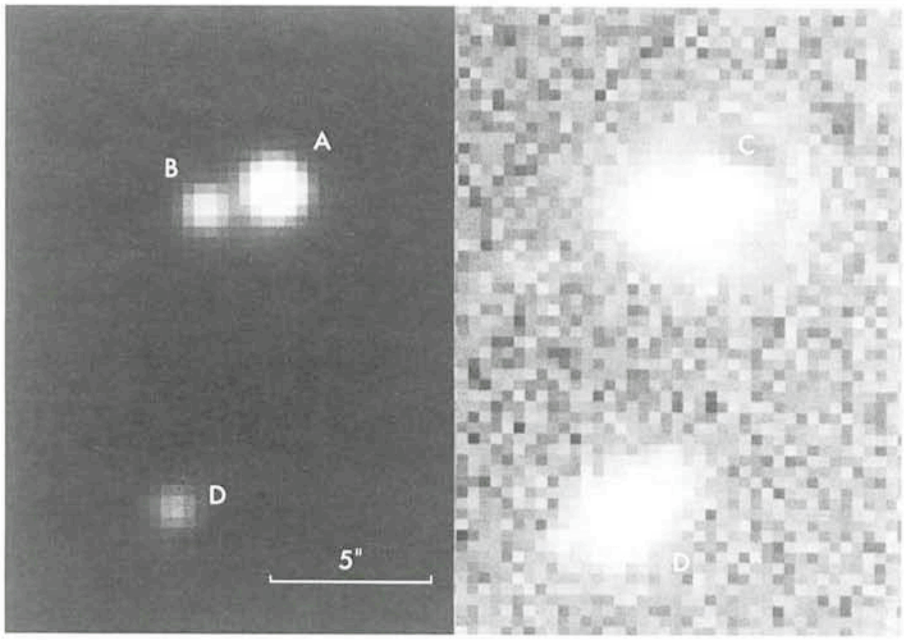
Discovery of a New Gravitational Lens System



From detailed observations of several of the most luminous quasars, it has been found that the QSO UM 673 ($z = 2.72$) is a gravitational lens system (Surdej, J., Magain, P., Swings, J.-P., Borgeest, U., Courvoisier, T.J.-L., Kayser, R., Kellermann, K.I., Kuehr, H., and Refsdal, S., 1987, *Nature* **329,** 695; Surdej, J., Magain, P., Swings, J.-P., Borgeest, U., Courvoisier, T.J.-L., Kayser, R., Kellermann, K.I., Kuehr, H., and Refsdal, S., 1987, submitted to *Astronomy and Astrophysics*). This observational programme is designed to estimate how many of the highly luminous quasars are so luminous because of amplification effects by gravitational lensing. It is mostly conducted at ESO by the team who wrote the quoted papers.

Spectral and imaging observations of UM 673 were obtained at ESO in late 1986. They showed that both images have nearly the same spectra, and that the difference can be explained if the observed light from the fainter object is contaminated by an intervening galaxy at redshift $z = 0.49$. This finding considerably strengthens the identification of the double image of UM 673 as a new case of a gravitational lens system. The intervening galaxy can also be seen directly, when the two images of the QSO are removed by computer processing.

The left half of the figure shows the central part of an EFOSC CCD frame, exposed 2 min through a Bessel R filter. The two QSO images are marked A (mag. 17) and B (mag. 19); the separation is only 2.2 arcsec. The right half shows the same frame after the two point-like images have been removed and the intensity interval near the sky has been significantly stretched. The intervening 19th magnitude lensing galaxy is clearly visible as extended residual emission (C). The object D is another galaxy, possibly in the same cluster.

Modelling of the geometrical properties of the lens system allows to compute the mass of the galaxy ($\sim 2.4 \cdot 10^{11}$ solar masses), as well as the most probable time difference along the two light paths, ~ 7 weeks (with $H_0 = 75$ km/s/Mpc and $q_0 = 0$). This time difference is short enough to be measured in one observing season, provided the QSO is cooperative and varies intrinsically on a sufficiently short time scale. Such measurements are particularly important, since they may give independent information about the absolute size of the system and therefore also about the Hubble parameter. A corresponding, observational campaign has already been started at ESO.

T.J.-L. Courvoisier (ST-ECF, affiliated to the Astrophysics Division, Space Science Department, European Space Agency)

Deep LMC Images

One of the most observed objects in the southern sky is the Large Magellanic Cloud. It is easily seen as a naked-eye object near the southern celestial pole together with its less conspicuous neighbour, the Small Magellanic Cloud. Looking at the LMC, the casual observer discerns the elongated bar and the bright 30 Doradus nebula and, since February this year, the famous Supernova 1987 A.

We show here two unusual views of the LMC, obtained with special equipment at the ESO La Silla observatory, in the course of other observing programmes.

Figure 1 is a reproduction of two CCD frames, exposed at UT 08 : 06 to 08 : 39 on February 17, 1986, with the ESO Wide-Field CCD camera, while preparing to observe Comet Halley. The camera consisted of a Canon f : 2.8/100 mm objective at full aperture, with a RCA CCD 503 (high resolution, 640 × 1,024 pixels) behind a BG 39 filter. This corresponds to a very broad wavelength band, extending from the near UV to the CCD cut-off in the near IR. The exposure time was 15 minutes for each frame.

The pixel size is 31 arcseconds, corresponding to a field size of about $5^\circ\!.5 \times 9^\circ$. After cleaning with MIDAS software on La Silla, the full frames were recorded on 70 mm film at the ESO-Garching Dicomed facility and photographical copies were assembled to give the composite image in Figure 1. No flat-fielding was made, due to lack of adequate exposures, and the frames were not corrected for geometric distortion or vignetting. For these reasons, the two frames do not join perfectly.

The composite field size is $8^\circ\!.6 \times 9^\circ\!.6$ and north is up and east to the left. The two bright stars above the left centre are δ Dor (upper) and ε Dor (lower), while the two in the lower right part are β Dor (left) and μ Dor (right).

During the exposure, the minimum counts near the corners of the frames reached 1,500, still above the normal sky background. This indicates that the LMC halo extends beyond the field of