tions of NGC 2346, and the staff of La Silla Observatory for assistance.

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CCD Pictures of Peculiar Galaxies with Jets or Extensions

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Astrophysical Jets

The phenomenon of "jets" seems to be rather universal in astrophysics. The astrophysical jets are seen in different wavelengths, from radio to X-rays. Their more general definition is "some emitting material well collimated along a straight or curved line". Such features appear on very different scales. Jets having a length of the order of a megaparsec and of a kiloparsec have been detected in different extragalactic systems, respectively QSO (e.g. 4C18.68; Gower, Hutchings, *Ap. J.* **253,** L1, 1982) and radio galaxies (e.g. PKS 0521-36; Danziger et al. *MNRAS,* **188,** 415, 1979). Jets of a few parsecs have also been suspected in galactic objects as the exotic SS 433, Sco X-1 and R Aquarii. Königl (*Ap. J.,* **261,** 115, 1982) even proposed to call jets the asymmetrical outflows which appear in the models of bipolar nebulae, bipolar CO emission lobes and aligned Herbig-Haro objects. Part of the galactic jets could be miniature models of some of the extragalactic ones.

Jets in Galaxies

The presence of jet asymmetry is relatively frequent in the nuclei of galaxies. 50 % of the high-luminosity radio sources and 10 % of the low-luminosity ones show a jet of a few kiloparsecs; all strong X-ray radio galaxies could have a jet; and the asymmetry of the VLBI structures is usually the rule (Fomalont, Workshop on Astrophysical Jets, Turin, 1982). Precessing radio jets in the centre of our own galaxy have also been reported.

Difficulties arise if one tries to precise the first mentioned general definition and to classify the different cases of observed jets, because they do not seem to form a very homogeneous class of objects. In particular, their spectral properties are not well defined. A great number of jets is seen only in radio, but radio-quiet jets exist too, as the optical jets of NGC 1097 (Wolstencroft, ESO/ESA Workshop on Optical Jets, 1981). Other jets emit in both energy ranges, as the well-known jet of M87. Strong optical emission lines can be present without any continuum counterpart (NGC 7385), although cases with an optical continuum and no lines (M87) are also found, as well as intermediate cases with both optical continuum and line emission (3C277.3; Nieto, Workshop on Astrophysical Jets, Turin, 1982). That diversity implies that the materials and the radiation processes are not the same in all jets. The jet of M87 is probably made of a plasma which emits synchrotron radiation, while some other jets could be a mixture of stars and gas.

The first duty of a theoretical model of jets is to propose a way to break the usual spherical symmetry of many astrophysical phenomena. Astronomers found different possibilities: rotation of a compact object, anisotropy of the ambient medium, two-body interaction, magnetic field, etc. Two main families of jets have been suggested in the literature (i) matter ejected from an active nucleus, as the M87 jet, or relics of such an ejection, (ii) tidal extension or bridge due to gravitational interaction or collision of galaxies, as in the case of IC 1182 (Bothun et al., 1981, *Ap. J.,* **247,** 42). Cases concerning both of those families could also exist, since for example the activities of galactic nuclei are expected to be enhanced during a collision event.

CCD Observations

Only a small number (< 20) of optical jets in galaxies have been studied in some detail until now. But a greater number of galaxies have been suspected by visual inspection of Schmidt plates to have a jet and are classified in different catalogues as "jet-galaxy" or "galaxy with extension". Last year I made a CCD survey of 50 of those suspected cases in order to search for and to study optical jets in a statistical way. Some jet galaxies already described in the literature have also been observed to be used as references: M87, 3C273, 3C120, IC1182, PKS0521-36. At the same time, new information has been obtained about them. The jet of 3C273 appears to be composed of 3 regions which coincide with the radio wiggles. The westward 4 arcsec optical elongation of 3C120 as well as the jet nature of the feature seen in PKS0521-36 are confirmed (Sol, Workshop on Astrophysical Jets, Turin, 1982.

The observations were made at the 1.5 m Danish telescope equipped with ESO's CCD during three different runs in January, July and November 1982. The CCD was still in its testing phase for the first two runs. Pictures of the galaxies have been obtained in different colours, using a set of broad-band filters which covers the wavelength range of the CCD response, from 4000 Å to 1 micron (B and V Johnson's filters and g, r, i and z filters described in Wade et al., *PASP,* **91,** 35, 1979).

As mentioned by Pedersen and Cullum in the *Messenger* of December 1982, the CCD data reduction is not completely without problems if one wants to optimize the CCD capabilities. The first difficulty to face is the correction of several effects as the discrepancy in sensitivity of the different pixels, the non-linearity of the cold columns and the interference rings due to the night sky emission lines. A good and easy way to clean the pictures from those three effects is simply to divide the frame of scientific interest by a correction frame, the offset and dark current being first subtracted from both frames respectively. The correction frame is a picture of the night sky obtained by

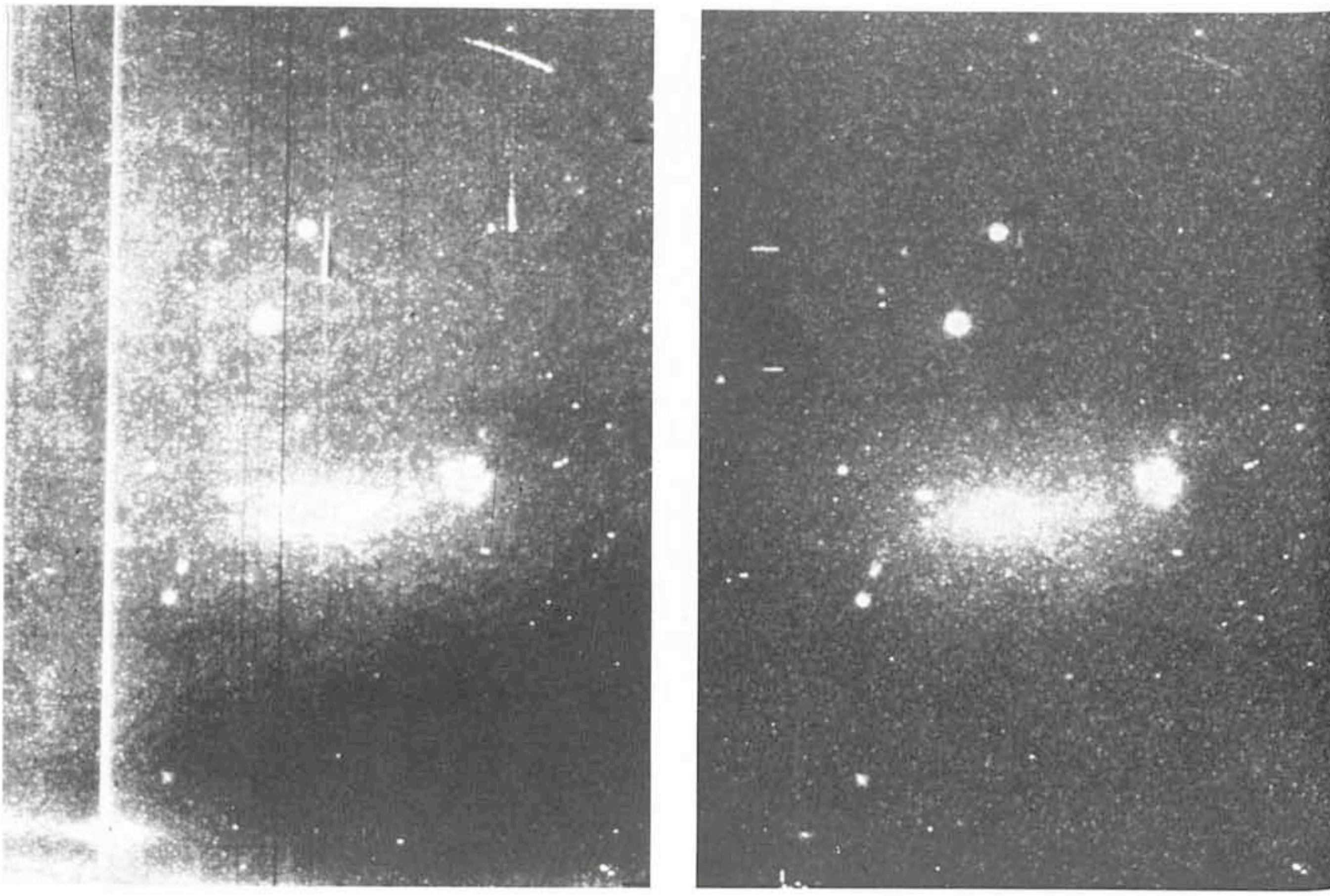

Fig. 1: *(a) First image of the galaxy NGC 1602 in the near IR (January 1982; 15-min exposure; z filter); (b) Image obtained after a pixel-to-pixel division of the image (a) by the night sky correction frame. Note the peculiarity of the galaxy which presents a bright region with multiple condensations at the edge of a large diffuse component. A knotty jet hardly visible here is seen in bluer colour bands.*

erasing all the objects contained in the scientific frames in one given filter during one observing night, and by adding the empty frames obtained that way. The creation of that correction frame does not consume any observing time, except if all the objects of the scientific programme are very extended. (As long as we do not know if standard correction frames can be made once and for all and used by every astronomer, it might be a good idea to incorporate in the programme of every observing night some rather empty fields, for example for detection of faint objects, which can be used to build the correction frames.) The photographs 1 a and b show the result obtained after such a correction. The large-scale background variations were initially (photo 1 a) of 10 % in the central zone of the picture, and the fluctuations due to the interference rings of 2 % of the sky value through the z filter. On the corrected image (photo 1 b) the interference pattern as well as the cold lines are no more visible and the background variations are reduced to less than 1 %.

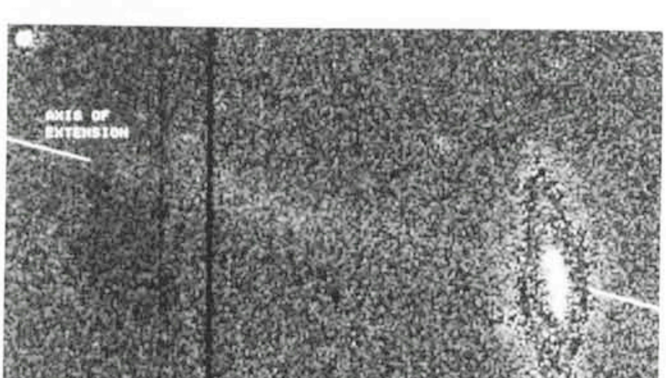

Fig. 2: *This 15-min exposure (January 1982; g filter) of the galaxy ESO 347 G22 shows several nuclear condensations. A large jet feature aligned with the central condensation is clearly visible (1 pixel = 0.471 arcsec).*

Of course the cleaning procedure outlined above cannot reduce the interference rings when they are due to emission lines of the studied objects themselves. Other problems also remain, as the dead and hot pixels and the cosmic ray events, which can be cleaned by the use of software routines now available in the MIDAS image-processing system (Banse et al., *The Messenger*, March 1983). The charge transfer which occurs in the CCD during the picture read-out was not perfect during the testing phase of the CCD. A few per cent of the electrons corresponding to a stellar image were not well transferred and produce faint nebulosities around the stars. Although that effect does not seem to affect directly the photometric results in a very strong way, it makes difficult the precise determination of the sky background in the vicinity of stars (Sol et al., submitted to *A.A.*, 1983). The charge transfer is expected to be substantially improved by an adequate preflash of the CCD chip before each exposure. The outflow of charges from the strongly exposed to the underexposed zones which occurs in regions of high luminosity gradient would also be reduced by a preflashing procedure.

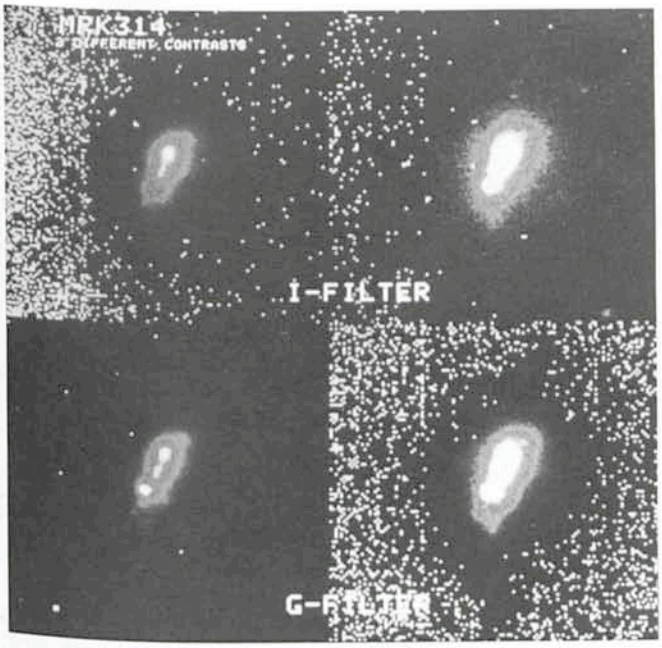

Fig. 3: *The two upper (respectively lower) pictures have been obtained from one exposure of the central part of the galaxy Mrk 314 (July 1982; 15-min exposure) in the i (respectively g) colour band, seen with 2 different contrasts. There is a bridge of matter between 2 main condensations, the southern one is very blue. Mrk 314 is likely to be an interactive case. The inner parts of 2 curved extensions are slightly visible at the upper and lower parts of the g exposures.*

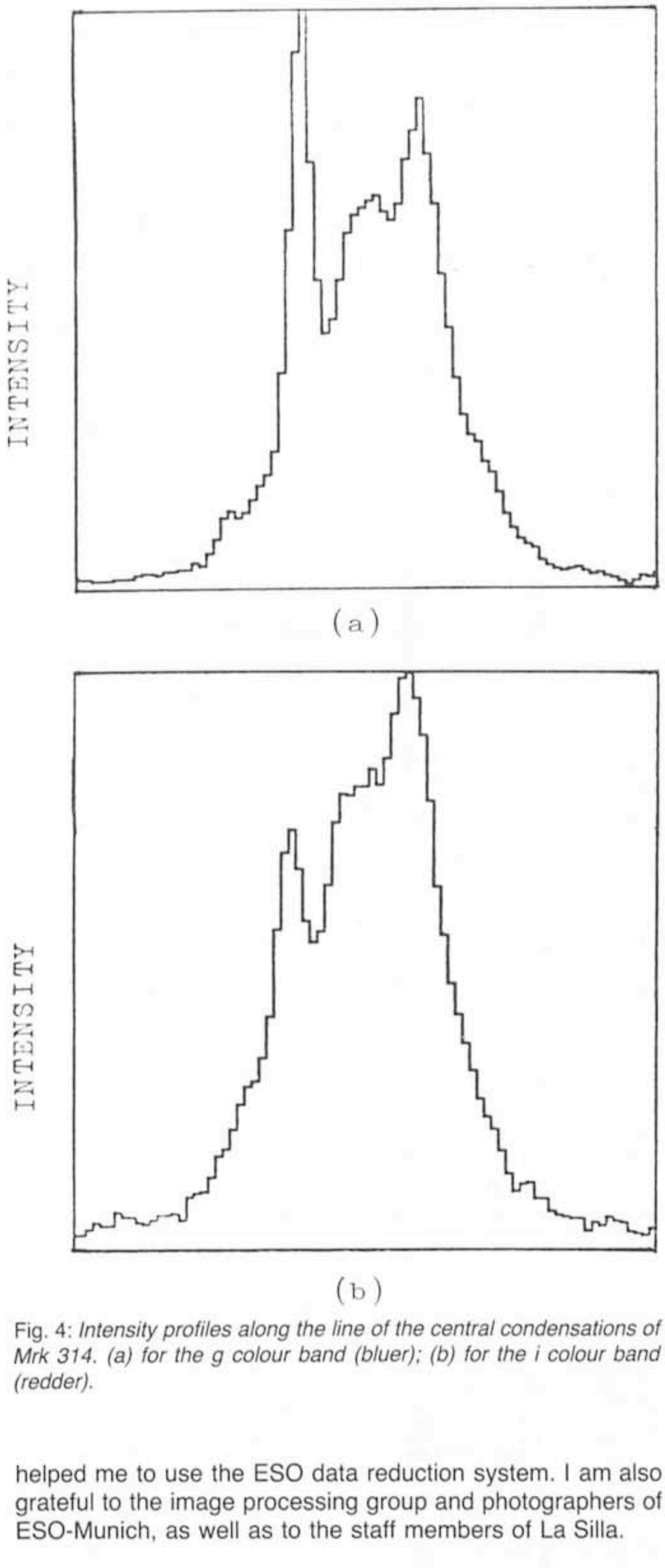

Fig. 4: *Intensity profiles along the line of the central condensations of Mrk 314. (a) for the g colour band (bluer); (b) for the i colour band (redder).*

From a qualitative point of view, the main superiority of a CCD image of one galaxy as compared to what is seen on a Schmidt plate concerns the resolution of the brightest central regions of the galaxy. The sensitivity of the CCD permits a statistical approach while its dynamical range allows a simultaneous investigation of the faint extensions themselves and of the parent galaxies. It is therefore possible to roughly classify all the objects of the sample into different groups by using (i) morphological criteria on the extensions and on the parent galaxies and their nuclei, (ii) photometric properties as the jet-to-galaxy or jet-to-nucleus luminosity ratio in different colours. Among the objects of the sample, 10% appeared, on the CCD images, to be possibly a superposition of classical astronomical objects, as faint stars or edge-on galaxies. The majority of the objects, however, remain very peculiar. 20% are likely interactive cases with tidal extensions. 20% show, besides their jet-like features, multiple nuclear condensations, illustrated by the photographs 2 and 3 and the Fig. 1. No jet strikingly similar to the case of M87 seems to have been found, but further information as spectroscopic and radio data on the jet features are necessary to draw more precise conclusions.

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New Optical and X-ray Observations Yield Progress in Understanding of an Old Nova

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Nova Aquilae 1918 was the brightest new star that was discovered since Tycho's and Kepler's supernovae in 1572 and 1604, which reached a peak brightness of -4^m and -3^m, respectively. On June 10, 1918, Nova V603 Aquilae went through a sharp maximum of visual brightness $-1^m.1$, followed by a subsequent steep decrease, making it an outstanding