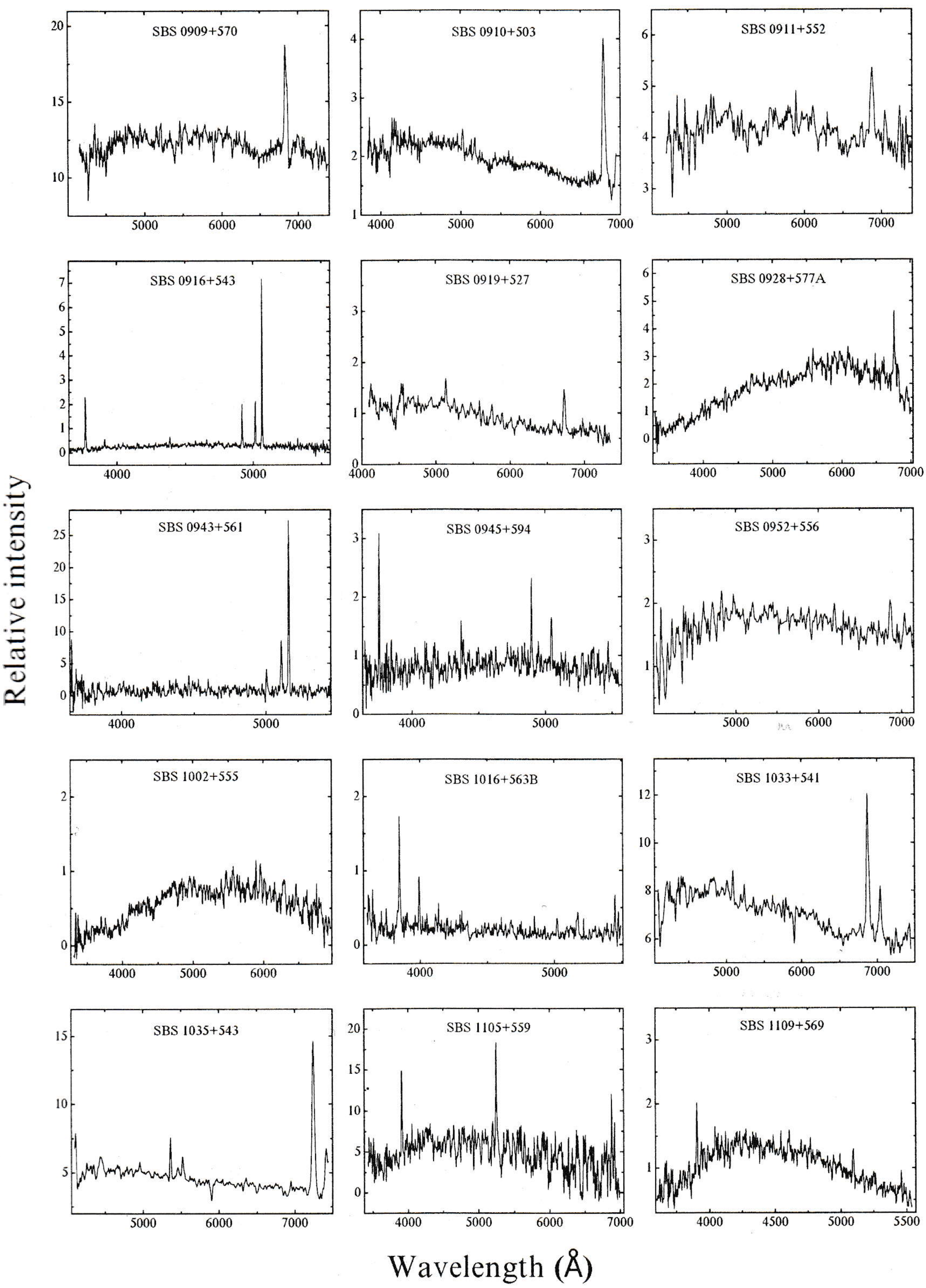
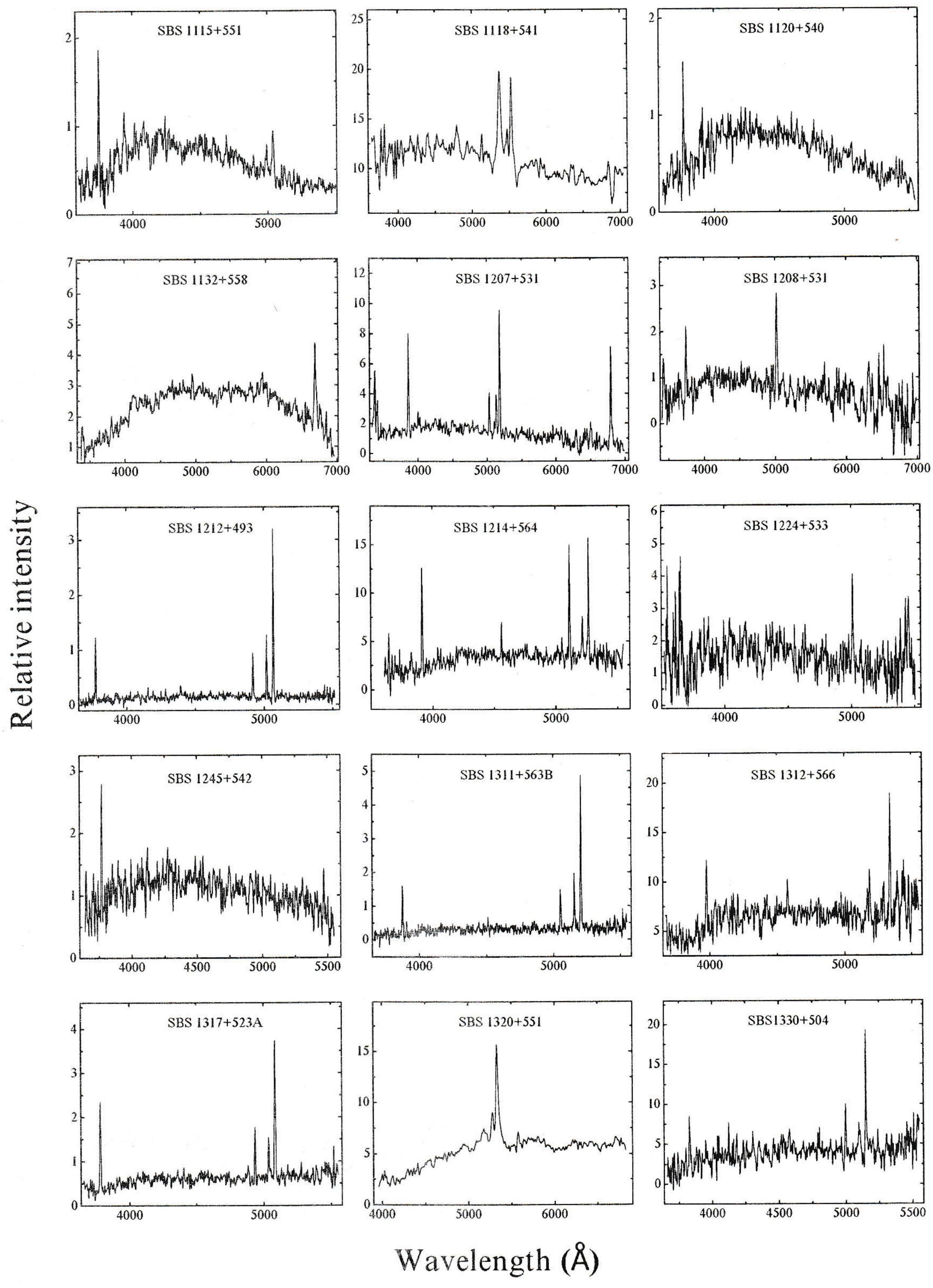


Figure 4: – *(Continued)*



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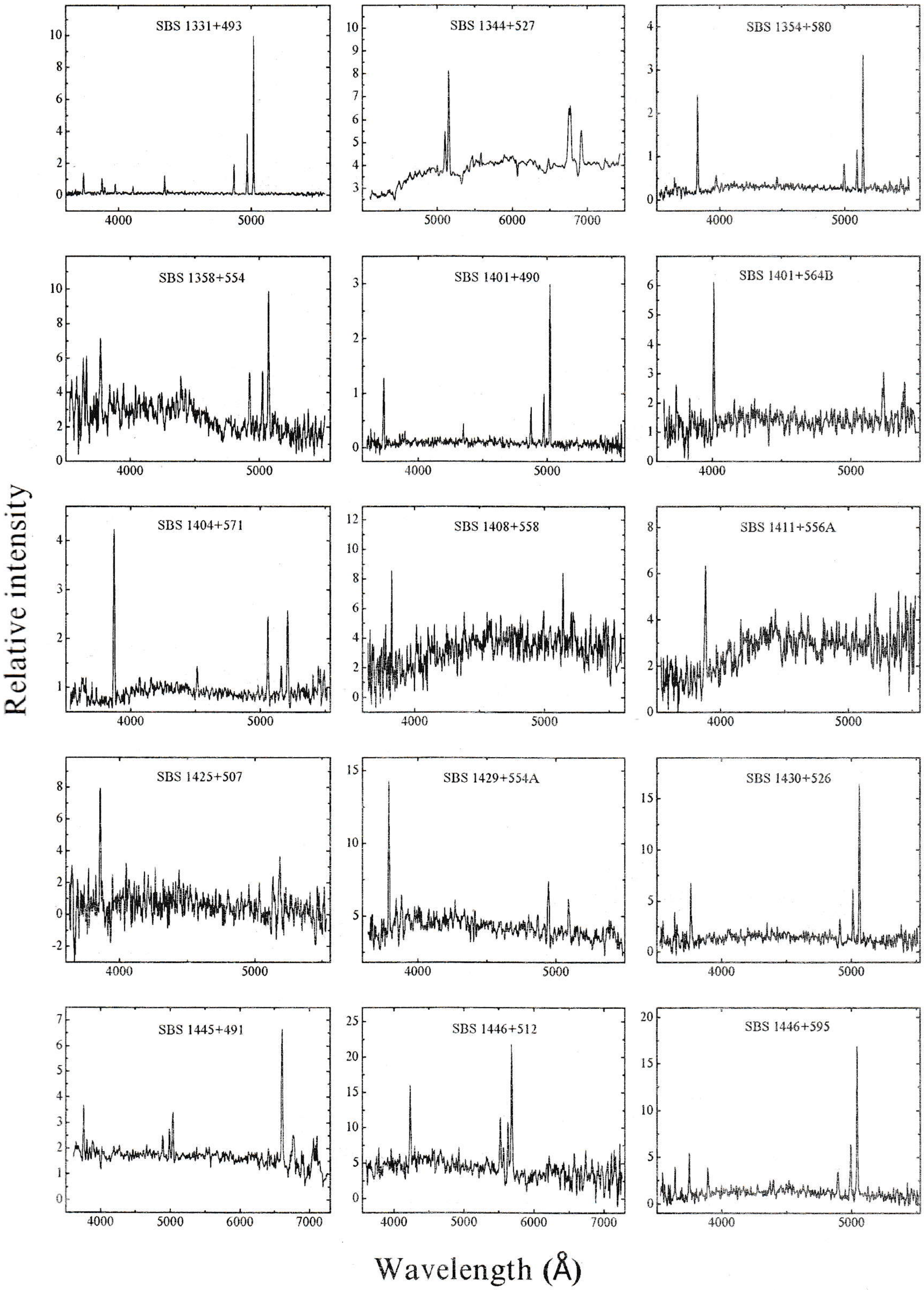

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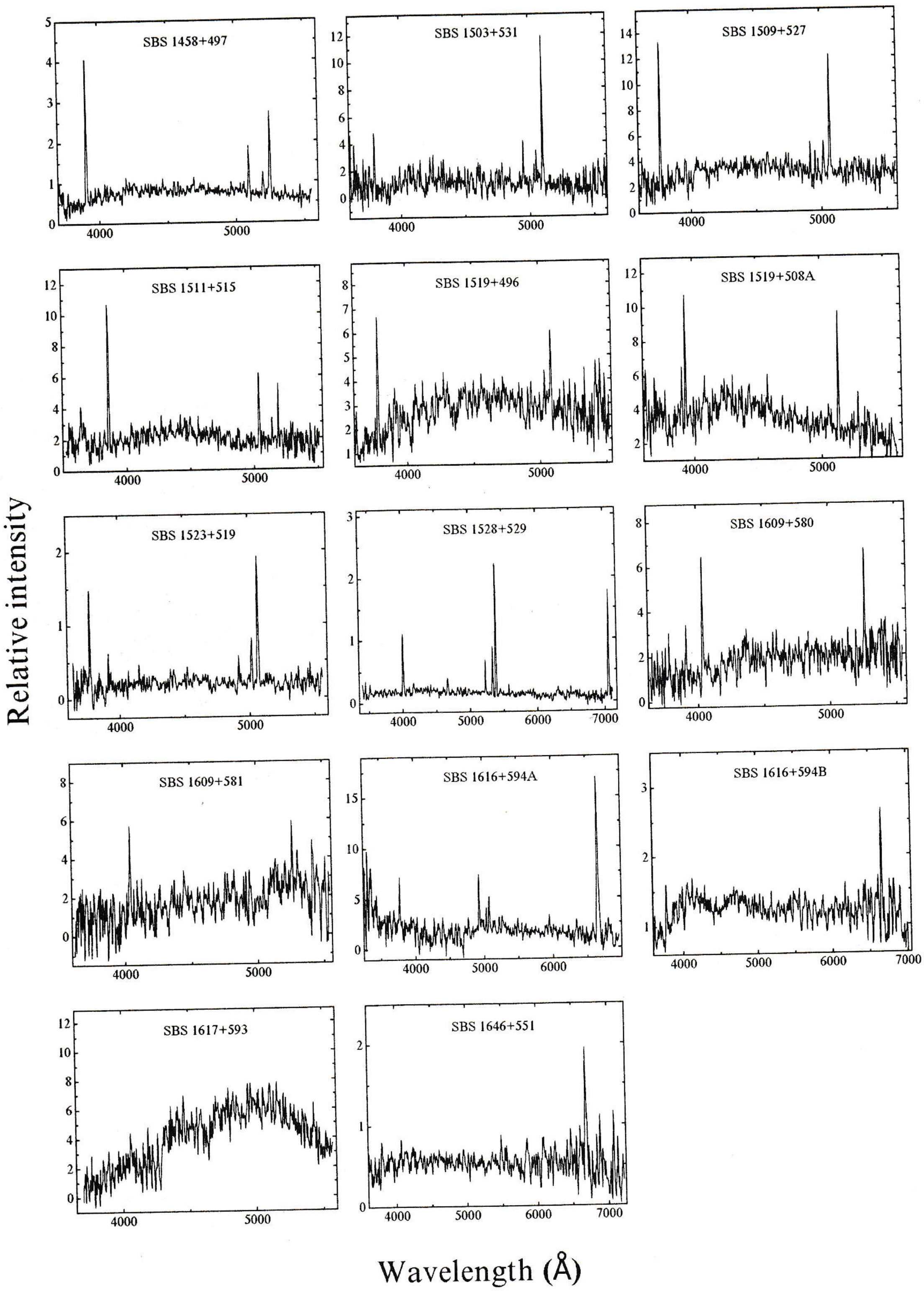

Figure 4: – *(Continued)*