RADIO SOURCES IN THE 6DFGS – TEST DATA

Tom Mauch (Sydney)

The current generation of radio imaging surveys (SUMSS, Bock et al. 1999 ; NVSS, Condon et al. 1998) are covering the whole sky to sensitivities of a few mJy or less. These surveys probe a population of both AGN and star-forming galaxies over a wide range of redshift, however radio data alone are inadequate for classifying galaxies and determining redshifts. Using these surveys in conjunction with optical spectroscopic surveys is vital to determine if an individual source is an AGN or starburst and to measure its redshift.

The 6dF Galaxy Survey is an excellent tool for studying the local population of radio sources. In my thesis I plan to cross-match the SUMSS $\delta <-30$ and NVSS $\delta >-40$) surveys with galaxies in the 6dF Galaxy Survey. We expect to detect radio emission from about 16% of galaxies from the main 2MASS selected redshift survey. We are also providing a list of targets for spare fibres which will contain radio identifications with stellar objects and galaxies in SuperCOSMOS which are not part of the main redshift survey. We expect a total of about 20,000 radio–source identifications over the entire 6dF survey area. This article describes some results from a preliminary observation of NVSS radio sources made during 6dF commissioning time.

The objects observed were 105 stars and galaxies selected from SuperCOSMOS in a circle of 6 degrees diameter centered on α =14h, $\delta =-30^{\circ}$, with a radio identification in NVSS not more than 10 arcsec from the optical position for galaxies and stellar objects. An optimal separation of 10 arcsec was determined by Monte–Carlo tests on a large sample of NVSS–SuperCOSMOS matches. On the basis of these tests, the probability of a chance coincidence rose to about 25% for a radio-optical separation of 10 arcsec. Objects fainter than b_J=19 were removed from the list. This cutoff was set to be fainter than that of the survey in order to determine a realistic magnitude limit for our list of spare fibre targets.

The data were reduced using the IRAF task DOFIBRES which combines all of the steps of fibre reduction into one package. The flatfield image was used for the fibre throughput correction. The spectra had a typical

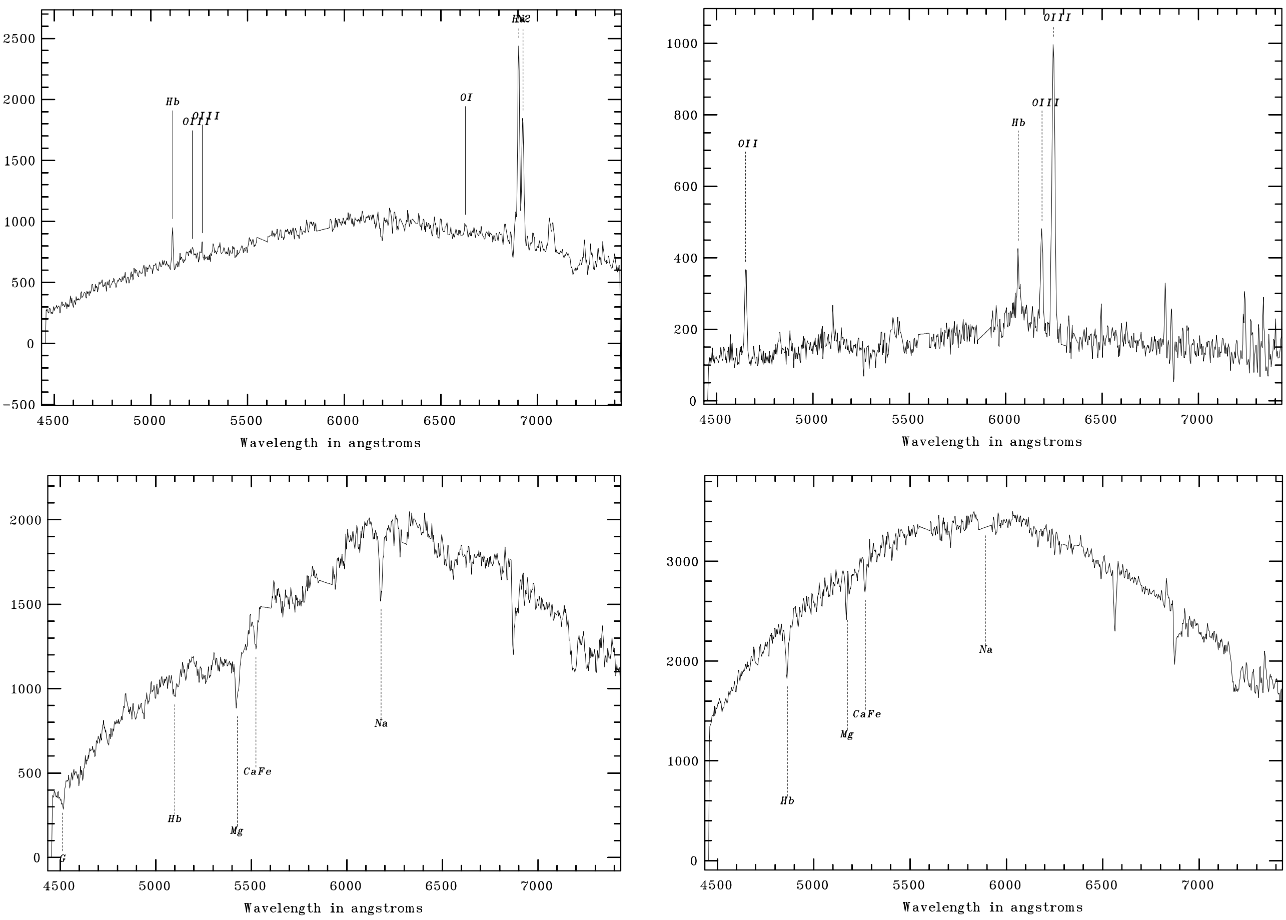

Figure 1. Some examples of reduced spectra. Residual sky lines at 5500Å and 6000Å have been removed manually.

Table 1: Classification of the 105 objects in the sample.

Classification	N
Stars	22
Galaxies	39
Low S/N or R	42
QSO	2

resolution of 2.9 Åpixel^{-1}. Sky subtraction using this package needed careful attention but recent results with the pipeline reduction package 6dFDR show improved sky subtraction.

Redshifts were measured with the RVSAO package in IRAF. This package uses both cross correlation with template spectra and line fitting to obtain redshifts. The template spectra used in the 2dF Galaxy Redshift Survey were used for cross correlation. A correlation coefficient of R=5 with 2dF spectra was deemed to be enough to produce a reliable redshift, however all spectra with coefficients between R=4 and R=6 were inspected visually to verify the results of RVSAO. Figure 1 shows some examples of reduced spectra from this observation.

Table 1 shows the classifications made from the 105 spectra obtained. Twenty percent of the galaxies were not classifiable due to low signal-to-noise. Most of these were fainter (b_J>18) objects well below the intended magnitude limit of the 6dF survey. No quasar template was used in RVSAO, so the spectra with low R were inspected visually to find QSOs. This search turned up two candidate quasar spectra – one at z=0.25 and the other at z=0.8. The higher fraction of stars shown in Table 1 is probably because of the fields proximity to the galactic plane (b=25^{o}). These results indicate that a more conservative cutoff in galactic latitude and Radio–Optical separation may be necessary for stellar identifications. Many of the spectra in the sample had reasonable signal-to-noise but no distinguishing features for cross correlation, most of these were fainter objects (b_J>18). This might be due to bad sky subtraction or could indicate a population of BL–Lacs in the sample.

Figure 2 is a histogram of the redshifts measured from the galaxy spectra. The mean redshift obtained was z=0.05 which is in good agreement with the expected value for the survey. The small number of galaxies with z>0.2 all had very strong emission lines making calculation of redshift possible even at very low signal-to-noise in the continuum.

This test data provides a very encouraging result for future work on radio sources in the 6dFGS. Most of the spectra out to b_J=18 had sufficient signal-to-noise to determine a redshift, and this has allowed us to push our spare fibre target list out to this magnitude. In my PhD thesis I expect to use about 10,000 of these identifications to investigate the local space density of radio sources. With such large numbers it should be possible to determine the local radio luminosity function for both star–forming and AGN type galaxies at low radio luminosity. From the list of spare fibre targets I expect to find a population of QSOs and BL–Lacs at low radio flux density as well as nearby star forming galaxies not part of the main 2MASS sample. Results from this work will provide a benchmark for studies of the cosmological evolution of these radio sources at higher redshift.

Acknowledgements

I'd like to thank Will Saunders for all his help up at the Schmidt Telescope and Matthew Colless for providing 2dF template spectra.

References

Bock, D.C-J., Large, M.I. & Sadler, E.M. 1999, AJ, 117, 1593
Condon, J.J. et al. 1998, AJ, 115, 1693
www.aao.gov.au/ukst/6df.html

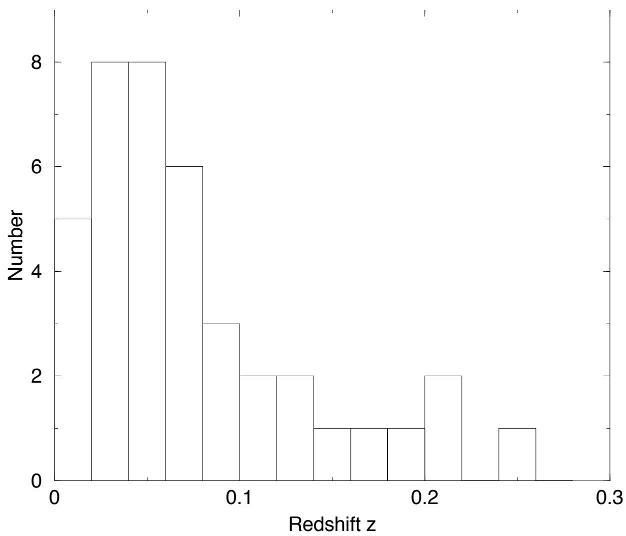

Figure 2. A histogram of the redshifts obtained for the galaxies in the sample.