

## Survey Catalogues of Kiso Ultraviolet-Excess Galaxies

Nagako Miyauchi-Isobe

*National Astronomical Observatory, Mitaka, Tokyo 181, Japan*

Bunshiro Takase

*Kokugakuin University, Shibuya-ku, Tokyo 150, Japan*

Sadanori Okamura

*Department of Astronomy, School of Science, University of Tokyo,  
Tokyo 113, Japan*

**Abstract.** Our survey for KUGs (Kiso Ultraviolet-excess Galaxies) is based on the multi-colour method applied to photographic plates taken with the Kiso Schmidt telescope. In total, 8,968 KUGs were detected on 170 plates covering some 5,100 square degrees. They are listed in 17 separate catalogues, where morphological type and UV-excess degree are given for each object together with position, size, and magnitude. After the appropriate editing of multiple entries of the same object detected on different plates, we produced a merged catalogue where 8,162 KUGs were arranged in order of right ascension. The accuracy of the position of KUGs was examined using the data of 806 KUGs whose positions were measured on different plates.

### 1. Introduction

A survey for KUGs (Kiso Ultraviolet-excess Galaxies) has been carried out with the Kiso 100 cm Schmidt telescope since the late 1970s, when a series of catalogues of Markarian galaxies was being successively published on the basis of objective prism plates taken with the Byurakan 100 cm Schmidt telescope.

We used UGR three-colour (later often UR two-colour) photographs instead of the Byurakan spectral method. However, the detection criterion for ultraviolet-excess galaxies is quite similar between Byurakan and Kiso. Markarian and collaborators compared the relative strength of the two portions of the objective prism spectrum, the violet-blue side and the yellow-red side, separated by the so-called green dip, while we compared the U, (G), and R images, which were exposed adjacently on the same plate. Our exposure times were adjusted so that the three colour images of an A0 star appeared equally bright on the plate.

Our method is based on direct images and it has a few advantages over the Byurakan method, at the cost of spectral information. Our limiting magnitude is fainter by at least 1 magnitude and detailed morphological features including

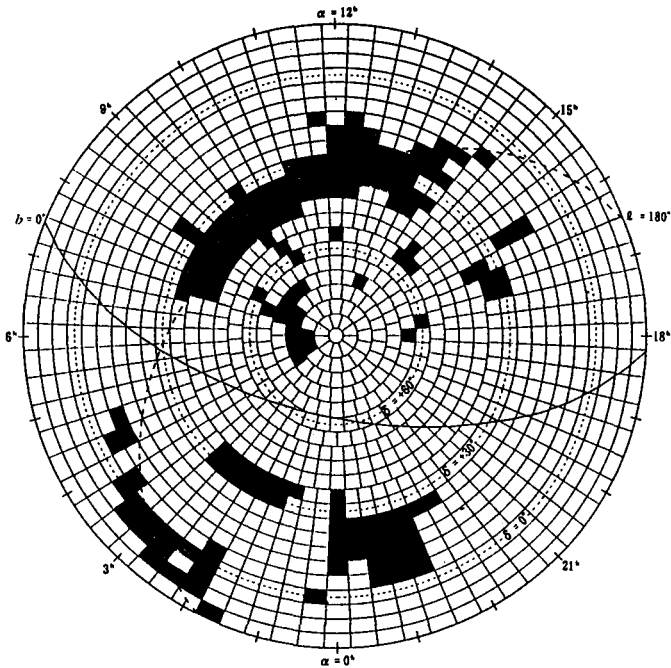


Figure 1. Distribution of the surveyed areas for KUG

the distribution of blue regions in a galaxy are visible on the plate. Our multi-colour method owes much to a unique mechanical feature of the Kiso Schmidt; any of three filters that are preloaded in filter holders in the telescope tube can be selected remotely from the control desk without interrupting the telescope guiding.

## 2. Results of the Survey

Our initial survey plan was to cover the Kiso celestial areas located along the great circle of galactic longitude  $l = 180^\circ$  together with those which include several Markarian galaxies. However, this plan has not been well fulfilled during the course of the actual survey observation. The distribution of the areas surveyed so far is fairly scattered as seen in Fig. 1.

In total, 8,968 KUGs have been detected in 170 areas. Adjacent areas are overlapped. Those KUGs that are located in the overlapped regions were detected on different plates independently and entered the catalogues repeatedly. After the deletion of multiple entries of the same object, the net number of KUGs results in 8,162. One area covers about 30 square degrees, so the total surveyed area amounts to some 5,100 square degrees. The surface number density is thus

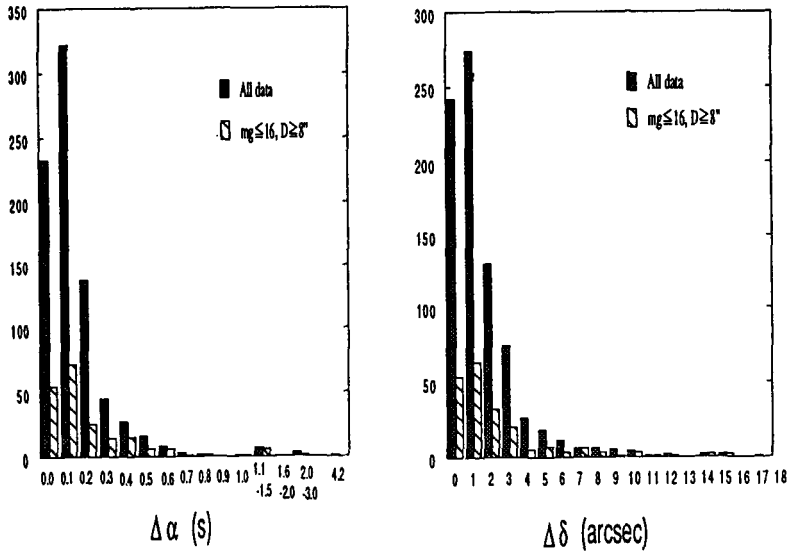


Figure 2. Histograms of position differences measured on different plates. Shaded and hatched parts are for the total and bright samples, respectively.

found to be 1.8 KUGs per square degree, which is nearly 20 times as high as that of Markarian galaxies (0.1 per square degree).

The limiting magnitudes of the survey range from 17 to 18.5 photographic magnitude, depending on observing conditions and plate qualities. It should be noted, therefore, that the survey is not very homogeneous over the whole surveyed area.

### 3. Catalogues of KUGs

During the past ten years, 17 catalogues of KUGs were published sequentially (Takase and Miyauchi-Isoe 1984-1993a: KUGC I-XVII). Each catalogue includes KUGs detected in ten areas and lists coordinates, morphological type, size, magnitude, and UV-excess degree, together with other names, if any. The finding chart for every KUG is also given as an appendix of the catalogues.

Efforts were made to give consistent data for objects that were detected repeatedly on different plates. KUG name, type, size, magnitude, and UV-excess degree were reconciled whenever the same object appeared again in the later catalogues (see errata tables attached to KUGC II through XVIII).

Recently, we produced a new catalogue of KUGs (Takase & Miyauchi-Isoe 1993b: KUGC XVIII, see Table 1) by merging the original 17 catalogues together. The multiple entries were deleted and all 8,162 KUGs detected so far are arranged in order of right ascension. Each KUG in the merged catalogue

Table 1. The first page of the merged catalog of 8,162 KUGs

No.	KUG Name	R. A. (1950.0)	Dec.	Type	Size	Mag.	UV	Index	No.	KUG Name	R. A. (1950.0)	Dec.	Type	Size	Mag.	UV	Index	Notes
1	0000+163	0 0 6.8	13 19 19	Sp	0.9X0.2	16:	L	C13A0671019	51	0003+285	0 3 16.8	22 30 28	Sp	0.2X0.1	17.5:	L	C03A0455052	
2	0000+333	0 0 8.5	13 19 19	Sp	0.6X0.2	16:	L	C04A0383024	52	0003+222A	0 3 18.0	22 15 30	Sp	0.7X0.2	16:	L	C14A0527054	=C14A0527051
3	0000+266	0 0 10.0	26 37 6	Sp	0.3X0.3	17.5:	L	C14A0527046	53	0003+318	0 3 20.0	31 52 41	Sp	0.2X0.1	17:	L	C03A0455057	
4	0000+293	0 0 22.0	29 18 20	Sp	0.6X0.3	16.5:	L	C03A0455094	54	0003+222B	0 3 21.7	22 12 49	Sp	0.9X0.3	16.0:	L	*C05A0599052	
5	0000+185	0 0 29.1	18 35 39	Sp	0.6X0.3	15.5:	L	C05A0599039	55	0003+085	0 3 24.3	8 33 20	Sp	0.6X0.1	17:	L	C14A0743035	
6	0000+216	0 0 35.7	21 40 54	Sp	0.9X0.7	14.4:	L	C05A0599040	56	0003+270	0 3 28.1	27 4 9	Sp	0.6X0.6	17:	L	C03A0455058	
7	0000+158	0 0 41.5	15 52 5	Sp	6.7X2.2	12.0:	L	C13A0671020	57	0003+174	0 3 30.6	17 29 28	Sp	0.3X0.2	17:	L	C05A0599053	
8	0000+223	0 0 44.2	22 21 49	Sp	0.7X0.3	16.0:	L	C05A0599041	58	0003+272	0 3 30.9	27 27 12	Sp	0.4X0.2	16:	L	*C03A0455059	
9	0000+222	0 0 47.1	22 12 52	Sp	0.3X0.2	17:	L	C05A0599042	59	0003+275	0 3 34.5	27 32 44	Sp	0.2X0.1	16.5:	L	C03A0455060	
10	0000+218	0 0 47.6	21 49 28	Sp	0.9X0.5	16.0:	L	C05A0599043	60	0003+083	0 3 35.6	8 19 20	Sp	0.3X0.2	17:	L	C14A0743036	
11	0000+305	0 0 47.8	30 30 12	lc	0.4X0.2	15.7:	H	C03A0455043	61	0003+218	0 3 39.9	21 50 19	Sp	0.3X0.2	17:	M	C05A0599054	
12	0000+271	0 0 51.1	27 7 28	Sp	0.2X0.2	17:	L	C03A0455044	62	0003+190	0 3 44.3	19 0 6	Sp	0.4X0.2	16.5:	L	C05A0599055	
13	0000+348	0 0 53.2	34 52 49	Sp	0.1X0.1	18.5:	L	C04A0383025	63	0003+199	0 3 45.2	19 05 29	C	0.3X0.3	14	H	C05A0599056	
14	0000+164	0 0 54.0	16 27 30	Sp	0.3X0.2	15.5:	L	C13A0671021	64	0003+171	0 3 47.5	19 24 34	Sp	0.7X0.7	14.6	H	C05A0599057	
15	0000+213	0 0 54.8	21 22 10	Sp	0.3X0.3	17:	L	C05A0599044	65	0003+235	0 3 48.4	23 30 38	Sp	0.8X0.2	16:	M	C14A0527057	
16	0001+167	0 1 1.3	16 43 35	Sp	2.2X1.1	14.0:	L	C14A0527047	66	0004+240	0 4 0 8	24 44 8	Sp	0.2X0.2	16.5:	L	C03A0455061	
17	0001+167	0 1 1.3	16 43 35	Sp	0.5X0.2	15.7:	L	C13A0671022	67	0004+247	0 4 2 1	24 54 13	C	0.3X0.2	16.5:	L	C14A0527058	
18	0001+201	0 1 3.9	20 16 39	Sp	0.8X0.4	16.5:	L	C05A0599045	68	0004+249	0 4 2 4	24 54 13	C	0.3X0.2	16.5:	L	C14A0527059	
19	0001+282	0 1 9.8	28 10 39	Sp	0.6X0.2	16.5:	L	C03A0455045	69	0004+080	0 4 3 9	8 5 22	C	0.9X0.7	15.4:	L	C14A0743037	
20	0001+300	0 1 18.0	30 0 1	C:	0.3X0.3	16:	M	C03A0455046	70	0004+328	0 4 5 3	32 48 53	Sp	0.3X0.2	16.5:	M	C04A0383032	
21	0001+179	0 1 18.6	17 58 0	?	0.4X0.2	17:	M	C05A0599046	71	0004+169	0 4 7 4	16 57 29	Sp	0.3X0.2	17:	M	C13A0671025	
22	0001+180	0 1 22.7	18 0 29	Sp	0.4X0.3	17:	M	C05A0599047	72	0004+190	0 4 16.0	19 2 34	Sp	0.8X0.7	15.5:	M	C05A0599058	
23	0001+253	0 1 41.8	25 23 26	C	0.2X0.2	16.5:	L	C14A0527048	73	0004+270	0 4 20.7	27 3 21	C	0.2X0.2	16:	M	*C03A0455062	
24	0001+311	0 1 50.3	31 11 38	Sp	1.6X1.1	14.3:	L	C03A0455047	74	0004+134	0 4 37.6	13 29 18	Sp	0.7X0.2	15.7:	M	C13A0671026	
25	0001+332	0 1 58.4	33 16 50	Sp	1.2X0.2	16.0:	L	C04A0383026	75	0004+325	0 4 47.6	32 32 33	C	0.1X0.1	17.5:	M	C04A0383033	
26	0002+314	0 2 0 7	31 26 5	?	0.6X0.3	16.5:	L	C03A0455048	76	0004+260	0 4 53.4	26 5 47	Sp	0.3X0.3	16.5:	L	C14A0527061	
27	0002+312	0 2 0 8	31 13 37	Sp	0.4X0.2	17:	M	C03A0455049	77	0005+081	0 5 10.1	8 6 58	Sp	0.3X0.3	17:	L	C14A0743038	
28	0002+155	0 2 4 4	15 32 18	Sp	0.3X0.2	16.5:	L	C13A0671023	78	0005+315	0 5 12.2	31 30 45	Sp	0.3X0.1	17:	M	C03A0455063	
29	0002+211	0 2 10.5	20 11 28	Sp	0.3X0.1	16:	M	C05A0599048	79	0005+175	0 5 15.6	17 30 22	Sp	0.4X0.3	16:	M	C05A0599059	
30	0002+285	0 2 50.4	26 33 16	Sp	0.7X0.5	14.5:	M	C14A0527049	80	0005+327	0 5 26.6	32 47 32	Sp	0.7X0.3	13.8:	L	C04A0383034	
31	0002+079A	0 2 13.2	7 57 8	Sp	0.5X0.2	16:	L	C14A0743033	81	0005+357	0 5 26.8	35 44 0	?	0.2X0.1	17.5:	L	C04A0383035	
32	0002+278A	0 2 18.9	27 48 19	Sp	0.4X0.3	16:	L	C03A0455050	82	0005+344	0 5 29.1	34 29 12	C:	0.3X0.2	16:	L	C04A0383036	
33	0002+239	0 2 19.0	23 55 16	Sp	0.3X0.3	17.5:	L	C14A0527050	83	0005+323	0 5 30.9	32 21 18	Sp	0.3X0.2	15.5:	M	C03A0455064	
34	0002+278B	0 2 25.1	27 50 49	P1:	0.3X0.2	16.5:	L	C03A0455051	84	0005+322	0 5 32.5	32 17 14	Sp	0.2X0.2	17:	L	C03A0455065	
35	0002+180	0 2 25.1	18 1 15	Sp	0.8X0.3	16:	H	C05A0599049	85	0005+267A	0 5 35.5	26 43 32	Sp	0.7X0.9	4.7:	L	C14A0527062	
36	0002+325	0 2 34.9	32 34 32	Sp	0.2X0.1	17:	L	C04A0383027	86	0005+272	0 5 36.1	34 14 58	Sp	0.1X0.1	16.5:	M	C14A0527063	
37	0002+223	0 2 34.9	22 31 35	Sp	0.3X0.3	16.5:	M	C05A0599050	87	0005+267B	0 5 39.4	26 43 35	Sp	0.4X0.2	16.5:	M	C14A0527064	
38	0002+169	0 2 36.4	16 57 35	Sp	0.7X0.2	16.5:	L	C13A0671024	88	0005+345	0 5 45.5	34 30 27	P1:	0.4X0.2	16.5:	M	C04A0383037	
39	0002+273A	0 2 36.9	27 20 28	Sp	0.4X0.1	16:	L	*C03A0671025	89	0005+176	0 5 57.5	17 53 4	Sp	0.4X0.2	16.5:	M	C05A0599060	
40	0002+079B	0 2 38.5	7 58 30	Sp	0.6X0.1	16.5:	L	C14A0743034	90	0005+279	0 5 59.0	27 54 29	P1:	0.3X0.2	17.5:	M	C05A0599061	
41	0002+292	0 2 51.6	22 20 59	C:	0.1X0.1	17.5:	M	C04A0383028	91	0005+295	0 6 0 3	28 34 41	Sp	0.2X0.1	17.5:	M	C03A0455067	
42	0002+273B	0 3 1 6	27 16 46	Sp	0.2X0.1	16.5:	L	C14A0527052	92	0005+084	0 6 1 9	8 24 59	Sp	0.5X0.3	17:	L	C14A0743039	
43	0003+272	0 3 1 8	22 14 47	Sp	0.3X0.2	16.5:	M	C05A0630053	93	0005+152	0 6 10.9	26 33 55	Sp	0.3X0.3	16.5:	M	C14A0527065	
44	0003+297	0 3 4 4	22 44 27	Sp	0.3X0.2	16.5:	M	C05A0630051	94	0005+243	0 6 11.3	15 32 14	Sp	2.8X2.2	13.3:	M	C13A0671027	
45	0003+306	0 3 4 8	32 40 30	Sp	0.1X0.1	17:	L	C04A0383030	95	0005+145	0 6 14.3	24 35 47	Sp	0.9X0.2	16.0:	M	C14A0527066	
46	0003+306	0 3 12.3	32 40 30	Sp	0.2X0.2	17:	L	C03A0455053	96	0005+235	0 6 26.4	23 32 24	Sp	0.8X0.3	17.5:	M	C14A0527067	
47	0003+306	0 3 12.3	32 40 30	Sp	0.1X0.1	17.5:	M	C04A0383031	97	0006+171	0 6 26.4	17 6 24	Sp	0.3X0.2	14.5:	M	C13A0671028	
48	0003+279	0 3 12.3	27 59 26	Sp	0.3X0.3	16.5:	M	C03A0455054	98	0006+253	0 6 30.3	25 20 26	Sp	1.7X1.3	15.7:	L	C14A0527068	
49	0003+361	0 3 14.2	36 6 14	Sp	0.2X0.2	18:	M	C04A0383031	99	0006+102	0 6 30.3	10 17 11	Sp	0.5X0.3	15.6:	M	C14A0743040	
50	0003+315	0 3 15.3	31 33 55	Sp	0.2X0.2	17:	M	C03A0455055	100	0006+333	0 6 56.6	33 23 51	Sp	0.3X0.2	16.5:	L	C04A0383038	

has an index which enables us to identify its location in the 17 catalogues. An asterisk (\*) is attached to the index for KUGs with multiple entries. The index for those KUGs corresponds to their first entry, and the indices for later entries are given in the last column of Notes. General descriptions of the survey and some statistics are also given in the merged catalogue.

The morphological types in the catalogues are given based on the classification scheme presented by Takase et al. (1983). When the type is not so certain, a colon (:) is attached to the type designation. The meaning of each type designation is as follows;

- Ic: Irregular with clumpy HII regions
- Ig: Irregular with a conspicuous giant HII region
- Pi: Pair of interacting components
- Pd: Pair of detached components
- Sk: Spiral with knots of HII regions along arms
- Sp: Spiral with peculiar bar and/or nucleus
- C: Compact
- ?: Unclassifiable

The UV-excess degree is estimated from the appearance of the KUG on the multi-colour plate. The letters H, M, and L mean high, medium, and low, respectively. Explanations of this UV-excess degree can be found in Takase et al. (1983). For the KUGs with multiple entries, right ascension and declination given in the merged catalogue are averaged values. The difference among multiple entries is typically less than a few arcsec (see the next section).

#### 4. Positional Accuracy

In the course of preparing the merged catalogue, the accuracy of the catalogued position was examined using the data for 806 KUGs which were detected more than once on different plates.

Positions of KUGs were measured on the plate with the XY measuring machine at the Kiso Observatory. The centre of each KUG was defined by visual inspection of the image on the monitor screen of the machine. When the nucleus was visible, the center was unambiguously defined. However, quite a few KUGs had fairly irregular shapes and the definition of the center for those KUGs, in particular, for large bright ones, was subject to some uncertainty.

The measured (x,y) positions were converted to the equatorial coordinates using the standard coordinate method. About 25 position standard stars were used for each plate. Those stars were taken from either AGK3 or SAO catalogue (see Noguchi et al. 1980). The nominal accuracy of the catalogue position at the epoch 1985.0 are 0.4 arcsec and 0.9 arcsec for AGK3 and SAO, respectively. The typical positional error for a star measured on a Kiso Schmidt plate was estimated to be 0.17 arcsec on the basis of the analysis of 9 plates (Nakamura and Sekiguchi 1993). This value includes the bisection error and the random and systematic errors due to plate modelling. The error in the catalogue position is not included, however. The corresponding error would be slightly larger for our

plates because of the longer exposure time. However, the catalogue error is still the dominant component in the position error of a stellar object in our case.

We examined the position error of non-stellar KUGs. The 806 KUGs were divided into bright and faint samples. The bright sample includes KUGs with diameter larger than 0.8 arcsec and also with magnitude brighter than 16 photographic magnitude. Fig. 2 shows the histogram of their position differences measured on different plates. The shaded and the hatched parts are for the total and the bright samples, respectively. The data for AGK3 and SAO are not discriminated here.

Twelve KUGs which show large position differences ( $\Delta\alpha > 0.9''$ ,  $\Delta\delta > 9''$ ) all belong to the bright sample. This indicates the difficulty in defining the center of large bright KUGs noted above. Except for these 12 KUGs, the rms position difference is  $\Delta\alpha \sim 0.1''$  and  $\Delta\delta \sim 2''$ . These are roughly 2–3 times the estimated error for stellar objects. These numbers may be regarded as the typical position accuracy of the KUG catalogues although the accuracy for faint KUGs is slightly better as seen in Fig. 2.

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