A Complete 2dF Survey of Fornax

M.J. Drinkwater¹, E.M. Sadler², J.I. Davies³, R.J. Dickens⁴, M.D. Gregg⁵, Q.A. Parker⁶, S. Phillipps⁴, R.M. Smith³

¹ University of New South Wales, Physics, Sydney 2052, Australia
² University of Sydney, Physics, NSW 2006, Australia
³ University of Wales, Cardiff, Physics, PO Box 913, Cardiff CF2 3YB, UK
⁴ University of Bristol, H.H. Wills Physics Lab., Tyndall Av., Bristol BS8 1TL, UK
⁵ IGPP, Lawrence Livermore National Laboratory, Livermore, CA 94550, USA
⁶ Anglo-Australian Observatory, Coonabarabran, NSW 2357, Australia

Abstract. We are using the 2dF spectrograph on the Anglo-Australian Telescope to obtain spectra for a complete sample of all 14000 objects with \(16.5 < B < 19.7\) in a 12 square degree area centred on the Fornax cluster. The aims of this project include the study of dwarf galaxies in the cluster (both known low surface brightness objects and putative normal surface brightness dwarfs) and a comparison sample of background field galaxies. We will also measure quasars, any previously unrecognised compact galaxies and a large sample of Galactic stars. Here we present initial results from the first 680 objects observed, including the discovery of a number of dwarf galaxies in the cluster more compact than any previously known.

1 The Complete Sample

Our primary goal is to obtain a complete sample of galaxies over a large range of magnitude and surface brightness to study the luminosity function and dynamics of both the Fornax cluster and background galaxies. Previous cluster samples were compiled from 2-D images without spectra so it was hard to tell if small galaxies were cluster dwarfs or background giants. We can solve this problem with 2dF which allows us to make a complete spectroscopic survey in the direction of the Fornax cluster. A further limitation of most existing galaxy surveys is that they only considered resolved images, so were biased against compact galaxies. Our survey will measure all images and thus avoids this bias.

One important advantage of our survey is that by including all morphological types it will provide a unique test of the presumed continuity of QSOs and Seyfert-1s as well as measuring the Seyfert luminosity function. Our 2dF spectra have a resolution of 0.85 nm (400 km/s) and can therefore resolve the broad lines of active galaxies. The only other unbiased Seyfert samples have been limited to very bright magnitudes, (e.g. the Hamburg QSO survey to \(B < 17\), Kohler et al. 1997). Our sample of 12 square degrees to \(B < 19.7\) will contain 200 QSOs and 50 Seyfert 1s, all with spectral classifications.

In this paper we describe the results of our first 2dF observations of a sample of 300 galaxies (1 and 2 hour exposures) and 380 unresolved sources (30 minute exposure). The 380 stellar sources were chosen with a bias to very blue and very red stars.
1.1 Galaxy Sample Results

Our galaxy observations have confirmed many members of the cluster and we have also discovered 7 new dwarf cluster galaxies; these are among the most compact dwarf galaxies known (see Drinkwater & Gregg, 1998). Three of the new cluster members show strong emission lines and are very small blue compact dwarf galaxies and one of these may be the first true dwarf spiral discovered. We are also correlating our optical data with an 843 MHz radio continuum survey of the field with the University of Sydney MOST telescope. Two radio sources we have identified with quasars are shown in Fig. 1.

Fig. 1. 2dF spectra of blue stellar objects (upper 4 panels, 30 min exposure) and radio-loud sources (lower 2 panels, 2 h exposure).

1.2 Stellar Sample Results

Many of the bluest stellar images are QSOs; we detected 13 (see Fig. 1). Allowing for the fraction of all stars observed and our magnitude limit, this number is quite consistent with the expected QSO number counts (for $z < 2.2$ and $B < 19.75$) of 55 per 2dF (Boyle et al. 1990). We found one unusual AGN spectrum in the stellar sample, shown in Fig. 1. The broad bands are real, although the peak at 590 nm is next to a poorly removed night sky emission line. This source has previously been identified as an X-ray source at a red shift of $z = 1.1$ from the Einstein Medium Sensitivity Survey (Stoke et al. 1991).

References

Boyle, B.J., Fong, R., Shanks, T., Peterson, B.A. (1990): MNRAS, 243, 1
Drinkwater, M.J., Gregg, M.D. (1998): MNRAS, in press, astro-ph/9801016
Kohler, T., Groote, D., Reimers, D., Wisotski, L. (1997): A&A, 325, 502
Stoke, J.T., Morris, S.L., Gioia, I.M., Maccacaro, T., Schild, R., Wolter, A., Fleming, T.A., Henry, J.P. (1991): ApJ.Sup., 76, 813