nights. No clouds were detected during these nights, except low sea-level clouds above the Pacific, which do not affect the sky above La Silla.

Year	Period	Photometric nights
1974	August 15–September 2	4
1975	March 20–May 12	19
1976	November 1–December 10	18
	Total:	41

But the determination of nightly extinction coefficients revealed that only 27 of them ($\sim$ 65 %) were of the required quality. The extinction for these so-called "good nights" did not differ by more than 2 % (at 5000 Å) from the curve given in the figure. This was determined from the mean of 19 "good nights" during the period March 20 to May 12. The mean of the other two observing runs agreed with this result to $\pm$ 0.005 mag/airmass (at 5000 Å). The points are measured values to illustrate the typical fluctuations for only one star in a "good night". Fourteen nights showed higer values of extinction and were not useful. Because Rayleigh scattering could not have changed (constant air pressure) and the ozone is limited to fixed wavelength regions from the shape of the total extinction curve, it was obvious that this was definitely due to aerosol scattering.

The most surprising result is that the contribution of aerosol in "good nights" is only 0.01–0.02 mag/airmass, although the soil on La Silla is dry and the wind is sometimes rather strong. No observatory is known in the northern hemisphere with a comparably low extinction. The best observing sites in California and Arizona show 0.05–0.10 mag/airmass aerosol extinction. Considering the number of photometric nights and the observed transparency of the sky, La Silla is one of the best observing places in the world.

We can summarize our experience with extinction measurements by the following statements:

1. If a cloud was visible during the daytime, either before or after a clear night, this night had to be omitted.
2. Condensation trails from aircraft visible on a blue sky, even for seconds, indicated unstable layers in the higher atmosphere and gave rise to uncertain nights.
3. No correlation was found between the extinction coefficients and the direction of observation.
4. Sometimes cloudless nights showed higher extinction but good stability. In this case the aerosol must be spread out uniformly around the sky.

The author wishes to express his gratitude to Dr. W.A. Sherwood, Dr. A.F.J. Moffat and Prof. J. Hardorp, who were helpful in collecting the extinction data during the calibration work.

High-dispersion Investigation of the Nucleus of NGC 253

M.-H. Ulrich

Dr. Marie-Hélène Ulrich is a well-known authority on emission-line galaxies and comes originally from the Observatoire de Paris, France. She has worked for a long period in the USA, at the University of Texas, Austin, and recently came back to Europe to join the ESO Scientific Group in Geneva. She here discusses the nearby galaxy NGC 253 and shows how optical, infrared and radio observations come together in a model of this very interesting object.

The nearby galaxies are particularly interesting because they are the ones which can be studied with the best linear resolution. Among the galaxies which are at distances less than $\sim$ 5 Mpc, there are a few galaxies which are truly exceptional such as M82 = NGC 3034 and NGC 5128 = Centaurus A. Other galaxies show mild cases of activity which may represent normal but short stages of the evolution of galaxies. For example, M81 has a very compact, flat-spectrum central radio source of low absolute luminosity; in M31 the ionized gas shows non-rotational motions of small amplitudes. Another very informative case of activity in a galactic nucleus is provided by the Sc galaxy NGC 253 (fig. 1). The main signs of activity are (i) motions of the gas indicating that gas is escaping from the central region and (ii) extremely intense infrared radiation emitted by the nucleus. The results of recent spectrographic observations of NGC 253 (M.-H. Ulrich, 1978, in press) are briefly outlined below.

NGC 253 is at 3 Mpc and its heliocentric systemic velocity is 250 km s^{-1}.

Spectrograms of the central region of NGC 253 were obtained with the RC spectrograph of the 4 m telescope at Kitt Peak National Observatory, Arizona, USA. One of the spectrograms is shown in figure 2. On the original plate the dispersion is 54 Å/mm^{-1} and the scale perpendicular to the dispersion is 25 arcsec/mm^{-1}. The set of spectrograms reveals departures from rotational motions in the south-east quadrant with apex at the nucleus. In particular on spectra taken along the minor axis, the velocity of the gas is definitely smaller than the systemic velocity indicating that gas is flowing out of the nucleus and towards us. The velocity field observed from measurements along the emission lines of the ionized gas is in excellent agreement with the velocity field mapped by interferometry of H I 21 cm observed in absorption in front of the continuum source (S. Gottesman et al., 1976, *Ap. J.* **204,** 699). No velocity larger than the systemic velocity is observed in the atomic gas, ionized or neutral. In contrast, the molecular lines of H_2CO and OH show both higher and smaller velocities than the systemic velocity. This suggests a model for the gas in the nuclear region where the gas in its densest form, i. e. molecular gas, is expanding but is still in the region emitting the radio continuum whereas the atomic gas is outside the continuum source. In this model, the part of the atomic gas flowing out of the nucleus and away from us is behind the continuum source and therefore cannot be seen in H I 21 cm absorption, nor can it be seen in the optical emission lines because of the absorption by dust in the equatorial plane.

Fig. 1. — *Photograph of NGC 253 with the ESO Schmidt telescope (IIa-O + GG385, 60 min).*

It would be particularly interesting to conduct a spectrophotometric study of the ionized gas flowing out of the nucleus. Relative line intensities can provide the reddening—which is probably small since the gas is outside the equatorial plane—and the density of the gas. This information combined with a measure of the absolute intensity of one of the lines would allow to calculate the mass of the ionized gas escaping the nucleus. The temperature cannot be determined because [O III] 4363 is very weak; however, the mass of the emitting gas is only a slow function of the effective temperature T_e. Such an investigation is planned for the autumn of 1978 using the IDS scanner of the ESO 3.6 m telescope.

In an exploratory step towards such an investigation, the absolute intensity of Hα in the nucleus of NGC 253 has been estimated by comparison with M82 for which absolute spectrophotometry exists. Using this estimate, the rate of mass loss from the nucleus of NGC 253 is approximately 10^{-2} $M_\odot$/year. It can be shown that 1,000 O6 stars in the central region can provide the ionizing flux necessary to keep this outflowing gas ionized and also provide the mechanical energy to accelerate it above the velocity of escape. The presence of this large number of young stars is consistent with the infrared luminosity observed by G. Rieke and F. Low (*Ap. J.* **202,** 197, 1975) between 2 and 30 μm. It can also be argued that the present rate of star formation cannot last for the entire life of the galaxy; otherwise the nucleus would lose most of its mass and it is tentatively concluded that there is now an outburst of star formation. Clearly, this very informative galaxy deserves further study which should enable one to reach definitive conclusions regarding the above important points.

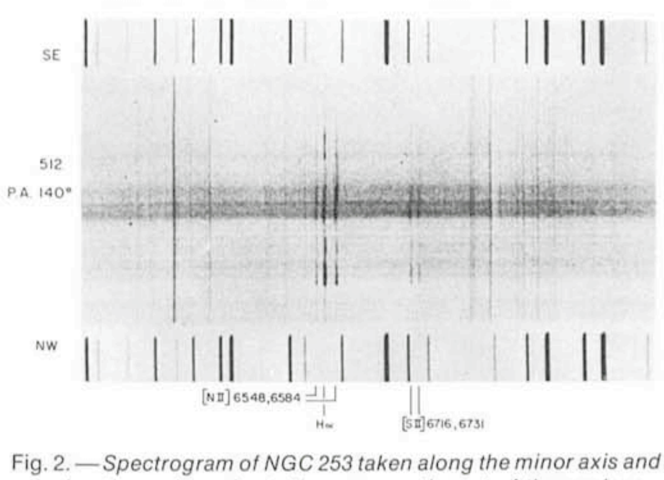

Fig. 2. — *Spectrogram of NGC 253 taken along the minor axis and crossing the major axis at 15 arcsec north-east of the nucleus.*