tend to have stronger HI counterparts than the blueshifted lines. This suggests that the infalling clouds suffer from enhanced cosmic-ray ionization rates, enhanced dissociation or shock-induced processes. The study of these very lines provides the exciting possibility of *finding out just how an active galaxy nucleus is fed by the surrounding galaxy.* As in most molecular species these absorption lines have optical depths of only a few tenths or less, very long integration times (4–8 hours per species) are needed with the present sensitivity of the SEST receivers in order to obtain a sufficiently high signal-to-noise ratio. We have now observed almost all molecular transitions in the 85 to 115 GHz range to the limits feasible at present (but wait till SEST gets a 115 GHz SIS receiver!).

Future Observations

Still to be done are most transitions in the 230 GHz range. For this task, the new SIS receiver is essential. Even then it is not an easy task given the often non-optimal sky conditions at La Silla and the present pointing accuracy of the SEST. The planned installation of tiltmeters in the telescope, however, gives hope that the latter problem will be overcome soon. The observation of the 230 GHz window is of great importance, because it allows us to observe the higher transitions of the same species that were observed in the 100 GHz window. It is the comparison of different transitions of the same species, combined with interspecies comparison that has proven to be so fruitful in the past, and that we need here to unequivocally determine excitation temperatures, column densities and abundances.

References

Israel, F.P., van Dishoeck, E.F., Baas, F., Koornneef, J., de Graauw, Th.: 1990, *AA* **227,** 342 (Paper I).

Israel, F.P., van Dishoeck, E.F., Baas, F., de Graauw, Th., Phillips, T.G.: 1991 *AA* in press (Paper II).

Eckart, A., Cameron, M., Genzel, R., Jackson, J.M., Rothermel, H., Stutzki, J., Rydbeck, G., Wiklind, T.: 1990 *Ap.J.* **365,** 522.

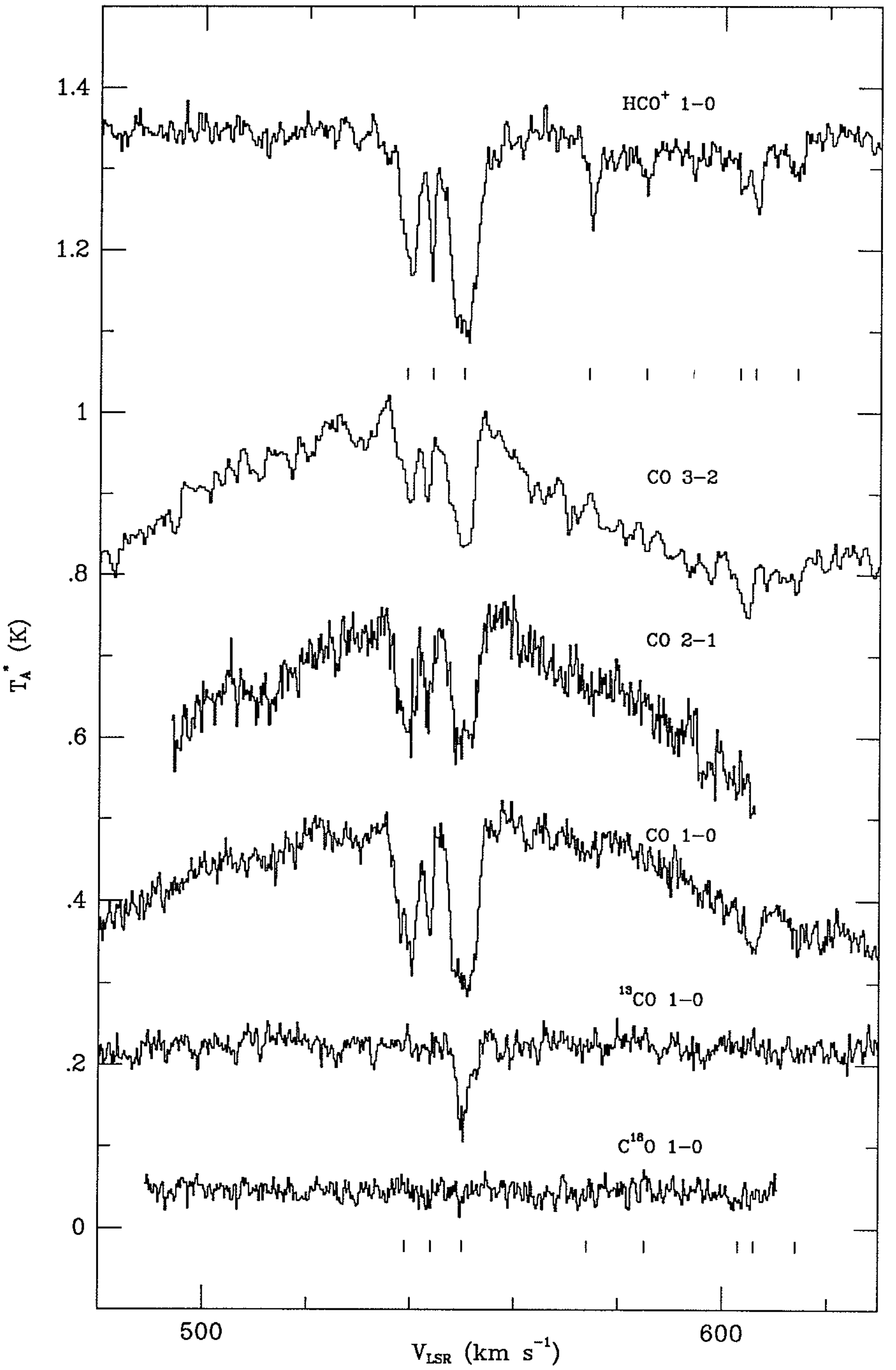

Figure 3: *High-resolution spectra of HCO^+ (1–0), CO (1–0), (2–1) and (3–2), as well as ^{13}CO (1–0) and $C^{18}O$ (1–0). The spectra have been shifted by +1.05, +0.4, +0.25, 0.0, –0.05 and –0.2 K respectively. Note the series of redshifted absorption components in the HCO^+ spectrum.*

Microlensing in the "Cloverleaf" Quasar H1413+117?

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1. Introduction

The broad absorption-line quasar H1413 + 117 has been resolved in four components having comparable brightness by Magain et al. (1988). This makes the object a superb candidate for gravitational lens models. The angular separations of the images (noted A, B, C, D) are between 0.77″ and 0.96″. Individual spectra of the components were obtained at CFHT during a period of very good seeing (0.5″–0.6″) by Angonin et al. (1990). The four components have the same redshift (z = 2.55) and overall similar spectra. One of the components (B), however, shows 2 narrow absorption-line systems at z = 1.438 and z = 1.466, which are not detected in C and D and are possibly visible in A. Gravitational models reproduce well the positions of the images and the predicted time delays are rather short (Kayser et al., 1990). Perhaps the most interesting point is that the gravitational models fail to reproduce the luminosity ratios of the components. Monitoring the luminosity of the object is therefore exceptionally interesting, both for measuring the time delay of luminosity variations between the four components and for the search of microlensing effects which could be responsible for additional amplification.

2. Observation of the Cloverleaf Using Seeing Fluctuations

Monitoring the object is done in the ESO Key Programme by Surdej et al. One of us (E. G.) observed it independently at the 2.2-m telescope on February 17, 1991, for testing a simple method of observation which takes advantage of seeing fluctuations. The point is that a seeing of 0.95″ to 1″, which is frequent in La Silla telescopes, is too poor for observing objects like the Cloverleaf. The seeing, however, is an integrated measure which becomes stable at integration times larger than 20s. Between the speckle lifetime (10 ms) and 20 s there is a region where the image moves and is distorted. Taking a number of sufficiently short exposures should give a distribution of FWHM where the best images are about 15% better than the mean seeing. In practice most of the gain is obtained at about 0.2 s and there are less and less good images as we approach 20 s. The various equations can be found in Roddier (1981), and experimental results on DISCO (based on this principle) are described in Maaswinkel et al. (1988a, b).

For the Cloverleaf, an exposure time of 2 s was adopted as a compromise between having enough signal and resolving the image. The seeing measured on the field just before the observations was 0.95″ which is insufficient to resolve the components. Twelve exposures were obtained, one is excellent, separating well the four components, and two or three are reasonably good. The images were not all obtained at the same position of the CCD.

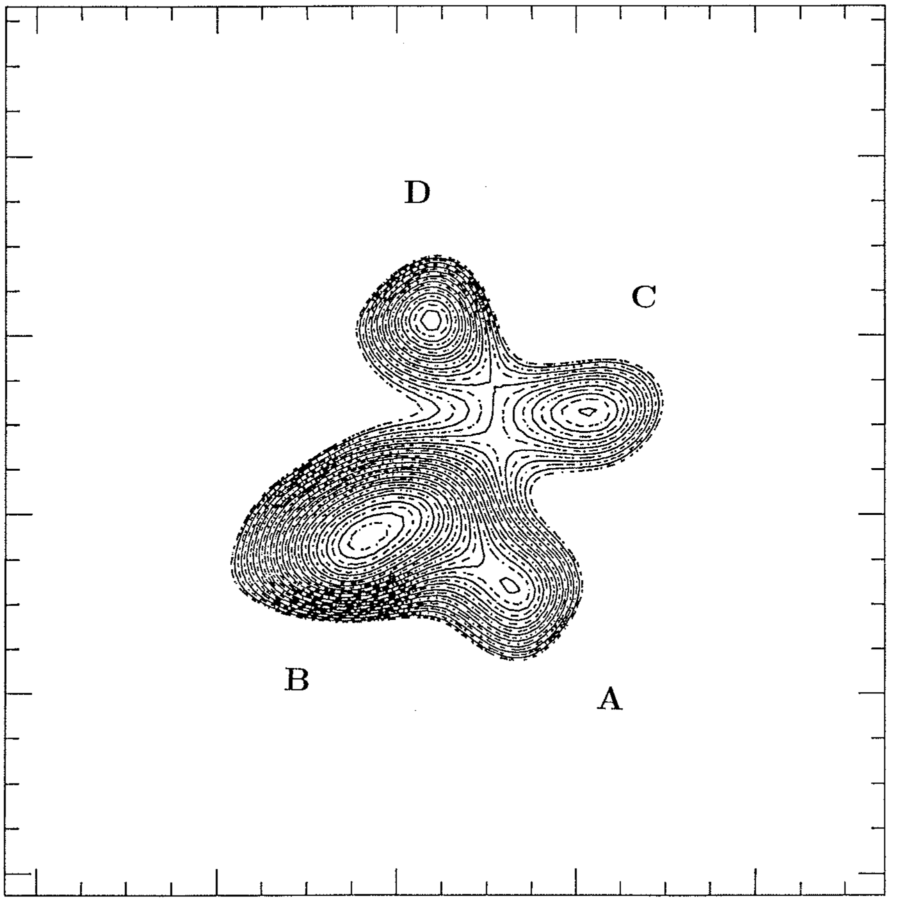

Figure 1: *Best image (in terms of spatial resolution) of the Cloverleaf quasar obtained from our data. North is up and east is to the left. Components A, B, C and D are as in Magain et al. (1988, their Fig. 1). The quality of the data is not sufficient for a comparison of A, C and D. Nevertheless, object B which was fainter than A in April 1988, is clearly brighter on this image, from February 17, 1991.*

3. Results and Discussion

Using MIDAS, we made the reductions on the images, and then recentred them after processing them with a rebin using a spline function, for the maximum positioning accuracy possible. The images were of different quality, because they were at a very faint, and therefore noisy level. However, they showed clearly the effect of image motions and distortions, due to seeing fluctuations between two short exposures. Our recentring involved only translation corrections.

With this method of short exposures, on almost every single image one can see distinctly at least three components, with surprisingly always a much more luminous one: component B. We therefore added some of the best images, whereby this result was confirmed.

In the image of Magain et al. (1988), obtained with a R filter as in Figure 1, object A is the brightest component followed by B, C, and D. The maximum luminosity difference is small: D–A = 0.4 mag. Within the accuracy of our composite image, the luminosities of objects C and D relative to A do not seem to have changed. This image, however, shows a dramatic increase in the relative luminosity of object B, which is now by far the most luminous component. This luminosity excess is well visible on our best (in terms of spatial resolution) individual images. The luminosity of B is about 1.5 ± 0.3 that of A, whereas it was $0.85 \times$ A in Magain et al. measurements. Indeed, the feature is very obvious on all image compositions and we believe it is real. Just to be sure, we very carefully checked the orientation of our images; it is indeed object B which has brightened.

If the luminosity excess of object B is due to an intrinsic variation in the quasar source, this variation will be seen successively in all components. It is also possible that the observed event is not intrinsic to the quasar and is due to microlensing. This may help to explain the discrepancy in the predicted amplifications with the observations. Component B may play a special role because the absorption-line systems at z = 1.44 and 1.46 are much stronger in this component. Since the time delays predicted by the gravitational models are rather short, it should be possible to separate intrinsic variability from microlensing.

We are pleased to thank M. Sarazin for his explanations on the variance of image motion.

References

Angonin, M.C., Vanderriest, C., and Surdej J., 1990, in Gravitational Lensing, eds. Y. Mellier, B. Fort, G. Soucail (Springer-Verlag), 124.
Kayser, R., et al., 1990, *Ap. J.*, **364**, 15.
Maaswinkel, F., et al., 1988a, *The Messenger*, **48**, 51.
Maaswinkel, F., et al., 1988b, *The Messenger*, **51**, 41.
Magain, P., et al., 1988, *Nature*, **334**, 325.
Roddier, F., in *Progress in Optics*, XIX, ed. E. Wolf (North-Holland, Amsterdam), 281.

A New Arc Candidate in a Compact Cluster

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1. Introduction

The number of arc candidates discovered in rich galaxy clusters over the past few years is less than about 10 (Fort, 1990). According to the lensing hypothesis, giant arcs such as those in Abell 370 and Cl 2244 are expected to be rarer than small arclets. Detecting faint arclets, however, requires doing photometry at extremely faint levels. While these objects can be used to trace the mass in clusters, they are not accessible to present-day spectroscopy. The number of reasonably good spectra of large arcs is still too small to prove that all distorted arc-like features are due to gravitational lensing. Hence it is crucial to substantially enlarge the sample of large arcs and obtain their redshifts.

The object presented here was discovered during a run of observations of rich clusters of galaxies. Our programme was not specifically designed to search for arc candidates. Nevertheless, since the observed clusters are rich and some are compact or have a compact core, they could have been included in a deep survey of arcs.

2. Results

The cluster (CL0017) was discovered on a deep CFHT prime focus plate in 1986 (Infante et al., 1986). It was first observed at La Silla during a non-photometric run of multispectroscopy with EFOSC at the 3.6-m ESO telescope. Measuring the redshift from red galaxies only, we find $< z > = 0.2716$. A 600-s B exposure shows a possible arc-like feature centred on the extremely compact core of the cluster.

We reobserved the cluster with EMMI at the NTT obtaining short exposures in B, V, and R. Our purpose was to obtain quick relative photometry to select blue objects for a further run. The image presented in Figure 1 is from a 120-s R exposure (seeing 0.9″). It shows the extremely compact core of the cluster and a thin faint arc. Clusters with such a compact core are not frequent. We included it in our survey to check the velocity dispersion around the core and to study the galaxy population in this case. The centre of curvature of the arc lies in the cluster core, and the object is significantly bluer than the red cluster galaxies. The feature is seen (with more or less contrast) on all the images, suggesting that it is real. The image quality is poor, and deeper images are of course necessary to study the object and confirm its appearance. The level of detection, however, is similar to that (for example) of the old (1975) video camera images of Abell 2218, Abell 379, and Cl2244 published by Petrosian, Bergmann and Lynds (1990) or those of Abell 963 obtained by Butcher et al. (1983). If confirmed, the arc will be accessible to spectroscopy using a purpose-made curved slit.

Using the red galaxies to probe the gravitational field around the cluster

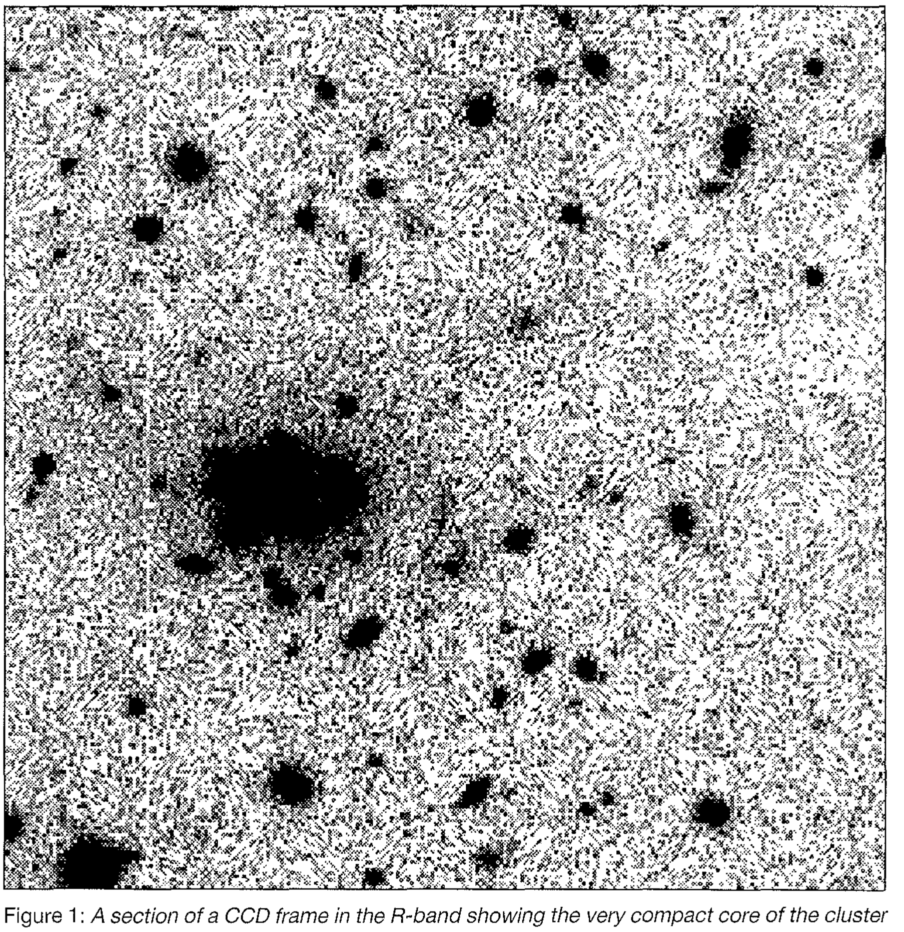

Figure 1: *A section of a CCD frame in the R-band showing the very compact core of the cluster CL0017 and a thin faint arc-like feature (telescope: NTT; instrument: EMMI; exposure time: 2 min., seeing 0.9″). North is up and east is to the right.*