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Photometric and Spectroscopic Observations of the CLASS Parent Population

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Abstract.
We present photometric and spectroscopic observations of a sample of 36 flat-spectrum radio sources between 5 and 12 mJy. These observations will be used to determine the radio luminosity function for faint flat-spectrum radio sources which is a vital part of the CLASS gravitational lens statistics used to constrain the cosmological parameters.

1. Introduction

Using the gravitational lens statistics from the JVAS lens survey ($S_{5GHz} > 200$ mJy; Patnaik et al. 1992) Helbig et al. (1999) calculated for a flat-universe, $\lambda_0 < 0.84$ at the 95% confidence level. The 5 times larger CLASS lens survey ($S_{5GHz} > 30$ mJy; Browne et al. 2000) will constrain λ_0 further, providing we know the redshift distribution of the lenses and the parent population of unlensed sources. The latter of these two will potentially produce the largest uncertainties since our knowledge of the redshift distribution of flat-spectrum radio sources is limited to $S_{5GHz} > 25$ mJy (Marlow et al. 2000). Since gravitational lensing magnifies a source's flux-density, objects with $S_{5GHz} \sim 5$ mJy could potentially be gravitationally lensed into the CLASS sample and therefore need to be included in the redshift distribution of the parent population. For this reason we observed a sample of 36 flat-spectrum radio sources between 5 and 12 mJy with the goal of reducing the uncertainties introduced by the parent population luminosity function.

2. Sample Selection and Observations

The 5 to 12 mJy sample was selected in exactly the same manner as the CLASS sample. Around 800 sources were selected from the NVSS 1.4 GHz catalogue above 2.5 mJy and observed with the VLA at 5 GHz in order to find only those flat-spectrum sources with $\alpha < 0.5$ where $S_{1.4GHz}^{5GHz} \propto \nu^{-\alpha}$. This left ~ 100 sources which were then observed with the VLA at 8.4 GHz, the frequency at which all CLASS sources are observed. 36 flat-spectrum radio sources between 5 and

12 mJy remained. Spectroscopy of the optically bright objects was attempted using the WHT. The $BRIJHK$ photometry of the optically faint objects was obtained using the NOT, WHT, and UKIRT telescopes in July 1999.

3. Photometric Redshifts and Preliminary Results

Photometric redshifts were calculated using the spectral energy distribution (SED) fitting technique. This method compares the observed SED with a template spectrum of a Starburst and Elliptical galaxy looking for common spectral features such as the Ly-α and 4000Å breaks. The photometric redshift package we use is *hyperz* (Bolzonella et al. 2000). Problems using photometric redshifts can occur when there is contamination of the SED from AGN light. AGNs were identified from their morphology, blue colour excess, spectroscopy, and from the χ^2 model fits

Of the 36 sources in the complete sample, 27 were detected in two or more colours. Those sources detected in less than four colours will have large photometric redshift errors. The objects are generally red and faint (mean $R - K \sim 4$, mean $m_K \sim 19$). The preliminary mean redshift of the sample based on the photometric redshifts obtained with *hyperz* and the limited redshifts obtained spectroscopically is $z \sim 1.5$, at $\sim 30\%$ completness. This will clearly change once all the photometric and spectroscopic data has been fully analysed.

4. Future Work

We are currently attempting to obtain spectroscopic redshifts for a sub-sample of objects within the sample in order to verify the photometric redshift technique. We also have a complete sample of 46 flat-spectrum radio sources between 25 and 50 mJy. Spectroscopy has yielded redshifts for 37% of this sample (Marlow et al. 2000). Most of the remainder are optically very faint. We have already begun a program of obtaining the remaining redshifts from this sample photometrically.

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