The Galaxy NGC 1365
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One of the most beautiful barred galaxies in the sky is found in the southern hemisphere, in the Fornax cluster at a declination of $-36^\circ$. The galaxy – NGC 1365 – with its diameter of 11 arc minutes and its prominent spiral structure stands out well among the cluster galaxies. Situated 1.2 degrees from the cluster centre and with a radial velocity of $+1,650\ km/s$ – very close to the average radial velocity of the cluster – it is very probably a member. Among its closest neighbours we find the peculiar radio galaxy Fornax A and NGC 1386, which is the nearest type 2 Seyfert galaxy known.

NGC 1365 was one of the first galaxies to be photographed with the ESO 3.6 m telescope by Svend Laustsen and Hans Emil Schuster during the commissioning phase, and it was observed by one of us (P.O.L.) during the first visiting observers run with the 3.6 m telescope in October 1977. Two plates from this observing run are seen as Figs. 1 and 2.

As can be seen in the two-hour exposure the bar and spiral arms are prominent – the latter delineated by bright H II regions. There are strong absorption lanes along the bar and the spiral arms, as well as an intricate pattern of dust lanes and bright branches and twigs. In particular, there is a set of dark wisps across the bar extending from (or rather running into) the prominent absorptions on the front side of the bar.

If we estimate the distance of the Fornax cluster to 20 Mpc, the diameter of NGC 1365 as seen in Fig. 1 is 65 kpc and the total absolute magnitude $-21.6$, i.e. it is a true supergiant galaxy. Spectral data show that the NE side is approaching and the SW side receding. If the spiral arms are trailing, then the NW side is the near one. With its inclination of $55^\circ$ to the plane of the sky and a position angle of the bar $35^\circ$ from that of the minor axis the orientation of the galaxy is very well suited for dynamical studies.

Fig. 1: ESO 3.6 m photograph of NGC 1365 obtained in a two-hour exposure on a III a–J plate with GG 385 filter.
clearly displayed by the inclined emission lines. The position
angles of the maxima and minima of the velocity gradients
coincide closely with the position angle of the line of nodes as
given from faint outer isophotes of the two-hour exposure in
Fig. 1. There is of course no need for the plane of the nuclear
disk to have the same orientation as that of the outer edge, but
we can state that the velocity gradients of the nuclear disk as
given by the Hα and [N II] lines give no reason to assume
anything but circular rotation of this disk with an angular
velocity of 280 km s⁻¹ kpc⁻¹, or about ten times the angular
velocity of the sun around the galactic centre. This gives a
mass for the nucleus of the order of 10⁹ solar masses.

The velocity field outside the nuclear region has been
measured from our slit spectra with the Boiler & Chivens
spectrograph on the ESO 3.6 m telescope equipped with
image tube or with the Image-Photon-Counting System of
Boksenberg; from image-tube slit spectra obtained by Charles
Peterson with the 4 m telescope at Cerro Tololo, from TAURUS
observations on the ESO 3.6 m and from 21 cm observations
by J.M. van der Hulst with the VLA. All these velocity measure-
ments are now in some stage of reduction. All of these
observations have strong signals in the spiral arms, but all
suffer from the weakness of the emission lines in the bar. Only
the IPCS spectra contain absorption lines to give information
about the stellar motions. A preliminary rotation curve based on
Charles Peterson's and our spectra is shown in Fig. 3. The
pattern of systematic deviations from this curve are studied and
will be combined with photometry and numerical calculations
carried out in Collaboration with Preben Grosbol and E.
Athanassoula.

As is well known from the observations of M51 by Mathew-
sen, van der Kruit and Brouw, large-scale galactic shocks may
reveal themselves by enhanced non-thermal continuum radio
emission. Inspired by these beautiful results, we set out to
observe NGC 1365 with the Very Large Array (VLA) in New
Mexico. The resolution with this radio synthesis interferometer
would be of the order of arcseconds and our hope was to detect
enhanced continuum radio emission from the strong dust lanes
along the bar and spiral arms, where the existence of galactic
shocks could be expected.

The observations with the VLA were carried out at 6 and
20 cm wavelength in November 1979 (Astron. Astrophys. 110,
336, 1982). At that time the VLA was not fully finished—in
particular the northern arm was very short, which resulted in
a rather elongated beam shape for this southern object. As
a matter of fact NGC 1365 lies rather close to the southern limit

Since the middle of the 1970s the dynamics of barred
galaxies has been intensely studied from a theoretical point of
view as it has been realized that the stability of bars made up of
stars and their perturbing influence on gas flow are fundamental
keys to the understanding of spiral structure in galaxies.
Numerical n-body calculations have shown that stellar systems
of sufficient angular momentum are highly apt to form bars that
are very stable. Numerical gas flow calculations have shown
how a bar potential can create large-scale shocks along the bar
as well as a spiral structure in the region outside the bar. On the
other hand, observational confirmation of the predicted
kinematics has been rather scarce. This is due partly to the
slow process by which an extragalactic object can be covered
with slit spectra, the low angular resolution of radio telescopes
and, in particular, the lack of neutral or ionized atomic hydrogen
in the bar region. NGC 1365 was chosen for studies with the
3.6 m telescope, because of its ideal orientation for kinematic
studies, its clean structure and richness of interstellar matter,
and, not least, because early observations by the Burbidges
at McDonald had shown that the strong emission line spectrum
from the nuclear region might imply violent noncircular
motions.

The nuclear region of NGC 1365 is penetrated by a strong
dust lane and contains a number of so-called "hot spots" and
H II regions, almost all situated along the nearer arm of a small
nuclear spiral as seen in Fig. 2. The nucleus itself is much
redder than the surrounding hot spots and shows a strong
infrared excess. At least part of this redness is caused by the
absorbing dust lane just touching the nucleus.

Already our first spectra of the nucleus showed that the Hα
line in emission was suspiciously broad. In our discussions at
ESO this aroused the immediate interest of Philippe Vérón. IDS
spectra secured by him and later by Danielle Alloin and P.O.L.
showed that the Hα line contained a broad component with a
full width at half maximum intensity of 1,700 km s⁻¹, while the
forbidden lines remained unresolved at 4 Å resolution. This
revealed the Seyfert 1 character of the nucleus (Astron.

This nucleus is surrounded by a rapidly spinning narrow line
disk with a radius of about 7'' corresponding to 700 pc as is

Fig. 2: ESO 3.6 m photograph of the nucleus of NGC 1365 obtained in
a one-hour exposure on a 127-04 plate with narrow-band Hα filter.

Fig. 3: Preliminary rotation curve of NGC 1365 derived from ESO 3.6 m
Boiler & Chivens spectra and spectra obtained by Charles Peterson
with the 4 m telescope on Cerro Tololo.
and Boesgaard (1976) showed that this emission is nearly
gested that these Fe II emission lines would be present in
practically all giants of sufficiently late type. Then, Boesgaard
3300 in the two supergiants a Herculis (M5 11) and a Scorpii
emission lines he observed in the spectral region n 3150­
corona-like nebulosity surrounding cool stars from strong Fe II
(M1 Ib). Fifteen years later, Bidelman and Pyper (1963) sug­
change of the radio emission over a short time. Our repeated
6 cm VLA observations in September 1982, although with
lower resolution, give no evidence for such a variation.
To support the supernova rate mentioned each of the radio
sources would have to be associated with about 10^5 O and B
stars. This number of hot stars may not be inconsistent with the
Hβ flux from the hot spots that may be places for recent bursts
of star formation. However, the luminosity function could not be
a standard one, as the mass in low luminosity stars required
would spoil the regular velocity field of the nuclear disk. Also
the lack of clear association between concentrations of supernova
remnants and hot stars needs an explanation.
In the midst of this puzzling situation a very important
observation has appeared to add to the confusion, but not
improbably to ultimately give the clue to what is going on. M.M.
Phillips, A.J. Turtle, M.G. Edmunds and B.E.J. Pagel show in a
recent preprint that extended regions of high-excitation gas
around the nucleus reveal a velocity field considerably more
complicated than the rotating disk inferred above from the Hα
and [N II] lines. As a matter of fact, the [O III] line at λ 5007 Å
over this region is split up into several components with
different velocities and velocity gradients. For some positions
of their slit the [O III] line is actually inclined in opposite sense to
that of the hydrogen lines. It seems that our IPCS observations
show a peculiar behaviour also for the Ne III λ 3869 line. This
may imply outflow of high-excitation matter from the nucleus in
directions out of the plane of the disk. It could very possibly
indicate a connection between the activity in the nucleus and
the radio sources and hot spots in its surrounding.

Active Chromosphere in the Carbon Star TW Horologium
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Introduction
Herzberg (1948) was the first to suggest the existence of a
corona-like nebulosity surrounding cool stars from strong Fe II
emission lines he observed in the spectral region λλ 3150­
3300 in the two supergiants α Herculis (M5 II) and α Scorpii
(M1 Ib). Fifteen years later, Bidelman and Pyper (1963) sug­
suggested that these Fe II emission lines would be present in
practically all giants of sufficiently late type. Then, Boesgaard
and Boesgaard (1976) showed that this emission is nearly
universal in M-type stars and thus appears to be a natural
occurrence in stars with low temperature. At present, these
emission lines are recognized as an undisputed chromo­
spheric indicator. Chromospheres have been detected in late­
type (F-M) stars, in particular for M giants through their bright
UV emission lines (the Fe II lines besides the Mg II h and k
lines), and most notably Linsky (1980) has pointed out that a
wider spectral range of stars than was thought previously may
possess chromospheres.