case the envelope cannot be considered as optically thin in the continuum. Note that the extrapolation of this relation to d = 0 (in fact to the immediate vicinity of the point *Fev 77* for which the emissions have almost disappeared) gives the interstellar colour excess of the star; this interstellar colour excess is the same in all phases and can then be subtracted, to obtain the colour excess due to the envelope alone.

Future Observations

All these observations will be extended to many stars. The fact that the discontinuity D_* as it has been defined on figure 1, is constant, justifies the picture of an *unvariable* central star. But the variable part of the spectrum is still a mystery: extended atmosphere or perhaps a chromosphere? A tentative representation of the Be phenomena by non-thermal phenomena in the stellar atmosphere is in progress (R. N. Thomas and J. Zorec) at the Institut d'Astrophysique in Paris and the present simultaneous observations done by us at La Silla (high dispersion to measure the emission in Balmer lines, low dispersion to measure all the parameters of the continuum: D_*, λ_1, d, φ_{rb}, φ_{uv}) will serve to test new models. Of particular interest are the correlations:

(1) between d and emission in Balmer lines ($W\alpha$, $W\beta$ . . . and Balmer decrements),
(2) between d and the colour temperatures on both sides of the Balmer Jump.

We hope that the large set of new data obtained in June 78 at La Silla together with theoretical efforts will throw some new light on the Be phenomenon!

The Environments of Active Galactic Nuclei

R.A.E. Fosbury

It is becoming increasingly clear that strange things happen in many galaxy nuclei and that their study is of extreme importance for our understanding of the behaviour of matter. Observations from satellites and with large telescopes have yielded new and often unexpected results and the possibility of the existence of black holes (or even more exotic objects) in the centres of active galaxies is now taken seriously by most astronomers. Dr. Robert Fosbury, who joined the ESO Scientific Group in Geneva in 1977, has been pursuing for a long time the study of galaxy nuclei with some of the world's largest telescopes. He gives some examples of recent work with the ESO 3.6 m telescope.

Small regions of intensely energetic activity are known to exist in the nuclei of many galaxies and there are a number of arguments which, taken together, provide rather convincing evidence that QSOs are distant, luminous examples of the same type of phenomenon. Understanding the nature of these energy sources is important because the extreme conditions encountered in them stretch our knowledge of basic physics. Also it would be possible to use the QSOs as cosmological probes with much more confidence if there was a better knowledge of what they were and whether their redshifts were entirely due to the universal expansion.

Aside from the cosmological information implicit in the study of QSOs, by moving a little nearer home and looking at activity in galactic nuclei, we are immediately presented with a number of observational and interpretative advantages. Not least of these is the chance to investigate the relationship between the nucleus and its galactic environment. The interaction between the central energy source (10^{15} cm from variability and other arguments) and its surroundings occurs on a very wide range of spatial scales and, depending on the nature of these surroundings, produces widely different manifestations of what are probably similar phenomena. This range of scales demands the application of a wide range of observational techniques. The radio band does not in general contain a large fraction of the luminosity of active nuclei, radio continuum observations do however provide a means of tracing events from the smallest to the largest angular scales. Optical and ultraviolet spectrophotometry are powerful techniques for studying the continuum radiation emitted from very close to the energy source and also, from the emission lines, the state of the ionized gas which is excited by the activity. Recently obtained X- and γ- ray results are putting very severe constraints on models of the energy source itself.

These are some interesting general correlations between the outward appearance of the nuclear activity we observe and the morphological type of the associated galaxy. For example, classical double radio sources seem only to be found straddling elliptical galaxies, while class 1 Seyfert nuclei (blue continuum, broad permitted emission lines, narrow forbidden lines) exist predominantly in spiral galaxies and are usually not strong radio sources. While correlations of this kind do not have the status of absolute rules, they do provide a starting point for a study of the link between events in the nucleus and the evolution of the galaxy as a whole.

As part of a larger programme studying the morphologies of radio galaxies in the Parkes Catalogue using the SRC IIIa-J sky survey, I obtained in April direct plates of some selected galaxies using the 3.6 m telescope at prime focus. Figure 1 shows the galaxy identified with the inverted-spectrum radio source PKS 1934–63. The radio source itself is worthy of note since it was among the first discovered to show the characteristic low-frequency cut-off due to synchrotron self-absorption (Bolton, Gardner and Mackey, 1963, *Nature*, **199**, 682). It is also extraordinarily powerful as a compact source associated with a galaxy rather than a QSO. Optical spectrophotometry has been published by Penston and Fosbury (1978, *M.N.R.A.S.*, **183**, 479), and figure 1 is a significant improvement over previously published photographs. Rather than being a "double" galaxy it is possibly a giant elliptical girded by a dust belt reminiscent of our nearest radio galaxy NGC 5128 (Centaurus A). As in Cen A, the radio structure, which is known to be a very close double from VLBI observations, would be aligned perpendicular to the dust belt. It is even possible that the dust is hiding a quasar-like nucleus, an idea which could be checked by infrared observations.

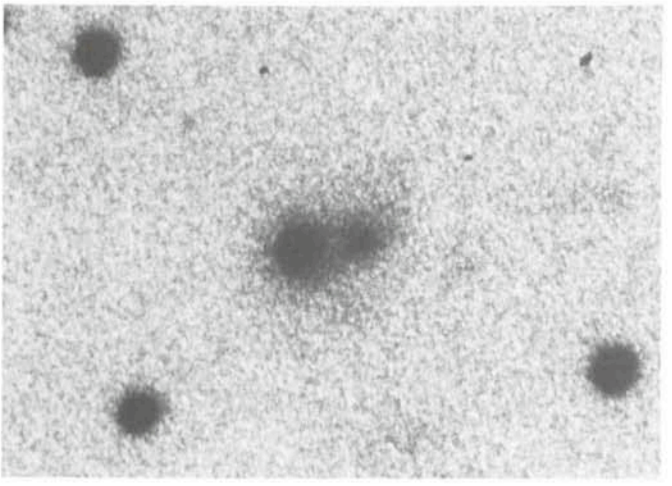

Fig. 1: *From a 3.6 m prime focus plate (60-min exposure on sensitized IIIa-J with GG 385 filter) of the galaxy associated with the powerful compact radio source PKS 1934–63. This may be a giant elliptical crossed by a dust belt like Centaurus A.*

Another topic receiving much attention in the current literature is the 21-cm detection of the neutral hydrogen gas in some elliptical galaxies. From the limited sample available it has been noted that those ellipticals with detectable amounts of H I have some form of nuclear activity, evidenced by optical emission lines and/or a compact nuclear radio source, and also occur in small groups with half a dozen or so member galaxies. This has led to the notion that the elliptical has not always contained the neutral gas (most ellipticals contain embarrassingly little) but that it is currently being accreted from gas left over in the group and perhaps finding its way down to the nuclear regions to power the activity there.

The galaxy associated with the flat-spectrum radio source PKS 1718-649 may have some relevance to this problem. It was originally classified as D-type (elliptical with extended halo) from the ESO (B) survey. The SRC IIIa-J survey however showed that this halo was not smooth but was in fact a pair of diffuse, very low surface-brightness spiral arms. (Fosbury, Mebold, Goss & van Woerden, 1977, *M.N.R.A.S.*, **179**, 89) showed that the system contains a large mass ($3 \times 10^{10} M_{\odot}$) of neutral hydrogen and that the nucleus has an emission-line spectrum reminiscent of the active ellipticals. The new 3.6 m photograph (fig. 2) shows the spiral structure in much more detail (a) than seen previously and also (b) the tidal interaction between the main galaxy and the companion spiral. Several fainter galaxies are visible in the viscinity which may be members of the same small group.

The IIIa-J survey from the Schmidt telescope in Australia is giving us a much clearer view of galaxies than the previous surveys. There is still, however, no substitute for the plates taken with a big reflector in a good site, and these plates, coupled with the radio observations of H I, are providing new insights into the galaxies around the nuclei.

I am happy to acknowledge that the prints reproduced in figure 2 were made by David Malin at the Anglo-Australian Observatory.

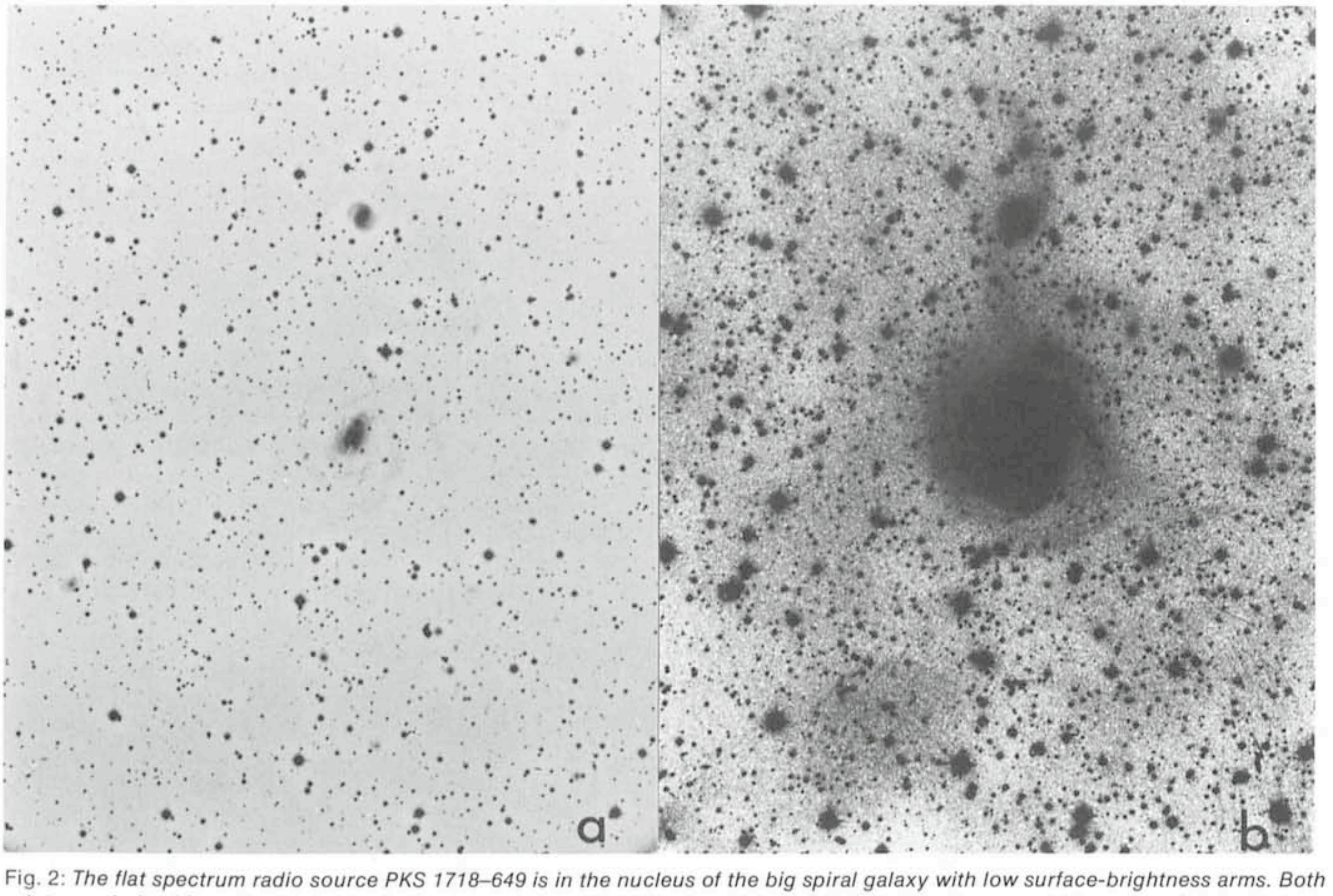

Fig. 2: *The flat spectrum radio source PKS 1718–649 is in the nucleus of the big spiral galaxy with low surface-brightness arms. Both prints are derived from the same 90-min exposure on sensitized IIIa-J emulsion with the 3.6 m telescope. (a) is made using an unsharp mask (Malin, 1977.* AAS photobull. *No. 16, 10) to filter out the low spatial frequencies and show the fine detail from the densely exposed original plate. (b) is a high-contrast derivative (Malin, 1978,* Modern Techniques in Astronomical Photography, *Geneva. Ed. R.M. West and J.L. Heudier) which shows the very faint tidal extension through the companion spiral.*