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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

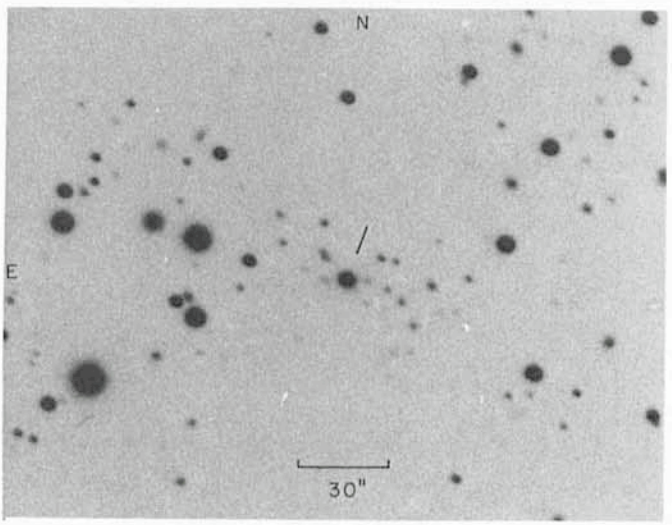

Fig. 1: *The quasar 3C 206 (z = 0.200), at centre. ESO 3.6-m prime focus plate (Kodak IIIa-F + Schott OG 570). Note clustering of faint (20–22 mag) objects within ~40 arc sec of the QSO.* ▶

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

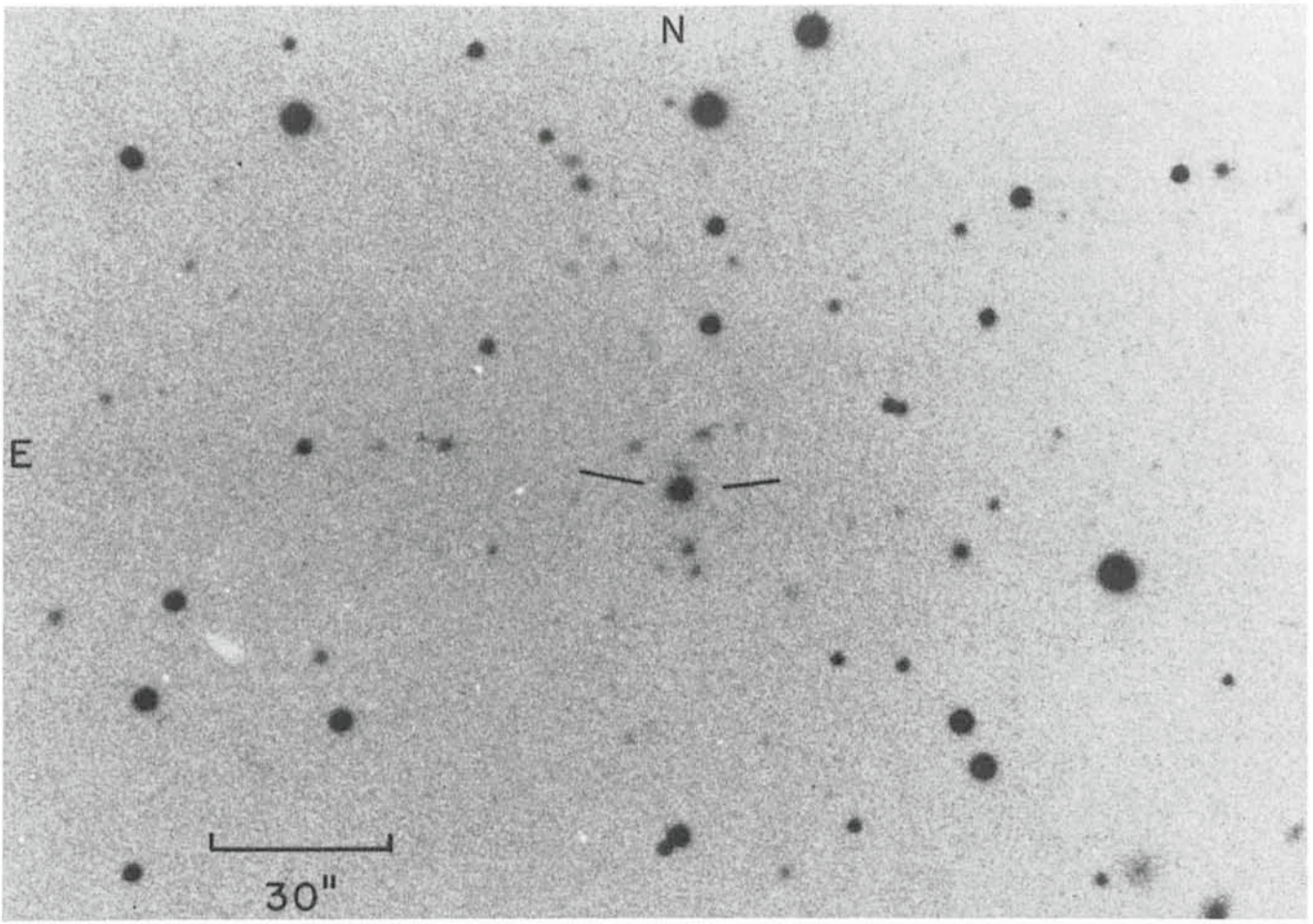

Fig. 2: *The quasar PKS 0812+020 (z = 0.402), at centre. ESO 3.6-m prime focus plate. Note faint objects north and south of QSO within ~20 arc sec of QSO.*

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 ~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 ± 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

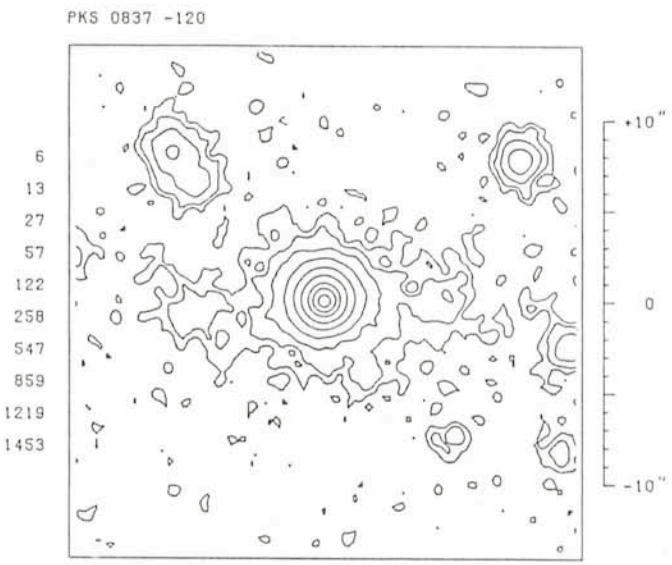

Fig. 3: *PDS logarithmic intensity contour map of 3C 206. Scale is indicated at right. Surface brightness contours are given at left (in per cent of red night sky).*

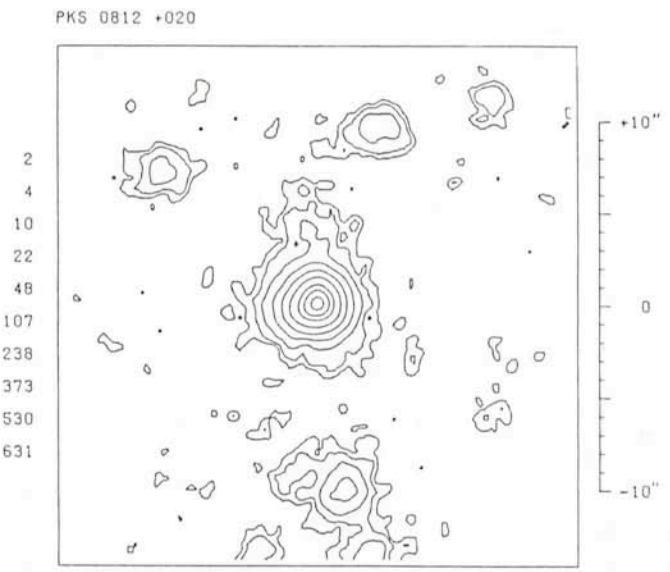

Fig. 4: *PDS logarithmic intensity contour map of PKS 0812+020. Other details same as in figure 3.*

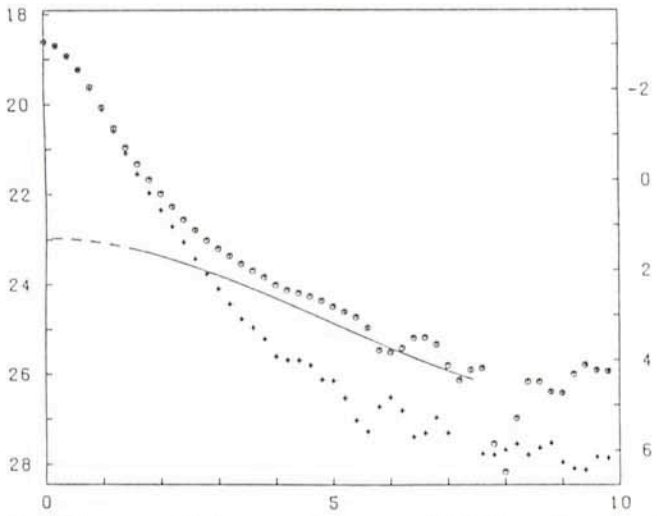

Fig. 5: *Image profile (mag sec^{-2} versus radial distance in arc sec) of the QSO 3C 206 (circles) and of the stellar point-spread-function (PSF, crosses). Solid line is difference between PSF and QSO profile, showing underlying galaxy surrounding the QSO. Scale on left is apparent red mag sec^{-2}.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