A SEARCH FOR QSOs IN THE FIELDS OF NEARBY GALAXIES

A S Pocock[1], M V Penston[1], M Pettini[1] and J C Blades[2]

[1] Royal Greenwich Observatory
[2] Space Telescope Science Institute

The extent and physical conditions of diffuse gas in the outer regions of galaxies are currently the subject of considerable interest. A very sensitive way to probe the gas is by observing the absorption lines it produces in the spectra of background objects. However, a detailed investigation of the interstellar medium associated with external galaxies requires the availability, in the field of the galaxy under study, of *several* probes (QSOs, Active Galactic Nuclei, supernovae) which are: (a) sufficiently bright for high-resolution spectroscopy ($B \leq 17.5$) and, (b) located over a range of projected distances from the galaxy, say from 10 to 200 kpc. As there are very few QSOs in the literature which meet these requirements, we have been carrying out a search of nearby galaxy fields for the specific purpose of finding a number of suitable background probes.

QSO candidates are first identified from visual inspection of objective prism plates obtained on our behalf by staff of the UK 1.2m Schmidt Telescope Unit at Siding Spring, Australia. The plates are short exposures ($\leq$ 20 minutes), as only QSOs brighter than $B \sim 17.5$ are useful for our purposes. The criteria used to select promising candidates are ultraviolet excess (objects with long spectra of approximately uniform intensity, unlike the spectra of field stars which show a rapid fall-off in intensity towards shorter wavelengths) and/or the presence of emission lines, which is diagnostic. QSO candidates are then confirmed by follow-up low-resolution slit spectroscopy carried out with the 1.9m telescope of the South Africa Astronomical Observatory, in Sutherland. On average, approximately 30 percent of the candidates turn out to be *bona fide* QSOs.

To date, we have searched and followed-up 13 objective prism plates centred on nearby galaxies (of different morphological types) and clusters which subtend a large angle on the sky. The search area extends over a projected distance of $\sim$ 100 kpc from the foreground galaxy, this being the extent of galactic haloes suggested by the statistics of QSO absorption line systems. So far, we have discovered 37 QSOs and 38 compact or emission-line galaxies (also useful for our

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purposes) in these fields. A high degree of success has been achieved for galaxies in the Sculptor group, particularly for NGC 253 (see figure), where we have discovered 7 bright QSOs within ~ 100 kpc of the galaxy centre. Statistically, however, the concentration of background QSOs in this field is consistent with random fluctuations from the average sky density of QSOs.

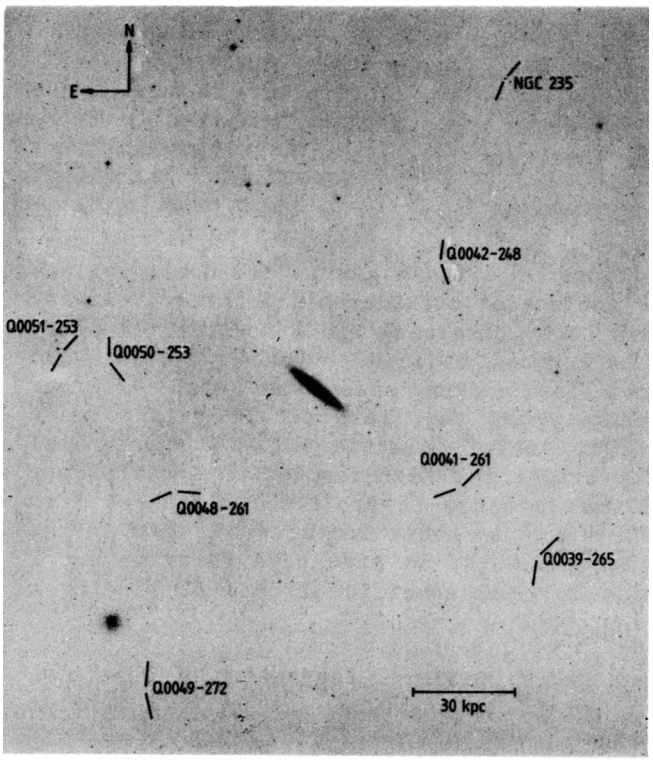

Figure 1.

The field of NGC 253, showing the relationship of the foreground galaxy to the QSOs we have discovered (reproduced from the ESO B survey).

To augment the list of suitable probes, we have carried out a literature search, which to our knowledge is complete up to the end of 1984, for all QSOs and AGNs which are noted in their discovery papers as being situated near galaxies. In addition, we have conducted an observational search, on Palomar Observatory Sky Survey prints, for foreground galaxies close (within 10 galaxy diameters) to bright QSOs discovered in optical and X-ray surveys, and have found a number of new cases.

Combining all these data, we have compiled a list of all QSO-galaxy and AGN-galaxy groupings which are suitable for studies of the intervening interstellar media. The compilation is given in a paper submitted for publication in Monthly Notices of the Royal Astronomical Society (Pocock et al. 1986). High resolution optical and ultraviolet observations of the background QSOs will be carried out in the near future with the Isaac Newton Telecope on La Palma and the Hubble Space Telescope.

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