THE EDINBURGH/DURHAM SOUTHERN GALAXY CATALOGUE

C.A COLLINS, N.HEYDON-DUMBLETON, H.T. MACGILLIVRAY,
University of Edinburgh, Blackford Hill, Edinburgh,
EH9 3HJ, U.K.

T. SHANKS,
University of Durham, South Road,
Durham DH1 3LE, U.K.

ABSTRACT

We review the current status of the Edinburgh/Durham southern galaxy catalogue. The aim of this project is to use COSMOS measurements of the UK Schmidt J survey to produce a unique data base of galaxies, complete down to bj ~ 20.5 mag and covering ~ 100 survey fields. We have developed the optimum procedures to classify objects as stars or galaxies and calibrate the galaxy magniudes on individual plates. We are confident that residual systematics will be ~ 5%, thereby ensuring that this catalogue will substantially contribute to our understanding of the Universe at large. One initial finding of the survey is a probable 6 sigma density fluctuation in the galaxy distribution.

INTRODUCTION

We are engaged in the construction of a large galaxy catalogue in the southern hemisphere using high-speed microdensitometer (COSMOS) measurements of grade A IIIaJ survey plate copies. We have begun to systematically build up a mosaic of plates around the SGP and hope to complete at least 100 such fields to a uniform depth of bj ~ 20.5 mag over the next couple of years. Since the COSMOS scanned region measures 5.3 X 5.3 degrees^2 on each plate, our catalogue will cover ~ 1 steradian of the southern sky. Given the uncertainty caused by hidden systematics in existing optical galaxy surveys, such as the Lick counts (Shane & Wirtanen 1967), the need for complete objectivity and strict quality control when constructing such a survey cannot be overstressed. The Edinburgh/Durham galaxy catalogue will be one of the largest and most complete surveys of its kind and the final calibrated survey will be made available to all astronomers.

J. Audouze et al. (eds.), Large Scale Structures of the Universe, 125–127.

https://doi.org/10.1017/S0074180900135922 Published online by Cambridge University Press

MECHANICS

There are two primary uncertainties associated with constructing a galaxy catalogue from digitised machine measurements. These are image classification and plate magnitude calibration. An estimate of the accuracy we aim to achieve is provided by Geller et al. (1984). They argue that surveys designed to measure the galaxy correlation function at the depth of the Lick counts must have systematic errors < 5%. We detail below our method for minimising systematics due to object mis-classification and plate mis-calibration.

a) Star-Galaxy Classification

After detailed investigation, we have implemented a rapid and reliable automated star-galaxy classification algorithm (Heydon-Dumbleton et al. 1987). There are two main features of our approach which are new and which enable consistent classification to be carried out over many fields at bj < 21, for the first time. Firstly, we correct for plate background variations. Figure 1 is a contour plot of the filtered background intensity, as measured by COSMOS, from a typical J survey glass copy. The strong background variation is the result of a combination of vignetting and emulsion desensitization during exposure. The range between the central contour and that at the edge of the scanned region is ~ 0.2 mag. Since star-galaxy classification works by separation in some separation parameter-magnitude plane, mis-classification rates will be strongly plate position dependent if these background variations are not accounted for. Secondly, we have implemented an automatic procedure to define a separation locus using the distribution of data in the classification parameter v's magnitude plane. This method removes the subjective element of defining separation by "eye" fitting curves to the data. In addition the algorithm supplies estimates of contamination and completeness for each plate. From comparisons between visual and automatic classification the automatic estimates of contamination and completeness are seen to provide a reliable quality control. In numerous trials on different plates our completeness of galaxies was always >95%, with a stellar contamination ~ 5 % (see Heydon-Dumbleton et al. 1987).

b) Magnitude Calibration

Calibration is carried out by exploiting plate overlaps and zero pointing using faint galaxy sequences. Problems due to sky background variations are overcome by defining magnitudes in terms of the ratio of the summed image intensity to the local sky background intensity. This results in a simple offset between the COSMOS magnitude and bj, which corresponds to the sky background magnitude in mags/arcsec^2. Recently we have obtained 60 galaxy CCD sequences at B & V to calibrate the sky background intensities for 50 plates.

PRELIMINARY RESULTS

Presently we have scanned 120 plates and reduced ~ 60. An example of some exciting early results is shown in Figure 2. This is a mosaic of 7 fields, constituting an area ~ 15 x 11 degrees^2, brighter than bj ~ 19.5 and centered on RA ~ 23 hrs, DEC ~ -37. The enhanced structure visable at approximately this position represents an areal overdensity $\Delta N/N$ ~ 2 in 10 degrees^2. There is a central cluster at z ~ 0.16, which gives the overall galaxy enhancement a linear size (R) of 15 h^{-1}Mpc, if those galaxies are at the same distance. From the galaxy correlation function we expect $\Delta N/N$ ~ $(hR/5\ \mathrm{Mpc})^{-1}$, for a correlation length 5 h^{-1}Mpc. Therefore, if this galaxy structure is real it represents ~ 6 sigma density fluctuation in the galaxy distribution. We intend to undertake searches for these supercluster size galaxy enhancements since statistics on their number density and distribution will provide a rather powerful constraint on the conditions that prevailed at very early times (e.g. Kaiser & Davis 1985).

REFERENCES

Geller, M.J., Lapparent, V. De. & Kurtz, M.J., 1984. Ap.J., 287, L55.

Heydon-Dumbleton, N.H., Collins, C.A. & Macgillivray, H.T., 1987. M.N.R.A.S., Submitted.

Kaiser, N. & Davis, M., 1985. Ap.J., 297, 365.

Shane, C.D. & Wirtanen, C.A., 1967. Pub. Lick Obs., Vol. 22, Part 1.

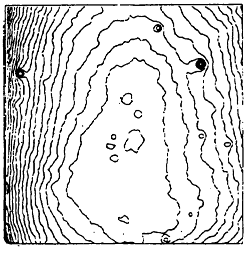

Fig. 1. Contours of sky background intensity on field J190. Each interval is ~ 0.02 mag.

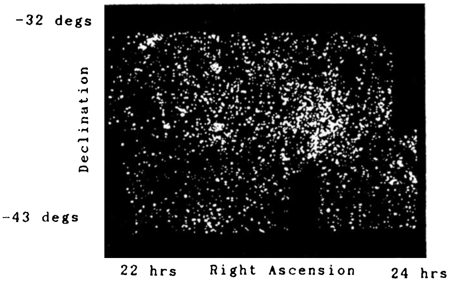

Fig. 2. 85000 galaxies on 7 fields down to bj ~ 19.5 mag, binned in 0.1 x 0.1 degree cells. Only cells with > 2 sigma peaks (> 3 galaxies) are shown.

https://doi.org/10.1017/S0074180900135922 Published online by Cambridge University Press