# QUASAR CANDIDATES IN A LARGE FIELD CENTERED AROUND NGC 450, AND THE DISCOVERY OF A NEW VERY INTERESTING PAIR OF QUASARS.

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RESUMEN. Se describen los resultados preliminares de una búsqueda de candidatos a cuasares, en un campo de 25 grados cuadrados alrededor de NGC 450, sobre la base de placas fotográficas duales U/B. Se encontró un caso posible de lente gravitacional o de cuasares gemelos, y se presenta, en forma breve, la espectroscopía y la "fotografía" CCD de larga "exposición" de estos dos objetos. Esta contribución es una actualización de las comunicaciones presentadas en la 24ª reunión de Liege (Swings *et al.* 1983, Surdej *et al.* 1983).

ABSTRACT. Preliminary results of a search for QSO candidates in a 25 square degree field around NGC 450 are described on the basis of U/B dual photographic plates. A possible case of gravitational lens or of twin quasars was found; spectroscopy as well as deep CCD "photography" of these two objects are briefly presented. This contribution is an update of two communications at the 24th Liege meeting (Swings *et al.* 1983, Surdej *et al.* 1983).

## I. SEARCH FOR QSO CANDIDATES

In order to further investigate the distribution, space density, and luminosity of quasars near to as well as far from bright galaxies, a large field area ( $\sim$25 deg.$^2$) centered around NGC 450 was searched for ultraviolet excess objects. On the basis of U/B dual image photographic plates obtained with the Palomar 48-inch Schmidt telescope, a homogeneous sample of 96 QSO candidates was selected; 92 were subsequently observed spectroscopically.

The 92 candidates included 6 fairly bright and very blue objects: 1 turned out to be a QSO, the other 5 being stars. Of the remaining 86, 60 are quasars, 2 are possible quasars, and 24 are not quasars. In addition to the 96 first choice candidates, there exists a set of about 200 ultraviolet excess objects that need confirmation. A statistical analysis of e.g. the location of the quasar candidates in several fields is presently in progress. A figure showing the location of the candidates was given in Swings *et al.* (1983) and will not be reproduced here.

From a plot of the number of quasars in the field around NGC 450 versus their continuum level at about 5000 A, seen on spectrophotometric scans, one may infer that the "limiting V (5000 A) magnitude" of the sample is around 19.75. UBV observations have now been performed in the same field, and Racine-wedge plates obtained, so that a true magnitude calibration will soon become possible, as well as a calibration of the CCD frames of small areas.

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Fig. 1 shows the redshift distribution of the 61 quasars in the 5°x5° field around NGC 450: a marked concentration of values of z exists around z ≃ 0.9, and is seen for 10 objects out of 61. The questions of the significance of such a peak, of evolution, and of quasar formation at a cosmic time corresponding to z ≃ 0.9 in this particular direction of the sky are to be examined in more detail.

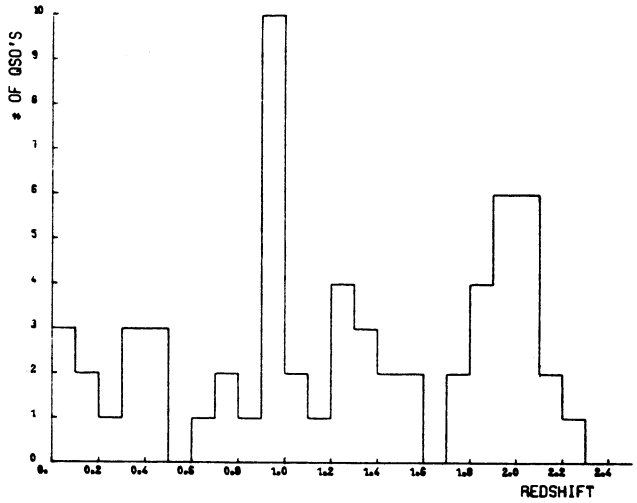


Fig. 1. Redshift distribution for 61 quasars.

## II. THE PAIR OF QUASARS Q 0107-025 A and B

The search briefly described in § 1 has revealed the presence of about 14 tight groups of quasar candidates: such associations typically include 2.6 candidates with a mean separation between the two nearest objects of roughly 5.2 arc min (limits: 27 arc sec and 8 arc min). On the basis of a random distribution one would have expected a mean nearest neighbor distance between objects of about 17 arc min.

One of these associations turned out to be very interesting: it contains 5 UV excess objects which were observed to all be quasars. Among these, two quasars, separated by 77 arc sec., and now labelled Q 0107-025 A ($m_V \simeq 18.2$) and Q 0107-025 B ($m_V \simeq 17.4$) form the pair which will be described hereafter (for coordinates and finding chart, see Surdej *et al.* 1983).

Spectroscopic observations obtained in October 1981 with the Palomar 5 m. telescope show that the two quasars have very similar spectra (see Surdej *et al.* 1983) and redshifts: z = 0.96 for A; z = 0.95 for B, on the basis of C III] λ 1909.

Q 0107-025 A and B have subsequently been observed in September 1982, using an IDS at the ESO 3.6 m. telescope: although a detailed analysis of these observations will be reported elsewhere, it is worth mentioning that they led to a confirmation of the reality of the redshift difference ($\Delta z \simeq 0.0004$) between Q 0107-025 A and B (from the Mg II line), and of the striking resemblance between their two spectra.

With the ESO CCD camera at the Danish 1.5 m. telescope, and during good weather and seeing conditions, several deep frames of the field containing the twin quasars were obtained in December 81, and January and November 1982. This enabled us to set g, r, i, z (Gunn filters) magnitudes to Q 0107-025 A and B, to determine that the magnitude difference between quasars A and B is roughly equal (≃ 0.65 mag) in the four Gunn filters, and to find that in the field (2.4 x 4 arc min$^2$) appear a large number of extended objects, that could be galaxies. These galaxies could perhaps be the brightest members of a very massive and hypothetical cluster ($M \simeq 10^{15}\ M_\odot$) at $0.1 < z < 0.9$ producing a lensed image of a single quasar (with a separation of 77 arc.sec. for the 2 images). A difference in light travel time $\Delta t \sim 10^{3\pm1}$ years between the two observed images could then be estimated, explaining the apparent redshift difference observed between Q 0107-025 A and B as due to time variations in the spectrum of the real quasar.

A more conservative approach would of course be to consider Q0107-025 A and B as twin quasars located within a cluster or group of quasars.

In order to elucidate which of the two distinct models applies to the case of Q0107-025 A and B, we are presently completing the reduction of deep CCD frames and of high spectral resolution data (obtained in the fall of 1982 at the Palomar 5 m. telescope, and in the fall of 1983 at the Anglo Australian Telescope and at the Multiple Mirror Telescope, in collaboration with P. Shaver and G. Robertson).

Acknowledgements

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