Counts of optically selected quasars in the magnitude range 19<J<22

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ABSTRACT. We present the current status of a survey of faint, optically selected quasars covering 0.7 square degrees. Candidates have been selected through multicolour search, grism spectroscopy, and, to some extent, variability analysis. Slit spectroscopy for almost all the high priority candidates brighter than J=20.84 yielded 22 confirmed quasars. In the magnitude range J=21-22 our results are in very good agreement with other existing surveys. The extension of the survey on an adjacent field is in progress.

1. INTRODUCTION

A number of surveys are now available at relatively bright magnitudes (Schmidt and Green 1983; Mitchell, Warnock and Usher 1984; Marshall et al. 1984), providing the basis for the study of the quasars' luminosity function and its evolution for redshift smaller than 2.2. At faint magnitudes (B>20) the available information from complete samples has grown up recently, with the use of 4m class telescopes for both search and spectroscopic follow-up (Koo et al. 1986, Zamorani et al. 1986, Shanks et al. 1986). After the first direct indication of a significant flattening of the counts of quasar candidates at magnitudes fainter than B=20 (Koo and Kron 1982), these spectroscopic surveys are providing the detailed information necessary to a complete description of the evolution of the quasar luminosity function at lower intrinsic luminosity. In this

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paper we present the current status of our work on a field of about 0.7 square degrees, where candidates in the magnitude range J=18-22 (J=B-0.1) have been selected through different criteria, namely colours, appearance on grism plates, and variability.

2. THE SELECTION OF THE CANDIDATES

From two sets of IIIa-J and IIIa-F plates (U, J, F) obtained in 1981 and 1982 at the 3.6m ESO telescope in La Silla and their PDS scanning, we have extracted a working list of about 6000 objects complete to J=22.0.

The observations and the data reductions are described in Marano et al. 1986a and 1986b. Using three different shape parameters we have classified all the objects of the working list into three classes: "stellar", "intermediate" and "extended" and we have constructed the colour-colour diagrams for the three classes. Then we have selected our quasar candidates following the criteria suggested by Koo and Kron (1982). In order not to introduce a potential bias against the selection of low redshift quasars, which may show some fuzziness on our plates, we have added to the list of candidates some objects selected from the classes of intermediate and extended objects.

In the same field we have also obtained at the 3.6m ESO telescope three IIIa-J grism plates, with a dispersion of about 2000 A/mm. The wavelength range (3400 - 5300 A) is such that the Lyα line would not be detected at redshifts higher than 3.3 . The two best among the three plates were visually inspected by each of us . The merging of the obtained lists yielded 146 objects. Candidates have then been extracted from this list adopting the criterion that a possible emission line was visible in the microphometric tracing of the spectrum. We are now planning to repeat the grism search adopting objective, machine-defined selection criteria.

In addition, we have searched for variability all the stellar objects in our field and a number of variable objects has been added to the final list of candidates.

3. RESULTS

Up to now we have obtained spectra for almost all the candidates brighter than J=20.84 using partly the Boller and Chivens spectrograph and partly the EFOSC at the ESO 3.6m. A summary of the results is the following:

a) Down to J=20.84 we have 22 broad emission lines objects, corresponding to a surface density of 32 quasars per square degree.

b) The redshift distribution covers the range $0.6<z<2.8$, with 8 objects with redshift larger than 2.

c) Three high redshift objects ($z>2.0$) were missed by our colour selection, while three relatively low redshift quasars ($z<1.0$) were missed by our selection from the grism plates. This result shows that, within our present magnitude limit, the grism selection can be as efficient as the colour selection in finding quasars (see Crampton et al. 1985). The complementarity of the losses of the two selection techniques stresses the usefulness of applying them at the same time on the same field in order to increase the combined level of completeness.

d) Variability selection has had a much lower success rate (5 variable quasars out of the 22 confirmed); however, given the small time baseline covered by our survey, a 20% success rate should be regarded as highly encouraging.

e) In the magnitude range J=21-22, our counts of quasars and quasar candidates are in good agreement with the results of similar surveys (see Koo et al. 1986). At brighter magnitudes (J=19-20), instead, our counts are lower (by a factor 1.5-2.0) than those in the Braccesi field (see Marshall et al. 1984). This discrepancy, which at present is only marginally significant, will be checked by adding new data from an adjacent field on which we are currently working.

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