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K_S NUMBER COUNTS IN THE GROTH AND COPPI FIELDS

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The COSMOS Survey is currently mapping 0.5 deg^2 of sky in optical and near-IR bands to define samples of compact galaxies at high redshift for spectroscopic studies with the GTC. We present galaxy counts in the K_s filter over an area of 120 arcmin^2 in two fields, Coppi and Groth, observed with the INGRID near-infrared camera on the William Herschel Telescope. Our galaxy counts bridge the gap between previous deeper surveys over a smaller area and other shallower but wide field surveys.

1. INTRODUCTION

Galaxy counts in the optical and near infrared are one of the classical tests for the study of the evolution of galaxies and the nature of the Universe. Near-infrared photometry is dominated by the old, evolved stars and is less affected than optical photometry by dust and the evolution of stellar populations; moreover, K-corrections are more accurately calculated in IR bands.

We present galaxy counts in the K_s filter over an area of 120 arcmin^2 in two fields, Coppi and Groth, of the COSMOS survey. The limiting magnitudes are roughly 21.0 mag in Coppi and 20.8 in Groth with $S/N > 3$ within the seeing radius. We have measured the efficiency correction as a function of the object brightness and size using synthetic images, and then science images for better calibration. In order to determine the detection reliability we present a procedure for calculating the number of spurious detections as a function of magnitude.

2. OBSERVATIONS AND REDUCTION

The observations were obtained in 2000 April with the near-infrared camera INGRID on the William Herschel Telescope (WHT). The fields presented are part of the COSMOS survey. Complementary observations with OMEGA-PRIME on the 3.5 m telescope at the Calar Alto Observatory cover the Groth flanking fields (Serrano et al., this volume, p. 000).

The data reduction procedure takes account of linearity correction, dark current, and flat-fielding. Sky subtraction and bad-pixel and cosmic-ray removal was made with DIMSUM in IRAF (Stanford et al. 1995).

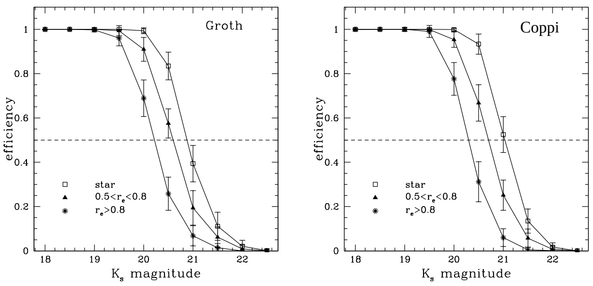

Fig. 1. Detection efficiencies for the Groth (left panel) and Coppi (right panel) fields, estimated using real object as models. Points and error bars are for 30 simulations for each 30 objects of the same size class and magnitude.

3. DETECTION EFFICIENCIES

We take the brightest sources in images as models that are scaled in flux and reintroduced into the science images. Models of different r_e ($r_e \leq 0.5''$, $0.5'' < r_e \leq 0.8''$, $r_e > 0.8''$) are considered in order to estimate detection efficiencies as a function of source size. Then SExtractor (Bertin & Arnouts 1996) is used to recover the objects. Finally, detection efficiency is estimated as a function of object size (see Figure 1).

4. DETECTION RELIABILITY

Determining detection reliability from the science image requires adopting a method that allows us to eliminate sources produced by noise. We have developed a procedure based on Bershady et al. (1998) that allows us to separate spurious from real detections using images constructed from two exclusive

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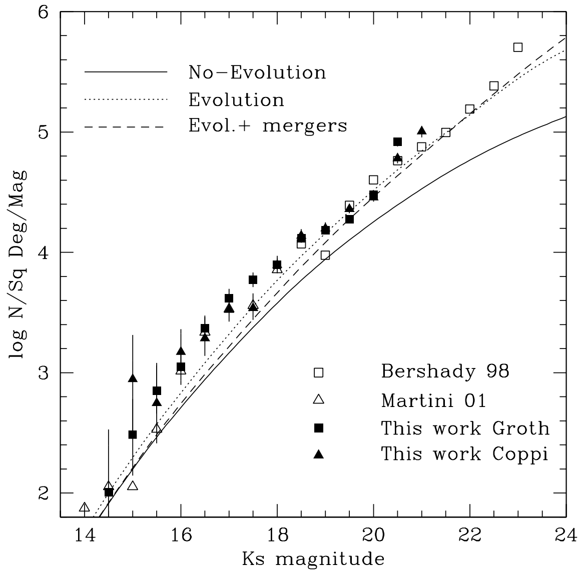

Fig. 2. Groth strip and Coppi field galaxy number counts. Number counts in K band from Bershady et al. (1998) and Martini (2001) are shown for comparison. Predictions for galaxy number counts were obtained with ncmod (Gardner 1998) using the $q_0 = 0.02$, $H_0 = 50\ \mathrm{km\ s^{-1}\ Mpc^{-1}}$ cosmology.

halves of the data. We have used the double-image mode in SExtractor to make the photometry in the total exposure image and in the two images with half exposure time, using the same adaptable apertures in each source. We considered as spurious detections those sources whose S/N were lower than a limit, $\mathrm{SN_{lim}}$, chosen by examining histograms of flux differences between the half-time exposure images for the spurious detections.

5. GALAXY COUNTS

We have computed differential galaxy counts (Figure 2) from the deepest regions of Coppi and Groth mosaic images ($\sim$71 arcmin^2 in Groth; $\sim$47 arcmin^2 in Coppi). The counts are corrected for detection efficiency, until 50% of detection efficiency for each size group (for stellar objects this limit corresponds to $\sim$21.0 mag in Coppi and $\sim$20.8 mag in Groth) and reliability. The separation between stars and galaxies was performed using the star–galaxy separation procedure in SExtractor with the default configuration. Error bars correspond to 1σ lower and upper confidence intervals, and include counting statistics (Gehrels 1986) added in quadrature to the estimated uncertainties in the detection efficiency corrections.

6. CONCLUSIONS

We have presented deep ($K_\mathrm{s} = 21.0$ mag) galaxy number counts over an area of $\sim$120 arcmin^2. Completeness and reliability corrections have been performed measuring efficiency as a function of image size. A novel method for discriminating between real and spurious sources has been developed.

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