this arc, it is usually assumed that this is also due to lensing of a background galaxy.

The arc-like feature detected in Cl 0500-24, a rich and compact southern cluster at z = 0.32 (Giraud, 1988), is different from the two other cases in several respects. First it is nearly straight, whereas the others are clearly curved toward the centre of the cluster. Secondly, the arc is shorter than in the other cases. Finally, the arc lies very close to a pair of bright galaxies which have the same redshift (z = 0.328). It is thus not clear whether this arc is also due to lensing or the result of the tidal interaction of the two interacting galaxies.

In a recent paper, we pointed out the attractiveness of the lensing hypothesis (Wambsganss et al., 1989). In particular, using a simple lensing model which incorporates only the cluster mass and the two interacting galaxies close to the arc, we were able to show that at the observed position it is reasonable to expect an arc. In other words: if a background source (with redshift in excess of 0.5) is seen at this position in the cluster, it is unavoidable, given the richness and compactness of the cluster as observed, that the image will be highly distorted. In addition, the distorsion will act in such a way that the image must be elongated in the direction perpendicular to that of the centre of the cluster.

New images have been obtained in January 1989 with the 2.2 m ESO-MPI telescope at La Silla under very good seeing conditions (0.9 arcsec). We used CCD No. 8 which has low noise (30 $e^{-1}$ rms) and high quantum efficiency. These observations have revealed that the arc-like feature has three components, which are seen as varying width and surface brightness along the arc (Fig. 1). When we tried to understand these new observations with a simple lens model, we were unexpectedly successful. An image of one of our models is shown in Figure 2. Not only are we able to understand the multicomponent nature of the arc, but also their relative size and orientation. These models, however, have shown that the arc is of a different nature concerning its lensing origin. The two other arcs are well understood as a source being close to the cusp point on the caustic of the lens. In the present case, the critical line intersects the arc twice, namely there where the arc is thinnest. In order to achieve this kind of configuration, the mass parameter of the cluster must be very well tuned. If it varies, either the arc becomes too short, or its multiple nature vanishes. If the redshift of the arc can be measured, the mass parameter of the cluster can be rather well determined.

On the other hand, while our photometry (in B, V, R, I) has shown that the arc is very blue and may have the colours of a very distant object, its colours are also compatible with those of intrinsically blue galaxies, at the redshift of the cluster, for which we have spectra. These very blue objects are emission-line galaxies (Fig. 3). Thus the presence of a blue population in the cluster did not allow us to prove without ambiguity that the arc-like feature is the image of a distant galaxy. Finally if we look at the photometry without theoretical prejudice, we cannot even be sure that the object is not foreground. If the arc is the result of the tidal interaction of the two galaxies, and the arc-like feature is a star-forming region, it seems reasonable to expect a well visible O II emission as in blue galaxies. A measurement of the arc spectrum may confirm the lensing nature of this object, and in that case will provide an independent measurement of the mass parameter of the cluster.

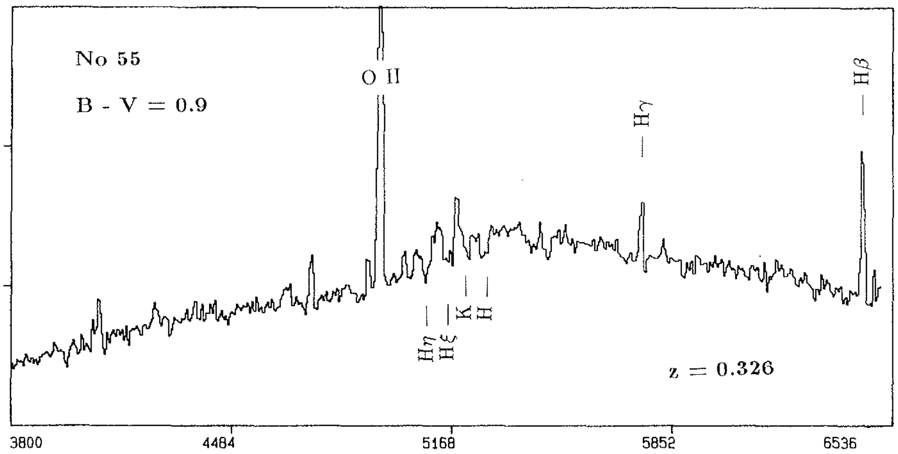


Figure 3: *A spectrum of a galaxy in Cl 0500-24 having colours similar to those of the arc. This spectrum was obtained in multislit spectroscopy with EFOSC at the 3.6 m telescope at La Silla (Giraud, 1989).*

E. G. expresses his thanks to all the ESO and MPI staff members for their hospitality.

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# A First Glimpse of the Spectrum of 3 C 255

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The radio source 3C 255 was identified by Spinrad et al. (1988) with a faint object having a complex, multimodal structure. The object was resolved in four components on CCD frames taken in good seeing conditions with the 2.2 m ESO-MPI telescope on La Silla (Giraud, *The Messenger* **55,** 60). This image also suggested that the main object itself, which is probably the radio source, might be multiple (on 1 arcsec scale).

The radio source and fainter components may constitute a distant aggregate of galaxies, the radio galaxy being the first ranked object. Obtaining a low resolution spectrum of a 23rd magnitude object such as 3C 255, in a reasonable amount of telescope time, is still a rather uncertain adventure which requires very good observing conditions. Fortunately, distant radio galaxies are known to show moderately strong emission-line spectra. It was thus assumed that our task would be greatly simplified by the presence of these emission features. The exposure time was estimated from two 90-min exposures of a 21st magnitude emission-line galaxy, obtained with EFOSC, which was degraded down to a level that still permits distinguishing emission from noise. It was found that an acceptable spectrum would be obtained in

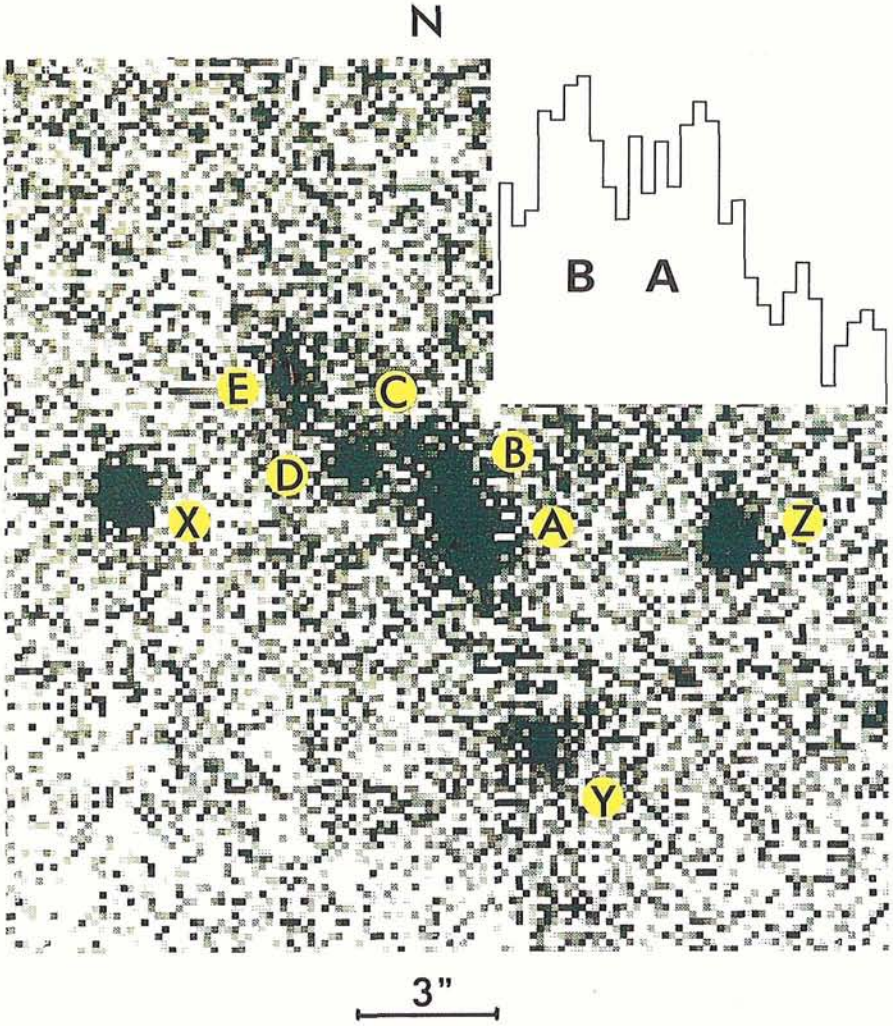


Figure 1: *A spatially resolved image of the radio source 3C 255 obtained with the 2.2 m telescope on La Silla. Exposure time: 2 × 3600 s in R (seeing 0.85 arcsec). Objects A and B were not separated on the image shown in the* Messenger *No. 55 where objects C, D, E could already be resolved. Object B is slightly redder than A. Magnitudes of the objects range between V = 23.4 and V = 24.9. The separation of objects A and B is shown in the upper right corner. North is up and east is to the right.*

3 × 150 min, if the emission lines were rather strong. In the present case the best grism would be a visible-red, i.e. covering approximately the range 4000–8000 Å, where the detector (RCA CCD No. 8 or No. 11) is the most efficient, and a dispersion of about 300 Å/mm. This is an intermediate value between the B 300 and B 1000 grisms currently used with EFOSC.

Just before the off-schedule night allocated to this programme, high resolution CCD frames could be obtained at the 2.2 m telescope under excellent seeing conditions. The image shown in Figure 1 is a stack of 2 × 1 h exposures in the R-band. The seeing measured on that frame is 0.85 arcsec. The main object appears elongated and a new component (marked B) is found. It could be only marginally seen on the previous frames due to poorer seeing. The V magnitudes and V-R colours of the objects in Figure 1, measured within disks of radius r, are as follows:

A: r = 6 pix, V = 23.4, V-R = 0.5; B: r = 4 pix, V = 24.3, V-R = 0.6

C: r = 4 pix, V = 24.9, V-R = 0.5; D: r = 5 pix, V = 24.2, V-R = 0.6

E: r = 6 pix, V = 24.1, V-R = 0.7; X: r = 6 pix, V = 24.1, V-R = 1.4

Y: r = 6 pix, V = 23.9, V-R = 0.6; Z: r = 6 pix, V = 23.4, V-R = 0.8

Galaxy X has the V-R colour index of an early-type galaxy at z ~ 0.6–0.8. The magnitudes and colours of objects A to E and Y are consistent with those expected for galaxies at z ≥ 1. Object Z might be foreground.

Spectra were obtained during the night on April 12–13 (first quarter moon). The night was clear and dry, the seeing measured when refocusing was between 0.9 and 1 arcsec. The CCD mounted on EFOSC was No. 8, a RCA CCD with a readout noise of 30 $e^{-1}$ rms and high quantum efficiency. Two exposures (2 h and 2 h 10) were recorded. The pointing for the first exposure was facilitated by calculated offsets.

A calibrated spectrum of 3C 255 is shown in Figure 2. It is of course very noisy, but some possible emission features can be seen, namely at 4494 Å, (4770 Å), 5484 Å, 6588 Å and (7043 Å). An identification of C III 1909, C II 2326, and Mg II 2799 with the lines that seem to be the most robust gives a redshift of z = 1.355 (C III, z = 1.354; C II, z = 1.357; Mg II, z = 1.354). We also tried a redshift of z = 1.9. In that case the feature at 6588 Å would be ignored and the identification would be C IV (z = 1.901), He II (z = 1.908), C III (z = 1.873), Ne IV (z = 1.905). The weakness of this system is the discrepancy between the redshifts of C IV and C III. Also, the V-R colour index would be very red for objects at such a high redshift. In contrast, the observed colours would agree quite well with a redshift of 1.3.

Finally, this observing test has shown that it is possible to obtain spectra of 23rd magnitude emission-line galaxies in 6–8 h under favourable weather conditions.

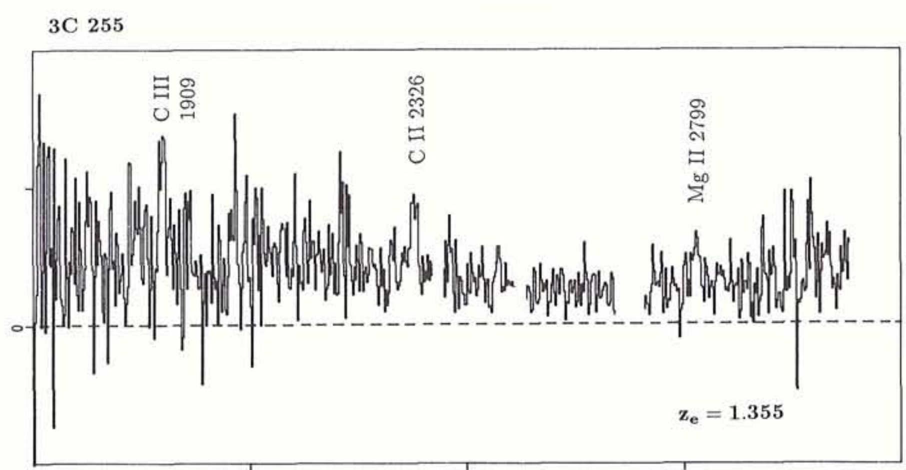


Figure 2: *The spectrum of the very faint galaxy at z = 1.355 associated with 3C 255. The emission features are quite narrow and suggest rather low ionization. The spectrum is similar to that of 3C 241. Regions of the spectrum corresponding to intense sky lines have been deleted.*

Deep images of extremely distant radio galaxies such as 3C 255 (and 3C 300.1 observed during the same run) taken in excellent seeing conditions, show that these objects do not look like nearby giant elliptical radio galaxies. Evolutionary links between these objects and nearby giant elliptical radio galaxies are still speculative. They may well constitute a different population.

The presence of very faint objects near 3C 255, having similar colours, speaks in favour of a very distant aggregate of galaxies. It might be a cluster core in the process of formation as 3C 326.1 (McCarthy et al., 1987) or 3C 294 (Spinrad et al., 1988) could also be.

I express my thanks to Professor H. van der Laan for the observing time allocated to this project, and to J. Breysacher and D. Hofstadt. This work was greatly helped by information on the seeing coming from Vizcachas. In particular, it was extremely important to know that before and when I was taking long exposures at the 2.2 m telescope, the seeing was constant and near 0.65 arcsec. It is a pleasure to thank M. Sarazin and the team at the seeing monitor for making these data available. I am grateful to all the ESO staff at La Silla who made these observations possible, in particlar P. Le Saux and C. Gouiffes (resident astronomers), E. Barrios and L. Baudet (setting of the instrument), Bahamontes (assistance at the telescope), and S. Vidal (data retrival).

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# A New and Improved Camera for the 1.5 m B & C Spectrograph

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A new dioptric camera was installed on the Boller and Chivens spectrograph at the ESO 1.52 m telescope in February 1989 to replace the old Schmidt camera. This allowed the removal of a focal reducing lens in front of the spectrograph slit designed to match the f/15 beam of the telescope to the f/8 focal ratio input of the spectrograph. The focal length of the new camera is 127.0 mm compared with 143.5 mm for the old camera. This means that the effective dispersions of all gratings as found in the recently published Boller and Chivens manual must be multiplied by 1.13 (= 143.5/127) when used at the 1.52 m telescope. The new slit scale is 9.2 arcsec $mm^{-1}$ (compared to 19.4 arcsec $mm^{-1}$ before) and the detector scale along the slit is 0.68 arcsec $pixel^{-1}$ (with 15 μm pixels, compared to 1.28 arcsec $pixel^{-1}$ before). Note also that the new TV slit-viewing field is now reduced by a factor of 2 giving a new field of about 1.5′ × 1.1′. The Nyquist sampling criterion is satisfied with a slit-width of 1.5 arcsecs (15 μm pixels and a small grating angle). For larger grating angles (say 10° or more), the grating demagnification must be considered (see Users' Manual).

Observers should also note that, like the old camera, a ghost spectrum will appear on the detector when the grating angle is between 21.5° and 29°. This will occur for all gratings. The ghost spectrum appears (at much reduced intensity) parallel to the real spectrum but displaced symmetrically with respect to the real spectrum about the optical axis of the spectrograph. This poses a problem for long-slit spectroscopy.

A major advantage of the new camera is that observers now have an almost unvignetted field along the spectrograph slit. Also, a three times improvement in efficiency over the old camera is obtained from 4000 Å up to at least 10000 Å (the longest wavelength measured). Using CCD # 13 (RCA) with grating # 13 (508 Å $mm^{-1}$), the absolute efficiency of the system (telescope + spectrograph + CCD) was measured to be 18 % at 5445 Å. Figure 1 shows the total system efficiency from 4000 Å to 10000 Å for CCD # 13 and this grating and CCD combination.

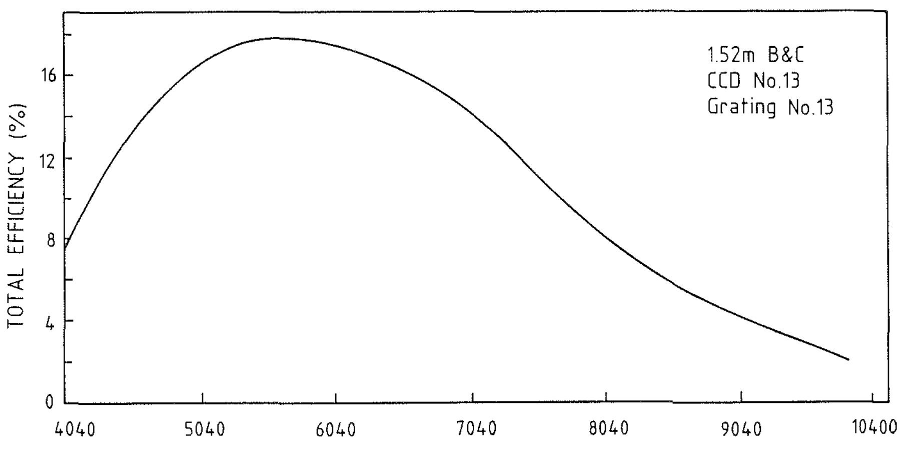


Figure 1: *Total system efficiency of the 1.52 m telescope and Boller & Chivens spectrograph fitted with the new camera.*

# MIDAS Memo

*ESO Image Processing Group*

### 1. Application Developments

The echelle package for reduction of CASPEC spectra has now been ported to the new MIDAS. This new version is basically compatible with the previous one, with minor modifications to support other instrument formats like ECHELEC and EFOSC in echelle mode.

The Table File Editor has been significantly improved. The new editor uses the Term Window package in such a way that it is device independent, using a terminal definition file which also