THE HITCHHIKER PARALLEL CAMERA AND STUDIES OF FAINT GALAXIES

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ABSTRACT. The Hitchhiker camera performs CCD imaging of an off-axis field on a 4 m telescope in parallel with the normal on-axis scientific programmes. Using a dichroic beam splitter it images in two colours simultaneously, obtaining deep images in random fields suitable for survey work. Recent research projects have given particular emphasis to studies of faint galaxies and we present new results on the association of faint blue galaxies with candidate giant galaxies.

1. The Hitchhiker Camera

The Hitchhiker camera is a parallel observing instrument attached to the 4.2 m William Herschel Telescope on La Palma. It performs simultaneous CCD imaging in an off-axis field while the telescope continues its normal scientific programmes, greatly increasing the efficiency of data acquisition. In addition, a dichroic beam splitter allows data to be collected in two colours simultaneously.

The camera (described in Disney et al. 1993) uses two P88200 EEV CCDs (770 x 1152 pixels) to image a single 6 x 4 arcmin field of view with an image scale of 0.3 arcsec $(\text{pixel})^{-1}$ through two broadband filters simultaneously by using a beam splitter. The centre of the field is 7 arcmin from the telescope's optical axis. Despite being off-axis, typical image sizes, including seeing effects, have been 1.2 arcsec full-width at half-maximum. Hitchhiker can observe through B, V, R and I broadband filters. The simultaneous use of two filters allows colour information to be derived using only one photometric calibration point. The camera has been operated on a regular basis since February 1991. The data set collected is already large, covering an area in excess of 2 square degrees.

Hitchhiker data have been used for studies of faint galaxy number counts, populations of faint field galaxies and of the medium redshift ($z = 0.2$) cluster Abell 963. These results are discussed in detail by Driver et al. (1993a, 1993b). Current research programmes include studies of galaxy populations, the distribution of galaxies, the extragalactic background light, searches for low surface brightness galaxies, and studies of faint stars and Galactic structure.

The Hitchhiker camera offers an unique opportunity to sample large volumes of the Universe with multi-colour CCD exposures and has demonstrated the value of parallel observing. We recommend that similar instruments be incorporated into the design and construction of all new, large telescopes, in particular the new generation of 8-metre class telescopes.

H. T. MacGillivray et al. (eds.), Astronomy from Wide-Field Imaging, 77–78.

2. Faint Blue Galaxies and Candidate Giant Galaxies

Attention has recently been directed to the possible association of faint blue galaxies and brighter objects. One possibility is that the blue galaxies have 'parent' giant galaxies, implying a physical (clustering) association between the two. If they are strongly clustered then a merging scenario may be favoured over fading to account for the lack of these low luminosity galaxies in the nearby universe.

We have investigated the association between faint blue galaxies and candidate giant galaxies at redshifts of $z \simeq 0.2$ to 0.4 using deep Hitchhiker images in the B and R bands. The model of galaxy populations of Driver et al. (1993a) predicts that magnitude-limited samples of galaxies with B < 22 mag are likely to be dominated by giants with luminosities close to L* of the Schechter luminosity function. We therefore select a sample of candidate L* galaxies using a magnitude range of $20.5 \leq B \leq 22.0$. We further constrain the sample by imposing limits in $(B - R)_c$, extending from 0.2 mag redder than the mean colour of non-evolving Sa giants at $z = 0.2$ - 0.4 to 0.2 mag bluer than the Sa giant colours modified by a Bruzual (1983) $\mu = 0.5$ evolution model. The resultant sample contains seven candidates.

The sample of faint blue galaxies is selected using an apparent magnitude range of B = 23.5 to 25.0 mag, and colour limits of $(B - R)_c$ = -0.4 to +1.2. Image detections lying outside the expected selection limits are rejected. The sample contains 61 galaxies.

The distribution of the separations between the candidate faint blue and L* galaxies have been compared with the results of a Monte Carlo simulation of the equivalent statistics for a random distribution of blue galaxies over the same area. No evidence is found within the errors in the data for an association between the faint blue galaxies and L* candidates for separations less than 1′, corresponding to scales of a few hundred kpc. This is inconsistent with some merger models of galaxy evolution which predict that the faint blue galaxies have nearby parent giants with which they later merge; if this effect did occur significantly, it would have to be at a redshift > 0.4. The result would therefore favour a fading scenario over merging as being the fate of the faint blue galaxy population.

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