The Data of the Surface Photometry Catalogue of the ESO-Uppsala Galaxies are Now Available

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We are happy to announce that most of the results of our extensive project on the surface photometry of the 16000 ESO-Uppsala galaxies are now publicly available.

We have scanned 15467 Southern galaxies on 407 Blue and 407 Red original ESO-Schmidt plates with the PDS micro-densitometer. The galaxies were selected from the ESO-Uppsala Catalogue, which was based on a visual inspection of the ESO Quick Blue Schmidt survey plates. The original selection criterion was a minimum visual angular diameter of 1 arcmin. The ESO-Uppsala catalogue was published in 1982 by Lauberts and provided visually determined information on the positions, morphological types, diameters, axial ratios and position angles for galaxies up to $\delta = -17.5°$.

In the new Surface Photometry project, computerized processing played a leading role, and was based on the original ESO-Uppsala catalogue, south of $\delta = -17.5°$, as the reference data base. An outline of the basic procedures for this project was given in the ESO Messenger (Lauberts and Valentijn, 1983).

At first, we compiled a catalogue with photo-electric standards, with photometric data of 1700 standard galaxies transformed to a photometric standard system (Cousin's). Aperture photometry has been accumulated both from the literature and from our own photo-electric observations. With these photo-electric standards, together with the calibration wedges present on many plates, we calibrated the survey plates involved in this project. Next, all the scanned images of the galaxies were calibrated to intensity. 28218 images with calibrated intensity in surface brightness units are now resident on two optical disks and a facility to retrieve these data is available at ESO, Garching. Provided that the proper optical disk is in ESO's optical disk drive, the user can retrieve and display his wanted galaxy in two colours almost instantaneously.

The intensity calibrated images were used by us to extract a great variety of photometric and structural parameters. In the book **"The Surface Photometry Catalogue of the ESO-Uppsala Galaxies"**, we give a detailed description of the calibration and automated parameter retrieval procedures. This hard cover book is now for sale at ESO.

In total, we reduced the input data (2.8 Gbyte) to 180 entries for 15467 objects ($\sim$ 11 Mbyte). The extracted parameters include radial surface brightness profiles, allowing further processing according to the user's needs. Furthermore, we determined magnitudes at several isophotal levels, colours, colour gradients, effective radius parameters, structural parameters such as axial ratios, position angles, profile gradients etc. In the book, we list the measured values for a subset of these parameters. On 440 pages values of 37 different parameters are printed ($\sim$ 600.000). This data base can be considered the principal result of the project.

A sample page of the printed parameter values is shown for the Right ascension interval $13^h54^m - 13^h56^m$. Let us focus on the 12^{th} magnitude galaxy NGC 5365 with coordinates $13^h54^m46^s$, $-43°41'.2$. Its ESO identifyer is 271-G 08, here coded as 2710080. Note that companion objects, when present, have identifiers terminating on '1' or '2'. The morphological type is a lenticular, S0, here coded as -2.0. The galaxy belongs to the 'diameter limited' sample, left flag is 1, but not to the complete subsample according our V/V_{max} tests, which were labeled with the left flag equal to 2. The morphological type was visually revised - right flag equal to 1. The galaxy is located somewhere near the Centaurus complex of galaxies and has a recession velocity of 2472 km/s; it is pretty bright, having a blue total magnitude of 12.20. The upper '$^-$' sign means that the innermost data was corrected with photo-electric data, well motivated by the high central surface brightness $\mu_B = 18.81$ per square arcsec. The red B-R colour, 1.62, and the small colour gradient, -0.06, are typical for an early type galaxy. The very extended faint envelope made the big difference between the diameters at the $\mu_B = 25$ and 27 isophotes.

The shape of such a galaxy is very difficult to characterize by the eye. With two rivaling algorithms, we let the computer sort out its structure. One code was more sensitive to the structure at maximum extent, the overall structure (upper line), while the second code determined the intensity weighted structure (second line). This resulted in quite different estimates - 1.62 and 1.14 - for the axial ratio, a/b. On the other hand, the two estimates for the position angle differed by not more than 11°. The radial intensity profile may be expressed by an index of the exponent in the so called generalized exponential law, where a value of the index of 0.25 characterizes a perfect $R^{1/4}$ law light profile, usual for elliptical galaxies and bulges, while an index value of 1.0 represents a pure exponential disk light profile. In this case the blue image returned a value 0.30, while the red image admitted 0.23. Both values are reasonably close to 0.25, indicating that the profile of this SO galaxy is dominated by a bulge component.

Being positioned in the outskirts of a large cluster, our object is seen against a projected galaxy density, 1.3 per square degree, constituted by neighbouring bright galaxies. The fraction of spiral galaxies amounts to 77 per cent. The final number on the line of printed data, 0.33, is the estimated blue extinction, a typical average value for an object at Galactic latitude +17°.

We have attempted to code the galaxy parameters in a transparent way. As fanatic as astronomers can be, with some understanding of the coding, one can read the printed lines as a novel. We guarantee, that there are quite some exciting characters on our printe d pages. As one of the readers remarked, the data base contains sufficient information to accurately reconstruct from the parameters the original input images.

The data is also available to the astronomical community in several other forms: on the ESO data base computer (IDM), as a MIDAS table on the ESO VAX computers and on magnetic tape.

The calibration coefficients of the 814 plates form an interesting auxiliary data base on the properties of sensitized (Red) and unsensitized (Blue) plates. Sky brightness values are also included in the calibration coefficient tables.

In the book we give an extensive discussion on the photometric accuracy of the data base. Both internal consistency checks and comparisons with other photometric observations are presented. The nominal accuracy of total magnitudes is expected to be better than 0.09, while surface brightness profiles are found to have residuals from photo-electric photometry less than 0.15 for $20 < \mu_B < 24$.

The photometric and structural parameters were used to determine morphological types for $\sim$ 3500 galaxies that could not be classified in the ESO-Uppsala catalogue, mostly because they were too faint. The availability of colours and profile gradient parameters allowed us to evaluate the expected morphological types with an automated computer programme. All early type galaxies have been re-classified by means of a visual inspection of Blue and Red digitized images. We made also extensive use of the recently published classifications by Corwin *et al.*(1985). Altogether, this resulted in a complete update of the morphological types of ESO-Uppsala galaxies and their companions.

An important quality of the data base is that it has been acquired in a homogeneous fashion for all types of galaxies in various environments. Thus it appears that scientific studies of galaxy properties as function of environment might be fruitful with this data base. In order to facilitate such studies, we computed a local projected galaxy density parameter. The catalogue was also cross-correlated with the recent Southern Cluster Catalogue (Abell, Corwin and Olowin,1989). The projected galaxy density parameter, which value is normally less than 10, has been updated for the galaxies supposedly associated with clusters, by replacing the value of the projected galaxy density with a representive value of the 'cluster count' (always greater than 10). About 900 galaxies were found to be associated with a Southern Cluster. On the example page, one can easily notice that six galaxies were found to be associated with two different clusters- one with a scaled 'cluster count' = 18.7 , the other with a scaled 'cluster count'= 13.0. For two systems without measured redshift our identifications were done on a positional basis.

An extensive discussion is given in the book on the selection effects and completeness. Various sub-samples were drawn from the total sample. Flags were defined to label these various samples. In Table 1 we list the distribution over morphological types of the various samples, together with the number of available redshifts. In total, redshifts of 3576 galaxies, acquired from the literature, are present in the data base.

In summary, the resulting data bases include:

- A catalogue with *photometric standards*, at least one per survey field
- A table with the *plate characteristics* of all 407 B and 407 R survey plates
- A set of 28218 B or R *images* with calibrated surface brightness and resident in FITS format on a set of two ESO optical disks, ready for direct access and display.
- A table with many *photometric parameters* - e.g., magnitudes, colours, dimensions, profile shapes and also including several environmental parameters.

This table is now available in several forms:

- An abstract in *printed version in the book*
- An abstract in the IDM *data base computer at ESO*
- The full table in *MIDAS table* format, resident on the ESO VAX computers, and also available on magnetic tape both in ASCII format and in MIDAS table format.

We are now preparing some scientific papers describing the interesting statistical properties of the galaxy parameters. This will include also a discussion on the fundamental properties of early type galaxies, (bulge to disk ratios, iso-photal twists in relation to the environmental conditions) and the role of central surface brightness in relation to morphological type, scale length and formation scenarios for late type galaxies. A new

Table 1. Subsamples in ESO-LV data base. Distribution over *Type* and available cz

	SAMPLES											
	ALL			DIAMETER$\geq 1'$			$B_T < 14.5,\ 1'$			VMAX		
Type	#	%	#cz	#	%	#cz	#	%	#cz	#	%	#cz
-5.0:-4.5	339	2.2	158	249	2.1	137	163	5.4	119	126	2.1	73
-4.5:-3.5	102	0.7	58	91	0.8	53	73	2.4	47	71	1.2	40
-3.5:-2.5	632	4.1	309	504	4.3	283	320	10.7	228	286	4.8	172
-2.5:-1.5	970	6.3	403	752	6.3	332	368	12.3	238	434	7.3	202
-1.5:-0.5	501	3.2	175	355	3.0	150	136	4.5	99	235	3.9	116
-0.5:+0.5	697	4.5	199	513	4.3	158	133	4.4	83	107	1.8	35
+0.5:+1.5	1663	10.8	382	1329	11.2	316	246	8.2	141	237	4.0	58
+1.5:+2.5	949	6.1	212	646	5.5	173	133	4.4	96	221	3.7	55
+2.5:+3.5	2248	14.5	421	1873	15.8	384	350	11.7	219	874	14.6	143
+3.5:+4.5	996	6.4	323	807	6.8	301	314	10.5	222	470	7.9	173
+4.5:+5.5	1060	6.9	333	828	7.0	315	306	10.2	226	578	9.7	226
+5.5:+6.5	1754	11.3	233	1395	11.8	207	158	5.3	100	945	15.8	141
+6.5:+7.5	1046	6.8	123	659	5.6	112	103	3.4	61	463	7.7	95
+7.5:+8.5	791	5.1	77	524	4.4	71	66	2.2	38	362	6.1	61
+8.5:+9.5	824	5.3	80	590	5.0	80	71	2.4	50	304	5.1	71
+9.5:+10	898	5.8	90	730	6.2	87	59	2.0	34	266	4.4	64
-5.0:-2.5	1073	6.9	525	844	7.1	473	556	18.5	394	483	8.1	285
-2.5:+0.5	2168	14.0	777	1620	13.7	640	637	21.2	420	776	13.0	353
+0.5:+10	12226	79.0	2274	9381	79.2	2046	1806	60.2	1187	4720	78.9	1087
-5.0:+10	15467		3576	11847		3159	2999		2001	5979		1725

Galactic extinction model for the Southern hemisphere, based on our own data, is also in preparation.

Copies of the book "The Surface Photometry Catalogue of the ESO-Uppsala Galaxies" by Andris Lauberts and
Edwin A. Valentijn are available for sale at the European Southern Observatory. The price of the volume is DM 50,-.

Also, some copies are still available of "The ESO Uppsala Survey of the ESO(B) Atlas" at a price of DM 40,-.

Orders should be accompanied by prepayment and directed to the European Southern Observatory, Information Service, Karl-Schwarzschild-Str. 2, D-8046 Garching bei München, FRG.

Copies of the magnetic tape may be ordered from the Centre de Données Stellaires, 11, rue de l'Université, F-67000 Strasbourg.

References

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