THE MESSENGER

EL MENSAJERO

No. 20–March 1980

Italy and Switzerland to Become Members of ESO

On 26 March the ESO Council, meeting in Geneva in special session, unanimously accepted Italy and Switzerland as new Member States in the Organization. This membership could become effective early in 1981, if the required parliamentary ratification procedure in the two countries will have been successfully completed.

According to the ESO Convention, new Member States have to pay a special contribution corresponding to their share in the investments made in the past. In fixing the amount of this contribution, the ESO Council also decided that it will be used to expand the observing facilities at La Silla. At present, these facilities are already heavily oversubscribed, and this could only become more so with a 25-per-cent increase in the user community. It is envisaged to build a 3.5-m telescope with a thin light-weight mirror, which could be completed within five years after final project approval. This telescope—the NTT (New Technology Telescope)—will give a much needed increase in the available large telescope observing time. Also, it will be valuable in obtaining the technological knowledge needed for the development of the large telescopes of the future, like the VLT.

With the entry of Italy and Switzerland, ESO will be more able to fulfil one of its principal tasks, to foster cooperation in astronomy in Europe. We welcome our colleagues from these two countries and look forward with anticipation to their full participation in all ESO activities.

L. Woltjer
Director-General

Quasars Resolved

P. A. Wehinger, T. Gehren and S. Wyckoff

While observers have obtained spectra of more than 1,400 quasars since they were discovered in 1963, fewer than one per cent have been studied by direct imaging techniques at significantly faint surface brightness levels and high angular resolution to detect anything more than a bright point-like source. La

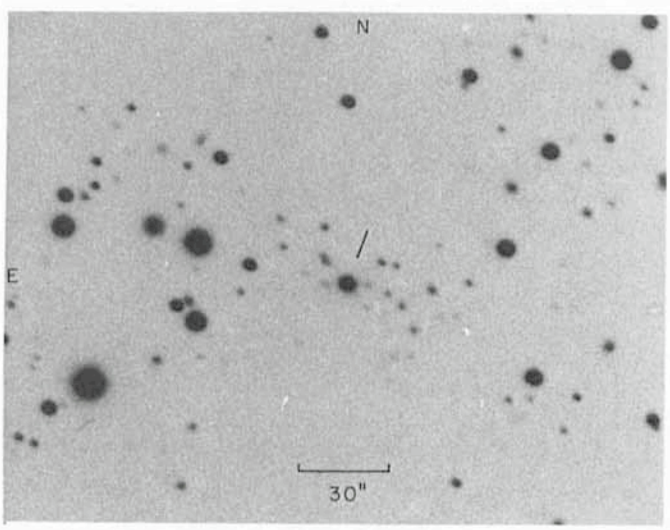


Fig. 1: *The quasar 3C 206 (z = 0.200), at centre. ESO 3.6-m prime focus plate (Kodak IIIa-F + Schott OG 570). Note clustering of faint (20–22 mag) objects within ~40 arc sec of the QSO.* ▶

Silla's very dark sky, excellent seeing, plus the superb optics of the 3.6-m telescope have been combined with digital analysis of sky-limited photographs to produce two-dimensional intensity contour maps and image profiles of quasars. The contour maps reveal extended structure on a scale of 5–10 arc sec for 80 per cent of a sample of 20 low redshift (z = 0.1–0.5) quasars. In a significant number of cases the data also show the presence of galaxies near the QSO's, some of which have measured redshifts nearly equal to the QSO redshifts. This programme is the joint effort of Drs. Peter Wehinger and Thomas Gehren of the Max-Planck Institute for Astronomy in Heidelberg and Professor Susan Wyckoff of Arizona State University in Tempe, Arizona.

Although extensive spectroscopic and photometric observations have been obtained of some 1,400 known quasars, only a very limited number of QSO's have been observed through deep large-scale direct imaging (i.e. photography and/or other two-dimensional detectors). In order to understand the nature of quasars and their possible relation to Seyfert and N-type galaxies, to which they are often compared, we have undertaken a programme of direct imaging with the ESO 3.6-m telescope. The direct imaging data serve as essential guides for follow-up spectroscopic observations to determine the nature of the resolved structure and of the clustering of faint (20–22 mag) diffuse objects near the QSO's.

Two quasars already analysed both through direct imaging and spectroscopy are: Markarian 205 (A. Stockton, S. Wyckoff and P. A. Wehinger, 1979, *Ap. J.*, **231,** 673) at a redshift, z = 0.070, and the radio quasar 3C 206 (S. Wyckoff, P. A. Wehinger, H. Spinrad and A. Boksenberg, 1980, *Ap. J.* (in press)), at z = 0.200. These objects have been observed with the Mauna Kea 2.3-m telescope and the ESO 3.6-m telescope, respectively. The combined imaging and spectroscopic data from Mauna Kea show that Mark 205 (z = 0.070) is at its cosmological distance, unrelated to the foreground spiral galaxy, NGC 4319 (z = 0.006). Spectra of an optically resolved extension, 4 arc sec north-east of the QSO, show an absorption-line redshift equal to the emission-line redshift of the QSO. In fact, it has been shown that Mark 205 is simply the luminous nucleus of one of a pair of galaxies (z = 0.07) which lie nearly in the same line-of-sight as the spiral galaxy NGC 4319.

In the case of 3C 206 (= PKS 0837-120), we first secured electronographs at Mauna Kea of this luminous quasar which showed an extended elliptical envelope 18 arc sec diameter (along the major axis) and clustering of at least a dozen objects (of 20–22 mag) close to the quasar (P. A. Wehinger and S. Wyckoff, 1978, *M.N.R.A.S.*, **184,** 335). Then we obtained deeper and somewhat improved resolution photographs of 3C 206 with the ESO 3.6-m telescope at the prime focus. These IIIa-F plates (sensitized by baking in forming gas) were calibrated and subsequently were

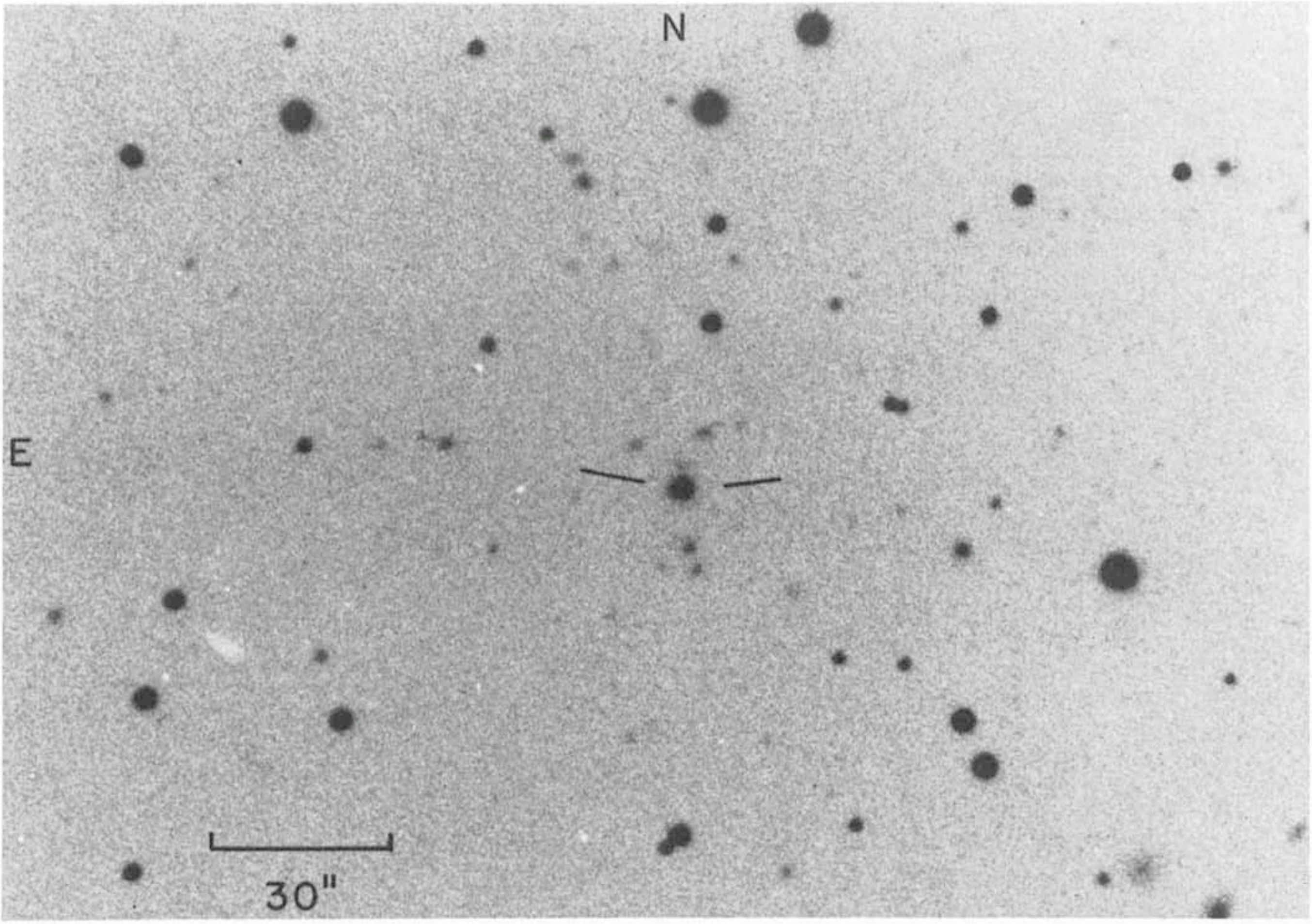


Fig. 2: *The quasar PKS 0812+020 (z = 0.402), at centre. ESO 3.6-m prime focus plate. Note faint objects north and south of QSO within ~20 arc sec of QSO.*

scanned with the PDS microdensitometer at MPIA in Heidelberg where software has been developed to analyse the images. (Cf. P. A. Wehinger, T. Gehren and S. Wyckoff, 1980, Proc. of ESO Workshop on Two Dimensional Photometry (ed. by P. Crane and K. Kjär), in press.) 3C 206 and PKS 0812 +020 (a QSO with $z = 0.402$), shown in figures 1–4, exhibit significant clustering of diffuse objects near ($\lesssim$ 30–40 arc sec) the QSO's. These cluster objects have apparent integrated magnitudes of ~20–23 at 6000 Å, just below the plate limit of the Palomar Sky Survey. In fact, typical cluster galaxies at $z = 0.2$ and 0.4 would be expected to have integrated magnitudes within this range, if they are galaxies at their cosmological redshifts.

The PDS digital scans of field stars define the point-spread-function (PSF), for a given plate, to a surface brightness limit of 1–2 per cent of the red night sky (~26–26.5 mag sec^{-2}). The PSF for each plate has been compared with the image profile (mag sec^{-2} versus radial distance in arc sec) of each quasar (see figure 5). Out of a sample of 16 quasars, 12 exhibit extended image profiles which are significantly broader than the stellar image profiles (as defined by the PSF). A point-by-point subtraction of the PSF from the quasar image profile reveals a profile with a surface brightness of $\gtrsim$22–24 mag sec^{-2} and a slope of $\sim r^{-2}$ (Hubble law) as expected for elliptical galaxies. The quasars observed thus far were selected from the Optical Quasar Catalog by G. R. Burbidge, A. H. Crowne and H. E. Smith, 1977, *Ap. J. Suppl.*, **33,** 113. In addition, all the QSO's we have observed at ESO thus far are radio-loud. Additional observations are planned to compare radio-loud and radio-quiet quasars, to see what differences can be detected in the underlying galaxies, i.e. which are elliptical galaxies and which are spirals. Since Seyfert galaxies are in general radio-quiet and are spirals (cf. T. Adams, 1977, *Ap. J. Suppl.*, **33,** 19, and P. A. Wehinger and S. Wyckoff, 1977, *M.N.R.A.S.*, **181,** 211), one might expect radio-quiet quasars to be seated in the nuclei of spiral galaxies.

Apparent integrated magnitudes can be obtained for the underlying galaxies extracted from the QSO image profiles. These magnitudes, when combined with their redshifts, and assuming a Hubble constant, $H_o = 50$ km sec^{-1} Mpc^{-1}, yields absolute magnitudes of the underlying galaxies of –21 to –24, typically 1–3 mag fainter than the quasars. Since the underlying galaxies are diffuse, while the QSO's are point sources, the galaxies have been difficult to detect.

Spectroscopic observations of the underlying galaxies around quasars, as well as associated cluster galaxies, are being obtained with the ESO 3.6-m and the Anglo-Australian Observatory 3.9-m telescopes. The observations employ fast Cassegrain spectrographs and Boksenberg's Image Photon Counting System (IPCS). For 3C 206, one cluster galaxy has been observed (~20 mag, 12 arc sec north-east of the QSO) to have an absorption-line redshift, $z = 0.2028 \pm 0.0015$, in close agreement with the emission-line redshift of the quasar ($z = 0.200$). A spectrum of the underlying structure, 3–6 arc sec west of the QSO, shows an absorption-line feature of Ca II H and K and a low excitation emission-line spectrum at the same redshift as the QSO, as well as a redder continuum than that in the QSO.

The measured surface brightness, slope of the image profiles, angular diameters versus redshift, and emission- and absorption-line redshifts are leading to a consistent picture of quasars being the nuclei of distant active galaxies, some of which are located in clusters or groups of galaxies. Observations of the type we have described here need to be carried out for both radio QSO's and optical (radio-quiet) QSO's, and also for quasars with different redshifts found in

Change in "Messenger" Editorship

Please be informed that I have resigned in December 1979 as Editor of the ESO *Messenger*. The Director-General has accepted my resignation and will presently appoint another person in this function.

I should like to thank all those who have contributed to the *Messenger* during the past years. With their generous help it has been possible to rapidly publish new information and to stimulate widespread interest in astronomy in general and in ESO in particular. I hope they will continue to write articles, notes, etc. and urge them to support the new editor as actively as possible.

Richard M. West

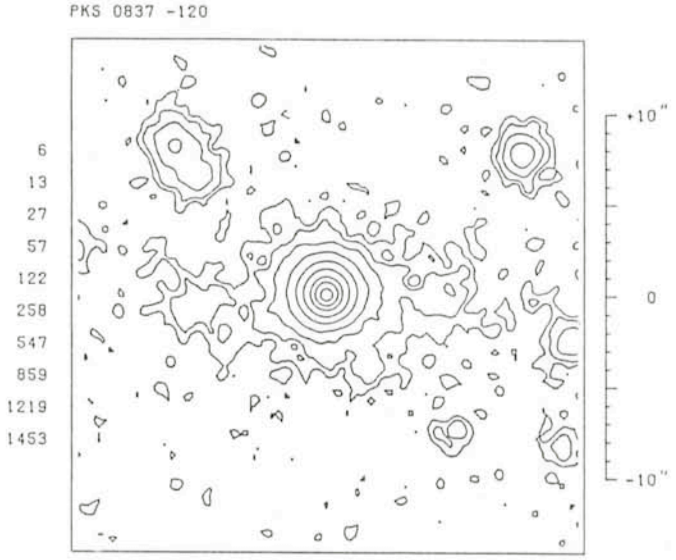


Fig. 3: *PDS logarithmic intensity contour map of 3C 206. Scale is indicated at right. Surface brightness contours are given at left (in per cent of red night sky).*

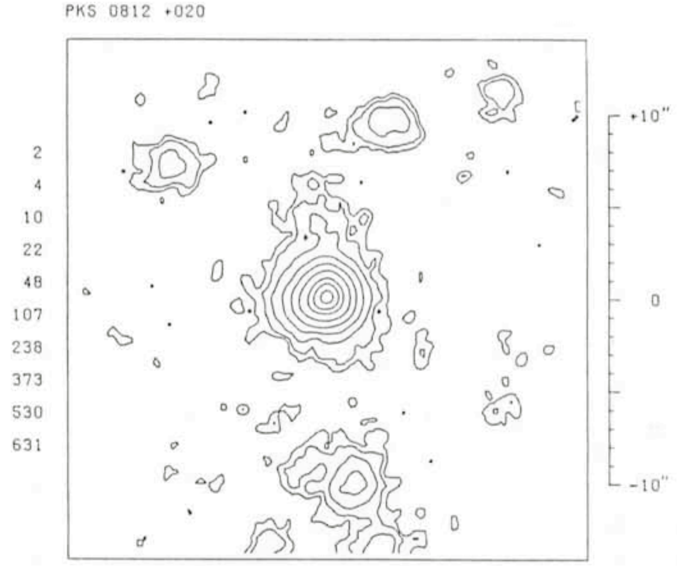


Fig. 4: *PDS logarithmic intensity contour map of PKS 0812+020. Other details same as in figure 3.*

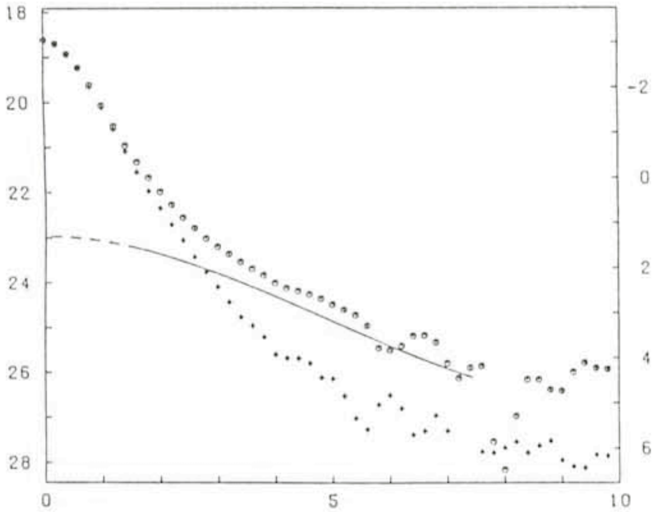


Fig. 5: *Image profile (mag sec^{-2} versus radial distance in arc sec) of the QSO 3C 206 (circles) and of the stellar point-spread-function (PSF, crosses). Solid line is difference between PSF and QSO profile, showing underlying galaxy surrounding the QSO. Scale on left is apparent red mag sec^{-2}. Scale on right is mag sec^{-2} with respect to the red night sky (5700–6900* Å).

unusual alignments by H. C. Arp. Through deep imaging and follow-up spectroscopy of extended sources associated with quasars we hope to derive a consistent picture of QSO redshifts.

We are grateful to D. McMullan and K. Gyldenkerne for their interest and support in this programme, especially in regard to the earlier electronographic observations. The able assistance of members of the technical staff on La Silla is appreciated with thanks, especially of P. Bouchet, P. Giordan, J. Perez, and M. Pizarro.

ESO ST WORKSHOP No. 1:

Dwarf Galaxies: The Need for Coordinated Space and Ground-based Observations

This workshop, which is the first in a series planned to encourage European cooperation and coordination in the use of the space telescope, will take place on May 12–13 1980 in Geneva. Participation by invitation.

Information may be obtained from Prof. P. O. Lindblad, ESO Scientific Group, c/o CERN, CH-1211 Geneva 23, Switzerland.

List of Preprints Published at ESO Scientific Group

December 1979–March 1980

73. N. VOGT: The SU UMa Stars, an Important Sub-group of Dwarf Novae. *Astronomy and Astrophysics.* December 1979.
74. G. TENORIO-TAGLE: Formation of "Super-rings". *Astronomy and Astrophysics.* December 1979.
75. J. SELLWOOD: Galaxy Models with Life Halos. *Astronomy and Astrophysics.* January 1980.
76. P. O. LINDBLAD: On the Relation between Local Kinematics and Galactic Structure. Astronomische Gesellschaft, Mitteilungen. February 1980.
77. P. A. SHAVER: Accurate Electron Temperatures from Radio Recombination Lines. *Astronomy and Astrophysics.* February 1980.
78. E. A. VALENTIJN: A Westerbork Survey of Clusters of Galaxies. XIII. Deep 610 MHz Source Counts from the Cancer Cluster Field. *Astronomy and Astrophysics,* Research Note. March 1980.

Visiting Astronomers

April 1–October 1, 1980

Observing time has now been allocated for period 25 (April 1 to October 1, 1980). As usual, the demand for telescope time was much greater than the time actually available.

The following list gives the names of the visiting astronomers, by telescope and in chronological order. The complete list, with dates, equipment and programme titles, is available from ESO/Munich.

3.6-m Telescope

April:	Bensammar, de Vries, de Loore/Burger/van Paradijs, Ilovaisky/Mouchet, Pakull, Alcaíno, Danziger, Chevalier/Motch/Ilovaisky/Hurley/Niel/Vedrenne, Valentijn, F. and M. Querci/Lamy/Daniel, Lamy/Koutchmy.
May:	de Graauw/Fitton/Lidholm/v.d. Stadt/de Vries/Israel, Vogt, Vigroux/Comte/Lequeux/Stasinska, Kohoutek, Seggewiss, Dennefeld, Vreux/Andrillat, Dennefeld, Krautter, Sibille/Perrier.
June:	Sibille/Perrier, Chevalier/Ilovaisky/Motch, Elvius/Westin, Westerlund, Rahe/Drechsel, Shaver/Danks/Pottasch, Lub, Pedersen, Alcaíno, Chevalier/Motch/Ilovaisky/Hurley/Niel/Vedrenne, de Vegt, Epchtein/Guibert/Q-Rieu/Lepine/Turon, Epchtein/Lecacheux/Vapillon/Combes/Encrenaz, Sherwood.
July:	Sherwood, Danziger / de Ruiter / Kunth / Lub / Griffiths / Wilson / Ward, Danziger, Danziger / Shaver / Ekers / Goss / Fosbury / Wall, Schnur / Sherwood, Moorwood/Salinari, Moorwood/Shaver/Salinari.
August:	Appenzeller, P. and M. P. Véron/Zuiderwijk, Bergvall, West/Kurtanidze, Gaida, Bergeron/Kunth, Chevalier/Motch/Ilovaisky/Hurley/Niel/Vedrenne.
September:	Tammann / Laustsen, Ardeberg / Lindgren / Lyngå, Chevalier/ Motch/ Ilovaisky/ Hurley/ Niel/ Vedrenne, Tarenghi/Crane/Ellis/Kibblewhite/Peterson/Malin, Ardeberg/Lindgren/Lyngå, Crane/Tarenghi/Materne/Chincarini, Ulrich, de Loore/Burger, van Dessel.

1.52-m Spectrographic Telescope

April:	Tjin A Djie/Thé, de Loore/van Paradijs/van den Heuvel, Grosbøl, Ilovaisky/Chevalier, de Loore/van Paradijs/van den Heuvel, Gieseking, Pakull/Reipurth, Ahlin/Sundman, Voigt/Schneider, Ardeberg/Gustafsson.
May:	Ardeberg/Gustafsson, Ahlin/Sundman, Lindblad/Lodén, Richter/Huchtmeier, Vogt, Krautter, Kubiak/Seggewiss, Andersen/de Loore, Andersen.
June:	Andersen, Nordström/Andersen, Ahlin/Sundman, Rahe/Drechsel, Ardeberg/Maurice, Barwig/Schoembs, Tarenghi, Ardeberg/Maurice, Ahlin/Sundman, Epchtein/Lecacheux/Vapillon/Combes/Encrenaz, Bouchet, Arpigny.
July:	Arpigny, F. and M. Spite, Schnur, Mauder, Ap Workgroup, Ott/Rindermann, Bouchet, Ott/Rindermann.
August:	Ott/Rindermann, Bergvall, Appenzeller, M. P. Véron, Danks/Gilra/Pottasch, Ardeberg/Gustafsson, Ahlin/Sundman, Häfner, Danks/Dennefeld, Thé/van der Hucht.

September: Thé/van der Hucht, Crane/Tarenghi/Materne/Chincarini, Ulrich, Rosa, Bouchet, Danks/Dennefeld.

1-m Photometric Telescope

April: Groote/Kaufmann/Filter, Groote/Schultz, Thé/Bakker, Bensammar, Ardeberg/Maurice, Bernard, Reipurth.

May: Reipurth, Motch, Mattila/Schnur, Mattila/Schallwich/Schnur, Kohoutek, Motch, de Loore/Sterken.

June: de Loore/Sterken, Bouchet, Tarenghi/Tanzi, Lub, Westerlund, Elvius/Westin, Barwig/Schoembs, Bouchet, Epchtein/Guibert/Q-Rieu/Turon.

July: Epchtein/Guibert/Q-Rieu/Turon, Mauder, Ardeberg/Gustafsson, Hoffmann, Schmidt/Engels/Schultz, Moorwood/Shaver/Salinari.

August: Moorwood/Shaver/Salinari, Moorwood/Salinari/Alcaíno, Geyer/Hänel/Nelles, Bergvall, Bouchet, Heck.

September: Heck, van Woerden/Danks, de Jong/Wesselink/Habing/Baud/Thé/van der Hucht, Bouchet.

50-cm ESO Photometric Telescope

April: Lodén, Motch, Ahlin/Sundman.

May: Ahlin/Sundman, Kohoutek, Mattila/Schnur, Mattila/Schallwich/Schnur, Terzan, Ahlin/Sundman.

June: Ahlin/Sundman, Lundström/Stenholm, Ahlin/Sundman, F. and M. Spite.

July: F. and M. Spite, Ahlin/Sundman, Bouchet, Mauder, Ap Workgroup.

August: Ap Workgroup, Ahlin/Sundman, Bouchet, Häfner, Bouchet, Lagerkvist/Rickman.

September: Lagerkvist/Rickman, Thé/v. d. Hucht, Schober, Bouchet.

40-cm GPO Astrograph

May: Debehogne.

1.5-m Danish Telescope

April: Reipurth, Grosbøl, Pedersen, Vogt, Ratier, Hansen.

May: Hansen.

June: Aurière, Pedersen, Motch/Ilovaisky/Chevalier, Barwig/Schoembs.

August: Gaida, van Paradijs, Pedersen, Motch/Ilovaisky/Chevalier, Pedersen.

50-cm Danish Telescope

April: Renson/Manfroid, Ardeberg/Gustafsson.

May: Ardeberg/Gustafsson, Kubiak/Seggewiss, Debehogne.

June: Debehogne, Radeke, Ardeberg/Gustafsson.

July: Wramdemark.

August: Ardeberg/Gustafsson.

90-cm Dutch Telescope

April: Lub, Thé/Bakker, Pakull, Lub, Pakull.

May: Pakull.

June: van Paradijs/van der Klis, Lub.

July: Lub.

August: de Ruiter/Lub.

61-cm Bochum Telescope

May: Hardorp, Kohoutek, Terzan.

June: Terzan, Radeke, Kozok.

July: Kozok, Ott/Rindermann.

August: Ott/Rindermann, Sanders.

September: Schober.

NEWS AND NOTES

One of the Founders of ESO Receives ADION Medal for 1978

The Association for International Development of the Nice Observatory (ADION) awards each year, since 1963, a medal honouring a French or foreign scientist known for the importance of his contribution to the development of astronomy and astrophysics and to the establishment of international cooperation in this science. The medal for 1978 has been awarded to Professor Jan H. Oort who played a major part in the creation of the European Southern Observatory.

Professor Jan H. Oort was born on April 28 1900 in Franeker in the Netherlands. He was educated at the University of Groningen and, after a two-year stay in the USA, he settled down in Leiden for the rest of his career. In 1945 he was nominated Professor and appointed Director of the Leiden Observatory. It can be said of Professor Oort that he is one of the founders of galactic astronomy: he analysed the differential rotation of our galaxy around its centre, evaluated the mass and dimension of our galaxy (1926–1927) and made a determination of the mass density in the vicinity of the Sun (1932). Furthermore, he participated in one of the first detections of the 21-cm atomic hydrogen line emitted by the interstellar gas (1951); he also gave a description of the spiral structure of our galaxy (1954) and of the galactic centre (1960) and discovered the high-velocity clouds. Moreover, he accomplished remarkable works on the origin of comets, on the synchrotron radiation theory and on the structure of the Crab Nebula.

The influence of Professor Jan H. Oort on contemporary astronomy was considerable. In the Netherlands he promoted the construction of the Dwingeloo radio telescope and of the Westerbork interferometer and gave his support to space research. He also played a major part in the creation of the European astronomical journal *Astronomy and Astrophysics*. He had important official functions in the International Astronomical Union as a General Secretary from 1938 to 1948 and as President from 1959 to 1961. He worked for the reconstruction of the astronomical union after the Second World War in a spirit of great international cooperation.

Other personalities to whom the ADION Medal was awarded are (in chronological order): 1963: André Danjon; 1964: Marcel Minnaert; 1965: Bengt Strömgren; 1966: Otto Heckmann; 1967: Charles Fehrenbach; 1968: Alexandre Mikhaïlov; 1969: Donald Sadler; 1970: André Lallemand; 1971: Bart Bok; 1972: Lubos Perek; 1973: not attributed; 1974: Evry Schatzman and Pol Swings; 1975: Kaj Strand; 1976: Wilbur Christiansen; 1977: Jean Delhaye.

Fifth European Regional Meeting

The Fifth European Regional Meeting, cosponsored by IAU and EPS, on "Variability in Stars and Galaxies" will take place in Liège from 28 July till 1 August. Four general lectures have been planned (J. O. Stenflo: Solar Variability; C. Hazard: Variability in Galactic Nuclei and Quasars; J. van Paradijs: X-ray Bursters; I. Shklovsky: SS 433). In addition, about 25 invited papers will be given in the area of Sun, variable stars, active nuclei and quasars, variable galactic X-ray sources and related objects, interstellar medium and star formation, supernovae and remnants, early universe.

Further information may be obtained from Prof. P. Ledoux, Université de Liège, Institut d'Astrophysique, 5, ave de Cointe, B-4200 Cointe-Ougrée, Belgium.

A Photometric Study of the Bright Cloud B in Sagittarius: III

A. Terzan and K. H. Ju, Observatoire de Lyon

While continuing the study of variable red stars and stars with proper motions and the U, B, V photometry of stars in the bright cloud B in Sagittarius or projected in this central region of the Galaxy (see *Messenger* No. 10, p. 1), we detected, in 1978, three diffuse objects and a planetary nebula (see *Messenger* No. 15, p. 14). These objects were discovered on R plates (098–04 with filter RG630, $\lambda_{eff} \simeq 6500$ Å) taken by H. E. Schuster and his collaborators at the ESO Schmidt telescope on La Silla.

With 7 more R plates obtained in 1979, we started a thorough study of all 18 R plates which are now available. This study permitted us to identify 20 more diffuse objects. The coordinates of these objects for the 1950 equinox and the position (X; Y in mm) on the POSS charts are given in table 1, and the identification charts are grouped in figure 1.

In figure 2, the position of these objects is indicated relatively to the known globular clusters and to the X-ray sources already discovered in this direction. The observational data α, δ and error boxes (shown here as circular areas) have been taken from the catalogue by AMNUEL *et al.* (P. R. Amnuel, O. H. Guseinov, Sh. Yu. Rakhaminov, 1979, *Astrophys. Journ. Suppl.* Ser. **41,** p. 327).

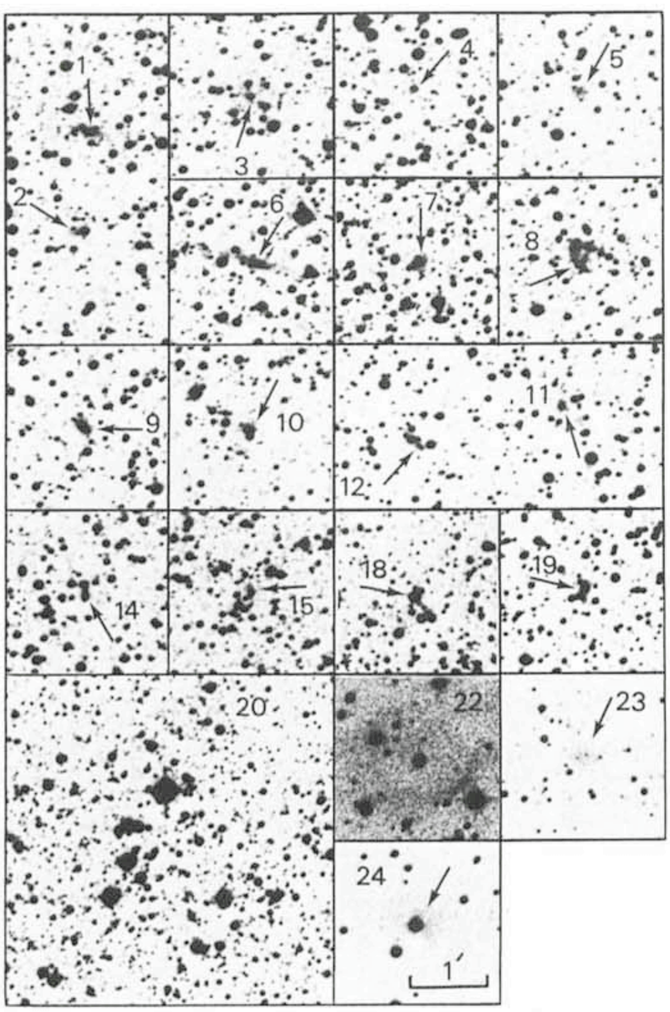


Fig. 1: *Identification chart, in R, of 24 new diffuse objects.*

Table 1

No.	α_{1950}	δ_{1950}	POSS		
			Charts	X_{mm}	Y_{mm}
1	$17^h05^m.3$	−25° 38′	−24° 16^h54	91.8	92.2
2	$17^h05^m.3$	−25° 39′	−24° 16^h54	91.5	91.1
3	$17^h06^m.3$	−25° 38′	−24° 16^h54	79.5	92.0
4	$17^h07^m.1$	−26° 11′	−24° 16^h54	70.7	63.0
5	$17^h08^m.1$	−27° 08′	−24° 16^h54	59.2	12.0
6	$17^h08^m.7$	−25° 41′	−24° 16^h54	52.3	89.7
7	$17^h08^m.8$	−28° 48′	−30° 16^h54	51.5	244.0
8	$17^h09^m.4$	−26° 22′	−24° 16^h54	42.8	53.0
9	$17^h09^m.5$	−25° 44′	−24° 16^h54	41.5	86.5
10	$17^h13^m.7$	−26° 45′	−24° 17^h20	299.4	29.4
11	$17^h14^m.2$	−26° 46′	−24° 17^h20	293.5	27.4
12	$17^h14^m.3$	−26° 33′	−24° 17^h20	292.0	27.0
13	$17^h15^m.1$	−27° 51′	−30° 17^h20	285.5	293.0
14	$17^h15^m.2$	−26° 19′	−24° 17^h20	281.5	52.6
15	$17^h15^m.3$	−26° 15′	−24° 17^h20	281.0	56.5
16	$17^h15^m.3$	−27° 43′	−30° 17^h20	282.5	300.0
17	$17^h15^m.5$	−27° 47′	−30° 17^h20	280.5	297.0
18	$17^h18^m.4$	−28° 50′	−30° 17^h20	245.0	239.0
19	$17^h22^m.2$	−26° 10′	−24° 17^h20	197.8	62.2
20	$17^h30^m.4$	−29° 17′	−30° 17^h20	106.3	217.0
21	$17^h32^m.5$	−30° 20′	−30° 17^h20	82.0	160.5
22	$17^h33^m.3$	−32° 04′	−30° 17^h20	75.0	68.0
23	$17^h41^m.8$	−32° 45′	−30° 17^h46	270.5	28.0
24	$17^h42^m.0$	−32° 07′	−30° 17^h46	270.2	62.9

Description of Objects

No. 1 and 2: *Nebulosities of elongated shape; visible on B and R plates.*

No. 3: *Nebulosity with strong central condensation; visible in B and R.*

No. 4: *Star surrounded by a nebulosity; visible in B and R.*

No. 5: *Appears to be a globular cluster; visible on B and R plates.*

No. 6: *Nebulosity of elongated shape whose aspect resembles that of a galaxy seen edge-on; visible in B and R.*

No. 7: *Star surrounded by a nebulosity; visible in B and R.*

No. 8: *Nebulosity; visible in B and R.*

No. 9, 10, 11 and 12: *Stars surrounded by nebulosities; visible in B and R.*

No. 13, 16, 17 and 21: *For descriptions of these objects, see (a)* Messenger *No. 15, p. 14; (b)* C. R. Acad. Sc. Paris, *1978, Série B, p. 157 and 235.*

No. 14: *Object resembling a planetary nebula; visible in B and R.*

No. 15: *Nebulosity of circular shape with decreasing intensity from the centre to the edge. Could it be the nucleus of a globular cluster? Visible in B and R.*

No. 18: *Planetary nebula? Visible in B, V and R.*

No. 19: *Nebulosity elongated in the direction N-S; the object is faintly visible in B.*

No. 20: *Visible on U, B, V, R plates, this object is most probably an open Galactic cluster.*

No. 22: *Reflection nebula? Visible above all in R and UV.*

No. 23: *Globular cluster? Visible in R, giving a very faint image in B.*

No. 24: *Bipolar nebulosity? Visible in B and R.*

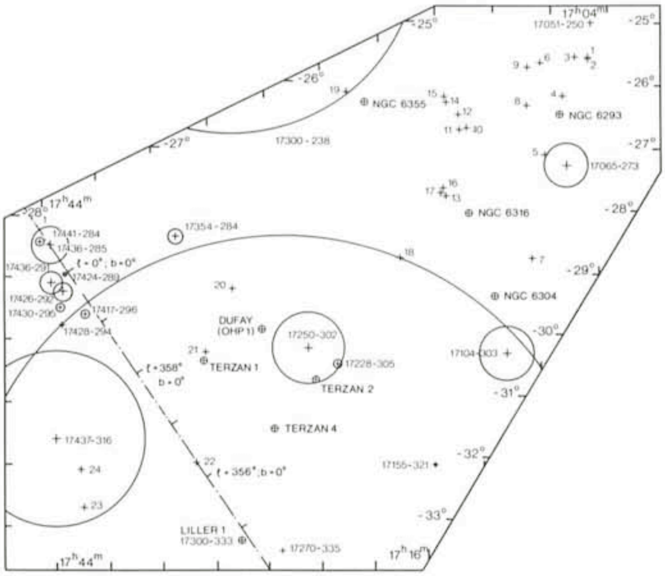


Fig. 2: *Position of the 24 new diffuse objects relatively to the globular clusters and to the X-ray sources already known.*

It is interesting to note that two objects, which appear to be globular clusters, are situated either *near to* (object No. 5 and the source 17065–273) or *in* the error box of an X-ray source (object No. 23 and the source 17437–316). Therefore, they might cause the X-ray emission, like the cluster TERZAN 2 which was recently identified with the source 17228–305 (E. Jonathan Grindlay, 1978, *Astrophys. Journ.* **224.** L 107).

In order to define more exactly the nature of these new diffuse objects, we plan further photographic, spectrographic and photometric observations with the ESO 3.6-m telescope on La Silla.

Acknowledgements

We are grateful to Dr. R. M. West for his interesting suggestions made during the many discussions we had together. We also thank Mr. Dumoulin (ESO-Geneva) and Mr. Bally (Lyon Observatory) for the photographic reproductions.

Tentative Time-table of Council Sessions and Committee Meetings

The following dates and locations have been reserved for meetings of the ESO Council and Committees:

May 20	Users Committee
May 21	Scientific/Technical Committee, Geneva
May 22	Finance Committee, Geneva
May 23	Committee of Council, Geneva
June 2–4	Observing Programmes Committee, Geneva
June 27	Council, Brussels
November 4	Scientific/Technical Committee, Munich
November 5–6	Finance Committee, Munich
November 7	Committee of Council, Munich
November 27–28	Council, Munich
December 2–4	Observing Programmes Committee, Munich

ESO Slides

Two slide sets are at present available from ESO-Garching:

1. First Slide Set from the ESO 1-m Schmidt Telescope (20 5 x 5 cm black-and-white slides).
2. The ESO La Silla Observatory (20 5 x 5 cm colour slides showing the ESO installations on La Silla).

A third slide set showing 20 5 x 5 cm black-and-white slides taken with the ESO 3.6-m telescope was already announced in the June 1979 issue of the *Messenger*. However, this set will only become available in July this year.

The price for each slide set is DM 18.— (or the equivalent) for Europe, and US $ 10.— by surface mail to all other countries, or US $ 12.50 by airmail (to be paid in advance).

ESO Publications

Also available from ESO-Garching are the Proceedings of the Conference on "The Role of Schmidt Telescopes in Astronomy", Hamburg, 21–23 March 1972. Edited by U. Haug (price: US $ 7.—).

A few copies of the following publications are still in stock at ESO-Geneva. Orders should be sent to: European Southern Observatory, c/o CERN, Attn. Miss M. Carvalho, CH-1211 Geneva 23.

ESO/SRC/CERN Conference on Research Programmes for the New Large Telescopes, Geneva, 27–31 May 1974. Edited by A. Reiz (price: US $ 12.—).

ESO Conference on Optical Telescopes of the Future, Geneva, 12–15 December 1977. Edited by F. Pacini, W. Richter and R. N. Wilson (price: Sw.Frs. 40.—).

ESO Workshop on Modern Techniques in Astronomical Photography, Geneva, 16–18 May 1978. Edited by R. M. West and J. L. Heudier (price: Sw.Frs. 16.—).

ESO/SRC Conference on Applications of CAMAC to Astronomy, Geneva, 27–29 September 1978. Edited by M. J. Cullum and C. L. Stephens (free of charge).

PERSONNEL MOVEMENTS

Staff

ARRIVALS

Geneva

Jean PAUREAU (French), Mechanical/Cryogenics Engineer, 1.12.1979

La Silla

Eric MAURICE (French), Astronomer, 1.3.1980

John Hendrik VAN DEN BRENK (Australian), Electronics Technician, 5.3.1980

DEPARTURES

Geneva

Bernard AMRHEIN (French), Laboratory Technician (Electronics, 31.1.1980

Leonard OOSTRIJK (Dutch), Senior Software Specialist, 30.4.1980

Fernand SIMON (Belgian), Technical Draughtsman (Mech.), 31.3.1980

Philippe ROSSIGNOL (French), Systems Analyst/Programmer, 10.4.1980

Paid Associates – Fellows – Coopérants

ARRIVALS

Geneva

Sandro D'ODORICO (Italian), Fellow, 1.3.1980

La Silla

Jan KOORNNEEF (Dutch), Paid Associate, 1.1.1980

CHANGE OF STATUS

La Silla

Christian PERRIER (French), Fellow, 1.2.1980

Observing Elliptical Galaxies with the IPCS

M.-H. Ulrich, ESO Scientific Group, Geneva

1. Introduction

The Image Photon Counting System (IPCS) developed in the early 1970's at University College London by Dr. A. Boksenberg and collaborators (A. Boksenberg, 1972 in *Auxiliary Instrumentation for Large Telescopes,* proceedings of ESO/CERN Conference, p. 295; A. Boksenberg and D. E. Burgess, 1972 in *Adv. in Electronics and Electron Physics,* 33B p. 285) is a two-dimensional detector. It has been used on the ESO 3.6-m telescope at La Silla to observe spectrographically a variety of faint astronomical objects: extended objects, in particular regions of galaxies outside the nucleus, nebulosities associated with active nuclei, etc., and star-like objects such as quasars or halo stars.

In this article we report on observations made with this detector attached to the Boller and Chivens spectrograph of the 3.6-m telescope.

The detector is described in section 2. The data acquisition and data reduction are outlined in section 3. Results on elliptical galaxies are presented in section 4.

2. Description of the UCL Image Photon Counting System (IPCS)

The conceptual design of the system is based on

(1) a combination of an image intensifier and a television camera tube having sufficient over-all gain to enable the photon events to be recorded easily and unequivocally;

(2) the electronic processing and storage functions which were especially developed to analyse and record each photon event individually. System noise and ion events are eliminated, and a pattern recognition logic analyses the spread of each scintillation, resulting in a substantial increase in resolution over that obtained by conventional analogue integration. The position of each centroided photon event is transferred to a small on-line computer where the appropriate memory addresses are incremented.

The system is photoelectron noise limited and its efficiency is essentially the quantum efficiency of the first photocathode of the image intensifier. Storage capacity depends only on the size of the on-line computer memory and is therefore effectively unlimited.

These characteristics make this instrument particularly well suited to observations of faint astronomical objects.

One of the first versions of the IPCS built by Boksenberg was carried to various observatories and installed on large telescopes for periods of a few days to a few weeks. Boksenberg has extensively and successfully used it at Hale Observatories, KPNO, and the RGO, usually in collaboration with local astronomers. Other copies of the IPCS, with some minor modifications, have recently been built and are in operation at the AAT and in South Africa.

Recently Boksenberg, in collaboration with several European astronomers, mostly of ESO, applied for and obtained observing time on the ESO 3.6-m telescope at La Silla. He brought his instrument to La Silla first in August 1978, then in May 1979, and he has a run scheduled for March 1980. The ESO runs with the IPCS are two weeks long so as to make it worth while installing the instrument on the telescope, and are shared by about half a dozen astronomers. Keith Shortridge and John Fordham, both of UCL, also come to La Silla to operate the system with Boksenberg.

2.1

The image intensifier is a 4-stage EMI tube which is magnetically focused and operates at 45 kV. Its face-plate is highly transparent down to the atmospheric cut-off at 3000 Å. The tube is usually used with an S-20 photocathode, allowing one to observe up to 8500 Å. The quantum efficiency of the photocathode is 10 % and the over-all blue-light gain of the tube is 10^7, i.e. 10^8 photons are generated at the phosphor screen for each photoelectron produced by the photocathode. The useful linear field at the entrance of the image intensifier is 35 mm.

The television camera is a Philips Plumbicon, which is a standard camera tube for colour television; the photosensitive layer is a polycrystalline lead-oxide layer which is formed structureless. Its sensitivity is about 70 % and it is peaked in the blue to match the P-11 phosphor screen of the image intensifier.

There is a transfer lens coupling the phosphor screen of the image intensifier and the entrance face of the television tube. This F/2 lens is optimized in the blue and transfers 1 % of the photons. Thus for each primary photoelectron there are 7×10^5 electrons in the television camera target. This gives a good video signal for further processing. (See figure 1.)

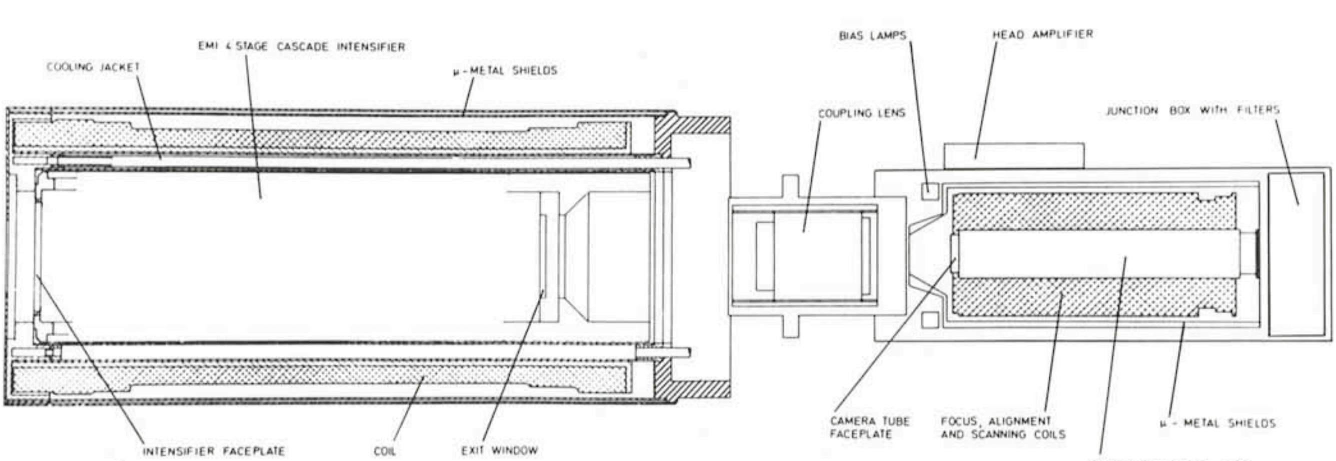


Fig. 1: *Sectional view of the image intensifier, transfer lens, and television camera head.*

Proceedings of the ESO Workshop on Two Dimensional Photometry Soon Available

The Proceedings of this workshop have now been edited and will be available in print at the end of April 1980.

The price for the 412-page volume is Swiss Francs 40.— including postage. Please send your order to:

European Southern Observatory
c/o CERN
Attn. Miss M. Carvalho
CH-1211 Geneva 23

2.2

In the format used at La Silla, the camera scanned 1,532 lines of 113 pixels each, and the "data window" (the area from which data were recorded) was 1,500 by 72. The frame is read perpendicular to the wavelength dispersion, i.e. one scan-line corresponds to one wavelength.

Photon and ion events are of a substantial size, covering up to 5 and 9 lines, respectively, for the 1,532 by 113 format. On passing through the shift register array these data are analysed by a hard-wired pattern recognition system, and the centre of the event, in the direction perpendicular to the scan-line, is determined. This position is then transferred to the computer system for incrementing the associated memory location, there being one location for each pixel within the "data window". Ion events are rejected in the pattern recognition system by comparing data in the photon + ion shift registers with those in the ions-only shift registers.

The number of photons per pixel per second beyond which saturation occurs depends on the speed with which the frame is read. With the large format used during the observations at La Silla, 1,532 lines of 113 pixels each, saturation starts at a rate of photon arrival in excess of one photon per pixel per second.

In practice, saturation is seldom a problem since the instrument is used to observe extremely faint stellar objects or extended objects of faint surface brightness. But care must be exercised in the choice and the observations of standard stars.

3. Data Acquisition and Data Reduction

The IPCS was installed on the 140-mm camera of the Boller and Chivens spectrograph at the Cassegrain focus of the 3.6-m telescope. As stated in section 2.2, the data window is 72 x 1,500, i.e. one IPCS image or frame is formed by 72 spectra of 1,500 pixels each. The distance between the individual spectra is 1″.7 and the whole image covers 2′. With the 600 lpm grating, the wavelength range covered is 4320 Å, corresponding to 2.28 Å per pixel.

An image of the He-Ar comparison spectrum is taken for each galaxy or star image, and when observing galaxies which extend over the whole slit length, images of the blank sky are also taken to enable sky subtraction to be performed. As usual, the pixel-to-pixel variations are calibrated by taking an image of a flat field, and the response curve versus wavelength is determined by observing standard stars.

At ESO in Geneva, there are two ways of doing the dispersion correction of the images. One way is to consider each of the 72 spectra individually and to reduce them separately as if, for example, they were IDS scans. A batch command allows automatic reduction of all the individual spectra in a frame after the first one has been reduced.

The main shortcoming of this method is that it does not use all the information contained in the arc images; specifically, it does not use the fact that each line of the comparison arc is continuous and can be represented by a smooth function such as a polynomial. Dr. Werner Krischer at CERN has developed a powerful computer programme to extract the shape of particle tracks recorded on bubble chamber photographs. This programme is being adapted to the reduction of IPCS spectra by Cheryl Bettels of ESO with the help of Dr. Krischer and Dr. Danziger.

4. Results on Elliptical Galaxies

4.1 Scientific Rationale

It has been known for several decades that a small fraction of elliptical galaxies contain some ionized gas.

Basic information such as the spatial distribution, the angular momentum, and the total mass of the interstellar gas in ellipticals is essentially missing. Even the origin of the gas is uncertain.

The amount of gas now observed in elliptical galaxies is much smaller than the quantity of gas produced by the stars through their evolution. There must, therefore, be an effective mechanism removing most of the gas from the ellipticals. Moreover, there is a large dispersion in M_{gas}/M_{total} among ellipticals. Could this be caused by an irregular rate of gas production? or is it due to irregularities in the regime of galactic winds believed to sweep ellipticals of most of their interstellar gas? An alternative explanation for the dispersion in M_{gas}/M_{total} is that some ellipticals are accreting intergalactic gas, as suggested by the recent discovery that a number of ellipticals have large irregular-shaped clouds of neutral hydrogen. If this later explanation turns out to be correct then the usual assumption, that galaxies do not receive any new material after the epoch of galaxy formation, should be abandoned.

A second important question relative to the interstellar gas in elliptical galaxies is the relationship between the interstellar gas and the radio galaxy phenomenon. It has recently become evident that many radio galaxies exhibit extended (i.e. extra-nuclear) optical emission features. In some cases, studies of long slit spectrograms have led astronomers to suggest that such features are "jets" of material, related in some unspecified way to the radio features or optical continuum jets being shot out from the galaxies' nuclei. A study by Ford and Butcher *(Ap.J.* 1979, in press) of the emission in M87, however, led those astronomers to conclude that the features in that galaxy are most likely manifestations of matter *infall* into the nucleus.

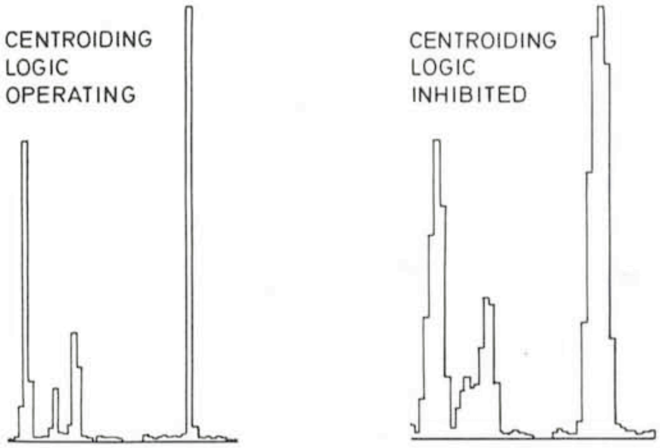


Fig. 2: *Comparison lines. The centroided line-spread-function is less than one channel wide, while the non-centroided case extends over many channels.*

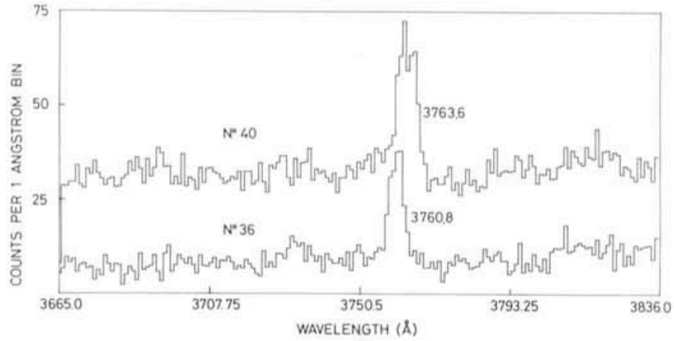


Fig. 3: *Two individual spectra extracted from an image of the spectrum of the elliptical galaxy NGC 3962. The two spectra come from two points symmetrically located with respect to the nucleus and distant by 900 pc from the nucleus. The measured wavelengths of the [OII]λ3727 indicate velocities of 2895 and 2670 km s⁻¹.*

If this is the case, then the presence of the gas is likely to be one of the elements leading to the formation of the radio source rather than a consequence of the radio source phenomenon. It is not possible to reach a definitive conclusion on this important question because detailed data on the gas exist only for a few exceptional ellipticals which have been studied because they are powerful radio sources, and quantitative information on normal ellipticals which could be used for comparison is lacking.

For the reasons just outlined above, a fairly extensive spectrographic survey of elliptical galaxies with reported nuclear or extended emission seems to be called for. I engaged in such a survey in the spring of 1979 with the following aims: (i) to map the distribution of the ionized gas; (ii) to measure the velocity field; (iii) to measure the absolute line intensities and line intensity ratios.

4.2 Results

The mapping of the gas was done in the spring of 1979 in collaboration with Harvey Butcher. We used the video camera system on the KPNO 4-m telescope to make direct imagery of a number of elliptical galaxies through narrow-band filters centred on the red-shifted Hα + NII λ 6584 lines and on an adjacent continuum band. In May 1979 the velocity field of a few of these galaxies was measured in a subsequent observing run with the IPCS at La Silla. The conclusion which can be drawn is that the gas shows velocity gradients of up to 200 km s^{-1} over a distance of 1 to 4 kpc, and evidently does not partake in the motions of the stars. The data on the velocity field are now being interpreted and detailed results will be presented later.

Figure 3 shows an example of the data obtained with the IPCS. It is extracted from an image of the spectrum of the elliptical galaxy NGC 3962. The two individual spectra, No. 36 and No. 40, come from two points that are symmetrically located with respect to the nucleus, and are distant by 3.″4 or 900 pc from the nucleus. The velocities measured by fitting the [OII]λ3727 unresolved doublet by a Gaussian profile are 2895 and 2670 km/s, respectively. This assumes that the doublet ratio, which is density-sensitive, is the same in the two regions sampled by these spectra; this assumption has been verified by taking spectra in the Hα, [NII]λ6548, 6584 region.

Another example of what can be achieved with the IPCS is illustrated in figure 4.

Figure 4 is extracted from an IPCS frame taken with the spectrograph slit located at 5″ or 9 kpc from the nucleus of 3C 445, which is a powerful radio galaxy with a Seyfert-type nucleus. Figure 4 shows the added signal coming from four contiguous spectra, which altogether cover the whole extent of the nebulosity in the EW direction, i.e. 6.″8 (thick line). The thin line is the scaled average of the sky spectrum obtained from 40 individual spectra containing sky signals only.

Figure 5 shows the spectrum of the nebulosity and of the nucleus after sky subtraction and photometric calibration.

Differences in line intensity ratios and line width between the nucleus and the nebulosity are evident. The line inten-

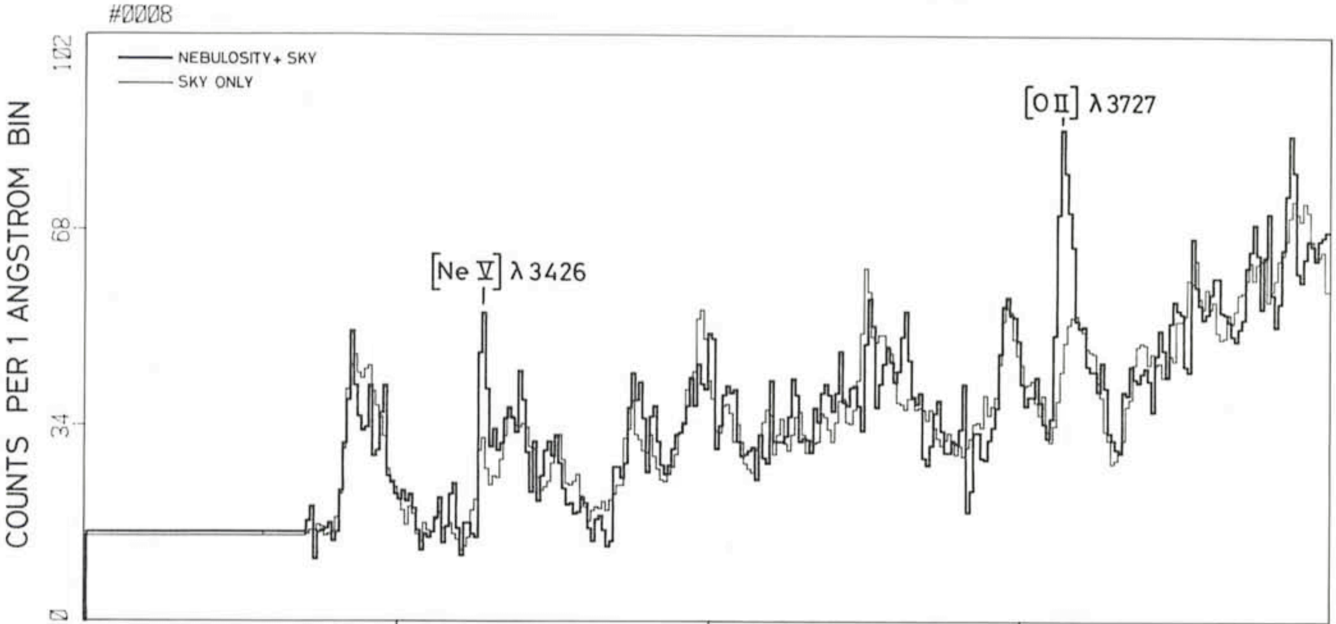


Fig. 4: *Portion of the spectrum of the gaseous nebulosity observed at 9 kpc from the nucleus of 3C 445. The thick line is the sum of the signal from 4 contiguous spectra covering the whole nebulosity in the EW direction. The thin line is the scaled average of the sky spectrum obtained from adding 40 spectra containing sky signal only.*

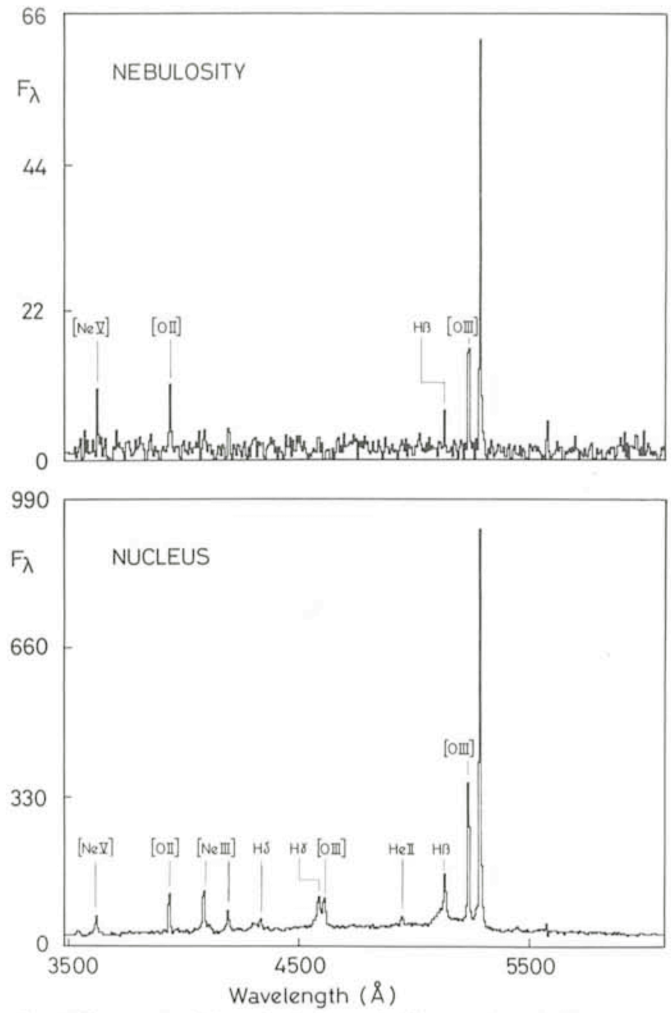


Fig. 5: Spectrum of the nebulosity and of the nucleus of 3C 445 after sky subtraction and photometric correction.

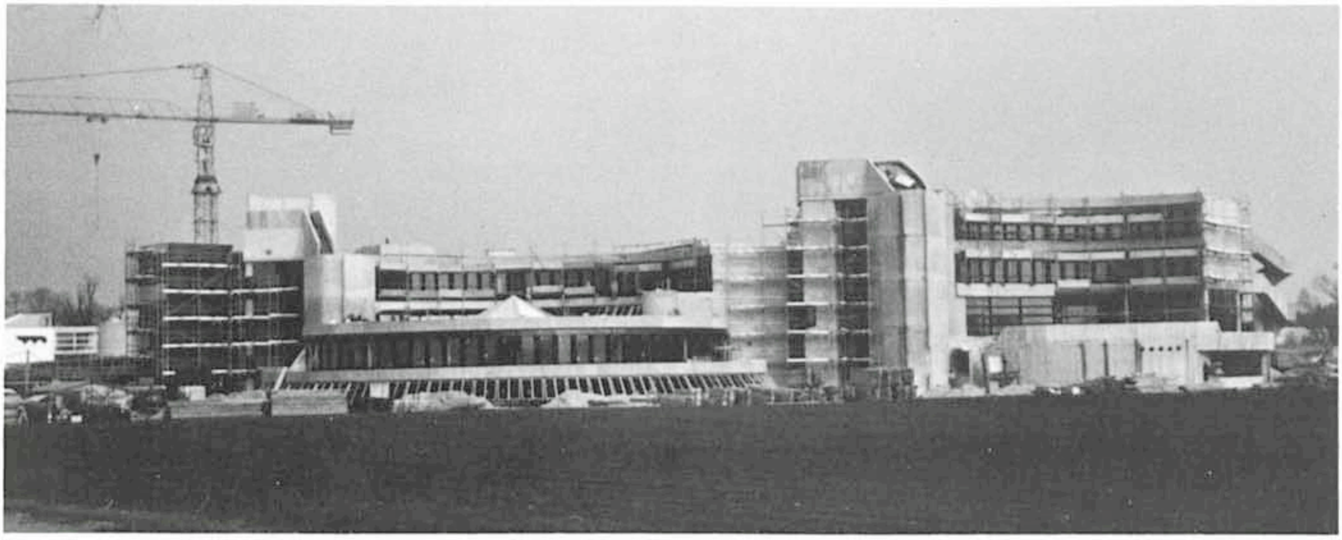
sities in the nucleus indicate a wider range of ionization than in the nebulosity. The interpretation of the spectrum of the nebulosity has been done as follows: in a nebulosity exposed to an ionizing source located at a distance R, the degree of ionization and therefore the line intensity ratios are essentially set by the parameter $\varphi/n_{part.}$, which is the ratio of the ionizing flux incident on the nebulosity to the density of particles in the nebulosity; φ is equal to $L_\nu/4\pi R^2 h\nu$, where L_ν is the absolute luminosity of the ionizing source. If φ is known, then the line intensity ratios give the particle density. Daniel Pequignot of Meudon Observatory and I have recently calculated models for a nebulosity exposed to a power-law ionizing spectrum and have applied them to the highly ionized nebulosity associated with the SB0 Seyfert galaxy NGC 3516 (Ulrich and Pequignot, 1 May, 1980, *Astrophysical Journal,* in press). These models can be applied to 3C 445. In this case, L_ν is estimated from the value of the continuum intensity of the nucleus at 3300 Å and assuming that the ionizing spectrum is a power law $f_\nu \propto \nu^{-1}$. Projection effects are neglected and R is taken to be equal to 9 kpc. For the value of φ so calculated, the line intensity ratios in the nebulosity of 3C 445 correspond to $n_{part.} \sim 15\ cm^{-3}$. This gives a total mass for the nebulosity observed in an area of 6ʺ8 x 1ʺ7 (11 x 2.8 kpc) of $10^6\ M_\odot$, i.e. as large as the mass of ionized gas present in the nucleus.

There are a number of cases already known of ionized nebulosities associated with quasars and radio galaxies and located at large distances from the nucleus. This is, however, the first case where the density of the nebulosity is determined. The reason is that we could detect [NeV] λ 3426, which is a good diagnostic of the degree of ionization. This detection was made possible by using a sensitive digital detector, which enabled us to detect faint lines and to perform sky subtraction satisfactorily.

ESO Headquarters Building Nearing Completion

In spite of the winter, construction work on the ESO Headquarters building has rapidly advanced during the past months. The outside is almost terminated and the work is now concentrating on the technical installations inside the building.

Below and on page 12 we show some photographs of the building, all taken on March 24.



ESO European Headquarters at Garching. View taken from the rear of the building (south-west). / La sede principal de la ESO. Vista de la parte posterior del edificio (lado sudoeste).

ESO, the European Southern Observatory, was created in 1962 to ... establish and operate an astronomical observatory in the southern hemisphere, equipped with powerful instruments, with the aim of furthering and organizing collaboration in astronomy ... It is supported by six countries: Belgium, Denmark, France, the Federal Republic of Germany, the Netherlands and Sweden. It now operates the La Silla observatory in the Atacama desert, 600 km north of Santiago de Chile, at 2,400 m altitude, where ten telescopes with apertures up to 3.6 m are presently in operation. The astronomical observations on La Silla are carried out by visiting astronomers—mainly from the member countries—and, to some extent, by ESO staff astronomers, often in collaboration with the former.

The ESO Headquarters in Europe will be located in Garching, near Munich, where in September 1980 all European activities will be centralized. The Office of the Director-General (mainly the ESO Administration) is already in Garching, whereas the Scientific-Technical Group is still in Geneva, at CERN (European Organization for Nuclear Research), which since 1970 has been the host Organization of ESO's 3.6-m Telescope Project Division.

ESO has about 120 international staff members in Europe and Chile and about 150 local staff members in Santiago and on La Silla. In addition, there are a number of fellows and scientific associates.

The ESO MESSENGER is published in English four times a year: in March, June, September and December. It is distributed free to ESO employees and others interested in astronomy.

The text of any article may be reprinted if credit is given to ESO. Copies of most illustrations are available to editors without charge.

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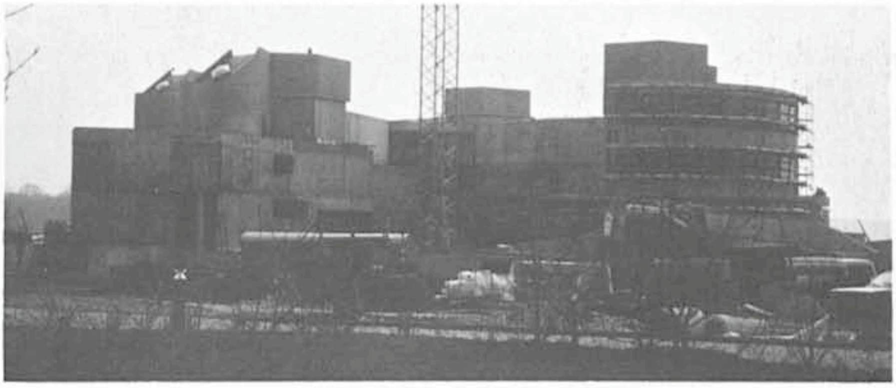
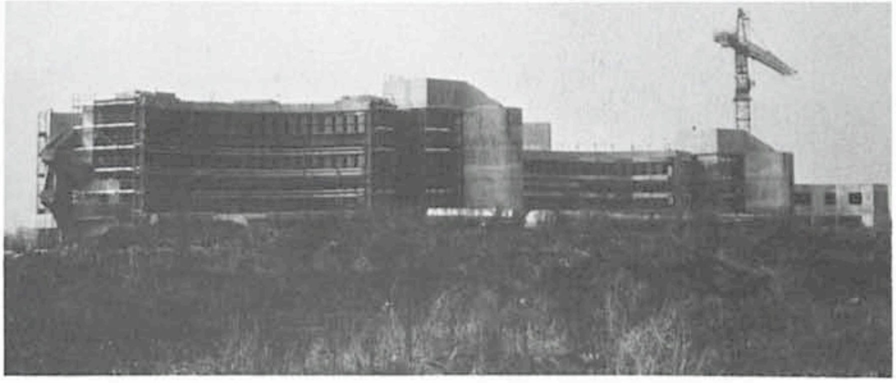


Northern part of the site with entrance to the Headquarters. / Lado norte de la sede principal de ESO con la entrada principal.



View of the building taken from east. / Vista del edificio tomada del lado este.

ALGUNOS RESUMENES

Italia y Suiza aceptadas como miembros de la ESO

En una sesión especial celebrada en Ginebra el día 26 de marzo el Consejo de la ESO aceptó por unanimidad a Italia y Suiza como nuevos estados miembros de la organización. Una vez que los procedimientos necesarios para la ratificación por las Cámaras de ambos países hayan sido concluídos con éxito, podrían ellos ser asociados efectivamente a principios del año 1981.

De acuerdo a la Convención de ESO, los nuevos estados miembros deben pagar una contribución especial que corresponde a su parte de las inversiones efectuadas en el pasado. Al fijar la suma de dicha contribución el Consejo de ESO decidió que ésta sería utilizada para construir un telescopio de 3,5 metros que podría ser terminado dentro de cinco años una vez aprobado el proyecto.

La sede principal de la ESO estará terminada muy pronto

La construcción del edificio para la sede principal de la ESO en Garching ha avanzado enormemente en estos últimos meses. Los trabajos exteriores están casi terminados y actualmente se concentran en las instalaciones técnicas en el interior del edificio.

Tanto en esta página como en la página 11 se muestran algunas fotografías del edificio tomadas el diá 24 de marzo.

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