CLUSTERING PROPERTIES OF FAINT BLUE GALAXIES

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1. Introduction

Log N - log S diagrams are being used as powerful diagnostic tools to probe evolutionary properties of different extragalactic populations. In the optical/near-infrared regime the discrepancy between near-infrared number counts which follow theoretical predictions and counts in the B band which show an excess density revealed a new population of galaxies. The nature of this population of faint blue galaxies is still unknown.

To study the clustering properties of the faint blue galaxies and to investigate whether they are related with excess populations in various other wavelength regimes, *e.g.*, the population of milli-Jansky sources in the radio domain, faint IRAS sources in the far infrared or X-ray sources, we have performed a medium-deep survey at optical and near-infrared wavelengths at the North Ecliptic Pole (NEP). This survey extends homogeneously over an area of one square degree.

2. The Optical/Near-Infrared Survey at the NEP

The optical surveys were carried out in the B_j (460nm) and R (700nm) bands at with a TEK CCD at the prime focus (0.40 arcsec pixel^{-1}) of the 3.5 m telescope at Calar Alto, Spain. The K′(2.1μm) data were taken with the MAGIC camera (1.6 arcsec pixel^{-1}) and a NICMOS3 array at the 2.2 m telescope on Calar Alto. To cover the area of 1 deg^2 in the R band we took a grid of 10×10 fields. In B_j and K′we used a grid of 9×9 exposures with smaller overlap between adjacent fields but still covering 1 deg^2.

To derive homogeneous photometry over the whole field we took in each band a snapshot survey with small exposure times and large fields in photometric conditions. In K′this was done with the 1.2 m telescope on Calar Alto. In the optical we used the focal reducer CAFOS at the 2.2 m tele-

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scope which has a circular field of view with a diameter of 15′. Although the snapshot survey does not cover one square degree, there is sufficient overlap with the frames of the deep survey to transfer the photometry with high accuracy. After standard reduction we identified sources automatically, derived the photometry and classified all objects due to their morphology. In the B_j and the R-band we detected 92,000 and 86,000 sources, respectively. In K′ we reach a detection limit of 19.0 mag. Down to this level we detect 25,000 sources.

3. Galaxy Luminosity Function in the Optical

We compared the galaxy luminosity function in B_j with results from other surveys (*e.g.*, Metcalfe *et al.* 1995). The data agree well up to 23.5 mag. At this level incompleteness sets in for the whole survey. Individual, good frames are deeper by up to 0.8 mag. Statistical corrections for incompleteness allow comparisons down to 25 mag. In the R band the comparison of published luminosity functions with our galaxy counts show the completeness limit of our survey at 23 mag with limiting magnitudes (and complete sub-samples from smaller fields) fainter than 24.0 mag.

4. Color-Magnitude Diagram and Correlation Function

Because of the difference between the B_j and the B-band the color-magnitude diagram in B_j-R from our survey shows around 0.2 mag redder colors than the B−R color-magnitude distribution in Metcalfe *et al.* (1995) The limiting magnitudes (25.0 mag and 24.0 mag in B_j and R, respectively) of our survey result in a cut-off at B_j=25.0, B_j-R=1 with slope 1.

In order to study the nature of the faint populations in the radio, far-infrared and X-ray bands we compared the color-magnitude diagrams of the counterpart—candidates to those of the entire survey and found no statistically significant difference. To study the correlation properties we computed the cross correlation function for the total sample and for various color-selected subsamples. The correlation strength on scales of a few hundred arcseconds is 1.75 in B_j and R. We compared the correlation strengths for four diffent samples in the color-magnitude plane. The red objects show a higher correlation strength than blue objects.

References

Metcalfe N. *et al.* 1995 Mon.Not.R.astron.Soc., 273, 257-276