Search for emission-line galaxies towards nearby voids. Observational data*

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Abstract. We present the observational results of our search for emission-line galaxies (ELG) towards nearby voids. In order to find ELG, we started a survey using the IIIa-J objective prism plates from the Hamburg QSO Survey. The plates are digitized and an automatic procedure was applied to select the candidates. Digitized direct plates were used to determine coordinates and to reject overlaps between spectra. The accuracy of the coordinates is ±2". A total area of 1248 deg² was scanned, distributed in four different regions.

All the selected objects were observed with follow-up spectroscopy. We have obtained a final sample of 203 objects, of which 196 are emission-line galaxies, four are galaxies with absorption lines and three are QSOs. Almost half of our objects are newly discovered ones and three quarters of the given redshifts are new. Our sample contains mainly high ionization galaxies and is less sensitive in the detection of low-ionization objects.

The apparent magnitudes, as derived from the objective prism plates, range between 15.0 ≤ B ≤ 19.5. The sample is dominated by nearby galaxies, with a peak in the redshift distribution at cz=4500 km/s.

Key words: large scale structure - galaxies - redshift survey

1. Introduction

Recent redshift surveys of galaxies (e.g. the Center for Astrophysics Survey (CfA)), revealed that bright galaxies are distributed in sheet-like structures which surround large voids. This has been a subject of intense investigation since the proposal of such structures by Zeldovich et al. (1982). Still under debate is the question whether all galaxies follow this non-uniform distribution or if less luminous galaxies are more equally distributed. Given the limitation of the actual surveys, the observed emptiness of the voids may be a result of observational bias. From an observer's point of view, the galaxy maps may reflect special observational selection effects in surface brightness, integral magnitude or diameter. From the theoretical point of view, there has been the prediction (e.g. Kaiser 1986, Bardeen 1986) that luminous galaxies were formed preferentially in high-density regions of the Universe, thus giving us a biased view of the large-scale distribution of matter.

Several studies of the spatial distribution of galaxies, especially of dwarf galaxies, were carried out to overcome some of these biases (e.g. Binggeli et al. 1990, Thuan et al. 1991). Unfortunately the results were contradictory and no definitive conclusions were drawn. Some interesting results came from the study of the spatial distribution of emission-line galaxies (ELG) (Salzer 1989, Weistrop et al. 1992). These objects are intrinsically small, very compact and with low luminosities. In some cases they are so compact that they look almost stellar, with no obvious underlying galaxy. Such galaxies can easily be missed by surveys that select their candidates on morphological criteria or discriminate stars from galaxies by the apparent diameter of the latter, and thus are good candidates to fill up the voids. III galaxies can be recognised because of their typical emission-line spectrum and an efficient way to find them is to use objective prism plates.

We therefore started a project to search for ELG towards nearby voids, using an objective prism survey. This project belongs to a larger one, that has the aim of finding faint galaxies within the voids (Hopp and Kuhn 1995, Hopp et al. 1995). Previous results on this project showed that while the central part of the voids remains free of galaxies, some of the dwarfs populate the outskirts of the voids. Most of these dwarfs are emission-line galaxies.

During the last two decades much effort has been spent to discover large samples of ELG. One method is to use multiple exposures on the same plate through different filters and search for UV excess objects, as was done by the Kiso UV-Excess Galaxy Survey (Takase and Miyachi-Isebe 1988) and the Montreal Blue Galaxy Survey (Coziol et al. 1993, Coziol et al. 1994). A second method is to use low resolution objective prism Schmidt plates and search for galaxies with strong UV-continuum. This method was used by Markarian (1967) for the First Byurakan Spectral Sky Survey. Perhaps the most unambiguous method is to use objective prism surveys and search directly for the presence of emission-lines.
A new era in the survey techniques was opened by the use of grazings and CCD cameras as detectors (e.g. Palomar Transit Grism Survey, Schneider et al. 1994). While this kind of surveys have the advantage of going deeper, their small field of view makes the photographic plate surveys still competitive when covering wide fields.

In this paper we present an objective prism survey that used digitized plates and an automatic procedure to search for ELG candidates. All the objects selected from the plates were observed with follow-up spectroscopy, thus providing a complete sample of emission-line galaxies. The paper describes the selection of the sample and the follow-up observations. The study of the spatial distribution of our sample of emission-line galaxies, as well as their properties, will be given elsewhere.

The paper is organized as follows. In § 2 we describe the method used to select the candidates from the objective plates. In § 3 the follow-up spectroscopy is presented. In § 4 we discuss the results of our survey and § 5 contains the conclusions.

2. Selection of candidates on objective prism plates

We used published cone diagrams to identify nearby ($r_R \leq 75000 km/s$) voids. Four void regions were selected according to the following criteria: diameter larger than 20 Mpc ($H_0 = 75 km/s/Mpc$), completely empty of CfA galaxies, galactic latitude $b \geq 30^\circ$. The location of the four void regions can be found in Table 1, where we give the exact coordinates of all the fields surveyed.

The ELG candidates were selected on the objective prism plates taken in the frame of the Hamburg Quasar Survey (HQS) (Hagen et al. 1995). The plates are taken with the 80-cm Schmidt-telescope at the German-Spanish Observatories, Calar Alto (Spain). The telescope is equipped with a 1.7'' objective prism producing a dispersion of 1390 \AA/mm at H\alpha. The 24-cm \times 24-cm hypersensitized Kodak IIIa-J plates (spectral range: 3400 \AA\text{-}5500 \AA), covering a field of 5.5'' \times 5.5'', were scanned with low resolution (LR), using a PDS 1010G microdensitometer. The LR mode used a 100 \mu m slit running perpendicular to the direction of dispersion. After on-line background reduction and object recognition, LR spectra were stored on optical disks. Automated search software was applied to the LR digitized data to select spectra in a specific parameter space. The two parameters used were the density sum of intensity ("brightness") of the integrated spectra and the slope of the continuum ("colour"), which is again a function of the density sum. Brighter objects are redder because the sensitivity of the photographic plate increases with wavelength. The selected spectra were re-scanned individually with high resolution (HR) (30 \mu m slit) and the final digitized spectra were visually inspected for emission lines.

The range in density sum excludes very bright objects, that are not needed for our study, but also very faint objects, that lie very close to the detection limit of the plate. The limit at the very bright end helps us to decrease the number of uninteresting candidates, while bright galaxies (brighter than our threshold) with emission are still found due to their HI regions. These knots are found as individual objects and their brightnesses are therefore fainter than those of the underlying galaxies. Nevertheless, these bright galaxies are already known and contained in galaxy catalogs like the CfA. The incompleteness due to the faint limit in the low-density region was analyzed as follows. For three plates we extended our search to the very faint end (which is only 20% of the whole range used), and we found twice (or even more) as many candidates as in the normal range. Most of these extra spectra were very noisy and could not be classified. Thus the efficiency of finding interesting objects was rather reduced and the number of objects and the quality of the spectra depended more strongly on plate quality. Our tests showed that we can miss some faint emission-line galaxies, on the order of 2 per plate (0.06 deg$^{-2}$), but one can correct for these numbers. Due to our automated
search software, the incompleteness at the very faint end of the “brightness” parameter can be quantified. The other parameter, the slope of the continuum, is set so that only the bluest objects are selected. To do this we estimate the slope as a function of density sum, and for each bin of density sum, a fraction $f=0.15$ of the bluest objects are considered. The colour selection causes our sample to be dominated by very blue galaxies. In order to test this selection effect, we searched two plates without any restriction in the colour parameter. Our tests showed again that we can miss some emission-line galaxies that are redder than our selection criteria. These galaxies are usually strong emission-line objects and have also strong continua, that is produced by an underlying older population of stars. As we are more interested in dwarf emission line galaxies, we believe that our blue criteria help us to select a sample that is less contaminated by other kinds of emission-line galaxies. We will refer to our selection criteria as the blue criteria, though it includes a selection in a two parameter space.

The number of candidates for high resolution varies between 1500 and 3500 per plate, depending on the plate quality and on the galactic latitude. Those HR spectra which show strong [OIII] lines are selected the final sample of candidates. The [OIII] line appears as a distinctive peak near the green head of the objective prism spectra. Often the [OII] doublet can be identified too. Some typical HR objective prism spectra are given in the left panels of Fig. 4. The aim of the Hamburg Survey is to cover every Schmidt field with two plates, in order to allow the distinction between real emission-line objects and plate defects. Unfortunately the regions we scanned were not always covered by two plates, as the Hamburg sur-
Table 1. The coordinates of the centre of the plates that were scanned in our ELG Survey. The first column gives the void region (from 1 to 4) for which the plates were selected

| Region | Coordinates |
|--------|-------------|
| 1      | $\delta = 2.5^\circ$: $\alpha = 00^h20^m$; $00^h40^m$; $01^h00^m$; $01^h20^m$; |
|        | $\delta = 7.5^\circ$: $\alpha = 00^h20^m$; $00^h40^m$; $01^h00^m$; $01^h20^m$; $01^h40^m$; |
|        | $\delta = 12.5^\circ$: $\alpha = 00^h20^m$; $00^h41^m$; $01^h01^m$; $01^h21^m$; $01^h41^m$; |
|        | $\delta = 17.5^\circ$: $\alpha = 00^h21^m$; $00^h42^m$; $01^h03^m$; $01^h23^m$; $01^h44^m$; |
|        | $\delta = 22.5^\circ$: $\alpha = 00^h06^m$; $00^h21^m$; $00^h43^m$; $01^h04^m$; $01^h26^m$; |
| 2      | $\delta = 57.5^\circ$: $\alpha = 08^h12^m$; $08^h17^m$; $09^h22^m$; |
|        | $\delta = 62.5^\circ$: $\alpha = 08^h00^m$; $08^h40^m$; |
| 3      | $\delta = 32.5^\circ$: $\alpha = 13^h10^m$; $13^h33^m$; $13^h56^m$; $14^h19^m$; $14^h43^m$; |
|        | $\delta = 37.5^\circ$: $\alpha = 12^h37^m$; $13^h25^m$; $13^h50^m$; $14^h14^m$; $14^h30^m$; $15^h03^m$; |
|        | $\delta = 42.5^\circ$: $\alpha = 14^h04^m$; $14^h50^m$; $15^h16^m$; |
| 4      | $\delta = 47.5^\circ$: $\alpha = 16^h00^m$; $16^h28^m$; |
|        | $\delta = 52.5^\circ$: $\alpha = 16^h42^m$; $17^h13^m$; |
|        | $\delta = 57.5^\circ$: $\alpha = 16^h59^m$; $17^h34^m$; |

Typical exposure times were 10-15 minutes, depending primarily on the strength of the emission lines: strong-line objects were not observed as long as weaker line galaxies. The exposure time depends also on the brightness of the galaxy, though not so strongly. For example, for very faint objects with almost no underlying continuum but with strong emission features, an integration of 10 minutes brought enough fluxes in the emission lines to properly reduce the spectrum. By contrast, brighter objects, with strong continuum but very weak lines (or no obvious emission features in the objective spectra) had to be integrated longer.

The frames were biased and flatfield-corrected. For the extraction of the 1-dimensional spectra from the 2-dimensional data, the optimal extraction algorithm of Horne (1986) was used. The spectra were rebinned to a linear wavelength scale using a third or fifth order polynomial fitted to the dispersion curve of the comparison spectra. A flux calibration was applied, and finally the wavelength scale was checked by comparison with the night-sky lines. A more detailed description of the reduction procedure is given by Stickel et al. (1993).

Once fully reduced, the emission lines in each spectrum were measured by fitting a Gaussian. The quoted redshifts were derived as means of the redshifts determined from the individual strong lines, and the errors of the redshifts were calculated as error of the mean. The observed redshifts were further corrected for the motion of the Earth and transformed in heliocentric redshifts. The calculated errors were compared with the deviations obtained from the night-sky line measurements. We estimate that for the spectra taken in the runs 3-4, which consist of 85% of our data, the errors are $\Delta z=0.0001$. This value can increase up to $\Delta z=0.0002$ for some of the galaxies with very noisy spectra. For the rest of our spectra (15%) the errors are bigger, up to $\Delta z=0.005$. During run 7, some planetary nebulae with known redshifts were observed (NGC6543, NGC0040, NGC1501, NGC2022, NGC2392, PN2120), in order to check the quality of our wavelength calibration. The reference values of the planetary nebulae were taken from The Strasbourg-ESO Catalogue of Galactic Planetary Nebulae. (Acker et al. 1992)

In Fig. 2 we plotted the observed velocities versus the reference velocities and applied a linear fit. As one can see, the differences between our velocities and those from literature are in the range of the assumed errors. We obtain a correlation

3. Follow-up spectroscopy

We observed our candidates during several observing runs, most of them being carried out with the 2.2m telescope at the German-Spanish Observatory at Calar Alto (Almeria, Spain).
Table 2. Dates and set-up of the spectroscopic observations: BCCS: Boller & Chivens Cassegrain Spectrograph, CAOS: Calar Alto Faint Object Spectrograph at the 2.2 m telescope, PFFR: Prime focus focal reducer, ESO/Faint Object Spectrograph and Camera 2, CA: Calar Alto, LS: La Silla

| No. | Dates     | Telescope | Instrument | Spectral Range (Å) | Spectral Resolution (Å) |
|-----|-----------|-----------|------------|--------------------|-------------------------|
| 1   | 1994 Jan 2-3 | 2.2 m CA  | BCCS       | 3600-6500          | 6.5                     |
| 2   | 1994 Jan 4-9 | 2.2 m CA  | BCCS       | 3700-9000          | 6.5                     |
| 3   | 1994 June 8-11 | 2.2 m CA | CAOS 2.2 | 3900-8200          | 18                      |
| 4   | 1994 Oct 9-12 | 2.2 m CA  | BCCS       | 3600-9000          | 12                      |
| 5   | 1994 Oct 13 | 3.5 m CA  | PFFR       | 3500-7600          | 20                      |
| 6   | 1994 Dec 10 | 2.2 m LS  | EFOSC2     | 3500-5500          | 12                      |
| 7   | 1995 Jan 31-Feb 3 | 2.2 m CA | BCCS       | 3460-8600          | 12                      |

Table 3. Candidates with available redshifts from literature, observed with the purpose of testing the redshift accuracy.

| name   | our redshift | reference redshift | difference in redshift |
|--------|--------------|--------------------|------------------------|
| CG 0419 | 0.0114       | 0.0114             | 0.0000                 |
| DDO 166 | 0.0031       | 0.0032             | 0.0001                 |
| UM 065  | 0.0210       | 0.0210             | 0.0000                 |
| DDO 13  | 0.0021       | 0.0021             | 0.0000                 |
| UM 306  | 0.0170       | 0.0164             | 0.0006                 |

Fig. 2: The observed velocities of the planetary nebulae used to check the redshift errors, versus their reference velocities. A linear fit is applied to the data points and a correlation coefficient of 0.95 is obtained.

A further test came from the observations of some candidates that had redshifts given in the literature. In Table 3 we give the names of the galaxies observed together with their velocities, both measured and from the literature. In the last column we indicate the difference between our values and the reference ones. These galaxies were measured during the runs for which we estimated an error of 0.0001 in $z$. Besides UM 306, for which we obtained a big difference, the rest show differences of about 0.0001. In order to see if the estimated error of 0.0001 in $z$ is constant through all the runs where we assumed such an error, we observed a few candidates twice, in different runs. The results of these tests indicate that the errors do not change with the run.

Before starting the observations, we checked our lists of candidates with the present catalogs of galaxies and emission-line objects, in particular with the NASA Extragalactic Data Base (NED). Candidates found by other surveys with available redshifts were normally not reobserved. There were cases in which the candidates were contained also in other catalogs, but with unknown redshifts. We observed these, together with the newly discovered objects. All first priority candidates with unknown redshifts (182 out of 234) were measured and also some of our second priority ones (83). The latter were observed to test their nature and we did not intend to be complete with these objects. From the observed 182 first priority candidates, 126 showed emission lines, the rest being failures (either featureless spectra or stars). If we consider the whole sample of
dependence of the success rate with the apparent magnitude, and of the frequency of objects with available redshifts, the success rate of our selection is 76%. Some of our failures come from the fields covered only by one plate (see § 2). But more important is the dependence of the success rate with the apparent magnitude (see p. 290, Hopp et al. 1995). For brighter objects the success rate is almost 100%, decreasing for the fainter ones.

The observed objects are listed in Table 4, which contains only the objects for which a redshift was assigned (failures not included). Most of our spectra show the emission lines of \([\text{O} \, \text{I}] \lambda \lambda 3727, \, \lambda \lambda 3861, \, \lambda \lambda 4959, \, \lambda \lambda 5007, \, \lambda \lambda 5077, \, \lambda \lambda 5099, \, \lambda \lambda 6563, \) and \([\text{Si} \, \text{II}] \lambda \lambda 6716, \, \lambda \lambda 6730\). Many spectra also show the fainter emission lines of ion species like \([\text{Ne} \, \text{III}],[\text{He} \, \text{I}],[\text{O} \, \text{I}],[\text{O} \, \text{II}],[\text{Al} \, \text{II}],[\text{Fe} \, \text{II}],[\text{O} \, \text{III}],[\text{S} \, \text{II}],[\text{N} \, \text{II}],[\text{C} \, \text{II}],\) as well as some further Balmer lines, from \(H_g\) to \(H_\alpha\). These are mainly high ionization type spectra, which dominate our sample of ELG. We have even cases with very strong \([\text{O} \, \text{III}] \lambda \lambda 4959, 5007\), despite the short exposures that were used to take the spectra. Nevertheless there are also intermediate ionization spectra as well as low ionization ones, the latter coming mainly from the second priority sample. A few cases contain objects in which only \(H_\alpha\) and \([\text{Si} \, \text{II}]\) were detected. The spectra with only one line detection (four cases) are marked with an asterisk in Table 4. The table is organized as follows:

- **Column (1)** gives the name of our objects, which is built with the prefix HS (from Hamburg Survey), followed by the first four digits of the 1950.0 right ascension and declination;

- **Column (2)** gives alternate designations for those galaxies contained in other catalogs. The abbreviations are explained in the List of Abbreviations, given at the end of the table.

- **Column (3)** and (4) give the 1950.0 positions. The coordinates are derived from the Hamburg direct plates and have an accuracy of \(\pm 2\) arcsec. There are few cases in which some HII regions in normal galaxies were found. The coordinates refer then to the position of the HII region rather than to the centre of the galaxy. Special remarks are made for each case.

- **Column (5)** gives the heliocentric redshifts.

- **Column (6)** the B magnitudes as derived from the Hamburg objective prism plates (\(B_P\)) and

- **Column (7)** the magnitudes from literature. \(B_L\) (where available). For details of the magnitude calibration see Engels et al. (1994). The magnitude accuracy is 0.5 mag. Sometimes our magnitudes were fainter than those found in literature, because they refer only to the emission region, and not always to the underlying galaxy.

- **Column (8)** contains a flag S (from selection) that gives the selection criteria used to select the candidates from the objective prism spectra: E for emission candidate (first priority) and B for blue candidate (second priority) (see § 2)

- **Column (9)** contains either the number of the run in which the object was observed (with the prefix o - from observed) or the code of the reference, when the object had available redshift (with the prefix l - from literature). The numbers of the observing runs are the same as listed in Table 2. The codes for references are explained at the end of the table, in the “References to Table 4”.

- **Column (10)** contains special remarks.

Finding charts of all our newly discovered objects can be found in Fig. 4. We also give the finding charts of some of our objects that were previously known as IRAS sources but without any follow-up spectroscopy. The finding charts were prepared by means of the Palomar Sky Survey plates, digitized and distributed on CD-ROM by the Space Telescope Science Institute. Fields are \(10' \times 10'\). North is up, and east is to the left.

Some typical examples of our slit spectra are given in the right panels of Fig. 4, while the corresponding HR objective prism spectra can be found in the left panels. In the last slit spectrum, HS0153+2205, the \([\text{O} \, \text{III}]\) line is under the limit of a clear detection, the only lines being the \(H_\alpha\)-\(\text{NII}\). The corresponding objective prism spectrum was very noisy, and what appeared to be an \([\text{O} \, \text{II}]\) line was in fact spurious. We also give the spectrum of a Sy 1 galaxy, HS0814+6439. The identified emission lines are listed in Table 5 while the lengthy discussion of their strength is left for a separate paper. Those objects which are certainly stars are listed in Table 6.
| object name | other names | R.A. | Decl. | redshift | $B_H$ | $B_L$ | S | run or reference | remarks |
|-------------|-------------|------|-------|----------|-------|-------|---|----------------|---------|
| HS0000+2252 | IRAS F00000+2252 | 00 00 01.0 | +22 52 20 | 0.0730 | 16.3 | 17.33 | E | o4 | IrS |
| HS0000+2422 | NPM1G +22.0001 | 00 00 26.0 | +24 22 35 | 0.0382 | 17.0 |       | E | o4 | IrS |
| HS0006+2133 | IRAS 00067+2133 | 00 06 43.7 | +21 33 09 | 0.0774 | 17.5 | 16.9 | E | I12 | IrS |
| HS0013+0809 |              | 00 13 02.0 | +08 09 37 | 0.0844 | 19.3 |       | E | o7 |       |
| HS0013+1942 |              | 00 13 14.4 | +19 42 08 | 0.0258 | 17.1 |       | E | o4 | abs |
| HS0013+2241 |              | 00 13 15.0 | +22 41 45 | 0.0217 | 17.7 |       | E | o4 |       |
| HS0016+1449 |              | 00 16 35.7 | +14 49 44 | 0.0147 | 17.6 |       | E | o7 |       |
| HS0020+0656 | UM 029       | 00 20 18.4 | +06 56 53 | 0.051  | 18.0 |       | E | I77 |       |
| HS0021+1347 | UM 241       | 00 21 50.5 | +13 47 33 | 0.0144 | 16.5 |       | E | o2 |       |
| HS0022+0014 | UM 241       | 00 22 46.1 | +00 14 54 | 0.0139 | 16.3 |       | E | o4 |       |
| HS0023+0145 | UM 241       | 00 23 44.8 | +19 45 23 | 0.0926 | 18.2 |       | E | o5 |       |
| HS0024+2314 | UM 241       | 00 24 15.4 | +23 14 37 | 0.0238 | 18.0 |       | E | o4 |       |
| HS0024+2422 | UM 241       | 00 24 32.2 | +10 22 28 | 0.0671 | 17.6 |       | E | o2 |       |
| HS0026+0332 | UM 241       | 00 26 52.4 | +03 32 49 | 0.0410 | 17.5 |       | E | o4 |       |
| HS0028+1747 | UM 241       | 00 28 42.1 | +17 47 58 | 0.0978 | 18.1 |       | E | o7 |       |
| HS0029+1748 | NPM1G +17.0024 | 00 29 26.5 | +17 48 11 | 0.0073 | 17.5 | 18.03 | E | o7 |       |
| HS0029+1443 | UM 258       | 00 29 42.3 | +14 43 38 | 0.0175 | 17.2 |       | E | o7 |       |
| HS0032+0116 | UM 258       | 00 32 03.3 | +01 16 10 | 0.0147 | 19.0 |       | E | o7 |       |
| HS0033+0421 | UGC 00359    | 00 33 36.0 | +04 21 37 | 0.01637| 16.5 | 15.5  | E | I19 | IrS |
| HS0035+0725 |              | 00 35 45.9 | +07 25 29 | 0.8541 | 18.3 |       | E | o7 | QSO |
| HS0036+0437 |              | 00 36 01.6 | +04 37 19 | 0.6289 | 17.3 |       | E | o4 |       |
| HS0036+0532 |              | 00 36 05.7 | +05 32 32 | 0.3884 | 18.5 |       | E | o5 |       |
| HS0037+0111 |              | 00 37 45.2 | +01 11 18 | 0.0136 | 17.0 |       | E | o4 |       |
| HS0038+0122 | PC 0038+0122 | 00 38 06.1 | +01 22 52 | 0.066  | 17.6 | 18.11 | B | i67 |       |
| HS0040+0952 |              | 00 40 51.5 | +09 52 29 | 0.0156 | 17.3 |       | E | o4 |       |
| HS0041+2333 |              | 00 41 41.3 | +23 33 36 | 0.0218 | 17.7 |       | E | o4 |       |
| HS0043+0531 |              | 00 43 16.2 | +05 31 37 | 0.0408 | 17.6 |       | E | o7 |       |
| HS0044+0453 | UM 065       | 00 44 52.8 | +04 53 27 | 0.021  | 17.2 |       | E | I77 |       |
| HS0045+0902 | UM 279       | 00 45 55.6 | +09 20 50 | 0.0381 | 18.9 |       | E | o7 |       |
| HS0049+0006 | UM 282       | 00 49 13.4 | +00 06 33 | 0.037  | 19.1 | 18    | E | I77 |       |
| HS0049+0017 | UCM 0044-0006 | 00 49 15.5 | +00 17 38 | 0.0150 | 17.0 | 16.76 | E | I58 |       |
| HS0051+0027 |              | 00 51 22.4 | +00 27 27 | 0.0202 | 18.9 |       | E | o7 |       |
| HS0051+0555 | UM 077       | 00 51 44.4 | +05 55 35 | 0.017  | 18.6 |       | B | I77 |       |
| HS0052+2119 |              | 00 52 33.0 | +21 19 52 | 0.0434 | 17.7 |       | E | o4 |       |
| HS0055+0104 | UM 293       | 00 55 19.8 | +01 04 04 | 0.0567 | 16.8 | 16.4  | E | I13 | Sy1.5 |
| HS0056+0044 | UM 295       | 00 56 21.3 | +00 44 09 | 0.0176 | 17.2 |       | E | o4 |       |
| HS0056+0043 | UM 296       | 00 56 30.0 | +00 43 55 | 0.0180 | 16.5 | 16.58 | E | I58 | IrS |
| object name | other names | R.A. | Decl. | redshift | $B_H$ | $B_L$ | S | run or reference | remarks |
|-------------|-------------|------|-------|----------|-------|-------|---|-----------------|--------|
| HS0058+1847 | UM 082      | 00 58 52.6 | +18 47 25 | 0.0376 | 17.4 | E | o7 |                  |        |
| HS0058+0638 | NPM1G +06.0048 | 00 58 44.7 | +06 38 42 | 0.051 | 17.2 | 17.88 | E | I77 |                  | Sy 2   |
| HS0101+0310 |            | 01 01 24.9 | +03 10 56 | 0.0564 | 17.3 | E | o4 |                  |        |
| HS0183+2441 |            | 01 03 42.0 | +24 41 12 | 0.0541 | 17.1 | B | o5 |                  |        |
| HS0103+1242 | IRAS F01037+1422 | 01 03 46.4 | +12 42 29 | 0.0447 | 16.5 | E | o4 |                  | IrS    |
| HS0104+0622 | UM 085      | 01 04 09.3 | +06 22 00 | 0.041 | 17.2 | 17.29 | E | I77 |                  | Sy 2   |
| HS0105+1304 |            | 01 06 14.5 | +13 04 14 | 0.0597 | 16.8 | E | o4 |                  |        |
| HS0107+1946 |            | 01 07 29.7 | +19 46 38 | 0.0423 | 18.0 | E | o4 |                  |        |
| HS0107+2458 |            | 01 07 58.5 | +24 58 26 | 0.0394 | 17.3 | B | o5 |                  |        |
| HS0110+0150 | UM 306      | 01 08 00.4 | +01 50 52 | 0.0176 | 15.9 | E | o4 |                  |        |
| HS0108+0103 | UM 307      | 01 08 56.6 | +01 03 19 | 0.0228 | 17.6 | 14.31 | E | I77 | HI1 region in an Sdm | IrS   |
| HS0110+2149 | NPM1G +21.0055 | 01 10 31.6 | +21 49 54 | 0.0563 | 18.3 | 16.69 | E | o4 |                  |        |
| HS0111+1560 | UGC 0074    | 01 11 12.4 | +13 00 25 | 0.0491 | 16.8 | 14.76 | E | I13 | Sy 1 | IrS | Radio S |
| HS0111+2115 | NPM1G +21.0056 | 01 11 55.6 | +21 15 25 | 0.0318 | 16.3 | 16.42 | E | o7 |                  |        |
| HS0113+1750 |            | 01 13 59.5 | +17 50 03 | 0.0626 | 18.5 | E | o7 |                  |        |
| HS0115+1156 | MRK 0979    | 01 15 22.6 | +11 56 38 | 0.0190 | 15.6 | 15.5 | E | I44 |                  |        |
| HS0116+2244 | NPM1G +22.0058 | 01 16 53.0 | +22 44 33 | 0.0439 | 17.2 | 16.80 | B | o7 |                  | abs   |
| HS0117+1017 |            | 01 17 13.6 | +10 17 33 | 0.0342 | 16.5 | E | o6 |                  |        |
| HS0117+1135 |            | 01 17 29.8 | +11 35 17 | 0.0615 | 16.2 | B | o7 |                  |        |
| HS0118+1126 |            | 01 18 36.4 | +12 36 49 | 0.0198 | 16.7 | E | o6 |                  |        |
| HS0119+0331 | UM 099      | 01 19 32.6 | +03 31 41 | 0.0237 | 16.5 | E | o4 |                  |        |
| HS0119+0044 | IRAS 01197+0044 | 01 19 43.9 | +00 44 42 | 0.0555 | 16.9 | E | I72 |                  | IrS    |
| HS0122+0473 | UGC 00993   | 01 22 57.1 | +04 43 47 | 0.0075 | 17.6 | 15.00 | E | I19 |                  |        |
| HS0123+1624 |            | 01 23 36.3 | +16 24 55 | 0.0290 | 17.2 | E | o7 |                  |        |
| HS0124+1126 | NPM1G +11.0056 | 01 24 46.4 | +11 26 42 | 0.0327 | 16.7 | 17.36 | E | o6 |                  |        |
| HS0131+1397 | IRAS F01318+1396 | 01 31 52.3 | +13 37 04 | 0.0359 | 17.6 | E | o7 |                  | IrS    |
| HS0134+1341 |            | 01 33 43.0 | +13 41 43 | 0.0239 | 17.7 | E | o7 |                  |        |
| HS0137+1539 | UGC 01176   | 01 37 36.4 | +15 39 34 | 0.0021 | 18.8 | 14.4 | E | o7 |                  | HI1 region in an Im |
| DDO 013    | [BC2] A0137+15 |           |       |          |       |       |   |     |                  |        |
|            | LGG 029: [G93] 006 |           |       |          |       |       |   |     |                  |        |
| HS0138+0458 | UM 126      | 01 38 48.8 | +04 58 04 | 0.032 | 17.4 | 18.0 | E | I80 |                  |        |
| HS0141+0719 |            | 01 41 23.4 | +07 19 46 | 0.023 | 16.3 | E | I80 |                  |        |
| HS0142+1651 | MRK 0361    | 01 42 03.7 | +16 51 31 | 0.0275 | 15.8 | 15.6 | E | I50 |                  |        |
| HS0143+2400 | NPM1G +16.0052 | 01 43 07.5 | +24 00 55 | 0.0346 | 18.4 | E | o7 |                  |        |
| object name | other names | R.A. | Decl. | redshift | B_H | B_L | S | run or reference | remarks |
|-------------|-------------|------|-------|----------|-----|-----|---|-----------------|---------|
| HS0143+0549 | UM 138      | 01 43 51.1 | +65 49 57 | 0.018     | 16.2 | 17.7 | E | 180             |         |
| HS0148+2170 |             | 01 48 32.0 | +17 00 13 | 0.647     | 16.8 |       | B | 07              |         |
| HS0148+2173 |             | 01 48 18.4 | +21 23 51 | 0.0165    | 17.2 |       | E | 07              |         |
| HS0153+2205 |             | 01 53 17.9 | +22 05 05 | 0.0664    | 18.0 |       | E | 07              |         |
| HS0733+6248 |             | 07 31 42.3 | +63 48 27 | 0.3447    | 18.6 |       | B | 02 Sy1          |         |
| HS0732+6503 |             | 07 32 09.2 | +65 03 38 | 0.0217    | 17.2 |       | B | 01              |         |
| HS0737+6442 |             | 07 37 35.2 | +64 42 18 | 0.036     | 17.7 |       | E | 180             |         |
| HS0746+6139 | KUG 0746+616| 07 46 54.6 | +61 39 40 | 0.023     | 18.7 |       | E | 180             |         |
| HS0747+6456 |             | 07 47 05.1 | +64 56 42 | 0.0247    | 16.5 |       | E | 02              |         |
| HS0749+5649 |             | 07 49 37.7 | +56 49 48 | 0.0190    | 17.4 |       | E | 07              |         |
| HS0750+6019 |             | 07 50 54.7 | +60 19 27 | 0.0356    | 17.8 |       | E | 02              |         |
| HS0752+5603 |             | 07 52 45.1 | +56 03 07 | 0.0275    | 16.5 |       | B | 07              |         |
| HS0752+6147 |             | 07 52 48.3 | +61 47 43 | 0.0287    | 16.0 |       | E | 01              |         |
| HS0757+6441 |             | 07 57 19.2 | +64 41 52 | 0.0733    | 17.7 |       | B | 05              |         |
| HS0805+5742 | IRAS F08054+5742 | 08 05 25.6 | +57 42 30 | 0.0271    | 17.4 |       | B | 07 IrS          |         |
| HS0808+5842 | SDS 0808+587 | 08 08 11.0 | +58 42 48 | 0.0272    | 17.7 | 15.5  | E | 143 Sy 2 IrS    |         |

VII Zw 217
CGCG 287-051
CGCG 0808.1+5843
CGPG 0808.1+5842
IRAS F08082+5842

| object name | other names | R.A. | Decl. | redshift | B_H | B_L | S | run or reference | remarks |
|-------------|-------------|------|-------|----------|-----|-----|---|-----------------|---------|
| HS0814+6439 |             | 08 14 47.8 | +64 39 03 | 0.0296    | 17.1 |       | E | 02 Sy1          |         |
| HS0831+6215 |             | 08 31 18.4 | +62 15 43 | 0.0187    | 17.5 |       | E | 07              |         |
| HS0838+6253 |             | 08 38 45.2 | +62 53 07 | 0.0044    | 16.0 |       | E | 01              |         |
| HS0847+6112 | MRK 0999    | 08 47 25.4 | +61 12 30 | 0.0125    | 16.2 | 16.6  | E | 144             |         |
| HS0912+5959 | MRK 0019    | 09 12 54.2 | +59 59 00 | 0.0141    | 16.7 | 16.0  | E | 145 G pair. IrS |         |
| HS0915+5540 |             | 09 15 35.8 | +55 46 35 | 0.0494    | 17.2 |       | E | 07              |         |
| HS0930+5527 | MRK 0116    | 09 30 30.3 | +55 27 46 | 0.0031    | 16.2 | 15.6  | E | 145             |         |
| I Zw 18     |             | 01 34 56.3 | +67 07 02 | 0.0125    | 17.2 |       | E | 07              |         |

HS1222+3741 | CG 1022     | 12 22 08.2 | +37 41 13 | 0.0469    | 18.1 |       | E | 07              |         |
| HS1223+3938 | NPMJG +39.0289 | 12 23 29.8 | +39 38 30 | 0.0366    | 16.8 | 16.92  | E | 07              |         |
| HS1232+3846 |             | 12 32 15.5 | +38 46 56 | 0.0528    | 17.2 |       | E | 07              |         |
| HS1232+3947 |             | 12 32 54.6 | +39 47 37 | 0.0210    | 17.2 |       | E | 07              |         |
| HS1232+3612 | KUG 1232+362 | 12 32 59.5 | +36 12 52 | 0.0425    | 16.2 |       | E | 07 G pair       |         |
| HS1236+3821 | UGC 07816   | 12 36 31.8 | +38 21 51 | 0.0073    | 15.4 |       | E | 07              |         |
| HS1244+3648 |             | 12 44 37.0 | +36 48 05 | 0.0472    | 16.4 |       | E | 07              |         |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| object name | other names | R.A. | Decl. | redshift | B_H | B_L | S | run or reference | remarks |
| HSi254+3323 | | 12 54 46.3 | +33 23 27 | 0.0032 | 17.7 | B | o1 | abs |
| HSi255+3506 | | 12 55 22.2 | +33 06 32 | 0.0155 | 17.1 | E | o2 |
| HSi256+3505 | CG 1058 | 12 56 02.9 | +35 05 10 | 0.0342 | 16.5 | E | o2 |
| HSi256+3512 | | 12 56 51.2 | +35 12 19 | 0.0035 | 16.8 | E | o2 |
| HSi301+4312 | | 13 01 05.5 | +33 12 27 | 0.0371 | 17.8 | E | o3 |
| HSi301+4325 | | 13 01 20.0 | +33 25 37 | 0.0246 | 17.5 | B | o2 |
| HSi301+43209 | | 13 01 59.4 | +32 09 02 | 0.0238 | 17.8 | E | o7 |
| HSi302+4306 | | 13 02 35.4 | +30 46 30 | 0.0355 | 16.0 | E | o3 | * |
| HSi304+4329 | CG 1085 | 13 04 03.7 | +35 29 43 | 0.0165 | 16.6 | E | o3 |
| HSi306+4325 | CG 1090 | 13 06 10.0 | +35 25 40 | 0.0165 | 16.6 | E | o3 |
| HSi306+4330 | | 13 06 12.8 | +33 20 39 | 0.0270 | 16.6 | E | o3 |
| HSi306+43527 | | 13 06 29.5 | +35 27 25 | 0.0371 | 17.0 | E | o7 |
| HSi308+43044 | CG 0984 | 13 08 42.5 | +30 44 55 | 0.0209 | 16.3 | B | o7 |
| HSi309+4309 | CG 1099 | 13 09 00.0 | +34 09 11 | 0.0785 | 17.0 | B | o7 |
| HSi309+4341 | KUG 1309+345B | 13 09 45.4 | +34 31 15 | 0.0168 | 16.2 | E | o3 | spiral |
| HSi311+43628 | UGC 08303 | 13 11 00.0 | +36 28 02 | 0.0031 | 18.0 | 13.48 | E | o7 | IrS, HII region |
| DDO 166 | CGCG 1311.0+3628 | MCG +06-29-061 | IRAS F13110+3628 | [RC2] A1310+36 | [RC1] A1311 | LGG 334;[G93] 004 |
| HSi312+3847 | | 13 12 14.1 | +38 47 53 | 0.0515 | 17.3 | E | o7 |
| HSi312+3508 | | 13 12 28.3 | +35 08 47 | 0.0035 | 18.1 | E | o3 |
| HSi318+4346 | CG 1131 | 13 18 36.1 | +34 06 45 | 0.0352 | 16.6 | E | o3 |
| HSi319+4384 | NGC 5107 | 13 19 08.3 | +38 48 05 | 0.00316 | 17.4 | 13.81 | E | l68 | IrS |
| MRK 1346 | KUG 1319+387 | CGCG 217-033 | CGCG 1319.1+3848 | MCG +07-28-001 | IRAS 13191+3847 | IRAS F13191+3848 | LGC 334;[G93] 011 |
| HSi323+43211 | KUG 1323+321 | [SMB88] 0540 | | | | | | * | SBa(s) |
| HSi323+43319 | WAS 69 | 13 23 31.4 | +33 19 28 | 0.0153 | 16.7 | E | o3 |
| HSi323+43316 | MRK 0453 | 13 23 40.8 | +33 16 16 | 0.0465 | 16.4 | 16.5 | E | l44 | IrS |
| object name | other names | R.A. | Decl. | redshift | B_H | B_L | S | run or reference | remarks |
|-------------|-------------|------|-------|----------|-----|-----|---|--------------------|---------|
| HS1328+3132 | UGC 08602 | 13 28 21.5 | +31 32 35 | 0.0342 | 15.3 | 14.6 | E | I14 |         |
|             | CGCG 1328.3+3132 |       |       |          |     |     |   |                     |         |
|             | MCG +05-32-035 |       |       |          |     |     |   |                     |         |
|             | MRK 0455 |       |       |          |     |     |   |                     |         |
|             | VV 326a |       |       |          |     |     |   |                     |         |
|             | [RC2] A1328+31 |       |       |          |     |     |   |                     |         |
|             | CGCG 161-074 |       |       |          |     |     |   |                     |         |
|             | [SMB88] 0767 |       |       |          |     |     |   |                     |         |
|             | CGCG 161-074E |       |       |          |     |     |   |                     |         |
|             | KUG 1328+315 |       |       |          |     |     |   |                     |         |
| HS1328+3424 | KUG 1328+344 | 13 28 44.5 | +34 24 35 | 0.0227 | 16.8 | B | 07 | G pair |         |
| HS1329+3703 | KUG 1329+3703 | 13 29 52.7 | +37 03 39 | 0.0557 | 16.9 | E | 07 |         |         |
| HS1330+3651 | MRK 0459 | 13 30 54.1 | +36 51 54 | 0.0167 | 16.7 | E | 07 |         |         |
| HS1331+3906 | KUG 1331+391 | 13 31 17.7 | +39 06 32 | 0.0643 | 16.4 | B | 07 |         |         |
| HS1332+3417 | MRK 0459 | 13 32 54.0 | +34 17 23 | 0.0241 | 15.7 | 17.0 | E | I14 | G pair |
|             | [RC2] A1332+34C |       |       |          |     |     |   |                     |         |
|             | CG 1165 |       |       |          |     |     |   |                     |         |
| HS1333+3149 | CGCG 1336.2+3115 | 13 33 06.8 | +31 49 36 | 0.0248 | 15.9 | E | 03 |         |         |
| HS1333+3058 | CGCG 1336.1+307 | 13 33 17.3 | +30 58 25 | 0.0402 | 17.3 | E | 03 |         |         |
| HS1334+3957 | CGCG 1336.3+312 | 13 34 11.5 | +39 57 32 | 0.0083 | 16.9 | E | 07 |         |         |
| HS1336+3114 | CGCG 1336.2+3115 | 13 36 12.5 | +31 14 26 | 0.0158 | 15.7 | B | 07 |         |         |
| HS1336+3650 | CGCG 1338.9+3038 | 13 36 43.8 | +36 50 56 | 0.0202 | 17.1 | E | 07 | G pair, IrS |         |
| HS1338+3037 | MRK 0268 | 13 38 54.0 | +30 37 51 | 0.0410 | 16.2 | E | I13 | G pair, IrS |         |
| HS1339+3046 | MRK 0067 | 13 39 39.5 | +30 46 17 | 0.0029 | 15.7 | 16.5 | E | I51 | IrS |
| HS1340+3307 | CG 1176 | 13 40 08.6 | +33 07 19 | 0.0158 | 16.8 | E | 03 |         |         |
| HS1340+3207 | CG 1176 | 13 40 28.3 | +32 07 59 | 0.0365 | 16.8 | E | 03 |         |         |
| HS1341+3409 | CG 1176 | 13 41 50.9 | +34 09 50 | 0.0171 | 17.3 | E | 03 |         |         |
| HS1344+3511 | IRAS F1344+3511 | 13 44 54.0 | +35 11 35 | 0.0539 | 16.8 | 16 | E | I12 | IrS |
| HS1344+3511 | IRAS F1344+3511 | 13 44 54.0 | +35 11 35 | 0.0539 | 16.8 | 16 | E | I12 | IrS |
| HS1349+4027 | MRK 0562 | 13 49 17.8 | 40 27 35 | 0.0079 | 17.0 | 15.38 | E | I44 |         |
| HS1349+3942 | NPM1G +40.0336 | 13 49 22.9 | +39 42 03 | 0.0054 | 16.7 | 15.86 | E | 07 |         |
| object name | other names | R.A.  | Decl.  | redshift | B_H | B_L | S  | run or reference | remarks |
|------------|-------------|-------|--------|----------|-----|-----|----|----------------|---------|
| HS1353+3849 | MRK 0464 | 13 53 45.4 | +38 49 07 | 0.0510 | 16.9 | 16.5 | E  | 13 | Sy 1.5, XrayS |
|            | KUG 1353+388 |       |        |          |     |     |    |                |         |
|            | HS 1356+390 |       |        |          |     |     |    |                |         |
|            | XRS 13505+390 |      |        |          |     |     |    |                |         |
| HS1354+3634 | CG 1200 | 13 54 27.5 | +36 34 28 | 0.0167 | 17.2 |     | B  | o7            |         |
| HS1354+3635 | CG 1201 | 13 54 29.8 | +36 35 39 | 0.0171 | 16.1 | 15  | B  | o7            |         |
| HS1400+3927 | CG 0330 | 14 00 29.8 | +39 27 37 | 0.0045 | 17.2 | 17  | E  | 178          |         |
| HS1402+3657 | MRK 1369 | 14 02 06.6 | +36 57 53 | 0.0120 | 15.5 | 17.0 | E  | 144 | IrS            |
|            | IRAS F14021+3657 |       |        |          |     |     |    |                |         |
|            | CG 0340 |               |        |          |     |     |    |                |         |
|            | NPMG +36.0325 | |      |          |     |     |    |                |         |
| HS1402+3650 | CG 0368 | 14 02 39.2 | +36 50 45 | 0.0347 | 16.3 |     | E  | o7            |         |
| HS1408+4429 | CG 0368 | 14 08 23.6 | +44 29 01 | 0.0533 | 16.9 | 16  | B  | 188          |         |
| HS1408+4201 | CG 0367 | 14 08 39.7 | +42 01 06 | 0.0939 | 17.9 |     | B  | o7, abs       |         |
| HS1410+4367 | CG 0366 | 14 10 02.1 | +36 27 15 | 0.0338 | 16.9 |     | E  | o7            |         |
| HS1410+4346 | MRK 0467 | 14 10 21.5 | +34 46 57 | 0.0316 | 15.8 | 16.5 | E  | 144 | IrS            |
|            | [RC2] A1410+34 |       |        |          |     |     |    |                |         |
|            | IRAS F14103+3447 |       |        |          |     |     |    |                |         |
|            | KUG 1410+347 |       |        |          |     |     |    |                |         |
|            | CG 0374 |               |        |          |     |     |    |                |         |
| HS1413+4402 | IRAS F14131+4402 | 14 13 08.2 | +44 02 07 | 0.0698 | 17.4 |     | B  | o7            | IrS     |
| HS1413+3956 | IRAS F14131+3955 | 14 13 10.4 | +39 56 08 | 0.0426 | 16.1 | 16.5 | E  | 16 | IrS            |
|            | KUG 1413+399 |               |        |          |     |     |    |                |         |
|            | NPMG +39.0344 | |      |          |     |     |    |                |         |
| HS1415+4203 | KUG 1416+359 | 14 15 57.1 | +42 02 05 | 0.0683 | 18.1 |     | B  | o7            |         |
| HS1416+3554 | KUG 1416+359 | 14 16 03.3 | +35 54 27 | 0.0163 | 17.0 | 16  | E  | o7, spiral    |         |
| HS1419+3639 | UGC 09218 | 14 19 16.2 | +36 39 19 | 0.0114 | 16.2 | 16.5 | E  | 159 | Sb             |
| HS1420+3437 | CG 0419 | 14 20 59.2 | +34 37 05 | 0.0246 | 18.2 |     | E  | o7            |         |
| HS1421+4018 | CG 0419 | 14 21 37.9 | +40 18 43 | 0.0982 | 17.6 |     | B  | o7            |         |
| HS1422+3325 | CG 0419 | 14 22 18.9 | +33 25 58 | 0.0341 | 18.5 |     | E  | o7            |         |
| HS1422+3329 | CG 0419 | 14 22 53.7 | +33 39 22 | 0.0114 | 17.1 |     | E  | o7            |         |
| HS1425+3835 | CG 0435 | 14 25 14.6 | +38 35 33 | 0.0223 | 16.8 | 16  | E  | o7            |         |
| HS1429+3451 | CG 0457 | 14 29 14.3 | +34 51 17 | 0.0444 | 17.5 | 17.3 | E  | o7            |         |
| HS1429+3514 | CG 1236 | 14 29 35.4 | +35 43 59 | 0.0117 | 16.7 | 16.9 | E  | o7            |         |
|            | NPMG +31.0320 | |      |          |     |     |    |                |         |
| HS1429+4511 | IRAS F14451+4511 | 14 29 45.9 | +45 11 41 | 0.0321 | 18.0 |     | E  | o7            |         |
| HS1435+4523 | MRK 0475 | 14 35 06.7 | +45 23 03 | 0.1267 | 18.3 |     | B  | o7            |         |
| HS1437+3701 | MRK 0475 | 14 37 03.6 | +37 01 12 | 0.0018 | 16.4 | 14.47 | E  | 144 |         |
|            | CG 0493 |               |        |          |     |     |    |                |         |
| HS1438+3147 | CG 1250 | 14 38 33.7 | +31 47 39 | 0.0443 | 18.4 | 18  | E  | o7            |         |
| HS1440+3805 | NPMG +38.0321 | 14 40 08.8 | +38 05 06 | 0.0322 | 16.7 | 17.0 | B  | o7            |         |
| HS1440+4302 | CG 0603 | 14 40 22.3 | +43 02 32 | 0.0085 | 17.6 | 17.0 | E  | o7            |         |
|            | NPMG +43.0283 | |      |          |     |     |    |                |         |
| HS1442+4250 | CG 0523 | 14 42 17.9 | +42 50 13 | 0.0025 | 17.7 |     | E  | o7            |         |
| HS1442+4322 | CG 0523 | 14 42 26.5 | +43 32 19 | 0.0811 | 17.5 | 16  | B  | o7            |         |
| HS1444+3114 | IRAS F14440+3114 | 14 44 01.6 | +31 14 23 | 0.0297 | 16.1 | 17  | E  | o7, IrS       |         |
|            | CG 1260 |               |        |          |     |     |    |                |         |
| HS1450+3854 | CG 0565 | 14 50 21.9 | +38 44 34 | 0.0140 | 17.8 | 16  | E  | 178 |         |
|            | [SP82] 25 |       |        |          |     |     |    |                |         |
| HS1502+4152 | MRK 0475 | 15 02 31.3 | +41 52 35 | 0.0164 | 19.1 |     | B  | o7            |         |
| object name | other names | R.A. | Decl. | redshift | $B_H$ | $B_L$ | S | run or reference | remarks |
|-------------|-------------|------|-------|----------|-------|-------|---|----------------|---------|
| HS1504+3922 | CG 0624     | 15 04 15.5 | 39 22 15 | 0.0302   | 18.8  | 17    | E | I78          |         |
|             |             |       |       |          |       |       |   |              |         |
| HS1505+3944 | CG 0632     | 15 05 53.6 | +39 44 19 | 0.0366   | 17.6  | 16    | E | o7          |         |
| HS1507+4375 | CG 0644     | 15 07 38.1 | +37 43 06 | 0.0322   | 18.3  | 18    | E | o7          |         |
| HS1522+4214 | CG 0702     | 15 22 23.3 | +42 14 40 | 0.0196   | 17.1  | B     | o7 |             |         |
| NPMG +42.043 |            |       |       |          |       |       |   |              |         |
| HS1524+4205 |             | 15 24 08.0 | +42 05 01 | 0.0225   | 18.4  | E     | o7 |             |         |
| HS1526+4045 |             | 15 26 56.7 | +40 45 17 | 0.0288   | 17.7  | B     | o7 |             |         |
| HS1543+4525 |             | 15 43 23.3 | +45 25 45 | 0.0389   | 17.4  | E     | o3 |             |         |
| HS1544+4736 |             | 15 44 28.0 | +47 36 20 | 0.0195   | 18.0  | E     | o3 |             |         |
| HS1546+4755 |             | 15 46 56.3 | +47 55 34 | 0.0377   | 18.9  | E     | o3 |             |         |
| HS1548+4745 | PC 1548+4745 | 15 48 04.2 | +47 45 09 | 0.070    | 18.9  | B     | 167|             |         |
| HS1549+4630 | PC 1549+4630 | 15 49 35.5 | +46 30 37 | 0.098    | 18.9  | B     | 167|             |         |
| HS1609+4827 |             | 16 09 44.4 | +48 27 44 | 0.0096   | 16.4  | E     | o3 |             |         |
| HS1610+4539 |             | 16 10 40.9 | +45 39 37 | 0.0196   | 17.7  | E     | o3 |             |         |
| HS1614+4709 |             | 16 14 54.2 | +47 09 22 | 0.0026   | 16.9  | E     | o3 |             |         |
| HS1626+5153 | MRK 1498    | 16 26 48.4 | +51 53 05 | 0.0547   | 16.8  | 17.0  | E | H2          | Sy 1, IrS |
|             | IRAS F16268+5152 |       |         |          |       |       |   |              |         |
|             | IRAS 16268+5152 |       |         |          |       |       |   |              |         |
|             | [dKM92] 408 |       |         |          |       |       |   |              |         |
| HS1627+5239 |             | 16 27 33.1 | +52 39 36 | 0.0288   | 18.3  | E     | o3 |             |         |
| HS1633+4703 |             | 16 33 12.7 | +47 03 44 | 0.0086   | 16.7  | E     | o3 |             |         |
| HS1634+5218 | MRK 1499    | 16 34 07.7 | +52 18 56 | 0.0087   | 15.0  | 16.0  | E | I44          | G pair, IrS |
|             | UGC A 412   |             |         |          |       |       |   |              |         |
|             | CGCG 276-029 |             |         |          |       |       |   |              |         |
|             | [RC2] A1634+52 |             |         |          |       |       |   |              |         |
|             | IRAS F16340+5219 |         |         |          |       |       |   |              |         |
|             | CGPG 1634.0+5220 |         |         |          |       |       |   |              |         |
|             | I Zw 159    |             |         |          |       |       |   |              |         |
| HS1640+5136 | CGCG 1640.8+5138 | 16 40 48.2 | +51 36 30 | 0.0308   | 15.8  | 15.6  | E | o3          | IrS     |
|             | MRK 1500    |             |         |          |       |       |   |              |         |
|             | CGCG 276-037 |             |         |          |       |       |   |              |         |
|             | IRAS F16408+5136 |         |         |          |       |       |   |              |         |
|             | IRAS 16407+5136 |         |         |          |       |       |   |              |         |
| HS1641+5053 | IRAS F16415+5053 | 16 41 31.6 | +50 53 22 | 0.0292   | 16.4  | E     | o3 | IrS         |         |
| HS1643+5313 | IRAS F16415+5053 | 16 43 10.2 | +53 13 16 | 0.785    | 19.5  | E     | o3 | QSO         |         |
| HS1645+5155 | IRAS F16415+5053 | 16 45 19.8 | +51 55 42 | 0.0286   | 19.5  | E     | o3 | QSO         |         |
| HS1657+5033 | CGCG 1657.3+5034 | 16 57 22.2 | +50 33 53 | 0.0102   | 16.0  | E     | o3 | IrS         |         |
|             | CGCG 252-012 |             |         |          |       |       |   |              |         |
|             | IRAS F16573+5034 |         |         |          |       |       |   |              |         |
|             | MRK 0891    |             |         |          |       |       |   |              |         |
| HS1657+5735 | IRAS F16576+5735 | 16 57 36.2 | +57 35 48 | 0.0505   | 16.2  | E     | o3 | IrS         |         |
|             | IRAS 16576+5735 |             |         |          |       |       |   |              |         |
|             | CGPG 1657.6+5736 |             |         |          |       |       |   |              |         |
|             | Zw 670      |             |         |          |       |       |   |              |         |
| HS1711+5758 |             | 17 11 38.2 | +57 58 34 | 2.996    | 19.0  | E     | o7 | QSO         |         |
| HS1723+5631 | IRAS F17237+5631 | 17 23 43.5 | +56 31 14 | 0.0286   | 17.0  | E     | o3 | IrS         |         |
| HS1728+5655 | IRAS F17237+5631 | 17 28 14.4 | +56 55 36 | 0.0160   | 17.0  | E     | o3 | IrS         |         |
| HS1734+5704 | IRAS F17341+5704 | 17 34 10.1 | +57 04 58 | 0.0475   | 16.3  | E     | o3 | IrS         |         |
| HS2353+2005 |             | 23 53 39.4 | +20 05 13 | 0.0236   | 17.5  | E     | o4 |              |         |

* - galaxies with only one line detection
** - galaxies with only one line detection but twice observed
## List of Abbreviations

| abrev. | reference |
|--------|-----------|
| A      | Abell galaxy 1 |
| CG     | Case Galaxy 53-57, 62-65, 71 |
| CGCG   | Catalogue of Galaxies and of Cluster of Galaxies 1968 93 |
| CGPG   | Catalogue of Selected Compact Galaxies and of Post Eruptive Galaxies 1971 92 |
| DDO    | David Dunlap Observatory catalog, van den Bergh 1966 3 |
| [dKM92]| de Grijp, Keel, Miley et. al. 1992 12 |
| [G93]  | Garcia '93 11 |
| II     | Hard X-Ray Sources 42 |
| IRAS   | Infrared Astronomical Satellite Catalogs 1988. The Point Source Catalog 15 |
| IRAS F | Infrared Astronomical Satellite Catalogs 1990. The Faint Source Catalog 46 |
| KUG    | Kiso Survey for UV Excess Galaxies 73-76 |
| LGG    | Lyon Group of Galaxies Catalog 11 |
| MCG    | Morphological Catalogue of Galaxies 1962 82-86 |
| MRK    | Markarian Galaxy 25-40 |
| NPM    | Lick Northern Proper Motion Program 16 |
| OA-OZ  | Ohio Source Catalog, 1415 MHz 17, 47, 18, 66, 7, 10, 8, 5, 9, 60 |
| PC     | Palomar Transit Grism Survey 67 |
| [RC2]  | The Second Reference Catalogue 1976 79 |
| [SMB88]| Slezak, Mars, Bijaoi et. al. 1988 69 |
| SBS    | Second Byurakan Spectral Sky Survey 41, 70 |
| [SP82] | Sanduleak and Pesch 1982 61 |
| UCM    | Universidad Complutense de Madrid 58, 89, 90 |
| UGC    | Uppsala General Catalogue of Galaxies 1973 48 |
| UM     | University of Michigan 20-24 |
| VV     | Vorontsov-Velyaminov 1959, 1977, Atlas and Catalog of Interacting Galaxies 81 |
| WAS    | Wasilewski 1983 87 |
| XRS    | Second Catalogue of X-ray Sources 2 |
| Zw     | Zwicky Compact Galaxy 91 |
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Complete follow-up spectroscopy of our first-priority candidates was accomplished. With a success rate of detecting true emission-line objects of 76%, this provide the bulk of our sample of ELGs. As mentioned in § 2, we also observed 83 second priority candidates, in order to test their nature. From these, many were stars, but we also found 23 emission line galaxies, one galaxy with emission and absorption, four galaxies with absorption lines and a QSO. The efficiency of finding emission line objects in the second priority sample is then 28%. This result is biased, because we observed mostly candidates that showed extended images on the direct plates. From the 23 emission line galaxies we found, 21 had obvious extended images, and only two looked like point sources. If one takes random candidates from the second priority list, the efficiency is as low as 10%. From the 23 galaxies with emission, only two had intermediate ionization spectra that could be detected in the IIIa-J objective plates. The others showed either low or very low ionization spectra, with faint Hβ and [OIII], or spectra with only Hα, or Hα and [SII]. These objects cannot be seen as emission-line candidates in the IIIa-J objective plate. We conclude then that there is no way to distinguish real emission-line galaxies from the rest of non-emission blue candidates. Taking into account the low efficiency of finding emission-line objects, such a blind search would cost too much telescope time. We believe that such objects can be very easily recognised in an IIIa-F survey (like that of Zamorano et al. 1994). Therefore, we do not intend to complete the follow-up spectroscopy for the second priority objects, and we leave them to the discovery of the IIIa surveys.

We obtained a final sample of 203 objects, of which 196 are emission-line galaxies, four are galaxies with absorption, and three are QSOs. From our sample of 203 objects, 98 (48%) are newly discovered objects, 52 (26%) are objects found already in the literature but with no available redshift (sometimes mentioned only as IRAS sources or only as NPM (Lick Northern Proper Motion Program) galaxies) and 53 (26%) are objects with redshifts given already in the literature. We have observed all the objects with unknown redshift. From the objects with available redshifts, five were reobserved, in order to estimate our redshift errors (see Section 3). The mean surface density of the emission-line galaxies of our survey is 0.16 deg⁻². This number is quite low in comparison with the mean surface density of 0.46, found by Salzer et al. (1989). But one must keep in mind that this is a sample of candidates selected in a special parameter region. We select our candidates in a certain “brightness” range and in a certain “colour” range. We are also losing the low-ionization objects into the second category objects, as discussed above. Thus our sample is dominated by high ionization galaxies, which should not come as a surprise, since the final selection was on the [OIII] line strengths.

The apparent magnitudes (derived from the Hamburg prism plates) of our sample range between $15.0 \leq B \leq 19.5$. We have selected all available magnitudes (56) from the literature for our sample (Table 4) and compare this heterogeneous data set with our own magnitude estimates (Fig. 5). The values agree sufficiently well below 15 mag, if we assume internal errors of about 0.5 mag in each sample. For the literature values, 0.5 mag is an estimated mean error, as these data came from various sources, with different measurement methods and calibrations. The estimated error for the prism plate magnitudes is known to be 0.5 mag. For galaxies with $B \leq 16$, our magnitudes seem to underestimate the total flux of the galaxies systematically. This can easily be explained by the fact that the objective prism spectra show up only with the bright HI region (or the core of the galaxy), while the fainter surrounding, without emission lines, is not detectable on these plates (see remarks in Table 4). A typical example is HSO106+0103, an Sdm galaxy, that we see only as an HI knot. The apparent magnitude of 17.6 describes only the flux that comes from the HI region, as compared with the value of 14.31'' of the whole galaxy. Another example is HSO137+1539, a very compact source near the edge of the low-surface brightness Im galaxy, DDO 013. With $B=18.8$, as compared with the $B=14.4$ apparent magnitude of the DDO, it was not obvious if the candidate was a separate object, or part of the DDO galaxy. A long slit spectra of the object confirmed that it belongs to the DDO galaxy. The same situation happened with HSO147+3628. The galaxy was reobserved in order to see if the emission knot we found is a separate galaxy or an HI region in the DDO 166. As the redshifts agree, the source we found is an HI region (apparent magnitude 18.0 instead of 13.48). Other galaxies where we sub estimate the contribution of the underlying galaxies are: HSO122+0743 ($B=17.6$ instead of $B=15.00$), HSO808+5842 ($B=17.7$ instead of $B=15.5$), HS1332+3417 ($B=15.7$ instead of $B=15.0$), HSO149+4027 ($B=17.0$ instead of 15.38), HS1437+3701 ($B=16.4$ instead of $B=14.47$).

To have a further independent comparison of our magnitudes, we used the on-line facility of the APM catalogue as

![Fig. 5. The comparison between our Hamburg objective prism magnitudes $B_H$ and the magnitudes from literature, $B_L$. In the bottom panel we plotted $B_H$ versus $B_L$. The solid line represents $B_H = B_L$. In the top panel we plotted the difference $\Delta B = B_H - B_L$ versus $B_L$.](image-url)
The emission lines detected in the spectra of the observed objects:

| Object Name | Emission Lines |
|-------------|----------------|
| HS0000+2252  | [OIII], Hβ, Hα, Hβ, [OIII], [OII], HeI, Hα+[NII], HeI, [SII] |
| HS0000+2422  | [OII], Hβ, [OIII], [OIII], Hα, [SII] |
| HS0013+0809  | [OII], Hα |
| HS0021+01942 | Mgβ, NaI, Hα |
| HS0021+01942 | [OII], Hβ, [OIII], [OII], Hα, [SII] |
| HS0024+1022  | [OII], Hβ, [OII], [OII], Hα, [SII] |
| HS0024+11499 | Hα, [SII] |
| HS0026+0332  | [OII], Hβ, [OII], [OII], HeI?, Hα, [SII] |
| HS0028+1747  | Hβ, Hα |
| HS0029+1748  | [NeIII], Hc, Hα, Hγ, [OIII], Hβ, [OIII], [OII], HeI, Hα+[NII], HeI, [SII], [AIII], [OII] |
| HS0029+1443  | [OII], [NeII], Hc, Hα, Hβ, Hγ, [OIII], Hα, [OII], [OII], HeI, HeI, Hα+[NII], HeI, [SII], [AIII], [OII], [AIII] |
| HS0035+0725  | QSO: MgII |
| HS0036+0437  | [OII], Hβ, [OIII], [OII], Hα, [SII] |
| HS0037+0352  | [OII] |
| HS0040+0952  | [OII], Hα, Hβ, [OII], [OII], [OII], HeI, Hα+[NII], [SII] |
| HS0041+2333  | [OII], [NeII], Hc, [NeIII]+[OII]+H?, Hα, Hγ, Hβ, [OIII], [OII], HeI, Hα, Hα?, [SII] |
| HS0043+0531  | [OII], Hβ, [OII], [OII], Hα+[NII], [SII] |
| HS0045+0020  | Hδ, [OII], [OII], Hα, [SII] |
| HS0051+0927  | Hβ, [OII], [OII], HeI, Hα+[NII], [SII] |
| HS0052+2119  | [OII], Hβ, [OII], [OII], HeI?, Hα, [SII] |
| HS0056+0044  | [OII], Hβ, [OII], [OII], Hα, [SII] |
| HS0058+1847  | [OII], [NeII], Hc, Hα, Hγ, Hδ, [OII], [OII], HeI, [OII], Hα+[NII], [SII], [AIII] |
| HS0101+0310  | [OII], [NeII]?, Hα?, Hβ, [OII], [OII], HeI?, Hα, [SII] |
| HS0103+2441  | [OII], Hβ, [OII], [OII], Hα, [SII] |
| HS0103+1242  | [OII], Hγ?, Hβ, [OII], [OII], HeI?, Hα+[NII], [SII] |
| HS0106+1304  | [OII], [NeII], Hβ, [OII], [OII], [OII], [OII], Hα+[NII], [SII] |
| HS0107+1946  | Hδ, [OII], Hα+[NII], [SII] |
| HS0107+2458  | [OII], Hβ, [OII], [OII], Hα, [SII] |
| HS0108+0150  | Hδ, [OII], [OII], Hα, [SII] |
| HS0110+2149  | Hδ, [OII], [OII], Hα+[NII], [SII] |
| HS0111+2115  | [OII], [NeII], Hc, Hα, Hβ, Hδ, Hα, [OII], [OII], HeI, [OII], Hα, [SII], [AIII] |
| HS0113+1755  | [OII], [NeII], Hc, Hα, Hδ, Hγ, [OII], Hβ, [OII], [OII], HeI, [OII], Hα, HeI, [SII], [AIII] |
| HS0116+2244  | abs: Hδ, Mgβ, NaD |
| HS0117+1017  | [OII], Hγ, [OII], [OII] |
| HS0117+1135  | [NII]+Hα+[NII], [SII] |
| HS0118+1236  | [OII], Hγ, [OII], [OII] |
| HS0119+0331  | [OII], Hβ, [OII], [OII], HeI?, [OII]?, Hα+[NII], [SII] |
| HS0123+1624  | Hγ, Hβ, [OII], [OII], HeI, [OII], Hα, [SII] |
| HS0124+1126  | [OII], [OII], [OII] |
| HS0131+1937  | Hδ, [OII], [OII], Hα+[NII], [SII] |
| HS0133+1341  | Hδ, [OII], [OII], Hα+[NII], [SII] |
| HS0137+1539  | Hδ, [OII], [OII], Hα+[NII], [SII] |
| HS0143+2400  | [OII], [NeII], Hc, Hα, Hβ, [OII], Hβ, [OII], [OII], HeI, Hα, HeI, [SII], [AIII] |
| HS0148+1700  | [OII], Hγ, Hβ, [OII], [OII], [OII], Hα+[NII], [SII] |
| object name | emission lines |
|-------------|----------------|
| HS0148+2123 | Hβ, Hγ, Hβ, [OIII], [OIII], Hα, Hα+[NII], [SII], [AIII] |
| HS0153+2205 | [OIII], [NII]+Hα+[NII], [SII] |
| HS0731+6348 | SyI: MgII, Hγ, Hβ, [OIII], [OII], Hα |
| HS0732+6503 | Hα+[NII], [SII] |
| HS0747+6545 | [OII], [NeII], Hβ, [OIII], [OII], [OII], Hα, [SII], [SII] |
| HS0749+6549 | [NeII], Hα, Hγ, Hγ, [OIII], Hβ, [OIII], [OII], HeI, [OIII], Hα+[NII], HeI, [SII], [AIII] |
| HS0750+6619 | [OII], [NeII], Hβ, [OIII], [OIII], Hα, [SII], [SII] |
| HS0752+6563 | Hγ, Hγ, Hβ, [OII], [OII], HeI, [OII], Hα+[NII], [SII], [AIII] |
| HS0752+6647 | [OII], Hγ, Hβ, [OIII], [OII], HeI |
| HS0757+6644 | [OII], Hβ, [OIII], [OII], Hα, [SII] |
| HS0805+6574 | Hγ, Hβ, [OIII], [OII], HeI, [OII], Hα+[NII], [SII] |
| HS0814+6549 | SyI: [OII], Hβ, Hγ, Hβ, [OIII], [OIII], Hα, [SII], [SII] |
| HS0831+6525 | [NeII], Hα, Hγ, [OIII], [OII], Hα+[NII], HeI, [SII], [AIII] |
| HS0833+6545 | [OII], Hγ, Hα, [OIII], [OII], incomplete spectrum |
| HS0915+6540 | [NeII], Hα, Hγ, [OIII], Hβ, [OIII], [OII], HeI, HeI, [OII], [OII], Hα+[NII], [SII], [AIII] |
| HS1222+3741 | [OII], [NeII], Hγ, Hα, [OIII], [OIII], HeI, Hα, [SII] |
| HS1223+3938 | [OII], Hβ, [OIII], [OIII], Hα+[NII], [SII] |
| HS1232+3846 | [OII], Hβ, [OIII], [OIII], Hα+[NII], [SII] |
| HS1232+3847 | [NeII], Hα, Hγ, Hβ, [OIII], [OII], HeI, Hα, [SII] |
| HS1232+3612 | [OII], [NeII], Hγ, Hα, [OIII], [OII], HeI, [OII], Hα+[NII], [SII], [AIII] |
| HS1236+3821 | Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1244+3648 | [OII], Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1254+3323 | abs: CaK, G-band, NaD, Mgβ? |
| HS1255+3506 | [OII], Hβ, [OIII], [OII], Hα, [SII], [SII] |
| HS1256+3505 | [OII], Hβ, [OIII], [OII], Hα, [SII], [SII] |
| HS1256+3512 | [OII], Hβ, [OIII], [OII], Hα, [SII], [SII] |
| HS1301+3312 | Hβ, [OIII], [OII], Hα, [SII] |
| HS1301+3325 | [OII], Hβ, [OIII], [OII], Hα |
| HS1301+3209 | Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1302+3406 | Hα |
| HS1304+3529 | Hγ, Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1306+3525 | [OII], Hα |
| HS1306+3520 | Hβ, [OIII], [OII], Hα, [SII] |
| HS1306+3527 | Hα, [SII] |
| HS1308+3444 | Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1309+3409 | Hβ, Hα |
| HS1309+3431 | [OII], Hα+[NII], [SII] |
| HS1311+3628 | [NeII], Hα, Hγ, Hα, [OIII], Hα, [OII], [OII], HeI, [OII], Hα, HeI, [SII], [AIII], [OII] |
| HS1312+3647 | [OII], [NeII], Hα, Hγ, Hα, [OIII], [OII], HeI, [OII], Hα+[SII], [SII] |
| HS1312+3508 | Hγ, Hβ, [OIII], [OII], HeI, [OII]+[SII], [OII], Hα |
| HS1318+3406 | Hβ, [OIII], [OII], HeI, [SII] |
| HS1323+3211 | Hα |
| HS1323+3219 | Hγ, Hβ, [OIII], [OII], HeI, [OII], Hα, [SII] |
| HS1328+3424 | Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1329+3703 | [OII], Hβ, [OIII], [OII], Hα+[NII], [SII] |
| HS1330+3651 | [NeII], Hα, Hβ, [OIII], [OII], HeI, [OII], Hα+[NII], [SII], [AIII] |
| HS1331+3906 | Hα+[NII], [SII] |
| HS1333+3149 | [OII], Hα+[NII] |
| object name | emission lines |
|-------------|----------------|
| HS1333-36058 | H_γ, H_β, [OIII], [OII], HeI, H_α, [SII] |
| HS1334-36057 | [NeII], H_γ, H_δ, [OII], [OIII], [OII], HeI, H_α+[NII], [SII], [AIII] |
| HS1336-36114 | H_β, [OIII], [OII], H_α+[NII], [SII] |
| HS1336-36150 | H_γ, [OIII], [OII], H_α |
| HS1402-36307 | H_γ, [OIII], [OII], H_α, [SII] |
| HS1402-36207 | H_α, [OIII], [OII], H_α, [SII] |
| HS1411-36409 | H_α, [OIII], [OII], H_α, [SII] |
| HS1419-36442 | H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1454-36364 | H_γ, H_β, [OIII], [OII], HeI, [OII], H_α+[NII], [SII] |
| HS1454-36365 | H_γ, [OIII], [OII], H_α+[NII], [SII] |
| HS1402-36550 | [OII], H_γ, H_δ, [OII], [OII], HeI, H_α+[NII], [SII] |
| HS1408-44201 | abs: MgI, NaD |
| HS1410-36227 | [OII], H_δ, [OIII], [OII], H_α, [SII] |
| HS1413-44402 | [OII], H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1415-44203 | H_α+[NII] |
| HS1416-36554 | [NeII], H_β, [OIII], [OII], HeI, [OII], H_α+[NII], [SII] |
| HS1420-34347 | H_γ, [OIII], [OII], HeI, [OII], H_α, [SII] |
| HS1421-44018 | abs: CaII, G_{CaII}, MgI, NaD |
| HS1422-43325 | H_δ, [OIII], [OII], HeI, [OII], H_α, [SII] |
| HS1422-43339 | H_δ, [OIII], [OII], H_α, [SII] |
| HS1425-43835 | H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1429-43451 | H_γ, H_δ, [OIII], [OII], HeI, [OII], H_α, HeI?, [SII] |
| HS1429-43514 | H_γ, H_δ, [OIII], [OII], HeI, H_α, [SII] |
| HS1429-44511 | H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1435-45253 | [OII], H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1438-34147 | [OII], [NeII], H_γ, [OII], H_δ, [OIII], [OII], HeI, [OII], H_α, [SII] |
| HS1440-43805 | H_δ, [OIII], [OII], HeI, [OII], H_α+[NII], [SII] |
| HS1440-43802 | [NeII], H_α, H_δ, [OII], [OIII], HeI, [OII], H_α+[NII], [SII], [AIII] |
| HS1442-44250 | [NeII], H_γ, H_δ, H_γ, [OIII], H_δ, [OII], [OII], HeI, [OII], H_α, [SII], [AIII] |
| HS1442-44332 | H_α? |
| HS1444-36114 | H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1502-44152 | [OII], [OIII], H_α, [SII] |
| HS1505-36944 | H_α, [SII] |
| HS1507-3743 | [OII], [NeII], H_γ, H_δ, H_γ, [OII], H_β, [OII], [OII], HeI, [OII], H_α, [SII], [AIII] |
| HS1522-44214 | H_δ, [OIII], [OII], H_α+[NII], [SII] |
| HS1524-42405 | [OII], [OII], H_α+[NII], [SII] |
| HS1526-44045 | [OII], H_α, [SII] |
| HS1543-45255 | H_δ, [OIII], [OII], HeI, [OII], H_{dph,a}, [SII], [AIII] |
| HS1544-37436 | emi: [OII], [SII] |
| HS1546-37475 | H_γ, H_β, [OIII], [OII], HeI, H_α, [SII], [AIII] |
| HS1609-44827 | H_δ, [OIII], [OII], HeI?, [OII]?, H_α+[NII], [SII] |
| HS1610-44539 | H_γ, H_δ, [OII], [OII], HeI, [OII], H_α, [SII], [AIII] |
| HS1614-44709 | H_γ, H_δ, [OII], [OII], HeI, [OII], H_α, [SII], [AIII] |
| HS1633-44703 | H_γ, [OII], [OII], H_α, [SII] |
| HS1640-51236 | H_α?, HeI?, H_δ, [OII], [OII], HeI, [OII], H_α+[NII], [SII] |
| HS1641-51503 | H_δ, [OII], [OII], HeI, [OII], H_α+[NII], [SII] |
| HS1643-51513 | QSO: MgII, FeII |
| HS1645-51555 | H_δ, [OIII], [OII], H_α, [SII] |
| HS1657-50633 | H_δ, [OIII], [OII], [OII], H_α, [SII] |
| HS1657-51735 | H_δ, [OIII], [OII], [OII], HeI, [OII], H_α, [SII] |
| HS1672-5239 | H_δ, [OIII], [OII], HeI, H_α, [SII] |
object name  emission lines

|                  |                  |                  |
|------------------|------------------|------------------|
| HS1645+5155      | Hα, [OIII], [OII], Hα+[NII], [SII] |
| HS1711+5758      | QSO: Lyα, [OII], CIV |
| HS1725+5631      | Hα, [OIII], [OII], [HeI], Hα, [SII] |
| HS1728+5055      | Hα, Hα, [OIII], [HeI], [OII], [OII], Hα, |
| HS1734+5704      | Hα, Hα, [OIII], [OII], [HeI], [OII], Hα, [SII] |
| HS2353+2065      | Hα, [OII], [OIII], Hα+[NII], [SII] |

The complete sequence of emission lines listed in the table (wavelengths given in Å): Lyα 1216, NV 1240, CIV 1549, MgII 2798, [OII] (blend) 3727.45, [N-III] 3868.76, Hc (blend Hε) 3889.05 (3889.65), Hc (blend [N-III], [OII]) 3970.07 (3967.47, 3967.40), Hε 4101.6, Hα 4340.3, [OIII] 4363.21, [HeI] 4686, Hα 4861.2, [OIII] 4958.92, [OII] 5006.85, Hα 5876.99, [OII] (blend with [SII]) 6300.3-6312.1, [OII] 6363.81, [NII] 6548.2, Hα 6562.9, [NII] 6583.6, Hα 6678.1, [SII] (blend) 6723.6, Hα 7065.3, [AIII] 7135.8, [OII] (blend) 7319.9, 7330.2, [AIII] 7751.02

described by Maddox et al. (1990), Irwin, Maddox & McMahon (1994). All objects with new redshifts have been searched in the APM catalogue facility and 146 have been retrieved by comparison of their position only. It is beyond the scope of this paper to clarify why some sources were missed. We note that there is no significant deviation between the RA and δ values from our measurements and those of the APM:

\[ RA_{(\text{this paper})} - RA_{\text{APM}} = -0.04 \pm 0.11 \text{sec} \]
\[ δ_{(\text{this paper})} - δ_{\text{APM}} = -0.62 \pm 1.25 \text{arcsec} \]

and, that the error distribution corresponds to our expectations (see above). The comparison of the B magnitudes, however, shows a surprising distribution (Fig. 6). The difference between the APM magnitudes and ours seems to increase monotonically with brightness, with a scatter of about ± 1.4 mag. superimposed. For fainter (B ≥ 16) galaxies one may understand the diagram in the sense of a small offset and a magnitude error in both samples in the order of 0.4 to 0.5 mag. The differences for the brighter objects however cannot be explained as before. According to the APM magnitudes, one would expect that we have NGC and even Shapley-Ames galaxies in our sample, which is not the case. The distribution ranges up to a unrealistic B_{APM}=11 mag. This may mean that there are still some uncertainties in the calibration of the APM magnitudes for the bright objects, where the plates tend to be saturated over a large extent of the galaxy (see also Mutch et al. 1995). We finally conclude that the subsample of our objects with 16 ≤ B ≤ 19.5 have good total luminosity estimates, while for the brighter ones, our values are only lower limits. It is customary to give a magnitude for which a survey is complete, but for our sample the incompleteness are also described in terms of colour, line fluxes and equivalent widths of the emission lines. (A detailed description of the incompleteness will be given in a future paper).

If we exclude the emission-line galaxies that were found as second priority objects, we find that our objects have redshifts between 0 < z < 0.1, which is exactly the range for which the [OIII] line and/or Hβ can be seen in the I11a-J plates, due to the cutoff of the emulsion at 5400 Å. In Fig. 7 we give the redshift distribution of our sample. With dotted line we plot the whole sample, included the blue candidates, while with solid line we plot only the first priority objects. The histograms have a peak at z=0.015, which shows that our sample is dominated by nearby galaxies (as intended for a study of the nearby large scale structure). The histogram drops very fast after 0.06, containing only a few objects with 0.06 < z < 0.10, most of them being blue objects. The few galaxies with z > 0.1 are also from the second category objects.

5. Conclusions

Our survey for emission-line galaxies contains a complete sample based on candidates selected from digitized objective prism plates. We used the I11a-J plates taken in the frame of the Hamburg QSO Survey. Automated search software is applied to the digitized data to select spectra in a certain parameter space. The two selection criteria are the “brightness” and the “colour” of the spectra. The selected candidates are then rescanned with high resolution and the final digitized spectra are visually inspected for emission lines. Some second priority candidates were also selected because of their blue spectra. We observed all the first priority candidates and also some of the second priority ones.

1. The final sample contains 203 objects, of which 196 are ELG, four are galaxies with absorption and three are QSOs. Almost half of our sample contains newly discovered objects, and three quarters of the given redshifts are new.

2. The mean surface density of our sample of emission-line galaxies is 0.16. This value is lower than the value obtained by the Michigan Survey, for example, but our sample is selected with an automated procedure, in a certain interval of parameters.

3. Our galaxies have apparent magnitudes between 15.0 < B < 19.5. A comparison with the magnitudes available in the literature, as well as with the APM ones, shows that our magnitudes are reliable only for the compact faint objects. In the
| Object Name | Coord. | B | Type | Abs. Lines |
|-------------|--------|---|------|-----------|
| HS0007+40520 | 00 07 16.1 +05 20 42 | 19.4 M | | |
| HS0014+40351 | 00 14 34.5 +03 51 43 | 18.0 | | |
| HS0015+41123 | 00 15 18.3 +11 23 00 | 18.4 M | | |
| HS0018+20400 | 00 18 35.1 +20 40 36 | 18.7 G | Hβ, Mgb | |
| HS0019+40006 | 00 19 20.5 +00 06 30 | 17.4 | Hγ, Hβ, Hα | |
| HS0024+24132 | 00 24 55.6 +24 13 43 | 17.3 G | CaK, CaII, Gband, Hβ, Mgb, NaD, Hα | |
| HS0028+41201 | 00 28 31.3 +12 01 18 | 17.9 F or G | Mgb, NaD, Hα | |
| HS0028+42419 | 00 28 41.7 +24 19 56 | 17.8 G | Gband, Mgb, Hα | |
| HS0030+41433 | 00 30 17.2 +14 33 09 | 17.4 F | Gband Hβ, Mgb, Hα | |
| HS0039+21512 | 00 39 53.0 +21 51 37 | 16.8 F | Gband Hα | |
| HS0040+43441 | 00 40 28.8 +13 44 15 | 18.2 F or G | Hβ, NaD, Hα | |
| HS0103+41520 | 01 03 19.3 +15 20 20 | 17.6 late-type star | Mgb, Hα | |
| HS0107+30006 | 01 07 55.7 +00 06 53 | 17.8 G | CaK, CaII, Hβ, Hα | |
| HS0109+41540 | 01 09 30.0 +14 00 07 | 15.8 early-type star | Hβ, Hα | |
| HS0739+40619 | 07 39 07.4 +60 19 32 | 18.0 G | Gband Hβ, Hα, Mgb, Hα | |
| HS0750+43637 | 07 50 44.4 +63 37 29 | 18.1 M | | |
| HS0753+50645 | 07 53 41.8 +56 45 12 | 17.1 G | CaK, CaII, Gband, Hβ, Hα | |
| HS0815+45598 | 08 15 57.3 +56 58 19 | 17.4 late-type star | Mgb, NaD, Hα | |
| HS1131+34350 | 11 31 21.4 +33 51 01 | 17.7 A | CaII Hα, Hγ, Hβ, Hα | |
| HS1313+43127 | 13 13 29.9 +31 27 04 | 18.0 Mgb, Hα | | |
| HS1315+43340 | 13 15 17.3 +33 40 27 | 18.4 | Hβ, NaD | |
| HS1328+43528 | 13 28 28.4 +35 28 39 | F or G | CaK, CaII, Gband, Hβ, Hα | |
| HS1406+43427 | 14 06 42.5 +34 27 55 | 16.5 G | Gband FeI, Hβ, Mgb, NaD, Hα | |
| HS1406+43844 | 14 06 22.2 +38 44 39 | A or F | Hα, Gband Hγ, Hβ, Hα | |
| HS1416+43932 | 14 16 30.3 +39 32 11 | F | CaK, CaII, Gband, Hβ, Hα | |
| HS1419+44116 | 14 19 29.9 +41 16 14 | M | | |
| HS1427+44200 | 14 27 12.9 +42 00 58 | A or F | CaK, CaII, Hβ, Hα | |
| HS1432+44255 | 14 32 35.5 +42 55 30 | M | | |
| HS1445+44412 | 14 45 17.9 +44 12 06 | Hα | | |
| HS1448+43952 | 14 48 32.3 +39 52 39 | F or G | CaK, Gband, Hβ, Hα | |
| HS1452+43009 | 14 52 25.2 +30 09 06 | A | CaK, CaII, Hα, Gband, Hβ, Hα | |
| HS1502+43444 | 15 02 38.7 +34 44 55 | F or G | CaK, CaII, Gband Hβ, Mgb, NaD, Hα | |
| HS1503+43822 | 15 03 21.8 +38 22 41 | A or F | CaK, CaII, Hα, Hγ, Hβ, Hα | |
| HS1508+40425 | 15 08 65.2 +40 25 29 | F | CaK, CaII, Hα, Hγ, Hβ, Hα | |
| HS1510+43551 | 15 10 40.6 +35 51 16 | late-type star | CaK, CaII | |
| HS1516+44414 | 15 16 19.1 +44 41 45 | M | | |
| HS1517+40421 | 15 17 55.0 +40 21 32 | F or G | CaK, CaII, Gband Hβ, Mgb, Hα | |
| HS1523+44240 | 15 23 22.3 +44 20 38 | F | Hα, Hβ, Mgb, Hα | |
| HS1523+44240 | 15 23 22.3 +44 20 38 | F | Hβ, Hα | |
| HS1547+47078 | 15 47 14.2 +47 08 45 | 18.4 | Hβ, Hα | |
| HS1548+44555 | 15 48 07.4 +44 55 20 | 18.5 | Mgb, Hα | |
| HS1611+44825 | 16 11 57.9 +48 25 35 | 18.1 A or F | Hα, Hβ, Hα | |
| HS1612+44505 | 16 12 45.5 +45 05 57 | 17.5 F? | Hβ, Mgb, Hα | |
| HS1626+51326 | 16 26 47.2 +51 32 05 | 18.0 A or F | Hβ, Hα | |
| HS1639+51036 | 16 39 43.1 +51 03 43 | 18.5 A | Hα, Hα | |
| HS1655+5209 | 16 55 56.6 +52 09 42 | 17.3 F or G | Gband Hγ, Hβ, Hα | |
| HS1657+52077 | 16 57 47.0 +52 07 33 | 19.5 F or G | Hβ, Mgb, Hα | |
| HS1721+5518 | 17 21 23.1 +58 19 51 | 16.1 G | Gband Hγ, FeI?, Hβ, Mgb | |
case of extended objects, with $B \leq 16$, our survey is sensitive only for the emission core, the total magnitudes being thus systematically fainter.

4. The redshift distribution ranges between $0 < z < 0.1$, with a peak at $z = 0.015$, which show that we found a sample of relatively nearby galaxies. The few galaxies with $z > 0.1$ were either selected as blue objects, or are Sy 1 galaxies.

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