A FAINT GALAXY SURVEY FROM COSMOS MEASURES ON DEEP UKST PLATES

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ABSTRACT

Deep photographs taken with the UK 1.2m Schmidt Telescope are being scanned with the COSMOS automatic plate-measuring machine in order to carry out a survey of galaxies over large areas of sky down to faint limits (B $\sim$ 21.5). Several fields have been examined, and the data are being used to investigate the properties and large-scale projected distribution of galaxies.

1. INTRODUCTION

Photographs taken with the UK 1.2m Schmidt Telescope (UKST) in Australia record the images of large numbers of faint galaxies. On any single plate are contained some 50000 - 60000 galaxy images down to B = 21.5 (a reasonable limit for most star/galaxy separation techniques), or $\sim$1300 galaxies/square degree. With the COSMOS plate-scanning machine at the Royal Observatory Edinburgh (ROE), we are attempting to extract this large quantity of information and make it available for statistical investigation. Large areas of the sky are being surveyed, producing a faint galaxy catalogue which will enable the properties and large-scale two-dimensional (2-D) distribution of galaxies to be examined from a completely objective sample. In this paper we describe the measurements and present an example for one area near the South Galactic Pole (SGP).

2. PLATE MEASUREMENT

The maximum square area of plate that can be scanned with COSMOS at present is an area of 287 x 287 mm^2 (equivalent to 5.35° x 5.35° on the sky for UKST plates). Since southern sky field centres are separated by 5° and the field of view of the UKST is $\sim$6.5°, then this means that there is a comfortable overlap of $\sim$1/3° on plates of adjacent fields. This is sufficient to ensure there are no gaps

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or missing "strips" in the sky coverage and that the magnitude system can be checked from plate to plate. The latter enables the calibration to be consistently maintained over the entire area under study.

At 16μm resolution, COSMOS carries out the scans on each plate in 6.5 hours. For image detection, a threshold at 7% of the night sky intensity level is usually applied (corresponding typically to the B = 25.6 mags/square arcsecond isophote). The information obtained for each image consists of both photometric (magnitudes) and geometric (positions, sizes, orientations and shapes) parameters. Star/galaxy separation is carried out on the data by means of surface brightness criteria (see MacGillivray and Dodd 1982b) for objects fainter than B $\sim$ 16.5, and by means of geometrical criteria for objects brighter than this value.

In other papers (MacGillivray and Dodd 1982a, b) we examined the usefulness of COSMOS for the photometry of faint galaxies. Depending upon the precise isophote used, we find that magnitudes for galaxies can be reliably determined at least in the magnitude range 13<=B<=23, the relationship between COSMOS magnitude and those from photoelectric or other photographic observations having a slope of 45°. We also find good agreement (with slope of 45°) between the magnitudes for the same objects in regions of overlap on different plates. Because of the high thresholds used in the present case, a distortion is introduced for the magnitudes of galaxies fainter than $B^{*} \sim 21$ due to the fact that much of the light falls below the threshold level.

3. RESULTS AND DISCUSSION

Several areas of sky, including the SGP, are being scanned and complete coverages of large regions being constructed. For the purpose of illustration, figure 1 shows the result of combining the data for 2 survey fields near the SGP. Galaxies were counted in cells of dimensions 7' x 7' and isopleths drawn using a computer routine. Note that in the figure several high density regions can be seen, corresponding to the presence of rich clusters. Indeed, 4 clusters recorded in the Abell (1958) catalogue are particularly noticeable (viz. A118, A140, A141 and A155). Thus from this galaxy survey, criteria could be defined which would enable also an objective rich cluster catalogue to be obtained.

Data of this nature are suitable for objective studies of the 2-D distribution of galaxies using suitable algorithms (e.g. n-point correlation functions) and also for searches for non-random effects in the properties of galaxies (e.g. large-scale coherent alignment trends). Similar coverages in more than 1 passband are also planned and would help with understanding the present of galactic obscuration and its effect on the galaxy counts.

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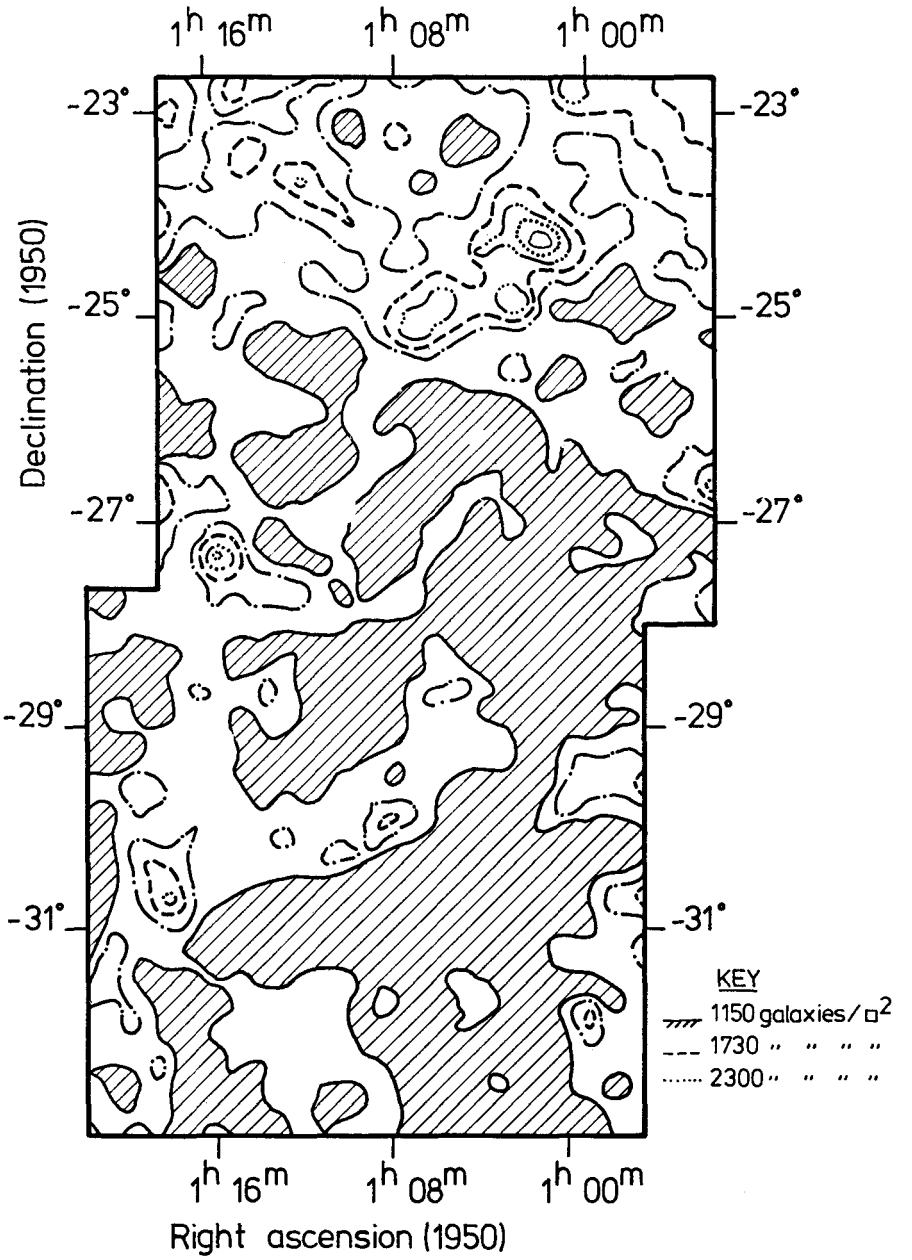

Figure 1 The distribution of galaxies detected down to B = 21.5 from COSMOS scans on the plates for the southern sky survey fields 412 and 475.

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This large-scale survey is being coordinated with other surveys which are under way on objective prism plates, e.g. the automated quasar search (Clowes, 1984, these proceedings) and galaxy automatic redshift surveys (Cooke et al 1984 and Parker et al 1984, both papers included in these proceedings).

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