UDC 524.7-126 *Astrofiz. Issled. (Izv. SAO)*, 1993, **35**, 38-42

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

STEPANIAN J.A., LIPOVETSKY V.A.,
Special Astrophysical Observatory of the Russian AS,
Nizhnij Arkhyz 357147, Russia

ERASTOVA L.K, HAKOPIAN S.A.,
Byurakan Astrophysical Observatory of the Armenian AS,
Byurakan 378433, Armenia

IZOTOV YU.I., GUSEVA N.G.
Main Astronomical Observatory of the Ukrainian AS,
Kiev, Ukraine

Received July 31, 1992

ABSTRACT. *The results of the follow-up spectroscopy of 34 galaxies from the Second Byurakan Survey are presented. The observations are carried out with the 6 m telescope of SAO RAS. The emission lines are observed on the scans of the most of galaxies. The redshifts and luminosities of all the galaxies are determined. SBS 1616+503 was discovered to be one possible Seyfert type galaxy.*

OBSERVATIONS

In the previous seven papers of this series (Markarian et al., 1984; Lipovetsky et al., 1988; Stepanian et al., 1991, 1993a,b,c) the results of spectral observations of 368 galaxies from the Second Byurakan Sky Survey are presented. In this paper the data on the slit spectra of 34 galaxies are collected together. These are the objects, which are out of the fields of SBS Survey and located in the region $\alpha = 13^h00^m - 17^h20^m$, $\delta = +49^\circ - +61^\circ$.

Spectral observations have been carried out with the 1000-channel TV scanner (Drabek et al., 1986), which was attached in the Nasmyth focus of the 6 m telescope of the Special Astrophysical Observatory. The diffraction grating giving a dispersion of about 100 Å/mm and a spectral resolution of 1.9 Å per channel was used. For some galaxies two scans in the same spectral region with approximate equal short exposures were obtained. The first scan of the objects was obtained on the object strobe, then on the sky strobe, and these two scans were added to each other.

Table 1 presents the data on investigated objects: 1 - SBS designation in accordance with the survey list, which will be published later, 2 - the 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, $\Delta z = 0.001 \sin l^{II} \cos b^{II}$, 6 - apparent magnitude in the blue spectral region, 7 - luminosities corrected for extinction in our Galaxy for H = 75 km/s Mpc, 8 - survey type. The general list and finding charts of the investigated objects are in preparation.

In the descriptions the results of studying the slit spectra are presented: morphology for some objects, observed emission and absorption lines, the estimations of the basic emission line intensity ratios, spectral type of a galaxy.

Table 1.

Designation SBS	Date of observation	Spectral range Å	Exposure time (s)	z_0	m_B	M_B	Survey type
1	2	3	4	5	6	7	8
1304+539	12.02.91	3520-5560	246	0.0242	15.5	-19.7	se
1315+606	12.02.91	3520-5560	234	0.0077	18.0	-14.7	d2e
1315+593	12.02.91	3600-5640	260	0.0290	18.0	-17.6	ds2e
1318+520	15.03.91	3660-5660	220	0.0170	16.0	-18.4	de
1319+539 A	12.02.91	3610-5630	286	0.0336	18.5	-17.4	de
1332+545	12.02.91	3520-5560	331	0.0508	18.0	-18.8	sd1e
1332+599	14.03.91	3640-5650	447	0.0352	17.5	-18.5	ds3e
1333+573	15.03.91	3670-5660	239	0.0249	18.0	-17.3	de
	20.03.91	3640-5660	373				
1341+594	12.02.91	3520-5560	198	0.0108	17.5	-16.0	d2e
1351+552	20.03.91	3640-5660	361	0.0402	18.5	-17.8	s1e
1351+589	12.02.91	3520-5560	255	0.0261	18.0	-17.4	sd2e:
1353+597 A	12.02.91	3520-5560	331	0.0228	17.5	-17.6	d2e
1353+597 B	12.02.91	3520-5560	268	0.0108	18.0	-15.5	de
1357+563	12.02.91	3530-5570	260	0.0346	17.0	-19.0	dse
1358+550	12.02.91	3520-5570	471	0.0137	14.5	-19.5	sd2e
1411+584	12.02.91	3620-5570	261	0.0747	18.0	-19.6	s2
1421+544	07.04.91	3700-5700	2178	0.0217	18.5	-16.5	de
1430+596	20.03.91	3640-5630	670	0.0070	17.5	-15.0	de
1430+521	14.04.91	3690-5690	694	0.0265	18.0	-17.4	s1e
1446+595	12.02.91	3520-5570	230	0.0081	18.0	-14.9	d2e
1453+526	14.04.91	3690-5690	335	0.0118	17.0	-16.7	sd1e
1504+514	12.02.91	3610-5630	222	0.0131	16.5	-17.1	sde

Table 1 (continued)

1	2	3	4	5	6	7	8
1524+554	14.03.91	3630-5670	263	0.0119	17.0	-16.7	d2e
1541+516	14.03.91	3640-5640	377	0.0360	18.0	-18.1	de
1541+590	12.02.91	3520-5560	279	0.0422	19.5	-17.0	se
1555+515	14.03.91	3640-5630	953	0.0131	18.0	-15.6	sde
1558+585	12.02.91	3520-5560	292	0.0144	18.0	-15.7	sd2e
1559+585	12.02.91	3520-5560	311	0.0142	14.5	-19.6	ds2e
1607+493	12.02.91	3520-5560	196	0.0453	17.5	-19.1	de
1610+586	12.02.91	3610-5630	159	0.0454	17.0	-19.7	ds2e
1614+600	12.02.91	3610-5630	168	0.0310	18.5	-17.3	s1e
1616+503	12.02.91	3610-5630	295	0.0433	16.0	-20.5	dse
1632+579	12.02.91	3700-5720	516	0.0181	19.0	-15.7	de
1707+565	20.03.91	3640-5660	247	0.0123	17.0	-16.9	se

DESCRIPTION

1304+539 - N_1, N_2, H_β, [OII] λ3727 emission lines are observed. The ratios $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta \sim 3$. The lines of Balmer series $H_\delta - H_{10}$ and H and K CaII are seen in absorption.

1315+606 - N_1, N_2, H_β, H_γ, [NeIII] λ3869 and [OII] λ3727 emission lines are present in this spectrum. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \sim 3$.

1315+593 - The emission lines N_1, N_2, H_β, [OII] λ3727 are observed in the blue region of the spectrum. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 3$. Balmer series lines H_δ-H_{10} are present in absorption.

1318+520 - There are the following emission lines N_1, N_2, H_β, H_γ and [OII] λ3727. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 3$.

1319+539 A- The spectrum shows strong emission lines N_1, N_2, H_β, H_γ, H_δ, [NeIII] $\lambda 3968 + H_\varepsilon$, [NeIII] λ3868 and [OII] λ3727. $N_1/H_\beta > 3$, [OII] $\lambda 3727 > H_\beta$. This object consists of two condensations, whose spectra are similar to each other and have comparable redshifts.

1332+545 - N_1, N_2, H_β, and [OII] λ3727 are observed in emission. $N_1/H_\beta < 3$, [OII] $\lambda 3727/H_\beta > 2.5$.

1332+599 - There are N_1, N_2, H_β, and [OII] λ3727 in emission, and H and K CaII in absorption. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta \sim 1.5$.

1333+573 - The emission lines N_1, N_2, H_β, [OII] λ3727 are observed with the following intensity ratios $N_1/H_\beta < 3$, [OII] $\lambda 3727/H_\beta \sim 1.5$.

1341+594 B- N_1, N_2, H_β, H_γ and [OII] λ3727 are seen in emission. $N_1/H_\beta \sim 3$, [OII] $\lambda 3727/H_\beta > 2.5$.

1351+552 - [OIII] λλ4959-5007, Balmer series lines $H_\beta - H_\varepsilon$ and [OII] λ3727 are observed in emission. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta > 2$.

1351+589 - This spectrum shows N_1, N_2, H_β, and [OII] λ3727 in emission. $N_1/H_\beta \geq 3$, [OII] $\lambda 3727 \sim H_\beta$.

1353+597 A- The emission lines N_1, N_2, H_β and [OII] λ3727 are observed in the blue region of the spectrum.

1353+597 B- N_1, N_2, H_β, [OII] λ3727 are present in emission. $N_1/H_\beta < 3$, [OII] λ3727/$H_\beta > 2.5$.

1357+563 - Emission line H_β is observed, [OII] λ3727 is suspected. The lines of Balmer series H_ε-H_{11} are seen in absorption.

1358+554 - N_1, N_2, H_β and [OII] λ3727 are observed in emission. $N_1/H_\beta = 3$.

1411+584 - There are low contrast emission lines of comparable intensities N_1, H_β, and [OII] λ3727, absorption lines H_γ-H_8, H and K CaII in this spectrum.

1421+544 - Strong emission lines are observed on the weak continuum: N_1, N_2, H_β - H_8, [OIII] λ4363, [NeIII] λ3869 and [OII] λ3727. $N_1/H_\beta > 3$, [OII]/$H_\beta < 1$.

1430+596 - The low contrast lines N_1, N_2, H_β are present in emission.

1430+521 - The emission lines N_1, N_2, H_β and [OII] λ3727 are observed. $N_1/H_\beta \geq 3$, [OII] λ3727/$H_\beta \sim 1$.

1446+595 - The following emission lines are seen in the spectrum: N_1, N_2, H_β, [OIII] λ4363, H_γ, H_δ, H_ε, [NeIII] λ3869+H_8 and [OII] λ3727. $N_1/H_\beta > 3$, [OII] λ3727 $\geq H_\beta$.

1453+526 - N_1, N_2, H_β are observed in emission. $N_1/H_\beta \sim 3$.

1504+514 - The spectrum shows the following emission lines N_1, N_2, H_β, HeII λ4686, H_γ-H_8, [NeIII] λ3869 and [OII] λ3727. $N_1/H_\beta > 3$, [OII] λ3727/$H_\beta \sim 2$.

1524+554 - The emission lines N_1, N_2, H_β - H_δ, and [OII] λ3727 are observed in the spectrum. $N_1/H_\beta \sim 3$, [OII] λ3727/$H_\beta > 1$.

1541+516 - N_1, N_2, H_β, H_γ and [OII] λ3727 are seen in emission. $N_1/H_\beta \geq 3$, [OII] λ3727/$H_\beta \sim 1$.

1541+590 - There are the following emission lines on the weak continuum: N_1, N_2, H_β, [OIII] λ4363, H_γ, H_δ, H_ε, H_8, [NeIII] λ3869, H_9-H_{11}, [OII] λ3727. $N_1/H_\beta > 3$, [OII] λ3727/$H_\beta < 1$.

1555+515 - N_1, N_2, [OII] λ3727 are seen in emission.

1558+585 - N_1, N_2, H_β, [OII] λ3727 in emission and H_ε-H_9, H and K Ca II in absorption are observed. $N_1/H_\beta < 3$, [OII] λ3727/$H_\beta > 1$.

1559+585 - This spectrum is similar to that of the previous object SBS 1558+585. N_1, N_2, H_β and [OII] λ3727 are observed in emission and H_ε - H_9 are seen in absorption. $N_1/H_\beta < 3$, [OII] λ3727/$H_\beta > 1$.

1607+493 - In this spectrum N_1, N_2, H_β and [OII] λ3727 are observed in emission. $N_1/H_\beta \sim 3$, [OII] λ3727/$H_\beta > 2$.

1610+586 - There are the following lines N_1, N_2, H_β-H_δ and [OII] λ3727 in emission. $N_1/H_\beta \sim 1$, [OII] λ3727/$H_\beta > 2$.

1614+600 - The emission lines N_1, N_2, H_β-H_δ and [OII] λ3727 are observed. $N_1/H_\beta \sim 1$, [OII] λ3727/$H_\beta > 1.5$.

1616+503 - N_1, N_2, H_β, [OIII] λ4363 and [OII] λ3727 emission lines are present.

$N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta \sim 1$. H and K CaII are seen in absorption. Probably a Seyfert type galaxy.

1632+579 - The following emission lines N_1, N_2, H_β, [OIII] $\lambda 4363 + H_\gamma$, H_δ, H_ε, H_8, [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ are observed. $N_1/H_\beta > 3$, [OII] $\lambda 3727 \sim H_\beta$.

1707+565 - There are N_1, N_2, H_β-H_8, [NeIII] $\lambda 3869$ and [OII] $\lambda 3727$ in emission in this spectrum. $N_1/H_\beta > 3$, [OII] $\lambda 3727/H_\beta > 1$.

CONCLUSION

All the galaxies have emission lines in their spectra.

SBS 1616+503 was discovered to be a probable Seyfert type galaxy.

It is noticed, that a considerable number of low luminosity galaxies have been discovered. They are 11 objects with $M_B < -17^m$.

At presents the slit spectra of about 400 galaxies from the Second Byurakan Spectral Sky Survey have been studied. These data could be used for selection of different type active galaxies.

REFERENCES

Drabek S.V., Kopylov 'I.M., Somov N.N., Somova T.A.: 1986, *Astrofiz. Issled. (Izv. SAO)*, **22**, 64.

Lipovetsky V.A., Stepanian J.A., Erastova L.K., Shapovalova A.I.: 1988, *Astrofizika*, **29**, 548.

Markarian B.E., Lipovetsky V.A., Stepanian J.A.: 1984, *Astrofizika*, **20**, 213; 1984, **21**, 35.

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Shapovalova A.I.: 1991, *Astrofizika*, **34**, 205.

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Shapovalova A.I., Gyulzadian M.B.: 1993a, *Astrofiz. Issled. (Izv.SAO)*, this issue, **V**.

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Shapovalova A.I., Hakopian S.A.: 1993b, *Astrofiz. Issled. (Izv. SAO)*, this issue, **VI**.

Stepanian J.A., Lipovetsky V.A., Erastova L.K., Gyulzadian M.B., Izotov Yu.I., Guseva N.G.: 1993c, *Astrofiz. Issled. (Izv. SAO)*, this issue, **VII**.