A DEEP 20 CM RADIO MOSAIC OF THE ESP GALAXY REDSHIFT SURVEY

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1. The Optical Sample

In two strips of $22° \times 1°$ and $5° \times 1°$ near the SGP Vettolani *et al.* have made a deep redshift survey as an ESO Key Project (the ESO Slice Project galaxy redshift survey). All the galaxies down to $b_J \sim 19.4$ were observed with the OPTOPUS multi-fibre spectrograph on the 3.6 m telescope in La Silla, yielding 3348 redshifts.

The survey has a typical depth of $z = 0.1$. It fully samples the optical luminosity function down to $B = -15$ and various galaxy populations *e.g.*, spirals, ellipticals, dwarfs) are present.

Interestingly, emission lines (OII, Hβ, OIII) have been found in a large fraction of the galaxy spectra ($\sim 47\%$), suggesting strong evolution of the galaxy population in terms of enhanced star formation.

For further information on the ESP galaxy redshift survey see *e.g.*, Vettolani *et al.*, this volume, p. 346.

2. The Radio Survey

In the last two years we used the Australia Telescope Compact Array (ATCA) at 20 cm to image the entire area of the optical survey (27 deg^2). The ATCA supports a mosaic observing mode which allows efficient coverage of large areas of sky by interleaving short observations of a grid of pointings.

Since our optical sample is rather deep but narrow and 'normal' galaxies are typically low-power radio sources, deep radio observations were needed.

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Observing times of the order of 1.2 hr/field allowed us to reach a 3σ radio limit of ~ 0.2 mJy, corresponding to a detection threshold of $P < 10^{21}$ W Hz^{-1} at $z < 0.1$.

The observing campaign (34 blocks of 12^h) started in November 1994 and has been completed in January 1996. Data reduction has also been completed.

We have obtained 16 big mosaiced radio maps, each covering 1.7 sq. degr. with spatial resolution of $16 \times 8''$. The noise level, after cleaning, is $\sim 70\,\mu$Jy and is fairly uniform (as needed for statistical studies) within each map and from map to map.

3. The Radio Properties of ESP Galaxies

On the entire region surveyed, we searched for radio emission associated with the redshift survey galaxies. We pushed the search down to a 3σ-threshold (which is allowed when sky positions are known). The searching box ($7.5 \times 7.5''$) was chosen so as to get the best 'identification to contamination ratio.'

Radio emission was found for 524 galaxies, corresponding to a detection rate of 16.4%. Spurious detections are expected to be less than 2% of the total sample of 3196 galaxies searched for, and incompleteness has been estimated to be $\sim 1\%$.

Typically radio detected ESP galaxies are associated to very faint, point-like radio sources ($\sim 86\%$ of them have $S_{peak} < 1$ mJy).

3.1. RADIO EMISSION VS. LINE ACTIVITY

The analysis of the correlations between optical and radio properties of ESP galaxies is now under way. As a first result, we found that a large fraction ($\sim 60\%$) of the radio detections is associated to galaxies showing one or more emission lines. This suggests that in normal galaxies radio emission is mostly induced by star formation, traced by the OII line (Kennicut 1983, Kennicut 1992). The same evidence comes from the cumulative distribution of galaxies with and without emission lines as a function of the radio to optical luminosity ratio, R (Condon 1980). For R values below ~ 100 the probability of being a radio source is higher for galaxies which show line activity than for galaxies which do not (see Figure 1).

4. A New Deep Catalogue of Radio Sources

We are producing a new catalogue consisting of all the radio sources present in the region surveyed above a 6σ-threshold. In a preliminary analysis of a 4 deg^2 area , we detected 360 radio sources above 0.4 mJy. A large fraction

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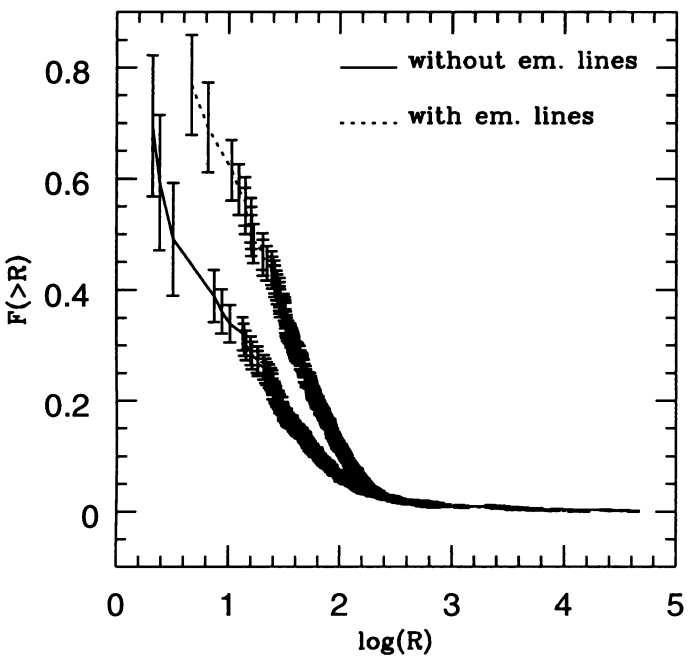

Figure 1. Cumulative distribution for radio detected ESP galaxies with (dot line) and without (solid line) emission lines as a function of the "radio excess" R.

of them ($\sim$ 40%) are sub-mJy objects. This leads us to expect a total number of $\sim$ 2500 radio sources in the entire area observed (27 deg^2) and $\sim$ 1000 sub-mJy sources. This catalogue will therefore be especially useful in studying the sub-mJy population which is still poorly understood (*e.g.*, Condon 1984).

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