ESO COUNCIL DECISIONS

At its last meeting on November 26, 1980, the ESO Council took a number of decisions; among them we note:

— The approval of the ESO plans to submit a proposal to ESA to host the Space Telescope European Coordinating Facility.

— The approval of the 1981 budget, including 5 million DM for the installation on La Silla of the Max-Planck-Gesellschaft 2.2 m telescope.

— Professor P. Ledoux was elected President of Council from July 1, 1981. Professor J.-F. Denisse will continue as President until that time.

— Mr. H. Grage was elected Chairman of the Finance Committee for the year 1981.

— Professor B. Westerlund was elected Chairman of the Observing Programmes Committee for 1981. Professor Hunger was Chairman of the OPC in 1980.

— Professor P. Lena was reconfirmed as Chairman of the Scientific Technical Committee.

— The inauguration of the ESO Headquarters in Garching will take place on May 5, 1981.

List of Preprints Published at ESO Scientific Group

September—November 1980

118. M. Azzopardi, J. Breysacher and G. Muratorio: Spectroscopy of the Small Magellanic Cloud Emission Line Star Hen S 18. *Astronomy and Astrophysics,* Research Note. October 1980.
119. J. Bergeron, T. Maccacaro and C. Perola: Far UV Study on the Non-thermal Activity in the Narrow Line Galaxies NGC 4507 and NGC 5506. *Astronomy and Astrophysics.* October 1980.
120. L. Martinet and P. Magnenat: Invariant Surfaces and Orbital Behaviour in Dynamical Systems with 3 Degrees of Freedom. *Astronomy and Astrophysics.* October 1980.
121. S. D'Odorico, P. Benvenuti, M. Dennefeld, M. A. Dopita and A. Greve: Astrophysical Interpretation of the λλ 1200—7300 Å Emission Line Spectrum of a Filament in the Cygnus Loop Supernova Remnant. *Astronomy and Astrophysics,* Main Journal. November 1980.
122. M.-H. Ulrich: 3C 273: A Review of Recent Results. *Space Science Reviews.* November 1980.
123. G. Chincarini, M. Tarenghi and C. Bettis: Observations of Galaxies in the Southern Cluster CA 0340—538. *Astronomy and Astrophysics.* November 1980.
124. R. Schoembs and N. Vogt: High-time Resolution Spectroscopy of VW Hydri and WX Hydri. *Astronomy and Astrophysics,* Main Journal. November 1980.
125. W. Eichendorf, A. Heck, J. Isserstedt, J. Lub, M. Pakull, B. Reipurth and A. M. van Genderen: On the Nature of the 125-day Cepheid V 810 Cen (= HR 4511): IUE Spectra. *Astronomy and Astrophysics.* November 1980.

The Density of the Broad-Line Emission Region in Seyfert 1 Galaxies

M. P. Véron and P. Véron, ESO

One of the characteristics of Seyfert 1 nuclei and quasars is the presence in their spectrum of broad permitted lines or broad wings to the permitted lines. The forbidden lines show no such wings. Because broad He I and He II lines appear in the spectra of quasars and Seyfert 1 galaxies, it seems very likely that ions such as O^+, O^{++} or Ne^{++} actually do exist in the broad-line region and that the forbidden lines are suppressed by collisional de-excitation in a region with electron densities Ne $> 10^7 - 10^{+8}$ cm^{-3} (Souffrin, 1969, *Astronomy and Astrophysics,* **1,** 305; Anderson 1970, *Astrophysical Journal,* **162,** 743). Some class 1 Seyfert 1 galaxies and low redshift quasars exhibit an anomalously strong He I λ 5876 Å line; this has been believed to show an unusually large helium-to-hydrogen abundance ratio; however, in a high-density nebula, the He I triplet line intensities are significantly enhanced by electron collisional excitation. Theoretical and observational evidence shows that the gas which gives rise to the broad He I lines is characterized by Ne $\sim 5 \times 10^9$ cm^{-3} and T $\sim$ 15,000° K with normal abundance (Netzer 1978, *Ap. J.,* **219,** 822; Feldman and MacAlpine 1978, *Ap. J.,* **221,** 486).

On the other hand, the presence of a broad [C III] λ 1909 Å line in the spectrum of almost every QSO where it should be observable sets an upper density limit Ne $\leq 10^{10}$ cm^{-3} (Osterbrock 1970, *Ap. J.,* **160,** 25); this line has also been observed in the UV spectrum of the Seyfert 1 galaxy NGC 4151 (Boksenberg et al. 1978, *Nature,* **275,** 404).

It has become customary to assume that the density of the dense region in all quasars and Seyfert 1 nuclei was the same, in the range $10^{8.5} - 10^{9.5}$ cm^{-3}. However, both higher and lower values have been suggested; in the case of the QSO Q1011 + 25 (= TON 490) which has a redshift z = 1.63, the lines of CIII at 977 and 1909 Å have been observed (the first one with the International Ultraviolet Explorer) with an intensity ratio of 1.4 which corresponds to Ne $\sim 19^9$ cm^{-3} if Te = 30,000° K and to Ne = 3×10^{10} cm^{-3} if Te = 15,000° K (Nussbaumer and Schild 1979, *Astronomy and Astrophysics,* Letters, **75,** L17).

ANNOUNCEMENT
of an ESO Conference in Garching
24–27 March 1981

ESO is organizing a conference on

Scientific Importance of High Angular Resolution at Infrared and Optical Wavelengths

to be held in the ESO building in Garching on 24–27 March 1981

The Scientific Organizing Committee: M. H. Ulrich, Chairman – A. Boksenberg – D. Dravins – A. Labeyrie – P Léna – G. Weigelt.

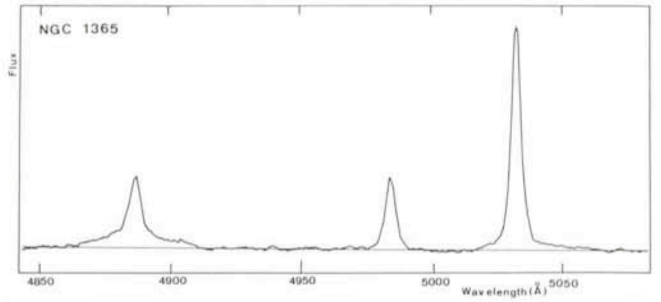

Fig. 1: *Spectrum of NGC 1365 obtained with the Boller and Chivens spectrograph and the IDS attached to the ESO 3.6 m telescope. The exposure time was 30 min, the entrance aperture 2 by 4 arcsec. A dispersion of 60 Å/mm was used, which gives a resolution of about 3.2 Å (FWHM). The emission lines shown here are* Hβ and [OIII] λλ 4959, 5007.

Most of the spiral Seyfert 1 galaxies have permitted Fe II lines in their spectra but the forbidden [Fe II] lines are usually not observed; if they are suppressed by collisional de-excitation, then Ne $\gtrsim 10^7$ cm^{-3} (Phillips 1978, *Ap. J. Suppl.* **38,** 187). However, both the forbidden and the permitted Fe II lines have been observed in the spectrum of the Seyfert 1 galaxy I Zw 1, which yields to a density Ne $\sim 10^7$ cm^{-3} (Oke and Lauer 1979, *Ap. J.,* **230,** 360).

In the course of a spectroscopic study of the line profile in emission-line galaxies, carried out with the ESO 3.6 m telescope on La Silla, we have found out that, in addition to a broad Hβ component, the spectrum of two Seyfert 1 galaxies (NGC 1365 and NGC 7469) show a broad component under the forbidden line [OIII] λ 5007 (Fig. 1). In both cases, the intensity of the broad N2 component is about half of that of the broad Hβ component. For the narrow components, we have I(N2)/I(Hβ) = 4 and 6 for NGC 1365 and NGC 7469 respectively. If we made the assumption that the excitation condition in both the low and high density regions are the same, then, in the broad line region, the N2 line is collisionally de-excited by a factor of 8 and 12 respectively.

According to the formula given by Seaton (1975, *M.N.,* **170,** 475), this implies a density of $(1-3) \times 10^6$ cm^{-3} for an electron temperature in the range Te = $(1-3) \times 10^4$ K. In NGC 7469, the [OIII] λ 4363 narrow line is rather strong, being about a tenth of the strength of the narrow component of the [OIII] λ 5007 line, indicating a rather high temperature in the low density region (Wampler 1971, *Ap. J.,* **164,** 1; Anderson 1970, *Ap. J.,* **162,** 743); if the temperature is the same in the high density region, the broad component of the λ 4363 line would be as strong as the λ 5007 line, as, at densities not exceeding 3×10^6 cm^{-3}, the auroral line is not significantly suppressed by collisions.

These observations have shown that the broad emission-line regions of Seyfert 1 galaxies may have densities as low as $\sim 10^6$ cm^{-3}, much smaller than previously thought.

We plan to try to detect the auroral line of [OIII] in these two galaxies and to observe more bright Seyfert 1 galaxies to find out if such low densities are common in the broad line regions.

Optical and Ultraviolet Spectroscopy of the Nuclei of Seyfert Galaxies

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The launching of the International Ultraviolet Explorer (IUE) in 1978 has made the ultraviolet sky in the wavelength region from 1150 Å to 3200 Å accessible to detailed spectroscopic study. The IUE is a satellite in a geosynchronous orbit, equipped with a 45 cm telescope with two spectrographs. For a more detailed description of this satellite, the interested reader is referred to the article by A. Heck et al. (*Messenger* No. 15, Dec. 1978). Although the diameter of the IUE telescope is quite small—its size is more typical of an amateur telescope than of a scientific instrument—it has been used successfully even for extragalactic spectroscopy.

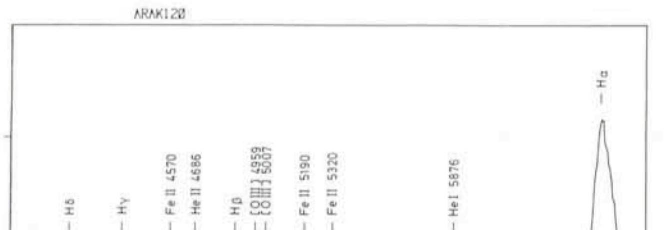

Fig. 1: *The optical spectrum of Akn 120, obtained with the IDS. The relative flux is plotted versus observed wavelength. No correction due to galactic extinction has been applied. The dashed line indicates the continuum.*

Seyfert Nuclei

The nuclei of Seyfert galaxies have become popular subjects for research, since it was realized that they resemble QSOs in several respects. Seyfert nuclei have smaller redshifts than QSOs; they are much less luminous and are embedded in a clearly visible galactic disk. The optical spectrum of a Seyfert nucleus is dominated by very broad emission lines of the Balmer sequence and by the relatively narrow forbidden lines of [O III] (in this article we will restrict ourselves to the case of Seyfert 1). Several other broad, but weaker, emission lines seen in Seyferts originate from He I and Fe II. Fig. 1 shows the optical spectrum of Akn 120, which one of us (H. S.) obtained with the IDS at the ESO 3.6 m telescope. Note the asymmetric, bumpy structure of the Balmer lines. The shapes of the permitted lines can be explained by a model in which the gas is confined in clouds or filaments surrounding a central compact source of continuum radiation. These filaments move relative to each other with high velocities. A bump in the Hβ profile of Akn 120, e. g. 80 Å shortward of line centre, would be produced by filaments which move towards us (relative to the mean velocity of all filaments) with a velocity component of 4800 km/s. Obviously the narrow forbidden lines originate in a different region of the nucleus with much smaller internal velocities ($\lesssim$ 600 km/s). Forbidden lines occur only if the electron density is less than $\sim 10^7$ cm^{-3}. The absence of broad wings in the [O III]-lines therefore indicates that the electron density exceeds 10^7 cm^{-3} in the "broad line" filaments.