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QSOs AND THE SURVEY OTELO

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OTELO is a survey of emission-line objects that will be carried out using tunable filters with OSIRIS at the GTC. The survey will have a deep impact on extragalactic astronomy due to its large area and its high sensitivity. In this paper we present new estimations of the number of QSOs that are expected to be found with this unique survey.

The recent discovery of substantial numbers of high-redshift QSOs up to $z \sim 6$ (Schneider et al. 2003; Fan et al. 2003) has not only allowed us to extend the investigation of the evolutionary properties of these sources to very early epochs (age of the Universe $\sim 5-10$ % of present age), but is also allowing us to explore directly the critical epoch of cosmic evolution corresponding to the end of the formation of the first generation of galaxies and QSOs. Some studies (e.g. Warren et al. 1994; Schmidt et el. 1995; Kennefick et al. 1995) indicate that the space density of QSOs declines for $z > 3$, as expected if this is the epoch of galaxy formation.

However, the results from the past five years have highlighted a flattening of the luminosity function at high z, suggestive of a higher formation efficiency of the most massive black holes, in optical (Fan et al. 2001), radio (Vigotti et al. 2003) and X-ray (Miyahi et al. 2000) selected samples.

OTELO (OSIRIS Tunable Emission Line Object Survey) is a survey that will use tunable filters to find emission-line objects (Cepa et al. 2003 and references therein). An important population that will be studied is AGNs. OTELO will be very efficient in detecting AGNs at different redshifts (see Sánchez-Portal et al. 2003). Quasars will also be detected both in emission lines and in the continuum and the survey offers us a unique opportunity to measure the space density of quasars at different redshifts (González-Serrano et al. 2003).

TABLE 1

EXPECTED NUMBER OF QSOS IN OTELO

Line	7075-7205	8072-8247	9060-9300
Lyβ	0.0002	0.0009	0.0016
Lyα	0.0144	0.0866	0.1633
Si IV	0.0009	0.0061	0.0129
C IV	0.0637	0.4470	1.0012
C III]	0.0253	0.2000	0.4970
Mg II	1.4960	13.350	28.500
Subtotal	1.6005	14.091	40.176

In this paper we present new estimations of number of QSOs to be found in OTELO. In a previous paper (González-Serrano et al. 2003) we used the QSO luminosity function by Pei (1995), which included a density decline at around $z = 3$. Here we use an alternative luminosity function derived by Fan et al. (2001) and based on the SDSS survey. It has also the advantage of being determined at redshifts $\sim 3.6-5$.

The OTELO survey will scan three windows at different line flux limits: (1) 7075-7205Å at 2×10^{-16} erg/s/cm^2; (2) 8072-8247Å at 3×10^{-17} erg/s/cm^2; (3) 9060-9300Å at 1×10^{-17} erg/s/cm^2. QSOs will be detected in these windows through different emission lines at different redshifts. For our computations we have considered only emission lines from QSOs at redshifts larger than 1.5.

To estimate the number of quasars from Fan's QLF we must first to convert from line intensities to M_{1450} (absolute magnitude at 1450Å) . We used mean values of line ratios from Zheng et al (1997) and the relationship between Lyα flux and absolute B magnitude:

$$M_B = 2.5\log W_0 - 2.5\log f_{Ly} - 5\log A(z) + 1.395\alpha - 61.60$$

where W_0 is the rest-frame equivalent width of the Lyα line (taken as 100Å), f_{Ly} is the line inten-

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sity, and $A(z)$ is the luminosity distance in units of (c/H_0). The cosmology used was $H_0 = 65, \Omega_{m0} = 0.3, \Omega_{\Lambda 0} = 0.7$. From this, conversion to M_{1450} is done through:

$$M_{1450} = M_B - 2.5\alpha \log(4400/1450) - 0.12$$

A mean spectral index α of -0.8 has been assumed. Table 1 shows the results of this computation for each emission line and redshift window for a single OSIRIS field of view ($\sim 8' \times 8'$). The number of quasars predicted in the OTELO survey is then 56 per field observed in the three spectral windows. The area surveyed will be different for the three windows, being 1000, 57, and 10 fields for the first, second, and third window, respectively. Thus, the expected numbers of QSOs are 1600, 800, and 400 in each window in the whole survey, making a grand total of 2800 QSOs. Note that this estimation refers to QSOs detected by their line emission only. The previous estimation in González-Serrano et al. (2003) was of 875 QSOs. This factor of ~ 3 reflects the uncertainty in the luminosity functions used which are based on different samples of quasars and assumptions.

In summary, OTELO is a very powerful tool to detect quasars at redshifts from 1.5 to around 7, providing well defined samples both in volume and in line flux. This will allow us to obtain quasar luminosity functions at different redshifts and to measure the space density of quasars up to redshift 7, which will have a deep impact on cosmological evolution models of quasars and galaxies.

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